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TECHNOLOGY: THE ENGINE OF ECONOMIC GROWTH

America can compete and win, but only if we have a positive vision guiding our economic policies. Our economic future depends on our capacity not only to invent and master the new technologies of the future, but to ensure that these ideas move rapidly to market to spur growth, create new jobs for our people and strengthen our industrial performance.

In **Putting People First**, Bill Clinton, announced his support for a revenue-neutral transfer from unnecessary defense R&D to civilian and dual-use R&D. On September 8, 1992, Governor Clinton announced how the details of his new civilian technology initiative would explicitly strengthen our manufacturing base. Today, Governor Clinton details further how his strategy will strengthen the ability of American firms to commercialize new technologies.

America's competitiveness rests ultimately with the private sector. U.S. firms must expand employee involvement and participation, continuously improve their product and process technology, increase their investments in R&D, plant and equipment, worker training, forge better relationships with their suppliers and customers, and shorten the time required to bring products to market.

Yet, it is imperative that we recognize that government has a role in encouraging pre-competitive technology development, encouraging dual-use technologies, supporting industry-led consortia, and making the most of technological advances.

Al Gore has been a leader for more than ten years in high technology and telecommunication policy. As Vice-President, Al Gore will head efforts to implement the Clinton/Gore national technology strategy.

In particular, we must move forward with the following reforms:

o **Build Information Superhighways**: to develop an advanced communications network, which will help companies collaborate on research and design for advanced manufacturing, allow doctors across the country to communicate, put immense resources at the fingertips of American teachers and students and much more.

o **Reform federal R&D programs to focus on critical technologies**: The funding will be focused so that more resources are devoted to critical technologies, such as advanced materials, information technology and new manufacturing processes.

o **Reform our National Labs**: Federal labs will have ten to twenty percent of their existing budget assigned to establish joint ventures with industry.

o **Create a world-class business environment for private sector investment and innovation**: Changes in America's tax, trade and regulatory policies are also needed to help restore America's industrial and technological leadership.

o **Invest in technology programs that empower America's small businesses**. The Clinton/Gore economic plan will create 170 market driven manufacturing extension centers over four years.

o **Establish education and training programs for a high-skill workforce**: The U.S. education and training system must make sure that American workers have the requisite skills for a technology intensive workforce.

TECHNOLOGY: THE ENGINE OF ECONOMIC GROWTH

A National Technology Policy for America

September 18, 1992

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SUMMARY

Last June, I introduced a National Economic Strategy called Putting People First. It will create 8 million new jobs and a higher standard of living for the American people and for our children. My Technology Policy is part of the ongoing effort to further define that vision and describe how we will implement it.

I have every confidence that America has the energy and the talent to regain its industrial and technological leadership. Unfortunately, the Bush-Quayle Administration has done nothing while wages have stagnated and our economic leadership has eroded. Despite the growing consensus on what needs to be done, they refuse to act, recycling the tired and failed policies of the past. America can compete and win, but only if we have a positive vision guiding our economic policies. Leadership in developing and commercializing new technologies is critical to regaining industrial leadership, creating high-wage jobs, and ensuring our long-term prosperity. Investments in research and development are important not only to high-tech industries such as aerospace and electronics, but to basic manufacturing industries, and to small businesses which must be innovative to survive.

Although the government has a role to play in restoring America's competitiveness, most responsibility rests with the private sector. U.S. firms must expand employee involvement and participation, continuously improve their product and process technology, increase their investments in research, development and technology, plant and equipment, and worker training, shorten the time required to bring products to market, and forge better relationships with their suppliers and customers.

Government can and must support these efforts. Our most successful competitors help their businesses -- large and small -- to compete more effectively. We must go beyond support for basic research and a reliance on "spin-offs" from defense R&D. My technology policy consists of six broad initiatives aimed at helping Americans develop and quickly utilize new technologies:

1. Investing in a 21st century infrastructure;

2. Establishing education and training programs for a high-skills workforce;

3. Investing in technology programs that empower America's small businesses;

4. Refocusing federal R&D programs on critical technologies that enhance industrial performance;

5. Leveraging the national R&D investment; and

6. Creating a world-class business environment for private sector investment and innovation.

I will give our Vice President Al Gore the responsibility and authority to coordinate the Administration's vision for technology and lead all government agencies, including research groups, in aligning with that vision. This is a real job for a distinguished national leader whose experience, energy and intellect are a perfect match for the challenge.

This technology policy outlines the kind of strong action I will take to bring America back to a leadership role in the world economy. Please join us in this history-making endeavor. I welcome your support and ideas.

Bill Clinton

A TECHNOLOGY POLICY FOR AMERICA'S ECONOMIC FUTURE

America's economic performance and international influence rest, in large part, on its technology base. Technology has accounted for the bulk of U.S. productivity gains during the past half-century, spawned entire new industries, created millions of jobs, and been a primary source of America's ability to maintain a high standard of living for its citizens. We are the world leaders in biotechnology, information technology, aerospace technology and many other fields on the frontiers of science applied to human life. As a result of intense international competition, however, the U.S. technology edge has eroded in some of our prominent industries.

Unfortunately, by losing the lead in the commercialization of many American invented technologies we are losing control of our own economic growth and prosperity. If U.S. productivity growth had grown at the same rate in the 1970's and 1980's that it did in the 1950's and 1960's, the standard of living of the American family would be 40 percent higher. Instead of struggling to get by, working men and women would be better able to buy a home, pay their health care costs, and send their kids to college. The United States must act now to establish a technology policy that will help U.S. companies to succeed in world markets and help American citizens earn a good living in the global economy.

I. NEEDED: A TECHNOLOGY POLICY TO COMPLEMENT OUR SCIENCE POLICY

At the end of World War II, Vannevar Bush defined the framework for U.S. science policy in his report, Science, The Endless Frontier. This policy has paid tremendous dividends to the nation. It made the United States a world leader in science; made America's university education and research system the best in the world; allowed us to supply ourselves and other nations with skilled scientists and engineers; and made it possible to provide technology to academia, industry and the government on a scale that no single company or laboratory could have accomplished alone.

For several decades after the war, we did not perceive the need for a technology policy to complement this science policy. After all, the U.S. economy enjoyed significant spillover dividends from defense R&D expenditures, and the largely self-sufficient U.S. private sector was ahead of other countries in its capability to invest in technology and capture the economic benefits of basic research.

Today, the United States faces a new environment:

- Natural resources, what we dig out of the ground, are being replaced by knowledge and technology, what we dig out of our minds, as the source of national economic competitiveness.

- Leading-edge technologies often find their first application in the civilian sector and only much later in defense, if at all. For example, the 8088 Intel microprocessor used in the Patriot missile, which symbolized U.S. high-tech defense systems in the Gulf war, is three generations old and is not even used in today's personal computers.

- The resources needed to develop technology are increasing dramatically and, in many cases, are far greater than any individual company can afford. It can cost $1 billion to bring to market a new jet engine for commercial airliners. On average, it takes about 12 years and over $200 million for a pharmaceutical firm to develop a new drug.

- Increased international competition has led to shorter product cycles, putting even more stress on resources. The product life for many electronic components today is less than one year, which, puts incredible pressure on firms to constantly upgrade existing products and develop new ones.

- Some foreign competitors have succeeded by exploiting a new innovation system that links R&D tightly to market needs. In 1975, the Japanese auto industry held only 10% of the U.S. market; today, it has about 30% of the U.S. market. It did so, not by devoting massive resources to basic research, but by stressing incremental improvements in existing technology, rigorous quality control, rapid time-to-market, and tight inventory controls.

- R&D results flow quickly around the world, but production know-how does not. As a result, many foreign competitors are able to rapidly absorb the results of America's research, while U.S. firms must often work for years to master the production systems that give industry in other countries an edge. For example, the research breakthrough in superconductors that was achieved in an IBM lab in Switzerland was soon confirmed in Japan and China, and within weeks extended by researchers in the United States. By contrast, it has taken years for American companies to begin to master the lean production system that the Japanese automobile industry developed.

Science policy alone does not address these issues. In essence, science policy is a supply-push policy in which the government supports science education,

basic research and some applied R&D that relates to specific national missions. During the Cold War, this policy worked well because U.S. industry dominated world markets and massive U.S. defense spending for high-tech weapons systems provided a big demand for leading edge technology. Today, however, U.S. industry faces intense international competition, and the global civilian market, not the Department of Defense, is the testing ground for most of the new technologies.

Technology policy picks up where science policy leaves off. It is not limited to just research and development. It also focuses on the rapid application of new ideas. The absence of a coherent technology policy is one of the key reasons why America is trailing some of its major competitors in translating its strength in basic research into commercial success, and why America is losing its lead in technology. Even in the technologies where we still lead, we face the challenge of translating the world's best research into the world's best jobs for American workers.

II. THE CHALLENGES TO AMERICA'S INDUSTRIAL AND TECHNOLOGICAL LEADERSHIP

The private-sector Council on Competitiveness put the problem bluntly in its report, Gaining New Ground: Technology Priorities for America's Future:

> "The U.S. position in many critical technologies is slipping and, in some cases, has been lost altogether. Future trends are not encouraging."

This conclusion is based on U.S. industry's assessment of the evidence, accumulated by detailed studies of nine major sectors of the economy and a review of over 90 different critical technologies. It is supported by the experiences of many different industries.

- Several billion dollars and more than a decade are required to bring a new commercial aircraft to market. While U.S. military R&D is providing fewer and fewer spillovers to America's commercial aircraft industry, Europe's Airbus industry has received $25 billion in direct government subsidies since its founding. Buoyed by these subsidies, Airbus has displaced McDonnell Douglas as the world's second largest aircraft manufacturer and is beginning to take significant orders away from the industry leader, Boeing. If these market losses continue, they will seriously erode Boeing's ability to invest in the next generation of aircraft technology and put hundreds of U.S. high technology contractors at risk.

- As a science-based business, the chemical industry has benefitted from America's strong research base. But over half of the chemical industry's products are sold to other manufacturing industries, and the growing weakness in segments of the U.S. manufacturing base has serious repercussions for the future health of the U.S. chemicals industry.

- The U.S. electronic components industry developed a significant amount of the basic technologies used by the industry today and has led in the formation of new electronic companies. Nonetheless, its inability to cross-subsidize businesses, its loss of volume markets, its manufacturing problems, and the high relative cost of capital in the United States over the past decade have allowed foreign competitors to dominate many market segments. U.S. industry is weak in actuators, optoelectronic components and hardcopy technology, and it is losing badly in memory chips, electronic packaging and interconnections; and display technologies.

- The U.S. machine tool industry is in trouble. The U.S. share of world production has declined from about 50% in 1955 to about 15% today, and imports account for half of the U.S. domestic market. The U.S. machine tool industry is made up mostly of small companies that do not have the resources to sustain the necessary investments in new technology or systematically upgrade the manufacturing skills of their employees.

- For many people, the U.S. computer industry symbolizes U.S. technological preeminence. Advances in computers and software have driven major changes in virtually every other sector of the economy and are also critical to national defense. U.S. computer systems firms are still the dominant producers in world equipment and software markets, but their leadership is under assault. The U.S. balance of trade in computers has deteriorated substantially in the last decade. The world market share of U.S. computer companies fell from 81% in 1983 to 61% in 1989, and the U.S. industry is increasingly dependent on foreign components for its products.

The growing problems of U.S. technology-intensive industries are backed up by economic indicators:

- The U.S. high-tech trade balance posted a deficit for the first time in 1986. It has since swung back into slight surplus, but remains negative in semiconductors and is approaching a zero balance in computers.

- In a recent high school career interest survey, the top five career choices of American students were lawyer, musician, psychologist, fashion designer and photographer. The bottom five were computer engineer, mechanical engineer, chemist, civil engineer and physicist. As a result, not enough U.S. students are pursuing training in technical fields. Over half of the doctoral degrees from U.S. universities in engineering, 40 percent of those in math and a third of those in physics go to foreign students who are increasingly choosing to return home after they graduate.

- Foreign companies are collecting almost half of all new U.S. patents and boosting their share every year. In 1990 the top four recipients of U.S. patents were Hitachi, Toshiba, Canon and Mitsubishi.

- The United States invests only 1.9% of its GNP in non-defense R&D, while Germany invests 2.8% and Japan invests 3.0%.

- In 1991 U.S. investment in plant and equipment hit a 14 year low of 10.7% of GDP, down from 11.4% in 1990. Even more alarming is the fact that the United States invested a smaller share of GDP in plant and equipment last year than any other Summit 7 country. The U.S. investment level is half Japan's rate of 22% and below Germany's rate of 14.5%.

- Using current exchange rates, the United States invested $550 billion in plant and equipment in 1991 and Japan invested $662 billion, despite the fact that Japan's economy is only 60% the size of the U.S. economy.

America cannot afford to ignore these warning signals. If we are to safeguard the standard of living of American citizens and improve the ability of U.S. industry to compete in world markets, we must develop a coherent technology policy.

III. A NEW FRAMEWORK FOR U.S. TECHNOLOGY POLICY

In order to implement an effective U.S. technology policy, I will declare that U.S. technological leadership is a national priority and organize the government for results.

The President alone has the authority to focus the national will and galvanize the necessary resources. When elected, I will do just that.

First and foremost, a Clinton-Gore Administration will emphasize the need to renew our civilian technology base. America cannot continue to rely on trickle down technology from the military to maintain competitiveness of its high-tech and manufacturing industries. Civilian industry, not the military, is the driving force behind advanced technology today. Only by strengthening our civilian technology base can we solve the twin problems of national security and economic competitiveness.

The Vice President will take on the task of organizing all facets of government to develop and implement my Administration's technology policy. As a first step, he will establish a central focus for the coordination of government activities related to civilian technology and create a forum for systematic private sector input into U.S. government deliberations about technology policy and competitiveness.

At present, three obstacles prevent close government industry interaction. First, the diffused nature of government technology programs, which span many departments and agencies, makes them hard to coordinate and manage. The Federal Coordinating Council for Science, Engineering and Technology (FCCSET) lends itself to planning these programs, but not to managing them. Second, some provisions of the Federal Advisory Committee Act (FACA) and the Freedom of Information Act prompt premature disclosure of information that is essential to U.S. long-term competitiveness by forcing open meetings and giving foreign competitors immediate access to sensitive material. Third, conflict of interest regulations, that were put in place for valid reasons, nevertheless inhibit the participation of knowledgeable private sector individuals in government discussions about how to strengthen America's competitiveness position in crucial technologies. These issues must be addressed to make sure that government technology programs are responsive to private sector needs.

Within the Administration, the Office of Science and Technology Policy (OSTP) and FCCSET play an important role in coordinating policy and enhancing cooperation between the private and public sectors. We will significantly strengthen both of these organizations. For example, the U.S. needs to strengthen its ability to monitor the position of the U.S. in critical technologies and industries, and to increase the collection and dissemination of foreign scientific and technical information. We rarely know what our market share is in a given industry, what our foreign competitors are doing to target the industries of the future, and what steps are needed to restore U.S. competitiveness.

A Clinton-Gore Administration will work with Congress to review the way it handles the budget process. The federal R&D budget is currently considered piecemeal by numerous Congressional authorization and appropriations committees, which makes it nearly impossible to set priorities among competing

programs or make trade-offs among related activities. Furthermore, although Congress must exercise oversight over technology programs, micro-management and pork-barrel politics will destroy the effectiveness of these programs. I will push for a line-item veto, and will aggressively use the Presidential rescission authority to stop these practices.

A TECHNOLOGY POLICY FOR AMERICA
Six Broad Initiatives

The Clinton-Gore technology policy consists of six broad initiatives that together will restore America's technological leadership: 1) investing in a 21st century infrastructure, 2) establishing education and training programs for a high-skill workforce, 3) investing in technology programs that empower America's small businesses, 4) refocusing federal R&D programs on critical technologies that enhance industrial performance, 5) leveraging the national R&D investment, and 6) creating a world-class business environment for private sector investment and innovation.

1. Building a 21st Century Technology Infrastructure. Infrastructure has traditionally been the responsibility of federal and state governments. Investing in infrastructure means more than repairing bridges, harbors and highways. Today, the United States faces a new series of communications, transportation and environmental needs for the 21st century. The creation of a 21st century infrastructure program would serve as a critical technology driver for the nation. It would stimulate major new national R&D efforts; create large, predictable markets that would prompt significant private sector investments; and create millions of new jobs.

