

National Science and Technology Council



2000 Annual Report

About the National Science and Technology Council

President Clinton established the National Science and Technology Council (NSTC) by Executive Order on November 23, 1993. This cabinet-level council is the principal means for the President to coordinate science, space, and technology policies across the Federal Government. NSTC acts as a virtual agency for science and technology (S&T). The President chairs the NSTC. Membership consists of the Vice President, Assistant to the President for Science and Technology, Cabinet Secretaries and Agency Heads with significant S&T responsibilities, and other White House officials.

Through the NSTC, Federal departments and agencies work cooperatively to ensure that Federal science and technology investments support national goals. NSTC Committees prepare R&D strategies that are coordinated across the Federal government to form a comprehensive investment package.

Call 202-456-6100 to obtain additional information regarding the NSTC, or see our web site at: http://ostp.gov/NSTC/html/NSTC_Home.html

About the Office of Science and Technology Policy

The Office of Science and Technology Policy (OSTP) was established by the National Science and Technology Policy, Organization and Priorities Act of 1976. OSTP's responsibilities include advising the President in policy formulation and budget development on all questions in which S&T are important elements; articulating the President's S&T policies and programs; and fostering strong partnerships among Federal, state and local governments, and the scientific communities in industry and academe. The Director of OSTP also serves as Assistant to the President for Science and Technology and manages the NSTC for the President.

Call 202-456-7116 to obtain additional information regarding the OSTP, or see our web site at: <http://www.ostp.gov>

THE WHITE HOUSE
WASHINGTON

January 17, 2001

Dear Colleague:

I am pleased to transmit the *National Science and Technology Council 2000 Annual Report*. President Clinton established the National Science and Technology Council (NSTC) in 1993 to coordinate the diverse parts of the Federal research and development enterprise, especially activities requiring resources from more than one Federal department or agency.

In more than 7 years of operation, the NSTC has assumed a prominent role in developing and advancing the Administration's broad-based research and development investment portfolio. One aspect of the *2000 Annual Report* is particularly pleasing: In repeated instances, we see the NSTC encouraging cooperation between the public and private sectors, resulting in new research and technology payoffs that far exceed those either party might reasonably expect.

With a strong budgetary commitment to the 21st Century Research Fund, we are enjoying the largest increase in civilian research in a generation. This is an historic period of investment in science and technology that augurs well for the future. The *2000 Annual Report* describes the careful stewardship by the NSTC of this investment--and affords us confidence that the Nation will reap considerable benefits from the investment.

Sincerely,

Neal Lane
Assistant to the President for
Science and Technology

National Science and Technology Council 2000 Annual Report

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EXECUTIVE SUMMARY

“It is our responsibility to open the world of science to more of our fellow citizens; to help them understand the great questions science is seeking to answer and to help them see how those answers will actually affect their lives and their children’s lives in profoundly important and positive ways.”

President Bill Clinton
January 21, 2000

The outputs of science and technology (S&T) have driven economic growth and improvements in the quality of life in America for more than 200 years. They generate new knowledge and new industries, create new jobs, ensure economic and national security, reduce pollution and increased energy efficiency, provide better and safer transportation, improve medical care, and increase living standards for the American people.

The President established the National Science and Technology Council (NSTC) in 1993 to ensure that the Nation’s investment in S&T is coordinated among the diverse parts of the Federal research and development (R&D) enterprise. In 2000, the NSTC worked closely with the Office of Management and Budget (OMB) to develop R&D budget guidance for the Federal departments and agencies so that our S&T investments are integrated into the overall national agenda.

Most striking of all has been the NSTC’s crucial leadership role in securing the budget commitment to S&T known as the 21st Century Research Fund. The NSTC provided the forum for Cabinet members and Agency heads to converge on a formula for stability and growth for the Nation’s highest priority research programs. It is unprecedented, and enables the cutting-edge research that will keep our economy strong, and our Nation at the forefront of the global S&T enterprise.

The NSTC worked by means of five goal-oriented committees, each of which is chaired jointly by a senior agency official and an Office of Science and Technology Policy (OSTP) Associate Director: Committee on Environment and Natural Resources; Committee on International Science, Engineering, and Technology; Committee on National Security; Committee on Science; and Committee on Technology

These standing committees, along with ad hoc working groups within the NSTC, continue to provide an effective forum to resolve crosscutting issues. In 2000, their work ranged from coordinating national initiatives for increased investment in nanotechnology and information technology, to collaborating on a strategy to combat emerging infectious diseases, to disseminating information – such as a program guide to Federally funded environment and natural resources R&D.

National Science and Technology Goals

President Clinton made a commitment to the American people to integrate Federal agency R&D budgets to ensure that the Nation's S&T investments served broad national goals, as well as agency missions. In 2000, the NSTC undertook activities related to the following broadly stated S&T goals: maintaining world leadership in science, mathematics, and engineering; promoting long-term economic growth; sustaining a healthy, educated citizenry; improving environmental quality; harnessing information technology; and enhancing national security and global stability

R&D Budget Guidance

Through the NSTC, Federal agencies and departments have identified a set of R&D areas that are important national efforts requiring coordinated investments across several agencies. As with all R&D investments, these interagency priority areas should reflect our objectives of maintaining excellence, maximizing effectiveness, and minimizing costs. This budget guidance, rather than providing an exhaustive list of all Administration R&D priorities, focuses on those activities that require a significant level of interagency coordination.

The Administration's approach to investments in S&T is guided by several fundamental principles (Appendix A). In general, Federal R&D investments should: a) sustain and nurture America's world-leading S&T enterprise, through pursuit of specific agency missions and through stewardship of critical research fields and scientific facilities; b) strengthen science, mathematics, and engineering education, ensure their broad availability, and contribute to preparing the next generation of scientists and engineers; c) focus on activities that require a Federal presence to attain national goals, including national security, environmental quality, economic growth and prosperity, and human health and well being; and/or d) promote international cooperation in S&T that would strengthen the advance of science and achievement of Administration priorities. These principles apply to all Federal R&D investments. They are particularly vital to the success of investments made through the 21st Century Research Fund, which promotes long-term stability and near-term growth for the highest priority research programs.

President's Committee of Advisors on Science and Technology

President Clinton established the President's Committee of Advisors on Science and Technology (PCAST) to advise him on matters involving S&T and to assist the NSTC in securing private sector involvement in its activities. The PCAST, which consists of distinguished individuals from industry, education and research institutions, and other non-governmental organizations, serves as the highest-level, private-sector advisory group for the President and the NSTC. The direct link to the activities of the NSTC reflects the Administration's intention to incorporate advice from the private sector

in developing the S&T budgets and policies of this Administration and to secure private sector advice on the implementation and evaluation of budgets and policies. Appendix B describes 2000 accomplishments of the PCAST.

NATIONAL SCIENCE AND TECHNOLOGY GOALS

The NSTC, through its Committees, focuses Federal R&D activities on the President's goals for S&T. These goals include:

Maintaining World Leadership in Science, Mathematics, and Engineering

The Administration is unequivocally committed to maintaining leadership across the frontiers of scientific knowledge. The nation's prior investment has yielded science and engineering advances without peer, promoted science and engineering education, and contributed to technological innovation. This scientific strength is a treasure on which we must continue to build. Thus, even as the deficit reduction efforts constrained Federal funding, the Administration protected and increased the level of investment in basic science programs.

Promoting long-term Economic Growth

Technical progress is the single most important factor in generating sustained economic growth, estimated to account for as much as half of the nation's long-term growth over the past 50 years. Technology underpins our fastest growing industries and high-wage jobs, provides the tools needed to compete in every business today, and drives growth in every major industrialized nation.

Sustaining a Healthy, Educated Citizenry

Improving the health of our nation's citizens continues to be a major goal of our Federal investment in S&T. Starting in 1862 with financial support for our Land Grant institutions and State Agricultural Experiment Stations, and through the establishment in 1887 of the laboratory that became the National Institutes of Health (NIH), the United States has developed a system of intra- and extramural support for health-related research. We have more recently committed ourselves to similar efforts in science, engineering, and mathematics education. The degree to which our nation prospers in the 21st century will depend on our abilities to develop scientific and technical talent in our youth, to provide lifelong learning to a well-educated workforce able to embrace the rapid pace of technological change, and to raise the level of public scientific and technological literacy.

Improving Environmental Quality

Environmental issues are enormously complex, requiring scientific understanding that is both deep and broad in order to address them. The dramatic increases in world population and industrial activities during the last century are affecting the environment in profound and potentially irreversible ways. The future of the United States rests on our ability to sustain the bounty of natural resources our environment provides.

Improving environmental quality requires supporting a broad and comprehensive research agenda, including observing, documenting, understanding, assessing, and predicting environmental change and its consequences; using natural resources in a sustainable manner; understanding and preserving biodiversity; and developing analytical tools that integrate social, economic, and natural sciences to support policy formulation and decision making that prevents or mitigates adverse effects on public health or ecological systems.

Harnessing Information Technology

No technology promises to affect our world more profoundly than the rapid sweep of digital technology. Every sector of our economy – manufacturing and services, transportation, health care, education, and government – is being transformed by the power of information technologies to create new products and services and new ways to communicate, resulting in significant improvements in productivity and knowledge sharing.

Enhancing National Security and Global Stability

National security and global stability are critical areas where international S&T collaboration and interagency coordination are needed for progress. Collaboration and coordination are needed because the issues faced cannot be solved through the efforts of a single country or a single agency. Threats to human health and safety, such as diseases and natural disasters, do not recognize national borders and require international coordination and effective application of S&T. International S&T relations have become an integral part of the overall U.S. foreign policy and play a vital role in the nonproliferation of weapons of mass destruction, arms control, meeting the challenges of global threats, and strengthening economic security.

2000 ACTIVITIES OF THE NSTC

The diversified Federal research portfolio serves the multiplicity of missions for which our Federal departments and agencies are responsible. This distributed system of research funding provides strong linkages between research and the core agency missions, but also places a premium on coordination of agency programs. Three NSTC initiatives are of a scale that requires coordinating offices for their management.

Global Change Research

The U.S. Global Change Research Program (USGCRP) seeks to provide a sound scientific understanding of the human and natural forces that influence climatic and other changes in the Earth system, and thus provide a sound scientific basis for national and international decision-making on global-change issues. The program supports research in several fundamental, interdisciplinary research elements, including: Understanding the Earth's Climate System; Understanding the Composition and Chemistry of the Atmosphere; Global Water Cycle; Global Carbon Cycle; Understanding Changes in Ecosystems; Understanding the Human Dimensions of Global Change; and Paleoclimate.

In its first decade, research supported by the program led to substantial increases in knowledge, advanced predictive understanding, and documented evidence of global environmental change, including major scientific advances in the understanding of stratospheric ozone depletion, the El Niño-Southern Oscillation phenomenon, global climate change, tropical deforestation, and other issues. In 2000, the USGCRP continued work on a major effort to develop a Long Term Research Plan setting out goals, objectives, and key scientific research challenges and management perspectives to guide the program in its second decade. A draft plan, drawing on the framework of key research challenges identified in several reports by the National Research Council (NRC), will be reviewed by the NRC in early 2001.

The U.S. National Assessment of the Potential Consequences of Climate Variability and Change, conducted under the USGCRP pursuant to the Global Change Research Act of 1990 and a request by the Assistant to the President for Science and Technology, continued in 2000. In November, the National Assessment Synthesis Team (NAST) transmitted *Climate Change Impacts on the United States: The Potential Consequences of Climate Variability and Change* to the Subcommittee on Global Change Research of the NSTC's Committee on Environment and Natural Resources and to the OSTP. In turn, the OSTP provided copies of the report to the President and to the leaders of Congress and appropriate committees. The NAST's overview report has been published in book form by Cambridge University Press. The NAST, chartered under the Federal Advisory Committee Act, is a committee of experts drawn from governments, universities, industry, and nongovernmental organizations. The National Assessment, built on a solid foundation of science conducted as part of the USGCRP, is a landmark

achievement in the major ongoing effort to understand what climate change means for the United States.

During 2001, strong support for basic global change research across the broad scope of the Earth system sciences will be maintained. Enhanced efforts will include moving forward with an interagency implementation plan for the USGCRP Carbon Cycle Science Initiative; development of an interagency Global Water Cycle program based on a Global Water Cycle Science Plan developed by leaders in the scientific research community; and enhanced surface-based climate observations, including first steps in the creation of a U.S. Climate Reference Network.

A full description of the USGCRP program and budget and highlights of research accomplishments is contained in *Our Changing Planet*, an annual report to Congress published since 1989. In 2000, the USGCRP published the 2001 edition of *Our Changing Planet*. In 2000, the USGCRP substantially upgraded its Web site and will continue to develop the site as a source of ready access to information about the program and the research that it supports. The web site for the USGCRP is: <http://www.usgcrp.gov/>.

