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THE WHITE HOUSE

WASHINGTON

April 9, 1991

MEMORANDUM FOR THE VICE PRESIDENT
THE SECRETARY OF STATE
THE SECRETARY OF DEFENSE
THE SECRETARY OF AGRICULTURE
THE SECRETARY OF COMMERCE
THE SECRETARY OF LABOR
THE SECRETARY OF TRANSPORTATION
THE SECRETARY OF ENERGY
THE DIRECTOR, OFFICE OF MANAGEMENT AND BUDGET
THE UNITED STATES TRADE REPRESENTATIVE
THE CHIEF OF STAFF TO THE PRESIDENT
THE ASSISTANT TO THE PRESIDENT FOR NATIONAL
SECURITY AFFAIRS
THE CHAIRMAN, COUNCIL OF ECONOMIC ADVISERS
THE ASSISTANT TO THE PRESIDENT FOR ECONOMIC AND
DOMESTIC AFFAIRS
THE ASSISTANT TO THE PRESIDENT FOR SCIENCE
AND TECHNOLOGY

SUBJECT: Working Group on Science and Technology

The economic performance of the United States is closely tied to increases in productivity through innovation and the development and application of new technologies. The President has continually demonstrated his commitment to a vigorous research and development agenda, most recently in the FY 1992 budget submission to Congress.

To support the Administration's leadership on research and development issues, the Economic Policy Council (EPC) Working Group on Research, Development, Technology and Innovation is being re-established. This group will be called the Working Group on Science and Technology. The Assistant to the President for Science and Technology will assume the role of chairman.

The Working Group will provide a forum for developing Administration policy on significant science and technology issues that affect U.S. economic performance. As initial tasks, the Working Group will review the policy approach of the federal government toward implementation of the networking aspects of the high performance computing and communications initiative and various joint industry-government cost-sharing consortia contemplated by the recent Administration initiatives.

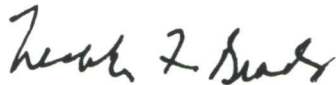
The Working Group should include representatives from the Office of the Vice President, Departments of State, the Treasury,

Defense, USTR, Commerce, Energy, Office of Management and Budget, Council of Economic Advisers, Office of Policy Development, and Office of Science and Technology Policy. The members of the Working Group should be at the Assistant Secretary level or above.

As the Working Group focuses on specific issues, representatives of appropriate Executive Branch agencies will be invited to participate.

The chairman of the Working Group should coordinate its activities with the Executive Secretary to the EPC.

Thank you very much for your cooperation.



Nicholas F. Brady
Chairman Pro Tempore
Economic Policy Council

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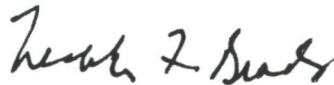
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Nicholas F. Brady
Chairman Pro Tempore
Economic Policy Council

Document Originally
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To Olin Wethington
From Blair Downing

FYI



The Secretary of Energy
Washington, DC 20585

May 7, 1991

MEMORANDUM FOR THE HONORABLE NICHOLAS F. BRADY
SECRETARY OF THE TREASURY

SUBJECT: Economic Policy Council Working Group on
Science and Technology

Thank you for inviting representation from the Department of Energy on the Economic Policy Council Working Group on Science and Technology. Linda G. Stuntz, Deputy Under Secretary for Policy, Planning, and Analysis, will serve as the Department's representative to the Working Group, with support from the Department's technical organizations as appropriate.

A handwritten signature in cursive script that reads "Jim Watkins".

James D. Watkins
Admiral, U.S. Navy (Retired)

cc: The Honorable D. Allan Bromley

*File 5&T Work
Group*

Document Originally
Attached to
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Booklet entitled
"Toward a US Technology Strategy"

NATIONAL ACADEMY OF ENGINEERING
NATIONAL ACADEMY OF SCIENCES

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Manufacturing Forum*

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AG

TOWARD
A
U.S. TECHNOLOGY
STRATEGY

*Enhancing Manufacturing
Competitiveness*

Discussion Paper Number 1

Erich Bloch

THE MANUFACTURING FORUM

TOWARD A U.S. TECHNOLOGY STRATEGY
ENHANCING MANUFACTURING COMPETITIVENESS

By
Erich Bloch

Discussion Paper Number 1
February 1991

This paper has been prepared by the author for the Manufacturing Forum and is published and distributed by the Forum as a public service. Its publication implies no endorsement of its conclusions or recommendations by the National Academy of Sciences, the National Academy of Engineering, the Institute of Medicine, or the Manufacturing Forum, nor by any of their members.

THE MANUFACTURING FORUM

National Academy of Engineering
National Academy of Sciences

NATIONAL ACADEMY PRESS
Washington, D.C.

THE MANUFACTURING FORUM

The Manufacturing Forum was established in 1990 by the National Academy of Engineering and the National Academy of Sciences to provide a means by which policymakers from government, industry, and universities can meet to discuss issues that influence the competitiveness of manufacturing industries. The Forum is based on the recognition that future challenges to the performance of U.S. manufacturing industries from increased foreign competition, from developments in new technology, and from changes in our domestic economic and societal climates can only be effectively met by a concerted effort on the part of industry, government, and academia.

The Manufacturing Forum is a device for improving communications among its members and to the larger community. It does not conduct studies, provide advice, or make recommendations on specific issues or policies.

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CHRISTOPHER T. HILL, Executive Director
PENELOPE GIBBS, Administrative Assistant

ACKNOWLEDGEMENT

The author wishes to acknowledge Dr. T. Samantha Solomon, Solomon Associates, for her invaluable assistance in the researching, writing, and editing of this report to the Manufacturing Forum.

He also wishes to thank the many members of the community who reviewed this report in draft and made valuable suggestions for its improvement.

FOREWORD

The Manufacturing Forum has identified many issues that need to be addressed and many opportunities that need to be grasped on the way to improving the future performance and competitiveness of U.S. manufacturing industries, including changes in management practices, changes in the climate for investment, upgrading of the manufacturing workforce at all levels, and changes in a host of public policies intended to facilitate and/or constrain our manufacturing industries.

To facilitate its consideration of specific manufacturing issues, the Forum commissions experts in a variety of fields to prepare discussion papers. Each author is encouraged to express his or her own views sufficiently sharply to catalyze serious discussion. The Forum members offer their individual views, which authors may accept or reject, but the papers do not in any sense represent the views of the Forum as a whole.

Few issues arise more consistently and more insistently than the need to discover, develop, apply, and continuously improve the technologies employed in our manufacturing industries and in the other parts of the economy that support or depend on them.

Ensuring a continual stream of new technologies and attending to their effective application is first and foremost a responsibility of individual industrial firms in the private sector. However, both our historical experiences and those of competitor nations demonstrate that wise public policies can play critical roles in encouraging and facilitating technological change and application in industry, and that such policies can bring benefits not only to industrial performance but to the nation as a whole through enhanced contributions of industry to the economy, to national security, and to the quality of life for all citizens.

In this paper, Dr. Erich Bloch, former Director of the National Science Foundation and a member of the Manufacturing Forum, presents his views on changes that should be considered in formulating our national technology policy in the interests of enhancing manufacturing competitiveness. This paper was a basis for discussions of technology policy in a meeting of the Forum in January 1991.

Ruben F. Mettler
Chairman

Executive Summary

Americans need to understand that the world they live in is fundamentally changing. The United States was in a dominant position at the end of World War II. It had the most advanced technology, and it had the manufacturing and marketing resources to dominate international trade. Today, the U.S. trade balance is overwhelmingly negative. Even the advantage in the high-technology industries we once took for granted has virtually disappeared.

The United States does not lag behind its competitors in generating basic research results or in the quality of its Ph.D. scientists and engineers. But America's former competitive advantage in the commercial application of technological developments and discoveries is quickly being eroded by our competitors who often deploy new technologies in products and processes with greater speed than we do. The results are an American "manufacturing gap" and, ultimately, an increasing deterioration of our technology base.

We are not just witnessing a "natural" adjustment in the post-war economy, as has been suggested, but rather a profound and critical decline in U.S. technology and manufacturing. While the primary responsibility for this decline in manufacturing competitiveness falls on the private sector, federal policies and practices—such as those affecting education, macroeconomic policy, regulatory policy, antitrust guidelines, tax policy, trade and investment policies, and science and technology policy—have a major impact on the country's ability to compete. To be successful in ensuring that the United States remains a world-class manufacturing competitor, then, its technology policy must be accompanied by a variety of policies, programs, and actions by government, industry, and universities in these other areas.

Because manufacturing is one of America's economic foundations, and because it is of strategic importance to the competitive position of the United States in the world economy and to the maintenance of national well-being and security, these declines in national capabilities relative to our major competitors require the immediate attention of both the private and public sectors.

First, industry, academia, and the federal government must look at science and technology—as well as technology and manufacturing—as a continuum, in which the insights of science, from the most fundamental through the applied, are linked to basic technology developments and to products and services in the marketplace. Today's trends in manufacturing toward shorter production runs, shorter product cycles, increasing quality, a greater variety of products with

increasing customization, and a shorter time to market for new products demand an integrated manufacturing environment and a greater harmonization of public policy and private actions.

Second, just as American industry traditionally has too often separated R&D from production, so has the U.S. government treated science and technology as if they were separable entities. In 1945, Vannevar Bush's report to President Truman, *Science: The Endless Frontier*¹, put in place this country's first federal science policy, but assigned no role to the government in technology development. Yet, the report needs to be seen as a product of the times: when Bush wrote his report, America's industrial technology base was very strong, while its science base was relatively weak. Today, the reverse is true—our science base and our basic research and higher education system are unparalleled in the world, while our civilian technology base is in trouble.

Third, the federal government has only lately addressed technology as an issue. Nevertheless, America has had a "de facto" technology policy in place for many decades. In important instances during the 1950s and 1960s, the federal government supported the development of "generic" technologies—most often as part of the war and national defense efforts—which later developed into important new commercial industries for this country. In fact, for nearly 40 years after World War II "strategic technology" was developed mainly in the context of military and space programs. This gave us world leadership in television, integrated circuits, advanced computers, aerospace, lasers, nuclear energy, polymers, and many other fields. However, because of recent developments, namely, the emergence of the civilian sector as the precursor of new technology development—supplanting the military sector, the end of the Cold War, and the aggressive investment by our foreign competitors in coordinated public-private sector initiatives for technology development, this traditional approach to supporting strategic technology development and utilization has become less effective than it was in the past.

While the primary responsibility for civilian technology development and commercial application lies with the private sector, the federal government can and should play a more proactive, participative role than it has traditionally. The White House Office of Science and Technology Policy's (OSTP's) publication in the fall of 1990 of the first "U.S. Technology Policy"² is a step in the right direction. What is now required is for the government and industry to translate that policy into practice by *jointly* developing a strategy to enhance economic growth and manufacturing competitiveness. To begin this task, definite actions should be taken.

REVERSE THE CONTINUING LOSS OF THE U.S. TECHNOLOGY BASE

Leadership

National security is no longer primarily a military concern. Economic growth and security have become vital considerations, and the strategic importance of technology can be a significant contributor to America's future growth and competitiveness. To disseminate this important message, President Bush should include in an appropriate message to Congress and to the American people his support for OSTP's newly issued "U.S. Technology Policy" and should articulate clearly the need to develop jointly with industry, labor, and academia a technology strategy and to establish a continuing industry-government dialogue at the highest levels of government to address strategic issues in science and technology.

Rebalancing R&D Expenditures

While a case can be made for additional R&D funding, the present R&D budget must be scrutinized for reallocation and priority setting in order to increase the effectiveness of current investments in our nation's science and technology base. Today, over 60 percent of the U.S. R&D budget is allocated to defense-oriented R&D. In view of the domain and role being assumed by the civilian sector in technology development, there is a need for more equal balance between civilian and defense R&D by 1995. A better balanced division of expenditures would enable the U.S. to achieve R&D spending on the civilian side of the ledger more comparable to that of our major foreign competitors.

IDENTIFY AND INVEST IN STRATEGIC, GENERIC TECHNOLOGIES

Support for Generic Technologies

Government must play a larger role in ensuring that the United States has the technology necessary to support economic growth and promote manufacturing competitiveness. The federal government should support and participate in collaborative efforts with industry and the universities to develop generic technologies in this country. There are generic technologies that are of prime importance to the future of American manufacturing and to America's technological leadership in the world. Prominent among these are electronics technologies, biotechnology, information technologies, manufacturing and process technologies, and advanced materials technologies.

The 1992 Budget Proposals

Congress should support the President's Fiscal Year 1992 initiatives in science and technology, including the high-performance computing and networking initiative, the embryonic initiative in materials technology and processing, and the manufacturing technology efforts in NIST, NSF, DOE, DOD, and other agencies. Congress and the Administration should also press forward with an imaginative education and human resource initiative to provide leadership to stimulate upgrading the skilled workforce American industry needs to handle tomorrow's advances in science and technology.

R&D Credit

Congress should make the R&D tax credit applicable to R&D related to manufacturing processes, make the tax credit permanent, and make special provisions for investment by firms in industry-government consortia and in academia.

SPEED-UP THE COMMERCIALIZATION OF NEW TECHNOLOGIES

The Role of the Federal Laboratories

The federal government operates more than 700 laboratories with an annual budget of approximately \$21 billion—three-fifths of which goes towards defense applications. This amount is almost one-third of the government's R&D expenditures, and nearly one-sixth of the nation's total. From the perspective of the American economy, these laboratories are an underutilized resource. As an experiment, the missions of some government laboratories, or specific divisions or projects of a single laboratory, should be redirected to support industrial coalitions aimed at creating leadership positions in strategic, generic technologies. Through joint industry-government funding and management, these efforts could become the nuclei of U.S. generic, precompetitive technology development.

ENHANCE COLLABORATION BETWEEN THE PUBLIC AND PRIVATE SECTORS

Collaborative Mechanisms and Technology Transfer

Developing collaborative mechanisms for technology transfer between the public and private sectors and within each sector is fundamental to the effectiveness of any technology strategy. Any viable technology strategy must include vehicles to promote the collaboration of government with industry and the universities. Such "partnerships" can take a variety of forms including

industry-government consortia like SEMATECH, industry-university-government research centers like the National Science Foundation's (NSF's) Engineering Research Centers and its Science and Technology Centers, multi-company industry efforts such as the Microelectronics and Computer Technology Corporation (MCC) and the Semiconductor Research Corporation (SRC), and technology transfer centers like the National Institute of Standards and Technology's (NIST's) five regional Manufacturing Technology Centers that focus on the needs of smaller businesses.

Support for State and Local Initiatives in Science and Technology

Over the past two decades, state and local governments have come to view science and technology programs as keys to economic development. These programs vary from state to state, but generally include funding for advanced technology research centers—sometimes referred to as “centers of excellence,” seed and venture capital funds, technical assistance, incubators, research parks, R&D grants, and information dissemination and technology transfer. The federal government should actively support these efforts and coordinate its activities with state program developers and clients.

CONCLUDING NOTE

The end of World War II was a critical time for the country to establish the science base, strategy, and organizational mechanisms to remain at the leading edge of scientific research. Today, the end of the Cold War, the increasing competition in the global marketplace, and the need for accelerating the economic growth of the U.S. should spur the long overdue effort to put in place the technology strategy and implementing mechanisms needed to return and keep America on the leading edge of technology and manufacturing.

The New Environment

“The world is in political, economic, and technological upheaval unparalleled since World War II. We find ourselves in a new polycentric world in which political, economic, and technological power is dispersed globally.”

(Robert M. White, April 13, 1990)³

Americans need to understand that the world they live in is fundamentally changing. Over the past 15 years, the United States and other nations throughout the industrial world have faced and are continuing to face economic, political, and technological realignment of unforeseen proportions. The United States was in an economically dominant position at the end of World War II. It had the most advanced technology, and it had the manufacturing and marketing resources to dominate international trade. But that favorable position is gone. Today, the U.S. trade balance is overwhelmingly negative. Even the advantage in the high-technology industries that we once took for granted has virtually disappeared. It is well recognized that the erosion of American manufacturing capabilities has contributed heavily to the U.S. trade deficit.

The development and use of new and better technology is essential to the future of manufacturing in this country. Although technology alone cannot solve the competitiveness problem—it takes, in addition, a supportive social, financial, and legal environment—technology can be an important tool in developing cost-effective products that will compete in world markets. Now, more than ever, success in the global marketplace means creating and applying new knowledge—which is to say new technology—faster than one’s competitors. That is the fundamental law in this competitive world.

In recent years, the markets in which we have to sell our products have become international; we no longer have a large domestic market dominated by our own industries. This is true for both new and established industries. During this period we also saw technology become the foundation for a global economy, a major impetus to economic growth, and a principal source of competitive advantage. In addition, we witnessed the emergence of Japan, the Pacific Rim countries, and now the European Economic Community as economic rivals in an increasing number of industries, and the erosion of the U.S. economic position in many of them.

Today, technology is critical to the continued growth of nations. Since World War II, the world economy has been transformed into a knowledge-based, skill-based economy. Industries based primarily on knowledge and fast-moving technologies, such as semiconductors, advanced materials, biotechnology, and information technologies, are the industries that are fueling economic growth. In this new environment, competitiveness is determined less by a nation's abundance of natural resources, low-cost labor, and other classical comparative advantages of the past than by its abilities to generate, access, and rapidly deploy new knowledge and technical insights, and to convert them into quality products and processes.

Academics and analysts have repeatedly raised the question: Is America's eroding competitiveness an inevitable result of our competitors' post-war investments in rebuilding their economies and in research and education, or is there something fundamentally wrong with this nation's capacity to compete? The answer is simple. We are not just witnessing a natural adjustment, but rather a profound and critical decline in U.S. technology and manufacturing. This is evident if we consider the loss in U.S. marketshare of automobiles, semiconductors, instrumentation and machine tools, and robotics in manufacturing processes. This decline in national capabilities requires immediate attention by both the private and public sectors because manufacturing is America's economic foundation and is of strategic importance to the competitive position of the United States in the world economy, and because it is essential to the maintenance of national security.