A 21st century infrastructure would address many practical problems. For example, the government can serve as a catalyst for the development of an advanced national communications network, which would help companies collaborate on research and design for advanced manufacturing; allow doctors across the country to access leading medical expertise; put immense educational resources at the fingertips of American teachers and students; open new avenues for disabled people to do things they can't do today; provide technical information to small businesses; and make telecommuting much easier. Such a network could do for the productivity of individuals at their places of work and learning what the interstate highway of the 1950s did for the productivity of the nation's travel and distribution system.

Each year, I plan to devote a significant portion of my four year, $80 billion Rebuild America fund to laying the groundwork for the nation's infrastructure needs in the 21st century. Federal funding for the National Research and Education Network is one example of how the federal government can serve as a catalyst for private sector infrastructure investment. We will also provide additional funding to network our schools, hospitals and libraries.

As part of the effort to assess U.S. needs and develop appropriate programs, the federal government must monitor, or "benchmark", what foreign governments are doing. For example, the Japanese government has committed to

invest over $120 billion by 1995 to develop a digital broadband communication infrastructure called the Information Network System, and plans to invest another $150 billion to establish model programs for business and residential users.

A comprehensive infrastructure program must also include effective standards and regulations. By establishing reasonable standards and a constructive regulatory environment, the government can send clear signals to industry about important, emerging markets and spur private sector investment. For example, the digital standard that the Federal Communications Commission (FCC), in cooperation with industry, established for high resolution television provides an excellent indication of the future technical direction of the industry and will do much to facilitate private sector R&D.

A 21st century infrastructure program should consist of the following five elements:

- Funding the establishment of key networks and demonstration projects;
- Benchmarking U.S. programs against those of other major industrial nations;
- Establishing standards and a regulatory climate that fosters private sector investment;
- Involving the federal labs, companies, and universities in conducting R&D on key technical issues; and
- Providing training for users of networks and databases.

2. <u>Establishing Education and Training Programs for a High-Skill Workforce</u>. The workplace place of the future will be technology intensive. The U.S. education system must make sure that American workers have the requisite skills. The focus should be not only on the top American students who measure up to world-class standards, but also on average and disadvantaged students. It must also take into account the need to upgrade workers' skills and help people make the difficult transition from repetitive, low-skill jobs to the demands of a flexible, high-skill workplace. Unlike Germany, the United States does not have a sophisticated vocational education program, and unlike Japan, U.S. firms do not have a strong incentive to invest in the training and retraining of their workers. We need more of both, geared to meet the needs of the mobile U.S. workforce.

I will implement the following programs to strengthen the skills of America's workforce:

- Establish tough standards and a national examination system in core subjects like writing, communication, math and science; level the playing field for disadvantaged students; reduce class sizes; and give parents the right to chose the public schools their child attends.

- Establish a national apprenticeship program that offers non-college bound students training in a marketable skill.

- Give every American the right to borrow money for college by establishing a National Service Trust Fund. Students can repay their borrowing as a percent of their earnings over time, or by serving their communities for one or two years doing work their country needs.

- Stimulate industry to provide continuing, high skills training to its frontline workers.

3. Investing in Technology Programs that Empower America's Small Businesses.

A healthy and growing small-business sector is essential to America's economic well-being. America's 20 million small businesses account for 40 percent of our GNP, half of all employment, and more than half of the job creation. My technology policy will recognize the importance of small and medium-sized business to America's economic growth by 1) creating a national technology extension service, and 2) expanding the highly successful Small Business Innovation Research (SBIR) program.

A national technology extension program will put the best tools in the hands of those companies that are creating the new jobs on which the American economy depends. In order to enhance U.S. industrial competitiveness, public policy must promote the diffusion and absorption of technology across the U.S. industrial base. Some state and local governments are already involved in technology diffusion. They are helping small businesses improve the productivity of their existing machinery and equipment, adopt computer-integrated or flexible manufacturing techniques, and identify training needs.

The federal government is beginning to follow their lead. The Commerce Department has five Manufacturing Technology Centers across the country and has plans for two more. Unfortunately, these efforts are only a drop in the bucket compared to those of our major competitors. Germany has over 40 contract R&D centers (Fraunhofer Gesellschaft) and a broad network of industry associations and

research cooperatives that effectively diffuse technology across industry. In Japan, major government-sponsored research projects, 170 kohsetsushi technology support centers for small businesses, and tight links between companies and their suppliers serve much the same function. There is no comparable system in the United States.

A Clinton-Gore Administration will build on the efforts of state and local governments to create a national technology extension program, designed to meet the needs of the millions of small businesses that have difficulty tracking new technology and adapting it to their needs.

The involvement of workers is critical to developing and executing successful industrial extension programs. In technology, as in other area, we must put people first. New production technology should be worker-centered and skill-based, not skill-eliminating. In the high-performance workplace, workers have more control over production and worker responsibility is increased. Some companies that have invested billions in new capital equipment have found that genuine employee involvement and good labor-management relations are ultimately more important.

The federal government should view the adoption of total quality management -- as pioneered by W. Edwards Deming -- as part of this extension system. The Baldridge Quality Award stands out as a symbol of America's effort to improve the quality of its products and services. Although the winners of this award are making a dedicated effort to share their expertise, they do not have nearly enough resources to satisfy the national need. The Baldridge award should be complemented by a serious government effort to make it possible for these winners to introduce total quality management expertise to companies of all sizes, to universities, to hospitals and to other organizations.

In addition to creating a national technology extension service for small and medium-sized businesses, I will also expand the Small Business Innovation Research Program. By requiring that federal agencies set-aside 1.25 percent of their R&D budget for small businesses, this program has helped create billions of dollars of new commercial activity while improving the research programs of the federal government. Given this track record, the SBIR program should be doubled, to accelerate the development of new products by innovative small businesses.

4. <u>Increasing Dramatically the Percentage of Federal R&D for Critical Technologies</u>. We will view the support of generic industrial technologies as a priority mission. The government already spends $76 billion annually on R&D. This funding should be refocused so that more resources are devoted to critical technologies, such as advanced materials, information technology and new manufacturing processes, that boost industrial performance.

At present, 60% of the federal R&D budget is devoted to defense programs and 40% percent to non-defense programs. This level of support for defense R&D is a holdover from the massive arms build-up of the 1980s. At the very least, in the next three years the federal government should shift the balance between defense and non-defense programs back to a 50-50 balance, which would free-up over $7 billion for non-defense R&D. Having achieved this balance, the government should examine whether national security considerations and economic conditions warrant further shifts.

We will create a civilian research and development program to support research in the technologies that will launch new growth industries and revitalize traditional ones. This civilian technology program will:

- Help companies develop innovative technologies and bring new products to market;
- Take the lead in coordinating the R&D investments of federal agencies; and
- Cooperate and consult with industry, academia and labor in the formulation and implementation of technology policy and R&D programs.

5. Leveraging the Existing Federal Investment in Technology to Maximize Its Contribution to Industrial Performance. R&D conducted at the federal labs and consortia should be carefully evaluated to assure that it has a maximum impact on industrial performance. Furthermore, cooperation between universities and industry should be encouraged.

America's 726 federal laboratories collectively have a budget of $23 billion, but their missions and funding reflect the priorities that guided the United States during the Cold War. Approximately one-half of their budget is directed toward military R&D. By contract, the budget for the National Institute for Standards and Technology (NIST) - the only federal agency whose principal mission is to assist industry - accounts for less than one percent of the total federal lab budget. Despite several years of legislative reform and many new directives, the labs still do not have the autonomy or funding to pursue joint ventures and industry aggressively.

These labs and other private non-profit research centers are national treasures because they house large, multi-disciplinary teams of researchers who have honed the skills of balancing basic and applied research for long-term, mission-oriented projects. It would take years to match these special capabilities elsewhere. Today, the labs and industry cooperate on defense needs; we need to

change regulations and orientation to get this cooperation on technology development for commercial usage.

To remedy these problems, I propose the following:

- The budget of the National Institute of Standards and Technology should be doubled.

- Federal labs which can make a significant contribution to U.S. competitiveness should have ten to twenty percent of their existing budget assigned to establish joint ventures with industry.

- Private corporations should compete for this funding through review by panels managed by the labs and made up of corporate and academic experts. Lab directors should have full authority to sign, fund and implement cooperative R&D agreements with industry. Some labs, such as NIST, already have this authority, but others do not.

- Industry and the labs should jointly develop measures to determine how well the technology transfer process is working and review progress after 3 years. If these goals have not been met, industry and the labs should reevaluate their involvement, and funds should be redirected to consortia, universities and other organizations that can work more effectively with industry for results.

University research accounts for a large part of the federal basic research budget. Funding for basic university research should continue to be provided for a broad range of disciplines, since it is impossible to predict where the next breakthrough may come. While maintaining America's leadership in basic research, government, universities and industry must all work together to take advantage of these new breakthroughs to enhance U.S. competitiveness.

Cooperative R&D programs represent another opportunity. Consortia can help firms share risks, pool resources, avoid duplication, and make investments that they would not undertake individually. By requiring that firms match federal contributions on at least a 50:50 basis, the government can leverage its investments and ensure that they are market-oriented. Many industries are demonstrating a new found willingness to cooperate to meet the challenge of international competition:

- SEMATECH has proven to be an important investment for the industry and the Nation. It has helped improve U.S. semiconductor manufacturing technology, helped reversed the decline in world-wide

market share of U.S. semiconductor manufacturing equipment companies, and improved communications between users and suppliers.

- U.S. automakers have recently formed the United States Council for Automotive Research to develop batteries for electric cars, reduce emissions, improve safety, and enhance computer-aided design.

- The Michigan-based National Center for Manufacturing Sciences, which now has 130 members, is helping to develop and deploy the technologies necessary for world-class manufacturing.

- The Microelectronics Computer Technology Corporation (MCC) is developing an information infrastructure which will enable businesses to develop, manufacture, deliver and support products and services with superior speed, flexibility, and quality.

- U.S. steel-makers are cooperating to develop manufacturing processes which would use less energy, create fewer pollutants, and slash the time required to turn iron ore and coal into steel.

A Clinton-Gore Administration will work to build a productive partnership between government, research labs, universities, and business.

6. <u>Creating a World-Class Business Environment for Private Sector Investment and Innovation.</u>

Changes in America's tax, trade and regulatory policies are also needed to help restore America's industrial and technological leadership. In a global economy in which capital and technology are increasingly mobile, we must make sure that the United States has the best business environment for private sector investment. Tax incentives can spur investment in plant and equipment, R&D and new businesses. Trade policy can ensure that U.S. firms have the same access to foreign markets that our competitors enjoy in the U.S. market. Antitrust reform will enable U.S. firms to share risks and pool resources. And an overhaul of cumbersome defense procurement regulations will strengthen both our civilian and defense industrial bases.

Permanent incentives for private sector investment:

Too many federal incentives meant to spur innovation are on-again-off-again programs that industry views as unreliable. As a result, they have not realized their full impact. Several permanent tax measures should be put in place immediately to stimulate commercial activity. They include the following:

- Make the R&D tax credit permanent to provide incentives for U.S. companies that invest in developing new technology.

- Place a permanent moratorium on Treasury Regulation 1.861-8 to encourage U.S. companies to perform more R&D in the United States.

- Provide a targeted investment tax credit to encourage investment in the new equipment that we need to compete in the global economy, and ensure that depreciation schedules reflect the rapid rate of technological obsolescence of today's high-tech equipment.

- Help small businesses and entrepreneurs by offering a 50% tax exclusion to those who take risks by making long-term investments in new businesses.

An effective trade policy

The Bush-Quayle Administration has failed to stand up for U.S. workers and firms. We need a President who will open foreign markets and respond forcefully to unfair trade practices. I will:

- Enact a stronger, sharper Super 301 to ensure that U.S. companies enjoy the same access to foreign markets that foreign companies enjoy to our market.

- Successfully complete the Uruguay Round. This will help U.S. manufacturers and high-tech companies by reducing foreign tariffs, putting an end to the rampant theft of U.S. intellectual property, and maintaining strong disciplines against unfair trade practices.

- Insist on results from our trade agreements. Although the U.S. has negotiated many trade agreements, particularly with Japan, results have been disappointing. I will ensure that all trade agreements are lived up to, including agreements in sectors such as telecommunications, computers and semiconductors. Countries that fail to comply with trade agreements will face sanctions.

Antitrust Reform:

Increasingly, the escalating cost of state-of-the-art manufacturing facilities will require firms to share costs and pool risks. To permit this cooperation, the United States should extend the National Cooperative Research Act of 1984 to cover joint production ventures.

Civil-military Integration:

Department of Defense procurement regulations are so cumbersome that they have resulted in an unnecessary and wasteful segregation of our civilian and defense industrial bases. The military specification for sugar cookies is 10 pages long. Government procurement is so different from private sector practices that companies now set up separate divisions and manufacturing facilities to avoid distorting the commercial part of their business. The U.S. must review and eliminate barriers to the integration of our defense and civilian industrial base. These barriers include cost and price accounting, unnecessary military specifications, procurement regulations, inflexibility on technical data rights, and a failure to develop technologies in a dual-use context.

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Taken together, the six initiatives discussed above comprise a technology policy that will restore economic growth at home, help U.S. firms succeed in world markets, and help American workers earn a good standard of living in the international economy.

BUSH AND TECHNOLOGY: A FACT SHEET

BUSH DOES NOT INVEST IN CIVILIAN R&D:

- Since 1980, only 25% of new Federal R&D has been spent on civilian research. Civilian R&D increased by only 1% in real terms since 1980, while defense-related R&D grew by 71%.

- Civilian R&D represents only 1.9% of GNP in the U.S. -- behind Germany's 2.8% and Japan's 3.0%. [Democratic Study Group, 2/25/92; House Budget Committee, 2/92]

BUSH PROPOSED CUTTING SEMATECH IN HIS JANUARY BUDGET SUBMISSION:

- Bush proposed cutting SEMATECH -- a public/private consortium to boost U.S. semiconductor manufacturing technologies -- by 20% ($20 million). [Defense News, 2/24/92]

BUSH HAS OPPOSED THE ADVANCED TECHNOLOGY PROGRAM (ATP):

- Bush requested no funds for ATP in his first budget and proposed freezing the ATP budget in his next two budgets. ATP is the government-industry program to help U.S. industry develop fundamental new technologies in computers and other areas. [Electronic News, 7/16/90 and 2/11/91; Christian Science Monitor, 11/14/90; Computerworld, 2/3/92]

COMMERCE DEPARTMENT CONCLUDES U.S. LOSING GROUND ON HIGH TECH

- The U.S. Department of Commerce issued a "report card" declaring that, in 12 areas of emerging technology, the U.S. is losing badly to Japan in 4 technologies, losing in 6, holding in 2, and gaining in none. [U.S. Dept. of Comm., Emerging Technologies: A Survey of Technical and Economic Opportunities, 1990]

MEMORANDUM

To: Laura Tyson, Bob LaRussa

From: Tom Kalil

Re: FCCSET initiatives, NIST and ATP programs

Date: December 3, 1992

This memo describes the FCCSET process and three of the ongoing FCCSET initiatives. Although the FCCSET process is in need of reform, it is a worthwhile effort to set priorities and coordinate R&D. I believe we should recommend budget increases for these initiatives, and build on the High Performance Computer and Communications Initiative, as proposed by Senator Gore's Information Infrastructure and Technology Act.

The memo also discusses possible funding increases for the Advanced Technology Program, NIST intramural research, and NIST facilities.

Possible funding increases for these programs:

- 10 percent increase per year for advanced materials, from a base of $1.8 billion;
- 20 percent increase per year for advanced manufacturing, from a base of $1.1 billion; and
- Full funding for the Information Infrastructure and Technology Act -- $1.1 billion over five years.

FCCSET INITIATIVES

Description: OSTP Director Allan Bromley has attempted to revitalize the Federal Coordinating Council for Science, Engineering, and Technology. In recent years, the FCCSET, acting through a series of inter-agency committees, has attempted to improve the effectiveness of federal R&D programs. The process has generally worked as follows:

1. An inventory, or "cross-cut" of federal R&D is undertaken in a given technology. For example, in the area of advanced materials, a cross-cut revealed that in FY92, 10 different federal agencies were spending a total of $1.6 billion on advanced materials R&D.

