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U.S.
TECHNOLOGY POLICY

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF SCIENCE AND TECHNOLOGY POLICY
WASHINGTON, D.C.

SEPTEMBER 26, 1990

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF SCIENCE AND TECHNOLOGY POLICY
WASHINGTON, D.C. 20506

September 26, 1990

Dear Messrs. Chairmen:

I am pleased to transmit to you a statement of the Administration's technology policy. This paper brings together the many facets of technology policy, describes what they are, and shows how they fit into a comprehensive framework. It consists of the goal and strategy of this policy and the program implementation proposed in the Administration's Fiscal Year 1991 budget submittal to Congress. It is also intended to serve as a baseline for future dialogue and discussion of technology issues, both inside and outside of the government. Areas associated with classified national security technologies are not included.

The issues involved in technology policy are varied and complex. Nonetheless, the underlying theme is that all sectors of our society have important roles to play in achieving the goal of this policy. There are formidable challenges facing us, but by working together and capitalizing on our strengths, we can ensure continued U.S. economic and industrial competitiveness.

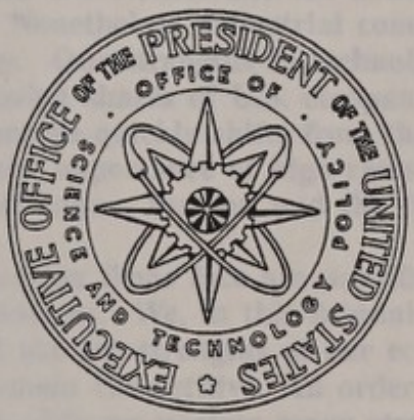
Sincerely,

D. Allan Bromley
Director

The Honorable Robert C. Byrd
Chairman
Appropriations Committee
U.S. Senate
Washington, DC 20510

The Honorable Jamie L. Whitten
Chairman
Appropriations Committee
U.S. House of Representatives
Washington, DC 20515

U.S. TECHNOLOGY POLICY



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OFFICE OF SCIENCE AND TECHNOLOGY POLICY
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U.S. TECHNOLOGY POLICY

A nation's technology policy is based on the broad principles that govern the allocation of its technological resources. Competitive market forces determine, for the most part, an optimal allocation of U.S. technological resources. Government can nonetheless play an important role by supplementing and complementing those forces. Technology policy is not something that, once set in place, remains immutable. Broad principles exist, but effective technology policy requires sufficient flexibility to permit response to changing national and international situations. We are in an era marked by increased international economic interdependency and increasingly stronger technological capabilities in other industrial nations. These factors pose competitive challenges for U.S. firms as well as opportunities. In formulating a national technology policy, consideration must be given to a nation's traditions, its strengths and weaknesses, and the international environment in which it exists.

In almost all respects the U.S. science and technology base remains the world's strongest. The Nation's research universities and the ability of its people to innovate remain the envy of the world. Nonetheless, industrial competitiveness depends on many factors besides technology. Our strengths in technology and innovation have not prevented an erosion in market shares of U.S. companies in many industries. As new products mature, the advantage quickly shifts from the innovator to the efficient producer. We have also seen the importance of high rates of capital investment for the industrial competitiveness of Japan, Europe, and the Pacific Rim countries.

The competitive challenges American firms face are multifaceted and complex. There will be no facile, short-term solutions. We, in this Administration, believe it is essential that we recognize and use the strengths of our economic system more effectively to help U.S. firms remain competitive. In order to do so, all elements of our society must recognize that while we possess many strengths and assets, problems do exist, and that we can mobilize our resources and solve them. At the same time, we need to refrain from actions that might distort our basic system of free enterprise -- the Nation's ultimate strength.

In order to build on its strengths, U.S. society needs to focus on ensuring:

- a quality workforce that is educated, trained, and flexible in adapting to technological and competitive change;
- a financial environment that is conducive to longer-term investment in technology;
- the translation of technology into timely, cost competitive, high quality manufactured products;
- an efficient technological infrastructure, especially in the transfer of information; and

- o a legal and regulatory environment that provides stability for innovation and does not contain unnecessary barriers to private investments in R&D and domestic production.