Information Technology R&D

In 2000, the NSTC coordinated the Federal Government's information technology (IT) R&D investments through the Information Technology R&D Interagency Working Group. Today's Federal IT R&D program enables the advancement of the technologies needed in software, information infrastructures, and applications in support of both the Nation's scientific and socioeconomic goals. Built on the foundation of the highly successful High Performance Computing and Communications (HPCC) program, IT R&D also includes the Next Generation Internet (NGI) initiative and the Information Technology for the Twenty-First Century (IT²) initiative. The National Coordination Office for Information Technology Research and Development (NCO/ITR&D) (formerly the National Coordination Office for Computing, Information, and Communications) coordinates the program, while program oversight is provided by a group of NSTC Principals.

The long-term R&D funded through the interagency Federal IT R&D program helps accelerate advances in computing, information, and communications technologies. These advances not only are essential for Federal agencies to fulfill their missions, but also help to assure national security and to meet national goals for improving environmental management, ensuring access to health care, providing tools for lifelong learning and training, and sustaining U.S. economic competitiveness. The program is organized into five Program Component Areas (PCAs) that make up the multiagency IT R&D portfolio: High End Computing (HEC), Large Scale Networking (LSN), Human Computer Interaction and Information Management (HCI&IM), Software Design and Productivity (SDP), High Confidence Software & Systems (HCSS), and Social,

Economic, and Workforce Implications of IT (SEW). A Coordinating Group for each PCA reports to the Interagency Working Group on IT R&D.

Accomplishments of the IT R&D programs in FY2000 are described in *Information Technology: The 21st Century Revolution*, a Supplement to the President's FY 2001 Budget (<http://www.ccic.gov/pubs/blue01>). Additionally, the NSTC sponsored the following IT R&D -related events during 2000:

- Critical Aviation Systems Workshop, February 2000
- Co-sponsored PKI for Advanced Network Technologies Program, April 2000
- Mass Storage Briefings, June 2000
- Co-sponsored The Blue Gene Parallel Supercomputer: Calculating at the Speed of Life, August 2000
- Gigabit Networking Workshop, August 2000
- IEEE/ACM SC2000 IT R&D Research Exhibit and Information Technology/Next Generation Internet Demonstrations, November 2000
- Medical Device Software Safety Workshop, November 2000

Information Technology for the Twenty-First Century Initiative

In February 2000, the President proposed a \$594 million increase in funding for IT R&D. This new investment is a continuation of support established for priority research areas established under the Information Technology for the Twenty-First Century (IT²) initiative launched in FY2000. The increases generated by the initiative, which is an integral part of the Federal IT R&D program, came in response to recommendations by the President's Information Technology Advisory Committee (PITAC) to sharply increase support for fundamental IT research over a period of 5 years. Funding increases for IT R&D have drawn bipartisan support from Congress, which provided approximately two-thirds of the President's request in FY2000. Appropriations for FY2001 are expected to amount to about 94 percent of the President's request, for a total IT R&D investment of \$2.006 billion.

The IT R&D agencies continued to support the basic goals established in last year's initiative, focusing on fundamental research in software; development of information systems that ensure privacy and security of data and allow people to get information they want, when they want it, in forms that are easy to use; support for continued advances in high-speed computing and communications, including work needed to ensure that raw speed translates into usable speed; and work to understand the social, economic, and other impacts of IT with emphasis on ensuring that all Americans will benefit from these technologies. The U.S. research community responded to last year's call for research ideas with a flood of creative new proposals. Priority research areas in FY2001 include:

- teams to exploit advances in computing;
- infrastructure for advanced computing;
- storing, managing, and preserving data;
- managing and ensuring the security and privacy of information;
- ubiquitous computing and wireless networks;
- intelligent machines and networks of robots;
- future generations of computers;
- more reliable software;
- broadband optical networks; and
- education and training for a new generation of researchers.

Next Generation Internet

The Next Generation Internet (NGI) initiative, coordinated by the LSN Coordinating Group, is a key component of the IT R&D's Large Scale Networking research agenda. Now in its fourth year, the initiative has exceeded its initial testbed goals for end-to-end performance, connecting approximately 200 sites to the 100-times-faster testbed (the goal was 100) and 15 sites to the 1000-times-faster testbed (the goal was 10). More than 300 NGI applications requiring advanced networking and demonstrating testbed capabilities have been developed and documented since the program's inception. Applications include distance education, telemedicine, national security, and collaboratories – laboratories without walls.

In 2000, NGI research addressed the following issues: 1) how host computers interact with network components; 2) how applications can signal their resource needs to the network; 3) how application users can monitor the resources they receive, and how to correct problems when they occur; 4) how the network can notify the application when problems occur; and 5) how network administrators can verify the correct operation of the network when multiple network resource requirements are present. A NGI network testbed provided required support for the development and testing of revolutionary applications. It was built on the following networks: NSF's very high performance Backbone Network Service (vBNS), NASA's Research and Education Network (NREN), DoD's Defense Research and Education Network (DREN), and the Abilene network sponsored by the university/private sector consortium, Internet2. This testbed, interconnecting a large number of sites, allows scaling and other operational issues to be examined.

Seven NGI applications were demonstrated at the November 2000 IEEE/ACM SC2000 Conference. The applications, which included high definition television (HDTV), large file transfers, Digital Amphitheater, and Distributed Image Spreadsheet, a near-real-time visualization of the Earth's environment, required Gbps service provided by the Supernet, a cross-country network funded by DARPA's NGI Program. The Supernet is composed of several interconnected and interoperating testbeds. It is used by

more than 40 research institutions for network and applications research, often in partnership with industry. More than 15 Supernet applications have been developed and documented.

NGI capabilities are being successfully transferred via partnerships with industry and academia. For example, researchers and commercial users are accessing Abilene and the vBNS+ thanks to the NGI's longstanding collaboration with Internet2. Distributed science collaboration toolsets have been deployed. In addition, high performance research networks have been interconnected through STAR-TAP, which includes 12 international research networks and 6 US research networks.

President's Information Technology Advisory Committee

Established by President Clinton in 1997, the President's Information Technology Advisory Committee provides the NSTC with guidance to accelerate development and adoption of information technologies vital for American prosperity in the 21st century. The PITAC's term extends to February 2001.

During 2000, the PITAC continued to explore "National Challenge Transformations," many of which were first identified in its 1999 report, *Information Technology Research: Investing in Our Future*. The Committee convened several member-led panels, invited speakers, and held workshops to assess specific technology needs. Five panels focused on national IT challenges: Transforming Government, Transforming Health Care, Transforming Learning, Transforming National Security, and Transforming Individual Security. Another five panels explored critical technology issues that span application areas, including Digital Divide Issues, Digital Libraries, International Issues, Open Source Software, and Next Generation Wireless Communications.

PITAC panel reports completed in 2000 include:

- *Report to the President on Resolving the Digital Divide* (February, 2000)
- *Report to the President on Transforming Access to Government* (August, 2000)
- *Report to the President on Developing Open Source Software to Advance High End Computing* (September, 2000)

Additional reports from the Digital Libraries, Learning and Health Care Panels are expected early in 2001. Work in the areas of national security, individual security, and next generation wireless communications was initiated late in 2000 and should be a major part of the PITAC's 2001 agenda.

Members of the PITAC held a panel discussion on Open Source Software for High End Computing during the November 2000 IEEE/ACM SC2000 Conference. Full

meetings of the PITAC were held February, May, and September 2000. The PITAC conducted its annual review of the NGI Initiative, as mandated by the Next Generation Internet Research Act of 1998, and was asked by the White House to review its FY 2001 IT R&D budget proposals. Results of these activities are presented in the following reports:

- *PITAC Year 2000 Report to Congress Reviewing the Next Generation Internet Program and Related Issues* (April, 2000); and
- *Letter to the President on PITAC's Review of the Federal FY 2001 Budget Request for the IT R&D Programs* (July 28, 2000).

Nanoscale Science, Engineering, and Technology

In 2000, a permanent Subcommittee on Nanoscale Science, Engineering, and Technology was chartered under the auspices of the NSTC's Committee on Technology. The Subcommittee is implement the National Nanotechnology Initiative, to:

- assure continued U.S. leadership in nanoscale science, engineering, and technology (NSET);
- satisfy the needs of the Federal Government for advanced NSET; and
- accelerate development and deployment of NSET to maintain world leadership in science, engineering, and mathematics; enhance national security; improve U.S. competitiveness; improve the health of the U.S. citizenry; protect the environment; improve education; and enhance the quality of life.

The Subcommittee is composed of representatives from agencies who participate in the NNI, or have plans for future participation, and White House officials. Initial membership includes the lead agency—National Science Foundation, Department of Commerce, Department of Defense, Department of Energy, Department of Transportation, Environmental Protection Agency, National Aeronautics and Space Administration, and National Institutes of Health.

Of the total \$495 million request for NNI, funding totaled \$423 million for FY-2001. The NNI request was a \$225 million increase from the funding received in FY-2000 for nanotechnology research and development. The initiative supports a broad range of scientific disciplines including material sciences, physics, chemistry, and biology, and creates new opportunities for interdisciplinary research.

The PCAST strongly endorsed the establishment of the NNI, beginning in 2001, saying that now is the time to act. The PCAST characterized the NNI as having an excellent multi-agency framework to ensure U.S. leadership in an emerging field that will be essential for economic and national security leadership in the first half of the next century.

Roughly 70 percent of the new funding proposed under the NNI will go to university-based research. These funds will help meet the growing demand for workers with nanoscale science and engineering skills. This will support long-term nanoscale R&D leading to potential breakthroughs in areas such as materials and manufacturing, nanoelectronics, medicine and healthcare, environment, energy, chemicals, biotechnology, agriculture, information technology, and national security.

This initiative builds upon previous and current nanotechnology programs. The research strategy is balanced across five kinds of activities: fundamental research; centers and networks of excellence; research infrastructure; grand challenges; and ethical, legal, and social implications and workforce programs.

An interagency memorandum of understanding created a National Nanotechnology Coordination Office (NNCO) to serve as the secretariat to the NSET Subcommittee, providing day-to-day technical and administrative support. The NNCO will support the NSET Subcommittee in the preparation of multiagency planning, budget, and assessment documents. The NNCO will also be the point of contact on Federal nanotechnology activities for government organizations, academia, industry, professional societies, foreign organizations, and others to exchange technical and programmatic information.

COMMITTEE ON ENVIRONMENT AND NATURAL RESOURCES

The purpose of the Committee on Environment and Natural Resources (CENR) is to foster and implement a coordinated multi-agency and interdisciplinary focus for Federal environmental R&D. CENR pursues the goals of maintaining biological diversity, protecting and improving air and water quality, reducing exposure to toxic substances, limiting losses from natural disasters, understanding climate change, and providing for sustainable use and management of natural resources. CENR accomplishes its goals largely through the work of its five Subcommittees – Ecological Systems, Toxics and Risk, Air Quality Research, Natural Disaster Reduction, and Global Change Research. (The Subcommittee on Global Change Research coordinates the activities of the USGCRP, described on p.6, herein.)

Ecological Systems

The Subcommittee on Ecological Systems is working to improve the scientific foundation for conservation, sustainable use, and management of ecological systems. An understanding of the relationships between environmental stresses and changes in ecosystem structure and function is essential to this effort and to meet societal needs in agriculture, forestry, fisheries, recreation, medicine, and quality of life. The focus of the Subcommittee is to coordinate research efforts to document change, synthesize and assess information, understand processes and the effect of scale, predict change, and provide for management and restoration.

In 2000, the Subcommittee continued to lead the development of a CENR-wide research initiative known as Integrated Science for Ecosystem Challenges (ISEC). The goal of this initiative is to monitor and understand the effects of environmental stresses on ecosystems with an emphasis on using the most recent technologies and approaches to ecological research. The Subcommittee continued to coordinate the budget requests of eight federal agencies on four critical areas: invasive species, biodiversity, and species decline; harmful algal blooms, hypoxia and eutrophication; habitat conservation and ecosystem productivity; and information management, monitoring, and integrated assessment.

The Subcommittee held a planning workshop in 2000 to refocus the long-term ISEC strategy. As a result of the workshop, ecological forecasting was adopted as an organizing focus for future ISEC activities. A priority will be to develop and improve ecological forecasts to better predict the impacts of physical, biological, and chemical changes on ecosystems, ecosystem components, and people. This focus on forecasts provides a solid bridge and common language between science and policy and builds on the recent convergence of new ecological theory, improved observation technologies, and advanced computational capabilities. The Subcommittee prepared a white paper on ecological forecasting that describes the state-of-the science, agency capabilities, and future options.

The Subcommittee sponsored a symposium at the 2000 Annual Meeting of the American Association for the Advancement of Science entitled, “New Strategies for Understanding Ecosystems.” National scientific leaders addressed ecological research, monitoring, informatics, and assessment.