The reasons for our decline are many. While the primary responsibility for the decline in manufacturing competitiveness falls on the private sector for not being more alert to technological changes, increasing competition, the role of quality, and market demands; federal policies and practices—such as those affecting education, macroeconomic policy, regulatory policy, antitrust guidelines, tax policy, and science and technology policy—can and do have a major impact on the private sector's ability to compete. In fact, the competitive posture of industry has been inhibited by the lack of integration between the government's economic policies and its ad hoc technology programs. To date, the government has not acted to ensure that economic and related policies—such as those listed above—are in place to provide the proper "business environment" for effective technology development and utilization in the private sector. While many of these federal policies and macroeconomic considerations are difficult to alter, particularly in the short term, others are within our reach to change.

However, our problems are not without solutions. America possesses unparalleled strengths in basic research and higher education, in the openness of our society to leadership and new ideas, in the enormous resources devoted to R&D by both the public and private sectors, in our numerous outstanding private and government laboratories, in our large domestic market, in the availability of venture capital, and in the free movement of people among the private, public, and academic sectors.

But America is at a crossroads. If we persist in our traditional attitudes and approaches and are unwilling to modify our institutions, our economic position in the global marketplace will further erode. If we recognize the changes that surround us, take advantage of our strengths, are willing to question established wisdom and to create new collaborations and alignments, and shed outmoded institutions and create new ones, the future can be bright.

Science, Technology, and Manufacturing

“So many of the world’s most advanced technologies, from robotics to the VCR, were first developed here. And yet, so many of those concepts were ultimately brought to the marketplace by our competitors. We can do better. And I am determined that we will do better.”

(President Bush, March 7, 1990)⁴

SCIENCE AND TECHNOLOGY AS A CONTINUUM

America’s economic growth and national security are intimately tied to its standing in science, technology, and manufacturing. Today, the speed of progress in research and development and product innovation makes it increasingly inappropriate to divide the activities of science and technology as if they are two separate spheres. Science and technology are a continuum, in which the insights of science, from the most fundamental through the applied, are linked to technology developments and to products and services in the marketplace. An important element of this continuum is the scientific and technological workforce that does the research, develops the technologies, and designs, markets, and services products.

Considering these activities as a continuum is not meant to imply that science, technology, and manufacturing progress sequentially and linearly, and that basic research results precede applied research or technology development. There are numerous cases in which technology development preceded theory. For example, electrical communication systems, the telephone, and the telegraph existed long before a theory of communications was established, and steam engines were developed before thermodynamics became a scientific discipline. Rather, science and technology should be seen as interactive and interdependent — with stimulation and feedback flowing back and forth between parts of the system. The flow is neither linear nor unidirectional. While science and technology share many things in common, such as the scientific approach to experimentation, they also differ philosophically. Science asks: “What is?” while technology asks: “What can be?”

TECHNOLOGY AND MANUFACTURING AS A CONTINUUM

Just as science and technology are a continuum, so are technology and manufacturing. Technology is the driving force in the design and manufacturing of products and the development of services. Technological innovation, design, and manufacturing are interactive and interdependent processes. For example, product development, design, and manufacturing all drive research and are, at the same time, highly dependent on research for successful innovation.

In fact, the continuum runs from basic research to marketing — an approach that in the “best practice” companies is characterized by systematic and incremental improvements in products and processes in response to changing signals from the marketplace. Successful U.S. firms — and many of our major foreign competitors — emphasize simultaneous improvements in engineering, function, quality, cost, and speed of commercialization. In general, the most competitive firms are closer to their customers and to their suppliers than their less successful industrial counterparts; have greater functional integration among research, design, manufacturing, and marketing; and have less hierarchical organizational structures.

The MIT Commission on Industrial Productivity⁵ correctly advocates a systems approach to manufacturing. Such an approach encompasses a great deal more than just what occurs on the production line. It includes designing and developing products as well as planning, marketing, selling, and servicing them. The technologies and processes used in these functions are also a part of manufacturing, as are the ways in which the workforce interacts with technology and is educated and trained.

In contrast to its competitors — particularly those in Japan — U.S. industry has too often placed artificial boundaries between research and design on the one hand, and production and marketing on the other. This counterproductive philosophy is embodied in many American companies in the physical separation of research facilities from the factory floor. Today’s trends in manufacturing are toward shorter production runs, shorter product cycles, increasing quality, a greater variety of products with increasing customization, and a shorter time to market for new products. This new climate demands an integrated manufacturing environment that facilitates making incremental improvements and refinements in both manufactured products and the manufacturing process.

There is a consensus that the United States does not lag behind its competitors in generating basic research results or in the quality of its doctoral scientists and engineers. But America’s ability to rapidly translate science and engineering into commercializable products, and its ability to take advantage of the detailed insights, understanding, and processes that are a prerequisite to product design and product manufacturing is another story altogether. Thus, in recent years it has become apparent that a “manufacturing gap”—like the technology gap of earlier years—has emerged, and this time it is the United States that lags behind.

Science Policy and Technology Policy

"America assumed that government support for science would be adequate to provide for technology. It is not."

(Council on Competitiveness, 1988)⁶

HISTORICAL OVERVIEW

Before World War II, the federal government played a limited role in the support of science. One major activity, besides the operation of its own laboratories, was the establishment of the National Advisory Committee on Aeronautics (NACA). NACA helped spawn the aeronautics industry in the United States and was the organizational forerunner to NASA. But World War II changed the course of the way science was conducted in this country by harnessing the talents of numerous scientists and engineers to work on the war effort to defend America's national security. The seminal experiences of organizations and individuals during the war fundamentally changed the interactions between the public and private sectors with regard to science and technology. The war led to a massive increase in the level of federal science funding and firmly established the concepts of awarding research grants and contracts for the conduct of R&D in universities and industry, rather than in government-operated laboratories.

In 1945, Vannevar Bush, then director of the federally created Office of Scientific Research and Development, submitted to President Truman his report, *Science: The Endless Frontier*, thereby laying out this country's first federal science policy. In the report, Bush stated that:

*"New products, new industries, and more jobs require continuous addition to knowledge of the laws of nature, and the application of that knowledge to practical purposes.... This essential new knowledge can be obtained only through basic research...that the impetus can come promptly only from the Government...[since] basic research is essentially non-commercial in nature."*⁷

Subsequently, Vannevar Bush's report led to the establishment of the National Science Foundation (NSF). For 40 years NSF, together with other,

mission-oriented R&D agencies of the federal government (e.g., DOD, NASA, DOE, NIH, USDA), has kept the United States at the leading edge of basic scientific and engineering research.

But in the same document, Bush made short shrift of any government role in technology development, asserting that: "industry will fully rise to the challenge of applying new knowledge to new products. The commercial incentive can be relied on for that." However, Bush's view notwithstanding, during the 1950s and 1960s there were important instances in which the federal government supported the development of generic technologies—as part of the war and national defense efforts—that later developed into important new commercial industries for the country. Television, for example, gained immensely from radar and electronic developments undertaken for military and defense reasons. In fact, for nearly 40 years after World War II, "strategic technology" was developed mainly in the context of military and space programs supported by DOD and NASA. This gave us world leadership in integrated circuits, advanced computers, aerospace, lasers, nuclear energy, polymers, and many other fields. However, recent developments have made dependence on military programs to support strategic technology development and utilization less effective than it was in the past.

THE PARADIGM SHIFT

Several factors make it less likely that defense and other mission-oriented R&D will be a primary source of commercial technology development in the years to come.

First, the fundamental shift away from U.S.-Soviet military confrontation is likely to reduce the military R&D budget and make it less possible for military agencies to develop important dual-use technologies.

Second, the time scales for the development of military products and commercial products are diverging, making commercial products the precursor for new technologies, and resulting in strategic technologies of the future being increasingly developed in civilian contexts rather than in military or space programs. Biotechnology, semiconductor manufacturing, robotics, artificial intelligence, high-definition displays, and materials technology are all being developed for and finding applications today in the civilian sector earlier than in the military sector. This is the reverse of the situation that existed prior to about 1980.

Third, federal government agencies are end-mission-oriented (e.g., defense, health, agriculture) in their selection and funding of projects and are not oriented towards the development of commercial technology. In addition, government standards and specifications—especially those of DOD—optimize technologies with different goals in mind than those sought by producers of commercial products. With defense accounting for close to 65 percent of federal R&D spending, and with defense technologies becoming less relevant to the needs of the marketplace and to the economic growth of the nation, it is

important that we consider a rebalancing and reoptimization of federal R&D spending to utilize these scarce resources more effectively.

The governments of most other industrial nations—and assuredly of our major competitors—have purposefully promoted research and technology for economic development. The role that governments have assumed in supporting research, technology development, and its applications varies over a wide spectrum of activities and programs. For example, in Japan emphasis is placed on reducing ideas to practice and making the commercialization process more rapid. The Ministry of International Trade and Industry (MITI) promulgates a broad strategy that harmonizes the efforts of government and industry in particular areas of technology development. The MITI-sponsored program on very-large-scale integration (VLSI) is thought to be one of its primary successes to date—a program that led to the dominance by Japanese manufacturers of the production of semiconductors and to the near world monopolization of dynamic random access memory (DRAM) chip production.

The governments of countries forming the European Community (EC) address science, technology, and manufacturing issues across the board, ranging from basic research to development of prototype products. Since its launch in July 1985, EUREKA has demonstrated success in bringing about transnational cooperation in fields of high technology close to the market. ESPRIT—the European strategic program for R&D in information technology—is designed to stimulate precompetitive R&D activities by means of projects carried out in collaboration with governments, industry and research centers in member states, and the EC. JESSI—the Joint European Submicron Silicon Initiative—is one of the newer internal collaboration activities in Europe. Funded at a level of \$3-4 billion for the first half of the 1990s, JESSI could become a significant challenge to established competitors in the semiconductor industry.

While our competitors engage in coordinated public-private sector initiatives for technology development and utilization, the debate in the United States centers on whether and how America's policy should deviate from its traditional approach of government-supported basic research, defense technology, and mission-oriented R&D.⁸ Other than spinoffs from defense and other mission-oriented technology programs, the commercial development and application of new technologies have for the most part been considered the responsibilities of the private sector.

In contrast to other countries, U.S. policymakers have not viewed science and technology as a continuum; rather, they have tended to draw an arbitrary dividing line between the two. Government involvement in science is widely viewed as a legitimate role, while its support of technology is not. We have had a science policy in place for over 40 years, concentrating almost exclusively on support for basic research. But government support for science is not sufficient to ensure a national comparative advantage in commercial technology development and utilization, because the problems and issues addressed by technology are different from those that form the basis of scientific research.

Because of the new international environment and the continuing erosion of our technology and manufacturing base, in the fall of 1990 the White House Office of Science and Technology Policy (OSTP) issued what is the first "U.S. Technology Policy."⁹ "The goal of U.S. technology policy," it states, "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." This statement outlines public and private sector responsibilities for ensuring sound technology policy, and in its introduction it proposes that:

"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.*" (emphasis added)

In elucidating federal R&D responsibilities, the document outlines two roles that are pertinent to this discussion:

"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 discussing the transfer of federally funded technology to the private sector and ensuring closer collaboration among industry, federal laboratory, and university personnel, the policy statement proposes two goals that build on previous federal government efforts in technology transfer:

"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."

"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."

OSTP's technology policy statement should be supported. What is now required as the next step is a strategy to implement this policy. The end of World War II was a critical time for the country to establish the science base, strategy, and organizational mechanisms that would enable it to remain at the leading edge of scientific research. Today, the end of the Cold War, increasing international competition, and the need to accelerate the economic growth of the U.S. should spur a long overdue effort to put in place a technology strategy for the country and to establish the implementing mechanisms needed to return and keep America on the leading edge of technology and manufacturing.

Generic Technologies

"This administration is also committed to working with [industry] in the critical pre-competitive development stage where the basic discoveries are converted into generic technologies that support both our economic competitiveness and our national security."

(President Bush, March 7, 1990)¹⁰

Since World War II, the federal government has accepted its role as a supporter of basic research. But over the years the government has been ambivalent about taking a proactive role in providing financial support for generic technologies except in areas, such as defense, where the government is the principal customer. We can no longer afford to be ambivalent. Rapidly growing technological complexity, increasing uncertainties, long lead times, and reduced market shares have increased costs and decreased profits for many U.S. firms. These circumstances militate against commercial firms investing sufficiently in generic technologies, and the indications are that these pressures will only increase. Meanwhile, the benefits of targeted and publicly financed strategic technology programs abroad continue to accrue to our foreign competitors. These programs—in Japan and Europe—have reduced the risks associated with technology and product development and those associated with investment in capital, taken advantage of a limited skillbase, and assured long-term government support for our competitors as well.

Numerous reports have been released recently describing technologies that are termed "generic," "enabling," "strategic," "emerging," or "critical." The Department of Defense, the Department of Commerce, the Computer Systems Policy Project, and the Aerospace Industries Association have produced lists, and OSTP and the Council on Competitiveness are about to do so as well. These lists have been assembled by a wide range of scientists, engineers, and leading industrialists, and yet they are remarkably consistent in the kinds of technologies identified as critical to America's economic and national security and to its ability to compete in the global marketplace, as well as in their assessments that the country is losing its technological leadership in the world.

The Department of Commerce report, released in the spring of 1990, identifies 12 emerging technologies with a combined U.S. market potential of about \$350 billion in annual product sales by the year 2000 and a world market of

about \$1 trillion.¹¹ However, competition from the world's other two economic powers—Japan and the EC—is strong. This study indicates that, if current trends continue, before the year 2000 the United States could lag behind Japan in most emerging technologies and it could trail the EC in several.

What is meant by the term "generic"? And, what does the Administration mean when it talks about "precompetitive R&D"? In a recent address, D. Allan Bromley, the President's Science and Technology Advisor, defined these terms as follows:¹²

"A generic technology is simply one that has the potential to be applied to a wide variety of products and processes extending across many industries. A generic technology is typically not something that is sold commercially. Rather, it requires subsequent research and development, generally by the private sector, to result in commercial application."

"Precompetitive refers to a particular part of the innovation process. It applies to activities before the point at which a company can tell whether a specific technology has commercial potential. It would not apply, for example, to the development of application-specific commercial prototypes."

Generic technologies are not related to narrow market sectors; rather, they often span entire industries or even multiple industries and market sectors. Generic technology stops short of design and development of particular products for the commercial marketplace. By the same token, precompetitive investments are not related to specific products; they are aimed at the development of common tools and technologies that will be used later in a variety of applications. Generic, enabling technologies include advanced materials, biotechnology, engineering and production technologies, information technologies, semiconductors, robotics, and artificial intelligence. These are prominent among the technologies that will fuel economic growth in the 1990s and beyond. It should be noted that the generic technologies of the twenty-first century are much more complex, more multidisciplinary, and more costly to develop than those on which our twentieth century technology has been based.

The rationale for federal government support of generic technology development is similar to the one that guides basic research investment: generic technologies require government support because of the high risks and high costs involved in the research and because no one firm can capture a return sufficient to justify the investment. Since the results of research and development on generic technologies diffuse rapidly to competitors at home and abroad, assuring adequate R&D investment in them requires a combination of industrial funds and government support.

Realizing benefits to the U.S. economy from government investments in generic technology requires that the private sector and universities be closely linked to government-supported generic technology development if commercial

application is to follow in the United States. This implies two related implementation steps. First, we must strengthen technology transfer mechanisms both between the public and private sectors and within each sector. Second, we must manage and utilize all of our scientific and engineering resources—including those in industry, the universities, and our more than 700 federal laboratories—to the maximum possible advantage in the collaborative development of generic technologies.

Several vehicles exist to put such collaborative partnerships in place. One such vehicle is the Advanced Technology Program (ATP), which was created by the 1988 Omnibus Trade and Competitiveness Act to assist U.S. industry to carry out R&D on precompetitive, enabling technologies. The ATP is a Department of Commerce program administered by the National Institute of Standards and Technology (NIST).

Another vehicle is the establishment of industry-government consortia such as SEMATECH. For years the Japanese semiconductor industry has recognized the advantages of cooperation in the precompetitive phases of R&D. By contrast, U.S. industry has been characterized by relationships that are mostly adversarial. Because U.S. firms have acted independently, each company is burdened with the full costs of advancing all aspects of new technologies. In an era of rapidly increasing costs of technology development, independent and duplicative efforts hinder competitiveness. The U.S. semiconductor industry has been late to recognize the advantage of such cooperative research efforts and American firms have only recently organized to pool their resources. One result is SEMATECH, a government-supported industry consortium dedicated to improving semiconductor manufacturing technology.¹³

Recently, the Administration has adopted the goal of maintaining the technology base of the country, at least in part, through the federal government's support of generic technologies at the precompetitive stage. It has issued a technology policy document and made public remarks to that effect, but it has yet to take the strategic implementation steps necessary to accomplish this. The first step is for the federal government, together with industry, to develop a joint technology strategy. This strategy does not involve the government in picking "winners and losers." The basic choices of which products to develop and when remain within the private sector, backed by private money and disciplined by the marketplace. Instead, the strategy must encourage the creation of collaborative coalitions between governments at the federal and state levels (including the vast resources at our national laboratories), industry, and universities to develop a small number of generic technologies that are of strategic importance to the U.S. economy now and in the future.

Towards a U.S. Technology Strategy

"The United States is not used to designing national strategies for helping its industries catch up with dominant producers in the rest of the world."

(MIT Commission on Industrial Productivity, 1989)¹⁴

Over the past decade, the problems of U.S. competitiveness and the role of technology have been studied by a wide variety of groups. These include President Reagan's Commission on Industrial Competitiveness, the Council on Competitiveness, the Computer Systems Policy Project, the National Academy of Engineering, the MIT Commission on Industrial Productivity, the National Association of Manufacturers, the Defense Science Board, and, more recently, the National Advisory Committee on Semiconductors, the Vice-President's Council on Competitiveness, the White House Office of Science and Technology Policy, and the Congressional Office of Technology Assessment. Their reports and studies all give voice to four consistent components that must be included in an effective strategy:

- Reverse the continuing loss of the U.S. technology base
- Identify and invest in strategic, generic technologies
- Speed-up the commercialization of new technologies
- Enhance collaboration between the public and private sectors, and within these sectors.

