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Tech file

THE WHITE HOUSE

Office of the Press Secretary

For Immediate Release July 30, 1992

The Bush Administration's Policies for an American Technological Revolution

FACT SHEET

The President today met with the scientists, management and workers at the world's largest science and engineering project, the Superconducting Super Collider (SSC). He reaffirmed his continuing strong support of the federal investment in this unprecedented scientific undertaking which will provide broad societal benefits.

The Problem

Technological innovation is essential to sustained economic growth. Those nations that innovate most successfully will compete best in an increasingly integrated global economy.

International competitiveness requires needed investments in basic research and efficiently commercializing the results of that research. It involves a technology policy that recognizes the important role of entrepreneurs, and the need for flexibility in deploying resources to their most efficient uses.

The Bush Administration Principles

Since 1989, President Bush has aggressively pushed a strong science and technology agenda, and he has proposed devoting an unprecedented level of resources to R&D.

The President's science and technology agenda relies on six basic principles:

- The private sector must be free to determine its own research priorities.
- The Federal government must promote sound tax policies that stimulate private sector investment in R&D and technological innovation.
- The Federal government must assure that its regulations do not impede firms from developing products or from bringing safe, new products to market.

- The Federal government must support a strong program of basic and applied R&D, which provides broad societal benefits.

- The Federal government must work cooperatively with the private sector in the development of generic or enabling technologies.

- Federally-funded technology must be transferred swiftly and effectively to the private sector for commercialization.

The President has taken these six principles and developed a comprehensive strategy for enhancing America's technology prowess and competitiveness. It includes:

- **Opening Up Foreign Markets to U.S. Goods;**

- **Accelerating Technology Transfer;**

- **Investing in the Future: Strengthening Our Knowledge Base and Increasing Federal Support for Emerging Technologies;**

- **Educating Our Students for a World of Technology;**

- **Coordinating with the Private Sector in Consortia and Other Arrangements to Develop Generic or Enabling Technologies;**

- **Stimulating Private Sector R&D Through Sound Tax Policies; and**

- **Promoting Technology Through a Sound Regulatory System.**

Opening Up Foreign Markets to U.S. Goods

The U.S. remains the world leader in the export of scientific and technological knowledge. Our high tech exports have increased by two-thirds since 1987, and we enjoy a $37 billion trade surplus of high tech exports with the rest of the world. The President is determined to maintain this position by opening new foreign markets, and by protecting the intellectual property rights of those on the leading edge of scientific and technological innovation.

1. Bilateral Agreements with Japan. The Administration has opened Japanese markets to U.S. high tech goods through trade agreements covering supercomputers, satellites, semiconductors, and amorphous metals.

2. Intellectual Property Rights in the Uruguay Round. The Administration is currently negotiating to ensure that the U.S. science and engineering base is protected from foreign pirating of technology.

3. North American Free Trade Agreement (NAFTA). The Administration is completing the negotiations on the NAFTA which will open new opportunities for American exporters and the free flow of investment capital into the technologically intensive fields of the environment, medicine, agriculture, electronics and telecommunications.

4. U.S./Asia Environmental Partnership. This unprecedented coalition of U.S. and Asian government units, businesses, and community groups is working together to enhance Asia's environment. This will result in the greater export of American technological know-how and equipment.

Accelerating Technology Transfer

The Federal government has invested billions of dollars in creating the world's finest, most advanced research laboratories. This valuable national resource can assist civilian research efforts to investigate and develop commercially viable technologies.

- Technology Transfer. The FY 1993 Budget proposes a significant increase in technology transfer activities, including almost 1,500 Cooperative Research and Development Agreements (CRADAs) between government laboratories and private industry, an increase of 60 percent over the past two years; approximately 4,500 new invention disclosures; 2,000 patent applications; and almost 300 technology licenses awarded.

  The Administration's National Technology Initiative. Ten conferences have been held across the country, and five more are scheduled between now and December 1, 1992. These conferences act as catalysts for creating new partnerships among government, universities and American companies to better translate new technologies into marketable goods and services. A list of the conferences is attached.

- Expanding the Role of the National Laboratories. The FY 1993 Budget proposes that National Laboratories play a greater role in high priority areas of civilian applied R&D by helping to form R&D consortia and other collaborative arrangements led by industry and academia.

- Improving Linkages Between Federal and Industry R&D. Presidential initiatives proposed in the FY 1993 Budget call for increased private sector roles in setting directions for federally funded R&D in critical areas such as high performance computing, advanced materials and biotechnology.

- Fostering Entrepreneurial Activity in Small High Technology Businesses. The Administration has removed impediments to the success and growth of small high technology businesses that are responsible for a disproportionate share of new jobs and innovations.

Investing in the Future: Strengthening Our Knowledge Base and Increasing Federal Support for Emerging Technologies

The Administration remains committed to funding basic and applied research, and to working with industry to develop generic technologies but believes that the market competition is best able to identify winners and losers.

- The President's FY 1993 budget proposes $76.6 billion in research and development. This represents an increase of nearly $2 billion, or 3 percent. Federal civilian R&D would increase by 7 percent. The budget proposes over $14 billion for basic research, an increase of 8 percent, and over $17 billion for civilian applied research and development, an increase of 6 percent.

A. Initiatives in Basic Research

- Superconducting Super Collider (SSC). The FY 1993 Budget proposes $650 million to support continued prototype superconducting magnet development, and construction of support facilities and a test tunnel segment. The budget maintains the 10-year project schedule approved last year.

- Doubling the National Science Foundation (NSF) Budget by 1994. The budget proposes an increase of 18 percent for NSF, including a 21 percent increase for basic research.

- Increasing Support for Individual Investigators. The budget proposes roughly $8 billion, an increase of 9 percent, for individual investigators funded by the Departments of Health and Human Services and Energy and the National Science Foundation.

- U.S. Global Change Research Program (USGCRP). The budget proposes $1.4 billion, an increase of 24 percent, for this initiative to understand more fully the Earth's climate system and to develop sound policies concerning issues such as ozone depletion and global warming.

- Astronomy and Astrophysics. The budget proposes a total of $890 million for these programs. This proposal is consistent with the recommendations of a recent report of the National Research Council.

- Agricultural National Research Initiative (NRI). The budget proposes a 51 percent increase to fund six areas of research: natural resources and the environment; nutrition, food quality and health; plant systems; animal systems; markets and trade policy; and processes antecedent to adding value and developing new products.

- Biotechnology Research. The budget proposes $4 billion, an increase of $271 million or 7 percent, for a new coordinated Presidential initiative in biotechnology involving 12 Federal agencies.

B. Applied Research and Development

- High Performance Computing and Communications (HPCC). The budget proposes $803 million, an increase of 23 percent, for the second year of the President's High Performance Computing Initiative.

- Advanced Material and Processing. The budget proposes $1.8 billion, an increase of 10 percent, for a new Presidential initiative intended to improve the manufacture and performance of materials.

- Advanced Manufacturing R&D. The budget proposes a total of over $1 billion, including $321 million for nondefense-related manufacturing R&D.

- Energy Technology R&D. The budget proposes $914 million, an 18 percent increase, for targeted energy technologies. These investments, guided by the National Energy Strategy, will increase energy efficiency, and generate advances in new electricity technologies.

- Fusion R&D. The budget proposes a 7 percent increase for the development of energy from nuclear fusion. This initiative maintains the U.S. commitment to the International Thermonuclear Experimental Reactor (ITER) engineering design.

- Transportation R&D. The budget proposes nearly $1.4 billion, an increase of 17 percent, for transportation research and development in the fields of high-speed rail, aviation and aeronautics technologies. This proposal includes $260 million for the National Aerospace Plane (NASP) program.

- Space Research and Technology. The budget proposes $305 million, a 12 percent increase, for NASA space technology development.

- Protecting the Public Health. The budget proposes $4.8 billion for applied research and development at the Department of Health and Human Services, including over $1.2 billion for research on Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome (AIDS) and an 80 percent increase for the Women's Health Initiative.

C. **Expanding the Geographical Frontier of Space**

- Space Station Freedom. The budget proposes $2.2 billion, an 11 percent increase, for fabrication and testing of critical components in preparation for first element launch in 1996.

- Improving Access to Space. The budget proposes $5.4 billion for civil space transportation, including the Space Shuttle, commercial expendable launch vehicle services, and other initiatives such as the SpaceHab module for microgravity research.

- New Launch System. NASA and the Department of Defense will propose $250 million for joint development of a new, more flexible and powerful launch system.

- Space Exploration. The budget proposes a total of $586 million for space exploration programs, including the planned mission to Saturn, two new robotic missions to explore the moon, and advancing key technologies needed for future missions to Mars.

Educating Our Students for a World of Technology

Our education system must produce American workers able to compete with any in the world. The National Education Goals call for U.S. students to be first in the world in science and mathematics by the year 2000.

- The President has proposed to Congress $2.09 billion for science and mathematics education programs, an increase of 7 percent over 1992.

- To enhance teacher training, the President has proposed federally-funded math and science training for 770,000 U.S. teachers, almost half of the total number of teachers in those fields.

- The President's budget proposes a series of

demonstration projects using electronic communications technologies to enhance math/science curricula.

Cooperating with the Private Sector in Consortia and Other Arrangements to Develop Generic or Enabling Technologies

It has long been recognized that it is not possible to predict where, when or to whom the benefits of basic research will flow so that no single institution can justify the necessary investment. The same argument applies to the development of generic or enabling technologies. Examples of Federal support for cooperative activity with the private sector in the development of generic technologies include:

- Sematech, a consortium in which the Federal government and the computer industry cooperate to develop technologies for semiconductor chip manufacture that will leapfrog the next generation and allow U.S. industry to recapture a substantial share of the international market for these chips.

- The Battery Consortium, involving the Federal government, major automobile manufacturers and a number of electrical battery companies, is working towards the development of storage batteries for electric automobiles.

- The Automotive Composites Consortium, involving the Federal government (through the National Institute for Standards and Technology) and major automobile manufacturers, is developing and testing composite substitutes for large metal automotive components (e.g. front-end assemblies) that will result in more fuel efficient but still safe automobiles, and technology with much wider industrial application.

Stimulating Private Sector R&D Though Sound Tax Policies

Fostering technological innovation requires tax policies that encourage research, investment, and risk-taking.

- Research and Experimentation Tax Credit. Since taking office, the President has urged the Congress to make permanent the current 20 percent research and experimentation tax credit.

- R&D Allocation Rules. The President has called on the Congress to extend the so-called section 861 R&D Allocation Rules, which foster R&D activities in U.S. labs. When Congress failed to act, the President used his administra-

tive powers to extend this important incentive for 18 months.

- Capital Gains Tax Cut. Since taking office, the President has repeatedly urged the Congress to cut the capital gains tax, which raises both the cost of developing new technologies and the cost of purchasing high tech goods.

Promoting Technology Through A Sound Regulatory System

Federal regulatory policy should protect health and safety and promote competition. Where possible, the Federal government should eliminate unnecessary regulatory burdens that stifle technological innovation and product development.

- Biotechnology. The U.S. is the world leader in biotechnology. This $2 billion domestic industry is expected to increase to $50 billion by the end of the decade. Some of the most promising advances will be in new drugs and gene therapies to treat existing diseases. Biotechnology will also produce healthier foods, safer pesticides, additional energy resources, and innovative environmental clean-up technologies.

- Drug Approval Process. On April 9, 1992, the Administration announced four actions to speed up the availability of new drugs and dramatically reduce unnecessary burdens in the drug development process: accelerated approval for "breakthrough" drugs for patients with life-threatening or serious illnesses; a new "parallel track" system under which promising new drugs for treating AIDS and other HIV-related diseases will be made widely available as early as possible; external review of some categories of new drug applications by qualified non-government experts; and, streamlined animal testing to reduce the testing time of new human drugs in animals.

- Extending the National Cooperative Research Act (NCRA). The NCRA of 1984 permitted firms to join forces on research projects without the fear of *per se* antitrust violations. The Administration supports legislation to expand the NCRA to permit firms to jointly produce goods.

- Advanced Television. The FCC is moving to promulgate new rules on a standard for high definition television. This standard will likely embrace the digital technologies pioneered by U.S. private sector firms, which has leap-frogged the analog technologies of foreign competitors.

# # #

NATIONAL TECHNOLOGY INITIATIVE CONFERENCES

DATE	LOCATION	TECHNOLOGY FOCUS
2/12/92	Cambridge, MA	Environment, Biotechnology
3/4/92	Austin, TX	Energy (Oil & Gas), Electronics
3/24/92	Orlando, FL	Aerospace, Food
4/9/92	Research Triangle, NC	Biotechnology, Environment
4/23/92	Cleveland, OH	Materials, Advanced Manufacturing
5/14/92	Seattle, WA	Transportation, Environment
5/29/92	Pasadena, CA	Aerospace, Biotechnology, Environment
6/11/92	Golden, CO	Natural Resources, Communications
6/25/92	Kansas City, MO	Agricultural Technology, Advanced Manufacturing
7/9/92	Gaithersburg, MD	Life Sciences, Information Technology
9/15/92	New Brunswick, NJ	Transportation, Electronics
9/25/92	Chicago, IL	Materials, Biotechnology
10/15/92	Palo Alto, CA	Environment, Information Technology
10/27/92	Pittsburgh, PA	Materials, Life Sciences
12/1/92	Baltimore, MD	Transportation, Aerospace

Office of Management and Budget
Energy and Science Division

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(2) Please note the *. These number are out of date as soon as they hit the paper. These are the right order of magnitude ± 1-5%

Table 6–1. ENHANCING RESEARCH AND DEVELOPMENT AND EXPANDING THE HUMAN FRONTIER–HIGHLIGHTS

(Dollars amounts in millions)

Budget Authority	1989 Actual	1992 Enacted	1993 Proposed	Dollar Change: 1992 to 1993	Percent Change: 1992 to 1993	Preliminary * 1993 Enacted	Dollar Change 1993 Enacted & Proposed
Applied Research:							
High Performance Computing and Communications	N/A	655	803	148	23%	734	–69
Advanced Materials and Processing	N/A	1,659	1,821	162	10%	1,708	–113
Biotechnology Research	N/A	3,759	4,030	271	7%	3,941	–89
Energy R&D	397	774	914	140	18%	901	–13
Moving Fusion Energy from Science to Engineering	347	337	360	23	7%	337	–23
Advanced Manufacturing R&D (non–defense)	N/A	252	321	69	27%	299	–22
Transportation R&D	802	1,224	1,433	209	17%	1,373	–60
Protecting the Public Health	3,482	4,757	4,849	92	2%	4,800	–49
Expanding R&D at the National Institute of Standards Technology	159	247	311	64	26%	384	73
Space Technology	256	273	305	32	12%	200	–105
Basic Research:							
Doubling the NSF Budget by 1994	1,923	2,572	3,026	454	18%	2,734	–292
Support for Individual Investigators (HHS, NSF, DOE)	5,884	7,273	7,939	666	9%	7,529	–410
Human Genome Project	N/A	164	175	11	7%	171	–4
Superconducting Super Collider	98	484	650	166	34%	517	–133
U.S. Global Change Research Program	N/A	1,110	1,372	262	24%	1,283	–89
Astronomy and Astrophysics	617	836	890	54	6%	859	–31
National Research Initiative (USDA)	N/A	98	150	52	53%	98	–52
Maintaining National Security: Defense R&D							
Defense	38,031	40,043	40,509	466	1%	41,000	491
Energy	2,321	2,668	2,936	268	10%	2,803	–133
Expanding the Geographic Frontier:							
Improving Access to Space	4,411	5,312	5,412	100	2%	5,001	–411
Space Exploration	1,433	2,646	2,836	190	7%	2,615	–221

* In some cases, these are very preliminary estimates.