The Subcommittee is working with the Subcommittee on Global Change Research to develop ecological components of the revised, 10-year USGCRP strategy.

The Subcommittee’s Task Teams also had significant activity in 2000. The Harmful Algal Blooms/Hypoxia Task Team completed the *Integrated Science Assessment of the Causes and Consequences of Gulf of Mexico Hypoxia* and the *National Assessment of Harmful Algal Blooms* called for in the Harmful Algal Bloom and Hypoxia Research and Control Act. The Gulf Hypoxia Assessment formed the basis for delivery to Congress of an intergovernmental Action Plan for reducing nitrogen loads to the Gulf from the 31-State Mississippi River Basin.

The Biodiversity and Ecosystem Informatics Task Team continued its promotion of the research agenda for bioinformatics as developed in ISEC and by the PCAST to the broader, non-Federal community. Three national workshops were sponsored in 2000, including a workshop on linkages between the biological sciences and computer and information sciences; a workshop on integrating remote sensing and biodiversity data; and a workshop to increase awareness and participation among nongovernment stakeholders in the development of the “next generation” of the National Biological Information Infrastructure (NBII) as a network of advanced nodes in selected regions around the United States.

The Invasive Species Task Team developed an invasive species research strategy that facilitates and supports Federal agency responsibilities set forth in Executive Order 13112 on Invasive Species (February 3, 1999). The team also assisted in the identification of research needs and opportunities to support the National Invasive Species Management Plan being prepared under the Order.

The Salmon Science Team completed an informal inventory of ongoing Federal science programs in the Pacific Northwest focused on protection, recovery, and restoration of salmonids and related species, and developed a statement of salmon science research needs (*Science Needs for Pacific Salmon and Related Species*) that build on current programs to meet the needs of resource managers. The Team also aided a scientific assessment of significant risks to salmon and related species throughout their life cycle, and of the role of mitigation and recovery options in reducing these risks, along with identification of significant gaps in scientific knowledge and priorities for addressing these gaps (*From the Edge: Science to Support Restoration of Pacific Salmon*). The Team is now working on a package of proposed multi-agency research initiatives for FY 2002 to address the research gaps identified in these two documents.

Toxics and Risk

The Subcommittee on Toxics and Risk coordinates research on existing and emerging issues related to toxic substances and their effects on human and ecological health. The Subcommittee sponsors the development of multi-agency research strategies, state-of-knowledge assessments on toxic substances effects, and new initiatives to address important issues that cut across agency programs and interests.

The Subcommittee's Interagency Working Group on Endocrine Disruptors continues to lead national and international efforts to define the scope of the endocrine-disruptor problem, identify areas of scientific uncertainty, and conduct research. In 2000, the group's focus centered on: issuance of a multi-agency research solicitation in the form of a Request for Applications; and discussion and outreach on the international level to develop research partnerships with other governments.

U.S. agencies continue to successfully coordinate their endocrine-disruptor research efforts. A joint solicitation among the National Institute for Occupational Safety and Health (NIOSH), the Centers for Disease Control and Prevention (CDC), the U.S. Environmental Protection Agency (EPA), the National Cancer Institute (NCI), and the National Institute of Environmental Health Sciences (NIEHS) was issued in June 2000. The solicitation was a specific result of identification of research gaps by the IWG, and sought research applications that would investigate the relationships between exposure to endocrine disruptors and adverse health effects, particularly reproductive and developmental effects in humans.

Discussions continue between the U.S. agencies and the European Union (EU) on opportunities for collaborative research programs. In 2001, the IWG plans to examine updating the Global Endocrine Disruptor Research Inventory (GEDRI), for which the EU's Joint Research Center in Ispra, Italy, has assumed overall responsibility; and review the forthcoming IPCS/WHO State-of-the-Science Assessment for endocrine-disrupting chemicals.

The IWG on Mercury was briefed on the National Research Council's (NRC) *Toxicological Effects of Methylmercury*. This July 2000 report was requested by Congress to evaluate data on the health effects of methylmercury, with particular emphasis on most recent human data and to provide recommendations regarding issues relevant to the derivation of an appropriate health benchmark or RfD for methylmercury. The report concludes that methylmercury is a highly toxic substance with particular concern for neurotoxicity, especially in developing organisms. It included specific recommendations for risk assessment grounded in the most recent, thoroughly evaluated human studies. Federal agencies agreed that the study would be helpful in the ongoing effort to update perspectives on risks from methylmercury.

Federal agencies have long recognized the need for better, more-complete human exposure data. When gathered for the U.S. population, such data can help identify new or previously unrecognized hazards related to chemical substances found in the environment, monitor changes in exposure over time, and establish the distribution of exposure levels among the general population. These data can also help identify subpopulations -- such as children, low-income groups, and ethnic minorities -- that might be at increased risk, because they face particularly high levels of exposure. In 2000, subcommittee representatives from EPA, NIEHS and CDC developed a concept paper for an Interagency Human Exposure Monitoring Survey. Based on this report and the General Accounting Office's *Toxic Chemicals: Long-Term Coordinated Strategy Needed to Measure Exposures in Humans* (May 2000), the Subcommittee decided that additional, interagency discussions would be beneficial. An existing, informal group--the Research Directors' Forum, composed of the directors of Federal environmental health research programs--continued the discussions at its spring and summer meetings and decided to seek the formal establishment of an IWG on Human Exposure. Steps will now be taken to formally establish such a group including the participation of other Federal agencies and eventually other key stakeholders.

Air Quality Research

Air quality issues continue to be at the forefront of the Nation's environmental agenda. The Air Quality Research Subcommittee (AQRS) serves as a forum for joint research planning and coordination among the Federal agencies engaged in air quality research. The interest and participation by the member agencies is testimony to their commitment to improved communication and enhanced effectiveness and productivity for Federal air quality research.

The Subcommittee's efforts are guided by its 1998 Strategic Plan. The Plan identifies the five most pressing air quality issues facing the Nation as particulate matter (PM) and visibility; ozone and associated air pollutants; acidic deposition; hazardous air pollutants (i.e., air toxics); and indoor air quality.

The Subcommittee's monthly meetings have focused on a series of research themes. As such, the meetings identify key information gaps affecting environmental policy and the development of collaborative programs to provide the needed information. When appropriate, brief white papers are prepared to describe the issue and the underlying science, ongoing and planned Federal research, and gaps in knowledge and capability. These reports are intended as information pieces to guide the development of future Federal research and communicate a joint Federal perspective to agency leadership and outside interests.

The Subcommittee made good progress in 2000 on coordination of particulate matter research. EPA has recently revised the air quality regulations for PM in response to research linking fine-particle exposure to increased illness and death. (Issues related to

the PM standards are currently undergoing Supreme Court review.) This problem is exacerbated by the lack of a clearly identified agent responsible for the observed health impacts. The AQRS has been working to foster close linkage among the health-effects, exposure, and atmospheric-research communities. The Subcommittee held several sessions discussing PM research programs in the member agencies, thereby avoiding unwarranted duplication and identifying opportunities for collaboration and cooperation. An inventory of atmospheric PM research in the Federal sector has been prepared and was presented to the NRC Committee on Research Priorities for Airborne Particulate Matter. The Subcommittee has worked to expand the role of the North American Research Strategy for Tropospheric Ozone (NARSTO) to include PM research. The Subcommittee worked through NARSTO and EPA to hold a workshop on PM measurements that brought together the health-effects, exposure, and air-quality communities, for the first time, to jointly develop a coordinated measurement program for PM. This multi-disciplinary effort resulted in specific recommendations for future research directions that are detailed in *Atmospheric Observations: Helping Build the Scientific Basis for Decisions Related to Airborne Particulate Matter*.

Building on the success of the workshop, the Subcommittee established a PM Research Working Group to provide a forum for ongoing communication among the health-effects, exposure, and atmospheric-science research communities. The group is working to craft a national PM research plan that integrates existing agency programs and is guided by the priorities and missions of the individual agencies and the recommendations of the NRC Committee on Research Priorities for Airborne Particulate Matter.

In 1998, the Subcommittee published an inventory of Federal PM research, *Atmospheric Particulate Matter Research: Inventory of Federal Research Programs*. The report provided the impetus for a similar effort (coordinated through NARSTO) in the private sector. The results of both efforts have formed the basis of a comprehensive inventory of PM-related research—both health and atmospheric processes—that is being maintained by the Health Effects Institute. An accurate catalogue of ongoing and planned research is the first step in the productive integration of existing programs and the joint planning of future efforts. In 2001, the PM Working Group will complete a strategic plan to govern its future direction and provide a framework for discussions.

In the area of atmospheric ammonia, the Subcommittee published *Atmospheric Ammonia: Sources and Fate – A Review of Ongoing Federal Research and Future Needs* (June 2000). A white paper on intercontinental transport of air pollution is due for release in early 2001. These reports are part of a series intended to guide the productive integration of Federal air quality research.

The Subcommittee's plans for 2001 call for a review and updating of the Strategic Plan. In addition, the Subcommittee intends to explore several new areas including:

- linkages between air quality and climate;
- air-quality forecasting; and
- integration of long-term research monitoring .

Natural Disaster Reduction

The Subcommittee on Natural Disaster Reduction (SNDR) is working to coordinate a multidisciplinary and multi-agency suite of research, application, and technology-transfer activities relating to disaster reduction. All SNDR activities are aimed at reducing the loss of lives and the cost of natural disasters to the U.S. economy. Key aspects of this program include improving analytical, modeling, forecasting, prevention, restoration, and information dissemination tools and focusing R&D and emergency preparedness efforts on improving future risk-assessment and risk-management capabilities.

Since 1999, SNDR has sponsored a series of interagency research reviews. The purpose of these reviews is to bring Federal researchers, managers, and policymakers together to review the state of knowledge in specific areas related to SNDR activities, discuss ongoing research programs and management needs, and make recommendations for improved coordination and changes in research focus. Reviews on *Fire in the Natural and Built Environments* and *Remote Sensing Applications for Risk and Vulnerability Assessment* are being finalized. A third review on *Risk Assessment* is planned for early 2001.

In 1998, SNDR and the Institute for Business and home safety established the Private Public Partnership 2000 (PPP-2000) to seek opportunities for government, nonprofit, and private-sector organizations to work together to reduce vulnerability to natural hazards in U.S. communities. PPP-2000 held a series of forums to foster novel partnerships among participants to address natural-disaster-reduction issues. Reports from each forum can be found at: <http://www.usgs.gov/ppp2000/index.html>. A final report synthesizing the lessons learned is due at the same site. In 2000, SNDR's working group on Natural Disaster Information Systems reported on *Effective Disaster Warnings* (http://www.nnic.noaa.gov/CENR/NDI_rev_Oct27.pdf).

The International Workgroup is preparing a white paper on the role of the U.S. government in disaster reduction in the international arena and is also working on a unified strategy. SNDR will continue to work with agencies across the Federal Government to improve coordination of loss-reduction activities, not only in areas of real-time monitoring and warning systems, but also in risk assessment and risk reduction. SNDR will also continue to encourage emerging, public-private partnerships to develop interoperable disaster information and warning systems. In 2001, SNDR will promulgate a revision of its 1996 Strategic Plan at <http://www.usgs.gov/sndr/>.

Program Guide to Federally Funded Environment and Natural Resources R&D

In 2000, the CENR released the fifth edition of the *Program Guide to Federally Funded Environment and Natural Resources R&D*. This document serves as a reference for colleges, universities, and other research institutions. The program guide describes the competitive processes for merit review and evaluation, describes potential funding sources, and provides points of contact and web site information for all agency extramural-funding programs.

COMMITTEE ON INTERNATIONAL SCIENCE, ENGINEERING, AND TECHNOLOGY

The Committee on International Science, Engineering and Technology (CISSET) addresses international scientific cooperation as it relates to foreign policy and the Nation's R&D agenda. CISSET's mandate is not defined within any particular area of S&T. Rather, CISSET's role is to review the wide range of bilateral and multilateral international scientific programs carried out by the technical agencies in the U.S. Government, and to identify opportunities for international cooperation and interagency coordination in response to new needs and opportunities. CISSET's activities are directed towards three broad, complementary goals:

- to identify and coordinate international cooperation that can strengthen the domestic S&T enterprise and promote U.S. economic competitiveness and national security;
- to utilize American leadership in S&T to address global issues, and to support the post-Cold War tenets of U.S. foreign policy – promoting democracy, maintaining peace, and fostering economic growth and sustainable development; and
- to coordinate the international aspects of Federal R&D funding across the Federal agencies.

CISSET supported the following working groups during 2000: the Working Group on the Intellectual Property Rights Annex in International S&T Agreements; the Emerging Infectious Diseases Task Force; the International Water S&T Working Group; the Agricultural Biotechnology S&T Capacity Building in Developing Countries Working Group; and working groups on U.S. bilateral and multilateral relationships.