Although the primary responsibility for civilian technology development and commercial application lies with the private sector, the federal government can and should play a more proactive, participative role in these processes than it has traditionally. The National Academy of Engineering's statement on "Technology and Competitiveness" correctly proposed that in this critical time of global competition, the government, working collaboratively with industry and the universities, "must assume more responsibility for the national civilian technology base in those areas of technology where industrial incentives or motivation are inadequate to meet the needs of the economy as a whole."¹⁵

For the government to assume this responsibility is a departure from the past. Traditionally, the government has felt an obligation to provide the principal support for the nation's science base, but not its civilian technology base.

The result of this policy position has been that the government has put more emphasis on basic research than on technology transfer and the commercialization of new technologies. As the OSTP report indicates, this is no longer a tenable position: if it is to regain its competitive edge in manufacturing, the United States cannot simply be content to dominate the basic research part of the technological innovation process without taking steps to reap the benefits of this investment in the marketplace. The release of this report and the planned establishment of the Critical Technology Institute by OSTP is evidence that our attitudes are beginning to change. But much more must occur before we can be satisfied that we have indeed a viable approach to our technology base.

Addressing the four steps identified above suggests the following implementation steps.

REVERSE THE CONTINUING LOSS OF THE U.S. TECHNOLOGY BASE

Leadership

Our nation's technological leadership is being tested and challenged in the global marketplace every day. The science and engineering enterprise has been called on in the past to address problems of extreme complexity and national importance, such as development of the atomic bomb during World War II, the design and building of the interstate highway system in the 1950s, and the Apollo program during the 1960s. Circumstances outside the research system drove the extraordinary scientific and technological accomplishments in these instances. Today, new, and in some ways more pervasive and threatening, challenges face the nation—sustaining U.S. economic growth and our technological pre-eminence, and stemming the erosion of the manufacturing sector.

National security is no longer a purely military concern. Economic security has become a vital consideration and the strategic importance of technology can be a significant contributor to America's future growth and competitiveness. To get this important message out to American citizens, President Bush should include his support for the newly issued "U.S. Technology Policy" and should articulate the need for an industry-government technology strategy—as well as the implementation steps outlined below—in an appropriate message to Congress and to the American people. The President should also address the need for a continuing industry-government dialogue at the highest levels of government to address strategic issues in science and technology.

Rebalancing R&D Expenditures

While a case can be made for additional R&D funding, the present R&D budget needs to be scrutinized for reallocation and priority setting in order to make our current investments in the nation's science and technology base more effective. Today, over 60 percent of the U.S. R&D budget is allocated to

defense-oriented R&D. Since defense-oriented R&D is not the precursor to civilian technology development that it has been in the past, there is a need to introduce greater balance between civilian and defense R&D by moving towards a more equal division of expenditures. Such a division of resources would enable the U.S. to achieve levels of R&D spending on the civilian side of the ledger more comparable to those of our major foreign competitors. One mechanism for attaining this more effective division of R&D funds is to ensure full public and private sector utilization of the vast resources found in the federal laboratories by involving them in the development of civilian-oriented generic technologies, rather than in development of defense-oriented technology.

IDENTIFY AND INVEST IN STRATEGIC, GENERIC TECHNOLOGIES

Support for Generic Technologies

Government must play a larger role in ensuring that the United States has the technology necessary to support our economy and promote manufacturing competitiveness. As was discussed earlier, NIST's newly implemented Advanced Technology Program is one step on the road towards government/industry collaboration in the development of generic technology. But much more is needed. It is striking that after all the reports and analyses are made, a few areas of technology come to the top of the priority list over and over. They are

- Electronic technologies
- Biotechnology
- Information technologies
- Manufacturing and process technologies
- Advanced materials technologies

These generic technologies are among those that are of prime importance to the future of American manufacturing and to the United States' technological leadership in the world. As an experiment, the federal government should redirect the missions of a small number of government/national laboratories so that, through joint industry funding and management, they could become the nuclei of generic, precompetitive technology efforts.

The 1992 Budget Proposals

Congress should support the President's FY 1992 initiatives in science and technology, including the high-performance computing and networking initiative, the embryonic initiative in materials technology and processing, and the manufacturing technology efforts in NIST, NSF, DOE, DOD, and other agencies. Congress and the Administration should also press forward with an imaginative education and human resource initiative to provide leadership to stimulate

upgrading the skilled workforce American industry needs to handle tomorrow's advances in science and technology.

R&D Tax Credit

Congress should make the R&D tax credit fully applicable to R&D related to manufacturing processes, which it is not today. In addition, the tax credit should be made permanent so that companies can plan their R&D expenditures ahead of time and use this economic incentive more effectively. Finally, Congress should make special provisions for investments by firms in industry-government consortia and in academia as a means of enhancing the private sector's participation with government in the development of generic, enabling technologies. These actions would constitute first steps towards a much needed integration of economic policy and technology policy.

SPEED UP THE COMMERCIALIZATION OF NEW TECHNOLOGIES

The Role of the Federal Laboratories

The federal government operates more than 700 laboratories with an annual budget of approximately \$21 billion—three-fifths of which goes towards defense applications. This amount is almost one-third of the government's R&D expenditures and nearly one-sixth of the nation's total. As military budgets decline, many government laboratories must find new missions or go out of business. Many already have no well-defined mission.

Although Congress adopted several laws in the 1980s to encourage the commercialization of federal laboratory technology and to promote technology transfer from the federal laboratories to the private sector, collaboration between laboratories and industrial firms has been modest at best. Our national laboratories are an underutilized resource in our quest for economic growth. They must become an effective, strategic resource.

Some government laboratories, or specific divisions or projects of a single laboratory, should be redirected to support industrial coalitions aimed at creating leadership positions in generic technologies. Within these coalitions, industries and the laboratories would collaboratively agree on project content, and both would provide financial, technical, and human resources.

Getting industry involved in working collaboratively with government to develop generic technologies will positively affect the outcome of R&D by applying a market test to the tasks and their execution. Such collaborative ventures would also reduce federal funds that are now devoted to the laboratories and make those funds available for other civilian R&D efforts.

ENHANCE COLLABORATION BETWEEN THE PUBLIC AND PRIVATE SECTORS

Collaborative Mechanisms and Technology Transfer

Developing collaborative mechanisms for technology transfer between the public and private sectors, and within each sector, is fundamental to the effectiveness of any technology strategy. Any viable strategy for technology must include vehicles to promote the collaboration of government with industry and the universities and multi-company collaboration among U.S. industrial firms. In order to make collaborative efforts between industry-government and university-industry work, American firms must supplement such collaborative efforts with in-house activities that are complementary to external ones so that they can rapidly take advantage of the outcomes of collaborative efforts.

Such "partnerships" can take a variety of forms. One such vehicle is the formation of industry-government consortia. SEMATECH, in the area of semiconductor manufacturing, is one example of this kind of joint venture. Another mechanism for facilitating closer collaboration between sectors is the National Science Foundation-supported Engineering Research Centers (ERCs) and Science and Technology Centers (STCs). These centers were established to foster close partnerships between universities, industry, and the government on industrially relevant interdisciplinary science and engineering research and education.

Another mechanism that has been tried in various forms includes multi-company industry efforts like the Microelectronics and Computer Technology Corporation (MCC) and the Semiconductor Research Corporation (SRC). Another mechanism that has been tried to increase collaborative technology development and deployment is the establishment by NIST of three regional Manufacturing Technology Centers. These centers are charged with helping small businesses improve their productivity through the transfer and application of new manufacturing tools and methods. Two additional centers are planned for 1991.

Support for State and Local Initiatives in Science and Technology

Over the past two decades, state and local governments have come to see science and technology programs as keys to economic development. Following the examples of California's Silicon Valley, Boston's Route 128, and North Carolina's Research Triangle Park, many states have adopted active technology-based development strategies. These programs vary from state to state, but generally include funding for advanced technology research centers—sometimes referred to as "centers of excellence," seed and venture capital funds, technical assistance, incubators, research parks, R&D grants, and information dissemination and technology transfer. The federal government should actively support these efforts and coordinate its activities with state program developers and clients.

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Sh: 507 CG

U.S. ADVANCED BATTERY CONSORTIUM

April 1991

BACKGROUND

- On January 30, 1991, Chrysler, Ford, General Motors formed a research consortium to evaluate and develop advanced battery technologies for use in electric vehicles.
- Consortium appears in the form of a partnership agreement.

U.S. Advanced Battery Consortium

Rationale for Consortium

- Electric propulsion is the only way to meet future emissions standards in California
- There is no clear advanced battery choice
- Development of a viable system is beyond the resources of any manufacturer or technology group
- A consortium is the only way to focus a collective effort and quickly identify the best options for commercialization

U.S. Advanced Battery Consortium

Objectives of Consortium

- Establish capability for U.S. advanced battery manufacturing industry
- Accelerate market potential of EVs by jointly researching the most promising advanced battery alternatives
- Develop electric systems capable of providing EVs with range and performance competitive with conventional petroleum-based systems
- Leverage funding for high-risk, high-cost advanced battery R/D for EVs

U.S. Advanced Battery Consortium

Organization

- 3 partners: GM, Ford, & Chrysler
- Partners' Committee
 - policy, business, plan to meet annually
- Management Committee
 - provides requirements, priorities, allocates funding
 - EPRI, SCE
- Working Groups
 - 3-each led by auto industry
- EPRI and Southern California Edison (wish to join)

Respective Roles of Pertinent Contributors

Consumer

- Transportation

Nation

- Achieve virtually pollution-free transportation
- Lessen transportation's dependence on petroleum
- Establish global leadership
- Strengthen competitiveness

Utilities

- Business opportunity for new infrastructure
- Improved utilization of existing power/distribution systems

Battery Developers/Suppliers

- New business opportunity

Auto Companies

- Sell commercially acceptable electric vehicles

D.O.E

- Support successful technology development for public good

U.S. Advanced Battery Consortium

Preliminary Battery Candidates

- o Sodium Sulfur
- o Lithium Metal Sulfide
- o Lithium Polymer

How the Auto Industry sees Advanced Batteries

- Auto industry considers electricity as an alternative fuel, like ethanol or methanol
- No intention either to produce new fuels for conventional vehicles or batteries for electric vehicles, rather, for EV's the intention is to buy these components from battery developers/suppliers who join the development effort

PROPOSED FUNDING

(\$ Millions)

	<u>1991</u>	<u>1992</u>	<u>1993</u>
Auto Industry	4.5	9.0	13.5
Utilities/EPRI	4.5	9.0	13.5
Battery	4.5	9.0	13.5
Manufacturers	-----	-----	-----
	13.5	27.0	40.5
Proposed Government/Industry Cost Share 50/50			
Totals	27.0	54.0	81.0

Justifying it back in US.

ENVIRONMENTAL ISSUES

GROUND RULE

Environmental Issues Will Be Adequately Addressed

- When selecting candidates for development
- During system research and development
- When recharging
- Ultimate disposal or recycling

No more environmental problems with new propulsion systems

RECENT / CURRENT USABC MILESTONES

- Jan 30 - Partnership Agreement Signed
- Jan 31 - Technical Advisory Comm. Formed
- Mar 4 - Partnership Agreement Legal
- Mar 21 - Administratively Organized
- Mar 21 - Request Battery Concepts from Industry (Pre-proposal)
- May 1 - Pre-proposal Responses Due
- Jul 1 - First Battery Candidate Selected

April 15 - Consortium will provide proposal to USG

Corporate Res Agreement take 90-100 days

Contracting phase

Sub: ST
N.G.

OFFICE OF CABINET AFFAIRS STAFFING MEMORANDUM

Date: 4-23-91

Due by: Now

Subject: OMB Clearance: DOC Report on American Technology

From: Holly Williamson Preeminence Act

	ACTION	CONCUR	FYI		ACTION	CONCUR	FYI
HOLIDAY	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	FITZHENRY	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
DANZANSKY	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	MCMUNN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ADAIR	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	PORTER	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
BUCHHOLZ	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	SCHALL	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
CASSE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	SECHLER	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
EVANS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	WETHINGTON	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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GUNN	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
LEFKOWITZ	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
JACKSON	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	_____	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Comments:

If you have comments, I need them ASAP -- we just received this.
My.

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
Washington, D.C. 20503

11 pages
total

APR 22 1991

LEGISLATIVE REFERRAL MEMORANDUM

LRM #M-183

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SUBJECT: COMMERCE Proposed Report on American
Technology Preeminence Act of 1991

The Commerce draft report comments on the House
Subcommittee on Technology markup sent to you on
4/12/91. The full Science Committee is scheduled
to mark up the bill on 4/24/91.

DEADLINE: Tuesday, 12:00 noon APR 23 1991

The Office of Management and Budget requests the views of your
agency on the above subject before advising on its relationship to
the program of the President, in accordance with OMB Circular A-19.

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Honorable George E. Brown, Jr.
Chairman, Committee on Science,
Space and Technology
House of Representatives
Washington, D.C. 20515-1536

Dear Mr. Chairman:

This letter provides the views of the Administration on the American Technology Preeminence Act of 1991 ("American Technology Bill"), as reported out of House Subcommittee on April 10, 1991, which we wish to bring to your attention prior to your Committee's markup of this legislation. Additional, more detailed, comments on the bill are contained in an enclosure to this letter.

We share your desire that a suitable reauthorization act for the Department of Commerce's Technology Administration and National Institute of Standards and Technology (NIST) be enacted, in order to reauthorize the Department's technology policy and research programs and to make important administrative improvements to a number of statutes under which the Department currently operates. However, certain aspects of the American Technology Bill raise very serious problems.

First, we want to reemphasize our strenuous opposition to an amendment we understand may be offered at full Committee markup which would establish a \$100 million loan program for the Advanced Technology Program (ATP) in Fiscal Year 1992. A copy of our previous letter on this issue is attached for your reference. As the American Technology Bill notes, the purpose of the ATP is to support industry-led private sector projects in areas of technological research, development and application that are not otherwise being adequately developed by the private sector. The Administration's support for the ATP has always been conditioned on this premise. A loan program, in contrast, would cause the ATP to evolve into a completely different type of program involving primarily low risk projects where commercial feasibility is well established, to avoid high default rates. These are the types of projects that can, and should, be financed by the private sector. While we appreciate the Committee's concern about affording high technology companies lower costs of capital, the Administration's proposals to make the research and expenditure tax credit permanent, and to cut the capital gains tax, are much more effective and broad-based tools to accomplish this goal than to target, and possibly undermine, the Department's new ATP program.

We also object to the foreign participation provisions in Title II of the bill, which impose restrictive conditions on the access

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of non-U.S.-owned companies to the ATP. Such provisions contradict the Administration's open investment policy; do not conform with our national treatment obligations under various investment agreements; and may thwart rather than support the stated objective of the bill -- to enhance U.S. competitiveness -- by restricting the Secretary's ability to allow qualified companies with proposals which may benefit the U.S. to participate in the ATP, and by restricting the ability of joint venture participants to decide for themselves which companies to include in their ventures. At the very least, we strongly recommend that the Committee add language to these provisions which ensures that they would not apply to the extent they are inconsistent with United States obligations under the General Agreement on Tariffs and Trade or an international agreement or treaty to which the United States is a party.

We also oppose an amendment adopted at subcommittee markup which would require the Secretary to submit annual reports identifying "civilian industries necessary to support a manufacturing infrastructure and critical to the economic security of the United States," and to develop a 10 year plan to ensure growth of those industries. This requirement is overly burdensome and unnecessary in light of reports we and the Office of Science and Technology Policy (OSTP) already prepare on critical technologies -- technologies which have applications across many industries. Moreover, we strongly oppose as directly contrary to Administration policy any requirement of having to target particular industries for "major public . . . efforts needed to ensure the growth" of the industry, therefore leaving other ones out, as this amendment would require.

We urge your Committee to take these concerns and the ones noted in the attachment into consideration in its markup, particularly our very serious concerns about the proposed ATP loan amendment. We remain committed to working with the Committee to enact appropriate reauthorization legislation for the Technology Administration.

The Office of Management and Budget has advised us that there is no objection to the submission of this letter to the Congress from the standpoint of the Administration's program.

Sincerely,

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Wendell L. Willkie, II
General Counsel

Enclosures

DRAFT**ADDITIONAL COMMENTS
on the****American Technology Preeminence Act of 1991,
as reported out of Subcommittee on April 10, 1991.**

Title I: We cannot support the authorization levels in the bill. These levels greatly exceed the President's FY 1991 and 1992 budget requests for the Technology Administration and NIST. The budget request of the President reflects the Administration's judgment, recognizing tight fiscal constraints, as to the amount of Federal funding which can be devoted to these particular programs at this time. We are particularly concerned about the levels for NIST's extramural programs such as the ATP, which has only just announced its first awards and has yet to be evaluated; the Manufacturing Technology Centers Program (MTCs), which is undergoing evaluation; and the State Technology Extension Program, the objectives of which are advanced through the MTCs and other technology transfer activities of NIST. The priority for funding for NIST should remain with its core laboratory and standards research functions, which provide essential support both for the extramural programs and for general U.S. industrial health and competitiveness.

Section 103(f): We support the amendment in this section which would allow NIST to undertake construction of and improvements to buildings and facilities above \$250,000 without notice to Congress.

Section 108: We object to the Buy-American provisions in this bill which, among other things, would unnecessarily restrict the Secretary's flexibility to administer departmental programs, and unduly complicate bilateral foreign relations. These provisions should be deleted.

Title II, Section 201(c): This section broadens the ATP to include direct grants (in addition to cooperative cost-sharing agreements), thereby undermining a basic premise of the ATP -- that projects be industry-led, and that industry be willing to put up its own funds.