Economic Report of the President

Transmitted to the Congress
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TOGETHER WITH
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is below that of other major industrialized countries, in part because the United States saves at a lower rate than other countries. A higher rate of investment will increase the competitiveness of the U.S. economy. Reducing the bias toward current consumption will increase saving, thereby raising the accumulation of capital assets—both domestic and foreign—by Americans. This accumulation in turn will expand the resources available for future consumption. Raising the rate of national saving is essential to fostering greater increases in future standards of living.

Government policies can have a major impact on the environment for economic growth. As stressed in Chapter 3, credible, stable monetary and fiscal policies are a key to reducing uncertainty and to promoting long-term growth. Tax and spending policies designed to remove impediments to working, saving, investing, and innovating can have a strong positive influence on economic growth. For example, reductions in marginal tax rates and broadening of the tax base, especially after the Tax Reform Act of 1986, have reduced the impact of tax distortions on economic decisions. Reducing the uncertainty in the legal system, removing barriers to the free flow of capital across international borders, and adopting regulatory policies that maximize market flexibility and encourage innovation can all improve the climate for growth.

DETERMINANTS OF GROWTH

The Nation's productive capacity depends on the level of technology, the supply and quality of capital, and the number and skills of workers. Increased utilization of labor and capital translates quickly into growth in the output of goods and services. As in most economic expansions, much of the relatively rapid growth since the recovery began in 1982 can be attributed to increases in the employment and utilization of existing resources, although productivity growth has also played a role and, indeed, has improved since the 1970s. Because fewer opportunities to increase utilization of available resources remain, the economy will need to rely more heavily on other sources of growth in the 1990s.

TECHNOLOGICAL CHANGE

Technological advances improve the productivity of inputs and the quality of output, thereby increasing the rate of economic growth and raising living standards. Innovations—in the form of new products, new machines, new production techniques, and new communication and transportation methods—exert an important beneficial effect on growth. Entrepreneurs, taking substantial risks (and sometimes failing), often translate new ideas into new products or processes. The Administration has advanced policies designed to spur investment in research and innovation and to provide a more favorable environment for entrepreneurial activity and new business formation.

INVESTMENT IN PHYSICAL CAPITAL

Investment is a second major vehicle for increasing the rate of economic growth. Increases in physical capital—such as tools and machinery—make the labor force more productive, as each worker has more capital to use. Further, new investment permits technological improvements to permeate the U.S. economy, providing each worker with better capital. Investment is also needed to start the new business ventures that help to give the U.S. economy its vitality. Sustained high investment leads to higher productivity, higher wages, and higher standards of living.

The cost and availability of financial capital are critical parts of the investment climate. Increases in the total supply of funds to finance investment decrease the cost and increase the availability of capital. Although domestic saving has provided the bulk of funds for U.S. investment in recent years, foreign capital inflows—reflecting in part the attractiveness of U.S. investment opportunities—have provided about one-sixth of investment financing. Increasing the rate of national saving will provide more funds for investment and, as discussed below, should help to reduce the U.S. trade deficit. For these reasons, removing impediments to saving is a high priority of the Administration.

INVESTMENT IN HUMAN CAPITAL

A third major source of growth is raising the number of workers and improving their skills. Efforts by workers to increase their skills through training and education is investment in human capital. A highly skilled work force and a flexible labor market have long been basic economic strengths of the United States. But the increased complexity and competitiveness of the world economy demand new skills, greater training, and additional flexibility. Chapter 5 analyzes the challenges and opportunities for growth in human capital in the next decade.

TECHNOLOGICAL PROGRESS AND ECONOMIC GROWTH

Technological change has played a central role in economic growth. Many famous innovations—in agriculture, textile manufacture, transportation, communications, and electronics—have played an important role in economic growth and have led to a transformation of society over the past two centuries. The combined effect of a host of less visible minor improvements in product designs and

production techniques has been equally important. There is a role for government policy in financing technological progress because the full benefits of research are rarely captured solely by the firm or individual undertaking the research. Rather, additional benefits accrue to society as a whole. Because these additional benefits cannot be captured as part of the private-sector return, there is a natural tendency for private markets to do too little research and development from society's broader viewpoint. The Federal Government can offset this tendency through policies to raise national spending on research and development.

FACTORS THAT AFFECT TECHNOLOGICAL PROGRESS

Many people view technological progress as the result of work by solitary scientists or inventors motivated solely by curiosity. Yet ample evidence suggests that economic factors influence innovation. Thomas Edison, after unsuccessfully trying to sell his first invention (an automatic vote counter), vowed that he would work only on ideas for things that people would buy. The size of the potential market determines the return on invention and therefore influences investment in applied research. Even in universities, the availability of funding influences the direction of basic research.

But invention is only the first step in technological progress. To raise economic growth, an idea must be translated into a marketable product or service, applied on a production line, or built into a new machine. Development, which brings the fruits of research to market, is expensive: two-thirds of U.S. research and development (R&D) expenditures in 1988 were devoted to development rather than to basic or applied research. The actual application of an innovation is an important step beyond development. Information about the technological advance must be disseminated, and workers must be trained to use it. In many cases, it is prohibitively expensive to modify the old capital stock to embody new technology. Therefore, *the rate at which new technology actually augments productivity depends in part on the rate at which new capital goods are created, i.e., on the rate of investment.* A recent study estimates that 20 percent of the contribution of technological change to growth in the United States between 1949 and 1983 came from advances that were embodied in capital.

Raising the rate of investment in the United States may increase the rate of technological progress in other ways, although the size of these effects is difficult to determine. Higher rates of investment shorten the lag between innovation and use, increasing the return on research efforts and spurring additional advances. Further, use of new capital equipment and facilities may trigger discoveries of new ways of doing business, new production processes, and new potential products.

TRENDS IN R&D SPENDING

The United States spent $127.7 billion on R&D in 1987. This level reflects dramatic growth, as real R&D spending grew more than fivefold since 1953 and doubled as a fraction of GNP. As shown in Table 4-1, the United States spends more on R&D than four other leading industrialized nations combined. The share of total world R&D performed by the United States has, however, fallen over the past 25 years as other countries have grown rapidly and have approached or reached the technological frontier.

TABLE 4-1.—*R&D Expenditures for Five Major Industrialized Countries, 1987*

	France[1]	West Germany	Japan[2]	United Kingdom[2]	United States
R&D expenditures (billions of dollars)	16.4	22.8	41.7	15.7	127.7
As a percent of GNP	2.4	2.8	2.8	2.4	2.8
Estimated nondefense R&D expenditures (billions of dollars)	13.1	21.6	41.4	11.7	88.6
As a percent of GNP	1.8	2.6	2.8	1.8	2.0

[1] Data for France are based on GDP; consequently, percentages may be slightly overstated compared to GNP.
[2] Data for Japan and the United Kingdom are for 1986.

Note.—Foreign currency conversions to U.S. dollars are calculated based on Organization for Economic Cooperation and Development purchasing power parity exchange rates.

Source: National Science Foundation

To the extent that R&D produces knowledge with the same benefits regardless of the size of the economy, the absolute level of R&D spending is the critical measure of R&D investment. An alternative measure of national R&D spending is its intensity—the share of GNP devoted to R&D. The United States, West Germany, and Japan each currently spend about 2.8 percent of their GNP on R&D, with France and the United Kingdom spending only slightly smaller fractions of their GNP (Table 4-1). But a larger proportion of the R&D in the United States is defense-related. The $88.6 billion that the United States spent on nondefense R&D in 1987 was a smaller fraction of GNP than were nondefense R&D expenditures in West Germany and Japan.

Although investment in R&D is only part of the explanation for the rate of technological change, it is clearly important. Average private rates of return on R&D investment are extremely high: estimated rates exceed 20 percent a year. Moreover, these returns do not reflect all of the returns to R&D, because it is difficult for an innovator to capture all of the benefits of an innovation. Some innovations cannot be patented; some patents are hard to defend; all patents eventually expire. An innovation may have spinoffs or ramifications that others bring to market. Users of the product, as well as the innovator, receive benefits. For these and other reasons, the returns to society of R&D investment are estimated to average twice those to the firm that makes the investment.

THE ROLE OF GOVERNMENT

For basic research, the difference between the benefits to society and the returns to those who perform the research is often particularly large. Basic research frequently increases knowledge that has wide application. Because it is usually difficult or inefficient to keep advances in basic research secret, the benefits accrue broadly. Private firms must weigh the costs and risks of a potential investment in basic research against the modest fraction of the total expected social benefit that they generally receive, and thus tend strongly to underinvest in basic research. Moreover, basic research contributes to the strength of universities, which train scientists and engineers for the private sector, as well as to our national defense. *The Federal Government has a key role in supporting basic research.*

Although industry performs about three-quarters of all R&D in the United States, the Federal Government plays an enormous role in science and technology. It provides 47 percent of the funds for R&D, most of which is undertaken by industry and universities. The Federal Government carries out R&D at many facilities, accounting for 11 percent of national R&D spending. It helps to finance the education of scientists and engineers. It protects the intellectual property rights of innovators through the patent system and laws dealing with copyrights, trademarks, and trade secrets. It encourages private innovation through a 20-percent income tax credit for research and experimentation (R&E) and by allowing most R&D expenses to be deducted for tax purposes immediately rather than spread over several years.

STRENGTHENING THE U.S. RESEARCH BASE

The Administration has proposed a broad program of initiatives that will strengthen the Nation's basic research base and enhance private-sector incentives to translate this knowledge into productive innovations.

Improving the Legal Environment

The Administration has advanced important proposals to improve the legal environment for innovation. First, the Administration is aggressively pursuing improved international protection of intellectual property. The current negotiations in the Uruguay Round of the General Agreement on Tariffs and Trade (GATT) are an important forum for developing better international rules. Negotiations on intellectual property rights are also being conducted in the World Intellectual Property Organization and in trilateral talks with the European Community and Japan.

Second, the Administration has proposed reform of product liability laws. The current product liability system, with 50 different

State laws, generates excessive litigation, increases the cost of doing business in the United States, and discourages innovation, particularly in the form of new products. The Administration supports the adoption of uniform product liability standards based on three principles of fairness: the right of an innocent person to fair compensation for actual damages; liability based on responsibility for harm and not ability to pay; and encouragement of alternatives to costly litigation. The proposed changes to product liability laws would maintain incentives to produce safe products, but would restore balance to the tort system and reduce uncertainty—particularly for new products.

Third, the Administration supports continued elimination of unwarranted regulation. Deregulation can spur innovation as well as lower prices. New telephone equipment was rapidly introduced after deregulation of the market. Airlines created more efficient route structures after deregulation. Lives are extended and research is accelerated by the expedited approval of drugs for acquired immune deficiency syndrome (AIDS).

Deregulation also requires a continuous reexamination of existing regulatory policies in light of new technologies. Antitrust regulation, in particular, must be sensitive to changes in technology and in international competition. Unnecessary and burdensome regulations must not be allowed to stifle new products and processes.

Restoring the Capital Gains Tax Differential

Although applied research and development have high average rates of return, they are also quite risky. The high cost of capital such risk produces is a particularly onerous burden for new ventures and small businesses, which have only limited access to traditional sources of finance. Much of the return to entrepreneurs and their backers who bring new products to market—particularly through startup ventures—comes through increasing the value of the business. Reducing the tax rate on capital gains will reward those who bring successful ideas to market and will help provide a climate that encourages businesses to invest in new technologies and products.

Because capital gains are taxed only when assets are sold, the current high tax rate discourages the sales of assets and locks in investors. Reducing the tax rate on capital gains will free these investors to search for more productive new investments.

The Administration has proposed restoring a capital gains tax differential such as existed before the Tax Reform Act of 1986. Most major foreign competitors tax long-term capital gains less heavily than ordinary income, if they tax them at all. A lower tax rate on capital gains will encourage entrepreneurs to take risks to advance themselves by creating wealth for others: new firms hiring

new workers producing new products for new markets here and abroad. *Reducing the capital gains tax rate will encourage innovation and, by increasing investment, hasten the adoption of these innovations.*

Making Permanent the R&E Tax Credit

Under current law, the R&E credit is scheduled to expire on December 31, 1990. Before 1989, the credit was designed so that higher R&E expenditures reduced future credits, which diminished the incentives to undertake further research. In 1989, the incentives in the R&E credit were improved without substantially affecting revenue. *The Administration proposal to make the credit permanent would be an even more significant reform.* It would permit businesses to establish and expand research facilities without fearing that the tax laws will suddenly change.

Increasing Basic Research Funding

America's leadership in science and technology depends on excellence in basic research. Support for basic research, especially at the Nation's universities, makes a critical investment in the 21st century, both by creating knowledge and by training a new generation of scientists and engineers.

The Administration believes that Federal investment in research should focus on fundamental advances in science and technology that have broad relevance and that no individual firm or industry would have the incentive to produce on its own. Accordingly, the Administration supported substantial increases in Federal investment in basic and applied research in the 1990 budget. For 1991, the Administration has a number of new initiatives designed to expand the human frontier. These initiatives include major increases in funding for the National Science Foundation's research programs (continuing the progress begun in fiscal 1990 toward doubling the Foundation's budget by 1993), for space science and exploration to maintain America's leadership into the next century, and for the Superconducting Super Collider to provide new insight into the fundamental structure of matter. Increased funding will be more effective if it is accompanied by improved management of Federal research programs. One way to increase the effectiveness of Federal research spending is to encourage the timely transfer of scientific advances to private-sector applications.

Relying on the Market

Some have argued for a broad new Federal role: choosing specific civilian technologies and financing their development or commercialization by special tax treatment or direct subsidy—a so-called industrial policy. Such an expansion of the current Federal role is strongly opposed by this Administration.

The private sector has inherent advantages over government in identifying potentially useful new technologies. Private decisions are disciplined by careful market evaluations of their prospects. Government decisions, in contrast, are often influenced by noneconomic objectives and based on information supplied by self-interested parties, without regard to taxpayers' cost.

Governments in the United States and elsewhere have shown themselves to be less able than private businesses to pick specific technologies that will be commercially successful. They have often supported fashionable technologies with powerful advocates, rather than those that are economically productive. The billions of dollars in development costs and operating losses that have been invested in the Concorde by the British and French governments illustrate this phenomenon well. Moreover, in many cases governments have continued to support technologies in which they have invested, even if those technologies have been long since demonstrated to be economically unsound by market and technological developments. For example, the synthetic fuels program in the United States lived on for years after its economic futility was evident to most observers.

Over the past 40 years, the world has learned that excessive government involvement in the economy leads to unsound decisions, chokes off productive innovation, and, in the final analysis, slows growth and costs jobs. *The best way to support development of civilian technology is through improving private incentives for applied research and development, not by attempting the impossible job of second-guessing private-sector investments.* It is appropriate, however, for the government to support the development of technologies clearly related to national defense that a careful analysis indicates would not be generated by the private market. In such cases, the government has always relied primarily on the private sector to undertake the R&D required in the development process.

The Administration's proposals will improve incentives for innovation by:

- Protecting intellectual property through international negotiations,
- Reforming product liability laws to restore balance to the tort system,
- Removing regulatory barriers to research, innovation, and development,
- Reducing the tax rate on capital gains to spur entrepeneurial activity,
- Making the R&E tax credit permanent to reduce uncertainty, and
- Substantially increasing funding for the basic research essential to America's future.