In addition, the Federal Government, industry, and academia need to take advantage of opportunities for:

- o technology transfer and research cooperation, particularly involving small and mid-sized companies;
- o building upon state and regional technology initiatives; and
- o mutually beneficial international cooperation in science and technology.

With its proven human resources and successful tradition of manufacturing, U.S. industry can assert the leadership required to meet the competitive challenges and to capitalize on its opportunities. The principal role of the Federal Government will be to provide an environment conducive to long-term economic vitality, and not allow special interests to divert attention or resources from this goal.

The following sections provide more detail on the Administration's goals and strategy to implement its technology policy, and then highlight some of the steps that it has already taken to improve the economic and technological competitiveness of U.S. industry.

Goal of Technology Policy

The goal of U.S. technology policy is to make the best use of technology in achieving the national goals of improved quality of life for all Americans, continued economic growth, and national security.

Strategy to Implement U. S. Technology Policy

The goal of U.S. technology policy is to be achieved by maintaining a strong science and technology base, a healthy economic environment conducive to innovation and diffusion of new technologies, and by developing mutually beneficial international science and technology relationships. Implementation of the policy must recognize that all parts of the economy -- the Federal Government, state and local governments, industry, and academia -- have roles to play. The education system provides the essential flow of well-trained, innovative manpower. Researchers in academia, the

Federal laboratories, and industry all contribute to the science and technology base. Industry makes the investments necessary to turn this knowledge base into commercial products and processes. Federal, state, and local governments support research both directly when they fund specific R&D projects, and indirectly through tax and other incentives for private sector R&D investment. The Federal Government also sets the overall macroeconomic and legal environment in which industry's decisions about product and process development and commercialization take place.

In that context, the Administration's strategy to implement U.S. technology policy includes the following major elements:

Role of the Private Sector

While the government plays a critical role in establishing an economic environment to encourage innovation, the private sector has the principal role in identifying and utilizing technologies for commercial products and processes. In particular, the private sector has the responsibility to:

- conduct research and development to advance industry-related knowledge and technology;
- identify and aggressively pursue potential commercial applications for technologies developed by its own laboratories as well as by universities, Federal laboratories, and foreign sources;
- increase quality, output, and productivity by undertaking necessary investments in physical capital;
- improve the skills and abilities of its workforce to meet its specific needs; and
- participate cooperatively in improving the quality of U.S. education.

Government policies can help establish a favorable environment for private industry to conduct these activities but cannot substitute for aggressive private sector action.

Government Incentives for the Private Sector

o Create an environment conducive to technological competitiveness by ensuring that technology policy concerns are factored into the formulation of related policies (e.g. fiscal, monetary, trade, environmental, etc.) with the overall objective of enhancing U.S. economic growth.

o Encourage private technology-related investment through Federal monetary and fiscal policies. For example, reducing the capital gains tax differential and making permanent as well as enhancing the tax credit for research and experimentation will provide incentives for added investment. Incentives can also be provided through appropriate tax policies.

- **Provide an appropriate legal environment at the Federal level that removes unnecessary obstacles to innovation. Reducing the uncertainties about antitrust enforcement related to inter-firm cooperation in research and technology development encourages the pooling of limited resources and a rapid diffusion of results while still protecting against anticompetitive practices. Reducing the antitrust uncertainties about joint production ventures will also enable firms to cooperate in the development and introduction of new products.**

- **Revise Federal procurement regulations and practices to permit greater integration of government and commercial production at the factory level, as well as encourage greater innovation and efficiency in development and production. Also encourage the use of commercial products, to the extent feasible, for defense, space, and other government applications.**

- **Improve opportunities for companies to commercialize technologies and computer software developed during the performance of government contracts by allowing the contractors to retain rights in technical data and by protecting their trade secrets.**

- **Provide a stable regulatory environment in order to decrease risk for private investment.**

- **Seek greater harmonization of regulations and standards for products and processes with our major trading partners.**