Intellectual Property Rights in International S&T Agreements

Over the past decade, the provisions defining intellectual property rights (IPR) in international S&T agreements have hampered collaboration with key partner countries of the U.S. Government. Federal agencies engaged in international S&T collaborations agreed to consider solutions to the problem. In 1999, CISSET tasked an IWG with reviewing the application of the 1990 Model Annex in international S&T agreements to consider whether the model annex approach was the most effective mechanism for allocating U.S. intellectual property rights in international S&T agreements and whether the current language needed modification. The IWG reached consensus on the need for a new policy approach emphasizing greater flexibility and alternative options. There was disagreement on whether the existing text or updated text should be used as the starting point for future negotiations until October 2000, when the IWG requested guidance on this issue from CISSET. As a result, the IWG continued its work and successfully developed a protocol for future use of the IPR annex in international S&T Agreements.

The core of the new policy approach is the adoption and use of an “IPR Annex Package” which includes a number of options for IPR Annexes, a 1990 Model Annex text, and the Revised 2000 IPR Annex Text, as well as criteria that can be applied to determine which of these texts might be most appropriate under different conditions.

With the changes introduced in the Revised 2000 IPR Annex Text, the U.S. Government hopes to avoid unnecessary future conflict with some international S&T partners who often perceive the 1990 Model Annex language to be structurally inequitable – because the U.S. market is often far greater in size than the partner country and U.S. laws provide the broadest protection in most cases. Only international S&T partners that meet the conditions for the use of the Revised 2000 IPR Annex Text would be entitled to the revised language.

The new approach calls upon an agency which develops a draft international S&T agreement to select an IPR Annex text option appropriate to the agreement the agency is considering, based on the new IPR Annex Package and on consultations with agencies with specific interest in IPR issues. Such agencies include, for example, the U.S. Department of State and the Office of the U.S. Trade Representative. In addition, new guidelines are being drafted by the IWG to provide further instructions for agencies to implement the new policy approach. The value of this approach is its inherent flexibility, which permits the U.S. to adapt its international IPR policy to changes in S&T worldwide.

Emerging Infectious Diseases

The Task Force on Emerging Infectious Diseases represents the second phase of a U.S. Government effort to promote interagency action to combat infectious diseases. The first phase was launched in 1995 with the publication of *Infectious Disease - A Global Health Threat*, a Government-wide review of our Nation’s ability to protect our citizens from emerging infectious diseases. The review concluded that existing mechanisms for surveillance, response, and prevention of outbreaks of emerging infectious diseases were inadequate, both at home and abroad. It became the basis of a 1996 Presidential Decision Directive that established a new national policy to address the growing health and national security threat posed by infectious diseases, including the potential threat of bioterrorism. In 1996, a Task Force on Emerging Infectious Diseases was formed to implement the new policy.

Over the past 5 years, the Task Force members have worked together and with international partners to:

- build global capacity for disease surveillance and outbreak response;
- support research and training as the key to the prevention and control of outbreaks;
- create partnerships with the private sector to ensure the availability of drugs,

- vaccines, and emergency medical supplies; and
- encourage other nations to make infectious disease control a national priority.

Task Force accomplishments include:

- increased agency engagement on global infectious disease issues;
- increased support for research and global capacity building on a broad range of emerging infectious diseases;
- better interagency coordination; and
- increased Administration and congressional support.

These accomplishments have occurred against a backdrop of new, reemerging, or drug-resistant infections. As a result, five priorities are outlined in the updated CISET policy report on emerging infectious diseases:

- supporting global initiatives to reduce deaths from the five leading infectious causes of death;
- preparing for emerging threats such as antimicrobial resistance, pandemic influenza, and outbreaks caused by acts of bioterrorism;
- increasing capacity building;
- developing country access to drugs and vaccines; and
- supporting new directions in research on emerging infectious diseases and increasing developing country participation in the conduct of this research.

The CISET 2001 policy report on emerging infectious diseases will also include recommendations for collaborative action in eight areas:

- global initiatives against tuberculosis, malaria, AIDS, and vaccine-preventable diseases;
- emergence and spread of antimicrobial resistance;
- access to vaccines and antimicrobial drugs in developing countries;
- regional disease surveillance networks;
- linkages between animal and human disease surveillance systems;
- research on new vaccines, diagnostic tests, antimicrobial drugs, and disease prevention strategies;
- research to understand the links between environmental change and the emergence of infectious disease; and
- training and capacity building in research and prevention.

International Water S&T

In May 2000, CISET convened an International Water Issues IWG to consider the response of the scientific and technical communities to the global threat and domestic implications of an emerging crisis in water quantity, quality, and management. The IWG, which included members from more than 16 different agencies and organizations, studied the world water crisis, reviewed current U.S. Government activities and capabilities, and made a number of recommendations.

The genesis of the water crisis is simple. Yet, it is exceedingly difficult to address. Water supplies are limited, and the population that depends on those supplies is inexorably increasing. Exacerbating the quantity shortfall is the extensive pollution of current water resources, rendering significant amounts of water unfit for human use. These problems directly impact several of our national interests, including global issues (e.g., ecology, population, human health, and environment); national security; economic prosperity; humanitarian response; and democracy and human rights.

The IWG made significant progress in defining the need for greater U.S. participation in global efforts to address international water issues and the critical role of the scientific and technical community. The process made evident the need to more fully coordinate the efforts of scientific and technical communities to better develop U.S. capacity to respond to this emerging crisis. The IWG recommendations to CISET are to:

- approve the establishment of a CISET Subcommittee on International Water Issues, and
- launch an interagency process to develop an International Water Security Initiative.

Future plans of the working group include activities to:

- raise awareness with the necessary constituencies and stakeholders to obtain the resources required to effectively address issues on international water;
- identify S&T opportunities where interagency coordination and communication with the broader scientific and technical community can improve scientific and technological capabilities and understanding of water management; and
- develop interagency resource requests to support the policies and activities identified by the IWG and the NSTC.

Global S&T Week

The Working Group on Global S&T Week was responsible for the coordination of the first such event ever held in the United States. In response to a call from leaders throughout the S&T community, including three Nobel Laureates, President Clinton proclaimed May 7-13, 2000 as “Global Science and Technology Week.” The purpose of this proclamation was to emphasize the international nature of science, the importance of

an internationally diverse and open scientific enterprise, and the benefits the U.S. receives through international scientific collaboration. Activities to celebrate the week were designed to help young students foster an appreciation for the international nature of science, along with international perspectives that will better prepare them to participate in the world's interdependent high-tech economy and the global scientific community.

Agricultural Biotechnology S&T Capacity Building in Developing Countries

In 2000, CISET set out to assess the potential of S&T partnerships with developing countries to strengthen their capacity to meet their food and agricultural needs, with a particular emphasis on the promise of agricultural biotechnology. A new IWG will:

- assess the opportunities that agricultural biotechnology provides in addressing global food needs;
- present to policy makers the value of building agricultural biotechnology capacity in the developing world;
- convey the benefits our Nation would derive from such capacity-building efforts; and
- provide recommendations for future Federal action.

Bilateral and Multilateral Regional Relations

Working groups related to specific bilateral and multilateral relationships were also active throughout the year.

The CISET Working Group on India was active in both India and the United States. Highlights included the conclusion of the Agreement on Indo-U.S. S&T Forum on March 21, 2000 in New Delhi during the visit of President Clinton. Immediately afterwards, a 1-day, Indo-U.S. Round Table Dialogue on S&T Cooperation was organized in Hyderabad on March 24, 2000. This was an informal, high-level meeting between eminent scientists and high-ranking government officials of India and the United States. It served to reinvigorate the strategically important S&T relationship between India and the United States.

In September 2000, during Indian Prime Minister Vajpayee's historic visit to the United States, high-ranking officials from the U.S. and India convened a second High Level Roundtable on S&T. Discussion focused on new directions for the 21st century in Indo-U.S. collaborations in the field of S&T in five main areas: genomics; agricultural biotechnology; nanoscale science and engineering; computer modeling with an emphasis on weather prediction; and energy S&T. In addition, conferees drew a strategic picture of

current challenges and opportunities in applying S&T to accomplish specific objectives for mutual benefit.

The CISET Working Group on Japan was instrumental in supporting the study of the U.S.-Japan S&T Advisory Panel regarding ways in which bilateral collaboration can be further strengthened. The U.S. and Japan account for over 60 percent of the world's R&D, and it appears that strategic cooperative activities can advance science even more effectively.

In 2000, the CISET Working Group on China was key to a successful meeting with China on both S&T and the Environment and Development Initiative.

The CISET Working Groups on Asia-Pacific Economic Cooperation, the Organization for Economic Cooperation and Development (OECD), and the Summit of the Americas continued to focus on bilateral and regional cooperation within multilateral forums. In the case of the OECD Committee on S&T Policy (CSTP), the IWG revitalized U.S. Government interest and engagement in the workings of the committee. As a result, a high-profile, interagency, U.S. delegation attended the CSTP meeting held October 12-13, 2000 in Berlin, Germany. Members of the delegation made important interventions in the areas of intellectual property and economic growth. Follow-up actions by the OECD are expected on the U.S. proposals to study the relationship between R&D investment and economic growth, and intellectual property protection.

In addition, CISET received presentations regarding the establishment of interagency working groups in the areas of: Green Chemistry; International Disaster Mitigation and Emerging Technologies; and a proposed trilateral summit between the U.S., Ireland, and the Northern Ireland Assembly to support the peace process defined by the Good Friday Agreement.

COMMITTEE ON NATIONAL SECURITY

The Committee on National Security (CNS) is chartered to facilitate coordination of Federal efforts in R&D in areas of national security. The Committee identifies relevant priorities, programs, and plans across Federal agencies with a view toward advising the NSTC about the vigor and appropriateness of Federal investments in R&D that underpin a sound national security posture. Committee activities facilitate coordination and integration of national security science and technology programs, increased operational collaboration among Federal agencies, and the identification of national security S&T priorities. As appropriate, the CNS identifies gaps and overlaps in programs with an emphasis on improving investment selections and coordination. Strengths and successes are identified to optimize performance, increase collaboration, leverage investments and employ economies of scale.

In 2000, the Committee supported three working groups: the Nonproliferation and Arms Control Technology Working Group, the International Technology Transfer Issues and Policy Working Group, and the Critical Infrastructure Protection Research and Development Interagency Working Group.

Nonproliferation and Arms Control Technology

Since its formation in 1994 as the result of a Presidential Decision Directive, the Nonproliferation and Arms Control Technology Working Group (NPAC TWG) has evolved into a highly credible and respected vehicle for coordinating a key element of our national security S&T strategy. The NPAC TWG is composed of 13 inter-agency, subject-specific focus groups and a Technology Needs Subcommittee. Throughout the year, approximately 100 R&D program managers representing 60 organizations conduct numerous program reviews in their respective focus groups. The NPAC TWG reports to the President through both the CNS and the National Security Council. The NPAC TWG is chartered to exchange information and coordinate NPAC R&D; review NPAC R&D programs, identifying gaps and unnecessary overlaps; advise agencies on NPAC R&D priorities; frame interagency issues and differences for decisions by adjudicating bodies; and make recommendations to the CNS on the coordination of all nonproliferation and arms control-related R&D programs in the President's annual budget.

In 2000, the NPAC TWG coordinated nearly 300 R&D programs and projects representing approximately \$700 million in federal investment. Dr. Robert Waldron, Department of Energy, joined Ms. Sallie Mullen, Department of State, and Dr. Anna Johnson-Winegar, Department of Defense as co-chair. The key thrust in NPAC TWG 2000 activities was to promote a shared interagency understanding of the evolving dynamics of effective R&D coordination in an era of constrained resources and expanding needs for national security technologies. In particular, the Chemical and Biological Detection groups have been reorganized with expanded participation and new leadership from the arms control, nonproliferation, and intelligence communities. This is

expected to relieve the current chairs from the conflicting priorities of managing chemical/biological defense while coordinating nonproliferation and arms control programs. Other important focus group activities included Active Electro-Optics, Ballistic Missile Sensors, Fieldable Nuclear Detectors, Nuclear Test Monitoring, Proliferation Modeling, Unattended Remote Sensors, and Underground Facilities. These groups will continue to assist in interagency coordination and encourage additional R&D activities in these important and topical areas.

As a result of the expanded dialogue within the Federal sector and beyond the NPAC TWG 5th annual symposium on coordination of Federal NPAC R&D grew in both size and new participation by policy makers and technology users. Three hundred twenty-five policy makers, program managers, and contractors attended the symposium. The symposium emphasized future R&D directions with two panels devoted to the topic in addition to nine focus group workshops.

The CNS concurred with an NPAC TWG recommendation to combine the Spectral Sensing and Active Electro-Optics Focus Groups, because advances in technology and operations have brought these areas so closely into concert. After careful consideration the TWG decided that the Chemical and Biological Detection Focus Groups should not be merged but that at least one joint meeting would be held by them per year for information exchange and coordination purposes.