Jim —
Great job. Many thanks.
Roger

THE WHITE HOUSE

Office of the Press Secretary

For Immediate Release February 19, 1992

INVESTING IN RESEARCH, DEVELOPMENT AND TECHNOLOGICAL INNOVATION

FACT SHEET

The President believes that to achieve long-term, sustainable economic prosperity and to improve America's standard of living, we must improve our nation's productivity. A key to improved productivity is greater investments in research, development and technological innovation. This Administration has proposed, over the past three years, a pattern of aggressive investment in areas of research and development that will help boost productivity and improve economic performance. These investments will enhance America's competitiveness in the 1990s and in the twenty-first Century. The Administration's proposals are based on three basic principles:

- Promoting sound tax policies that stimulate private sector investment in research, development and technological innovation.
- Increasing Federal support for basic and applied research and development.
- Accelerating the transfer of federally funded technology to the private sector for commercialization and expanding the role of the National Laboratories.

I. Stimulating Private Sector R&D Investments

- Research and Experimentation Tax Credit. The President proposes to make permanent the current 20 percent research and experimentation tax credit.
- Research and Experimentation Sourcing Rules. The President proposes extending these rules through December 31, 1993.

II. Increasing Federal Support for Emerging Technologies

The Fiscal Year 1993 budget reaffirms the President's commitment to science and technology. It proposes to spend $76.6 billion for research and development, an increase of 3 percent over last year. Within this total, the conduct of civilian research and development would go up 7 percent, to over $30 billion. Basic research funding would go up by more than a billion dollars, to $14.3 billion, an increase of 8 percent.

In the three years since George Bush became President, federal support for nondefense R&D has gone up by a third. Basic research funding has gone up by a quarter.

A. Applied Research and Development

- High Performance Computing and Communications. The budget proposes $803 million, an increase of 23 percent, for the second year of the President's High Performance Computing and Communications Initiative.

- Advanced Material and Processing. The budget proposes $1.8 billion, an increase of 10 percent, for a new program intended to improve the manufacture and performance of materials.

- Biotechnology Research. The budget proposes $4 billion, an increase of $271 million or 7 percent, for a new coordinated biotechnology program involving 12 Federal agencies.

- Advancing Manufacturing R&D. The budget proposes a total of over $1 billion, including $321 million, a 27 percent increase, for nondefense-related manufacturing R&D.

- Energy Technology R&D. The budget proposes $914 million, an 18 percent increase, for targeted energy technologies. These investments, guided by the National Energy Strategy, will increase energy efficiency, and advance new electricity technologies.

- Fusion R&D. The budget proposes a 7 percent increase for the development of energy from nuclear fusion. This initiative maintains the U.S. commitment to the International Thermonuclear Experimental Reactor (ITER) engineering design.

- Transportation R&D. The budget proposes nearly $1.6 billion, an increase of 17 percent, for transportation

research and development in such fields as high-speed rail, and aviation and aeronautics technologies. This proposal includes $260 million for the National Aerospace Plane (NASP) program.

- Space Research and Technology. The budget proposes $305 million, a 12 percent increase, for NASA space technology development.

- Protecting the Public Health. The budget proposes $4.8 billion for applied research and development, and $10.6 billion for R&D overall, at the Department of Health and Human Services, including over $1.2 billion for research on Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome (AIDS) and an 80 percent increase for the Women's Health Initiative.

B. Initiatives in Basic Research

- Doubling the National Science Foundation (NSF) Budget by 1994. The budget proposes an increase of 18 percent overall for NSF, including a 21 percent increase for basic research.

- Increasing Support for Individual Investigators. The budget proposes roughly $8 billion, an increase of 9 percent, for individual investigators funded by the Departments of Energy, Health and Human Services, and the National Science Foundation.

- Human Genome Project. The budget proposes a 7 percent increase for the Human Genome Project which has the goal of analyzing within 15 years the entire complement of human genetic material at the molecular level.

- Superconducting Super Collider (SSC). The budget proposes $650 million to support continued superconducting magnet development, and construction of support facilities and a test tunnel segment. The budget maintains the 10-year project schedule approved last year.

- U.S. Global Change Research Program (USGCRP). The budget proposes $1.4 billion, an increase of 24 percent, for this initiative to understand more fully the Earth's climate system and to develop sound policies concerning issues such as ozone depletion and global warming.

- Astronomy and Astrophysics. The budget proposes a total of $890 million for these scientific disciplines. This

proposal is consistent with the recommendations of a recent report of the National Research Council.

- Agricultural National Research Initiative (NRI). The budget proposes a 53 percent increase to fund six areas of research: natural resources and the environment; nutrition, food quality and health; plant systems; animal systems; markets and trade policy; and processes antecedent to adding value and developing new products.

C. Maintaining National Security

- Defense R&D. The budget proposes a total of $43 billion for national security related R&D supported by the Department of Defense and the Department of Energy. Defense Science and Technology programs will grow by $1.4 billion to a level of $12 billion in Fiscal Year 1993, an increase of over 9 percent. This will allow emphasis on technology demonstration and prototype development necessary to maintain future military capacity.

D. Expanding the Frontier of Space

- Space Station Freedom. The budget proposes $2.2 billion, an 11 percent increase, for fabrication and testing of critical components in preparation for first element launch in 1996.

- Improving Access to Space. The budget proposes $5.4 billion for civil space transportation, including the Space Shuttle, commercial expendable launch vehicle services, and other initiatives such as the SpaceHab module for microgravity research.

    - New Launch System. NASA and the Department of Defense will propose $250 million for joint development of a new, more flexible and powerful launch system.

- Space Exploration. The budget proposes a total of $586 million for space exploration programs, including the planned mission to Saturn, two new robotic missions to explore the moon, and advancing key technologies needed for future missions to Mars.

III. Accelerating Technology Transfer

- Technology Transfer. The budget proposes a significant increase in the level of technology transfer activities, including almost 1,700 Cooperative Research and Development Agreements, an increase of 40 percent over the past two years; approximately 3,300 new invention disclosures; 1,500 patent applications; and almost 500 technology licenses awarded.

- Expanding the Role of the National Laboratories. The budget proposes that the National Labs play an increasing role in high priority areas of civilian applied R&D, and in helping to form R&D consortia and other collaborative arrangements led by industry and universities.

THE WHITE HOUSE

Office of the Press Secretary

For Immediate Release March 7, 1990

REMARKS BY THE PRESIDENT
TO THE AMERICAN ELECTRONICS ASSOCIATION

The Washington Court Hotel
Washington, D.C.

11:42 A.M. EST

THE PRESIDENT: Mitchell, thank you. After listening to him, I'm glad it was the other guy from Massachusetts that I ran against a couple of years ago. (Laughter.) But really, thank you for that warm welcome, and I'm delighted to be here, and of course delighted to see Dick Iverson and so many familiar faces out here. Many of you came a long way to be here -- and so I won't ask you to sit through a long speech. The punishment should fit the crime. (Laughter.) Jim Baker stole my favorite story -- you remember about the kid who went to church with his grandfather, and he said, "Granddad, what are all the flags along the side of the church for?" And the grandfather said, "Well, that's for those who died in service." The kid said, "Oh, really? The 9:00 a.m service, or the 11:00 a.m. service?" (Laughter.) So I will try to be -- wasn't this Duke Ellington Band great? Listen, thank you -- the choir, just fantastic. Thank you. (Applause.)

And it is an honor -- really, I mean it -- and pleasure to be here back with this Association. And you are the leaders of a vital range of our most innovative and interrelated industries -- from semiconductors, microprocessors and circuit boards, to PCs, and mainframes, supercomputers, telecommunications, and defense electronics.

But at every stage of that impressive technological "food chain," yours are the people -- and the products -- that really keep this country competitive. I'd add a special tip of the hat to President Gary Tooker of Motorola, winner of last year's Malcolm Baldridge Quality Award. It's a prestigious award, and sets a great example for the rest of this country. So, congratulations. Where is he? I can't see with the light. Gary, congratulations to you. (Applause.)

But for almost 50 years now, your industries have been atthe center of a remarkable revolution: in the way work is done, the way ideas are managed -- even the way time and the vast reaches of space are understood.

And along the way, you've also become the nation's largest manufacturing employer -- creating jobs for over two and a half million Americans. Modernizing services and industries of every

kind. Assuring our national security. And providing a vital export market.

As technologies, economies, and geopolitics change almost weekly, your industries stand at a threshold of tremendous opportunity.

Our first priority is to encourage productivity gains, savings, long-term investment in high-tech industries, by lowering the cost of capital.

We believe that one of the most crucial federal priorities is to encourage planning for the long term -- because, for too long, where investment is concerned, the federal government has been more of a hindrance than a help. And so we intend to work with you closely, constantly and consistently to see that American electronics and technologies regain and retain a permanent position in world markets.

Last month, we sent to Congress our Savings and Economic Growth Act -- which includes an innovative family savings plan, to stimulate capital formation. New incentives for IRAs to help first-time home buyers. And a business-building, job-creating, revenue-enhancing cut in the capital gains tax. (Applause.)

Without it, every business in America -- of every size -- is at a competitive disadvantage abroad. Now, let me read you, lest you have forgotten, a list of the maximum long-term capital gains tax rates for some of America's competitors. Japan: about five percent; South Korea: zero; Taiwan: zero; West Germany: zero; Singapore: zero; Hong Kong: zero. And the list goes on. And why some American politicians don't understand the importance of this capital gains differential, I do not know. It's pure politics. (Applause.) And so we're going to fight hard, with your continued support, for that crucial tax cut.

Along with encouraging investment, we've proposed a budget that will bring the deficit down. Below those Gramm-Rudman-Hollings targets. Without raising taxes. And, we're committed to unprecedented support for R & D -- research and development efforts. We believe that the R & E tax credit should be made permanent. And our budget includes a record-breaking $70 billion in federal direct investment for research and development.

Our budget also devotes unprecedented resources to space. Education. The fight against drugs. Environmental initiatives. And other crucial investments in our own future.

Such investments, over the years, have ensured that this country has retained its leadership in terms of the basic research and fundamental discoveries underlying your industry. This administration is also committed to working with you in the critical pre-competitive development stage where the basic discoveries are converted into generic technologies that support both our economic competitiveness and our national security. Here again we can help to level the international playing field on which you compete.

But we understand, as you do, that no investment is more important than our human resources. So together with the nation's governors, we have set ambitious national goals for America's students. As one incentive, we've proposed a new National Science Scholars program. We have also requested a 70 percent increase for the Eisenhower Math and Sciences Educational Program and a $100 million increase in the National Science Foundation education budget.

By the year 2000, our kids can be first in the world in science and math achievement -- and with enough involvement and leadership from groups like this, they will be first. (Applause.)

Your industries face some unique challenges. The marketplace is tough enough without undue constraints and unfair restrictions.

So we've pledged to make sure that trade is fair and free -- by judiciously but firmly implementing the 1988 Trade Act. We're moving forward with Japan through the Structural Impediments Initiative and by working to develop a more productive relationship overall. Just last weekend, as Mitch referred to, I met with Prime Minister Kaifu and specifically discussed satellites, telecommunications, super computers, forest products, and yes, semiconductors. I hope, I fervently hope that on the basis of our talks, Japan will be moving toward early resolution of these problem areas.

We agreed that we must both do our very best to make these SII talks a success. We've presented ideas for removing structural impediments in Japan and they have presented ideas to us about our own structrual impediments. We remember, therefore, that it is a two-way street. Our task must be to make the American economy even stronger and even more competitive.

But we're also committed to strengthening and expanding the multilateral trading system, through the Uruguay round. I just can't tell you how important a successful conclusion ofthat round is for American business -- for business all around the world. We've proposed far-reaching reforms of the global trading system, working to bring a wide range of new trade areas under the GATT. These crucial negotiations will help us create a more equitable, more efficient trade climate, worldwide.

I've made it a priority to review and modernize our export controls, to provide vital help to the emerging democracies, without compromising national security. Given the pace of political change, rapid advances in technology, and the competitive position of American industry, we must ensure that export controls are effective or eliminated. I am happy to report this week we have a team at COCOM in Paris negotiating the modernization of export controls on computers. These controls have been an important part of our security for decades, and I know our allies want to work with us to ensure their relevance in the 1990s.

To provide a further competitive edge for American firms, we will support legislation to reduce the antitrust uncertainty that may discourage joint production ventures. Under such a proposal, the courts would weigh, on a case-by-case basis, the competitive

benefits as well as costs of joint production ventures. In addition, joint production ventures announced to the government would be liable only for actual damages in private antitrust suits. Such an initiative would build on the competitive strength of American business, by allowing firms to pool their skills, build new production facilities, and share investment risks.

One risk you all face -- and it's not just business -- citizens working in associations and volunteer organizations, in schools -- everyplace -- one risk that you all face at an intolerable level -- is liability. In your case, I'm talking about product liability. And the Council on Competitiveness, ably chaired by Vice President Quayle, has already begun a concentrated effort to significantly reform our cumbersome and expensive product liability system. It's about time that we made ourselves more competitive by getting rid of those lawsuits and claims that are purely frivolous and patently unfair. (Applause.)

And so today, I'm going to give the Competitiveness Council another challenge: to find ways that American industry can better translate new ideas and technologies into marketable products.

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

Today, I've outlined some of what we're doing to level the playing field. But it will be leaders like you right here in this room that have to take the ball and run with it.

You represent the vital core of America's competitive potential, with over 3500 of the most dynamic, technologically advanced, forward-thinking companies in the country.

Your ideas are important to us. And your success is absolutely crucial to America's future. So let me encourage you to work together, and with us, on a long-term program to meet the competitive challenge of a new century. It's a great pleasure to have been here with you.

Thank you very much. And God bless you all. And thank you, again, to the Duke Ellingtion choir. (Applause.)

END 11:56 A.M. EST

THE WHITE HOUSE

Office of the Press Secretary
(Detroit, Michigan)

For Immediate Release September 10, 1992

REMARKS BY THE PRESIDENT
TO THE DETROIT ECONOMIC CLUB

Cobo Hall
Detroit, Michigan

1:00 P.M. EDT

THE PRESIDENT: Thank you all very, very much. Good morning to everyone. And, Governor Engler, I'm proud to be with you, sir, and thank you for that kind introduction. Greetings to Chick Fisher, your Chairman, and Jerry Warren, both of whom have been most hospitable to me. I've been here several times before this most distinguished American forum and I'm delighted to be back.

This morning I am here for a very serious speech, serious business. And I'm releasing today an agenda for the American renewal. And I've come here today to introduce it to you and to the nation.

My agenda diagnoses the economic problems our nation faces, lays out the principles that should guide us in the years ahead, and explains the integrated approach that I am pursuing to meet the challenge.

Over the past weeks I have been discussing certain elements of my economic agenda, and in the weeks ahead I will be expanding on those and other ideas. The document that I'm releasing today shows how the pieces all fit together.

But let's begin this morning by stepping back, taking stock of where we are as a great nation in the broader sweep of history.

The American people have just completed the greatest mission in the lifetime of our country -- the triumph of democratic capitalism over imperial communism.

Today, this year, for the first time since December of 1941, the United States is not engaged in a war, hot or cold. Throughout history, at the close of prolonged and costly wars, victors have confronted the problem of securing a new basis for peace and prosperity. The American people recognize that we stand at such a watershed.

We sense the epic changes at work in the world and in the economy, the uneasiness that stirs the democracies who served as our partners in the long struggle.