2. A framework for the initiative is developed -- describing goals, objectives, priorities, and program components.

3. As part of the budget process, individual agencies submit requests to OMB for increased funding in a given technology. In some cases, certain agencies are given the "lead" in a given technical area.

FCCSET initiatives are ongoing or under consideration in high performance computing and communications (FY 92), global climate change (FY 91), advanced materials (FY 93), biotechnology (FY 93), math and science education (FY 92), and advanced manufacturing (FY 94).

Benefits of FCCSET process:

1. Inter-agency coordination has led to synergy -- with the whole of the research program being greater than the some of the parts. This has been particularly true in HPCCI and Global Change.

2. The initiatives have focused attention on particular technologies -- both within the scientific community and on the Hill.

Reforms needed in FCCSET process

While acknowledging that the FCCSET process has led to some improvements, critics point to the following shortcomings:

1. Some agencies, particularly DOD, have been unwilling to participate fully in some FCCSET initiatives. Others are unwilling to propose spending increases for FCCSET initiatives because they are afraid that in the current zero-sum environment, it will lead to spending cuts in other programs.

2. It has been too labor-intensive. Part of this has been OMB's fault -- because OMB has refused to make commitments on funding levels up front.

3. Industry complains that they do not have enough input into FCCSET decision-making. The Federal Advisory Committee Act is a barrier -- but it is not insurmountable. One suggestion is for the government to hold workshops and disseminate informal workshops before the budget process begins in earnest.

4. The FCCSET process has generally influenced <u>incremental</u> spending in an area as opposed to the <u>base</u>.

5. As an inter-agency committee -- FCCSET has an inherently difficult time managing a long-term R&D program. The Computer Systems Policy Project has noted that "there is no unified vision of the HPCCI or any ultimate point of responsibility for ensuring the overall program goals are met." In response to this criticism, an HPCCI program coordination office was established with

Donald Lindberg, Director of the National Library of Medicine, as its head. One former OMB official suggested that: (1) National Program Officers be assigned to OSTP to play a coordinating role; and (2) evaluation and independent assessment is very important.

ADVANCED MANUFACTURING INITIATIVE

Description: In June 1992, the FCCSET approved the Advanced Manufacturing Initiative as a budget "cross-cut." Manufacturing was chosen because of its importance to the economy, and because "a dramatic shift in leading-edge manufacturing technologies and concepts is underway." The FCCSET concluded that increased international competition would result in highly adaptive enterprises capable of producing a greater variety of products, faster "time to market", shorter production life cycles, and increased efficiency in the integration of information, machinery, materials and human resources.

The FCCSET has proposed thrusts in three areas:

- **Intelligent Manufacturing Cells**: Development of manufacturing cells capable of major improvements in manufacturing cost, quality, throughput and flexibility - using technologies such as intelligent sensors and advanced control techniques.

- **Integrated Tools for Product, Process and Enterprise Design**: Software and hardware tools for concurrent engineering, process modelling, simulation, enterprise design, etc.

- **Advanced Manufacturing Technology Infrastructure**: Technology deployment mechanisms, electronic techniques for transferring business and product information by small and medium-sized enterprises, monitoring global manufacturing R&D, international benchmarks to evaluate effectiveness of individual companies and industries.

Funding level: The Administration proposed funding of $1.1 billion for "advanced manufacturing R&D" in its FY 93 budget. An industry association position paper on the initiative concluded that (1) more than a 10-percent incremental funding increase is needed; and (2) "much of the current agency-driven manufacturing R&D is not useful to industry."

Industry recommendations: Industry groups are in the process of developing more concrete recommendations, but initial recommendations include:

- Alleviate the lack of exchange capability among computer-aided activities (engineering, design, simulation, processing) through the development of standards-based protocols.

- Promote programs to understand the science of key, generic manufacturing

processes. Science-based manufacturing rules are necessary to facilitate intelligent equipment.

- Establish a federal advisory committee to involve industry in the Advanced Manufacturing Initiative, and emphasize funding modes such as direct grants.

ADVANCED MATERIALS AND PROCESSING PROGRAM

Description: As part of the FY 93 budget, the Administration proposed $1.82 billion in funding for R&D in advanced materials R&D, a ten percent increase from the FY 92 level.

The components of the program are (1) synthesis and processing; (2) theory, modeling and simulation; (3) materials characterization; (4) education and human resources; and (5) national user facilities such as synchrotron light sources, neutron sources, and high-magnetic-field laboratories.

Ten different agencies reported funding for materials R&D. In FY 92, three agencies provided 79 percent of the funding: DOE (36 percent), DOD (27 percent), and NSF (16 percent). Materials are being conducted in biomaterials, ceramics, composites, electronic materials, magnetic materials, metals, optical/photonics, polymers, and superconducting materials.

The initiative describes "breakthrough opportunities" in: energy (more efficient photovoltaic cells, superconducting electric power lines), environment (CFC substitutes, biodegradable plastics), information and communications (semiconductors), and infrastructure (new steel alloys), etc.

HIGH PERFORMANCE COMPUTING AND COMMUNICATIONS INITIATIVE

Senator Gore has played a leadership role in high-performance computing. The passage of the High Performance Computing Act of 1991 established the framework for this initiative. The goal of the HPCCI is to "accelerate significantly the availability and utilization of the next generation of high performance computers and networks." In FY 93, the Administration requested a total of $803 million for the four major components of the program:

- **High Performance Computing Systems:** Development of prototype systems, with a goal of "teraop" systems by the mid-1990's. Also addressing mass storage and operating systems. ($178.4 million)

- **Advanced Software Technology and Algorithms:** Generic software technology, new algorithms, and prototype applications software. Oriented towards solving "grand challenges." ($346 million)

- **National Research and Education Network:** One goal of the NREN is to

"revolutionize the ability of U.S. researchers to carry out collaborative R&D." In the short-term, the focus is on upgrading the Internet. The long-term goal is to promote the technology base necessary for a gigabit network. The network will also serve as a testbed for new communications technology. ($122.5 million)

- **Basic Resources and Human Resources:** Basic research, university facilities, and education, training, and curriculum. ($156 million)

The FCCSET has identified a number of "grand challenges" that the HPCCI is intended to solve. These are problems of "such a magnitude and complexity that they will require continuous advances in computational power and improvements in computational models for the next decade or more." Examples of these grand challenges include rational drug design, simulation of high speed civil transport, design of combustion engines for greater fuel economy, and modeling of ozone depletion.

Future Directions:

Senator Gore recently introduced the Information Infrastructure and Technology Act of 1992. The bill is designed to ensure that high-performance computing and networking technology is applied in K-12 education, libraries, health care, and manufacturing.

The bill calls for $1.15 billion in new investments over five years, with $300 million for digital libraries, $300 million for education, $250 million for manufacturing, and $300 million for health care:

FY93	FY94	FY95	FY96	FY97
$90	$160	$230	$300	$370

Advanced Technology Program

Description: The Advanced Technology Program (ATP) at the National Institute of Standards and Technology (NIST) provides matching funds for technology development proposals from (1) individual businesses; and (2) industry-led joint R&D ventures. The purpose of the program is to "assist United States businesses to carry out research and development on pre-competitive generic technologies." Criteria for selection include scientific and technical merit, broad-based benefits to the U.S. economy and technology base, technology transfer benefits, and the proposer's level of commitment.

Background: The Advanced Technology Program was first authorized as part of the Omnibus Trade and Competitiveness Act of 1988. Its level of funding has increased from $10 million in FY90 to $67.9 million in FY93. The ATP program is highly competitive. In the first two rounds of awards, for example, (FY90, FY91), the ATP received 520 proposals, but was only able to fund 38. The ATP is supporting a broad range of technologies, including biotechnology, microelectronics, machine tools, advanced automobile manufacturing, advanced materials, etc. To date, the ATP has committed $137 million, matched by $158 million from the private sector.

Proposed funding levels: The FY 1994 NIST Authorization bill would have authorized $1.4 billion over 5 years:

FY 93	FY 94	FY 95	FY 96	FY 97
$68	$200	$300	$400	$500

NIST's private sector advisory committee believes that the ATP program is capable of expanding at this rate. At levels substantially above this -- they are not sure whether ATP could spend the money wisely. Some industry groups (e.g. the American Electronics Association) support a more rapid ramp-up to $1 to $1.5 billion.

Benefits of substantially increasing funding of the ATP:

1. Priorities are set by industry, which addresses the "picking winners and losers" argument.

2. The program funds a broad range of technologies, as opposed to the limited number of technologies funded by mission-oriented agency R&D.

3. The requirement of matching funds (on average, ATP recipients pay more than half of the total R&D costs) eliminates projects with little or no commercial potential.

4. ATP promotes cooperative research and strategic alliances. 14 of the 38 projects funded are joint ventures. Many of them bring together manufacturers, suppliers, end users, universities, and National Labs.

5. An ATP grant often help a company or consortia attract additional capital because of the "halo" effect.

6. The program promotes small businesses. 20 of the first 38 projects funded by the ATP are led by small businesses.

Examples of projects:

1. **The National Storage Industry Consortium:** The NSIC is a consortium of Hewlett-Packard, IBM, Applied Magnetics, Digital Equipment, Maxoptix, Eastman Kodak, DEC, Storage Technology, and a number of universities. It has been awarded 2 ATP grants totalling $10.9 million -- matched by $15.4 million from industry participants. The consortium has become a focal point of national efforts to develop ultra-high density magnetic recording heads and increase data storage density to 10 gigabits per square inch. DARPA has announced that it will provide the NSIC with an additional $10 million.

2. **Auto Body Consortium:** This consortium was formed to improve measurement technology and process control for part fabrication and motor vehicle assembly systems -- to achieve improved fit and finish of the basic body parts and subassemblies. Participants include General Motors, Chrysler, ASC Inc., CDI-Modern Engineering, Classic Design, Detroit Center Tool Inc., University of Michigan.

3. **Rapid Response Manufacturing Joint Venture:** Led by the National Center for Manufacturing Sciences, this joint venture is designed to shorten the time from product design to production through computer-integrated manufacturing. The project uses the production lines of consortium members as test-beds for evaluation of automated design and production systems. Members include Ford, GM, Texas Instruments, United Technologies, CAD Inc., and Oak Ridge National Labs.

NIST INTRAMURAL PROGRAMS

Description: The National Institute of Standards and Technology (NIST) was created in 1901 as the National Bureau of Standards. At its facilities in Gaithersburg, MD., and Boulder, CO., NIST conducts basic and applied research in the physical sciences and engineering, developing measurement techniques, test methods, standards, and other services. NIST has 3,000 scientists, engineers, technicians, and support personnel, plus roughly 1,000 visiting scientists.

Funding: As part of its FY 1991 budget, the Bush Administration proposed doubling the NIST internal budget -- from $166.2 million in FY 1991 to $349 million in FY 96. For FY 1993, Congress appropriated $192.9 million for NIST -- roughly $10 million less than the Administration's request. Clinton endorsed the goal of doubling the NIST budget in the September 18th technology policy paper.

NIST also has to rebuild its facilities, many of which are totally obsolete. The total cost is estimated to be $540 million over ten years. Congress appropriated $105 million in FY93 -- to be appropriated between FY 93 and FY 97.

FY93	FY94	FY95	FY96	FY97	FY98	FY99	2000
$13	$13	$190	$80	$80	$80	$80	$4

Current expenditure schedule:

FY93	FY94	FY95	FY96	FY97
$2	$13.65	$42	$26.35	$21

Rationale for increased funding for NIST:

- NIST's central mission is to enhance U.S. industrial competitiveness. Working with industry is part of NIST's culture, based on its 90 years of focusing on industry needs.

- NIST has in place an extensive evaluation system that provides for oversight of NIST laboratory programs by senior industry and academic experts.

- Important NIST services, most of which could not be easily provided by the private sector, include: information on national and international standards, standard reference data for use in technical problem-solving and R&D, standard reference materials, calibration and other measurement services, voluntary laboratory accreditation, and evaluation of product and processes designed to improve energy efficiency.

- NIST's research program in areas such as electronics and electrical engineering, manufacturing engineering, materials science, and computer systems is critical to U.S. competitiveness. Currently, NIST does not have the resources to meet industry needs.

Examples of NIST projects:

- NIST is working with the North American ISDN Users' Forum to develop test specifications, so that ISDN products (used to send voice, data, and images simultaneously over a telephone line) manufactured by different companies are compatible.

- NIST is developing a "molecular measuring machine" capable of accurate atomic-scale measurements (1 to 0.1 nanometers -- a nanometer being one-billionth of a meter.)

- NIST is conducting research on the chemical and physical properties of alternative refrigerants to help industry find effective replacements for CFCs.

MEMORANDUM

To: Bo Cutter

From: Tom Kalil

Re: Technology Agenda

Date: February 1, 1993

To help refine and execute the Clinton-Gore technology policy, we need to establish an interagency forum on these issues. There are enough technology policy issues which need immediate attention to justify the creation of such a forum, even if it is informal. To move forward on the creation of an inter-agency committee, we need to make decisions on issues such as:

- **Name**: (E.g. Technology and Innovation, Technology and Competitiveness)

- **Membership**: There are two strategies. One is to invite the entire Cabinet to every meeting. The other is to start out with a core membership of NEC, OSTP, Office of the Vice-President, OMB, CEA, Commerce, Defense, and Energy, and invite others as needed (e.g. Treasury on tax issues, Labor on technology and high-performance work organizations, HHS on biotechnology, EPA on green technology.)

- **Level of representation**: I assume that this would initially be a Deputies Committee Working Group. Does it, however, need a Cabinet-level counterpart? Will the NEC meet on specific topics?

- **Chair**:

- **Mandate/agenda**: Develop a strategy for execution of the Clinton-Gore technology policy, including definition of the roles and responsibilities of key agencies.

- **Subcommittee or working group structure**:

- **Secretariat**:

- **Division of labor between this and other inter-agency committees**: Many issues should continue to be handled through the FCCSET structure.

3. **Invest in technology programs that empower small businesses:**

   * Expand SBIR (This has been done).

   * Establish network of 170 manufacturing extension centers, with at least 25 in regions hard-hit by defense cutbacks. Link to worker training and dissemination of "best practices" on worker participation.

4. **Increase dramatically the percentage of federal R&D for critical technologies:**

   * Over three years, shift the balance between defense and non-defense R&D to a 50:50 balance.

   * Create a civilian DARPA. [Note: during the transition, there was no enthusiasm for creating a new organization. Most felt that we should build on existing organizations, such as NIST.]

   * Increase support for advanced manufacturing R&D, such as environmentally-conscious manufacturing, flexible micro- and nanofabrication, simulation and modelling of manufacturing processes, tools for concurrent engineering, and electronic networks.

   * Develop a strategy for acquiring, disseminating, and utilizing foreign technologies. Increased collection, translation, and dissemination of foreign scientific and technical information.

5. **Leverage existing federal investment in technology to maximize its contribution to industrial performance:**

   * Double the NIST budget.

   * Set aside 10 to 20 percent of federal lab budgets for joint ventures with industry, and increase authority of lab directors to sign and implement CRADAs with industry

   * While maintaining America's leadership in basic research, encourage university-industry cooperation to enhance U.S. competitiveness

   * Provide matching funds for industry-led R&D consortia

6. **Create a World-Class Business Environment for Private Sector Investment and Innovation**

* Investment incentives
  - Permanent R&D tax credit
  - Permanent moratorium on 861.8
  - Targeted investment tax
  - Incentives for long-term investments in small businesses (Bumpers seed and venture capital bills)
* Effective trade policy
  - Super 301, results-oriented negotiations, successful completion of Uruguay Round
* Antitrust reform
  - Extend National Cooperative Research Act of 1984 to cover joint production ventures
* Civil-military integration:
  - Eliminate barriers to civil-military integration, such as cost and price accounting, unnecessary military specifications, technical data rights, and a failure to develop technologies in a dual-use context.
* Export promotion:
  - Strengthen commercial sections of U.S. embassies, matching funds for trade associations to establish overseas offices
* Streamline export controls
  - Further liberalize East-West export controls; Avoid unilateral controls and controls on technology widely available in world markets, streamline current decision-making process.

Why include technology in FY93 stimulus?

* Clinton ran as a "new Democrat" -- arguing that both public and private investment are necessary for America to remain competitive. A small investment in technology programs would demonstrate a commitment to investment-led growth.

* Technology is a top Clinton-Gore priority. During the Economic Conference in Little Rock, President Clinton called his September 1992 position paper on technology policy "probably the best single piece of paper we put out."