The NPAC TWG assisted and participated in the National Technical Means Users' Conference held in September. This conference provided a forum for all stakeholders associated with sensors programs to express views on how best to utilize limited resources, recapitalize sensors and sensors programs, and ensure that Measurement and Signature Intelligence (MASINT) remains a priority.

In 2001, the NPAC TWG will build on the results and strengthened relationships of 2000 to continue formalizing the processes for identifying and validating needs and translating them into adjudicable technology options for existing interagency IWGs and agency resource managers. The NPAC TWG will consider approaches that include a forum for agencies to review R&D issues developed by the NPAC TWG Technology Needs Subcommittee (TNS) and present scenarios that support their missions where technology may be needed. The NPAC TWG will host its sixth symposium on March 6-8, 2001 at the Department of State. This symposium is planned as a full two-day working symposium followed by a one-day business meeting. The NPAC TWG expects to be involved more fully in the R&D budget process by highlighting successful interagency approaches for assigning resources to national needs, encouraging stable and supportive leadership in the R&D community, and ensuring existing and planned efforts have coordinated policy-level justification.

International Technology Transfer

The International Technology Transfer Working Group was established in December 1996 to identify ways to improve national policy procedures governing international technology interactions and execution mechanisms for technology transfer and control. The working group includes representation from the Departments of Commerce, Defense, Energy, and State; the Arms Control and Disarmament Agency (prior to its merger with State); and NASA. The tasks assigned to the Working Group include: reviews of mechanisms and legislation; refinement of definitions of critical technology and related export policies; review of the practices of other governments; consultation with U.S. industry; identification of interagency differences; consideration of improvements for interagency cooperation; risk assessment; and the relationship of export policies on the import of technology. The CNS principals directed the group to conduct case studies of international technology transfer with a focus on lessons learned and best practices that might be used improve management processes.

In 2000, the International Technology Transfer Working Group (ITTWG) addressed four case studies of international technology transfer to assess the lessons learned and to provide recommendations regarding possible improvements in the processes for managing these partnerships. The four case studies dealt with international technology transfer at the Federal laboratories, third party transfers involving the M109 howitzer, export controls and the case of rocket motor casing manufacturing, and the internationalization of SEMATECH, the SEMiconductor MANufacturing TECHNOlogy Consortium.

- The study of international participation in cooperative research and development agreements and similar arrangements, as well as exclusive licenses, with the federal laboratories led to recommendations for amending an existing Executive Order, E.O. 12591 "Facilitating Access to Science and Technology," promulgated by President Reagan in April 1987. Key provisions of this amendment were to direct agencies to consider the impact of the international partnerships on industry in the U.S.; to clarify responsibilities of agencies providing guidance with respect to intellectual property treatment, reciprocal access, and export controls; and to establish a process of interagency consultation and data collection regarding effective approaches to treating international participation in these cases, as well to ensure adequate data regarding the extent of such partnerships is made available. A report on approaches for improving interagency consultation on this issue was called for in one year.
- In the case of the M109 howitzer, DoD and DOC agreed to hold discussions on means of improving interagency communication regarding such cases of concern, and a memorandum of understanding between the agencies on this matter has been signed.
- In the case of export controls and rocket motor casings, the working group agreed that the key issues of concern with respect to the determination of export controls were

timeliness, transparency, comparable availability, and the absence of a clear mechanism for appeal. Nevertheless, it was noted that the treatment of satellite export controls was attempting to address these very issues, and the working group concluded that if successful, the satellite export control model might be extended to comparable technology areas, such as rocket motor casings.

- Finally, with regard to the internationalization of SEMATECH, the working group's assessment concluded that measures were being put in place in SEMATECH to protect intellectual property developed prior to the internationalization. Nevertheless, the group also noted that monitoring the progress of this international expansion would be important should the organization again seek to partner with the Federal government.

In 2001, the International Technology Transfer Working Group plans to complete coordination of an executive order on Federal laboratory international technology transfer and effect its promulgation. The group expects to complete the examination of all ongoing case studies and provide a final overview of its activities to the CNS. Any future activities of the group and its continuation will await CNS guidance and decision.

Critical Infrastructure Protection R&D

The Critical Infrastructure Protection Research and Development Interagency Working Group was formed in March 1998 in anticipation of Presidential Decision Direction 63 on Critical Infrastructure Protection, which was promulgated on May 22, 1998. The NSTC charged the working group with developing a federal R&D agenda that responds to vulnerabilities in our critical infrastructures and technology gaps and shortfalls. Chaired by OSTP, the working group emphasizes the need to protect our nation's critical infrastructures from terrorists and other threats through reviewing ongoing CIP related R&D across government, identifying areas of concern or in need of additional emphasis, and recommending new programs to the Office of Management and Budget that fill these needs. The CIP R&D IWG is working towards constructing a coordinated multi-department, multi-agency R&D portfolio that accelerates the development and deployment of advanced CIP technologies. The Critical Infrastructure Coordination Group also uses this IWG as its source of R&D information, inputs, and analyses.

The Critical Infrastructure Protection R&D Interagency Working Group organized its activities into six subgroups, the first five of which correspond to critical infrastructure sectors:

- Banking and Finance,
- Information and Communications,
- Energy,
- Vital Human Services,

- Transportation, and
- Interdependencies

Each subgroup followed a well-defined methodology to accomplish the goal outlined in Section II. This involved defining a vision for R&D in the subgroups subject area, reviewing ongoing programs across government, articulating what needs for realizing the vision were not being met by ongoing programs, and proposing new programs through the OMB National Security crosscut process to fill these gaps. In particular, the IWG:

- compared infrastructure protection R&D needs to current R&D programs and identified gaps;
- identified programs to meet needs, including the augmentation of existing programs when deemed necessary;
- accomplished preliminary work needed to prioritize, sequence, and recommend specific R&D programs to the incoming administration;
- determined funding needed to execute the overall R&D program; and
- identified Federal investment levels for ongoing critical infrastructure protection R&D.

During 2000, the group developed a draft Federal Critical Infrastructure Protection R&D Agenda for FY2002, awaiting a new Administration in January 2001. The working group operated from a baseline of ongoing critical infrastructure protection and related R&D programs for FY2000. Using inputs from government, industry, and academia, the working group developed a comprehensive list of vulnerabilities and R&D shortfalls. The programs that comprise the FY2001 R&D agenda directly address known vulnerabilities and technology shortfalls. The working group sought and incorporated comments on the agenda from industry and academia to ensure that the agenda complemented and did not duplicate ongoing private sector or university programs. The working group also helped plan workshops on intrusion detection, malicious computer-code detection, the insider threat, and infrastructure interdependencies.

In 2001, the working group will continue its ongoing projects; update the R&D agenda for FY2002 to reflect the evolution of technology, threats, and vulnerabilities; review and monitor ongoing technology programs and issues; and coordinate with the PCAST security panel and the Critical Infrastructure Coordination Group. It will work diligently to establish a community of R&D focused policy makers and researchers in all sectors, to include the Congress and the new administration's transition team, who understand the need for R&D in this critical area. Additionally, IWG members will work with their respective agency transition teams to ensure their new leadership team understands the critical importance of this issue. The IWG will produce a formal report of its activities during the first quarter of FY2001 that will form the basis for a formal CIP R&D vision, to be shared with all government agencies and the private sector. Finally, the working group will continue with its series of workshops with the private sector and

academia to refine further the federal government's critical infrastructure protection R&D agenda.

Additional Areas

In addition to the activities and accomplishments of the working groups, the Committee also considered a number of other subjects, including:

- Monitoring the research & development subgroup of the interagency Weapons of Mass Destruction Preparedness Group (WMDP). The WMDP has been chartered under Presidential Decision Directive 62 to address the Federal Government's preparedness to forestall or respond to terrorist incidents involving weapons of mass destruction. The WMDP's R&D subgroup is working to coordinate ongoing R&D activities and to assist in the preparation and review of the President's FY2002 budget request in this area. The CNS was briefed on and discussed the activities and progress of the R&D subgroup on several occasions.
- Discussion of the OSTP fiscal year 2001 and 2002 research and development priorities.
- Discussion of the United Kingdom, Ministry of Defence plan to privatize all or part of the Defence Evaluation and Research Agency.

The OSTP co-chair instituted quarterly coordination meetings among the working group chairs and other principal members to improve communication and coordination between and among the working and focus groups.

COMMITTEE ON SCIENCE

The purpose of the Committee on Science is to advise and assist the NSTC on federally supported efforts that develop new knowledge in the sciences, mathematics, and engineering. The Committee addresses significant national policy matters that cut across agency boundaries and provides a formal mechanism for interagency science policy development, coordination, and information exchange.

Aquaculture

The Subcommittee on Aquaculture serves as the Federal interagency coordinating body that increases the overall effectiveness and productivity of Federal research, technology transfer, and assistance programs in support of a globally competitive, technologically advanced, and environmentally sound U.S. aquaculture industry. Information regarding the Subcommittee including its quarterly meeting schedule, activities undertaken by it and output generated as a result of interagency coordination, can be accessed at <http://ag.ansc.purdue.edu/aquanic/jsa/index.htm>.

The Subcommittee is revising the National Aquaculture Development Plan for promulgation in early 2001. The Plan identifies high-priority, Federal Government actions necessary to support the progressive development of aquaculture in the United States, provides a Federal framework for addressing the critical aquaculture industry needs and opportunities, and identifies expected outputs, impacts, and agency responsibilities. The Subcommittee has also initiated the update of the Aquaculture Research and Development Plan first submitted to the NSTC in 1994. This plan outlines the Federal research and technology development agenda for aquaculture.

The Subcommittee has convened two Task Forces and a Working Group to address specific issues of national scope and importance. First, the Aquaculture Effluents Task Force provides a vehicle for national coordination and facilitation of stakeholder inputs with participants representing broad interests, experiences, and expertise. The Task Force is assisting the Environmental Protection Agency in the development of national effluent guidelines and industry profiles based on technical and economic peer-reviewed information. In 2000, the Task Force convened a Technical Information Exchange Forum that included the participation of each of the Task Force's 14 technical subgroups. The Task Force maintains a web page to inform the public of activities, progress and future meetings at: <http://ag.ansc.purdue.edu/aquanic/jsa/effluents/index.html>.

Second, the Working Group on Quality Assurance in Aquaculture Production continues to support the coordination of nationwide efforts to gain approval for new animal drugs for aquaculture. A 5-year, strategic plan was developed to guide and prioritize activities. The Working Group is assisting the Food and Drug Administration (FDA) in validating a crop-grouping approach for new animal drug approvals through

collaboration with diverse stakeholders, including several federally supported initiatives and FDA's Center for Veterinary Medicine (CVM). A National Coordinator for New Animal Drug Approvals for Aquaculture facilitates data development and collection in support of new animal drug approvals in consultation with FDA-CVM. The Working Group also supports industry quality assurance programs that have been developed by numerous aquaculture organizations.

Third, the Shrimp Virus Task Force continues to coordinate Federal activities in risk assessment and management of exotic shrimp viruses in wild and farm raised shrimp. The Task Force is developing management options and plans to protect both wild and cultured marine shrimp. The proceedings of a management workshop sponsored by the Task Force are being finalized, and the Task Force will host a second technical and management workshop in 2001.

In 2001, the Subcommittee on Aquaculture plans to release a revision of the *Guide to Drug, Vaccine and Pesticide Use in Aquaculture* as an electronic publication; establish an Aquatic Animal Health Task Force; assist the Department of Commerce in developing a code of conduct for responsible offshore aquaculture; and convene a special session at the upcoming Aquaculture 2001 international conference and exposition to highlight the Subcommittee's activities and Federal programs related to aquaculture.

Biotechnology

The tools of biotechnology permeate all areas of basic biological, agricultural and medical research, and applications of biotechnology are widespread in many sectors of industry. The rate at which genomics is being incorporated into research in all areas of life sciences in academia and industry continues to accelerate rapidly. Health-related biotechnology research is already profiting greatly from progress in the human genome project. Ethical and intellectual property issues are playing an increasing role in defining the rate of progress in biotechnology research in the academic world as well as in commercialization of biotechnology products and processes. Genome-enabled science will continue to take advantage of, and in some cases to drive, rapid advances in computation and communications technologies. In addition to the human genome and model organisms for the human genome project, plant and microbial genome projects are receiving increasing attention.

The Subcommittee on Biotechnology provides broad interagency planning and coordination to increase the effectiveness and productivity of the Federal investment in biotechnology research. While the U.S. Government no longer conducts regular, detailed inventories of all federally funded biotechnology research, it is estimated that the Federal investment in biotechnology research is now approaching \$7 billion. Thirteen different U.S. government agencies have interests in, and responsibility for, aspects of biotechnology research. The core activities of these agencies broadly employ biotechnology tools, or contribute to the development of new methods in biotechnology.