We feel the uneasiness in our own homes, our own communities; and we see the difficulties of our neighbors and friends who have felt change most directly.

And we know that while we face an era of great opportunity, we face great risks as well -- if we fail to make the right choices, if we fail to engage this new world wisely.

But America has always possessed unique powers, and foremost among them is the power of regeneration -- to transform

MORE

uncertainty into opportunity. Only in America do we have the people, the talents, the principles and ideals to fully embrace the world that opens before us.

For America to be safe and strong, we must meet the defining challenge of the 1990s: to win the economic competition -- to win the peace. We must be a military superpower, an economic superpower, and an export superpower.

My agenda for renewal asks that we look forward -- to open new markets, prepare our people to work, strengthen our families, save and invest so that we can win. Our renewal depends on economic growth -- but growth not for the few at the expense of the many, not for the present at the expense of the future.

In our country we've always prized an entrepreneurial capitalism that grows from the bottom up, not the top down; a prosperity that begins on Main Street and extends to Wall Street -- not the other way around.

That's the lesson I learned as a young man, packed up a Studebaker and moved to Texas after another war, at the start of another era. I saw jobs, prosperity -- an entire future -- built with the hands of ordinary men and women with extraordinary dreams.

Our nation has never been seduced by the mirage that my opponent offers -- of a government that accumulates capital by taxing it and borrowing it from the people -- and then redistributing it according to some industrial policy. We know that the clumsy hand of government is no match for the uplifting hand of the marketplace.

My international economic and trade strategy will guarantee our position as an export superpower, extending our global economic reach in tandem with our security presence -- to stretch beyond our borders so that we can create more jobs within our borders.

At the same time, we need to foster at home the capabilities that will keep us in the lead: radical changes in our education system to prepare our children for a constantly changing workplace; incentives for the entrepreneurs and new technologies to sharpen our competitive edge; job training, health care reform, to promote the economic security of our working men and women; and new approaches for reaching out to those who have been left behind, since in the century ahead we will need the talent and the energy of every single American.

And finally, because our greatest strengths flow not from government but from the personal initiative of free men and women, my agenda aims to check the growth of government, and, in some important ways, to reverse it. Together, the components of this new agenda should renew America according to her most cherished principles.

And this renewed America will be empowered toward a grand goal: to nearly double the size of our economy, to $10 trillion, by the early years of the next century.

To place this agenda in a larger context, let me turn briefly to five profound changes now at work in our economy. When Americans gather around the kitchen table at night and talk about how they'll meet a mortgage, or pay the doctor's bill, they're feeling these changes in their daily lives. And before the changes have run their course, they will have forever altered the way Americans buy and sell, work and create.

The first great change in our economy is ironically caused by our very success in ending the Cold War. In the short run, deductions in defense spending have meant painful lay-offs in

many industries, and we are taking steps to ease this transition. But in the medium and long run, deductions in defense spending will free up priceless skills and technologies for peacetime growth.

Second, most of our industries are transforming themselves from old-style hierarchies into flatter organizations, with fewer layers between customer and executive. The new organizations emphasize a skill-based workforce, "lean production," and shorter production cycles. From castings to computers, this is a revolution as dramatic as the one made earlier this century, when Henry Ford led the country from craft-based production to mass manufacturing.

While these changes are essential to maintaining our competitive edge, they've come with a cost; everyone in this room knows that -- lay-offs, cutbacks among both white- and blue-collar workers. These hard-working people need reassurance -- not only about their economic security, but about preserving the sense of self-worth that only work can provide. The third change: While the 1980s brought us the greatest peacetime expansion in our history, the boom also led too many of us to take on too much debt. We have been paying that down, that debt -- and lower interest rates have helped us do it. The process is largely over, but consumers and companies remain cautious.

The fourth change involves our financial system. We entered the '80s with a 50-year-old banking system, designed for the days when tellers wore green eye-shades, not for an era when billions -- billions of investment dollars can cross borders at the speed of light.

In the late '70s, record interest rates and inflation rates rocked this anachronistic system. The less efficient institutions could not survive, obligating the federal government to protect the savings of millions of Americans.

Now, this process of paying debt down is nearing its end. Our financial system will become more flexible and efficient. But for now, lenders are cautious and, despite low interest rates, small business still can find it hard to get the credit.

But the most far-reaching of these five changes is the emergence of a global economy. No nation is an island today. One out of every six manufacturing jobs is directly tied to exports. The crops sown from one out of every three acres of farmland are sold abroad.

Consider some implications of the global economy: when growth slows abroad, as it has recently, our own growth slows as well. And America will only grow in the next century if we can compete globally -- in every part of the world. So we must seize every opportunity to open new markets, particularly those with the greatest potential for expansion.

Now, in drafting an agenda for America's future, we had to assess our strengths as well as our weaknesses. Conveniently, the other side has discovered many weaknesses and very few strengths. And, of course, they might find temporary political gain in portraying an America as past her prime, over the hill. But they have no more right to argue, for partisan purposes, that our economy is weaker than it is, than I have to understate our problems.

Our strengths are real. Now, here are some facts. The Misery Index -- the sum of inflation and unemployment -- is 10.8 percent, down from 19.6 Percent in 1980. Inflation stands at about three percent. Interest rates are at a 20-year low. The purchasing power of Americans gives us the highest standard of living in the world. We enjoy the highest home ownership rate of all major industrialized countries. And we send 68 percent of our

children on to higher education -- more than any other country -- and well above Germany's 32 percent and Japan's 30 percent. And with 5 percent of the world's population, we produce 25 percent of the world's total output -- and 37 percent of its high-tech products.

Now, I don't mean to suggest that all is well -- that we don't need to lead and manage the changes that are transforming our economy. But you can't chart the stars if you think the sky is falling down. Over the past 12 years we have almost doubled the size of our economy. It's as if we'd created two extra economies the size of Germany's from scratch.

And how will we meet our goals? Before you hear the specifics of this agenda, let me tell you a little bit about what I believe -- because change, if it is to be a force for good, must be guided by principles. And the principles that must guide change are the principles that never change.

I believe we are a nation of special individuals, not special interests. Individuals draw their enduring strength from their families, from their neighbors and communities, not from the government. So I believe we must never ask government to do what families and neighbors and individuals can better do for themselves -- and for one another.

I believe -- because I've seen it -- economic growth comes from the small businesswoman who takes a risk on a new product, from the computer hacker working in a garage, in a cluttered way; from the merit scholar in South L.A., South Central L.A. with a future as big as his dreams.

And I believe government owes it to them, and to you, to keep tax rates low and make them even lower; to keep money sound; to limit government spending and regulations; and to open the way for greater competition, and freer trade.

But I do not believe, as some might, that government's obligation ends there. As a conservative I believe that government can help people -- offer them hope and opportunity -- by giving them the means and the confidence to make the decisions that matter in life.

My background has also prepared me for the task of bringing our foreign policies and our domestic policies together; to turn our strength as a world power to our advantage as an economic power; to match the security we feel militarily with the economic security that we must build at home. From now on, if America is to lead the world, we need a leader who knows the territory.

My agenda for American renewal calls for action on six interconnected fronts. There's no single cause of our present situation. There can be no single cure. The whole of our agenda will be -- must be -- greater than the sum of its parts.

First, challenging the world. During the Cold War, we built a global security structure with military alliances across the Atlantic and the Pacific. And in the same way, the post-Cold War era requires a strategic economic and trade policy -- global in scope, and built on our foundation as an economic and export superpower.

We are uniquely positioned to achieve this goal. As the largest fully integrated market in the world, we wield leverage with other countries that want access to our market. As both a Pacific and a European power, we are tied to the largest and most rapidly growing economies across both oceans. And as the strongest nation in our hemisphere, we are looked to for leadership by free economies emerging from Chile all the way up to Mexico.

The same holds true for the newly born economies of Eastern Europe and the former Soviet Union, where our values, our products, even our language, carry a unique appeal. In Moscow today, the lines at McDonald's are longer than the lines at Lenin's Tomb.

The key to America's growth, expansion, and innovation has always been our openness to trade, investment, ideas, and people. As this openness is at last being reciprocated around the world, we find ourselves again at a special advantage.

The next steps in my strategic trade policy are to secure congressional approval of the North American Free Trade Agreement and to complete the global trade negotiations, the GATT round, creating high-wage American jobs and expanding the pool of customers hungry for the fruits of American labor.

Let me emphasize: these agreements are steps, not ends in themselves. And so I want to announce today that it is my goal to develop a strategic network of free trade agreements -- with Latin America; with Poland, Hungary and Czechoslovakia; and with countries across the Pacific. And then, as these external barriers fall, I believe we can help reduce internal barriers to competition as well -- in North America, Western Europe, Japan, and elsewhere. Greater competition will encourage entrepreneurial capitalism at the expense of government power and entrenched interests, spurring unprecedented economic growth.

Traveling around the country I've seen it happen already -- particularly in some small businesses, as they strengthen themselves for international competition. A couple of weeks ago, in St. Louis, I visited Public Safety Equipment -- they're a company -- they make the light-bars that you've seen on police cars. The president of Public Safety told me that a few years ago, they recognized they could no longer just sell their products in 50 states, leave it at that. And so they took on the world. And now 35 percent of what they make is sold in 48 countries, creating good jobs right here in the United States of America.

Public Safety, and the hundreds of thousands of companies like it, offer a glimpse into the future I see for all American business. But a business is only as efficient, as resilient as innovative, as the people who keep its books and build its products and devise its strategy. Materials, machines, methods -- they'll come and go, but the American worker will remain the key to our economic security.

That brings me, then, to the second part of our agenda: preparing our children.

The workplace of the 21st century will be constantly changing. I've heard that from many businesspeople sitting right here at the tables in this hall. We must prepare the American people for a lifetime of learning, to keep a step ahead of that process of change. Now, developed nations need developing minds. The burden will fall on our educational system. As in the past, education should be the ladder that children can climb to better themselves.

Our current school system is not up to the task. Designed for the 19th century, it will collapse under the weight of the 21st. And our educational establishment is caught in the same time warp, where standing still means falling behind.

Money alone is not the answer -- the United States already spends more per pupil than any other country but Switzerland. The answer is a radical overhaul of the system itself. If we want to change our country, we've got to change our schools.

The catalyst for change -- the one reform that drives all others -- is school choice, giving children scholarships so that

all parents have the freedom to choose which schools will best serve their children. Competition is the principle that must underlie education reform, to break the establishment's monopoly on the system. And competition will not work unless parents are allowed to choose their children's schools -- whether it's the public school across town or the parochial school across the street. (Applause.)

Consider just one statistic: in Chicago, 46 percent of public school teachers send their children to private schools. Clearly they know something about monopoly education that my opponent doesn't. Our different approaches to education reform reveal the grand canyon that divides me and my opponent. You see the same contrast in child care, or health care, and a host of other issues. My opponent prefers uniformity to variety and choice, relying on these government bureaucracies to offer "one-size-fits-all service." I don't want to pull everyone down to make everyone equal. I want to give everyone the tools to climb as high as they can dream.

Even as we fix our schools, the question remains: Will there be good jobs for the kids? And that's the third part of my agenda: sharpening businesses' competitive edge. I learned my economics the way most of you did -- a lot of late nights sweating over a balance sheet, or P & L statement, trying to meet a payroll. And I saw that if people are allowed to keep more of what they produce, they will produce more. It's common sense.

When capital is taxed lightly, there's more of it. And when it is taxed heavily, it becomes scarce -- available only to those who are already wealthy, who need it least of all. That's not the kind of economy that I want.

And if capital were more abundant, labor would be more in demand, wages would rise, unemployment lines would shrink. That is the kind of economy that I want. And that's why I want enterprise zones in our inner cities and in our rural areas. That's why I want to make this research and development, this R & D tax credit permanent. And that's why I want to cut the capital gains tax and index it for inflation. (Applause.)

Those are the fundamentals. I also see three other ways to sharpen the competitive edge of American business:

-- first, strengthening small business, by cutting taxes, making sure that credit is available, and by lifting the deadweight of government regulation;

-- second, supporting civilian R & D, by bringing the development, production and marketing of technology closer to the consumer;

-- and third, reforming our legal system. Every year American business and consumers spend up to $200 billion just in direct costs to lawyers -- far more than our competitors in Japan and Europe. And my product liability reform and access to justice act will restore rationality to the system and stop undermining the American worker. (Applause.)

This is a fact: We will never lead the world in the 21st century until we learn to sue each other less and care for each other more. (Applause.)

The fourth part of my agenda: promoting economic security -- for working men and women.

Again, common sense shows the way: true security will come only by developing individual capability, not dependency. And that independence, in turn, comes through the private sector, not the government.

Government's role will be to ease individuals' adjustment to a fast-changing marketplace. The average worker today will change jobs, it's estimated, 10 times over the course of his or her working life.

So we need a wider and more flexible range of job training and placement services -- for both the young and old, the blue and white-collar worker, and now especially for our workers from the defense industries.

Pensions must be portable -- and health care must be affordable. Our health care system today, I think everyone here would agree, provides the best care, but at an unacceptable price. More than thirty million Americans have no health insurance. Health care costs are the fastest-rising part of our budget for government, businesses, and yes, families.

My reforms get to the base of these problems while preserving and building on our system's strengths -- our state-of-the-art care, openness to innovation, and consumer choice. Taken together, my reforms cut health care costs by $394 billion over five years.

My opponent's plan could eventually place a full 13 percent of our economy under the control of the federal government -- meaning more bureaucracy, rationed care, inefficient service and, in the end, higher costs.

We must enhance competition and market forces, not restrict them; we must preserve individual choice, not hand decision-making over to centralized bureaucracies; we must reduce the burden on employers and employees, not bury them in a tide of new taxes and government regulations. (Applause.)

The programs I've outlined and that are detailed in this agenda are based on the principles that will empower all Americans to make their own choices and better their lives. But I believe we need to do more for some of our citizens who have been left behind. And that is the fifth component of this agenda: leaving no one behind.

The American Dream is nothing more than the belief that all Americans can make a better life for their children. The dream has made us the most dynamic society in the world; it's yet another strength we can draw upon for the challenge ahead. And so we must give every American a shot at making good on the dream.

And I reject the shopworn logic that sees poverty as a simple lack of income -- a kind of economic shortfall that can be replaced with a government check. A conservative philosophy of empowerment must have at its foundation the creation of character, through the ownership of property, through the dignity of work. That means sweeping away the nightmare of crime from our cities, building a core of property owners, creating business incentives, and making individual discipline and self-reliance the goal of all of our programs

I call the final component of my agenda -- "rightsizing government."

You'll recognize that I take the term from the business world -- which has a lot to teach those of us in government. At a time when companies across the country have been restructuring, increasing efficiency -- all to prepare for the economic competition of tomorrow -- the federal government faces an obligation to do the same. (Applause.)

Today the federal government spends nearly twenty-four cents of every dollar -- twenty-four cents of every dollar of the nation's income. And that's the fact: government is too big and

spends too much. The size and structure of government are relics of a different age -- artifacts more suited to the dilemmas of 50 years ago than the problems of today. Every institution in our society has learned that by pushing power down through organizations, by using technology to speed the flow of information, you don't just save money, you improve productivity. It's time for the government to do the same.

I will streamline government -- consolidating agencies, tightening budgets, and cutting the salaries of highly paid federal employees. And I'll start by cutting the White House budget 33 percent if the Congress cuts its own budget by the same amount. (Applause.) You might say: Why the linkage? Well, with fewer congressional staff badgering us for endless reports and endless visits to Capitol Hill, I know we can cut costs by that amount. (Applause.) And I'll cut the salaries of all federal employees earning more than $75,000 by 5 percent. Taxpayers have tightened their belts. The better-paid federal workers should do the same.