- **Encourage increased U.S. participation in multi-lateral international standardization efforts through the standards activities of the National Institute of Standards and Technology.**

- **Seek better international protection of intellectual property to allow more benefits to be recovered from R&D investments.**

<u>Education and Training</u>

- **Revitalize education at all levels including not only the training of scientists, engineers, and the technical workforce, but also educating our population to be sufficiently literate in science and technology to deal with the social issues arising from rapid scientific and technical change. Achieving such a goal will require a broad-based approach involving business, academia, and educational organizations, as well as Federal, state, and local governments.**

- **Develop a framework for Federal interagency coordination and collaboration in mathematics, science, engineering, and technology education. The goal is to define an effective and appropriate role for the Federal government in support of the states, localities, and universities as they improve science and technology education to build human capital in the U.S.**

- **Encourage continuing education and training, recognizing that, particularly in scientific and technological fields, education must be a lifelong activity.**

Federal R&D Responsibilities

- **Increase Federal investment in support of basic research. Private industry does not invest heavily in basic research because the payoffs are so unpredictable and diffuse that individual firms cannot be confident of fully recovering their investments. However, the long-term potential benefits of this research are so large that society cannot afford not to make the investment, especially in university research which, in addition to new knowledge, also produces trained scientists and engineers of the future.**

- **Participate with the private sector in precompetitive research on generic, enabling technologies that have the potential to contribute to a broad range of government and commercial applications. In many cases these technologies have evolved from government-funded basic research, but technical uncertainties are not sufficiently reduced to permit assessment of full commercial potential. In pre-competitive research, which occurs prior to the development of application-specific commercial prototypes, research results can be shared among potential competitors without reducing the financial incentives for individual firms to develop and market commercial products and processes based upon the results.**

- **Continue the Federal government's development of products and processes for which it is the sole or major consumer, such as national defense, provided that no commercially available products can be substituted. The government, in such cases, must rely principally on the private sector to undertake the development process. Revise current Federal procurement regulations to strengthen the abilities of companies involved in developing and demonstrating these products to use the same research results and technologies for commercial purposes.**

- **Maintain a strong Defense technology base to provide options for future weapons systems development and to help avoid technological surprises by potential adversaries. Special emphasis needs to be placed on shortening the time required for transferring R&D results to production and on using commercial products.**

- **Streamline Federal decision-making structures and mechanisms to eliminate unnecessary and cumbersome regulations and practices that inhibit industrial competitiveness.**

- **Encourage international cooperation in science and technology, where mutually beneficial, and inform U.S. researchers of opportunities to participate in R&D initiatives outside the U.S.**

Transfer of Federally Funded Technology

- **Improve the transfer of Federal laboratories' R&D results to the private sector. Where appropriate, these laboratories should give greater consideration to potential commercial applications in the planning and conduct of R&D, and these efforts should be guided by input from potential users. To achieve this goal, there must be a closer working relationship among these laboratories, industry, and universities. Defense-related laboratories can make major contributions while still providing adequate safeguards for classified information.**

- **Promote increased industry-Federal laboratory-university collaboration, including personnel exchanges, to help convert Federally-supported R&D into new technologies that the private sector can then turn into commercial products and processes.**

- **Promote and encourage access by U.S. industry to Federal laboratories within the guidelines established by the Federal Technology Transfer Act of 1986 (P.L. 99-502), other existing legislation, and Executive Order 12591.**

- **Expedite the diffusion of the results of Federally-conducted R&D to industry, including licensing of inventions and removal of barriers to commercialization of Federally developed computer software.**

- **Encourage direct laboratory-industry interaction within broad, flexible Federal guidelines, since effective technology transfer occurs at the operational level.**

Federal-State Activities

Recognize the importance of decentralization, and encourage states to develop programs that take into account the individual characteristics of each state. Federal programs in such areas as education, training, the national infrastructure, and regional generic technology centers, should build upon state initiatives.