* Although some of these technology programs may not fully outlay in FY93 -- we can get them started. For example, on the Commerce Department's Advanced Technology Program, we can announce competitions and possibly some awards in FY93. The proposals we made on NSF funding would merely restore cuts made to President Bush's FY93 budget.

* The levels of investment required are relatively small -- $100 million for ATP, $200 million for NSF.

* Since Clinton wants to substantially increase funding for programs which are currently at the experimental level -- we think it would be better if they were increased more gradually, which would require FY93 funding.

Questions

* Does full funding of ISTEA fully outlay by this summer -- or is it more important that there be "signs of activity" by the summer?

THE WHITE HOUSE

WASHINGTON

February 2, 1993

MEMORANDUM FOR VICE PRESIDENT AL GORE, SCIENCE ADVISER JOHN GIBBONS

FROM: THOMAS KALIL TAK

SUBJECT: CAMPAIGN COMMITMENTS ON TECHNOLOGY AND MANUFACTURING

Based on the September 1992 campaign position papers on technology and manufacturing, I have summarized the major campaign commitments made on these issues. I am sure there are others, but this should serve as a starting point.

1. **Decision-making**:

* Lead role for the Vice President in technology policy

* Increase private sector input by reforming Federal Advisory Committee Act, conflict-of-interest regulations, Freedom of Information Act

* Strengthen the role of OSTP and FCCSET in coordinating technology policy

* Increase capability of U.S. to monitor its competitiveness in critical technologies and industries

* Work with Congress to reform budget process and stop earmarking

2. **21st Century Infrastructure**

* National Information Infrastructure: fund key networks and demonstration projects; establish standards and regulatory environment to foster private sector investment; provide training for users of networks and databases; involve companies, labs and universities in R&D on key technical issues; benchmark U.S. programs against those of other major industrial nations.

* Other?

3. **Invest in technology programs that empower small businesses:**

   * Expand SBIR (This has been done).

   * Establish network of 170 manufacturing extension centers, with at least 25 in regions hard-hit by defense cutbacks. Link to worker training and dissemination of "best practices" on worker participation.

4. **Increase dramatically the percentage of federal R&D for critical technologies:**

   * Over three years, shift the balance between defense and non-defense R&D to a 50:50 balance.

   * Create a civilian DARPA. [Note: during the transition, there was no enthusiasm for creating a new organization. Most felt that we should build on existing organizations, such as NIST.]

   * Increase support for advanced manufacturing R&D, such as environmentally-conscious manufacturing, flexible micro- and nanofabrication, simulation and modelling of manufacturing processes, tools for concurrent engineering, and electronic networks.

   * Develop a strategy for acquiring, disseminating, and utilizing foreign technologies. Increased collection, translation, and dissemination of foreign scientific and technical information.

5. **Leverage existing federal investment in technology to maximize its contribution to industrial performance:**

   * Double the NIST budget

   * Set aside 10 to 20 percent of federal lab budgets for joint ventures with industry, and increase authority of lab directors to sign and implement CRADAs with industry

   * While maintaining America's leadership in basic research, encourage university-industry cooperation to enhance U.S. competitiveness

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* Streamline export controls
  - Further liberalize East-West export controls; Avoid unilateral controls and controls on technology widely available in world markets, streamline current decision-making process.

For Immediate Release
April 19, 1993

For more information, contact:
Ralph Brescia 202-456-6215

SIX MAJOR R&D INITIATIVES
INCLUDED IN PRESIDENT'S FY'94 BUDGET

President Clinton's FY'94 budget includes funding for six major research and development initiatives that will be implemented through coordinated efforts of a number of agencies. These six initiatives reflect the Administration's commitment to invest in America's future by investing in science and technology.

Jack Gibbons, Assistant to the President for Science and Technology, says "These initiatives are essential to the President's economic program. They are an integral part of the President's overall strategy to use science and technology to achieve national goals. A strong economy and high quality of life depend on initiatives like these."

Specifically, the President has proposed $1.4 billion for Advanced Manufacturing Technology; $1 billion for High Performance Computing and Communications (HPCC); $1.5 billion for Global Change Research; over $2 billion for Advanced Materials and Processing; $4.3 billion for Biotechnology Research; and $2.3 billion for Science, Mathematics, Engineering, and Technology Education. In addition, $96 million is proposed for Information Infrastructure Technology and Applications, a component of the HPCC Initiative. (See attached Table for Department and agency budget requests.)

The initiatives were developed through the Federal Coordinating Council for Science, Engineering, and Technology (FCCSET), chaired by Gibbons, who is also Director of the Office of Science and Technology Policy. "These FCCSET initiatives demonstrate that government can work cohesively to improve the efficiency in all our science and technology investments," Gibbons says.

The six FCCSET initiatives are summarized in a report supplementing the President's FY 1994 Budget entitled "FCCSET Initiatives in the FY 1994 Budget," now available from the Office of Science and Technology Policy.

Gibbons adds, "In the current, very constrained budget climate, the support for the FCCSET Initiatives reflects the determination by the President and the Vice President to make research and development essential elements of economic growth."

The Advanced Manufacturing Technology (AMT) Initiative will help industry harness technology to improve the Nation's economic strength. It will foster the shift from rigid mass production to flexible manufacturing that responds quickly and cost-effectively to rapidly changing market demands. A top priority is coordination of the public/private partnership to produce a low-pollution vehicle that can recapture world market share for the American auto industry.

The agencies participating in the HPCC Initiative intend to partner with industry to "network the nation," ensuring that each sector of the economy has access to state-of-the-art computing and communications equipment. This type of access will mean that students in Idaho can participate in lab experiments in New York,

that the medical records of accident victims are available in distant States, that businesses can form regional alliances to develop and market new products, and that scientists modeling global change have ready discourse with their colleagues around the globe.

The U.S. Global Change Research Program Initiative seeks to reduce the uncertainties about the rate and consequences of global change by probing current atmospheric conditions and the historical record. The information generated by the basic research program is analyzed to develop policy options for response strategies -- mitigation and adaptation -- that provide cost-effective insurance against potentially severe effects of environmental change.

The Advanced Materials and Processing (AMP) Initiative will help establish the United States as the leader in advanced materials and processing. In FY '94, AMP participants will direct resources toward projects such as: improving the function and lowering the cost of superconducting materials for use in power lines; developing new refrigerants to replace ozone-depleting CFC's; and developing materials to enhance the suitability and durability of biomedical implants, such as artificial joints and organs.

The Biotechnology Initiative aims to sustain and extend U.S. leadership in biotechnology research, enhance the quality of life for all Americans, and spur the growth of the U.S. economy. Advances in health-related biotechnology can help contain spiralling health care costs through new diagnostic, prevention, and treatment techniques. Gene therapy offers hope for treating cystic fibrosis, cancer, AIDS, and other diseases. The Federal research program spurs much of the commercialization effort for biotechnology.

In support of the President's efforts to improve mathematics and science education, the Science, Mathematics, Engineering, and Technology Education Initiative will help to ensure U.S. world leadership in basic science, mathematics, engineering, and technology, build a highly trained work force, and increase public understanding of science. It will address elementary and secondary system reform by fostering standards-based systemic reform, support curriculum revisions, provide pre- and post-doctoral student support, foster improvements in technical education, and assist technology transfer, particularly by helping transfer military expertise in education and training to the civilian sector.

Sixteen Cabinet Departments and independent agencies that are members of FCCSET are participating in one or more of the FY 1994 Initiatives. Seven FCCSET members are participating in all six Initiatives: Departments of Commerce, Defense, Energy, and Health and Human Services, as well as the National Aeronautics and Space Administration, Environmental Protection Agency, and National Science Foundation.

FCCSET plays a critical role in planning, budgeting, and coordinating government-wide R&D initiatives. It helps ensure efficient use of Federal R&D resources. In close cooperation with the Office of Management and Budget, FCCSET strives to achieve consensus on how to use R&D programs to reach national goals and to guide the actions of participating agencies.

MORE

THE WHITE HOUSE

WASHINGTON

Bo,
1) set up a time to talk
2) NII/GII people?
B.

To: Bo Cutter

From: Tom Kalil TK

Re: Technology policy priorities for 1994 and beyond

Date: July 23, 1994

In my view, the Administration's technology policy has two goals:

1. Maximize the contribution that research, development and technology can make to national goals such as increased productivity, job creation, national security, sustainable development, more efficient delivery of government services, expansion of fundamental knowledge, and a more productive education and training system; and

2. Ensure that the United States is the best place in the world to perform high value-added economic activity by seeking changes in tax, trade, regulatory, procurement, and other microeconomic policies.

The progress that we make on technology policy also has a significant impact on our relationship with the business community. In 1992, it was harder for then-President Bush to attack our economic program when leading high tech CEOs were praising Clinton's commitment to a government-industry partnership. Because many elements of our technology policy will take many years to bear fruit, reporters and other analysts will use the attitudes of industry leaders as proxies for the success or failure of the Administration's policy.

Below are a list of significant technology policy issues that I would like to spend time on. (I will write a separate memo on the NII/GII agenda).

1. **R&D tax credit/other tax incentives:**

Because we were unable to get support for a permanent R&D tax credit, it is due to expire in mid-1995. This will be on the most important high-tech issues in 1995. If there is a broader review of tax expenditures, we should determine which expenditures are actually creating incentives for investment in R&D, plant

and equipment, and business formation. You indicated at one point that you were interested in considering a broader range of business incentives.

2. **Administration's relationship with other industries**:

Our periodic meetings with the CEOs of the top 13 computer companies have been very helpful in identifying areas where we can cooperate. Bob has asked me to think about extending this model to other industries.

I think that other possibilities are (1) the life sciences cluster -- pharmaceuticals, medical devices, and biotech; (2) aerospace; and (3) other parts of the electronics industry.

One-on-one meetings with key industry leaders (e.g. Andy Grove of Intel), either in person or using video conference technology, would also be very helpful.

3. **Sectoral initiatives**:

The Administration has launched a number of high-profile sector-specific technology initiatives, such as the Clean Car and the flat-panel display initiative.

I will be involved in the National Electronics Manufacturing Initiative (NEMI), which is an industry-led effort to define the generic technologies necessary to produce the next generation of "information appliances." In addition to establishing an R&D agenda in areas such as photonics, packaging, RF technology, manufacturing information and management systems, etc., NEMI will also be examining a wide range of policy options.

I will also continue to be involved in flat panels, and will organize a meeting following awards under the TRP program.

4. **R&D budget**:

I continue to be involved in the budget preparation and authorization/appropriations process for key technology initiatives, particularly for programs at NIST, ARPA, and the National Science Foundation.

I believe that the FY96 Department of Energy budget will be highly contentious. The national security community (e.g. DOD, NSC) will be pushing for a substantial increase in nuclear weapons R&D, which would cut funding for a number of the technology initiatives.

5. **Participation in NSTC process**:

The NSTC has 9 committees. I have been active in the Committee on Industrial Technology and the Committee on Information and Communications.

6. **Export controls**:

With the exception of encryption policy, I have no responsibilities in this area, but believe that making progress on export control liberalization is essential. A number of the commitments the President made in September 1993 have not been implemented.

7. **International S&T issues**:

My involvement in international S&T issues has been limited to supporting the technology access and technology cooperation discussions occurring under the Framework.

8. **SBIR**:

Funds for the SBIR program are increasing from 1.25 to 2.5 percent of the budgets of the major R&D agencies. Currently, there is little strategic allocation of these funds. I plan to work with OSTP to see if we can reorient some SBIR resources to Presidential priorities.

Other potential projects

There are a number of other potential projects that I think are important, but that I have currently have little time for. The Commerce Department's Technology Administration will probably get a substantial increase in its budget for FY95, which might allow us to task some of TA's analysts with these projects.

The Competitiveness Policy Council (currently chaired by Fred Bergsten) is another, largely untapped resource. Currently, no one in the Administration is paying attention to the output of their studies or asking them for input on specific policy questions.

1. **Analytic capability**:

How can we improve the ability of the U.S. Government to monitor industry and sector trends, and benchmark U.S. performance against rest-of-world? In many cases, I do not think government should be conducting the analysis, but it does need a mechanism for acquiring the best analysis.

I also believe that there is a lot of room for improvement in the way that we collect, exploit and disseminate "open source" economic intelligence.

2. **Procurement:**

Our discussion on procurement has primarily focused on making the government behave more like a commercial customer (e.g. eliminating cost accounting and milspecs).

We have not really discussed the power of government procurement to help create new markets for leading-edge products and services. At one of the meetings we held with the National Academy, several executives noted that procurement often had a bigger impact on their investment decisions than R&D grants.

3. **Securities litigation reform:**

For many high tech companies, curbing "frivolous" 10 (b)(5) suits is a top public policy priority. Some law firms have "stables" of shareholders that allow them to sue virtually any company that experiences a sizable drop in their stock price. Since the discovery process can tie up senior management, many companies are forced to settle out of court even if the case is meritless.

4. **Who is Us?**

Jaw Stowsky from CEA has the lead on this issue. We need to come to closure on this at some point.

5. **Nature of the U.S. R&D enterprise:**

You have often asked whether the end of the Cold War, the increase in international competition, and the end of long-term R&D funded by oligopolistic profits at companies like IBM and AT&T is having a fundamental impact on the U.S. R&D enterprise.

The Council on Competitiveness is trying to collect some real data on this, which may provide some food for thought.

6. **Technology financing**

Some members of Congress continue argue that there are "gaps" in capital markets (e.g. for seed capital) that should be filled with government guarantees to leverage private sector investment.

Although there has not been a great deal of support for this option, we have never looked at the issue of "patient capital", or the interplay between technology companies, our financial system, and corporate governance.

7. **Personnel**:

We won't execute technology programs successfully without the ability to attract first-rate people at the policy level, office director level, and program manager level.

8. **Communications**:

There is still very little coverage of the Administration's initiatives in this area. Even industry is often unaware of how much is going on. Agency public affairs people trumpet their own programs, but not the technology initiative as a whole.

9. **Evaluation**:

Currently, NIST is doing the best job of attempting to evaluate their programs. Other agency efforts are spottier.

THE WHITE HOUSE

WASHINGTON

September 13, 1995

MEMORANDUM FOR MEMBERS OF CONGRESS

FROM: DR. LAURA D'ANDREA TYSON
National Economic Adviser

DR. JACK GIBBONS
Science and Technology Adviser

SUBJECT: Investing in Science and Technology

For the past 50 years, Americans have demonstrated an unwavering, bipartisan commitment to U.S. leadership in science and technology. From basic research to product development, public and private investments in science and technology have generated new knowledge, spawned new industries, created new jobs, ensured sustained economic and national security, and increased living standards for the American people. Research and technology by both government and private industry has led to the invention of the computer, lasers, satellites, microwave ovens, and medical devices and drugs that have changed the way we work, live, and play. Indeed, since World War II, innovation has been responsible for at least a quarter -- and possibly as much as half -- of the Nation's economic growth.

According to the American Association for the Advancement of Science (AAAS), Congressional Majority action would slow federal R&D spending on civilian technology by a third over the next seven years. Moreover, as the AAAS also reports House Appropriations action to date would slash funding for key technology programs. When it was released last week, the AAAS interim report (*Interim Report on Appropriations R&D, FY 1996*) attracted substantial comment from Americans who fear that the de-funding of science & technology threatens our nation's future. That is why we have included for your information a collection of news articles that reported on the AAAS report:

- "Sacrificing the Future to Balance the Budget," *San Francisco Chronicle* editorial, September 1, 1995.
- "Budget Cuts Seen by Science Group as Very Harmful for U.S. Research," article by Malcolm W. Browne, *The New York Times*, August 29, 1995.
- "25 Nobelists Join to Save Institution," article by Malcolm W. Brown, *The New York Times*, September 12, 1995.

Reduction in technology investments could not come at worse time. Japan currently invests 35 percent more than the United States on a per capita basis in civilian technology; and Germany invests 30 percent more. Japan plans to double the country's R&D spending by 2000. Meanwhile, premier U.S. high tech firms continue to reduce long-term R&D investments, instead focusing on short-term product commercialization.