The agenda I publish today contains specific proposals to cut the fat: a cap on the growth in mandatory spending -- without touching social security -- and a freeze on domestic spending; a balanced budget amendment, a line-item veto -- (applause) -- and a new mechanism -- disciplinary mechanism -- a check-off box on tax returns to give the taxpayer the power to cut the deficit. I will fight to reduce spending and spur growth so we can get this budget in balance.

And unlike my opponent, I do not believe the American people are undertaxed. Quite the opposite: I am committed to cutting taxes across the board. And let me offer an example -- this is just an example -- as an illustration of what we could do: My cap on the growth of mandatory spending allows for population growth and inflation. It specifically exempts Social Security. But that cap alone, with those caveats, would save about $300 billion over five years. If we used just $130 billion in specific spending cuts that I have already proposed -- specific spending cuts of $130 billion that I have already proposed -- we could cut income tax rates by one percentage point across the board; reduce the small business tax rate from 15 percent to 10 percent, and reduce the tax on capital gains.

That's the direction that I want to go: tax less, spend less, cut the deficit, and redirect our current spending to serve the interests of all Americans. I honestly believe that this is the way -- the only way -- to control the size of the federal government. The facts are painful, but plain: For congressmen, spending is power. And they will exercise that power until they have spent every last dime they can squeeze from the working men and women of America. And it's as simple as this: raising taxes won't cut the deficit.

Here, then, is my agenda for American renewal. It comes at a time unique in our history, a turning point, a moment when one era is passing away and another is being born.

In the agenda published today, you'll find 13 proposals that I intend to achieve in the first year of my second term. I present them as a single program, a unified strategy to make change work for America.

Over the last three years I've shown how America can change the world; and we've made a respectable start managing the change at home. Our primary task now is to target America.

I intend to fight for this agenda, to fight as hard as I can. With a new Congress that can have as many as 150 new members, I am optimistic. If congress balks, will move forward anyway -- just as I have done with education, regulatory and welfare reform. I'll work with our great governors, like John Engler, with the state and local governments, with the private sector -- with anyone who shares the urge to renew our country.

The American people know that the events of recent years have shaken the world. With the close of the Cold War we can achieve peace, prosperity and promise at home. The American people want that. The American people deserve that.

And I want America to seize this moment. I want to stimulate entrepreneurial capitalism, not punish it; I want to empower people to make their own choices, not yoke them to new bureaucracies. I want a government that spends less, regulates less, and taxes less. And I will fight without hesitation for a free flow of trade and capital and ideas around the world -- because Americans never retreat -- we always compete. (Applause.)

My agenda draws together our people and our government to meet this challenge. We will create a $10-trillion economy. And we will renew America. And we will win the peace. (Applause.)

I know that times have been very, very difficult for many Americans. The world that we knew as children -- no matter your age -- will never be the same. America will change -- that's our destiny; how it will change will soon be decided.

I ask, as you consider the choice that you face, to consider carefully whose agenda for change best fits America's principles, our national experience, and our hopes for lasting peace and prosperity.

Thank you for your attention. And may God bless our great country. Thank you. (Applause.)

END 1:40 P.M. EDT

PIONEERING THE ELECTRONIC FRONTIER:
Challenges and Choices in Telecommunications and Media

remarks by

Todd G. Buchholz
Economic Policy Council
The White House

to the
Bear, Stearns & Co. Inc.
Media and Entertainment Conference
San Diego, California

November 7, 1991

Gene Roddenberry, the creator of *Star Trek*, depicted a vision of the future and a challenge. Recall the opening lines of the original television series: "Space -- the final frontier...to boldly go where no man has gone before!" No man may have gone before, but by *Star Trek VI*, Paramount had taken a billion viewers along for the ride.

As we look at the media, telecommunications, and computing industries, we see that the frontier called "space" can mean more than "outer space," more than an astronaut's view of solar systems and galaxies. Engineers and businessmen in these industries explore other kinds of space: spectrum space, creative space, shelf space, and the signal space within waves, wires, cables, and fiber optic strands. They boldly explore the "Electronic Frontier" with the same drive and energy that NASA scientists devote to exploring outer space.

Throughout the United States, our best scientists are exploring previously unimagined frontiers, from the crackling of radio waves, to the secrets of DNA, to the power of the atom, to the farthest reaches of our galaxy.

Of course, you conferees are more interested in some frontiers than others! In the next century, harnessing the power of information will be America's great infrastructure challenge. In the 19th century, railroads and

waterways met our infrastructure challenge. Railroads sewed our country together. While in 1850 it took three weeks to send a package from New York to Chicago, by 1854 a package would arrive in only three days. Today, we can transmit instantaneously by fax or send parcels by overnight express delivery. And if we want to savor the flavor of the 19th century, we can use the good ol' post office.

Moving from 19th century rails, in the 20th century the great infrastructure challenge was met by highways and roads, which permitted suburbs to grow and spurred new industries along the way.

In the 21st century, neither rail, nor canals, nor roads will set the pace for economic growth. Instead, we must look to information highways -- to our ability to transmit and process information. This ability will determine whether the United States continues to set the pace for the world, or whether we drift back to the middle of the pack.

Star Trek presented an international cast of characters conquering unknown frontiers -- actually, it was not just an international crew, it was intergalactic. Nonetheless, I think the American spirit is best suited for pioneering the Electronic Frontier. The idea of an America infused with the pioneering spirit goes back hundreds of years.

The great historian Frederick Jackson Turner wrote: "To the frontier, the American intellect owes its striking characteristics, its inventive turn of mind, its restless, nervous energy, dominant individualism, working for good and working for evil, and with all the buoyancy and exuberance which comes with freedom." I might add that I recently visited MIT's media lab in Cambridge, Massachusetts, where I saw the exuberance and buoyancy of true pioneers. It is no surprise that American laboratories slash open the thorny paths, while other countries follow.

Think about the astounding developments along the Electronic Frontier and in media products over the last fifteen years. In 1975, personal computers did not exist. Now Americans have plugged in 60 million. There were no VCRs. Now there are 70 million. Of course, we don't yet have 70 million people who can program them properly! There were no video stores, no fax machines, no cellular phones, no CNN, no Black Entertainment network, no MTV, no Madonna -- except the one in the Church. In 1975 we did have Michael Jackson, but back then he had a different nose and a different face, so even Michael Jackson has been revolutionized and transformed in the past fifteen years.

Not only have firms delivered sparkling new products to the market, but they have continually improved and enhanced them, while -- and this is startling to many people -- lowering the prices for the consumer! A $2,700 personal computer today is 35 times more powerful and hosts 1,200 times more storage space than the version that was sold in 1980. If the automobile industry enjoyed such progress, a Rolls Royce would cost just $10 today and fit on a $10 dollar bill.

Many people are stunned to hear that the computer industry achieved these breakthroughs without the government regulating memory capacity, microprocessor speed, power, or even safety. Imagine, we have seen plummeting prices and skyrocketing quality improvements without Congress, bureaucrats in Washington, or even Ralph Nader "protecting" us from competition and forcing industry to conform to "standards." Too many people in and out of Congress think that such progress is mutant behavior. They cannot understand that entrepreneurs can enrich and revolutionize the world through the clash of ideas and competition, and without any guidance from the gray-suited folks in Washington, DC.

Let me quote a compelling line from the movie *The Third Man*. The Orson Welles character says:

> "In Italy, for 30 years under the Borgias, they had warfare, terror, murder and bloodshed, but they produced Michelangelo, Leonardo da Vinci and the Renaissance. In Switzerland, they had brotherly love; they had 500 years of democracy and peace -- and what did that produce? The cuckoo clock."

My point is that advances along the Electronic Frontier cannot come in an excessively stable, serene environment. Progress will come only through the clash of competition. Sometimes it may seem chaotic, but competition will produce more and better products at lower prices than any mastermind who tries to design the details of the future. I am not suggesting that the Bushes should act like the Borgias in Italy, but I do think that those industries that depend on creative inspiration, creative development, and creative execution, will thrive only in a politically free environment and a fundamentally free regulatory environment.

What sorts of constraints on freedom are we at the White House concerned about? What sorts of barriers and walls have been erected between our best scientists, engineers and business people, forbidding them

from entering the Electronic Frontier? First, we can cite the European Community's broadcast directive, which mandates that a majority of programming be European in origin. Of course, the French have their own spin on this -- 40 percent of programming must be French. This edict denies our companies the freedom to export product. But it also denies French citizens, French consumers, the right to buy the products they want. If the French love Jerry Lewis, then they should be permitted to watch *The Nutty Professor* until their stomachs ache from laughter, even if it brings heartburn to French intellectuals and bureaucrats.

Why does the United States enjoy a $3.5 billion trade surplus in film and television video? To answer that question, recall the story of Hollywood mogul Harry Cohn. Thousands from Hollywood attended his funeral. A reporter asked Red Skelton why so many people turned out to pay their respects. "You give the public what it wants, and they show up," he replied. Well, we have a trade surplus in film and video because we are giving the world what it wants to see. The EC broadcast directive is a terrible barrier to the Electronic Frontier. It hurts our companies, our consumers, and the citizens of Europe.

Second, the White House is concerned about cable re-regulation. Simply put, price caps do more damage than good. In fact, they do only damage. Over the last fifteen years, through huge investments, the cable industry has dramatically expanded the amount of programming offered. Now, it is true that most cable companies are local monopolies and that some consumers are unhappy. But the answer -- and I believe most consumers believe this -- is not for government to squeeze prices. The only answer is more competition.

I know quite a few people who have been frustrated by their cable service. And I know many people who, while phoning in their frustration, yearn to be able to flip through their yellow pages -- not electronic yellow pages yet, but old-fashioned paper yellow pages -- and find some alternative service. Those alternatives may come from new satellite or microwave technologies, or from second cable franchises in municipalities. Many towns still grant exclusive franchises and thereby create monopolies. There is no good reason for this.

Furthermore, as the FCC recommended last week, the telephone companies are in a good position to create competition. Some people doubt whether the phone companies will find video services profitable. We should let the market decide. Surely, preventing telco entry hurts consumers. And

in the long run, such artificial barriers cannot be sustained, whether they are barriers preventing cable companies from offering telephone service or telephone companies from offering cable service. Technology moves so fast that it befuddles the guards at the barriers.

What is the government's role? Does President Bush simply want to delete regulations and let the world run loose? It is true that the President wants to deregulate. However, the President is also convinced that the Federal government must play a significant role in funding basic research and development that eventually leads to commercialized technologies. The President's 1992 Budget proposes $76 billion for research and development -- a record level, 13 percent above last year's record. And the President has proposed specific projects in high performance computing, superconductors, intelligent highways and intelligent vehicles (IVHS). By the way, the exciting IVHS program promotes cellular and satellite capacities. The President has beseeched Congress to extend and make permanent the R&D tax credit. And of course, the President and U.S. Trade Representative Carla Hills have wrestled with trade ministers throughout the world to open up more and more markets for American export, which creates American jobs.

All of this is not just an issue of profit for corporations. This Administration fights for open markets and competition because they benefit American households. Those benefits will come today and also in the future when, for example, experts at the Mayo Clinic can diagnose x-rays transmitted over high speed lines and then give instantaneous advice to sick people who live thousands of miles away. Those benefits will come when intelligent highways and vehicles allow American consumers to travel more safely and swiftly, and we hope, in less traffic.

The pioneers of the Electronic Frontier teach businesses to increase their efficiency. Over 500 companies are permitting some employees to "telecommute," a concept no one spoke of a few years ago. About four million full-time employees work at home at least one day a week, a 20 percent rise over 1989.

Not only does the explosion of technologies boost efficiency and help consumers, but it ensures that our political freedoms remain in place. Two months ago, hard-core communists took Mikhail Gorbachev hostage, holding him in total isolation, except for the crackling tones he heard across the Voice of America and BBC, telling him that his people would not let the junta steal their freedom. The televised image of Boris Yeltsin standing

defiantly atop a tank and staring down the coup d'etat united the Russian people in their fight for freedom.

As political and technological walls come tumbling down, we will see good ideas and bad ideas emerge. Not all products will be good. Not all will be valuable. The clash of competition does not ensure that we get more Eugene O'Neill plays and fewer *Nutty Professor* movies. That's up to consumers to decide.

But the United States government and all governments around the world should free their pioneers to explore the Electronic Frontier and to bring back the bounty that will make life richer and sweeter in the 21st century.

Todd G. Buchholz is Associate Director of the White House Economic Policy Council and the author of *New Ideas from Dead Economists* (Penguin).

A DRAFT SPEECH FOR THE PRESIDENT ON TECHNOLOGY
July 28, 1992

I. CHANGE

With the end of the Cold War, we are now living in a period of unbelievable change. The whole world has been transformed. Our age is a hinge of history: the doorway to a new era has opened.

As Americans we have been especially privileged to play a part in its opening. In so many ways, we have been the change. Thanks to our leadership, the world has sloughed off communism, an antiquated economic and political system. But we've also experienced tremendous changes here at home: a quantum leap in technology. A seachange not just in the way new technologies are created, but in the very way we organize ourselves to develop and deploy technology.

We have leaped to new forms of less hierarchical organization, so called "flattened" organizational structures, -- to a skills-based workplace -- to a global marketplace -- to "lean" production of short product cycles rather than mass production. These leaps are, taken together, comparable to the one we made when Henry Ford let the country from craft-based production to mass manufacturing in the early 20th century.

In those days, labor was cheap and plentiful, foreign competition was not much of a factor, markets were domestic, consumer demands were relatively similar and stable, and the workplace demanded few highly skilled workers.

But in today's competitive environment, technology changes ever more rapidly and knows no national borders, markets have become specialized and fragmented, foreign competitors have become global leaders, and the demand in the workforce is for more highly skilled workers.

II. THREE FACTORS OF TECHNOLOGICAL CHANGE

At least three factors are involved in this new technological transformation: First, the significance of the speed of innovation: how quickly an idea can be brought from lab to marketplace. Research shows that Japanese firms generally introduce manufactured products twice as fast as U.S. firms because they have managed to integrate R&D, manufacturing, and marketing into a seamless process of innovation.

The second factor is the new realization that a given technology must be used to its fullest extent: if we fail to put a given technology to work in all its applications, we will not reap the full competitive and economic

benefits our public and private R&D can deliver. By now we all know that while Americans invented such devices as the VCR and the fax machine, we did not always realize their fullest use.

And third, there is a new reliance on flexible, agile manufacturing rather than old-style mass production. Agile manufacturing or "lean production" means the capability to make a variety of products quickly and economically -- a process characterized by flexibility, short product cycles, and high-quality output.

As I said, these changes have not come without pain. Some, but not all, of the recent sluggishness in the economy can be attributed to a working out of these fundamental economic changes. And if the Democratic Congress had gone along with my policies for growth, such as cutting the capital gains tax, the pain would have been much, much less and millions of firms and families might have been spared economic agony.

So it's with particular force that I say to those who are seeking to turn their backs on change, "Get out of the way. You've already done enough damage." To those who would pursue the antiquated and now-discredited idea of "national industrial policy" in which government bureaucrats, not consumers, pick the winners among the industries, I say, take a look a what the people of Eastern Europe think about economics-by-bureaucrat.

To those who would deny the fact that the world is the marketplace and that there's no shutting ourselves off from it, I say, "Take off your protectionist blinders, and join me in reaching out the hand of free and open trade, beginning with our neighbors in North America. We'll win that competition hands down."