Programs To Implement U.S. Technology Policy

The Administration has undertaken a broad range of programs and initiatives aimed at translating the technology policy into action. These programs and their associated budget levels requested for Fiscal Year 1991, where applicable, are summarized here.

Incentives for the Private Sector

The Administration has proposed improvements in incentives for private sector innovation by:

- **Reducing the tax rate on capital gains permanently to spur entrepreneurial activity.**

  The Administration has proposed restoring a capital gains tax differential such as existed before the Tax Reform Act of 1986. A lower tax rate on capital gains will encourage investors and entrepreneurs to make the investments necessary to be competitive.

- **Making the research and experimentation (R&E) tax credit permanent to reduce uncertainty.**

  Under current law, the R&E tax credit is scheduled to expire on December 31, 1990. The Administration proposal to make the credit permanent would permit businesses to establish and expand research facilities without fearing that the tax laws will suddenly change.

- **Protecting intellectual property through international negotiations.**

  The Administration is aggressively pursuing improved international protection of intellectual property. The current negotiations in the Uruguay Round of the General Agreement on Tariffs and Trade (GATT) are an important forum for developing better international rules. Negotiations on intellectual property rights are also being conducted in the World Intellectual Property Organization and in trilateral talks with the European Community and Japan. In addition, the U.S. is pursuing bilateral negotiations on intellectual property rights under the provisions of the 1988 Omnibus Trade and Competitiveness Act.

- **Liberalizing export controls to enhance high technology product exports.**

  Dramatic changes in the Eastern European security environment have permitted an Administration re-evaluation of U.S. export controls, and paved the way for an expanded trade potential for U.S. high technology industries.

- **Reforming product liability laws to restore balance to the tort system.**

  The Administration supports the adoption of uniform product liability standards across the 50 states based on three principles of fairness: the right of an innocent person to fair compensation for actual damages; liability based on responsibility for harm and not ability to pay; and encouragement of alternatives to costly litigation. The proposed changes to product liability laws would

maintain incentives to produce safe products, but would restore balance to the tort system and reduce uncertainty -- particularly for new products.

o Reforming the Federal procurement process.

The Administration supports continued efforts to streamline the procurement process, reduce its complexity and paperwork burden, and provide contractors with incentives to innovate and reduce costs. The Administration has proposed changes in legislation and regulations to foster commercial style competitive procedures for the acquisition of commercial products. A revision of the Federal Acquisition Regulations is being drafted that will allow contractors to retain commercial rights in technical data developed under Federal contracts. The Administration is also developing a policy mandating increased agency use of performance based contracting that gives contractors more freedom and incentive to innovate.

o Removing barriers to research, innovation, and development.

The Administration supports continued elimination of unwarranted regulation. Deregulation can spur innovation as well as lower prices. It also requires a continuous reexamination of existing regulatory policies to avoid unnecessary stifling of new products and processes. The Administration has proposed antitrust legislation that would reduce the legal uncertainties for companies to enter joint production ventures while still protecting against anticompetitive practices. Challengers would be required to prove that such ventures would harm competition. The legislation would also eliminate punitive treble-damage awards under certain circumstances.

Education and Training

In addition to the President's broad initiatives on education, there are a number of programs directed at improving education in mathematics and science and at training of the technical workforce. These include:

o National Science Foundation: $463 million plus research assistantships proposed in Fiscal Year 1991

The National Science Foundation has a broad range of programs dealing with mathematics and science education and human resources at all levels. Major programs are:

- Research career development (graduate research fellowships and enrichment activities for talented high school students).

- Teaching materials development and informal science education (aimed primarily at the pre-college level).

- Teacher preparation and enhancement (upgrading quality of faculty, providing Presidential Awards for Excellence in Science and Mathematics Teaching, and developing model programs for women, minorities, and the handicapped).

- Undergraduate science, engineering, and mathematics education (includes instrumentation grants, curriculum development, faculty revitalization, comprehensive regional centers for minorities, and research experiences for undergraduates).