Some in the Congress believe that if the government cuts back on R&D, the private sector will fill the gap. But independent analysis shows that over the past 30 years a decrease in federally funding of R&D on average has been followed by a decrease in industry support of R&D. And, in a world of relentless foreign competition, American businesses cannot be expected to devote sufficient resources to long-term, high-risk R&D whose benefits are difficult for any one firm to capture. Instead, American business and the government must work together to leverage their resources and ensure adequate investment in the technologies that will fuel and sustain economic growth and job creation.

That is why President Clinton's balanced-budget maintains investments in science and technology, including industry-led technology programs that are working to ensure America's technological leadership. It is these investments coupled with a balanced-budget that will help to ensure future economic growth and prosperity for the American people. We hope that in the current debate over how to balance the budget, you will carefully consider the relationship of public and private investments in research and development to the nation's future.

Attachments

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The San Francisco Chronicle

SEPTEMBER 1, 1995, FRIDAY, FINAL EDITION

SECTION: EDITORIAL; Pg. A22; EDITORIALS

LENGTH: 470 words

HEADLINE: Sacrificing the Future To Balance the Budget

BODY:

IN ITS ideological antipathy to government and its single-minded pursuit of a balanced budget within seven years, Congress is about to sacrifice many of the programs that have helped to make America the most productive nation on Earth. The clear and present danger in next month's final round of congressional budget deliberations is that the nation will be put on two contradictory trajectories: a fast- track route to a balanced federal budget and a slightly slower track to national bankruptcy in the technological, scientific and quality-of-life measures by which American wealth is best assessed.

Nowhere in the current scramble over the budget are those trends clearer than in the appropriations to date on federal research and development -- the building blocks of tomorrow's national strength. One stunning pair of statistics says it all: While appropriations for military R&D at the Department of Defense is scheduled to increase by 4.2 percent to $ 36.8 billion (or $ 1.6 billion more than the Pentagon requested), funds for nonmilitary R&D are slated for the steepest across-the-board cuts since World War II: a reduction of a full 33 percent by 2002, when the budget presumably will be balanced.

As Richard Nicholson, head of the American Association for the Advancement of Science, whose members include most of the nation's scientists, said in an interview with The Chronicle: ''The reason for balancing the budget is so that we don't screw our children and our children's children. If, in the process of doing that, we reduce the level of scientific research, we may be making their future much worse than anything done by debt.''

According to a detailed budget analysis by AAAS, the nearly 8 percent cut in overall nonmilitary R&D between this year and next masks devastating reductions -- from a third to virtual elimination -- for scores of worthy programs in such diverse areas as alternative energies, global warming, species preservation, building of new telescopes and development of new materials for electronics. The only major R&D category to escape unscathed is health sciences, which will receive a moderate increase.

Among significant programs going under the knife in fiscal 1996: NASA's global warming monitoring (down 22 percent), mass transit (down 36 percent), water quality (29 percent), hazardous waste disposal (24 percent), toxic substances (30 percent), nuclear nonproliferation (26 percent), new materials research (100 percent).

President Clinton's promise to veto at least eight of the 11 appropriations

lls may result in a so-called budget train wreck on October 1. We think that's clearly preferable to letting Congress put the nation on a certain course to scientific and technological bankruptcy in the next decade.

LANGUAGE: ENGLISH

LOAD-DATE: September 1, 1995

The New York Times

8/29/95

Budget Cuts Seen By Science Group As Very Harmful For U.S. Research

By MALCOLM W. BROWNE

FEDERAL financing of nonmilitary scientific research in the United States will decline by one-third within seven years, the American Association for the Advancement of Science says in a report to be released today. It warns that "the long-term effects of dismantling a coherent scientific enterprise could be very harmful."

The study projects financing trends through the year 2002, based on the budget resolution passed by Congress on June 29 and on subsequent actions by the House and Senate in drafting appropriations bills for the fiscal year 1996. Deep projected reductions in the support of research and development, in some cases 100 percent, represent "the most significant across-the-board funding cuts to the research-and-development enterprise in the post-World War II era," the authors of the report wrote.

The A.A.A.S., a professional society with more than 140,000 individual members, is the largest scientific federation in the world and tracks the financing of American science every year. Dr. Albert H. Teich, who directs the association's division of science and policy programs, said in an interview that "what we're trying to do is call people's attention to the implications of present trends."

The current drive in Congress toward deficit reduction and a balanced budget by 2002 is strongly supported by new members of Congress whose election platforms called for sweeping cutbacks in Government spending.

The budget cuts will affect science unevenly. Money appropriated for the National Science Foundation may decline only a few percent in 1996, and the National Institutes of Health may actually get an increase of more than 6 percent. But some major programs of NASA, the United States Geological Survey and the National Institute of Standards and Technology face extinction, and the overall trend in Federal support of science alarms many scientists.

Scientific groups are worried that the era of generous treatment from Congress may be waning. "For many years," Dr. Teich said, "we had a protective umbrella of members of Congress who understood science, were sympathetic toward it and were associated with it. But now we have an awful lot of new people in Congress who don't have any connection with science. It's up to the scientific community to try to reach them."

Many scientists and research administrators acknowledge that Federal belt-tightening has made cuts in research support inevitable. But they believe that Congress has been moving too hastily and without adequate consultation with experts.

An important factor in the trend, besides the need to cut Federal spending across the board, has been the conclusion of the cold war, which, Dr. Teich said, had "provided a geo-

> When the cold war was under way, science had friends in Government.

political situation in which political-military power was strongly associated with a nation's scientific and technological prowess." With a decline in the perceived need to maintain that prowess, he said, science has lost political support.

Among the fields in which the association expects the sharpest reductions are research on environmental issues, fusion-energy development, atmospheric and geological problems, unmanned space programs and research assistance to industry.

For 1996, research funds for Federal agencies, other than the Defense Department, have been reduced in Congressional appropriations bills by more than 5 percent. The National Institutes of Health was the only major Federal agency granted a budget increase, of 6.2 percent, but it was included in a bill that President Clinton might veto for other reasons.

Some Federal departments and the research they support may not survive the next few years. The Commerce Department has been made a target for elimination by many Congressmen, leading to uncertainty about the future of two of its major research agencies, the National Oceanic and Atmospheric Administration and the National Institute of Standards and Technology.

NOAA investigates changes in global climate, like the possible greenhouse warming of the planet caused by gaseous emissions of human industry and the so-called ozone hole, a thinning of the atmosphere's protective ozone layer believed to have been caused by the release of chlorofluorocarbon compounds. NOAA faces a probable reduction in 1996 of 14.1 percent in money for its operations, research and facilities, the science association says.

At the National Institute of Standards and Technology (formerly the National Bureau of Standards), Congress has already eliminated the Advanced Technology Program, a $466.5 million undertaking to assist private industry in the development of technology.

In a recent speech, Dr. Arati Prabhakar, the institute's director, said that "if the current Congress has its way, it will turn the clock back years and put technological innovation on the shelf."

Republican leaders in Congress, however, have argued that Federal subsidies for research conducted to benefit private industry are unnecessary, and that industry should pay for its own research.

The biggest expected dollar reduction in 1996 Federal support for science is the $716.5 million that the House has voted to pare from NASA's $9.5 billion budget. A major share of that reduction would come from Mission to Planet Earth, a system for using satellites to track changes in the earth's ecosystem.

Another research casualty of the 1996 budget will be the Interior Department's Bureau of Mines, which Congress has provided no money at all. The bureau, which this year is spending $102 million, studies mine safety and supervises the Helium-conservation program under which some of this irreplaceable gas, separated from the natural gas with which it is mixed, is stored in underground caverns.

Faced with so-called rescissions or cuts in money previously appropriated by Congress for the present year, as well as the further cuts expected for 1996, many Federal research groups have begun dismissing scientists and other employees.

For example, the United States Geological Survey, founded in 1879, is part of the Interior Department, and has been forced to truncate one of its three main programs, its geology program, which was created to explore and map the nation's geological resources.

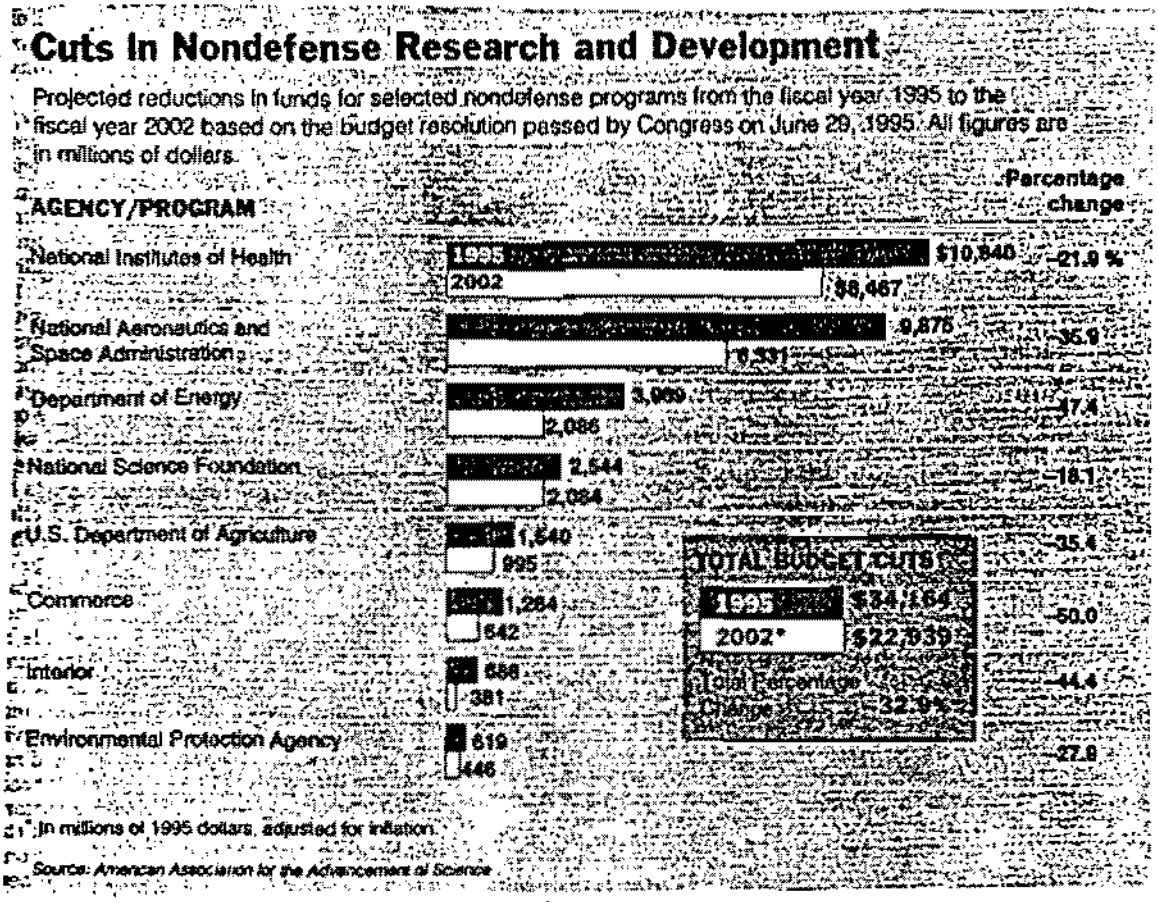
"We have reached the point," says Donovan B. Kelly, spokesman for the agency, "at which there is no longer enough money after fixed expenses are paid to support field research in geology. We therefore have to make deep cuts. Nationwide, about 500 employees of the program will be separated by mid-October, and another 200 will be downgraded or transferred to other jobs. It's really hard doing this, when you know the names and faces of the people leaving, people who were highly trained to

> Anticipating cuts, some Federal agencies are already dismissing workers.

special jobs on behalf of the nation and who are now being cast off."

Mr. Kelly said he hoped the geological survey's international ea

The New York Times



quake network would be preserved. The network links seismographic instruments operated by about 120 countries with the survey's network, giving participating nations timely information about all earthquakes and greatly broadening the data base on which seismological research depends.

High-energy physics research suffered a devastating blow last year when Congress, charging mismanagement, cut off funds for the $10 billion superconducting supercollider, a proton accelerator that would have made the United States the world's leader in the field until well into the next century. Leadership is now expected to pass to Europe after the turn of the century, as a consortium of nations completes the Large Hadron Collider near Geneva. Many American physicists hope to find work there.

Another branch of physics, which holds out the hope of developing hydrogen fusion as a cheap, nonpolluting, renewable source of energy, is expected to suffer a serious reduction of financing in 1996. House action calls for a reduction of 38.4 percent in the budget for magnetic confinement fusion, whose main beneficiary is the experimental Tokamak reactor at the Princeton Plasma Physics Laboratory in New Jersey.

Dr. Ronald C. Davidson, director of the laboratory, said in an interview that if only $229 million of the requested $366 million budget for the laboratory was granted, as Congressional appropriations committees have done, it would be impossible to build a new-generation experimental reactor, the Tokamak Physics Experiment.

Another major fusion experiment, in which microscopic pellets filled with hydrogen isotopes are bombarded by intense lasers, is in progress at the Lawrence Livermore National Laboratory in California, which is operated by the University of California for the Department of Energy. But this, too, faces an uncertain future.

Many of Livermore's projects, including the development of nuclear weapons, are directed and paid for by the Defense Department, which provides the laboratory with a traditionally reliable financing pipeline. Defense Department research is not included in the overall research cuts that Congress has been making, and the House Appropriations Committee has set a 4.2 percent increase in military research and development for 1996, bringing financing to $36.7 billion.

Officials of the A.A.A.S. said the association's gloomy new report was not a prediction, merely a projection.

"Between now and 2002 a lot of things could happen," Dr. Teich said. "We could get another President and a different Congress, or we could have a war, or a recession. Lots of things could change. But what worries scientists is the Congressional resolution enacted in June, which is a broad statement of where Congress wants us to be in 2002. It's not a vision that bodes well for the health of American science."

THE NEW YORK TIMES, TUESDAY, SEPTEMBER 12, 1995

25 Nobelists Join to Save Institute

By MALCOLM W. BROWNE

WITH the National Institute of Standards and Technology facing possible extinction at the hands of a budget-cutting Congress, 25 American winners of the Nobel Prize in Physics and the presidents of 18 scientific societies joined yesterday in an 11th-hour plea to save the institute.

Representatives of the group said they knew of no instance in which so many prominent American physicists had shown such unity.

The National Institute of Standards and Technology, or NIST, is a research subsidiary of the Department of Commerce, which would be dismantled under bills pending in both the House and Senate. Congress is expected to take final action on those bills in the next few weeks. Both versions would sell off the institute's laboratories to some private enterprise, if one could be found within 18 months; otherwise, its property would be sold for whatever price it might command.

President Clinton may veto any bill that completely closes the Department of Commerce, but under another bill, the 1996 appropriation for scientific and technical research at the institute would be reduced by about $48 million from the Administration's request to $263 million. A reduction this large would drastically hamstring research programs, supporters of the institute say.

The House Commerce appropriations bill would specifically eliminate the Advanced Technology Program, a major operation of the institute that was supported by the President but denounced by many House Republicans as "corporate welfare." Beyond that, the institute is implicitly threatened by the potential demise of the Department of Commerce.

The institute, which until 1989 was called the National Bureau of Standards, operates laboratories near Gaithersburg, Md., as well as timekeeping laboratories at Boulder, Colo. Since the agency was founded in 1901, it has not only refined the units of measurement on which scientific research is based, but has made many important discoveries.

At a Washington news conference sponsored yesterday by the American Physical Society, Dr. Norman F. Ramsey, winner of a Nobel Prize in Physics in 1989, presented an open letter signed by himself and 24 other of the standards institute.

"As recipients of the Nobel Prize in Physics," they said, "we are writing to emphasize the essential role to the nation of the NIST laboratories and urge that Federal funding of these facilities be maintained in the process of downsizing or reorganizing the Department of Commerce."

The letter called the institute's contributions in measuring time, power and materials, as well as its measuring expertise in health and medicine, vital to the nation. "It is unthinkable that a modern nation could expect to remain competitive without these services," it said. The physicists urged Congress to "make every possible effort to preserve this national treasure."

The presidents and directors of American scientific societies representing more than one million experts in engineering and the mathematical, physical and medical sciences submitted an open letter of their own. Among the signers were Richard D'Eustachio, president of the American Dental Association; Dr. Richard Herman, chairman of the Joint Policy Board for Mathematics, Dr. Cathleen S. Morawetz, president of the American Mathematical Society; Dr. Kumar Patel, president of the American Physical Society, and Geri Marullo, executive director of the American Nurses Association.