III. THE BUSH STRATEGY: FOUR PARTS

We have a strategy for change -- for channelling the energies of change to build a better America. From the beginning, my Administration has understood that improving America's productivity is the key to long-term economic growth and competitiveness. To that end I have pursued a four-part strategy for enhancing our country's productivity and competitiveness. These are:

- Dramatically increased funding for <u>basic and applied research and development</u>.
- <u>Tax policies</u> to promote long term investment.
- Support for <u>opening foreign markets</u> to U.S. exports.
- And <u>preparing America's workforce</u> to compete in the 21st century.

First, we have dramatically increased funding for basic and applied research and development. Despite cuts by Congress in my Administration's budget for each of the last three years, we have managed to increase funding for basic research by 25 percent since we started back in 1989.

- I have proposed to keep funding the National Science Foundation, which is a major source of support for the individual investigators who are the backbone of American science, on a path that would allow it to double over the period 1987 to 1994.
- As part of our effort to promote human health and longevity, we have proposed major increases in funding for the National Institutes of Health and the National Institutes of Mental Health, with a particular emphasis on research conducted by individual investigators.
- Since taking office, we have created the world's most advanced research program to understand global climate change, while doubling support for the U.S. Global Climate Research Program, to over $1.3 billion.
- Our lastest budget proposes $650 million to support the continued prototype Superconducting Super Collider.
- I have also proposed a 7 percent increase for the Human Genome Project with a goal of analyzing within 15 years the entire complement of human genetic material.
- In addition to a 12 percent increase in funding for NASA space technology development, my budget proposes $2.2 billion, an 11 percent increase, for fabrication and testing of critical components of Space Station Freedom.

We have also vigorously supported applied R&D by launching a series of new, high-payoff investments in critical areas of <u>applied research</u> and development:

- We secured a 25% increase in funding during the current Fiscal Year (FY 1992) for a new High Performance Computing and Communications initiative. This will assist development of a thousand-fold increase in computing capability and a one hundred-fold increase in communications speed by 1996.
- We launched a new initiative to speed research and development in advanced materials and processing, which can improve U.S. manufacturing performance and enhance industrial productivity and competitiveness.

- The FY 1993 budget includes a 26% increase for the National Institute of Standards and Technology. The generic applied R&D performed there will help spur U.S. industrial competitiveness.
- We have begun an expanded program to increase Federal investment in biotechnology research. This has applications in health, agriculture, and environmental protection. Our FY 1993 budget represents an increase of more than half a billion dollars for biotechnology research since FY 1991 alone.
- We proposed almost $1 billion for energy research and development designed to carry out the National Energy Strategy, improve America's energy security, and reduce dependence on imported oil.
- As part of this effort, my Administration established the U.S. Advanced Battery Consortium, a jointly-funded, four-year effort to develop an advanced battery for an emissions-free electric car. The FY 1992 budget included a 40% increase for batteries research and development.
- And we launched a new program to provide grants to industry to deregulate the development of generic technologies such as superconductors, semiconductors, and displays.
- Finally, five regional manufacturing technology centers have been established as focal points for the distribution of modern manufacturing tools such as computer-aided design, numerically controlled machines, and robotics.

Besides funding research, we have also placed new emphasis on the way national science policy is formulated. For example:

- We upgraded the Science Advisor to an Assistant to the President, established a high-level President's Council of Advisors on Science and Technology (PCAST), and revitalized the Federal Coordinating Council for Science, Engineering, and Technology (FCCSET).
- I announced my intention, in our U.S. Technology Policy, for this Administration to work cooperatively with the private sector to develop other generic technologies that will boost economic growth and help meet long-term national needs.
- And we established a new working group on Commercializing Federal R&D under the Council on Competitiveness, which Dan Quayle has so ably run, to increase the transfer of Federally funded R&D to the private sector and to identify and help remove barriers to the private sector's ability to bring new

technology products and services to the market.

Second, we have put forward tax policies to promote long-term investment:

- Every year I have been in office, I have proposed making the tax credit for Research and Experimentation permanent, thus providing increased incentive for private sector investment. Congress has resisted, although it has provided a series of short-term extensions of the credit -- most recently for six months. Paradoxically, these extensions for short period have had the downside of increasing uncertainty and greatly decreasing the effectiveness of the credit in stimulating R&D. That has got to change!
- I continue to call for a reduction in the tax rate for long-term capital gains, in order to reduce the existing bias against financing through equity investment. The last time capital gains taxes were reduced, in 1978, the result was an explosion of new jobs and an increase in government revenues. I will continue to push for this critical reform.

Third, we have pressed our trading partners hard to open their markets to our exports. I believe that an open world trading system will enhance U.S. exports and maximize worldwide economic growth. Every increase of $1 billion in manufacturing exports results in about 20,000 U.S. jobs. So we have worked to knock down trade barriers and increase U.S. exports.

- We have worked hard to ensure a successful outcome of the Uruguay Round of the General Agreement on Tariffs and Trade (GATT). I insisted at the economic summit just past in Munich that America's competitors join in a common effort to reduce agricultural subsidies and other market access barriers; that they reduce them substantially, and that they protect intellectual property rights, and open their markets to American goods and services.
- In San Diego, I recently met with President Salinas of Mexico to put the finishing touches on a North American Free Trade Agreement (NAFTA) with Mexico and Canada. Trade liberalization with Mexico has already resulted in a doubling of U.S. exports to Mexico since 1986, creating 264,000 American jobs. A NAFTA will create one of the world's largest markets -- 360 million producers and consumers, with $6 trillion in annual output.
- During my trip in January to Asia, I proposed the U.S.-Asia Environmental Partnership, an effort

designed to enhance U.S. export and other commercial opportunities while addressing Asia's severe environmental problems.

Our fourth and final principle in enhancing productivity and competitiveness concerns preparing America's workforce to compete.

- We have invested heavily in improving mathematics and science education and will propose $2.1 billion in FY 93 Federal spending, an increase of $137 million, or 7%. Federal spending for math and science education is up 43% since 1990, and for elementary and secondary math and science education, we have more than doubled Federal spending.
- My Administration has also launched a new multi-agency initiative to strengthen teacher training, improve math and science curricula in schools around the country, and deploy key national assets -- such as our national labs -- in strengthening math and science education in our Nation's schools.
- This initiative nearly doubles the number of teachers receiving intensive training over the FY 1992 level and examines mechanisms to make excess Federal personal computers and scientific equipment available to local school systems.
- Finally, we have also initiated an historic, broad-based effort to improve America's schools. The program, AMERICA 2000, stresses accountability, performance measures, and giving parents a choice of the kind of schools their children can attend, whether public, private, or parochial.

IV. CONCLUSION

This four-part strategy -- basic and applied research, tax and regulatory reforms, opening up markets abroad, and preparing our workforce to compete -- is already working to bring America into the next century as the world's greatest commercial nation. We cannot turn our backs on the world market as others would have us do. We cannot compete in a world of accelerating technological change if we rely on the government to pick the economy's winners and losers. National industrial policy is a bullet train to bankruptcy.

But let government clear the underbrush by replacing burdensome taxation and regulation with simplified, stable policies, let American workers wield American technology, and there's nobody that can match American know-how.

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(Grady, 9/22/92)

PRESIDENTIAL REMARKS: NATIONAL TECHNOLOGY INITIATIVE
CHICAGO, ILLINOIS
FRIDAY, SEPTEMBER 25, 1992

Thank you, Governor Edgar, for that introduction. At a certain convention I attended last month in Houston, an 82-year old American named Ronald Reagan said something very revealing about our country. "Like most Americans," he said, "I live for the future."

It is that spirit which defines America, and it is that spirit which brings us together today.

A few weeks ago in Detroit, I presented my ideas for an Agenda for American Renewal. That Agenda is guided by my fundamental belief that the most important challenge we face as Americans -- the defining challenge of the 90s -- is to win the economic competition.

That's what our future plans must be all about. Getting ready to compete in an increasingly interdependent world. Our world is tied together as never before by new technology and new information systems. It is linked in seamless competition by the free flow of capital across borders. And, most importantly, it filled with new promise and new opportunity because of the explosion of new freedoms and new markets in places where the light of liberty had never before dared to shine.

Some will tell you that America is in trouble in this new world of opportunity. But I have a simple vision -- and that is to compete, not retreat.

In order to win that economic competition -- in order to win the peace -- we must <u>prepare</u> to compete. We need an <u>integrated</u>

strategy -- not one that places economic policy and foreign policy and domestic policy in three different boxes --because, in fact, they are related. My agenda ties them together, because that's what's required to make America safe and strong.

My strategy is based on opening markets, on preparing our workforce, on sharpening our competitive edge by investing in the future, on creating opportunity by training our workers and fixing our health care system, and on rightsizing government -- by cutting spending and holding the line against taxes.

That strategy is not without controversy. Some want to close access to our markets, and risk future growth in exports. Some in the Congress are today sacrificing our investments in the future to the irresistible appeal of spending on current consumption. Some believe that higher taxes will give us the money to have the government take over America's investment strategy. I want to talk to you today about which strategy will work for America.

Let's be clear about one thing: despite what the pessimists say, we have begun to succeed already in opening markets and becoming more competitive. Just look at our export performance over these past four years. We have increased exports by 40%. We have gained worldwide market share in manufacturing output. In just these last four years, our exports to Japan have grown 12 times faster than our imports. So we can win.

But in order to do so, we must sharpen the competitive edge of American business by investing in knowledge, in new ideas, and in the technologies we will need to compete. That is a key part of my

agenda. This should be no surprise, because knowledge is an historic American strength, and we must build on our strengths.

New knowledge and new technology will give us the chance to increase productivity -- to help the economy grow -- to create jobs. For proof of the relationship between technological success and job creation, we need look no further than here in Illinois. 588,000 jobs in this state are tied to high technology -- that's over 11 percent of Illinois' work force. Illinois is America's number one manufacturer of telecommunications equipment. So winning the race for new ideas, winning the technology race, means jobs for Illinois, and jobs for America.

By every measure, the United States leads the world in the generation of new knowledge. We have produced the most scientific literature, the most new patents, the most Nobel prizes. We cannot keep that lead without investing in new knowledge -- so my budget for this year represents a 35% increase over 1989 in basic research.

But basic research is only half the story. For America to lead, we need to take our ideas from the laboratory to the marketplace -- and do it more quickly. And that is where this Administration is making new strides.

Two years ago, we pulled every Federal agency together to launch a new program to develop the supercomputers of tomorrow -- computers 1000 times more powerful than today's -- within four years. Our vision is a Cray the size of a McIntosh -- a supercomputer you can put on your desktop.

We also proposed a nationwide network -- an information backbone that will transmit 1000 times more information than we can today in one second. This year, we've proposed over $800 million, a 23% increase, for this High Performance Computing and Communications initiative.

Last year, we launched another crosscutting technology plan -- an investment of over $1.8 billion in the materials of tomorrow. These new kinds of materials will help us make products that are stronger, lighter, and faster -- everything from cars to airplanes to military equipment. You've heard of "planes, trains, and automobiles" -- we'll be more competitive in all three with the investments we are making today in the development of advanced materials.

And that's not all. We've launched a $4 billion program in biotechnology -- and proposed to knock down the regulatory barriers that might prevent technologies in this area from helping us to cure disease, improve agricultural performance, and clean up the environment.

We've turned some of the expertise at the Federal labs toward the task of cleaning up the legacy of the Cold War -- forty years worth of accumulated environmental problems left from making the weapons that defended freedom around the globe. Winning the peace means protecting the public from these hazards, and managing dangerous materials in the Federal government's possession more responsibly in the future.

The key to all of these initiatives is partnership. We cannot move ideas and technologies from the laboratory bench to the

commercial marketplace without bringing people together -- business and government, universities and the Federal labs.

That's what this National Technology Initiative, or NTI, is all about. This is the eleventh NTI meeting we've had -- each in a different part of the country; each designed to get the word out that we've going to make it easier to deal with the Federal government as a partner. If you attend the workshops and visit the technology fairs, we hope you'll get a window on today's opportunities, and an early start on tomorrow's successes.

We've brought this cooperation to new heights. A year ago, I directed the Secretaries of Commerce and Energy to increase the number of cooperative research and development agreements signed between our Federal facilities and private partners. These CRADAs ((CRAY-DAHS)), as they are called, help speed the transfer of the most promising technologies to the private sector -- so they can be developed into commercial products and services.

And in the one year since that directive was issued -- we've doubled the number of these agreements. There are now more than 1,400 operating and in place. Computers. Ceramics. Environmental cleanup. We are achieving an unprecedented level of success in taking the best ideas from our labs and turning them into American products and American jobs.

In just a few minutes, we will sign several new breakthrough agreements. The first one involves two Federal labs and three industry partners -- working together to solve several problems at once. The agreement will determine the right mix for burning pelletized trash along with coal to generate electricity. The

results will be less sulfur dioxide emissions into the air, less trash overflowing in our landfills, and more jobs created in here in Illinois producing this new fuel.

A second one -- between Argonne Lab and Motorola -- will help improve circuitry for communications and electronics. A third will bring the Oak Ridge National Lab together with IBM to extend America's leadership in High Performance Computing. The fourth involves a partnership between General Motors and the National Insistute of Standards and Technology to develop new software to solve problems in automated manufacturing equipment.

These agreements bring the concept of partnership to life -- providing rules of the road, protection of patents and intellectual property, and other understandings -- so that technology transfer is not a concept but a job-producing reality.

This partnership will also take form in our Manufacturing Technology Centers. This Administration has established seven such centers around the country -- in order to help introduce new equipment and improve manufacturing processes for small and medium-sized firms. Just since 1989, more than 6,000 companies have used the services provided by these centers -- and we plan to start up four more next year.

In next year's budget, we will launch a new cross-cutting initiative to increase our investment in R&D into new technologies to advance the manufacturing process. Today's factories face a different set of challenges from those a generation ago. In the face of fast changing requirements, more flexibility is needed.

We want to advance the development of systems and software, of robotics and artificial intelligence, to make this flexibility possible for all kinds of companies. And the key is this: we will pursue with the private sector.

I have used the word partnership advisedly today, because it reflects a fundamental belief about the path to successful technology development. Our efforts to transfer technology from the labs, to invest in the most promising technologies of tomorrow, have recognized the fact that the private sector must commercialize these technologies.

We are providing the tools for the private sector to do the job. No investment that is not guided by this technology pull from the market is ultimately going to be successful.

And on this point, there is a real difference. The other side believes that government experts can pick the best technologies and push them out the door. My opponent's proposal is to create hundreds of centers, with money he will not have unless he raises your taxes. It is a prescription to "hurry up and wait." Rather than waiting to build more government buildings, I believe we should work to develop the technology we have right now. Rather than waiting for the bureaucrats and planners decide what's best, I believe we should build the kind of partnerships that allow the private sector to help identify and commercialize promising technologies in which we are pursuing leadership <u>today</u>.

Now, it's a political year, and my opponent has made a specialty out of saying things that sound good, but that aren't backed up by his record or his philosophy. And on the subject of

R&D, as on so many other subjects, Governor Clinton has truly earned his reputation as Governor Doublespeak.

Bill Clinton has told America that he would invest in civilian R&D -- and he has said flat out, with a straight face, that we have cut this investment. He must have been smoking something again on that one.

The fact is that this Administration has increased the Federal investment in civilian R&D by 28% just since 1989. We have increased basic research. We have increased applied R&D. We have invested in energy R&D and environmental R&D. Aeronautics and magnetically levitated high speed rail. Computing and communications. Protecting the public health and exploring the frontiers of space.