In addition, almost 16,000 graduate students are supported by research assistantships through regular research grants to universities.

o Department of Education: $333 million proposed in Fiscal Year 1991

- Eisenhower mathematics and science program (provides funds to help State and local educational agencies carry out programs to train teachers and improve instruction in mathematics and science).

- Adult education program (aimed at skills needed to cope with new technologies and providing for workplace literacy).

o National Institutes of Health: $292 million plus research assistantships proposed in Fiscal Year 1991

- Almost 12,000 graduate students receive training grants.

- Tens of thousands of graduate students are supported by research assistantships through the $4.4 billion in extramural research grants.

o National Aeronautics and Space Administration: $51 million proposed in Fiscal Year 1991

Program activities cover informal K-12 science education, mobile presentations on space to elementary and secondary schools, teacher workshops and internships at NASA research centers, grants for undergraduate and graduate students, and programs for minorities in science and engineering education.

o Department of Energy: $25 million plus research assistantships proposed in Fiscal Year 1991

- Programs include science and mathematics exposure for middle and high school students, research training of undergraduates, and graduate fellowships in science and engineering.

- An estimated 4,000-4,500 graduate students are supported by research assistantships through research grants to universities.

o **Department of Defense: $364 million projected for Fiscal Year 1991 for non-military personnel**

- **Pre-college programs (summer programs for minorities).**
- **Undergraduate programs (primarily ROTC scholarships in technical fields).**
- **Graduate fellowships and research assistantships.**
- **Post-doctoral and faculty research appointments.**

o **Department of Agriculture: $125 million proposed in Fiscal Year 1991**

- **Challenge grants to strengthen undergraduate education.**
- **Capacity building grants to strengthen teaching and research programs in the "1890 Land Grant" institutions.**
- **National needs fellowships to recruit and train scientists in the most critically deficient areas.**
- **Graduate assistantships associated with research grants projects. About 13,000 graduate students are supported for graduate studies.**
- **Ag-In-The-Classroom to support science strengthening in K-12 programs.**
- **Research apprenticeships to bring high school students into university and government laboratories to stimulate interest in science.**
- **School enrichment program to function as a catalyst between schools and community to strengthen science programs.**
- **Postdoctoral program in Agricultural Research Service and Animal and Plant Health Inspection Service laboratories.**

<u>Federal R&D Responsibilities</u>

The Fiscal Year 1991 budget proposes to allocate about $71 billion for research and development. This is an increase of $4.5 billion, or 7 percent, over 1990 enacted levels. Civilian R&D will increase by 12 percent, while defense-related R&D will increase by 4 percent. Within this total, $12 billion will be allocated for basic research, an increase of $1 billion or about 8 percent over 1990. The budget contains a number of new and expanded programs that will contribute to the Nation's R&D enterprise and competitive posture. These include:

- o A 13 percent increase in the National Science Foundation's budget request for research and facilities, which account for over 75 percent of the NSF budget. Support for basic science and engineering is the foundation on which U.S. technology is built. Within the overall increases there are emphases on Science and Technology Centers, networking and communications, Engineering Research Centers, and major research equipment for universities.

- o Developing advanced technologies to meet Defense and civilian agency needs. Based on the results of a special survey of the support for selected advanced technologies that are funded by more than one Federal agency, the budget proposals are:

  - Robotics - The budget provides $192 million to six Federal agencies for support of robotics R&D. The focus of this R&D is on the development of systems that are more autonomous and capable of interacting with changing and uncertain environments.

  - High Performance Computing - The budget provides $469 million for Federal support of R&D focused on high performance computing. This activity includes the full range of advanced computing technologies as well as systems and applications software, networking, and underlying research and human resource infrastructure.

  - Semiconductors - The budget provides $537 million for research on semiconductor materials, development and application of semiconductor materials to meet agency mission needs, and support of R&D on semiconductor manufacturing processes. The largest single Federal program is DOD funding of $100 million per year for SEMATECH, a semiconductor industry R&D consortium.

  - Superconductivity - The budget provides $215 million for superconductivity R&D. Programs in five Federal agencies deal with both high temperature and low temperature superconducting phenomena and materials.