Section 201(e): This section retains the concept of recoupment which presents serious conceptual and administrative problems for the Department. We appreciate the recognition by the Congress that the current ATP license and royalty provision -- 15 U.S.C. 279n(d)(7) -- is a significant deterrent to the participation in the ATP of private companies, particularly computer software and other copyright-oriented companies. However, the alternative provision suggested in the bill is equally problematic. The

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Government should not be deciding whether or not a specific project is a "commercial success." Also, notwithstanding the ceiling on repayment provided in the bill, a recoupment requirement in the context of the ATP is inappropriate as it undermines private sector incentives to risk funds to promote the commercialization of federally-funded or developed technology. We suggest, therefore, that the original provision -- 15 U.S.C. 278n(d)(7) -- be repealed.

Section 201(c)(6): In addition to the objections we stated in our cover letter regarding the restrictions on foreign participation in the ATP in this section, we have a number of objections to restrictions which are imposed here on non-U.S.-incorporated companies with respect to the vesting and transfer of intellectual property which may arise under the ATP. Both sets of restrictions could discourage participation by qualified foreign companies in the ATP, as well as qualified U.S. companies, and result in retaliatory measures in the laws of other countries.

The restriction on the transfer of intellectual property to non-U.S.-incorporated companies is a restraint on alienation of property. Such restraints are generally discouraged since they inhibit instead of encourage trade. Under this provision, for instance, a U.S.-incorporated company could not transfer title to its patent to its subsidiaries or other parties in foreign countries. This would inhibit exploitation of patents in other countries, and as a result, reduce profits of the U.S. companies.

There are a number of technical problems with these provisions as well. For example, since title to the intellectual property arising from the ATP must vest in a "company" incorporated in the U.S., partnerships and individuals would not be able to take title under this section. This could preclude partnerships from entering into the venture, or preclude subsequent contracts between the venture and partnerships or individuals. Also, the sentence prohibiting the United States from publicly disclosing proprietary information related to its license may be inconsistent with information required to be disclosed to obtain a patent.

These provisions also unnecessarily complicate the disposition of ownership rights in and licensing of inventions made under federally-funded research, which is guided by Chapter 18 of Title 35 of the United States Code. At the very least, we strongly suggest revising the provisions to state that "The disposition of rights to any inventions resulting from the joint venture shall be governed by the provisions of Public Law 96-517 (35 U.S.C. Chapter 18). The requirements contained in that law shall apply without regard to the size or profit or non-profit status of the joint venture participants."

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Section 301: This section amends the Stevenson-Wydler Technology Innovation Act of 1980 to make permanent a set-aside of 0.008 percent of each Federal agency's research and development budget for transfer to NIST to fund the activities of the Federal Laboratory Consortium (FLC). We recommend against extending this funding mechanism indefinitely, with no cap on the total amount of funds to be transferred, since such an approach leaves the FLC's funding levels without proper Congressional and Executive Branch oversight.

Section 305: This section authorizing the Department's Under Secretary for Technology to "serve as a focal point for discussions among United States companies on topics of interest to industry and labor . . ." could create a conflict between the proper roles of the Technology Administration and the Department of Labor. We suggest that it be narrowed to matters pertaining to the technological competency of the workforce.

Section 504: While we question the need for the Commission on Technology and Procurement established in this section in light of work already being done in this area by the Council on Competitiveness and the Office of Federal Procurement Policy, we recommend the addition of other appropriate agencies to the board of the Commission if it continues to be included in the legislation, such as the United States Trade Representative, the Department of Energy, the National Aeronautics and Space Administration, the Treasury Department and the Small Business Administration.

Section 504, as added at Subcommittee markup: In addition to the very serious concerns we stated in our cover letter regarding the requirement in this amendment to identify and prepare a ten-year plan on critical manufacturing industries, we note that the Department's Industrial Outlook already provides vital information on the manufacturing industry. Also, OSTP publishes the Biennial National Critical Technologies Report pursuant to section 603 of the National Science and Technology Policy, Organization and Priorities Act of 1976 (42 U.S.C. 6683), and heads a working group through the Federal Coordinating Council for Science, Engineering and Technology which focuses specifically on manufacturing technologies.

Section 506: In this section regarding the National Technical Information Service, the Administration strongly prefers an approach which allows borrowing necessary sums from the Treasury.

Title VI: This title directs NIST to offer unsolicited technical advice to the Environmental Protection Agency (EPA) regarding EPA's regulatory responsibilities with respect to lead-based materials, some of which (e.g., technical criteria to implement a voluntary accreditation program) would not be reimbursable or otherwise funded. We do not believe these provisions are

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appropriate for this legislation. However, if such advice is to be offered, it should be made first to the Secretary of Housing and Urban Development (HUD), since HUD is the lead agency regarding lead-based paint. At the very least, therefore, we recommend the substitution of language which directs NIST "to provide, to the extent funds are made available and to the extent consistent with its other responsibilities, such technical assistance as HUD and EPA may require in connection with the implementation of a laboratory accreditation program and development of detection technology standardization criteria with respect to lead in paints, films, soil and dust."

General: The bill also requires that a number of commissions and boards be established -- such as in section 401 (the Commission on Reducing Capital Costs for Emerging Technologies), section 501 (the High-Resolution Information Systems Advisory Board, within OSTP), and section 506 as added at Subcommittee markup (the National Quality Council), among others -- which impose inappropriate new requirements on the Executive Branch and are duplicative of existing programs. We object to the establishment of permanent commissions and boards to address issues which are already being studied or can more effectively be addressed through reports or other existing mechanisms, such as the Council on Competitiveness. For example, the Commission on Reducing Capital Costs for Emerging Technology is related to on-going capital cost work at Treasury. The High-Resolution Information Systems Advisory Board appears to duplicate efforts being undertaken by the Council on Competitiveness, and the research and development efforts of several agencies. We are also concerned that the new National Quality Council would be duplicative, and may diminish the value, of the Department's successful Malcolm Baldrige National Quality Award Program.

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GENERAL COUNSEL OF THE
UNITED STATES DEPARTMENT OF COMMERCE
Washington, D.C. 20230

APR 9 1991

Honorable George E. Brown, Jr.
Chairman, Committee on Science,
Space and Technology
House of Representatives
Washington, D.C. 20515-1536

Dear Mr. Chairman:

This is to indicate the Administration's serious concerns about a possible amendment which may be offered at the markup of the American Technology Preeminence Act of 1991, which would authorize a \$100 million loan program for the Advanced Technology Program (ATP) for FY 1992. We strongly oppose adoption of such an amendment.

We believe this amendment would undermine the basic objective of the ATP, which is to fund cooperatively, through grants with U.S. industry, research and development in high-risk, generic pre-competitive technologies. We are concerned that the loan program could not only decrease the incentive for companies to commit their own resources to high risk ventures, but could also result in their having much more short term goals due to loan repayment requirements.

Because of the high-risk nature of the proposals to be funded under the ATP and the significant number of small companies which are likely to be funded, we expect the default rate for such a loan program to be high. The loan program would also entail extensive overhead costs for the National Institute of Standards and Technology (NIST), which administers the ATP. For the purpose of scoring the program under the Omnibus Budget Reconciliation Act of 1990, we believe the loan program could score a significant amount of the loan authority due to the above-referenced costs and others we anticipate. A potential effect of this scoring could be to reduce possible availability of appropriations for the ATP cooperative grants program and NIST core research.

We also note that the ATP is still a relatively new program. NIST only recently completed the first ten awards totalling approximately \$10 million. NIST is striving to meet the demands of the new cooperative grants program and to make it as effective and efficient as possible. The addition of a substantial new loan program could seriously impair these efforts.

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The Office of Management and Budget has advised us that there is no objection to the submission of this report to the Congress from the standpoint of the Administration's program.

Sincerely,

Wendell L. Willkie, II

Wendell L. Willkie, II
General Counsel



UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Technology Policy
Washington, D.C. 20230

S&T Work Shop

APR 17 1990

MEMORANDUM FOR Hollis McLaughlin
Assistant Secretary for Policy Management
Department of the Treasury

FROM: Deborah L. Wince-Smith *D L Wince-Smith*
Assistant Secretary for Technology Policy

SUBJECT: Recent Speeches of Secretary Brady and
Related Matters

I applaud the recent statements by Secretary Brady on the importance of investments that create wealth. The objective of increasing the use of modern technology by U.S. companies depends on their ability to obtain low cost and 'patient' capital.

We agree with the emphasis on the national savings rate. But members of my staff and I are not convinced that increasing the rate alone will substantially increase productive investments. There are too many other things that people can do with their savings, such as increasing their speculation, margin trading, and consumption.

Policy options such as capital gains tax provisions and IRAs need to foster genuine productive investments rather than just feeding the short-term churning of financial markets. Attached are some relevant comments we made recently on a draft paper, entitled "Competitiveness and the Cost of Capital: Executive Summary" prepared for the EPC Working Group on that subject. Also attached for your information is our historical analysis of the R&E tax credit legislation.

Attachments

cc: Thomas Murrin
Robert White
Allan Bromley
Olin Wethington
French Hill

Analysis of the Research Tax Credit*

Background

Under section 41 of the U.S. Tax Code, a 20 percent tax credit is available for certain incremental expenditures related to two types of research activities: (1) qualified research and (2) basic research. The credit for qualified research activities, which is the subject of this paper, is calculated based on the increase in a taxpayer's qualified research expenditures in the current year over a "base amount" for that year. The credit for basic research is available to corporations funding certain research activities by universities and other qualified organizations.

The research credit was enacted originally in 1981 as part of President Reagan's first tax package. According to the 1981 House Report 4242, the stated purpose of the credit was "to reverse [a] decline in research spending by industry" and to "overcome the reluctance of many ongoing companies to bear the significant costs of staffing and supplies, and certain equipment expenses such as computer charges, which must be incurred to initiate or expand research programs in a trade or business."

Since its enactment, the concept of a research credit has enjoyed almost universal support by Congress and the Administration, as well as business. Controversies that have surrounded the credit have dealt with the question of how to create an efficient mechanism to encourage businesses to increase their R&D expenditures beyond the level they would have spent in the absence of a credit, and how to do this with a minimum revenue loss to the Treasury.

Major changes to the research credit were made by Congress in 1986, 1988, and 1989. The character of these changes clearly reflects the tension between Congress' desire to ensure a strong R&D incentive and Congress' need to exercise fiscal restraint. Beginning in 1986 the dollar value of the credit has been significantly reduced by reducing the rate from 25 to 20 percent, narrowing the definition of qualifying research activities, and disallowing section 174 research deductions. On the other hand, the incentive value of the credit has been increased by reforming the base amount and making the credit available to new technology ventures. These changes are detailed below.

*Prepared by the Office of Technology Policy, Technology Administration, U.S. Department of Commerce, April 6, 1990.

Legislative History

The 1981 Act

Credit Rate and Base Period: As enacted in 1981 on a temporary five-year basis, the rate of the research credit was 25 percent. This rate applied to the excess of a taxpayer's qualified research expenditures for the taxable year over the taxpayer's "base period research expenses," i.e., the average amount of such yearly expenditures in the base period (generally the preceding three years). At a minimum, the amount of base period research expenses is treated as equal to 50 percent of a taxpayer's qualified expenditures for the current year. The incremental nature of the credit was designed specifically to limit the credit only to those research expenditures that would not have been undertaken in the absence of the credit.

Definition of Qualified Research: Under the 1981 Act, "qualified research" had the same meaning as the term "research or experimental" under section 174 (the R&D deduction), i.e., R&D in the experimental or laboratory sense. However, certain expenditures such as research conducted abroad and for the humanities or social sciences were specifically excluded from eligibility for the credit.

Limitations on Qualified Research Activity: Only certain types of expenditures for qualified research activities could be included in the research credit calculation. These include in-house expenditures for research supplies and wages paid to individuals who are supervising, performing or directly supporting research activities. In addition, 65 percent of the amount paid or incurred by a taxpayer for contract research conducted on the taxpayer's behalf could be included.

Availability: Significantly, the research credit was made available only for research expenditures paid or incurred in carrying on a trade or business of the taxpayer. This meant that the credit was unavailable to start-up firms, many joint ventures, or existing firms entering a new line of business. Thus, from its inception, the research credit encompassed a more limited array of research activities than those eligible for current deductibility under section 174.

The 1986 Act

Credit Rate Reduction: The Tax Reform Act of 1986 significantly modified several important credit provisions, the most important of which were reduction of the rate from 25 to 20 percent and the tightening of the definition of qualified research. According to Congressional explanations of the 1986 Tax Reform Act, the rate reduction was deemed appropriate "in the context of the base broadening and rate reduction provisions of the Act, and the continued allowance of full expensing of research expenditures."

Narrowing the Definition of Qualified Research: Following several years of debate, Congress, Treasury, and representatives from industry arrived at a compromise definition that narrows the definition of "qualified research" for R&D credit purposes. Proponents of a narrower definition believed that the 1981 definition had been applied too broadly, and that taxpayers had claimed the credit for virtually any expense related to product development regardless of whether the taxpayer's activities involved any attributes of technological innovation. Thus, the new definition is intended to limit the research credit to research activities undertaken to discover information that is technological in nature and reflects a process of experimentation. Specifically excluded activities include: research conducted after a business component has been developed to its functional and economic requirements, and adaptation of existing business components (e.g., modifications for the needs of a particular customer).

While some have argued that the narrower definition provides little incentive for the final phases of technology commercialization and the adoption of advanced manufacturing processes, industry has not advocated reopening the issue. Considering the fact that both Treasury and the Congress regard the definition as settled, proponents of greater tax support for technology commercialization might have more success in advocating a separate tax provision (e.g., an investment tax credit for the purchase of flexible computer automated manufacturing equipment).

The 1988 Act

Deduction Disallowance: A new Code provision enacted by the Technical and Miscellaneous Revenue Act of 1988 limits the deduction available when a taxpayer claims a research credit. As enacted by the 1988 Act, section 280C(c) disallows section 174 research deductions for the portion of a taxpayer's qualified R&D expenses that equalled 50 percent of the taxpayer's research credit. According to one estimate this new disallowance reduced the credit's effective rate from 20 to 16.6 percent.

GAO Report: The 1988 Act also required GAO to report to Congress on the operation and effectiveness of the research credit, and to consider alternatives to the structure of the credit. Issued in September 1989, the GAO report concludes that the credit "stimulated between \$1 billion and \$2.5 billion of additional research spending between 1991 and 1995 at a cost of \$7 billion in tax revenues." Although the revenue cost was greater than the additional spending stimulated by the credit, the report acknowledges that the credit may still be sound tax policy due to the larger social benefits of increased R&D activities. The GAO report also noted that the research credit is difficult for the IRS to administer and that the incentive value of the credit would be increased if the moving-average base enacted in 1981 was replaced with a fixed base indexed to GNP growth or some other factor.

The 1989 Act:

More Deduction Disallowance: The Revenue Reconciliation Act of 1989 amended section 280C(c) to further increase the deduction disallowance to 100 percent of the research credit, thereby further reducing the credit's effective rate to 13.2 percent.

The Base Amount: The 1989 Act redefines the "base amount" used to calculate the proper amount of the incremental research credit. The three-year moving base period that had applied since 1981 had been long criticized as reducing the marginal incentive of the credit because it so intricately linked current spending to future base amounts. Thus, while an increase in research expenditures would result in an increased credit for that year, it would also result in increased base period amounts and a tendency towards smaller credits in

the following three years.

The provisions adopted in the 1989 Act attempt to enhance the credit's incentive effect while retaining a structure designed to limit the credit to those expenditures that would not have been undertaken in the absence of the credit.

The new provisions define the base amount in terms of two different elements: (1) the ratio of each company's spending on qualified research activities during a five year period to the company's total gross receipts during the same period (referred to as the "fixed base percentage"), and (2) the taxpayer's average annual gross receipts for the four taxable years preceding the taxable year for which the credit is claimed.

The fixed base percentage is the percentage that the taxpayer's qualified research expenditures for the five taxable years beginning in 1984 through 1988 is to the taxpayer's total gross receipts for the same period. (This percentage may not exceed 16 percent and is three percent for certain categories of start-up companies).

The base amount is determined by multiplying this fixed base percentage by the taxpayer's average gross receipts for the four taxable years preceding the taxable year for which the credit is claimed. Thus, for a company to receive the credit its research expenditures in given tax year must exceed a fixed base that is indexed to the company's average growth in receipts for the four preceding years. As under previous law, the base amount used for R&D credit calculation purposes may not be less than 50 percent of the taxpayer's qualified R&D expenditures for the year.

Expanded Availability: The 1989 Act expands the availability of the research credit by modifying the requirement that expenditures must be incurred "in carrying on a trade or business" to qualify for the credit. With respect to in-house research expenditures of certain start-up ventures, the trade or business limitation is deemed to be satisfied if the principal purpose of the taxpayer in making the expenditures is to use the results of the research in the active conduct of a future trade or business.

Need for Permanence

Lack of permanence is the most common business complaint concerning the research credit. Re-extended for an additional three years by the 1986 Act until December 31, 1988, the credit has been renewed twice more on a one year basis by the 1988 and 1989 Acts. It is now scheduled to expire at the end of 1990 (although as a practical matter, the credit will be effective only through September 1990 due to a special provision that prorates expenditures incurred before January 1, 1991, i.e., allowing only 75 percent of expenditures to qualify for purposes of computing the credit). Thus, although taxpayers did not know from year to year whether the research credit would remain, it was available continuously from the time of its enactment in 1981 through 1990.

The fact that Congress regarded research credit legislation as experimental in 1981 was the principal rationale for making it temporary. However, with the enactment of structural refinements in subsequent years and the increasing recognition that the provision's very impermanence may be its greatest detriment, this rationale has lapsed. Currently, Congress' desire to reduce revenue losses is the chief roadblock to permanence as evidenced by the reduction of recent extensions to only one year.

While it is generally believed that the research credit has contributed to industrial R&D efforts and the general prosperity of U.S. business, the start and stop nature of the credit to date has created a degree of uncertainty that impairs the ability of firms to make long-range plans. Complex, sophisticated research programs must necessarily be planned years in advance. With a constantly expiring credit provision, however, firms must make such plans completely in the dark without foreknowledge of the tax consequences.