Budget cutters see fat where scientists see a national treasure.

"We recognize that your effort to balance the budget is forcing tough choices regarding the Department of Commerce," the letter said. "However, the laboratories operated by NIST and funded by the Department of Commerce are a vital scientific resource for the nation and should be preserved in the process of downsizing the Federal Government."

While the keeping of standards of measurement once involved the storage of platinum bars marked with scratches defining units of length, measurement today must be accurate even at subatomic distances, and improvements in accuracy are constantly sought.

The development of ultra-accurate standards, for example, was vital to redefining the length of the meter as the distance that light travels in a vacuum during one 299,792,458th of a second. Arcane though such measurements may seem, they are the bases of many practical applications, including the satellites supporting the new Global Positioning System (G.P.S.), by which anyone on earth with a receiver costing a few hundred dollars can navigate with uncanny accuracy.

To improve the accuracy of its atomic clocks still further required chilling components to within a few trillionths of a degree above absolute zero, and reaching such low temperatures in itself has produced significant discoveries. Last July, Dr. Eric A. Cornell of the institute, in a joint project with Dr. Carl E. Wieman of the University of Colorado, exploited ultra-low temperatures to create a new atomic state called a Bose-Einstein condensate. This condensate is likely to help answer some profound scientific questions, and the standards institute played a crucial role in discovering it.

The institute has pioneered techniques for making solid-state electronics, secure computer codes, fireproofing and new materials, and it maintains vast stores of special-purpose standards used by American scientists and technical specialists for comparison purposes.

"NIST is a resource the nation can't afford to lose," Dr. Ramsey said.

Dr. J. Robert Schrieffer, a winner of the Nobel Prize in Physics, said: "Some Congressmen have suggested that the Commerce Department and NIST could be broken up and parceled out among other agencies. But we have already seen how this kind of division has reduced basic research at AT&T Bell Laboratories and other industrial laboratories that have broken up their research arms."

Nobel laureates who joined in the plea, besides Dr. Ramsey and Dr. Schrieffer, were Philip W. Anderson, Hans A. Bethe, Nicolaas Bloembergen, James W. Cronin, Hans Dehmelt, Jerome I. Friedman, Val L. Fitch, Sheldon Lee Glashow, Ivar Glaever, Russell A. Hulse, Henry W. Kendall, Leon M. Lederman, Arno A. Penzias, Edward M. Purcell, Burton Richter, Arthur W. Schawlow, Clifford G. Shull, Joseph H. Taylor, Charles H. Townes, Steven Weinberg, Kenneth G. Wilson, Robert R. Wilson and C. N. Yang.

THE WHITE HOUSE

WASHINGTON

November 8, 1995

The Honorable Laura D'Andrea Tyson
The Honorable John Gibbons
The White House
Washington, D.C. 20500

Dear Laura and Jack:

The White Paper we are releasing today makes clear how investments in technology drive economic growth, generate new knowledge, create new jobs, build new industries, ensure sustained economic and national security, and improve our quality of life. Indeed, over the past 50 years, innovation has been responsible for as much as half of the nation's economic growth.

As you well know, spurring public and private investment in technology has been a key element of my economic strategy. Through deficit reduction, extension of the R&E tax credit, liberalization of export controls, investments in educational technologies, increased support for basic research, continued commitment to mission research and development (R&D), and expansion of industry-led technology partnerships, this Administration has enhanced our nation's economic and security interests.

Our country is now on the move. Our economic strategy is working, and our economy is the strongest in the world. We are seeing continued strong economic growth with very low inflation. The budget deficit has been cut nearly in half since I became President and dropped three years in a row for the first time since the Truman Administration. The American people should be proud of their accomplishment.

Now is the time to finish the job and balance the budget. But we need to do so in a way that reflects our core national values and lays a foundation for strong private sector growth. That is why my balanced-budget plan maintains vital investments in science and technology.

In contrast, under the guise of balancing the budget, Republicans have vowed to cut federal spending on non-defense research and development, including both basic and applied

research, by a third over the next seven years (as calculated by the American Association for the Advancement of Science) and to gut or eliminate critical technology programs that are enhancing America's ability to compete and win in the global marketplace.

These actions run counter to the purpose of balancing the budget: ensuring the foundation of economic growth and prosperity. A pro-growth, balanced budget should never sacrifice U.S. leadership in science and technology. It is a foolish choice that does not have to be made but that, if made, would have adverse consequences for years to come.

For more than 200 years, partnerships among the public and private sectors have kept this nation at the forefront of technological and industrial success. The results -- lasers, personal computers, the Internet, microwave ovens, software, modems, jet aircraft, and satellites, just to name a few -- play an important part in our daily lives and our economy.

In the global economy, innovation means jobs, economic growth, and increased living standards. It means opportunity -- and the opportunity for families to prosper. That is why I will fight to promote innovation and why my plan both balances the budget and secures our future. This is the common ground on which American economic progress and quality of life depend.

Sincerely,

Bill Clinton

Technology and Economic Growth:
Producing Real Results for the American People

The White House
November 8, 1995

TECHNOLOGY CREATES JOBS

Congressional Republicans are proposing unprecedented cuts in critical research that the nation needs for future economic growth and job creation, better health, environment, and national security. These cuts would mean lost jobs, lower wages, and a poorer quality of life for all Americans.

Since World War II, America has demonstrated an unwavering, bipartisan commitment to U.S. leadership in technology. This commitment has paid rich dividends to the American people, from the development of computing technologies, like the Internet and personal computers, that are changing the way we work, learn, and play; to satellites that are helping us communicate and stay informed; to the discovery of DNA and innovative technologies, like MRI, that are helping us live longer, healthier lives.

- Over the past 50 years, innovation has been responsible for as much as half of the nation's economic growth. Economic growth means more jobs and improved living standards.

- Americans hold millions of jobs in industries that have grown as a result of wise public and private investment in R&D. These include (as of 1992): Biotechnology (79,000 jobs), Computers (479,000 jobs), Communications (366,000 jobs), Software (450,000 jobs), Aerospace (895,000 jobs), Semiconductors (317,000 jobs).

- In 1992, average pay for workers in these and other high-technology industries was 60 percent higher than the average for all American workers.

The Republicans budget resolution would, as estimated by the American Association for the Advancement of Science, cut by 30 percent in real dollars the federal investment in non-defense R&D.

- Under the guise of balancing the budget, Congressional Republicans would gut or eliminate public-private partnerships like the Department of Commerce's Advanced Technology Program, the Department of Energy's energy efficiency and renewable energy R&D programs, and EPA's Environmental Technologies Initiative.

- These cuts could not come at a worse time: Japan will surpass the United States in total government dollars spent on non-defense R&D by 1997, if the Congressional budget cuts proceed as noted above and the Japanese government implements its plan to double R&D by 2000.

Investments in technology create high-paying American jobs. **To gut or eliminate these investments is tantamount to unilateral disarmament in the battle for global economic competitiveness.** The longstanding R&D partnership between the government, industry, and academia must not be dismantled: America's budget must be balanced in a way that protects and enhances our future. That is why the President and Congressional Democrats will fight to preserve investments in technology and America's technological future.

Technology and Economic Growth:
Producing Real Results for the American People

"Investing in technology is investing in America's future: a growing economy with more high-skill, high-wage jobs for American workers, a cleaner environment where energy efficiency increases profits and reduces pollution; a stronger, more competitive private sector able to maintain U.S. leadership in critical world markets; an education system where every student is challenged, and an inspired scientific and technological research community focused on ensuring not just our national security, but our very quality of life."

President Bill Clinton and Vice President Al Gore
Technology for America's Economic Growth, February 22, 1993

DRIVING ECONOMIC GROWTH AND IMPROVING QUALITY OF LIFE

Science and technology are powerful drivers of economic growth and improvements in the quality of life in America. Advances in technology have created millions of good new jobs, better health and longer lives, new opportunities for individuals, and enrichment of our lives in ways we would not have been able to imagine half a century ago. Superior technology is the cornerstone of U.S. national security, just as U.S. economic security depends as never before on our ability to master new technology in areas like information, biotechnology, and advanced materials.

Because these investments have paid such rich dividends to the nation, sustaining U.S. leadership in science and technology is a cornerstone of President Clinton's economic and national security strategy. Put simply, investments in science and technology produce real results for the American people. As much as half the nation's economic growth since World War II can be traced directly to advances in science and technology.

Today, however, America's technological leadership -- and its long history of bipartisan support for science and technology -- is under assault. Congressional Republicans propose to cut federal civilian research and development by one-third over the next seven years -- research cuts unmatched in the history of America. These cuts are not necessary to balance the budget, and will in fact undermine the economic prosperity that a balanced budget is designed to ensure.

The Clinton Administration has vigorously supported a diverse portfolio of investments in science and technology in pursuit of many national objectives -- defense, environmental protection, health, and education among them. This issues paper focuses on one of several areas that would be disproportionately affected by planned Congressional cuts: long-term R&D investments in the development and application of new technologies that are enhancing America's ability to compete and win in the global marketplace.

INVESTMENT IN TECHNOLOGY PAYS OFF

Investments in research and development are among the highest-payback investments a Nation can make. A recent report by the Council of Economic Advisers notes, for example, that over the past 50 years technological innovation has been responsible half or more of the nation's growth in productivity.[1]

We see the fruits of this innovation every day. Many of the products and services we have come to depend on for our way of life in America -- lasers; computers, magnetic resonance imaging (MRI), teflon and other advanced materials and composites, communications satellites, jet aircraft, microwave ovens, solar-electric cells, modems, semiconductors, storm windows, human insulin, and others -- are the product of federal science and technology investments made over the past 50 years.

These innovations also mean jobs and economic prosperity for America. It is no accident that our country's most productive and competitive industries are those that benefited from sustained federal investments in R&D:

Computers and Communications: Defense-related R&D to provide for communications in the event of war led to what has become today's Internet, the backbone of a global electronic communication system. Federal investments in computing research have driven the evolution of a $590 billion domestic telecommunications and information technology industry, which supports more than 3.6 million American jobs. In just the past 10 years, American employment in the computer and software industries has almost tripled.

Semiconductors: The U.S. semiconductor industry developed as a direct result of federal R&D investments and procurement activities. During the 1980s, however, U.S. companies lost their lead in semiconductor manufacturing, resulting by some estimates in the loss of $2 billion in earnings and 27,000 American jobs between 1980 and 1986. Today, American semiconductor manufacturers are back on top supplying 46 percent of the world's market for microchips while the Japanese supply 41 percent. Industry experts credit much of this resurgence to Sematech, a joint industry-government research consortium.

Biotechnology: Federally funded discoveries in biology, food science, agriculture, genetics, and drugs upon which the private sector has been able to build and expand a world-class industry today support $7 billion in annual sales and more than 100,000 American jobs.

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[1] "Supporting Research and Development to Promote Economic Growth: The Federal Government's Role," The Council of Economic Advisers, October 1995.

Aerospace: The federal government traditionally has funded the lion's share of aerospace R&D, and this support has made U.S. aerospace companies the world's most advanced. Aerospace leads all other industry sectors in net exports. In 1994, the U. S. aerospace industry shipped nearly $40 billion worth of commercial aircraft and employed more than 800,000 people.

Environmental Technologies: The federal government provides nearly $2 billion a year in support of R&D related to environmental technologies. Almost unheard of 10 years ago, more than 30,000 environmental technology and services businesses today employ 1 million Americans in high-growth, high-wage jobs. The environmental technology industry has annual sales approaching $134 billion in the United States alone, a number that is expected to grow significantly by the year 2000.

Energy Efficiency: Today, energy efficiency is a $2-billion industry led by entrepreneurial private-sector firms and utilities, but many of the products sold and installed by this industry are the product of partnerships between the federal government and private industry. These partnership efforts produced energy-saving light bulbs and other lighting products, which alone generate $200 million in annual sales and have saved American consumers $400 million in energy costs. New designs and materials for windows have saved consumers another $760 million in energy costs. These savings also decrease U.S. dependence on foreign oil.

These are not isolated examples: U.S. industrial strength in medical devices, agriculture, manufacturing, transportation, and other industries can be traced directly to sustained federal support for R&D. From satellites, to software, to superconductivity, the government has supported -- and must continue to support -- exploratory research, experimentation and innovation that would be impossible for individual companies or even whole industries to afford.

These partnerships in pursuit of innovation enable the private sector to generate new knowledge and adopt novel technologies that ultimately lead to commercial success, increased jobs, and healthier and more productive lives for all Americans.

Technology: Changing the Way We Live

The results of public and private investments in science and technology are deeply embedded in our daily lives and our economy. Here are just a few examples:

Lasers: Discovered not quite 40 years ago and refined through government, industry, and university research, today the laser is one of the most powerful, versatile, and pervasive technologies in our lives. Each day lasers are used by millions of Americans for high quality reproduction of music recorded on compact discs and for fast, efficient checkout in grocery and retail stores. Laser systems carry simultaneously up to 1.5 million transatlantic phone conversations. Lasers are also used for guidance and navigation, to print documents, for precision measurements, for manufacturing, and throughout industry to perform intricate tasks quickly and accurately. Lasers have become a powerful tool for eye surgery; especially for the one percent of Americans who are diabetic and for whom laser surgery has decreased blindness by 60 percent.

Computers: Today, more than 70 million personal computers are installed in the United States and between one-fifth and one-third of U.S. households have one. Industries as diverse as entertainment, education, communications, medicine, government, and finance rely on computers to provide the goods and services that enhance our lives. These industries use computers for applications from Automated Teller Machines, to airline reservations, to the design and operation of airplanes and automobiles, to medical diagnostic equipment, just to name a few.

Magnetic Resonance Imaging (MRI): The development of this important medical tool depended on basic research and technological applications. Nuclear physicists and chemists worked out the fundamental technique of using radio beams and magnetic fields to analyze the chemical structure of biological and other materials. The technique initially was too slow for medical use, but modern electronics and superconducting magnets developed with federal support helped craft the scanners in use today. MRI is a remarkable diagnostic tool that allows us to see into the brain, diagnose diseases, and test drugs for control of the immune system without resorting to surgery or other invasive medical procedures.

A FEDERAL ROLE IN ADVANCING TECHNOLOGY

Private businesses are the principal actors in converting technology to profits and jobs, and support much of the research needed to develop new products, processes and technologies. But government has an indispensable role to play in advancing new technology development -- by ensuring a strong base of fundamental science, by providing a business environment that encourages innovation and investment, and in investing in research that is critical to the economy and social needs of the nation, but that cannot attract adequate private support.

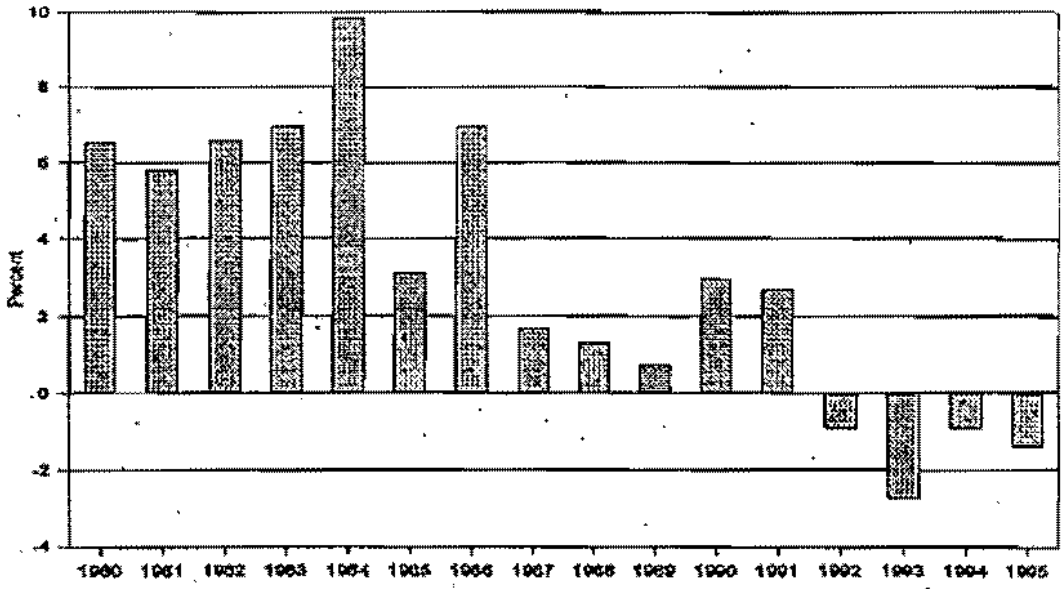
Investments in R&D have high rates of return, but as much as half the return on an individual firm's R&D investment goes to other companies and competitors -- not to the investing company. This "spillover" effect means that private industry cannot and will not commit the level of resources to R&D that is best for society. As a consequence, government support for R&D has been a critical element of federal policy for more than 200 years, and it has kept our nation at the forefront of technological and industrial success.