Overall guidance and coordination of the Subcommittee on Biotechnology is provided by a Steering Group. In 1999, the Steering Group supported a workshop on access to research resources held by the National Academy of Sciences (NAS; see *Finding the Path: Issues of Access to Research Resources* at <http://www.nap.edu/books/0309066255/html>). NAS identified five priorities for study, including a review of the Bayh-Dole Act, and an analysis of the effects of biotech-related patent law on university R&D.

In 2000, the steering group established two, new, *ad hoc* interagency working groups. First, a Microbe Project Working Group is charged with developing a coordinated, interagency effort to promote the research and infrastructure that will seize the opportunities offered by genome-enabled microbial science. A draft long-range plan is in preparation. Second, a Biotechnology Safety Assessment Research Working Group is charged with preparing a catalogue of intramural and competitively funded research activities that support the biotechnology risk assessments that underlie regulatory decisions at the EPA, FDA, and USDA.

Two standing IWGs support the Subcommittee. The Biotechnology Research Working Group is comprised of 13 Federal agencies with responsibilities for, and interests in, biotechnology research. Meeting monthly, the IWG facilitates exchange of information, and interagency coordination of activities, related to biotechnology research. In 2000, the IWG reported on *Biotechnology for the 21st Century: Recent Accomplishments*. The report highlights results from the Federal investment in biotechnology research, both contributions to basic knowledge and to a wide range of applications.

The Biotechnology Research Working Group coordinates interagency activities in the environmental biotechnology, metabolic engineering, marine biotechnology, tissue engineering, and microbial genomics.

In environmental biotechnology, bioremediation was the focus of a 3-year, interagency program. Research is examining the bioavailability of pollutants in complex mixtures to microbial consortia. Workshops and reports summarizing the research results are underway. In 2000, a new interagency program focused on phytoremediation began.

In metabolic engineering, awardees from the first interagency competition in metabolic engineering presented their initial research results at a workshop in May 2000. In 2000, the second metabolic engineering competition yielded six new awards, and a third round is set for 2001. Eight agencies are participating, and a web site serves to coordinate the activity (see: <http://www.epa.gov/opptintr/metabolic/index.htm>).

In marine biotechnology, an informal summary of the Federal investment in marine biotechnology has been prepared. The Biotechnology Research Working Group

is coordinating with a Council on Environmental Quality working group, following on the *Year of the Ocean* report.

In tissue engineering, a Multi-Agency Tissue Engineering Science group held a workshop in June 2000 to develop a baseline of information on U.S. R&D activities and regulatory issues related to tissue engineering. An international review, including site visits and benchmarking of activities, interests, and policies related to tissue engineering in Europe and Japan, is underway. A report is due in early 2001.

In microbial genomics, publication of the *Interagency Report on the Federal Investment in Microbial Genomics* was followed by creation of the Microbe Project Working Group to pursue follow-on activities.

The Research Resources and Infrastructure Working Group addresses research resources and infrastructure issues in biotechnology. A 1998 workshop on bioinformatics aired critical issues, identified problems and challenges, and offered potential solutions. Three broad areas worthy of support were identified: basic research into bioinformatics and its applications; bioinformatics infrastructure (e.g. databases) and other user resources; and education and training in bioinformatics. In 1999, the results of that workshop were promulgated in *Bioinformatics in the 21st Century*.

Human Subjects Research

The Human Subjects Research Subcommittee coordinates the implementation of the “Federal Policy for the Protection of Human Subjects”, otherwise known as the Common Rule. The Common Rule is a uniform policy governing federally conducted or supported research involving human subjects, and the Subcommittee provides a mechanism for a consistent approach to implementation of the Common Rule, as well as providing clear and uniform interpretation of it. Information regarding the Common Rule and the Subcommittee can be found at: <http://ohrp.osophs.dhhs.gov/>.

In 2000, the Subcommittee has fostered consistency in the interpretation and implementation across agencies of the Common Rule. Specific accomplishments include:

- coordination of the pending codification of requirements for classified research pursuant to March 27, 1997 Presidential Memorandum on “Strengthened Protections for Human Subjects of Classified Research”;
- achievement across agencies of substantial agreement on interpretation of covered versus exempt activities, including behavioral and social research activities;
- achievement across agencies of substantial uniformity on mechanisms for obtaining the institutional Assurances of Compliance required of all entities engaged in Federally supported human subjects research;

- continuing education of agency representatives through formal presentations on emerging issues related to human subject protections and discussion of difficult cases encountered by the member agencies;
- special educational events for member-agency General Councils;
- discussion of individual agency actions and initiatives related to the protection of human subjects; and
- continued uniform implementation of the 1998 categories of research eligible for expedited IRB review procedures.

In 2001, the Subcommittee will:

- finalize codification of requirements for classified research pursuant to March 27, 1997 Presidential Memorandum on “Strengthened Protections for Human Subjects of Classified Research”;
- develop recommended agency actions in response to the National Bioethics Advisory Commission reports on *Research Involving Persons with Mental Disorders That May Affect Decisionmaking Capacity* and *Research Involving Human Biological Materials*;
- facilitate continuing education of agency representatives through formal presentations on emerging issues related to human subject protections and discussion of difficult cases encountered by the member Agencies;
- facilitate discussion of individual agency actions and initiatives related to the protection of human subjects; and
- hold special educational events for member-agency General Councils

Reviewing and Renewing the Government/University Partnership

The long-standing S&T partnership between the Federal government and universities aimed at advancing science and technology in the national interest, is a core element of America’s world-leading R&D enterprise. Stresses in the evolving partnership require attention. The Assistant to the President for Science and Technology initiated a review to determine what might be (i) the major stresses in the areas of research, education and administrative regulations, and (ii) the best ways to address the issues raised in this examination. The products of the review were intended to assist in developing strategies that promote cost-effective, university-based research, allocate research costs fairly, strengthen the research-education linkage and maintain appropriate accountability for the expenditure of public funds.

In 1999, an interagency task force charged with reviewing the government/university partnership produced a *Report on Renewing the Federal Government-University Research Partnership for the 21st Century*. The President directed the NSTC to implement the recommendations of the report. He called upon the NSTC to: issue a statement of principles based on the draft statement contained in the

NSTC report and revised on the basis of public input; to develop and implement recommendations to more firmly tie government policies and practices to the integration of research and education; and to implement a set of recommendations that will help make the partnership more effective and efficient.

In 2000, the President's request to implement the recommendations of the NSTC report was fulfilled. First, the President signed an Executive Order (December 29, 2000) establishing a statement of guiding and operating principles that will be the foundation for all Federal actions affecting the government-university partnership. The Executive Order also directs the OSTP, in consultation with all stakeholders, to conduct regular reviews of the state of the partnership. Second, the NSTC released *Implementation of the NSTC Presidential Review Directive-4 Renewing the Federal Government-University Research Partnership for the 21st Century*, which outlines the specific steps taken or planned to implement the 1999 report, including the release of a clarification memo from OMB on specific aspects of OMB Circular A-21, "Cost Principles for Institutions of Higher Education."

Research Misconduct

A proposal to develop a common definition of research misconduct for federally sponsored research was developed by the Committee on Science's Research Integrity Panel in 1996. In 1999, a proposed "Federal Policy on Research Misconduct to Protect the Integrity of the Research Record" was published in the *Federal Register*. It proposed a definition of research misconduct applicable to all research funded by the Federal government at universities and Federal facilities alike. It also provided guidelines for the conduct of fair and timely investigations. In 2000, an IWG charged with implementation of the new policy was formed. The proposed policy was revised in response to public comment and approved by the NSTC. The final "Federal Policy on Research Misconduct" was published in the *Federal Register* on December 6, 2000. The IWG will continue to meet in 2001 to help Federal agencies meet the 1-year deadline for implementation of this policy. A workshop to exchange information on best practices is set for February 2001.

Plant Genomes

The goal of the Interagency Working Group on Plant Genomes is to develop a comprehensive Federal effort aimed at expanding our knowledge of plant genomes, specifically focusing on those plants that contribute significantly to the nation's plant-based industries including agriculture, energy, health, and the environment. In 1998, the IWG published a six-goal strategy for the National Plant Genome Initiative (NPGI). Reports on progress toward those goals were published in 1999 and 2000.

The NPGI has supported the sequencing of the genomes of model organisms. In 2000, publication of the genome of *Arabidopsis thaliana*, a small mustard-like plant,

marked it as the first flowering plant genome to be completely sequenced. It is also the most completely sequenced genome of any higher organism, to date. The IWG has also participated in an international effort to fully sequence the rice genome. Since most grasses have common sets of genes, what is learned from the study of the rice genome will be immediately applicable to other grasses such as barley, corn, sorghum, sugarcane, and wheat. In 2000, the Monsanto Corporation offered to share with the international consortium its database of rough draft sequence of the entire rice genome. With the Monsanto data, scientists estimate that the rice sequence will be completed by 2004, 4 years ahead of the original schedule.

As a result of IWG coordination, biological research resources have been developed to enable the elucidation of the structure and organization of complex plant genomes. Collaborative, structural-genomics, research projects continue to provide the research community with genetic maps, physical maps, expressed sequence tags, DNA clone libraries, microarray data, and mutant populations with specific genes tagged for many widely grown plants such as barley, corn, cotton and rice. These resources have changed the way individual laboratories conduct research, allowing them to pursue biology-based research in a cost-efficient manner.

In 2000, functional-genomics activities increasingly became a focus of IWG activities. Functional-genomics activities target genes important to plant production and productivity, such as those coding for disease and stress resistance, seed development, grain-quality traits, carbon allocation, flowering time, biomass production, and synthesis of valuable fuels and chemicals. Technologies and methods specifically designed to advance plant genomics are also being developed as a result of the NPGI. The IWG will continue to encourage the community to develop new technologies and methods to push the frontier of plant genomics further.

All NPGI sequence data are deposited rapidly in GenBank, the international repository for sequence data, and in turn, are made widely available to the scientific research community. Likewise, biological resources developed with NPGI support are being made available to the public freely and rapidly. In 2001 and beyond, the NPGI will support community-driven development of standardized nomenclature, the development of minimum common principles for database design, and the development of software tools designed to facilitate query across multiple databases.

In 2001, the IWG plans to continue to encourage, participate in, and actively support education and training activities relevant to plant genome activities at the undergraduate, graduate, and postdoctoral fellow level, as well as public outreach activities.

The Children's Initiative

In 1997, the NSTC published *Investing in Our Future: A National Research Initiative for America's Children for the 21st Century*. In analyzing the Federal investment in research focused on the biological, cognitive, and social development of America's children, the NSTC reported that only an estimated 3 percent of the total Federal research enterprise was aimed at understanding the growth and development of 30 percent of our population. This level of investment was viewed as highly inadequate, and the NSTC outlined three content areas in which substantial Federal research support could be most helpful in promoting the healthy development of America's children: environmental hazards; health and behavior; and learning. Two IWGs are pursuing these issues.

An IWG on Environmental Health Risks and Safety Risks to Children is exploring the feasibility of a longitudinal cohort study to examine the link between environmental exposures and developmental disorders in humans. The range of developmental disorders affecting children includes intrauterine growth restriction, infant mortality, birth defects, suboptimal growth and development, functional deficits (e.g., neurobehavioral, immune, reproductive, respiratory), and possibly the foundations for chronic diseases in adulthood. Factors that might be responsible for these outcomes include genetic disorders; *in utero* exposures to infectious agents, poor maternal nutrition, tobacco, alcohol, drugs and other chemicals; and early childhood exposure to lead and tobacco smoke; and a lack of a nurturing and intellectually stimulating environment.

A separate IWG is creating an Interagency Children's Research Initiative on children's health, behavior, and learning. The initiative would create an integrated national research agenda based on current Federal research in these areas and would seek to develop recommendations for future R&D investments.

Future U.S. Workforce in S&T

An IWG on the U.S. S&T Workforce of the Future was established to define and make recommendations on the Federal role in developing a strong U.S. S&T workforce in the 21st century. The IWG considered the effect of demographic and socioeconomic changes on workforce development; the potential contributions that could be lost when elements of the population do not participate fully in the S&T enterprise; and current policies and programs of Federal agencies that might influence participation rates, particularly of women and under-represented minorities. In 2000, the IWG reported on *Ensuring a Strong U.S. Scientific, Technical, and Engineering Workforce in the 21st Century*, and identified important human-resource-development strategies to help prepare a 21st century workforce equipped to meet the demands of an increasingly technological society.