Proponents of a permanent research credit argue that a stable tax provision would permit firms to plan and undertake research activities with a much greater assurance of the tax consequences. Accordingly, firms could establish and expand their research facilities and projects without the concerns brought about by constantly changing tax rules.

Administration Position

The Administration's budget for FY 1991 "proposes to make the 20 percent research tax credit permanent by allowing 100 percent of total research expenses to be used for computation

of the credit for all years after December 31, 1989." The Administration estimates that permanent enactment of the credit will incur revenue losses of \$0.5 billion in 1991, \$0.9 billion in 1992, and \$1.1 billion in 1993. To assure tax stability the Administration concurs with industry that the current research credit should be made permanent and allowed to operate for a while before considering any further changes or structural adjustments.



UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Technology Policy
Washington, D.C. 20230

APR 10 1990

MEMORANDUM TO: J. Antonio Villamil
Chief Economist
Office of Economic Affairs

FROM: Deborah Wince-Smith ^{DWS}
Assistant Secretary for Technology Policy

SUBJECT: EPC Working Group on Competitiveness and the
Cost of Capital

Thank you for sending us a copy of Treasury's draft paper, "Competitiveness and the Cost of Capital: Executive Summary."

There is no question that much of the business community views the U.S. cost of capital as high, and that this impedes our competitiveness. Accordingly, the Working Group's efforts are on target, and we have prepared the attached technical comments to assist it, particularly from the standpoint of investment in technology-based businesses.

As our comments indicate, it is important to break down the cost of capital issue into its constituent elements in order to develop effective policy initiatives. We should also ensure consideration of related aspects, such as the 'patience' of capital, internal financial accounting techniques which can skew investment decisions, and measures to distinguish between the efficiency of capital markets and the efficiency of capital uses.

Clearly, OEA and TA have a mutual interest in this area. We will be co-hosting a Roundtable in conjunction with the National Center for Manufacturing Sciences on April 25/26. The program will discuss a number of these issues as they apply to small manufacturing companies, and I understand Charlotte Zakour will try to attend.

In addition, we would appreciate your assistance in holding a Financing Technology Roundtable late this summer or early fall. Next month we will send you a draft paper that begins to frame the issues and gather views from others.

Attachment

TECHNICAL COMMENTS* ON THE PAPER,
"COMPETITIVENESS & THE COST OF CAPITAL:
EXECUTIVE SUMMARY"

(Paper prepared for the EPC Working Group
on Competitiveness and the Cost of Capital)

Section II: Defining the Cost of Capital

NEWS ITEM: On March 28, Oracle Systems Corporation, whose revenues have doubled in 12 of the past 13 years, announced that its quarterly earnings were a flat 18 cents a share, instead of the anticipated 23 to 25 cents predicted earlier. The difference was due to auditors' disallowance of sale-on-trial contracts which customers might still decline. The next day, Oracle closed at \$17.50, down \$7.875 or 31%. (From a 4/5/90 New York Times article which discusses business problems that Oracle may or may not have.)

Comment: The paper defines the cost of capital as the return a corporation has to pay to attract investors. It might be useful to define investors in terms that support the concept of competitiveness. Investors, including managers of large investment funds, can have a variety of motivations, many of which have nothing to do with the competitive success of the companies in which they invest. Those who dumped oracle are an example. Failure to distinguish between the types of investors at the outset may limit the value of the paper.

Section III: Why the Cost of Capital is Important to Investment

Comment: It might help to distinguish the business objectives of different groups of technology company owners or their representatives. Some "owners" manage funds for others and are measured on the basis of safety and consistent earnings. Often, these "owners" even set their target selling price for a stock when they buy it, and have no continuing interest in the companies contained in their portfolios. Expenditures made for long term competitive benefits, particularly those such as R&D, process improvement, and worker training which accounting conventions treat as expense, destroy values for this class of "owners." Should the study serve to aid, discourage, or be neutral toward "owners" of this type of disengaged owner/representative?

*Prepared by the Office of Technology Policy, Technology Administration, U.S. Department of Commerce.

We are testing the idea that investors can be classified as "conservative" or "productive." On a typical cash flow chart, the conservative investor seeks predictable and steady gains from the outset with no chance for loss of principal. Buyers of Treasury bills fit this profile. The productive investor, on the other hand, accepts the fact that the value of the investment will decline before it produces a revenue stream which is intended to recover the investment plus profits. The productive investor, who is needed to finance new competitive products and new processes, also recognizes that the entire investment may be lost.

Most investors fall between these two extremes, but it appears that capital increasingly is being concentrated toward the conservative end of the spectrum in the hands of managers of large pension, mutual, and trust funds. Since the objectives and methods of the two types of owners are so different, the effects of the cost of capital probably are also different.

Reducing the cost of capital is not a cure-all for U.S. competitiveness. For example, sharp reductions in the cost of capital will not change corporate management strategies in such key areas as quality, concurrent engineering or management, or the formation of long term relationships between suppliers and their primes (e.g., Xerox and Honda of America).

Section IV: Factors Impacting the Cost of Capital

Comment: It may be useful to compare investment rates with GNP for the 1980s. For example, the February Business Conditions Digest shows that commercial and industrial loans outstanding in 1982 dollars grew about 74% while GNP in fixed dollars grew only about 30%. A Federal Reserve Board chart shows a similar pattern for 1953-77. If other measures also show that investment grew more than GNP, perhaps there is more of a capital productivity problem than a cost of capital problem.

One way of looking at interest rates for an industrial project is that they comprise at least four components:

- (a) The price paid for the privilege of using the money (overcoming the lender's liquidity preference).
- (b) Anticipated loss of the principal's purchasing power due to inflation.
- (c) The risk of loss of the principal or interest.

- (d) The opportunity to earn significantly more than the minimum acceptable interest rate.

But for the types of productive investments we are seeking, with a period of negative cash flow, (c), the risk of loss, becomes the most important factor. This varies with each investment. It is outside the range of macro economic control but is reflected in hurdle-rate calculations. Since risk normally grows with time because of unknowns like unanticipated technical problems, market responses, and competitor actions, the risk element of the interest rate normally will be higher for longer range projects. It seems unlikely that changes in (a), which most observers appear to advocate, can offset the increases in (b) and (c) to cause longer range investments.

Conservative capital managers must ignore (d) if significant risk is indicated by (c); and, if they are obliged to show steady growth, they cannot accept the time delay. So, while (d) is what drives the truly productive capital managers, it is of little interest or incentive value to the conservative ones.

Savings and Macroeconomic policies

Comment: This section opens by saying that savings supplied by individuals, governments, and businesses determine the amount of funds which are available for investment. It may be useful to point out that much U.S. functional investment is treated as expense. Private autos used for commuting are consumption while taxis and buses are investment. Similarly, company expenditures for knowledge-related activities such as education, worker training, R&D, and most software are booked as current expenses although they are made for long-term reasons. If discrepancies such as these were resolved, the investment rate and the savings rate might show more favorably.

Market efficiency

Comment: This section begins by saying, "The extent to which impediments to capital flows remain between nations and within a given country determine how efficiently capital is allocated, which in turn, influences its cost to specific users." As this paper is directed toward competitiveness, it may be important to distinguish between capital market efficiency and capital use efficiency. The Japanese are widely cited for both their competitiveness and their low capital cost. But they created an inefficient capital market to the degree that they restricted both capital exports

and low cost loans for consumption. For years, they induced capital use efficiency by restricting capital market efficiency.

There is a serious question of how much new capital that is raised is used for productive investment. According to an article in the April 2, 1990 New York Times business supplement, from 1982 to 1989, new investments by venture capital companies in buyouts and acquisitions tripled. As of 1988, only 13% of venture capital firms' dollar commitments went to startups. And these are supposed to be the classic productive capitalists.

It is not clear that new capital such as pension fund contributions will be channeled into productive investment as opposed to speculation. It also appears that much of the pension fund money "invested" in blocks of S&P 500 stocks did little more than inflate their market price value while adding few productive assets.

The Japanese are now having to cope with the effects of low cost capital in land and stock speculation.

Agency Costs and Costs of Financial Distress

Comment: This may well be where most of the U.S. problem is located. There seems to be a growing gap between the "Techies" who need money for new products, processes, training, etc., and the "Buckies" who control the money. Although the theory of efficient markets rests on a presumption of perfect knowledge, most of these people just don't understand each other, and so far, the Buckies have done well enough without even trying to.

One of the elements of an interest rate calculation discussed above was (c), or the risk of loss of the principal or interest. There is also a (c')--the risk or cost of the capital manager's inability to understand and evaluate the factors that cause (c).

This leads to the conclusion that the highest cost of capital situations probably occur when (c) and (c') are cumulative. Unfortunately, this is increasingly the case, with most productive investments now carrying a significant (c) factor, and capital increasingly being concentrated in the hands of investment managers who add the (c') factor. Whether or not one wants to call this a cost of capital issue, it appears to be a primary reason why productive investment is lagging.

The Japanese keiretsu are ideally suited to handle the (c) and (c') problem. Members of the same industrial group can, together, explain to their member megabank how one company's advanced development program will help the others, and an assured partial market can be established even prior to the investment. Given assurances like this, the project has a lower (c) cost, and the lender who may be a member bank, customer, or a supplier, has much less of a (c') problem. This is where the Japanese can obtain a lower cost of capital.

Section V: Policy Implications

Comment: This section proposes policies that reduce the cost of capital. As the debate proceeds on this, it would be useful to distinguish the particular aspects of the cost of capital affected--liquidity preference cost, inflation adjustment, project risk, and investors' lack of knowledge of the risk.

If the (c) and (c') problem is the real capital cost driver, the actions mentioned above under Section IV dealing with agency costs may be the most useful part of the paper. For example, there is some evidence that family controlled businesses outperform others because they have more latitude to make long term strategic investments. The Japanese keiretsu are similar.

Another mechanism to reduce the cost of capital in an important area would be an investment tax credit for the purchase/lease of flexible, automated computer integrated manufacturing equipment, including related training and software expenses.

fb: S&T WG

R&D IN THE FEDERAL BUDGET: 1991 AND BEYOND

D. ALLAN BROMLEY

Assistant to the President for Science and Technology

Executive Office of the President

AAAS Science and Technology Policy Colloquium

Washington, D.C.

April 12, 1990

When the President's FY 1991 budget was released on January 29, I held a press conference at which I called it an excellent budget for R&D in what is otherwise a very difficult budget year. I continue to believe this budget to be an excellent one for R&D. The overall increases in the budget -- 7 percent total for federal R&D, with a 12 percent increase in nondefense R&D and an 8 percent increase in basic research -- reflect President Bush's strong belief that research and development are a vital investment in our nation's future.

I am not going to describe in detail the components of the budget, because I know that will be done during much of this colloquium. Rather, I thought I would describe some of the thinking that went in to the formulation of the President's 1991 budget, and that will go into the formulation of future budgets. I will mention some of the problems that this budget tries to address -- and some that will have to be addressed in future budgets. And I will cover some of the long-term priorities for the Office of Science and Technology Policy.

FCCSET AND PCAST

But before that, I thought I would describe some of the institutional changes associated with OSTP that have been going on during the last several months, changes that may have a substantial effect on future R&D budgets. First, and most important, for the first time in the history of OSTP I now have the four Presidentially appointed, Senate-confirmed Associate Directors called for in OSTP's founding legislation.

One of the next most important developments, in my view, is the reorganization and revitalization of the Federal Coordinating Council for Science, Engineering, and Technology (FCCSET), which was established by that same legislation. FCCSET is the interagency group within the Executive Office that is charged with reviewing, integrating, and coordinating the R&D activities of the federal government that cut

across the missions of more than one federal agency. As such, FCCSET has the potential to play a substantial role in shaping federal R&D efforts and guiding budget decisions.

There have been two meetings of FCCSET since I came to Washington last summer, and at both meetings we had excellent representation from the agencies, with Cabinet secretaries and heads of independent agencies constituting the majority of those in attendance. In general, we foresee a substantially altered and enhanced role for FCCSET within the White House. For the first time since it was created, FCCSET should be functioning as it was designed to function.

Much of the impetus for FCCSET's revitalization has come from the recent success that several FCCSET committees have had in coordinating cross-cutting areas of science and technology. For example, the Committee on Earth Sciences has taken all of the formerly disparate research being done by federal agencies on the global environment and has organized it into the U.S. Global Change Research Program -- a coherent, government-wide approach to the scientific understanding of global change. This is the kind of coordination I expect FCCSET to bring to many other important areas of science and technology.

FCCSET has recently formed seven new umbrella committees, each chaired by a high-level official of a Federal agency or department, to oversee broad areas of science and technology. Subcommittees and working groups will be active within each of these umbrella committees to examine, coordinate, and integrate federal activities in selected areas of science and technology. The seven umbrella committees are in (1) earth and environmental sciences (chaired by Dallas Peck, Director of the U.S. Geological Survey), (2) education and human resources (chaired by James Watkins, Secretary of the Department of Energy), (3) food, agriculture, and forest research (chaired by Charles Hess, Assistant Secretary for Science and Education of the Department of Agriculture), (4) international science and engineering (chaired by Reginald Bartholomew, Under Secretary for Security Assistance, Science and Technology of the Department of State), (5) life sciences and health (chaired by James Mason, Assistant Secretary of the Department of Health and Human Services), (6) physical, mathematical, and engineering sciences (chaired by Erich Bloch, Director

of the National Science Foundation), and (7) technology and industry (chaired by Thomas Murrin, Deputy Secretary of the Department of Commerce).

I expect FCCSET to be a powerful influence in helping to shape and implement federal science and technology policy. The planning and coordination provided by FCCSET will allow for more effective use of the scientific and technological resources of federal agencies. FCCSET will also help to develop and review, in close cooperation with the Office of Management and Budget, annual and long-range federal budget plans in selected cross-cutting areas of science and technology.

Policy matters internal to science and technology will be resolved within FCCSET. Policy input involving science and technology to broader issues with strong political and economic components -- such as global change -- will be channeled to the Domestic Policy Council or the Economic Policy Council for Cabinet-level consideration and eventual presentation to the President through a new Working Group that will report to both Councils and that I chair.

One problem with FCCSET in the past has been that it has had very little input from the private sector. In the future, much greater input will come from the President's Council of Advisors on Science and Technology, a group of 12 distinguished scientists and engineers that the President established in February. PCAST has held two meetings thus far -- the first at Camp David in February, and the second in the White House complex last month. The President and several of his top advisers participated in all or part of both those meetings and were involved in very candid discussions with the PCAST members.

Because I chair both FCCSET and PCAST, I have the opportunity to coordinate their actions so that each benefits from the other's activities. For example, much of the work of PCAST will be carried out through panels chaired by PCAST members and with extensive private sector representation. These panels will in many cases parallel the committee and subcommittee structure of FCCSET, so that the concerns and activities of the private sector can be taken into account in the deliberations of FCCSET committees and so that PCAST can be aware, in detail, of relevant governmental plans and activities.

SETTING PRIORITIES IN THE FEDERAL BUDGET

As in the case of the Committee on Earth Sciences, FCCSET committees can have a very substantial effect on federal R&D budgets. Working through OSTP and through the Office of Management and Budget, FCCSET committees can scrub the components of cross-cutting programs, making it possible to consider the program as a whole, as a coherent national activity rather than a collection of agency programs.

Regarding the interactions between OSTP and OMB, our two offices have established an excellent working relationship. Our respective staffs work together at all levels to review the distribution of federal funds and to ensure that the Administration's proposals to Congress represent the most efficient and effective allocation of those funds. This interaction is also extremely important in the priority-setting process that goes into the development of the Presidential budget requests.

It may be helpful to describe how this priority-setting process worked last fall, because some variant of it will be applied in the future. Last fall Dick Darman and his senior staff reviewed all R&D programs to determine an optimum allocation of funds across the R&D agency budgets. I participated in virtually all of the reviews dealing with science and technology and will continue to do so in future years. It was a very difficult process, since almost all of the agency budget proposals were excellent and worthy of support. Unfortunately, in the reviews that were completed this past fall, the available budget resources would not stretch to cover all agency efforts -- nor, I suspect, will there ever be enough resources to cover all of the proposals.

As a result, this last fall, OMB, with substantial input from OSTP, applied three quite simple guiding principles in prioritizing the agency requests.

1. The first principle is that support is required for certain programs that address national needs and national security concerns. Examples would be scientific research to address global change, a preeminence in space, and adequate support for the defense technology base. Out of these considerations, I might add, comes the division between civilian and defense needs.

2. The second principle is the adequacy of support for basic research. In my view, basic research--and particularly university-based, individual-investigator and small group research--constitutes the heart of our science and technology enterprise. Funding for "small science" must be guaranteed if American science, as a whole, is to flourish. Thus, in evaluating agency programs, a concerted effort was made to ensure that small science received high priority in the agencies' final programs.

3. The third principle is to ensure an adequate level of funding for the scientific infrastructure and facilities in this country, including large facilities. Large facilities, such as the superconducting supercollider, Space Station Freedom, and, in a more distributed sense, the human genome project, are essential if American scientists are to have, in the future, the facilities and the infrastructure necessary to take them to the research frontiers of their fields. Once these facilities are built, they serve thousands of scientists and make possible a scientific understanding of the world and universe in which we live.

The final step in preparing the Administration's budget was a series of meetings with the President. Dick Darman and I, in each case with the affected Cabinet secretary or R&D agency head, sat down on a case-by-case basis with the President to resolve the budget priorities within the constraints of the available budget resources. The President made the final priority decisions -- as indeed he should. The budget that was presented to the Congress this January was the end result of this process, and the same basic process--with a substantially enhanced FCCSET role--is expected to apply to the R&D component of federal budgets in the future.

PROBLEM AREAS IN THE BUDGET

That process resulted in a good budget for science and technology this year, but there remain several areas of concern.

One very serious problem involves the funding rate for grants at the National Institutes of Health and the National Science Foundation. Despite nearly a decade of funding increases at those two agencies, the money available for new, young investigators is very tight. During fiscal year 1989, for the first time ever, the fraction of excellent, peer-reviewed, new proposals that were actually funded by these two agencies fell below 30 percent. The discouragement caused by a lack of funding is particularly unfortunate at a time when the nation has a very serious need to recruit more young people into scientific careers.