Joint public and private cooperation in research and development dates back to the birth of the Republic. It led to the invention of the American system of manufacturing -- interchangeable parts and the machine tools to make them -- by the government's Connecticut River and Harper's Ferry armories and civilian inventors like Eli Whitney. Half a century later, in 1863, it was a public-private partnership that guided the federal establishment of land-grant universities to improve the practice of agriculture and engineering, and supported further investments after the turn of the century in agricultural extension services and cooperative research. These government investments have made it possible for American farmers to increase productivity a dozen times over, feeding the United States -- and much of the rest of the world -- well and profitably.

As we move into a new information-age economy, the federal role in advancing technology will be increasingly critical. The accelerating pace of technological advance, shorter product cycles, and rapid worldwide diffusion of technologies mean that many companies are finding it harder to invest in long-term R&D than in the past. Moreover, many in industry are undertaking a critical review of their R&D programs and are scaling back R&D growth (chart 1, below). Since 1992, even premier companies like AT&T, General Electric, IBM, Kodak, Texaco, and Xerox -- world renowned for their investment in long-term R&D -- have dramatically reduced their R&D spending.

CHART 1

Real Annual Growth in R&D Performed by
U.S. Industry 1980-1995



Supporters of a reduced federal role in supporting R&D maintain that if the government cuts back on R&D support, the private sector will fill the resulting gap. Recent independent empirical analysis, however, shows that over the past 30 years a decrease in federal funding for R&D has been followed on average by a decrease in industry support for R&D. The author concludes:

> ". . . there is little in the recent historical record to suggest that industry will pick up the slack if government cuts back on R&D spending. Only a radical change in the beliefs and behaviors of industry would yield that result. In view of the contemporary sharp reductions in R&D funding by many leading American corporations, such an outcome seems unlikely."[2]

That is why American businesses and the government must work together to leverage their resources and ensure adequate investment in the technologies that will fuel and sustain economic growth and job creation. The Administration is committed to these programs.

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[2] "Private Funds Are Unlikely to Replace Cuts in Public Funds for R&D in the U.S.," Christopher Hill, Professor of Public Policy and Technology at George Mason University, June 19, 1995.

Key Federal partnership programs in technology include:

- The Technology Reinvestment Project is designed to increase Department of Defense access to affordable, leading-edge technology by leveraging commercial know-how, investments and markets for military use. For example, the Global Positioning System that guided American troops during Desert Storm took advantage of commercial advances in GPS technology.

- **The Advanced Technology Program** aims at developing high-risk, high-payoff enabling technologies that otherwise would not be pursued. Government supplies the catalyst. Industry conceives and executes each project. ATP is accelerating development of electronics, new materials, advanced manufacturing processes, information technology, and other areas critical to future U.S. economic competitiveness.

- **The Manufacturing Extension Program** helps the nation's 381,000 smaller manufacturers battle foreign competition by adopting modern technologies and production techniques. Survey data of companies served by the MEP indicate an 8-to-1 payoff on federal investment in terms of increased productivity, better paying jobs, and enhanced competitiveness.

- **The Partnership for a New Generation of Vehicles** is an alliance between automobile manufacturers and the government to design and build a vehicle that will be more fuel efficient and better for the environment. Manufacturers are experimenting with alternative engines, new aerodynamic designs, alternative fuels and new materials to build a cleaner and safer car of the future.

- **The Environmental Technology Initiative (ETI)**, a multi-agency program, stimulates private sector investment in innovative environmental technologies that reduce pollution and clean up the environment. Streamlining activities alone from ETI can reduce regulatory compliance costs by $700 million or more throughout the economy.

- **Education Technology programs** include creative partnerships such as the Technology Learning Challenge Grant (TLC) program and the Star Schools program, both at the Department of Education, which stimulate R&D aimed at helping Americans acquire the skills and technological proficiency they need to work and prosper in the 21st century. For example, one TLC grant in Baltimore to a consortium of business and academia will employ electronic networks to link high-school students with employers in real work environments to strengthen the school-to-work transition in an enterprise zone.

- **Telecommunications Information Infrastructure Assistance Program** (TIIAP) is working to leverage private sector investments in innovative telecommunications applications that demonstrating early, concrete benefits in the areas of health, education, and community development.

LEADERSHIP UNDER CHALLENGE

Since World War II, each President and every Congress has maintained an unwavering, bipartisan commitment to U.S. leadership in science and technology. This commitment has helped to stock the nation's storehouse of innovative ideas, to create economic opportunities for the American people, and to ensure that the United States remains the largest, most vibrant and advanced economy in the world.

Today, the United States is undisputed as the leader in the emerging global marketplace, but our lead is neither comfortable nor certain.

A recent report by the Office of Science and Technology Policy[3] points out that, while we lead the world in 25 of 27 technologies critical to economic and national security, our lead in virtually every one is stagnant or slipping. By contrast, the growth curve in these same technologies is rising sharply in many other countries.

Meanwhile, foreign competitors are increasing federal support for R&D. As a percentage of Gross Domestic Product, Japan and Germany consistently out invest the United States in non-defense research and development (chart 4 below). The Japanese government recently announced plans to *double* its R&D spending by the year 2000. Recent analysis by the Council of Economic Advisers suggests that the effect of the Congress' plan to cut research funding and the Japanese plan would be that by 1997, Japan will overtake the United States in government support of non-defense R&D -- in total dollars, not just as a share of Gross Domestic Product (chart 2, below).

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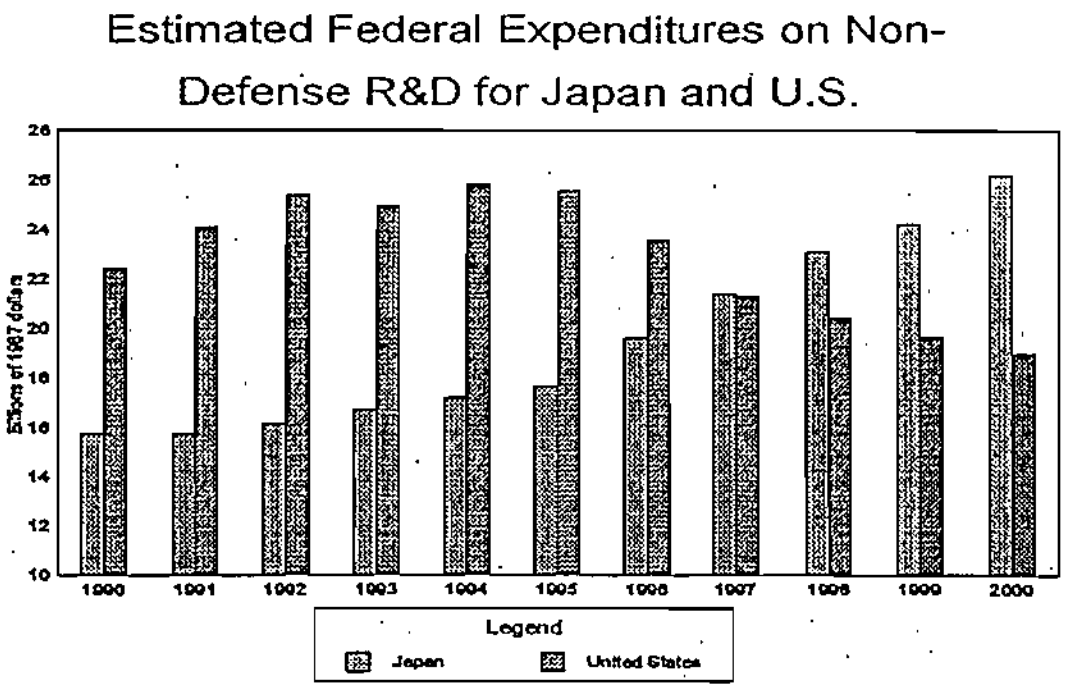
[3]National Critical Technologies Report, Office of Science and Technology Policy, March, 1995.

CHART 2



Japan is not alone. Traditional economic powers such as Germany, and emerging economies such as China, India, Taiwan, Singapore, and South Korea are aggressively promoting investment in R&D and deployment of technology (chart 3, below). Earlier this year, China announced that it will increase publicly supported R&D by nearly 1 percent of GDP by the year 2000.

The Congressional response to these aggressive moves by other countries has been to propose cutting U.S. investments in non-defense R&D by a third over the next seven years and gutting or eliminating technology programs that enhance America's ability to compete and win in the global marketplace. Rather than support a historically successful technology policy with clear benefits to the American people, the 104th Congress has targeted R&D for immediate elimination or crippling cuts, as seen in the table below:

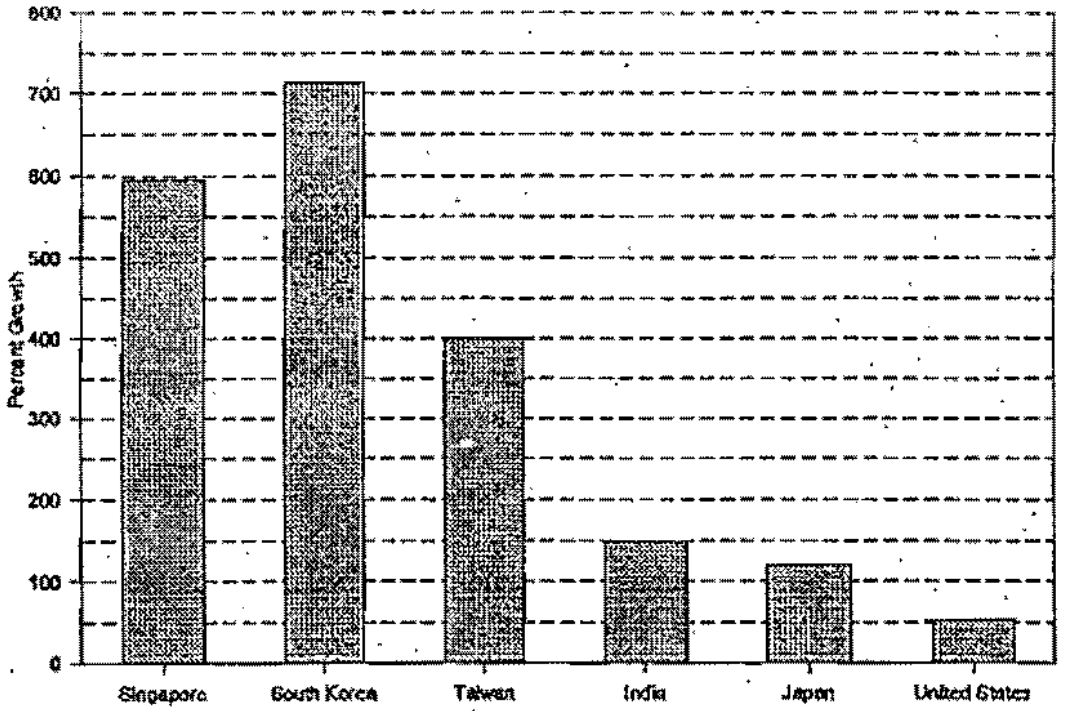
Table 1:
R&D Appropriations Action in Illustrative Technology Programs

	FY 1995 Enacted	FY 1996 Request	House Level	Senate Level	Conference Level
Department of Commerce					
Advanced Technology Program	341	491	0	25	tbd
Manufacturing Ext. Partnership	74	147	81	76	tbd
National Info. Infrastructure Grants	42	100	40	19	tbd
Department of Energy					
Cooperative R&D Agreements	274	291	25	254	tbd
Partnership for New Gen. Vehicle	168	251	123	178	tbd
Environmental Protection Agency					
Enviro. Technology Initiative	72	127	0	22	tbd
Department of Education					
Technology Learning Challenge	10	70	25	15	tbd
Department of Defense					
Technology Reinvestment Project	208	500	0	238	195
Total	1,189	1,977	294	827	tbd

These proposed Congressional cuts could not come at a worse time for America. They jeopardize our economic and national security, and threaten to undo the work of generations that has kept America strong and prosperous.

CHART 3

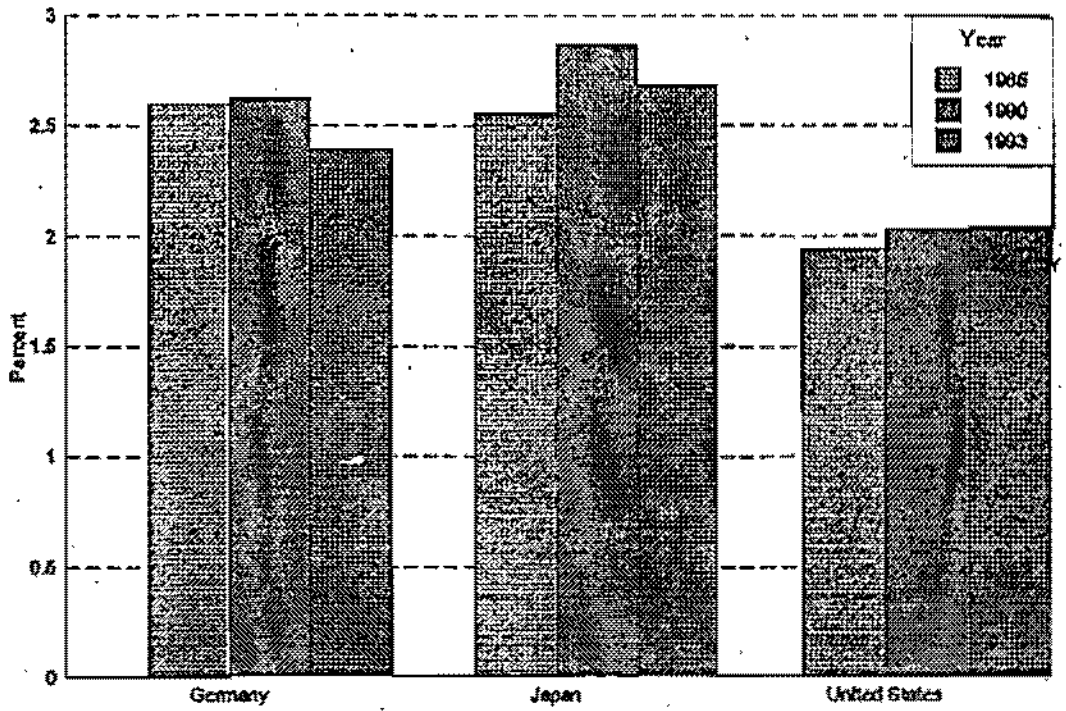
Real Growth in R&D (1980-90) Selected Asian Countries Compared to the U.S.



Source: National Science Foundation/SRS

CHART 4

Non-Defense R&D as Percentage of GDP by Country (1985,1990, 1993)



Source: National Science Foundation/SRS

BUILDING PARTNERSHIPS FOR THE FUTURE

> "I've given the Congress a balanced budget that cuts all kinds of spending; it eliminates hundreds of programs. But it increases our investment in education, in technology, in research."
>
> President Bill Clinton
> October 23, 1995

The investments this country has made in education, science, and technology have benefitted all Americans, regardless of political stripe, and continue to bear a rich harvest of goods and services that keep our economy growing. Continuing these investments is part of the President's overall strategy for bringing this country into the 21st century, a strategy that includes a strong education for America's children; a cleaner environment where energy efficiency increases profits and reduces pollution; a robust, more competitive private sector freed from unnecessary regulatory burdens; and an inspired scientific and technological research community.

This strategy is working -- in 1995, the economy is growing, inflation is low, employment is high. New business starts are at an all-time high. More than 7 million new jobs have been added to the U.S. economy since this Administration came into office -- many of them in the high-skill, high-technology industries.

Continued gains will require balancing the budget. And we've made great strides: for the first time since the Truman Presidency, we've cut the federal deficit for three years in a row. The annual deficit is about half what it was in 1992.