COMMITTEE ON TECHNOLOGY

The purpose of the Committee on Technology is to advise and assist the NSTC to increase the overall effectiveness and productivity of Federal technology R&D efforts. The Committee addresses significant national policy matters that cross agency boundaries and provides a formal mechanism for interagency policy coordination and development of Federal technology activities. The Committee has improved the coordination of all Federal efforts in technology. This includes developing balanced and comprehensive R&D programs, establishing processes to improve the way the Federal government plans and coordinates R&D, and advising the Office of Science and Technology Policy and the Office of Management and Budget on R&D budget crosscuts and priorities. The Committee accomplishes this mission through a series of Partnerships, Subcommittees, and IWGs.

Construction and Building

The Subcommittee on Construction and Building continued to advance the National Construction Goals. In 2000, Subcommittee provided ongoing support to the Partnership for Advancing Technology in Housing (PATH), published a baseline report on reducing construction worker illness and injury, and planned a program focusing on the R&D needs to enhance the stewardship of commercial/institutional buildings in the public and private sectors. Also, the Subcommittee cooperated with the Construction Industry Institute (CII) to establish a not-for-profit R&D consortium called FIATECH (modeled after SEMATECH) with the aim of helping the industry achieve fully integrated and automated project processes. The Subcommittee has completed a database and web site of best practices in construction regulation, compiled from innovative local jurisdictions around the Nation. Finally, the Subcommittee continues to work in cooperation with the Civil Engineering Research Foundation to solicit industry support for the Partnership for Advancing the Infrastructure and its Renewal (PAIR).

PATH, a \$10 million, public-private partnership managed by the Department of Housing and Urban Development, supported a Federal R&D program and conference on housing durability. In cooperation with the National Institute of Standards and Technology, PATH issued more than over \$1 million in research grants to industry for the development of new technologies. In cooperation with the National Science Foundation, PATH issued more than over \$1 million in research grants to universities for fundamental research in building technology.

FIATECH's goal is to promote the seamless integration of advanced IT and automation technologies in capital projects through collaborative, leveraged R&D. This organization is supporting and developing technologies that will significantly reduce project cycle time, improve quality, and reduce costs. Already nearly 50 organizations

have accumulated about \$1 million in private sector funding. A number of Subcommittee member agencies are active partners in FIATECH.

A Subcommittee report on reducing construction worker illness and injury is the third report in a series setting the baselines for the National Construction Goals.

In 2001, the Subcommittee will launch a multi agency R&D program on the stewardship of commercial/ institutional facilities aimed at reducing the burden of maintaining both new and existing facilities on owners and occupants. The Subcommittee will solicit cooperation with private and public sector organizations, including the Construction Industry Institute, the National Institute of Building Sciences, the Federal Facilities Council, ASTM, Carnegie-Mellon University, and Lawrence Berkley Laboratory. The Subcommittee will issue an updated report on Federal R&D in construction using the RaDiUS database, support a symposium on emerging information technologies to further streamline the building regulatory process, and support a bibliographic study on the effects of the indoor environment on performance in schools.

Materials

The Materials Technology Subcommittee provides a forum to assess broad issues that affect the materials research and development community. The Subcommittee is organized into Working Groups and Communication Groups that convene to address specific topics. In 2000, the Structural Ceramics Communication Group and the Nondestructive Evaluation Communication Group conducted reviews of government programs in these fields and prepared summary reports. The Subcommittee addressed the changing nature of materials research and funding issues at multi-user facilities operated by National Laboratories. The major changes with respect to materials are the increased importance of materials research in the life sciences and the need for increased interaction between these two fields. The Subcommittee reviewed the National Research Council study on the management of the Nation's multidisciplinary user facilities with an eye toward inclusion of information on materials and instrumentation issues in the Federal budget planning process.

Subcommittee members participated in National Nanotechnology Initiative (NNI) development. In 2001, the Subcommittee will be briefed and provide input to a National Materials Advisory Board study that will identify the needs and opportunities in nanomaterials, an important component of the general field of nanotechnology.

Nanoscale Science, Engineering, and Technology

The Interagency Working Group on Nanoscience, Engineering, and Technology, which was created to develop a National Nanotechnology Initiative with an implementation plan, completed its charge and was restructured into a permanent Subcommittee on Nanoscale Science, Engineering, and Technology reporting to the

Committee on Technology. The Subcommittee will coordinate the Federal Government's multiagency nanoscale R&D programs, including the NNI. (NNI activities for 2000 are highlighted on page 11, herein.)

Transportation R&D

In 2000, the Subcommittee on Transportation R&D moved forward with implementation of the *National Transportation Science and Technology Strategy*, which it had completed the previous year. Efforts were focused in two areas. First, a *National Transportation Technology Plan* established 13 priority areas for private-public partnerships to promote the implementation of new technologies with significant potential for meeting identified national needs. Second, a *National Transportation Strategic Research Plan* identified 7 key enabling research areas that – if supported by sufficient resources and effort – could significantly transform transportation in the future. Both plans were broadly disseminated throughout the Federal Government and the transportation enterprise as resource documents to support development of R&D budgets and program proposals.

The *National Research and Development Plan for Aviation Safety, Security, Efficiency and Environmental Compatibility* was released in December 1999. It set goals and established a variety of joint research efforts involving NASA, DOT/FAA, DoD, academia, and the aviation industry that continued throughout 2000. The document responded to recommendations from the White House Commission on Aviation Safety and Security, and the National Civil Aviation Review Commission. More than \$1.3 billion of the FY-2001 transportation R&D budget request addressed issues covered by the plan.

As part of the *Aviation Plan's* implementation activity, the NASA, DoD, and the Federal Aviation Administration began collaborating on a vision for the Aerospace Transportation System After Next. The result of this effort was to be a series of visionary goals for aviation R&D for the next 50 years. In this effort, participants quickly recognized that aviation is only one piece of the Nation's transportation system, and should be viewed in that broader context. An Interagency Working Group on the Transportation System After Next was formed, to develop a high-level, long-term conceptual vision of local, national, and global transportation system technologies out to the year 2050. The group sponsored a workshop for leading futurists to contribute to this vision in September 2000 and a systems concepts workshop to explore alternatives for meeting long-term needs in November 2000. The IWG's vision report is due for completion in early 2001.

In May 2000, the Subcommittee published *Public/Private Partnerships: Engines for Innovation in Transportation*. This document was the second in a series of studies highlighting successful public/private approaches that might be used to stimulate the development and deployment of advanced transportation-related technologies. As in the

first of these reports (*Public/Private Partnerships: Implications for Innovation in Transportation*, December 1998), four actual partnership examples are described and assessed based on important characteristics, such as the motivations and agendas, resources, and legal and institutional frameworks of the participants.

In 2001 the Subcommittee will continue its activities to implement the *National Transportation Science and Technology Strategy*, developing updates of the *Transportation Technology* and *Transportation Strategic Research Plans* which reflect the insights gained from the 2050 visioning exercise.

Partnership for a New Generation of Vehicles

Partnership for a New Generation of Vehicles (PNGV) is a research collaboration between Federal agencies and USCAR, a consortium representing DaimlerChrysler, Ford, and General Motors. The partnership's goal is to produce a production prototype by 2004 of a mid-sized car that will get three times the mileage of 1994 models with no sacrifice in safety performance, affordability, or compliance with emission standards.

In March 2000, PNGV unveiled three concept cars demonstrating the technical feasibility of creating cars capable of getting 80 miles per gallon. All three cars employ some form of hybrid technology that combines a gasoline- or diesel-powered engine with an electric motor to increase fuel economy. The three major automakers also confirmed their commitment to move PNGV technology out of the lab and onto the road by putting vehicles with significant improvements in fuel economy into volume production and into dealers' showrooms. Work continues on technologies that might contribute to the full achievement of goals for the 2004 prototype.

The PNGV steering group met in November 2000 to approve updated timetables for PNGV work through 2004 and beyond.

Crime Technology

The Federal Government has provided substantial benefits to society through its S&T investment in medicine, national defense, agriculture, space science and exploration, information technology, materials science, energy conservation, and environmental quality. A similar national focus on S&T for criminal justice could likewise be expected to reap significant benefits. While S&T alone cannot solve the societal problem of crime, it can provide valuable tools to assist in all major phases of the criminal justice process, including crime prevention, criminal apprehension, adjudication, and corrections.

A recent RAND report notes that technology is playing an increasingly valuable role in enhancing public safety and the efficiency of many criminal justice operations,

particularly information management and communications, but the potential benefits of advanced technology tools for criminal justice have yet to be realized. Such advanced technology, requiring substantial R&D investment, will only be realized with support from the Federal Government.

In response to this need, the OSTP convened a Crime Technology Initiative Forum (July 2000) as a first step in a multi-step process to develop a Presidential Initiative for crime technology. This forum identified major criminal justice issues of national concern that will be formulated into clear national challenges amenable for attacking, at least in part, with the best S&T tools that our governmental and private sectors can muster. Participants in this forum included representatives from local, state, and Federal law enforcement and corrections agencies, the courts, criminal justice professional organizations, academia, and nine Federal agencies. The Department of Justice and the National Science Foundation agreed in November 2000 to serve jointly as the focal point for any initiative. The two will co-chair an interagency working group, whose Terms of Reference are under development.

Critical Infrastructure Protection R&D

The Critical Infrastructure Protection R&D Interagency Working Group is charged with developing a Federal R&D agenda that responds to vulnerabilities in our critical infrastructures and technology gaps and shortfalls. The IWG has:

- compared infrastructure protection R&D needs to current R&D programs and identifying gaps;
- identified programs to meet needs, including the augmentation of existing programs when deemed necessary;
- accomplished preliminary work needed to prioritize, sequence, and recommend specific R&D programs to the incoming administration;
- determined funding needed to execute the overall R&D program; and
- identified federal investment levels for ongoing critical infrastructure protection R&D.

In 2000, the group began development of a draft Federal Critical Infrastructure Protection R&D Agenda for FY-2002. The IWG is working from a baseline of ongoing critical infrastructure protection and related R&D programs for FY-2000. Using inputs from government, industry, and academia, the IWG developed a comprehensive list of vulnerabilities and R&D shortfalls. The programs in the FY-2001 R&D agenda directly address known vulnerabilities and technology shortfalls. The IWG sought comments from industry and academia to ensure that the agenda complemented and did not duplicate ongoing private sector or university programs. The IWG also helped plan workshops on intrusion detection, malicious computer code detection, the insider threat, and infrastructure interdependencies.

In 2001, the IWG will update the R&D agenda for FY-2002 to reflect the evolution of technology, threats, and vulnerabilities; review and monitor ongoing technology programs and issues; and coordinate with the PCAST security panel and the Critical Infrastructure Coordination Group. It will work to establish a community of R&D focused policy makers and researchers in all sectors, including the Congress, who understand the need for R&D in this critical area. Additionally, IWG members will work with their respective agency transition teams to ensure their new leadership team understands the critical importance of this issue. The IWG will report on its activities in early 2001 to form the basis for a formal Critical Infrastructure Protection R&D vision, to be shared with all Government agencies and the private sector. Finally, the IWG will continue with its series of workshops with the private sector and academia to refine further the Federal Government's critical infrastructure protection R&D agenda.

Wire System Safety

Wiring is so fundamental to our society that we often forget it is a system unto itself. The aging of wire systems can result in loss of critical functions in equipment powered by the wire system, or loss of information regarding the operation of certain equipment. This can result in health and safety hazards from loss of control to smoke and fire. Consequently, the safety of the Nation's wire systems is an issue of major importance to all of us.

The aging of wire systems was first recognized as an issue of national concern in commercial aviation. Through efforts underway at various Federal agencies, however, it has become apparent that aging wiring is an issue that extends far beyond aviation. With this realization, the Wire System Safety Interagency Working Group was formed in May 2000. Its focus went beyond aircraft into other areas, including consumer products, homes and other buildings, nuclear power plants, and railroads.

In *Review of Federal Programs for Wire System Safety* (November 2000), the IWG documented Federal programs in wire system safety and recommend strategies for improving wire system safety. The report serves to benchmark interagency efforts to optimize government research and will facilitate the formulation of a national strategy for wire system safety. Seventeen agencies have begun collaboratively drafting a national strategy for wire system safety.

Activities to Promote Innovation

The Committee on Technology has been involved in a number of activities aimed at gaining a better understanding of our National Innovation System and determining directions and priorities for Federal policies that will support and enhance innovation. The Committee followed a 1999 National Summit on Innovation with a June 2000 Scenarios Workshop. A broad range of public and private sector participants developed

plausible, alternative futures based on various geopolitical and economic trends. A crucial element of this process was to describe the dynamic path by which we might arrive at these alternative futures. The result of this process was a robust analysis of the mechanisms and strategies that are important for Federal policymakers.

Based on the information distilled from the 1999 National Summit and the Scenarios Workshop, the Committee, in conjunction with RAND, outlined an innovation roadmap “Agenda for Action” to help guide policymakers (<http://www.rand.org/publications/MR/MR1338.0>). That report aims to ensure that the Federal framework underlying our National Innovation System encourages private-sector, innovative activity.