There are several reasons for this state of affairs. One is that the rate of inflation for research in the physical and life sciences is higher than the consumer price index (sophistication inflation), and the non earmarked dollars available to NIH and NSF have not kept pace.

Members of the scientific community also built part of this problem for ourselves. For years, we argued for multiyear grants and contracts to cut down on the amount of paperwork required to do research. Both NSF and NIH have responded to those requests, and in the process they have built substantial "outyear mortgages" for themselves.

Simple demographics are yet another contributing factor. About 87 percent of all the scientists and engineers who have ever lived and worked are active today, whereas only 4 percent of all the human beings to have lived on this planet are alive today.

Finally, we must also recognize that, to some extent, we are the victims of our own success. It has been a remarkable decade in science. The increased funds devoted to research during the 1980s have produced a wealth of advances, which in turn have created an exponentially increasing number of exciting opportunities throughout the scientific disciplines. The number of high-quality applications is growing steadily. We must find some way of dealing with the remarkable progress that we have made.

Another area of concern for the budget involves how Congress will treat the President's proposals. As you well know, the President proposes, but the Congress disposes. There is a strong base of support on Capitol Hill for science and

technology, but the next few years will not necessarily be easy ones for science and technology on Capitol Hill; nor are substantial increases for R&D guaranteed. There are a variety of pressures on the federal budget that will continue to increase, and support for R&D is eminently vulnerable.

First and foremost are the pressures of the deficit. The Gramm-Rudman-Hollings deficit reduction act calls for a deficit target in fiscal year 1991 of \$64 billion. In fiscal year 1992 the deficit target drops to \$28 billion, and the year after that to zero. Barring a very great reduction in defense spending--and I do not believe that we can count on that at this time--savings will have to be found in current programs.

Science and technology in the federal budget are also in direct competition with programs that have very active and vocal constituencies. For example, funding for the National Science Foundation and for NASA falls under the same Appropriations Subcommittee that supports Veteran Affairs, Housing and Urban Development, and a number of other independent agencies.

A useful way to consider the problem such Subcommittees face is to reflect on the types of programs funded by the federal government. These can be divided into three categories: (1) outlays for obligations made in the past, such as commitments to Veterans or to Social Security (2) current needs, such as health care, the homeless, or the war on drugs, and (3) investments in the future. Thus, in the case of the National Science Foundation and other scientific agencies, the future is in direct competition with current needs and past obligations. In such a situation, it is always tempting to defer investments in the future and to respond to the much more demanding needs of the past and present.

Given these pressures, Congress does remarkably well at supporting science and technology. But Congress cannot do it alone. Research and development must have a constituency that is more commensurate with the importance of science and technology to our nation. I have talked a great deal this spring about developing a constituency for science -- a constituency for the future -- that would support the federal government's efforts to invest our future. Partially, this will depend on developing a level of scientific literacy in the country that enables people to

understand, at least in outline, the importance of science and technology in almost every aspect of modern life. But it will also rely on your efforts, as the individuals who are at the interface between science and technology, the federal government, and the public.

Those of you here this morning bear a very special responsibility in helping the Congress to respond to the President's budget requests. It is essential that you make known your concerns about the importance of continuing -- and increasing -- the nation's investment in research and development to your Representatives and Senators. I have been asked repeatedly by members of Congress why, if the problems of funding are as serious as I maintain them to be, these members have not heard directly from their scientist and engineer constituents. This is a fair question.

It is simply no longer possible for the scientific and technology communities of this nation to expect someone else to make the case for science and technology. We need your help so that we can better help you and the nation.

FUTURE INITIATIVES

This problem of funding is, of course, one with which OSTP is continually involved. But there are other areas in which our office has begun to focus, and let me conclude today by mentioning a few of them. They include science and technology for economic growth, global change, science and mathematics education, high performance computing, materials science and engineering, and biotechnology.

SCIENCE, TECHNOLOGY, AND THE ECONOMY In the area of science and technology for economic growth, much has been written about the proper role of the federal government in promoting commercially important technologies. Some people have pointed to the loss of market share in key industries and have advocated that the U.S. government should move to bolster those industries through favorable tax treatment or direct subsidies. But the Bush Administration believes that private industry, not the federal government, knows what is best for private industry. The

Administration will not adopt a policy that has the effect of picking winners and losers in the marketplace.

Nevertheless, the Bush Administration does acknowledge the very important role for the federal government in supporting the development of generic, enabling technologies. These are technologies that are important in a wide variety of commercial applications and to our national security; however, no single company can capture enough of the benefits to justify investing an adequate amount of R&D in them. The rationale for investing in these enabling technologies is essentially the same as that for investing in basic research: individual companies cannot bear the cost and risk of such investments alone given the diffuse nature of the benefits.

In a speech to the American Electronics Association on March 7, President Bush pointed specifically to the importance of these enabling technologies. He said, "This Administration is committed to working with you in the critical precompetitive development stage where the basic discoveries are converted into generic technologies that support both our economic competitiveness and our national security. Here again we can help to level the international playing field on which you compete."

Later in the speech, the President noted that he would charge the Competitiveness Council, which is chaired by the Vice-President, with a new task: "to find ways that American industry can better translate new ideas and technologies into marketable products."

At OSTP, we believe that this is an important function for the Administration. OSTP's Associate Director for Industrial Technology William Phillips, who was confirmed last week, will be working with the President, with the Competitiveness Council, and with the other parts of the Administration to further this work on leveraging technologies.

The FY 1990 Defense Authorization Act requires OSTP to establish a panel to merge the lists of critical technologies prepared by the Departments of Defense and Commerce as of importance to the long-term national security and economic prosperity of the United States. We are now in the process of setting up that panel and beginning the examination of candidate technologies. The panel's first report will be submitted to the President on October 1 of this year and transmitted to Congress

30 days later. This will be an important process within OSTP, and we will devote a considerable amount of time to it this spring and summer.

GLOBAL CHANGE Another area that has occupied much of our time in the last few months has been global change. Next week I will be cochairing, together with Michael Deland of the Council on Environmental Quality and Michael Boskin of the Council of Economic Advisers, an international White House Conference on Science and Economics Research Related to Global Change. The conference will bring together delegations from 18 countries, the Organization for Economic Cooperation and Development, and the European Community for two days of discussions on the key scientific and economic questions surrounding global change. The conference will look at what is known about global change, what is not known, and how long will it be before the remaining uncertainties are reduced. In this way, the conference will complement other ongoing national and international activities that are contributing to the formation of policies on this issue.

A primary function of the conference, which is complementary and supporting the work of the U.N.-sponsored Intergovernmental Panel on Climate Change (IPCC), will be that of emphasizing the importance of economics as the glue that binds scientific understanding of global change phenomena with rational policy making -- both national and international -- in this area. Economic analyses have been conspicuous by their absence in most discussions to date of national and international policies concerning global change.

HIGH PERFORMANCE COMPUTING A third area of emphasis for our office will be high performance computing -- an important example of an enabling technology for industrial, research, and national security applications. Last fall I sent to the Congress a report entitled The Federal High Performance Computing Program, produced by the Computer Research and Applications committee of FCCSET. The program laid out by the report had four distinct parts. The first concerns developing the hardware that will, both with enhanced mainframes and through the use of

parallelism, make possible TERAOP computers operating at trillions of operations per second. The second is developing the user friendly software technology and algorithms that will permit full and efficient use of the hardware capabilities that are now and will soon be available. The third is building a national fiber optic network that will increase the accessibility of geographically dispersed users to these supercomputers and reduce the incompatibility that now characterizes many computer networks. One of the major new areas that I see as a target here is that of education --- an area that has been more resistant to technological change than any other in our society. Another is the small business that up to now simply has been denied access to the power of major computer facilities. And the fourth is training the personnel who will extend the tremendous advances that have been made in the past.

To further coordinate and increase high-level attention for high performance computing, and to explore where there exists a basis for extending the Federal program into a national program, I convened a meeting earlier this year of agency heads and their deputy directors for R&D agencies that support high performance computing. A second meeting of this group was held last month and further meetings will be held as necessary. I expect that the result of this effort will be a far more coordinated program and budget submission for FY 1992.

SCIENCE AND MATHEMATICS EDUCATION A fourth area of emphasis within our office is that of science and mathematics education. I do not have time to discuss education in detail, but I want to outline our overall approach. During his State of the Union message, President Bush set down six goals for education, including making American students the best in the world in science and mathematics education. The Administration takes this set of national goals and objectives very seriously. The President and the Governors have agreed to work with Congress, with education groups, and with business to institutionalize a process to oversee the development of ways to measure progress against these goals and report regularly to the nation on whether they are being achieved.

We need to pursue a number of detailed steps to achieve the goals and objectives that the President and Governors have established. We need more magnet

schools for science and mathematics that can inspire our most gifted young people. We must focus on the "forgotten middle"--the technicians who will be running the high-technology factories of the future. And we need to encourage more women and minorities to study science and engineering and to pursue technical careers.

MATERIALS SCIENCE AND TECHNOLOGY A fifth area is that of materials science and technology -- in my opinion an orphan area in the federal government because it does not fall neatly into any given agencies or, indeed, into any of the traditional scientific or engineering disciplines. Yet this area is of enormous importance to almost every aspect of our increasingly technological society.

BIOTECHNOLOGY Finally, biotechnology may hold the promise in the coming decades that electronics and other products of the physical sciences did in the postwar decades. While we still hold a commanding lead in the related basic research areas, we are falling behind on international competitiveness in the critical scale-up of laboratory to industrial production facilities.

CONCLUSION

We are committed in OSTP, and indeed throughout the Administration, to strengthening, to the greatest extent possible, the science and technology base on which so much of our national future depends. But hard choices lie ahead: how best to balance large projects in science against funding for individual investigators and small groups, how to produce the steady stream of trained scientists and engineers that industry and universities will require in the 21st century, how to increase cooperation among universities, government, and the private sector.

The federal budget will reflect the decisions that are made in these and other areas. But the decisions themselves will come from our vision for the future of science and technology, from our deeper ideas of where we are and where we should be going. The first rule of the budget examiner is that God is in the details, and if I

might apply that analogy to science, I would hope that as you delve into the numbers that we have presented this year, you might also spend some time reflecting on the broader import of those numbers.

And let me reiterate my plea for your individual help in building a national constituency for science and technology. In a very real sense, those of you in this morning's audience hold the future of American science and technology in your hands. Working together, we can maintain it as a central part of our national future -- and as perhaps the great adventure that is available to members of our species.

Document Originally
Attached to
Following Page



**Assistant Secretary
for Technology Policy**

DATE: 4/10/90

FROM THE DESK OF:

Deborah L. Wince-Smith

TO: Olin Wethington

- Per our conversation.
- For your information.
- For appropriate action.
- For draft of an appropriate reply for my signature.
- Please answer directly.
- Let's discuss.
- Please return with your comments.



APR 10 1990

*file SET
Working
Group*

MEMORANDUM TO: J. Antonio Villamil
Chief Economist
Office of Economic Affairs

FROM: Deborah Wince-Smith *Deborah Wince-Smith*
Assistant Secretary for Technology Policy

SUBJECT: EPC Working Group on Competitiveness and the
Cost of Capital

Thank you for sending us a copy of Treasury's draft paper,
"Competitiveness and the Cost of Capital: Executive Summary."

There is no question that much of the business community views
the U.S. cost of capital as high, and that this impedes our
competitiveness. Accordingly, the Working Group's efforts are on
target, and we have prepared the attached technical comments to
assist it, particularly from the standpoint of investment in
technology-based businesses.

As our comments indicate, it is important to break down the cost
of capital issue into its constituent elements in order to
develop effective policy initiatives. We should also ensure
consideration of related aspects, such as the 'patience' of
capital, internal financial accounting techniques which can skew
investment decisions, and measures to distinguish between the
efficiency of capital markets and the efficiency of capital uses.

Clearly, OEA and TA have a mutual interest in this area. We will
be co-hosting a Roundtable in conjunction with the National
Center for Manufacturing Sciences on April 25/26. The program
will discuss a number of these issues as they apply to small
manufacturing companies, and I understand Charlotte Zakour will
try to attend.

In addition, we would appreciate your assistance in holding a
Financing Technology Roundtable late this summer or early fall.
Next month we will send you a draft paper that begins to frame
the issues and gather views from others.

Attachment

TECHNICAL COMMENTS* ON THE PAPER,
"COMPETITIVENESS & THE COST OF CAPITAL:
EXECUTIVE SUMMARY"

(Paper prepared for the EPC Working Group
on Competitiveness and the Cost of Capital)

Section II: Defining the Cost of Capital

NEWS ITEM: On March 28, Oracle Systems Corporation, whose revenues have doubled in 12 of the past 13 years, announced that its quarterly earnings were a flat 18 cents a share, instead of the anticipated 23 to 25 cents predicted earlier. The difference was due to auditors' disallowance of sale-on-trial contracts which customers might still decline. The next day, Oracle closed at \$17.50, down \$7.875 or 31%. (From a 4/5/90 New York Times article which discusses business problems that Oracle may or may not have.)

Comment: The paper defines the cost of capital as the return a corporation has to pay to attract investors. It might be useful to define investors in terms that support the concept of competitiveness. Investors, including managers of large investment funds, can have a variety of motivations, many of which have nothing to do with the competitive success of the companies in which they invest. Those who dumped oracle are an example. Failure to distinguish between the types of investors at the outset may limit the value of the paper.

Section III: Why the Cost of Capital is Important to Investment

Comment: It might help to distinguish the business objectives of different groups of technology company owners or their representatives. Some "owners" manage funds for others and are measured on the basis of safety and consistent earnings. Often, these "owners" even set their target selling price for a stock when they buy it, and have no continuing interest in the companies contained in their portfolios. Expenditures made for long term competitive benefits, particularly those such as R&D, process improvement, and worker training which accounting conventions treat as expense, destroy values for this class of "owners." Should the study serve to aid, discourage, or be neutral toward "owners" of this type of disengaged owner/representative?

*Prepared by the Office of Technology Policy, Technology Administration, U.S. Department of Commerce.

We are testing the idea that investors can be classified as "conservative" or "productive." On a typical cash flow chart, the conservative investor seeks predictable and steady gains from the outset with no chance for loss of principal. Buyers of Treasury bills fit this profile. The productive investor, on the other hand, accepts the fact that the value of the investment will decline before it produces a revenue stream which is intended to recover the investment plus profits. The productive investor, who is needed to finance new competitive products and new processes, also recognizes that the entire investment may be lost.

Most investors fall between these two extremes, but it appears that capital increasingly is being concentrated toward the conservative end of the spectrum in the hands of managers of large pension, mutual, and trust funds. Since the objectives and methods of the two types of owners are so different, the effects of the cost of capital probably are also different.

Reducing the cost of capital is not a cure-all for U.S. competitiveness. For example, sharp reductions in the cost of capital will not change corporate management strategies in such key areas as quality, concurrent engineering or management, or the formation of long term relationships between suppliers and their primes (e.g., Xerox and Honda of America).

Section IV: Factors Impacting the Cost of Capital

Comment: It may be useful to compare investment rates with GNP for the 1980s. For example, the February Business Conditions Digest shows that commercial and industrial loans outstanding in 1982 dollars grew about 74% while GNP in fixed dollars grew only about 30%. A Federal Reserve Board chart shows a similar pattern for 1953-77. If other measures also show that investment grew more than GNP, perhaps there is more of a capital productivity problem than a cost of capital problem.

One way of looking at interest rates for an industrial project is that they comprise at least four components:

- (a) The price paid for the privilege of using the money (overcoming the lender's liquidity preference).
- (b) Anticipated loss of the principal's purchasing power due to inflation.
- (c) The risk of loss of the principal or interest.

- (d) The opportunity to earn significantly more than the minimum acceptable interest rate.

But for the types of productive investments we are seeking, with a period of negative cash flow, (c), the risk of loss, becomes the most important factor. This varies with each investment. It is outside the range of macro economic control but is reflected in hurdle-rate calculations. Since risk normally grows with time because of unknowns like unanticipated technical problems, market responses, and competitor actions, the risk element of the interest rate normally will be higher for longer range projects. It seems unlikely that changes in (a), which most observers appear to advocate, can offset the increases in (b) and (c) to cause longer range investments.

Conservative capital managers must ignore (d) if significant risk is indicated by (c); and, if they are obliged to show steady growth, they cannot accept the time delay. So, while (d) is what drives the truly productive capital managers, it is of little interest or incentive value to the conservative ones.

Savings and Macroeconomic policies

Comment: This section opens by saying that savings supplied by individuals, governments, and businesses determine the amount of funds which are available for investment. It may be useful to point out that much U.S. functional investment is treated as expense. Private autos used for commuting are consumption while taxis and buses are investment. Similarly, company expenditures for knowledge-related activities such as education, worker training, R&D, and most software are booked as current expenses although they are made for long-term reasons. If discrepancies such as these were resolved, the investment rate and the savings rate might show more favorably.

Market efficiency

Comment: This section begins by saying, "The extent to which impediments to capital flows remain between nations and within a given country determine how efficiently capital is allocated, which in turn, influences its cost to specific users." As this paper is directed toward competitiveness, it may be important to distinguish between capital market efficiency and capital use efficiency. The Japanese are widely cited for both their competitiveness and their low capital cost. But they created an inefficient capital market to the degree that they restricted both capital exports

and low cost loans for consumption. For years, they induced capital use efficiency by restricting capital market efficiency.

There is a serious question of how much new capital that is raised is used for productive investment. According to an article in the April 2, 1990 New York Times business supplement, from 1982 to 1989, new investments by venture capital companies in buyouts and acquisitions tripled. As of 1988, only 13% of venture capital firms' dollar commitments went to startups. And these are supposed to be the classic productive capitalists.

It is not clear that new capital such as pension fund contributions will be channeled into productive investment as opposed to speculation. It also appears that much of the pension fund money "invested" in blocks of S&P 500 stocks did little more than inflate their market price value while adding few productive assets.