But cutting investments in R&D is not the way to balance the budget; such cuts not only run counter to our national history, they undermine the true purpose of balancing the budget in the first place -- namely, ensuring the foundation of economic growth and prosperity.

The Clinton Administration has initiated or expanded industry-led partnerships in order to spur private-sector investment in innovations with broad economic impact that are necessary to our nation's future. Together these partnerships are a small fraction of our overall federal R&D spending. But they provide a crucial link between the $70 billion federally funded technology base and industry's own investments in technology.

With careful choice and firm management, these modest investments will yield new medicines, new forms of transportation, better educations, a strong national defense, and other benefits. It is partnerships like these that enable the private sector to pursue novel ideas or adopt novel technologies that ultimately lead to commercial success, more jobs and a better quality of life for all Americans.

SELECTED

FEDERAL TECHNOLOGY

PROGRAMS

THE ADVANCED TECHNOLOGY PROGRAM

The Department of Commerce
National Institute of Standards and Technology

The goal of the ATP is to benefit the U.S. economy by cost-sharing research with industry to foster high-risk, enabling technologies that create opportunities for new, world-class products, services, and industrial processes. The ATP invests in long-term, risky, challenging technologies that have the potential for a big pay-off for the nation's economy. By reducing the early-stage technical risks for individual companies, the ATP enables industry to pursue promising technologies that otherwise would be ignored or developed too slowly to compete in rapidly changing world markets.

A competitive, cost-shared program, the ATP is providing a mechanism for extending U.S. industry's technological reach and pushing the envelope of what can be accomplished in today's fiercely competitive global marketplace. Because this program is only a few years old, its full economic impact has not yet been realized. Already, however, there is encouraging evidence that the ATP is fostering research efforts with the potential to deliver a sizable return on the federal investment. For example, ATP is

- Fostering and accelerating the development of technologies in electronics, materials, manufacturing, biotechnology, information technology, and other areas critical to our nation's future economic competitiveness;
- Promoting industrial alliances, including joint ventures and unprecedented industrial collaborations;
- Creating opportunities for companies of all sizes, with roughly half the awards going to small companies or joint-ventures led by small companies; and
- Opening the way for job creation, with more than 90 percent of awardees surveyed expecting to add new employees within five years as a result of the ATP technologies.

For example: At several automobile assembly plants, Chrysler and General Motors workers have already implemented new technologies to help them control variations in the fit of automobile body parts to 2 millimeters – about the thickness if a nickel – or less. The "2mm Program" partnership of the Auto Body Consortium, a group of eight small automobile technology suppliers, together with Chrysler, GM, and two universities, produced new manufacturing technologies, practices, and training techniques. The ABC technologies are not only effective, they are "agile" – readily adaptable to new models. The plants that have implemented the 2mm Program have been rewarded with significant improvements in customer satisfaction. More importantly, they have been able to meet the challenge of foreign competitors, especially in Japan, that also have achieved variation control at 2mm or better. International competitiveness is a life-or-death issue in the auto industry, which affects one in every seven jobs in the United States.

	FY 1995 Enacted	FY 1996 Request	FY 1996 House Appr	FY 1996 Senate Appr	FY 1996 Conference
Advan. Tech Prog.	$341 million	$491	$0	$25	tbd

THE MANUFACTURING EXTENSION PARTNERSHIP

The Department of Commerce
National Institute of Standards and Technology

Begun in 1989 with the establishment of three extension centers, Commerce's Manufacturing Extension Partnership (MEP) is now making the transition from a modest pilot program to a nationwide network leveraged to achieve sustainable impact. By September 1995, more than 40 MEP centers were operating and sending engineers and other specialists with manufacturing or business experience into the field to work with firms. Another 18 centers have just been established, extending MEP direct services to manufacturers in 42 states and Puerto Rico.

When completed, the national network will put hard-to-find technical assistance within reach of the nation's 381,000 small and medium-sized manufacturing establishments. Cost-shared by federal, state and local organizations, all MEP centers are established through a rigorous merit-based competition. The MEP builds on the foundation of existing state and local industrial extension services. It focuses on needed services that the private-sector either does not provide or cannot deliver economically to smaller manufacturers. Emphasis is on grassroots delivery of service, facilitated by a small NIST staff of fewer than 60 people.

Early evaluations suggest that by making technical assistance accessible to smaller manufacturers in all regions of the country, the MEP will deliver sizable benefits, reaped on scales ranging from individual factories to the national economy. Already, the MEP is making a real difference:

- **Benefits anticipated by the 610 firms responding to the MEP centers' surveys totaled $167 million**, the cumulative result of sales increases and cost savings attributed to actions undertaken with technical assistance from MEP centers.

- **Anticipated benefits translated into a conservatively estimated economic benefit of $8 on each $1** that the federal government invested in the MEP.

Applied Solar Energy Corp., a leading producer of space solar arrays and power subassemblies used in satellites, provides an excellent example. This California company is saving $3 million annually from improvements made after working with MEP's California Manufacturing Technology Center. The improvements helped Applied Solar Energy to reduce breakage of the fragile solar cells and increase production process yields. With CMTC's recommendations, the company achieved double digit improvements in yield and double digit reduction in breakage within one year after improvements were put in place. The company, with a workforce of 250 employees and now exporting its products worldwide, was able to hire an additional 56 employees. The $3 million annual savings achieved by the company equals the total provided to the CMTC through the MEP each year.

	FY 1995 Enacted	FY 1996 Request	FY 1996 House Appr	FY 1996 Senate Appr	FY 1996 Conference
MEP	$74 million	$147	$81	$76	tbd

TECHNOLOGY REINVESTMENT PROJECT (TRP)

Department of Defense
Advanced Research Projects Agency

Advanced technology remains the linchpin of U.S. military superiority. The mission of the Technology Reinvestment Project (TRP) is to increase Department of Defense (DoD) access to leading-edge, affordable technology by leveraging commercial know-how, investments and markets for military use.

The technological environment for defense is changing in fundamental ways. Increasingly, commercial industry is the source of the new technologies essential to maintaining our military edge; currently DoD access to these technologies is limited. Moreover, commercial manufacturing practices are key to ensuring the affordability, as well as the performance, of modern weapon systems.

The TRP is a response to this new reality. With an investment of $440 million a year, the TRP has successfully leveraged billions of dollars of industry R&D to meet defense needs. TRP-supported projects are developing promising "dual-use" technologies in a range of areas:

- **Low-cost night vision:** U.S. troops will be able to "own the night," through widespread use of infrared sensors made 10 times cheaper by leveraging new commercial technology.

- **High-density data storage:** Vast increases in portable, low-cost data storage will give our front-line soldiers immediate access to the best information and intelligence.

- **Battlefield casualty treatment:** New sensors and information systems will greatly improve the ability to find and diagnose injured combatants during the critical first hour they are down in the field.

Congress proposes to slash TRP funding by 60 percent or more. But the TRP has been and continues to be a critical program to the Department of Defense, helping to provide advanced, affordable technology for the 21st century.

	FY1995 Enacted	FY1996 Request	House Appr	Senate Appr	Conference Appr
TRP	$443 million	$500	$0	$238	$195

THE ENVIRONMENTAL TECHNOLOGY INITIATIVE (ETI)
The Environmental Protection Agency

Begun as a Presidential Initiative in 1993, the goal of the Administration's Environmental Technology Initiative is to increase environmental protection and improve public health by accelerating the development and use of innovative environmental technologies. The Initiative will also enhance the competitiveness of the U.S. environmental technology industry. More than 1 million Americans are presently employed by more than 30,000 businesses in this high-wage, high-skilled industry. Our key trade competitors, Germany and Japan, recognize environmental technology as a key industry and are positioning themselves to compete aggressively in the $400 billion global market for environmental goods and services.

The Environmental Technology Initiative encourages the development and use of innovative and more efficient technologies by: (1) reducing barriers in federal and state environmental policies and regulations which discourage capital investments in innovation and inhibit the development and commercialization of new environmental technologies, (2) overcoming barriers to demonstrating new technologies, and, (3) helping disseminate information on new environmental technologies and successful applications to U.S. businesses.

Even without counting the cost savings that come from the use of more efficient technologies, *the permitting and process streamlining activities under the Environmental Technology Initiative can reduce regulatory compliance costs by $700 million or more throughout the economy*, making the Initiative an example of a "win-win" for both the regulated community and technology entrepreneurs.

In fiscal year 1994, the ETI funded 78 projects. In FY 1995 more that 1500 public-private partnerships sought funding for environmental technology innovations.

Examples of ETI Funded Projects

ETI funded MPI Label Systems, an Illinois label maker with seven plants who wanted to eliminate employee exposure to liquid/gaseous solvents. As a result of the project, MPI now uses a harmless water-based ink and saved $16,500 annually in one plant. If applied industry-wide, a 150,000,000 pounds per year reduction in toxic solvent emissions would result.

ETI is funding work with the Arizona Department of Water Quality and the City of Phoenix to facilitate the use of constructed wetlands as an alternative wastewater treatment and water reuse technology. This alternative can reduce city spending to meet water quality standards by $300 - $500 million and enhance recreational, educational, and wildlife values throughout the watershed.

	FY 1995 Enacted	FY 1996 Request	FY 1966 House Appr	FY 1996 Senate Appr	FY 1996 Conference
ETI	$68 million	$126	$0	$20	tbd

TECHNOLOGY LEARNING CHALLENGE
Department of Education

The quality of this nation's educational system is crucial for a prosperous economy and to ensure that all Americans benefit from economic growth. Investments in education have been central to this administration's priorities.

- New computer technology, the information superhighway, and multimedia technology have the power to transform the way Americans learn.

- Today information can already be tailored to the needs of individual learners and to encourage experimentation and creativity impossible with conventional instructional tools. New technologies allow teachers to spend more time focusing on individuals, allowing them to create challenges specialized for the capabilities and interests of individual students.

- Information networks can tie even the most remote schools into the vast information resources available over the Internet and improve communications between schools, homes, and other parts of the community.

The Technology Learning Challenge, a Presidential initiative in the Department of Education, is designed to challenge teams in communities around the country to work together to apply new technologies and new learning tools to local education needs. Technology Learning Challenge (TLC) Grants were recently awarded to 19 innovative communities. The winning consortia included schools in 23 states, 120 private sector firms, 34 universities and colleges, 10 museums, and 5 libraries. The total value of the matching commitments to the $10 million in federal funds will be over $70 million in 1996. The projects will support the use of new technologies in reading, writing, science, mathematics, the arts, and other disciplines; aid professional development for teachers; and promote greater parent and community involvement in education.

	FY 1995	FY1996	House	Senate	Conference
Tech. Learning	Enacted	Request	Appr	Appr	Appr
Challenge	$9.5 million	$70	$25	$25	tbd

PARTNERSHIP FOR A NEW GENERATION OF VEHICLES (PNGV)

The Partnership for a New Generation of Vehicles (PNGV) is an innovative program that brings together eight agencies of the federal government and Chrysler, General Motors and Ford all working toward the common goal of developing a new generation of fuel efficient cars. Traditional auto suppliers, high technology industries, inventors, and universities are all contributing.

PNGV will lead to automobiles that will have triple the fuel efficiency of today's cars, without sacrificing affordability, performance or safety. Imagine driving a car with the ultimate in aerodynamic styling, constructed of light weight materials that are just as strong as steel, with an engine that is a dramatic departure from the traditional internal combustion engine and has a fuel efficiency that is three times that of today's cars. These are just some of the ideas that are being pursued as part of the PNGV research efforts.

The technologies that will be the product of the PNGV program will serve both the auto industry and the Nation. The PNGV is a win-win proposition for all partners:

- One out of seven American jobs is connected with the auto industry. Keeping this industry globally competitive is directly reflected in the standard of living of Americans.
- By increasing fuel efficiency, we are decreasing our dependence on foreign oil, which enhances both our national and economic security.
- Increasing fuel efficiency decreases the adverse effects that cars have on the environment.

Early PNGV successes are already evident. For example, a PNGV Cooperative Research and Development Agreement between General Motor's Delphi Steering Systems and the Department of Energy's Sandia National Laboratory has just resulted in a new technology process to make the shafts used in Saturn drive trains. The hardening process for the drive trains are computer controlled which improves the energy efficiency of the process and results in higher quality shafts. Widespread application of this technique in the auto industry is expected.

There are many other promising areas of research in the program. Applications of lightweight materials will be critical to achieve improved fuel efficiency, from aluminum to new composite materials to high strength steel. Several different alternatives to the internal combustion engine are showing promise, including fuel cells and fly wheels. In partnership with government, what now seems like science fiction will become a reality.

For example, the PNGV Budget for the Department of Energy:

	FY1995 Enacted	FY1996 Request	House Appr	Senate Appr	Conference Appr
PNGV	$188 million	$251	$123	$178	tbd

HIGH PERFORMANCE COMPUTER AND COMMUNICATIONS (HPCC) PROGRAM

The Federal High Performance Computer and Communications (HPCC) Program is a triumph of collaboration between the 12 Federal organizations that participate in HPCC research and development. HPCC research has changed the way we think about information access and delivery and has only begun to transform our lives. The impacts of the HPCC Program span almost every aspect of our lives including national security, educational systems, health care, the way we work and the way we are entertained.

The HPCC Program was formulated with the insight that information technologies were not only critical, but would require long term investments to fully develop. The long-time horizon for the development of information technologies prevent any one company from bearing the burden of supporting the necessary research and development. The federal government has invested wisely in these technologies, and these years of investment are now paying dividends.

Some exciting new capabilities brought about by the HPCC Program include:

- Using modern techniques requiring high performance computing, NOAA developed a hurricane prediction system that can more accurately predict the path of a hurricane, provide earlier warning, and in turn, save lives.

- In the medical field, application of telemedicine is bringing the physician instantly in contact with patients in remote locations using advanced computer networks.

- Digital models of human anatomy are being developed to provide a new education tool for researchers, health care providers, students, and the general public.

- The spectacular images transmitted around the world of the recent collision of comet fragments with the planet Jupiter illustrate the power of HPCC technologies. A once-in-a-lifetime observation of an astronomy event was captured for the world to see.

- The aeronautics industry has improved engineering productivity by cutting design time in half for jet engine compressors used in the Boeing 777. The new design also reduces fuel consumption - saving billions of dollars in fuel cost over the life of the fleet while also reducing harmful environmental impacts.

- The National and Global Information Infrastructures are based on emerging technologies from HPCC research. The ultimate impacts of these networks are limited only by the imagination of those engaged in the research and the budget cuts proposed by Congress.

	FY 1995 Enacted	FY 1996 Request	House Approp	Senate Approp	Conference Approp
HPCC	$1084 mill.	$1143	$1034	$1074	tbd

TELECOMMUNICATIONS AND INFORMATION INFRASTRUCTURE ASSISTANCE PROGRAM (TIIAP)

The Department of Commerce
National Telecommunications and Information Administration

The National Telecommunications and Information Administration, an agency of the U.S. Department of Commerce, administers the Telecommunications and Information Infrastructure Assistance Program (TIIAP). TIIAP is a matching grants program which provides seed funding for innovative projects that demonstrate the benefits of telecommunications and information technology in education, health care, community development, and other services. TIIAP is a component of the Administration's National Information Infrastructure initiative.

In the first year of the program (1994), TIIAP attracted more than 1,000 funding applications from all 50 states. The program awarded $24.4 million in grants to 92 projects, and generated more than $40 million in non-federal matching funds.

In the second year (1995), applications increased by 80 percent (to 1,811), and funding requests totalled $680 million. The program made 117 awards totalling $35.7 million, and generated more than $60 million in non-federal matching funds.

Examples of TIIAP Funded Projects

- Youth services organizations in New Haven, Connecticut and East Palo Alto, California are linking by computer at-risk teenagers in the two cities for education and training for future job opportunities.

- A Kentucky non-profit economic development group will develop an information network providing comprehensive worker training as well as support for entrepreneurs, small and new businesses and the expansion of the region's existing industries.

- Reducing health care costs, rural Oklahoma hospitals and clinics are using an advanced telecommunications system to assist doctors with complex diagnoses and examine x-rays without transporting patients long distances.

Colleges and universities in 15 western states used distance learning technologies to prepare residents for new careers in natural resource management and health care.

TIIAP	FY 1995 Enacted	FY 1996 Request	FY 1996 House Appr	FY 1996 Senate Appr	FY 1996 Conference
	$64 million	$100	$40	$19	tbd