APPENDICES

Appendix A – Follow-on Guidance for FY 2001 Interagency Research and Development Activities (Lane/Lew Memorandum)

This memorandum serves to emphasize those activities highlighted in the President's FY 2001 Budget that will continue to require significant levels of interagency coordination to sustain the strength of national efforts. We would like to thank the agencies for helping to pull together a very strong, well balanced, FY 2001 research and development (R&D) budget that is captured in the 21st Century Research Fund. This budget highlights the emphasis we placed on basic research; balance among agencies and fields of science; important initiatives such as information technologies and nanotechnology; research conducted at universities; and competitive, peer-review processes. We urge agencies to continue to work together, through the National Science and Technology Council (NSTC), to ensure that we are prepared to implement these important efforts as promised in the FY 2001 budget and have them ready for a future Administration.

Investment Principles

The Federal government's investments in science and technology have been guided by several fundamental principles. These principles include the following: a) sustain and nurture America's world-leading science and technology enterprise, through pursuit of specific agency missions and through stewardship of critical research fields and scientific facilities; b) strengthen and expand access to high quality science, mathematics, and engineering education, and contribute to preparing the next generation of scientists and engineers; c) focus on activities that require a Federal presence to attain national goals, including national security, environmental quality, economic growth and prosperity, and human health and well being; or d) promote international cooperation in S&T that would strengthen the advance of science and achievement of national priorities.

Interagency Priorities for Research and Development Budgets

During the remainder of FY 2000 and in preparation for FY 2001, the NSTC expects to focus on 10 interagency activities highlighted in the President's FY 2001 Budget. Each of the activities listed below should continue to develop the following: 1) a clear and concise definition of program activities and priorities; and 2) an inventory of the programs in the baseline budget. The U.S. Global Change Research Program, Information Technology R&D, Integrated Science for Ecosystem Challenges, and Nanotechnology activities should also continue to develop and improve implementation plans to ensure that interagency coordination is as strong as possible. Descriptions of and specific action items for each of the activities are listed below.

1) National Nanotechnology Initiative (NNI) – The program supports long-term nanoscale R&D leading to potential breakthroughs in materials, electronics, energy, biotechnology, medicine, agriculture, environmental improvement and information

technology. The NNI incorporates long-term research leading to new fundamental understanding and discoveries of phenomena, processes, and tools for nanotechnology, and applies them towards grand challenges that support agency missions. The NNI will create centers and networks of excellence to encourage research networking and shared academic users' facilities, develop enabling infrastructures to accelerate commercialization, and prepare a new generation of skilled workers with the multidisciplinary perspectives necessary for rapid progress in nanotechnology. Agency investments must be consistent with interagency planning documents such as the NNI implementation plan.

2) Information Technology R&D - The program will stimulate information technology innovations -- including digital government, tele-health, universal access, crisis management, real-time environmental monitoring using networked sensors, the development of a "Digital Earth," and advanced manufacturing -- and serve a broad range of scientific and engineering needs. Agencies must justify investment levels based on commitments made in 2000 interagency planning documents, such as the Information Technology for the 21st Century and High Performance Computing and Communications implementation plans. The President's Information Technology Advisory Committee will conduct its annual assessment of the program by September 2000.

3) Energy Initiatives – This program consists of five different initiatives. They are: 1) Biobased Products and Bioenergy, to work toward a goal of tripling U.S. use of biomass; 2) the Climate Change Technology Initiative, to promote research aimed at technologies, such as products and production methods that reduce greenhouse gas emissions and increase the efficiency of energy and materials used in transportation, buildings, and manufacturing, for reducing U.S. carbon emissions at the lowest possible cost; 3) the International Clean Energy Initiative, to encourage open competitive markets and remove market barriers to clean energy technologies in developing and transition countries and to provide new incentives for clean energy technology innovation and export; 4) Partnership for a New Generation of Vehicles, to achieve the goal of increasing fuel economy of cars, while improving performance and affordability; 5) Partnership for Advancing Technology in Housing, to develop and promote the adoption of advanced housing technologies that will reduce energy consumption in building, heating/cooling and maintenance of the nation's residential housing.

4) Integrated Science for Ecosystem Challenges – The goal of this program is to develop the knowledge base, information infrastructure, and modeling framework to help resource managers predict/assess environmental and economic impacts of stress on vulnerable terrestrial and marine ecosystems, with particular focus on invasive species, hypoxia and harmful algal blooms, recovery of Pacific salmon, restoration of damaged ecosystems, bioinformatics, and integrated monitoring.

5) U.S. Global Change Research Program – The goal of this program is to improve our understanding of climate change and other global changes, with a particular focus on the storage of carbon in terrestrial ecosystems, the effects of climate change on the hydrological cycle, the relationship of land cover and land use change to changes in

climate and loss of biodiversity, coordination of programs in marine resources, and the development of better tools for observing, monitoring, and projecting future rates of climate change.

6) Interagency Education Research Initiative – The program supports research to strengthen understanding of the learning process and to apply that understanding to the development and evaluation -- particularly through large-scale, long-term, and experimental studies -- of educational systems, technologies, and other approaches aimed at improving educational outcomes. Agency plans should reflect a coordinated, five-year interagency plan, a draft of which has been prepared by the Interagency Working Group of the Interagency Education Research Initiative. The final plan will be completed by May 2000, and address previously identified priorities, including recommendations contained in the report from the PCAST on the *Use of Technology to Strengthen K-12 Education in the United States*.

7) Protecting Against 21st Century Threats – The program promotes and coordinates research to reduce vulnerabilities in our nation's critical infrastructures and promotes the research and development of technologies that will detect, contain, and mitigate attacks or other failures in these infrastructures. The Critical Infrastructure Protection R&D Interagency Working Group will draft recommendations based on PDD-63 by May 2000. The program also promotes and coordinates research to enhance our ability to detect, respond to, and heal the effects of possible terrorist attacks using chemical, biological, radiological, and related weapons. The Weapons of Mass Destruction Prevention R&D Interagency Subgroup will draft recommendations based on PDD-62 by May 2000.

8) Emerging Infectious Diseases (EID) – The program continues to implement the second phase of the interagency effort to address emerging infectious diseases, pursuant to PDD/NSTC-7. Program priorities include Hepatitis C, antimicrobial resistance, emerging viral infections, pandemic influenza, vaccine development, and the effort to address global emerging infectious disease challenges. Activities will address technologies and methodologies for surveillance and response, factors associated with emergence and reemergence, research, training, and capacity building. The NSTC Committee on International Science, Engineering, and Technology EID Task Force will draft recommendations based on PDD/NSTC-7 by Fall 2000.

9) Aviation Safety, Security, Efficiency, and Environmental Technologies – The program supports research and development aimed at (a) reducing the aviation fatal accident rate by eighty percent by 2007; (b) strengthening the security of our aviation system; (c) continuously improving our national airspace system and airports to increase their capacity and efficiency of operations; and (d) fostering the environmental compatibility of our aviation system. These activities encompass the recommendations of the White House Commission on Aviation Safety and Security and implement the NSTC report, *National Research and Development Plan for Aviation Safety, Security, Efficiency and Environmental Compatibility*.

10) Plant Genome – The program promotes the coordinated development of plant genomic information, new technologies, and resources that will improve our understanding of plant biology and be applied to the enhancement of economically important plants. Agency plans are based on existing coordinated interagency plans that address the program priorities contained in the NSTC's 1999 *National Plant Genome Initiative: Progress Report*. By September 2000, agencies will be expected to provide OSTP an interim status report on FY 2000 activities with a full report due in January 2001. In addition, the interagency working group will provide the NSTC Committee on Science with an assessment of how Federal funding for plant genome research relates to the broader needs of plant science and make recommendations if appropriate.

R&D Performance Measures

We continue to encourage agencies to include the following R&D goals and measures in their agency performance plans.

- Federally funded research will be of the highest quality. (1) Each agency should establish a goal for the percent of its research project portfolio (by amount of funds) that will be allocated through a merit-based competitive process. The goal should reflect a thoughtful balance between those mission-driven research programs that are managed by other processes, and research for which the merit-based competitive process is most appropriate. (2) Each agency should ensure that independent assessments of its research programs evaluate both the quality and the progress of the agency's research toward stated goals. The goal will be to achieve a "satisfactory" rating from such assessments, consistent with the format provided in the Government Performance and Results Act. Existing advisory committees, groups within the National Academy of Sciences, or other outside groups could conduct the assessment.
- Major scientific facilities will be built and operated efficiently. As established by law in the Federal Acquisition Streamlining Act, agencies will keep the development and upgrade of facilities on schedule and within budget, not to exceed 110 percent of estimates. Agencies will establish a goal for scheduled operating time for each facility and request operating funds consistent with that goal.

Appendix B - Activities of the President's Committee of Advisors on Science and Technology

President Clinton established the PCAST to advise the President on S&T matters and to assist the NSTC in securing private sector involvement in its activities. PCAST, composed of distinguished individuals from industry, education, and other nongovernmental research institutions, serves as the high-level, private-sector, advisory group for the President. In June 2000, PCAST issued the following report:

Wellspring of Prosperity - Science and Technology in the U.S. Economy - (Spring 2000)

The credit for America's record-breaking performance in the current world economy goes to the powerful system we have generated to create new knowledge and develop it into technologies that drive our economy, guarantee our national security, and improve our health and quality of life. *Wellspring of Prosperity* was prepared by PCAST in response to the Vice President's request to document some of the benefits of our past and present investments in science and technology. The technologies summarized in *Wellspring of Prosperity* illustrate how much we have come to rely on technology in our everyday lives. But, the marvels of today are really the fruits of research seeds planted decades ago — investments that have not only given us new technologies, but have also helped educate generations of engineers and scientists who now form an essential component of our modern workforce. The decades of investment required for these advances underscore the importance of our future investment strategy. This investment has also helped to keep America safe from aggression, defend our allies, foster democracies across the globe, and improve the quality of our lives.

In *Wellspring of Prosperity*, PCAST supports a steady funding stream for scientific and technological advances to help ensure prosperity and wellbeing for our children and grandchildren. PCAST continues to support these principles: 1) science and technology are major determinants of the American economy and quality of life; 2) public support of science and technology is an investment in the future; 3) education and training are crucial to America's future; 4) the Federal government should continue to support strong research institutions and infrastructure; 5) the Federal investment in science and technology must support a diverse portfolio of research, including both basic and applied science; and 6) stability of funding is essential.

In 2000, PCAST also advised the President on the following topics:

Letter to the President endorsing a National Nanotechnology Initiative (December 1999)

Letter to the President regarding FY2001 Budget Priorities (December 1999)

Review of the NSB Report on Environment Science and Engineering for the 21st Century (December 1999)

Appendix C – NSTC Reports

Research Misconduct - A New Definition and New Procedures for Federal Research Agencies (October 1999)

National Research and Development Plan For Aviation Safety, Security, Efficiency and Environmental Compatibility (November 1999)

Nanotechnology Research Directions: IWGN Workshop Report (January 2000)

Nanotechnology - Shaping the World Atom by Atom (January 2000)

National Plant Genome Initiative Progress Report 1999 (February 2000)

Report to the President on Resolving the Digital Divide (February 2000)

National Nanotechnology Initiative – Leading to the Next Industrial Revolution (February 2000)

The Future Management and Use of the U.S. Space Launch Bases and Ranges – Report of the Interagency Working Group (February 2000)

Program Guide to Federally Funded Environment and Natural Resources R&D (February 2000)

Ensuring a Strong U.S. Scientific, Technical, and Engineering Workforce in the 21st Century (April 2000)

PITAC Year 2000 Report to Congress Reviewing the Next Generation Internet Program and Related Issues (April 2000)

Follow-on Guidance for FY 2001 Interagency Research and Development Activities (Lane-Lew Memo) (June 2000)

Interagency Report on the Federal Investment Microbial Genomics (June 2000)

Atmospheric Ammonia: Sources and Fate – A Review of Ongoing Federal Research and Future Needs (June 2000)

National Nanotechnology Initiative – The Initiative and Its Implementation Plan (July 2000)

Letter to the President on PITAC's Review of the Federal FY 2001 Budget Request for the IT R&D Programs (July 2000).

Discovery, Education & Innovation: An Overview of the Federal Investment in Science & Technology (Summer 2000)

Report to the President on Transforming Access to Government (August 2000)

Report to the President on Developing Open Source Software to Advance High End Computing (September 2000)

Effective Disaster Warnings (October 2000)

Review of Federal Programs for Wire System Safety (November 2000)

Federal Policy on Research Misconduct (December 2000)

New Foundations for Growth: The U.S. Innovation System Today and Tomorrow (January 2001)

Implementing the NSTC Presidential Review Directive-4: Renewing the Federal Government-University Research Partnership for the 21st Century (January 2001)

NSTC publications on the World Wide Web:

http://ostp.gov/NSTC/html/nstc_pubs.html