The Japanese are now having to cope with the effects of low cost capital in land and stock speculation.

Agency Costs and Costs of Financial Distress

Comment: This may well be where most of the U.S. problem is located. There seems to be a growing gap between the "Techies" who need money for new products, processes, training, etc., and the "Buckies" who control the money. Although the theory of efficient markets rests on a presumption of perfect knowledge, most of these people just don't understand each other, and so far, the Buckies have done well enough without even trying to.

One of the elements of an interest rate calculation discussed above was (c), or the risk of loss of the principal or interest. There is also a (c')--the risk or cost of the capital manager's inability to understand and evaluate the factors that cause (c).

This leads to the conclusion that the highest cost of capital situations probably occur when (c) and (c') are cumulative. Unfortunately, this is increasingly the case, with most productive investments now carrying a significant (c) factor, and capital increasingly being concentrated in the hands of investment managers who add the (c') factor. Whether or not one wants to call this a cost of capital issue, it appears to be a primary reason why productive investment is lagging.

The Japanese keiretsu are ideally suited to handle the (c) and (c') problem. Members of the same industrial group can, together, explain to their member megabank how one company's advanced development program will help the others, and an assured partial market can be established even prior to the investment. Given assurances like this, the project has a lower (c) cost, and the lender who may be a member bank, customer, or a supplier, has much less of a (c') problem. This is where the Japanese can obtain a lower cost of capital.

Section V: Policy Implications

Comment: This section proposes policies that reduce the cost of capital. As the debate proceeds on this, it would be useful to distinguish the particular aspects of the cost of capital affected--liquidity preference cost, inflation adjustment, project risk, and investors' lack of knowledge of the risk.

If the (c) and (c') problem is the real capital cost driver, the actions mentioned above under Section IV dealing with agency costs may be the most useful part of the paper. For example, there is some evidence that family controlled businesses outperform others because they have more latitude to make long term strategic investments. The Japanese keiretsu are similar.

Another mechanism to reduce the cost of capital in an important area would be an investment tax credit for the purchase/lease of flexible, automated computer integrated manufacturing equipment, including related training and software expenses.

File: S&T ^{Wally}
Group

macro economic

- i) cost of capital
- ii) anti-trust
- iii) inc. savings
- iv) deficit
- v) R&E tax credit
 permanent + structures
- vi) capital gains
- vii) financial account system
 Jones again
 Frank Hill ~~is~~ interested



Human Frontier Research Program

- I. Intelligent Manuf. Systems ^{system}
- I S&T Agreement ^{integrated}
- NIST
what does US want back
- why not approach this thru the agreement
- Manuf. Ministerial hosted by Dornley
- I. Defense Agency rejected all
DAEPA overtures

→ protect copyright on software of Fed. money
Natl. Lab.

} Do C program as part of legis. package

→ how involve the private sector in determining research priorities
Industrial Research Institute - study on which programs
has most commercial effect
Dornley wants use PCAST to look at this
PCAST sees this as a direct line to President
where is this aggregated?
Dorman + Deskin at the two PCAST

large scale res. + dev prog - which will be funded

- o Hum. H-atom HHS/DOE ^{67%} supported by U.S. industry
- o Superconductors / Superlattices (SSC) 8% of 12 b. spent in Universities
- o Space Station -- NASA had to compromise of space
- o Global Change FCCSBT coord. agency research agency
- o Natl. Aerospace Plane (DOD)

what should be role of natl. labs.

spending 20-22 b. in natl. labs
is helping industry

a lot of issues here

last study - 1981 by W. A. Sainc Louis

→ shared facilities for use of U.S. industry

all fed. research grants need environ. impact statements

govt procurement - why not procure from the co.

in R. S. T issues

Supram. Cent. Tech. (Gore)
cost + security

how encourage mixing of ^{country} ~~goods~~ fiber optics
→ House bill High Performance Computing

a) { AT&T MFS
was no incentive to
wire before

[standards setting
NIST believes greater word of mouth standards

AAST by 10-20%

[fed compliance of ~~the~~ bill -- procurement metric statutory
Kudos from Hill spare station not metric
GSA/DoD J. said no metric is an impediment to STB

R+E Tax credit permanent -- details

DSTP changed by legislat. to come up the key tech. } end of 1990 deadline?
plan use DoD + DoC

DARPA's authorities very broad

S&T Working Group

DRAFT TEXT OF PRESS RELEASE

ON S&T WORKING GROUP AND FCCSET REORGANIZATION:

WHITE HOUSE POLICY APPARATUS
FOR SCIENCE AND TECHNOLOGY

For Immediate Release

March 21, 1990

The White House today announced the appointment of D. Allan Bromley, Assistant to the President for Science and Technology and Director of the Office of Science and Technology Policy, as chairman of the White House Working Group on Science and Technology. The Working Group currently reports to the Economic Policy Council and assists in the formulation, coordination, and implementation of Administration policies involving science and technology. The Working Group will also develop all science and technology issues related to domestic and social policy for consideration by the Domestic Policy Council. Members will include White House officials and senior representatives from all Federal agencies and departments with substantial involvement in scientific and technological issues.

The Working Group will analyze the scientific and technological components of economic and domestic policy issues, including Federal encouragement of investment research and development by the private sector; cooperation among government laboratories, university laboratories, and business; and access by American firms to international research and technology.

In addition, the Working Group will act as a conduit through which the deliberations and actions of the Federal Coordinating Council for Science, Engineering, and Technology (FCCSET) that relate to policy issues broader than science and technology can be considered by the Economic Policy Council or the Domestic Policy Council.

In a related action, Dr. Bromley announced a substantial restructuring of the Federal Coordinating Council for Science, Engineering, and Technology, which is charged with reviewing and coordinating Federal activities in science and technology that cut across the missions of more than one Federal agency. Dr. Bromley is the chairman of FCCSET, and a list of the new FCCSET membership is attached. Other agencies may be requested to participate in meetings of the FCCSET concerned with matters of interest to those agencies.

FCCSET is in the process of forming seven umbrella committees, each chaired by a high-level official of a Federal agency or department, to oversee broad areas of science and technology. Subcommittees and working groups will work within each of these umbrella committees to examine, coordinate, and integrate Federal activities in selected areas of science and technology.

The Federal Coordinating Council for Science, Engineering, and Technology (FCCSET) was originally established in 1976 by Public Law 94-282, the National Science and Technology Policy Organization and Priorities Act, which also established the Office of Science and Technology Policy. FCCSET is charged with:

- o Providing for more effective planning, coordination, and administration of Federal scientific and technological programs.**
- o Identifying research and development needs, including areas requiring additional emphasis.**
- o Achieving more effective use of the scientific and technological resources of Federal agencies.**
- o Developing and reviewing, in close cooperation with the Office of Management and Budget, annual and long-range Federal budget plans in selected cross-cutting areas of science and technology.**
- o Furthering international cooperation in science and technology.**

FCCSET is also charged with identifying scientific and technological issues of importance to the nation and with developing authoritative scientific and technological expertise and advice for the Executive Branch.

FCCSET also expects to receive information and advice on issues of science and technology from the President's Council of Advisers on Science and Technology, which the President established on February 2. PCAST consists of 12 distinguished

scientists and engineers from academia and industry and is chaired by Dr. Bromley. PCAST members will chair panels on specific areas of science and technology that in some cases will parallel the committee structure of FCCSET, allowing private sector input into high-level government policy making.

**FEDERAL COORDINATING COUNCIL
FOR SCIENCE, ENGINEERING & TECHNOLOGY
MEMBERSHIP**

March 1990

Chairman: D. Allan Bromley
Assistant to the President for Science and Technology
Director, Office of Science and Technology Policy

Members: Manuel Lujan
Secretary of the Interior

Clayton Yeutter
Secretary of Agriculture

Louis Sullivan
Secretary of Health and Human Services

James D. Watkins
Department of Energy

Lauro F. Cavazos
Secretary of Education

William K. Reilly
Administrator
Environmental Protection Agency

Donald J. Atwood, Jr.
Deputy Secretary of Defense

Thomas J. Murrin
Deputy Secretary
Department of Commerce

Alfred A. DelliBovi
Under Secretary
Department of Housing and Urban Development

Elaine Chao
Deputy Secretary
Department of Transportation

Anthony J. Principi
Deputy Secretary
Department of Veterans Affairs

Richard McCormack
Under Secretary for Economic Affairs
Department of State

Richard H. Truly
Administrator
National Aeronautics and Space Administration

Erich Bloch
Director
National Science Foundation



UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Technology Policy
Washington, D.C. 20230

MAR 26 1990

S&T Working Group

Dr. Kenneth P. Yale
Special Assistant to the President
Domestic Policy Council
The White House
Washington, D.C. 20500

Dear Dr. Yale:

On behalf of the Department of Commerce, I would like to invite you to a meeting of the Interagency Committee for Federal Laboratory Technology Transfer. The meeting will be held on April 4 at 1:30 p.m. in room 4830 of the Department of Commerce.

During the meeting the Committee will review the responsibilities of Federal agencies in implementing the Federal Technology Transfer Act and Executive Order 12591. We hope you can attend this important meeting.

The Department of Commerce is required by the Federal Technology Transfer Act to report to the President and Congress every two years on agency implementation of that Act. The next report will cover the period ending in October 1990. Because Congressional oversight committees have indicated that they plan to carefully scrutinize each agency's implementation plan, the meeting will focus on agency responsibilities under the Act.

Enclosed is background information on the Department's first biennial report on technology transfer and a copy of testimony by Lee Mercer, Deputy Under Secretary for Technology, on commercialization of Federally-funded research.

Sincerely,

Deborah L. Wince-Smith

Deborah L. Wince-Smith

Enclosures

MEMBERSHIP OF THE
INTERAGENCY COMMITTEE FOR FEDERAL LABORATORY TECHNOLOGY TRANSFER

Commerce

Deborah Wince-Smith
Assistant Secretary for Technology Policy
U.S. Department of Commerce
Room 4818, Hoover Building
14th Street and Constitution Ave., N.W.
Washington, D.C. 20230
Phone: 377-1581

Agriculture

Dr. Charles E. Hess
Assistant Secretary for Science and Education
U.S. Department of Agriculture
Room 217W, Administration Building
Washington, D.C. 20250
Phone: 447-5923

Interior

John Sayre
Assistant Secretary for Water and Science
U.S. Department of the Interior
18th & C Street, N.W.
Room 6660
Washington, D.C. 20240
Phone: 343-2186

EPA

Frich Bretthauer
Assistant Administrator for Research
and Development
U.S. Environmental Protection Agency
Waterside West Building, Room 913
Washington, D.C. 20460
Phone: 382-7676

Air Force

John J. Welch, Jr.
Assistant Secretary for Acquisition
U.S. Department of the Air Force
Pentagon, Room 4E964
Washington, D.C. 20330-1000
Phone: 697-6361

Army

George E. Dausman
Assistant Secretary for Research, Development,
and Acquisition
U.S. Department of the Army
SARD-ZA
Pentagon, Room 2E-661
Washington, DC 20310-0103
Phone: 695-6153

Navy

Gerald Cann
Assistant Secretary for Research, Development,
Acquisitions
U.S. Department of the Navy
Pentagon, Room 4E732
Washington, D.C. 20350
Phone: 695-6315

Defense

Dr. George Millburn
Deputy Under Secretary for Research and
Advanced Technology
U.S. Department of Defense
Pentagon, Room 3E114
Washington, D.C. 20301-3000
Phone: 695-5036

NASA

Kenneth S. Pedersen
Deputy Associate Administrator,
External Relations
National Aeronautics and Space Administration
Federal Office Building 6, Room 7021
400 Maryland Avenue, S.W.
Washington, D.C. 20546
Phone: 453-8310

Energy

James F. Decker,
Acting Director, Office of Energy Research
U.S. Department of Energy
Room 7B-058
1000 Independence Avenue, S.W.
Washington, D.C. 20585
Phone: 586-5430

Transportation

Mark Dowis
Executive Assistant to the Administrator
Research and Special Programs Administration
U.S. Department of Transportation
Room 8410
400 Seventh Street, S.W.
Washington, D.C. 209590
Phone: 366-4433

HHS

Dr. Frank E. Young
Deputy Assistant Secretary for Health,
Science, and Environment
U.S. Department of Health and Human Services
Humphrey Building, Room 701-H
200 Independence Avenue, S.W.
Washington, DC 20201
Phone: 245-6811

OSTP

Dr. William Phillips
Associate Director for Industrial Policy
Office of Science and Technology Policy
New Executive Office Building, Room 5026
Washington, D.C. 20506
Phone: 395-3125

USTR

S. Bruce Wilson
Assistant U. S. Trade Representative
Office of the U.S. Trade Representative
Room 401A
600 17th Street, N.W.
Washington, D.C. 20506
Phone: 395-7320

VA

Stephen Litwin
Deputy Assistant Chief Medical Director
Veterans Administration Central Office
810 Vermont Avenue, N.W.
Washington, D.C. 20420
Phone: 233-2618

CPSC

Dr. Robert D. Verhalen
Associate Executive Director
5401 Westbard Avenue, N.W.
Washington, D.C. 20207
Phone: 301-492-6440

STATEMENT OF LEE W. MERCER
DEPUTY UNDERSECRETARY FOR TECHNOLOGY
BEFORE THE HOUSE SUBCOMMITTEE ON REGULATION,
BUSINESS OPPORTUNITIES, AND ENERGY

OCTOBER 5, 1989

Thank you for this opportunity to testify before the Subcommittee on an issue which is very important to the Department of Commerce-- increasing the commercialization of federally funded research by United States industry.

The U.S. Government funds approximately one-half of all our R&D, supports about 80% of U.S. basic research and employs one-sixth of our scientists and engineers. We must translate this investment of the American taxpayer into new products, jobs, and business opportunities if we are to remain competitive in an increasingly tough international economy.

We have made enormous strides forward in the last eight years. This is not to say that all barriers have been overcome. Nevertheless, we have removed the main legal obstacles preventing joint R&D efforts between our federal laboratories, universities and the private sector. The public sector is becoming increasingly skillful in applying new authorities allowing our universities and federal laboratories to manage their technologies. We should not lose sight of this substantial progress.

By removing these barriers, U.S. industry can now draw from the world's largest research pool. They can tap into long-range, high risk research using unique facilities which took billions of dollars to establish and are impossible for the private sector to replicate. This ability is increasingly important as our companies operate in today's complex and competitive world market.

As Secretary Mosbacher stated in his recent report to the

President and Congress on the implementation of the Federal Technology Transfer Act, in order to judge how far we have come, we must remember where we started. After World War II the basic policy toward all Government funded R&D was essentially a Marshall Plan for technology. Any patentable or commercially valuable discoveries made with federal funding were freely available to anyone who chose to exploit them -- domestic or foreign.

The policy of licensing patents resulting from federally supported R&D non-exclusively, and the lack of incentives for the public sector institutions to pursue commercially important research, led to a widening gap between the U.S. public and private sectors. Ignoring the observation of President Lincoln that the patent system was designed to "add the fuel of interest to the fires of genius," few incentives were available to reward our federal scientists or their laboratories for successful technology transfers. The result was predictable.

President Johnson conducted a study of the Department of Health, Education and Welfare (now HHS) in 1968 and found that not one drug had ever been commercialized when the Government owned the patent. A decade later the situation had not improved. By the late 1970's the U.S. Government had stockpiled over 28,000 patents on its shelves and was licensing less than 5% of them for development. It routinely took up to 3 years for universities to receive final answers on their petitions to Washington for ownership of the inventions they made with federal support.

Recognizing that a new approach was needed in a hurry, Congress tried a revolutionary approach-- allowing for decentralized technology management coupled with incentives for success. Passage of the Bayh-Dole Act in 1980 (P.L. 96-517, as amended) for universities and small business contractors, and the Federal Technology Transfer Act in 1986 (P.L. 99-502) for federally owned and operated laboratories, were clear breaks with the past. President Reagan in Executive Order 12591 in April, 1987 made these laws the centerpieces of the Administration's technology management policy. However, it takes time for the full benefits of this change to become fully evident.

We have already seen significant economic benefits from the new policies. The U.S. biotechnology industry was greatly assisted because universities were allowed to manage their technologies without interference from Washington. This permitted the creation of a series of small biotechnology spin-off companies around our major universities.

Universities adapted this model to other promising technologies. The University of Utah, for example, became a leader in medical device technology creating more than 35 small-high tech businesses in the last 8 years. And, it is no accident that Silicon Valley, Route 128 in Boston, and Research Triangle in North Carolina are located near federally-supported universities. States and local governments are increasingly citing their universities as centers of their economic development plans.

This progress in commercializing university R&D has been

made without sacrificing the prime educational mission of the universities. Indeed, according to the National Science Foundation, since 1980 university scientific publications have steadily increased. Universities are reporting that their ability to perform joint R&D with industry is also proving very beneficial in better training our future scientists and engineers in state-of-the-art research.

This experience is important to the rest of Government. In crafting a new policy to increase technology transfer from federally-owned and operated laboratories to U.S. industry, Congress drew on the successful university model. The enactment of the Federal Technology Transfer Act in 1986 gave similar authorities to manage inventions to these laboratories as universities received in 1980. In analyzing how successful these laboratories have been in utilizing the new Act, it is helpful to compare their progress with that of the universities who went through the same learning curve six years earlier.

The first indicator of the impact of the Bayh-Dole Act on campus was a jump in university patent disclosures after years of stagnation. This was followed by a steady increase in royalty revenues as university inventions were licensed to industry and began to be marketed. As more and more universities identified promising research on campus and became aware of the successes of other schools, a great interest was shown in training campus technology managers to successfully negotiate with industry. The membership of the Society of University Patent Administrators, for instance, increased from less than 50 members in 1978 to more

than 600 today. Universities began trading model agreements, royalty sharing plans for their scientists, and policies for guiding the faculty in using the new law. Different universities applied different models to meet their specific needs, but this information exchange allowed them to greatly speed up the process.