Now here's the best part. In each and every year that we have sent our budget to the pork-happy partisans on Capitol Hill, they have cut our R&D budget. They have spent it on water projects. They have spent it on providing subsidies to, get this, vacant public housing units. They have funded every pet project from mink research to subsidies for rich rural telephone cooperatives who just happen to give big contributions to Congressmen.

This year, we proposed an increase for the National Science Foundation to advance our plans in both basic and applied research. And even as Governor Clinton called for more investment, and even as his team consults with the Democratic leaders on Capitol Hill every day, that increase was wiped out.

So when Governor Doublespeak looks you in the eye and says he wants to invest in civilian R&D, I say -- we're already doing it. And your allies in Congress are not helping.

Governor Clinton says he wants to take every dollar we save in defense R&D and spend it on civilian R&D. In this year's budget, I increased civilian R&D by 8%, and defense R&D by only one percent. Every cent from defense went to civilian.

But get this, when we sent the Congress a proposal to transfer $50 million from weapons research to promote the kind of technology partnerships we're talking about today, they denied the transfer. And last week, when we proposed to transfer another $186 million from unneeded nuclear weapons materials production to new technologies which will help stop the spread of weapons around the world and help clean up our weapons facilities, Congress denied most of that transfer, too. They wanted to spend the money on pork instead.

So when Governor Doublespeak looks you in the eye and says he's for shifting R&D funds from defense to civilian, you tell him we're already doing it. But you might ask him to speak to his partners in pork on Capitol Hill.

And here's the best one of all. Bill Clinton says that he's for our proposal to make the R&D tax credit permanent, and for a modified reduction in capital gains taxes. At the exact moment he is looking the American people in the eye and telling them these things, his allies on Capitol Hill are blocking their enactment. So when Governor Doublespeak looks you in the eye and says he's for

investment incentives, tell him we've already proposed and financed them, but let's cut the partisan games and pass the bills.

I'm afraid that Bill Clinton on the subject of technology is like Bill Clinton on any subject -- promise them anything, but keep two fingers crossed behind your back.

Behind my opponent's charges lies the worst kind of cynicism -- saying things he knows to be not true with the straight face of the professional prevaricator.

For the real story on Bill Clinton and technology, let's look at the record.

The most recent report card on technology indicators, published by the Corporation for Enterprise Development, rated Arkansas near the very bottom among states in virtually every technology-related factor. For "technology resources", Arkansas received an "F". And Bill Clinton has allowed Arkansas' incubator program to die on the vine for lack of state funds.

Compare that to Illinois under Jim Thompson and Jim Edgar. Right here at the University of Chicago, they've helped to launch exactly the kind of partnership I'm talking about. The ARCH Development Corporation, a partnership between state and university and private sector, helps to identify and develop the most promising new technologies coming out of this great University and out of our Argonne National Lab. This cooperative venture has helped to launch new companies that are doing everything from improving the use of superconducting liquids to improving the lighting of computer screens.

Jim Thompson and Jim Edgar have started, in partnership with the Federal government and the private sector, five technology centers -- working on everything from advanced cement based materials to magnetic resonance.

When the chips were down in Arkansas, Bill Clinton did not deliver on technology. And when "Promise them Anything" Clinton teams up with "Spend it on Anything" Congress, Lord knows what they will deliver.

The fact is that Bill Clinton talks about the future, but his ideas and his support come from the patrons of the past. For these and so many other reasons, it is clear that Bill Clinton is the wrong man for America.

One of the most quintessentially American figures of our time, John Wayne, once said that: "Tomorrow is the most important thing in life."

When the shouting is finished, when the campaign winds down to its end, it will come down to a very personal and serious decision for every American. What kind of tomorrow do you want?

Do you want a tomorrow in which we look forward and take on the competition, or one in which we turn inward in retreat?

Do you want a tomorrow in which we invest in the technologies that can make us more competitive, or in which we allow the patrons of the past to spend our future away?

Do you want a tomorrow in which work and innovation are rewarded, or in which we turn back down the path of higher taxes and more regulation?

Winston Churchill once said about elections: "What it all comes down to is a little man, in a little booth, marking a little "x" on a little piece of paper."

When Americans step into that booth this year, they will face a fundamental choice about the kind of future they want. I have come to Chicago today, to this city that works, to offer my ideas for a future full of promise. A future in which America works, America competes, and America wins.

I ask you to join me in this future. America today faces opportunities that previous generations only dreamed about. Let us seize them.

Thank you, God bless you, and God bless the United States of America.

# # # # #

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

MIKE FROMAN —

HERE IS THE CONFERENCE AGENDA. I AGREED TO DO THE KEYNOTE ADDRESS ON OCT. 6 AT 8:30 A.m.

RBP 9-17-92

DATE: 9/11/92

TO: Ann Haimes

ADDRESS:

TELEPHONE NUMBER:

FAX NUMBER: x 2878

FROM: **RALPH P. BRESCIA**
SPECIAL ASSISTANT TO THE DIRECTOR

TELEPHONE: **(202) 456-7116**

FAX: **(202) 395-3261**

NUMBER OF PAGES, INCLUDING COVER SHEET 11

COMMENTS:

Per request.

___ **If checked, please confirm receipt.**

DRAFT: 5/28/92

TARGETING R & D FOR COMPETITIVE ADVANTAGE*
Proposed Date: October 6, 1992
Proposed Sponsor: Michael K. Young, Deputy Under Secretary of State for Economic and Agricultural Affairs
Site: Loy Henderson Conference Room and Diplomatic Reception Rooms, Department of State

8:00 - 8:30 Registration and Coffee

8:30 - 9:15 **INTRODUCTION:**

*Ambassador Hume Horan
AFSA President

Keynote Address: Research and Development: The Cutting Edge of Competitiveness

Speaker: D. Allan Bromley
Science Advisor to the President

Introduced by: *Michael K. Young
Deputy Under Secretary for Economic and Agricultural Affairs
Department of State

* Individuals identified with an asterisk are confirmed. Approximately one-third of the individuals here indicated have not yet been notified that they are under consideration, meaning there is still considerable flexibility in the program. Please submit comments or suggestions to John J. Harter, AFSA (Tel. 202-338-4045; Fax 202-338-6820).

9:15 - 10:45 **PLENARY PANEL:** How can the federal government most effectively encourage and support private sector R & D relating to emerging technologies?

Moderator: *Kent Hughes
President
Council on Competitiveness

Panelists: Robert White
Under Secretary of Commerce for Technology Affairs

Walter Robb
Chief, R and D
GE

*Brian M. Rushton
Senior Vice President, R and D
Air Products and Chemicals, Inc.

Walter E. Massey
Director
National Science Foundation

10:45 - 11:00 Coffee Break

11:00 - 12:30 **CONCURRENT PANELS**: How the U.S. government can and should promote commercially useful research and development -- a closer look.

PANEL A: Macroeconomic policies. What macroeconomic policies would create a climate that would optimize private sector R & D?

Moderator: C. Fred Bergsten
Director
Center for International Economics

Panelists: Sidney Jones
Assistant Secretary for Economic Policy
Treasury Department

George Hatsopoulos
Chairman and President
Thermo Electron

Jerry Jasinowski
President
National Association of Manufacturers

Michael Jacobs
Harvard School of Business (?)
Author of Short Term America

PANEL B: **The Federal laboratories:** Can they contribute to U.S. competitiveness? How could federal research be made more relevant to industry priorities?

Moderator: John Armstrong
IBM

Panelists: *Deborah Wince-Smith
Assistant Secretary for Technology Administration
Department of Commerce

Al Trivelpiece
Director
Oak Ridge Laboratories

*Irwin Pikus
Director, Science and Technology Program
Center for Strategic and International Studies

*Graham Mitchell
Director of Planning
GTE

PANEL C: **Military R & D:** How can the contribution of military R & D to commercially useful innovations be optimized in the 1990s?

Moderator: Senator Jeff Bingaman

Panelists: Eugene Wong
Assistant Director for Industrial Technology
OSTP

Donald M. Kerr
President
EG&G

*Albert C. Westwood
Vice President, R and D
Martin Marietta Corporation

*Erich Bloch
Senior Fellow
Council on Competitiveness

12:45 - 2:15 **LUNCH:** Benjamin Franklin Diplomatic Reception Room

Speaker: Senator Al Gore: A Congressional perspective on research, development, competitiveness, and the role of the United States in a rapidly changing world.

Introduced by: *Michael K. Young

2:30 - 3:30 **CONCURRENT PANELS:** A closer look at the impact of global economic integration and international competition on R & D.

PANEL D: International trade and investment in high technology products: What role do trade and investment play in stimulating or inhibiting R & D?

Moderator: Roland W. Schmitt
President
Rensselaer Polytechnic Institute

Panelists: Olin Wethington
Assistant Secretary for International Affairs
Treasury Department

*Richard W. Heimlich
Director of International Strategy
Motorola

*Gerald J. Mossinghoff
President
Pharmaceutical Manufacturers Association

*Alan W. Wolff
Dewey, Ballantine, Bushby, Palmer, and Wood

PANEL #1: Other governments: What can the United States learn by examining the R & D policies of its foreign competitors?

Moderator: *Peter Doer
Executive Vice President
W. R. Grace and Company

Panelists: *Edward Malloy
Science Counsellor
American Embassy
Tokyo, Japan

*Kenneth P. Wolski
Vice President, Strategy and Policy
Merck Research Laboratories

*John Bush
Vice President, R and D
The Gillette Company

John P. McTague
Vice President, Technical Affairs
Ford Motor Company

PANEL F: Universities and private research laboratories: How can non-government and non-commercial laborities contribute to U.S. competitiveness? Do foreign corporations exploit U.S. R & D more effectively than American corporations do?

Moderator: Linda Stuntz
Acting Deputy Secretary
Department of Energy

Panelists: *Fred Bernthal
Deputy Director
National Science Foundation

Kumar N. Patel
Bell Laboratories
AT&T

S. A. Heininger
American Chemical Society

Martin Rachmaler
University of California at San Diego
and President, Association of University Technology Managers

2:30 - 2:45 **COFFEE BREAK**

2:45 - 4:45 **FINAL PLENARY: Putting It All Together:** What should the President of the United States recommend to the Congress and the American people in January 1993 in order to strengthen the contribution of R & D to the competitiveness of the American economy?

Moderator: Curtis Bohlen
Department of State

Panelists: *Kent Hughes
C. Fred Bergsten
John Armstrong
Senator Jeff Bingaman
Roland W. Schmitt
*Peter Boer
Linda Stuntz

5:00 - 6:30 **RECEPTION:** Benjamin Franklin Diplomatic Reception Room

Host: Michael K. Young

Possible alternates to panelists listed above:

Lew Allen
Director
Jet Propulsion Laboratories

Lou Branscomb
Harvard University

Harry Broadman
Special Assistant to the Chairman
Council of Economic Advisors

Ray Kammer
National Institute of Standards and Technology (NIST)

Fumio Kodama
Harvard University

Arthur Kornberg
Professor of Biochemistry
Stanford University

Dick Messinger
Milliciron
Cincinnati, Ohio

Ted Moran
Georgetown University

Henry Nau
George Washington University

David Robinson
Carnegie

Ian Ross
AT&T

Alexander Trowbridge
Consultant

ABOUT THIS SYMPOSIUM

An emerging consensus among the American people appears to perceive research and development as the cutting edge of American competitiveness in an increasingly globalized and rapidly changing economy. But there is no clear agreement among industrial managers, academic analysts, government officials, and politicians as to the role government should play in stimulating commercially useful innovations; nor do corporate managers have recourse to meaningful and reliable guidelines as to how they can select from a bewildering array of emerging technologies those that will ensure their long-term financial success.

The symposium will feature seven expert panels that will seek to define precisely how the United States can and should increase the contribution of research and development to the competitiveness of American goods and services in world markets, specifically with respect to the following questions:

o What is the optimal division of responsibility between the government and industry, looking toward commercially useful new technologies?

o What macroeconomic policies are most likely to create the economic environment that would be most conducive to effective private sector research and development?

o What can be done to ensure that government laborities contribute to the competitiveness of American goods and services in foreign markets?

o Can the relevance of military research and development to the commercial production of goods and services be enhanced?

o What trade and foreign investment policies should the United States pursue to ensure that the living standards of the American people are optimal?

o What can the United States learn by examining the research and development policies of its foreign competitors, especially Japan?

o How can the contribution of American universities and private research laboratories to U.S. competitiveness be enhanced?

A final plenary will seek to distill views expressed at the symposium, looking toward the recommendations the President of the United States might make to the Congress and the American people in 1993.

The program is designed to be of particular interest to enterprises seeking to ascertain the optimal role of research and development in their own operations, economists concerned with evolving trends in the American economy, and government officials responsible for administering programs that affect research and development activities in the United States.

The symposium will be hosted by Michael K. Young, Deputy Under Secretary of State for Economic and Agricultural Affairs. D. Allen Bromley, Science Advisor to the President, will be the keynote speaker; and Senator Al Gore will be the featured luncheon speaker.

Open dialogue between attendees and panel experts will be encouraged.

Notes on Technology Policy

Smith, American Science Policy Since WWII

36 Post-war consensus based on belief that basic research drove the system, that the government would have to nurture the system, and that this would take place in the universities.

Government would also support applied research to the degree that it was related to a mission, i.e. where Government was the primary consumer.

37 Commercialization would automatically follow from government support of basic research and more applied researcg and development operations -- through market innovation.

Light regulation because science was basically benevolent.

39 Consensus allowed federal support for R&D to grow 14% annually in constant dollars between 1953 and 1961,

43 Relationiship between basic research and applications is like a back from which deposits may be withdrawn. Cannot depend on importing basic knowledge for research.

44 Result was finding that university research must be funded through matching grants that relied on iuniversity administrations to save costs.

45 USG had to provide secure funding and maintain university autonomy, but existence of funding itself would affect the institutions.

National Science Foundation founded on quality review, discretionary funding, and regional spread. Funding would focus on specific projects, rather than institutions per se.

46 Peer/merit review plus regional spread, rather than state-by-state allocations.

This system coexisted with elements of institutional support, formula funds, and continued assistance from corporate philanthropy, but project focus defined the essential character of the post-war system.

48 Meanwhile, events pushed U.S. research toward a mission orientation. Basic research was viewed as a desirable complement to more mission-oriented research. Basic research tilted toward the practical ends of government.

50 National defense drove basic research until 1965. In 1963, 93% of all federal R&D funds came from DOD. AEC, and NASA.

51 In this context, NSF's role was to support basic science as

a whole, superimposing a national perspective on the practices of various agencies, and filling in gaps of mission-oriented projects. But had onle 7-10% of basic research funding. In the mid-1960's the NSF accounted for less than 2% of federal R&D budget and slightly les than 15% of all support for basic research.

52 Government research establishments focused on applied mission-oriented research. Universities would do most of the basic research, and industry would get most of the funding for development. In-house research facilities spent about half of their basic research funds themselves and contracted the rest out.

57 In government facilities, applied research was emphasized, but government scientists -- in order to be good consumers of contracted basic research -- sought to keep up with basic research and the most advanced industrial applications.

Facilities have pretty well retained their role, with some controversies over contracting out too much responsibility to unaccountable institutions and technology transfer.

58 No conscious idea about how technology should move from discoveries to commercialization. All that was needed was market incentives.