  - Advanced Imaging Technologies - The budget provides $118 million for advanced imaging R&D. Advanced imaging systems include interactive graphics, high definition displays, advanced signal processing, and advanced digital switching technologies.

- o Improving productivity and the quality of life through biotechnology. The budget proposes $3.6 billion for biotechnology R&D. In pharmaceuticals, foods, agriculture, waste management, and energy, biotechnical advances offer the possibility of improvements that will make a real difference in people's lives.

- o Developing technologies for improved transportation. The budget proposes funding for transportation R&D of $1,527 million. This R&D is aimed at maintaining a modern, efficient transportation infrastructure, an essential factor

in being industrially competitive. Federal programs are focused on aeronautics, highways, mass transit, railroads, maritime, water, aviation, and other transportation areas.

- o Promoting alternate sources of energy. For conduct of energy R&D programs in the Department of Energy, the budget proposes total funding of $2,450 million. The R&D is aimed at maintaining abundant, reliable, and economic sources of energy. Federal programs cover a broad spectrum of energy technologies including solar, renewable, conservation, nuclear fission, nuclear fusion, and fossil energy, and supporting energy sciences.

- o Enhancing industrial productivity and development of standards. The budget proposes $198 million for the National Institute of Standards and Technology. R&D in fundamental measurements and standards provides the foundation for U.S. industry, commerce, and science to achieve levels of accuracy and compatibility required to support technological development, efficient processing, process control, and quality assurance. Special activities include R&D on advanced manufacturing technologies. In addition, the Advanced Technology Program provides grants to industry-led ventures to support research on pre-competitive generic technologies.

Transfer of Federally Funded Technology

Many important steps have been taken, pursuant to the Federal Technology Transfer Act and other legislation, to increase the degree to which Federal laboratories collaborate with private industry in commercializing the results of Federally-funded research and development. These activities include:

- o Establishment of over 200 active cooperative research and development agreements between Federal laboratories and private companies.

- o Creation of the Precision Manufacturing Technology Program by the Department of Energy to provide U.S. industry greater access to the extensive manufacturing technology, expertise, and facilities available within the Department's Defense Programs weapons complex.

- o Formation of the Biotechnology Research and Development Consortium, a joint research effort between the Department of Agriculture's Northern Regional Research Center, the University of Illinois, the State of Illinois, and six U.S. companies.

- o Formation of a joint venture in high temperature superconducting materials and applications by Du Pont, Hewlett-Packard, and Los Alamos National Laboratory.

- o Establishment of Regional Manufacturing Technology Centers. The budget provides $5 million for this program. The approach is to reduce the barriers

faced by small- and medium-sized manufacturers in adopting new technology by creating awareness and providing up-to-date, practical information and expertise on manufacturing technologies and practices.

Federal-State Activities

Federal programs have already been initiated to build upon the advantages offered by decentralized programs operating at the state and local level. These programs include:

- o Department of Commerce Clearinghouse for State and Local Initiatives on Productivity, Technology and Innovation:

  The Clearinghouse gathers and analyzes information on the many technology development centers at the state and local level. It will help to develop a network of contacts among state and local officials and staff.

- o Small Business Development Centers:

  Each Small Business Development Center (SBDC) serves as a one-stop assistance center for businesses and provides services ranging from pre-business start-up counseling to technical advice for existing businesses. The centers have a legislative mandate to assist in technology transfer, make use of Federal laboratories and equipment, and coordinate and conduct research they deem worthwhile.

- o University Centers Program:

  This program provides funds to involve the resources of universities in economic development within the community.

- o NASA Industrial Applications Centers Program:

  The centers offer clients access to a national data bank that includes over 100 million documents of accumulated technical knowledge, along with their expertise in retrieving information and applying it in support of clients' needs. The centers are backed by state-sponsored business or technical centers that provide access to the technology transfer network.

- o Trade Adjustment Assistance Centers Program:

  The centers provide trade-impacted small and medium-sized manufacturers with in-depth technical assistance.