The federally owned and operated laboratories are showing exactly the same traits as the universities in the early 1980's. The Department of Commerce has already seen its patent applications triple since enactment of the Federal Technology Transfer Act. The Department of Agriculture reported 76 inventions in FY 1987 and 139 in FY 1988. The Army's inventions disclosures increased 40% and the Navy's 30% during the last year. Health and Human Services reported that as many inventions were disclosed during the first nine months of 1988 as in all of 1987.

The National Technical Information Service reported a quadrupling of federal royalty income between FY 1985 and FY 1988 when royalties reached \$5.6 million. While modest compared to current university royalties, this growth is indicative of the excitement caused by the Federal Technology Transfer Act and should show steady growth each year.

Former Secretary of Commerce Baldrige recognized the need for the agencies to have a support network similar to that developed by the universities, and formed the Interagency Committee on Federal Technology Transfer to quicken the learning process.

The Committee, which Commerce chairs, is composed of Assistant Secretary's from each agency responsible for implementing the Federal Technology Transfer Act. A working group of senior staff meets approximately every six weeks. Over the last two years the working group developed models for answering questions like: how do you delegate authorities to the laboratories pursuant to the Act, what is the relationship between the labs and headquarters for reviewing agreements, what types of arrangements are appropriate and which are not, what percentage of royalties should an agency share with its personnel, should all of the remaining royalties go to one laboratory or should a certain percentage go to other laboratories, how do agencies advertise their research to insure equal access by different companies, do current agency procedures on conflict of interest need revision or clarification for the Act, how do agencies identify foreign owned or controlled companies as required by the law, how do agencies account for cost sharing arrangements with industry under the Act, how do agencies reconcile the Freedom of Information Act with the Federal Technology Transfer Act, etc. These are not simple questions, yet until the laboratories received guidance on their full use of the Act was not possible.

In passing the law, Congress recognized that the answers to such questions would vary from agency to agency depending on its mission. For example, the needs of a regulation-oriented agency such as the Food and Drug Administration are considerably different from those of the Department of Commerce.

Nevertheless, as Secretary Mosbacher pointed out in his July, 1989 report to the President and Congress on implementation of the Act, substantial progress has been made in developing the infrastructure for applying the new law. The tools for success have been painstakingly created and the Administration now expects each agency to use them.

While it is not appropriate for the Department of Commerce to judge the different models adopted by the agencies, we do take seriously our responsibility to report objectively on their performance. In our next report, due in 1990, we will cite objective indicators such as numbers of agreements signed by each agency, inventions disclosed, and royalties received so that the President and Congress can make informed judgements on how various models are working.

There has already been considerable success in using the Act. Secretary Mosbacher cited more than 100 cooperative research and development agreements (CRADA's) already signed in the first two years of the law. This number has steadily increased since the report was written. There are now about 200 agreements in effect and many more pending.

Recent articles like that appearing in Science on September 19, 1989: "NIH, Inc.: The CRADA Boom" illustrate the considerable impact the Act is having on our agencies, its laboratories, and most importantly, on research scientists. Washington Technology in its September 14, 1989 issue cites the implementation of the Act by the Air Force in its story "CRDA's Tie Military, Civilian Research." The Department's National

Institute of Standards and Technology has been a leader in implementing the Act, and is completing approximately four agreements a month.

Other exciting new cooperative efforts are underway which would have been impossible just a few years ago. The Secretary cited the formation of the Biotechnology Research and Development Consortia (BRDC) in Peoria, Illinois. BRDC is a joint research effort between a USDA lab, the University of Illinois, six U.S. companies and the State of Illinois. Such projects have enormous potential for helping the U.S. stay on the cutting edge in high technology. This effort was initiated by the City of Peoria after identifying its local technology assets. Such decentralized economic leadership is our most appropriate technology transfer model.

The Department intends to vigorously address the remaining obstacles agencies now face. One of the most challenging is involving a larger segment of U.S. industry in commercializing federally funded research. The Department through its new Technology Administration will be undertaking a major initiative to alert the private sector to the recent changes in the law allowing them to perform joint R&D with universities and federal laboratories. We will focus on small as well as large companies in this effort. The working group of the Interagency Committee on Federal Technology Transfer has scheduled a meeting later this month with industry leaders to exchange ideas for this campaign.

The Technology Administration will also work toward

developing more efficient training methods for our laboratory technology managers. We will work closely with the Federal Laboratory Consortium in this effort. It is one thing to receive legal authority to negotiate a joint research project with industry, and quite another thing to actually do it. This type of nuts-and-bolts information is increasingly important.

In summary, we have made considerable progress in breaking down the formidable barriers which had grown up over forty years between universities, federal laboratories and American industry. Agencies are taking this responsibility seriously. The Department of Commerce sees its role as a facilitator of this effort. The Department will use its reporting responsibilities to objectively monitor agency compliance with Executive Order 12591. The Department will continue to strive to promote increased cooperation between our public and private sectors which will greatly strengthen the U.S. economy.



UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Technology Policy
Washington, D.C. 20230

Set working paper

March 22, 1990

MEMORANDUM FOR THE SECRETARY

FROM: DEBORAH L. WINCE-SMITH
Assistant Secretary for Technology Policy

Deborah L. Wince-Smith

SUBJECT: INTELLECTUAL PROPERTY RIGHTS IN THE GLOBAL MARKET

Attached is an excellent case study the Technology Administration developed about the importance of intellectual property rights in the global market, and the direct linkage to our federal technology transfer initiative. Corning Glass protected its fiber optic technology advantage over a Japanese competitor by using its patent portfolio. Since Corning now has a cooperative agreement with a federal laboratory, we can appreciate the importance of intellectual property right sections in government-to-government science and technology agreements. Companies such as Corning must have confidence that foreign competitors will not indirectly obtain access to U.S. technology, when they cannot obtain it directly.

Attachment

cc: Thomas Murrin
Wayne Berman
Bruce Soll
Wendell Wilkie
Michael Farren
Michael Skarzynski
Harry F. Manbeck



UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Technology Policy
Washington, D.C. 20230

28 MAR 1990

MEMORANDUM FOR LEE W. MERCER *Lee W. Mercer*
Deputy Under Secretary, Technology Administration
DEBORAH L. WINCE-SMITH *DWS*
Assistant Secretary for Technology Policy

FROM: JAMES V. LACY *James V. Lacy*
Chief Counsel for Technology
MARK LIEBERMAN
Director, Office of Technology Commercialization

SUBJECT: THE IMPORTANCE OF ENFORCEMENT OF INTELLECTUAL
PROPERTY RIGHTS - A CASE STUDY.

This memo summarizes the Corning Glass Works v. Sumitomo, U.S.A. case, in which Corning, the inventor of optical fibers, successfully protected its patents from infringement and stopped Sumitomo from marketing optical fibers in the United States. The case demonstrates that protecting intellectual property rights from infringement can provide U.S. companies with a competitive advantage.

The Corning Case

U.S. companies are increasingly recognizing that they must not only acquire an advantage for their company over competitors by superior research and engineering efforts, but that they must also protect that hard earned advantage with the same vigilance they used to acquire it. Corning, a New York glass manufacturer, began researching the possibility of transmitting information by light in 1966. After sixteen years of research and spending several hundred million dollars to develop the product and a market, Corning made its first major sale in 1982. Just as Corning was achieving commercial success however, Corning noticed that its Canadian customer, Canadian Cable and Wire, was using optical fibers based on Corning's patents. The fibers were made by Sumitomo, the Japanese electronics firm.

Corning faced several choices when they learned Sumitomo was manufacturing optical fiber based on Corning's patents. First, Corning could ignore it; two, Corning could license the technology to Sumitomo; or lastly, Corning could sue to protect its patents. Corning chose to sue. As David Duke, Corning's optical fiber manager explained, "Few materials companies put as much into research as Corning. Over \$100 million a year. Out of all that the firm might get one major breakthrough a decade. The

only way to continue a high level of research was to get the maximum possible profit from each of those breakthrough products." In essence, research and development was not worth doing, if it could not be legally protected.

Corning sued Sumitomo and Canadian Wire and Cable in the Canadian courts and won. Sumitomo was forced to stop shipping optical fibers into Canada. Sumitomo then began shipping optical fibers into the United States. Rather than fight Sumitomo in the courtroom, Corning decided to protest to the International Trade Commission (ITC). A favorable ruling would prevent Sumitomo and other importers from shipping infringing optical fibers into the United States. The ITC ruled that Sumitomo had infringed Corning's patents, but could not find the necessary injury to bar Sumitomo's imports since Sumitomo's import sales had suddenly become so small.

Sumitomo had in the meantime, converted a research center in North Carolina into an optical fiber manufacturing center and began producing optical fiber in anticipation of an adverse ITC ruling. (Sumitomo's U.S. production of optical fiber would not be subject to the ITC decision, because the ITC has jurisdiction only over imports.) Corning again sued, this time in U.S. district court, claiming that Sumitomo was infringing its patents. Corning won, Sumitomo was ordered to close its North Carolina plant and pay Corning for past damages.

Corning is now the primary seller of optical fiber in the United States, after several years of lawsuits and spending millions of dollars to enforce its patents. Its investment in optical fibers has paid off, not only because it kept investing in technology nobody else believed in or would buy, but because it spent the resources to defend its patents. Never complacent Corning has recently entered into a cooperative agreement with several federal laboratories for further fiber optics research.

Intellectual Property Rights

As the Corning case demonstrates, companies need to vigorously defend their patents and other intellectual property rights to protect their markets. Other firms will infringe on another company's patents to reap commercial rewards, if permitted. As the District Court in the Corning stated,

There is no evidence that Sumitomo made any effort to change the composition of its optical waveguide fibers to avoid Corning's 915 patent after the ITC and Canadian court decisions. ... To proceed thereafter to manufacture and sell the same fibers without changes designed to avoid infringement can only be construed as outright defiance or baseless optimism. 671 F.Supp. 1369,1401 (S.D.N.Y. 1987).

Other firms may not be so bold as Sumitomo, but they will exploit opportunities to profit from unprotected intellectual property.

In such an environment, the U.S. government and U.S. corporations need to recognize that U.S. technology is a major national economic asset, but only if it can be adequately protected from theft or misappropriation. U.S. firms need to appreciate the interest they have in protecting intellectual property from infringement. Firms must begin to devote as much attention to intellectual property rights, as they do to research, development, and innovation. Some have even suggested integrating intellectual property right strategies into the concurrent engineering process. Firms that fail to protect their inventions, especially as ideas, information, and technology become the center of their ability to compete, will increasingly find other companies copying their product and selling it cheaper.

Similarly, the U.S. government has a policy interest in emphasizing that the legal protection of intellectual property is as important as research and development. Firms may be reluctant to participate in cooperative research and development agreements, or the Advanced Technology Program, if the federal government does not vigorously protect the intellectual property developed under the agreement from infringement.

Cooperative agreements and overall government policy should be structured so the technology developed remains with the participating company and can be protected from infringement by other firms who have not invested in similar research and development efforts. This proper protection and use of technology and information will further encourage innovation, new product and service development, efficiency, and competitive advantage in the global marketplace.

Olin Wethington

EXECUTIVE SECRETARIAT CORRESPONDENCE PROFILE

PROFILE #: 91-98477

CREATE DATE: 05/03/91

ADDRESSEE: Brady, Nicholas F.
Secretary

AUTHOR: Mosbacher, Robert A.
Commerce

SUBJECT: Working Group On Science And Technology

ABSTRACT: Secretary of Commerce nominates Robert White for Commerce's representative at the EPC's Working Group on Science and Technology.

DISTRIBUTION: ECONOMIC POLICY
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91-98477
THE SECRETARY OF COMMERCE
Washington, D.C. 20230

May 2, 1991

The Honorable Nicholas F. Brady
Chairman Pro Tempore
Economic Policy Council
The White House
Washington, D. C. 20500

Dear Mr. Secretary:

Thank you for your recent letter on the new Working Group on Science and Technology under the Economic Policy Council. I appreciate the opportunity to name a representative of the Department of Commerce to sit on the working group.

The economic performance of the United States is largely dependent upon our country's technological prowess. This is a major concern of the Commerce Department's Technology Administration. Therefore, I would like to have Under Secretary for Technology, Robert M. White, represent Commerce on the Working Group. His mailing address and telephone are:

Technology Administration
U.S. Department of Commerce
14th & Constitution Avenue, N.W.
Room 4824
Washington, D. C. 20230
(202) 377-1575

Sincerely,

A handwritten signature in black ink, appearing to read "R. Mosbacher", is written over the typed name.

Robert A. Mosbacher



DEPARTMENT OF THE TREASURY
WASHINGTON
15TH & PENNSYLVANIA AVE, N.W.
WASHINGTON, DC 20220

FACSIMILE COVER SHEET
ECONOMIC POLICY

DATE 7/8/91

FAX MESSAGE NUMBER: _____

NUMBER OF PAGES TO FOLLOW: 3

TO: Olin Wethington
Economic Policy Council

ADDRESSEE'S FAX NUMBER: 456-7739

ADDRESSEE'S CONFIRMATION NUMBER: 456-7968

FROM: Maynard Comiez
566-5808

SENDER'S FAX NUMBERS: (202) 786-8452

SENDER'S CONFIRMATION NUMBER: (202) 566-5808

COMMENTS/SPECIAL INSTRUCTIONS:

PER OUR TELEPHONE CONVERSATION.

UNCLASSIFIED



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Sincerely,

A handwritten signature in black ink, appearing to read "R. Mosbacher", written over a large, stylized flourish.

Robert A. Mosbacher

21 MAY - 2 11 53 AM '91

91-99752



THE SECRETARY OF TRANSPORTATION

WASHINGTON, D.C. 20590

June 4, 1991

Mr. Nicholas F. Brady
Chairman Pro Tempore
Economic Policy Council
The White House
Washington, DC 20500

Dear Nick:

Thank you for your memorandum describing the re-establishment of the Working Group on Science and Technology. The Department of Transportation (DOT) is strongly committed to programs which promote innovation, and one of the six major tenets of our National Transportation Policy is to engage vigorously in such activities.

I am designating Mr. Travis P. Dungan, Administrator of the Research and Special Programs Administration, as our representative to the Working Group. Mr. Dungan has oversight of research in the Department, and acts as the chairman of the Department's Research and Development Coordinating Council. The Council is the top level body setting technical directions for DOT. He also is an active advocate for technical activities in the Department's program development and budgeting activities.

We look forward to contributing to the effectiveness of the Working Group through Mr. Dungan's participation.

Sincerely,

A handwritten signature in black ink, appearing to read "Sam", with a long horizontal line extending to the right.

Samuel K. Skinner



The Secretary of Energy
Washington, DC 20585

May 7, 1991

MEMORANDUM FOR THE HONORABLE NICHOLAS F. BRADY
SECRETARY OF THE TREASURY

SUBJECT: Economic Policy Council Working Group on
Science and Technology

Thank you for inviting representation from the Department of Energy on the Economic Policy Council Working Group on Science and Technology. Linda G. Stuntz, Deputy Under Secretary for Policy, Planning, and Analysis, will serve as the Department's representative to the Working Group, with support from the Department's technical organizations as appropriate.

A handwritten signature in black ink that reads "Jim Watkins".

James D. Watkins
Admiral, U.S. Navy (Retired)

cc: The Honorable D. Allan Bromley

THE WHITE HOUSE

WASHINGTON

April 9, 1991

MEMORANDUM FOR THE VICE PRESIDENT
THE SECRETARY OF STATE
THE SECRETARY OF DEFENSE
THE SECRETARY OF AGRICULTURE
THE SECRETARY OF COMMERCE
THE SECRETARY OF LABOR
THE SECRETARY OF TRANSPORTATION
THE SECRETARY OF ENERGY
THE DIRECTOR, OFFICE OF MANAGEMENT AND BUDGET
THE UNITED STATES TRADE REPRESENTATIVE
THE CHIEF OF STAFF TO THE PRESIDENT
THE ASSISTANT TO THE PRESIDENT FOR NATIONAL
SECURITY AFFAIRS
THE CHAIRMAN, COUNCIL OF ECONOMIC ADVISERS
THE ASSISTANT TO THE PRESIDENT FOR ECONOMIC AND
DOMESTIC AFFAIRS
THE ASSISTANT TO THE PRESIDENT FOR SCIENCE
AND TECHNOLOGY

SUBJECT: Working Group on Science and Technology

The economic performance of the United States is closely tied to increases in productivity through innovation and the development and application of new technologies. The President has continually demonstrated his commitment to a vigorous research and development agenda, most recently in the FY 1992 budget submission to Congress.

To support the Administration's leadership on research and development issues, the Economic Policy Council (EPC) Working Group on Research, Development, Technology and Innovation is being re-established. This group will be called the Working Group on Science and Technology. The Assistant to the President for Science and Technology will assume the role of chairman.

The Working Group will provide a forum for developing Administration policy on significant science and technology issues that affect U.S. economic performance. As initial tasks, the Working Group will review the policy approach of the federal government toward implementation of the networking aspects of the high performance computing and communications initiative and various joint industry-government cost-sharing consortia contemplated by the recent Administration initiatives.

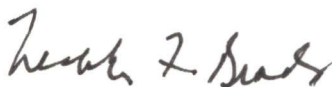
The Working Group should include representatives from the Office of the Vice President, Departments of State, the Treasury,

Defense, USTR, Commerce, Energy, Office of Management and Budget, Council of Economic Advisers, Office of Policy Development, and Office of Science and Technology Policy. The members of the Working Group should be at the Assistant Secretary level or above.

As the Working Group focuses on specific issues, representatives of appropriate Executive Branch agencies will be invited to participate.

The chairman of the Working Group should coordinate its activities with the Executive Secretary to the EPC.

Thank you very much for your cooperation.



Nicholas F. Brady
Chairman Pro Tempore
Economic Policy Council

THE WHITE HOUSE

WASHINGTON

April 9, 1991

MEMORANDUM FOR THE VICE PRESIDENT
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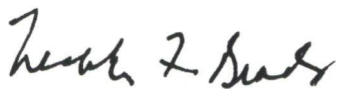
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Nicholas F. Brady
Chairman Pro Tempore
Economic Policy Council