Universities would train scientists as a by-product of basic research, some of which would work in industry. Government would stimulate private sector by focusing on national priorities and by providing a market for some products.

59 Fundamental belief that market incentives, together with some support for basic research, would lead automatically to commercialization. Government's assistance would be in the form of tax and patent policy.

62 Industry assumed a stable macroeconomic environment with steadily increasing demand for new products, combined with fixed exchange rates.

63 Regulation of science was the fourth pillar of post-war technology policy. The other three were support for basic research, national facilities, and commercialization laissez-faire.

64 Saw no problem with regulating and promoting new technology simultaneously. Technology seen as basically good.

72 Consensus lasted until 1970, when much of the conventional wisdom was seen as naive. No longer could scientists, like other members of the government community, assume that policy would be managed much the same way after the war as it was during the war. There was a decline in broad public

support, deference to executive leadership, and subordination of partial interests to the interests of the whole.

73 1960's crisis because rate of expansion declined and funding was redistributed.

74 Attack on rationalism social structure and corporate use of technology. 1966 Johnson speech emphasizing applications not basic research.

75 By 1966, decrease in money for basic research in constant terms; greater pressure for immediate payoffs; growing rift on universities concerning the role of defense contracts; public concern that unchecked technology was not necessarily benign. Right wanted less basic research; left did not trust defense contracts or technology.

76 Vietnam War undermined faith in technological accomplishments.

78 Old consensus: important of basic research, need to support it through a variety of sources and especially the mission agencies, and principle that scientific merit should govern funding decisions.

Resulted in directing funding away from promising results to strengthening a more geographically diverse set of institutions. NSF charter amended to allow funding of applied research, social sciences.

81 Growth of funding for R&D slowed, reversed, and regained slowly as the old consensus crumbled. Most were less interested even in mission-oriented basic research.

82 Government cuts back on funding for project supplementing mechanisms, creating a quiet crisis in universities.

85 Neither Bush nor Steelman thought much about commercialization. If the U.S. maintained leading edge universities, new technology for national security, economic growth, job creation, and social welfare would be generated almost automatically. Govenment policy should, therefore, focus on supporting research and training scientists, etc.

87 Kennedy began study of market imperfections that prevented commercialization of technology. There was a need to stimulate civilian technology because government monopolized a good portion of the talent pool on projects that did not have immediate economic effect. Needed to expand pool so that needs of civilian and defense were not in conflict. 1965 State Technical Services Act focused on exchanging technical information for better use.

88 There were calls to redirect scientists away from aerospace, but government found it inconclusive that the private sector neglected innovation.

89 Commerce Department's Robert Charpie Report called for regulatory relief. OST called for R&D housing support, but Budget Bureau rejected both. No clear objective for civilian technology or commercialization of research.

91 Nixon tried to impose coherence, but there was division and fundamentally ideological perspectives prevented the funding of projects that belonged more in the private sector.

92 Nixon did succeed in funding some energy research, but Ford tried to limit demonstration programs (i.e. New Technologies Opportunities). Ford's OMB truied to restrict federal funding to those projects in which the government was the consumer, in which there was market failure, or in which there was a strong national consensus as to an urgent need. Left energy, space, and basic research, but phased out some of Nixon's programs.

93 Deregulation was part of Ford's strategy because it would allow the market to play a less-encumbered role.

Carter: move toward regulatory reform, increased emphasis on support for basic research, and application of more stringent market tests for large demonstration projects.

94 Carter proposed spending R&D on various generic technologies and launched university-government-industry projects.

95 Business leaders suggested that these programs were less important to technological innovation than broad economic policy, such as tax reform: tax credit and accelerated depreciation.

Promote commercialization through transfer of technology from federal labs to state and local governments and to provate sector. General dissatisfaction with NSF's activities in applied R&D and push toward greater centralization. Also, increased support for basic research.

102 U.S. remains highest R&D although other countries have increased relatively. Germany and Japan have spent higher ratios of R&D to GNP.

103 On output, U.S. has slipped in market share for high-technology industries

108 Reagan accelerated four trends: strong belief in basic research, disenchantment with large demonstration projects, deregulation, more optimistic view of science's contribution to defense/health/welfare -- basically the post-war

consensus.

Supported basic research despite general budget cuts, but recession, defense increases, withou cuts in domestic spending led to economic crisis.

111 Revival of faith in basic research

119 Aging equipment base at universities with tumult during 1960s and 1970s

120 Industry changing to employ more R&D as shift toward service sector, challenges from abroad, advent of research parks for unitverity-industry collaboration,

122 Turn around real decline in R&D spending. Carter had issues message that basic research could seolve nation's problems.

129 Reagan rejected spending for bringing technologies to market. Defense R&D focused primarily on development. Non-defense R&D was cut $3.3 billion. Tax reductions were to be the incentive for innovations.

130 Support for techological development related to specific missions, as well as other technologies that required long lead times for initial development. The main federal responsibility was to provide an environment that encourages private sector R&D investment: research, spending, regulatory relief, and taxes.

131 Twin priorities of defense and basic research. SDI as an example of Reagan's reliance on technology to solve his problems.

133 Chart of R&D increases/decreases

134 Most defense R&D was mission-oriented, but some amount went to independent R&D.

135 But concern about security constrained flow of information and transfer of technology from military to civilian use,

Reagan initially supported innovation by minimizing government's role in the economy, cutting back budget, clarifying antitrust and patent laws, and streamlining regulations and taxes: R&D tax credit of 23% on new research expenditures, accelerated depreciation, and investment tax credit.

137 Support for energy research collapsed with prices of oil.

138 Dilemmas for most admnistrations' innovation policy: unsure at which point along the stream of innovation intervention would be most effective; difficulty separating effects of

specific innovation policies from context of macroeconomic policies as a whole. Congressional pressure to do something in light of recession of 1981-82 and growing international competition.

1985 Report of Commission on Industrial Comepetitiveness supported free trade, but advocated greater intervention in trade policy, technological development, and sectoral policy. WH gave report a cool reception and Council on Competitiveness continued along the same line.

139 Reagan moved toward fostering greater innovation but within basic philosophy. Federal Technology Transfer Act of 1986 expanded commercial transfer of R&D research in federal laboratories. Gave federal labs the athority to engage in cooperative R&D agreements with firms and consortia.

140 Omnibus Trade Act of 1988 renamed National Institute of Standards and Technology and gave power to assist industry to develop technology, to modernize manufacutring base, and improe product quality, and to commercializew new technology rapidly.

1987 began Sematech with private-public cooperation. Tax Reform Act of 1986 left R&D tax credit but lessened it from 25 to 20%.

141 Space station, superconducting colliders, new NSF science and technology centers: almost an industrial policy.

Reagan combined market forces with intervention to provide incentives, to remove impediments, and sometimes to provide direct support for particulay developments.

Questions: What effect does the climate of government activity have on the pace and direction of innovation in the private ector? Does direct support from the government displace or induce additional private industrial research? Do industries and univerisities cooperate more effectively with, or without, government as a third partner?

143 Defining the role of DoD proved difficult because it was unclear how much it should get involved in nurturing civil technology. Mansfield Amendment et al militated in favor of mission-seocific role.

144 Ultimately, DoD adopted a Manufacturing Technology Program to provide modest matching funds to encourage defense firms to upgrade manufacutring capabilities. Also aided university infrastructure.

145 Deregulation pursued economically, using scientific knowledge better in health and environment, and imposing fewer constraints on scientific research itself.

154 Intersection of national security and other national interests remained at the central core of science policy, as it was in the immediate postwar period.

155 But high proposed R&D start-ups had to be accompanied by a new commitment to prioritizing.

157 Reagan came in embracing science and technology with zeal and a clear vision, but made compromises as doctrine collided with reality.

167 Mission-oriented diffused technology works ok when departments have well-defined missions, but it does not tend to cover adequately training, research, and technical infrastructure.

185 Problems with commercialization: find it difficultto produce reliable products, pay insufficient attention at the design stage to the likely quality of the manufactured product, take too long to develop a product, reactive approach to problem solving, underexploit potential for continued improvement in products and processes.

190 Purpose of policy: to disseminate existing knowledge or to ensure a steady supply of new knowledge.

OSTP, 1992 Report

5 New technologies are developed and deployed at an increasingly rapid pace; they diffuse rapidly through the global market place and are quickly duplicated. Improvement of manufacturing process itself is key to increased success.

6 Changes in national security and environmental concernn affect R&D, S&T.

7 Blurring of basic and applied research because R&D requires advanced instrumentation. Technology gives rise to improved S&T tools.

8 U.S. spends more on R&D than the other four countries combined, and the Federal role in basic research is particularly significant. However, the growth of non-federal spending outside basic research has slackened.

9 Increased federal spending on creation of new knowledge, better organization of science policy function.

10 But increased federal spending is not enough for S&T. Also need improved capital formation through reduced capital gains tax, improved education of labor force, R&D tax credit for private sector, more cooperative anti-trust environment, and level playing field in international trade.

Accelerated transfer of Federally-supported new knowledge from the lab to the private sector.

15 Basic research provides the foundation and helps train new scientists.

17 Industry-financed R&D alone accounts for 1/3 of annual average increase in productivity.

Social return + risk + long lead time for development make this a legitimate federal function.

18 1991: $3.5 billion on basic research, 14.5 or 61% from government; 350% real growth since 1960; 51% real growth since 1980. Only 12% of basic research conducted in federal labs.

48 Bush has proposed a strategic Federal investment to advance the frontiers of high performance computing to accelerate commercialization and utilization: High Performance Computing Systems, Advanced Software Technology and Algorithms, National Research and Education Network, Basic Reseaech and Human Resources.

49 Partnership of government, industry, and universities to spped translation of lab results to new products.

68 In biotech, Bush supports basic research and research training, Human Genome Project, etc.

69 Fundamental basic research needs to be coupled with thematic research and with development of generic enabling technolofy tools which have application over entire spectrum of U.S. industries. This takes place at interface of biology and engineering, rather than basic bological research. In addition to supporting this, the Council on Competitiveness supports transfer of technology from Federal of Federal-supported labs to marketplace.

Also, risk-based regulation rather than process-oriented regulation.

76 Bottleneck between lab and industrial-scale production. This requires biotechnology process research that can apply generically to the development of numerous products.

77 Process research neglected because peer review placed emphasis on basic research rather than applied. Market insufficient because small companies do not have the resources and large companies get proprietary.

U.S. will need to improve its ability to scale-up lab processes to industrial application, plus risk-based regulation and free-market atmosphere.

84 Defense spending has decreased but spending on defense R&D has continued to increase. Fed labs play a particularly important role.

94 Department of Commerce assist competitiveness of U.S. businesses abroad, and particularly high tech sectors which constitute about 1/5 of U.S. manufacturers.

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

October 2, 1992

MEMORANDUM FOR ALLAN BROMLEY

FROM: **STEVE OLSON**

SUBJECT: **SPEECH TO AMERICAN FOREIGN SERVICE ASSOCIATION CONFERENCE**

Next Tuesday at 8:30 you are scheduled to give the keynote address at a conference being sponsored by the American Foreign Service Association. The conference is being held in the State Department (Room 3644), and about 150 businessmen and government officials are expected to be in attendance. You will be introduced by Michael Young, Deputy Under Secretary for Economic and Agricultural Affairs at the State Department.

Attached are draft remarks for the event. Though they have allotted 45 minutes for your talk, the conference organizers would prefer that the time be divided evenly between prepared remarks and questions. I will be in the office Monday afternoon to make changes to this draft and to print out a large-type version.

cc: **Ralph Brescia**

Sorry Mike. I had a 1:30 meeting that I'd overlooked. Here's the speech for tomorrow. DAB asked me to insert a few lines from his 9/24 speech (attached), but time constraints will probably limit what he can do.
Steve

[DRAFT]

[October 2, 1992]

RESEARCH AND DEVELOPMENT: THE CUTTING EDGE OF COMPETITIVENESS

D. ALLAN BROMLEY

Assistant to the President for Science and Technology

Executive Office of the President

American Foreign Service Association

State Department

Washington, D.C.

October 6, 1992

A week ago last Friday I was in Chicago with President Bush, where the President spoke to the eleventh meeting of the National Technology Initiative. Let me read you a passage from that speech, because it demonstrates what I believe is a thorough recognition of today's realities. He said:

> In the old days, economists would tell you that capital and labor were the two ingredients that you needed to make the economy product. Today, it's universally accepted that a third ingredient is needed: knowledge. We need the best ideas in the world -- and America has always had them.

George Bush has always believed, as the title of my talk puts it, that research and development are at the cutting edge of competitiveness. The result has been an administration that has done more, and fought harder, for science and technology than has any administration in recent history.

Of course, investments in science and technology do not pay off immediately. Like investments in education or preventive children's health care, investments in science and technology sometimes do not pay off until many years after they are made. But by making these investments now, we are building the foundation for future advances. And by continuing to emphasize R&D, we will do much to ensure the future competitiveness of the United States.

In making these investments, George Bush is following in the footsteps of another Bush -- no relation, he assures me -- who charted the course for the last half century of federal R&D. In Science -- the Endless Frontier, Vannevar Bush wrote in 1945 that:

> It has been basic United States policy that government should foster the opening of new frontiers. It opened the seas to clipper ships and furnished land for pioneers. Although these frontiers have more or less disappeared, the frontier of science remains.

Today, some might wonder whether the frontier of science remains as endless as it was then. Indeed, a recent document on the travails of the scientific community was entitled "Science: The End of the Frontier?" But even a cursory glance at ongoing research reveals that the promise of science is, if anything, even greater today than it was following World War II.

In biomedicine, for example, we are on the verge of a watershed in human health care, thanks to new knowledge and the development of biotechnology. After centuries of fighting against disease, we have reached the point where we can begin to focus on improving the quality of life for all of our citizens. To take just one example, the Bush Administration is supporting a Children's Vaccine Initiative, which has as its objective the development of a vaccine that can protect against 20 to 30 diseases with a few injections or oral administrations at or shortly after birth. If successfully developed, such a vaccine would have tremendous benefits not only to children in this country but to children around the world, eliminating immeasurable human suffering.

In information technology, modern computers and communications have linked the world into a global network of knowledge. If current trends continue, we can expect to have the power of today's supercomputers on our desktops within 15 years, and there is no end in sight to continued advances. As I have said on other occasions, the day that you wake up to discover that your toaster is smarter than you are will mark a turning point in human history.

In the area of the environment, though we face very serious challenges, new knowledge in chemistry, physics, and biology has made it possible to approach the area of toxic waste in an entirely new fashion. We can think not of disposing of toxic waste but rather of eliminating it entirely. For example, the extraction of useable -- and often quite valuable -- compounds from waste streams can reduce waste significantly, and the residues can now be treated until they are environmentally benign.

These examples can be multiplied endlessly. The conclusion is inescapable: we are on the verge of a golden age of discovery in science and technology, and the benefits to people throughout the world will be unparalleled in human history.

Science and Technology in the Bush Administration

This Administration has sought to derive the maximum benefits possible from the endless frontier of science and technology. First of all, funding for R&D has risen dramatically under George Bush. If Congress enacts the President's FY 1993 requests for R&D, civilian R&D will have gone from about $21 billion in FY 1989 to over $30 billion, an increase of 43 percent. Basic research will have gone from $10.6 billion to $14.3 billion, an increase of 35 percent. Even defense R&D will have gone up in current dollars, though the total defense budget has fallen.

What makes these increases particularly remarkable is that they occurred when real growth in the U.S. domestic discretionary budget has been essentially frozen to the rate of inflation as a result of the budget agreement made between the President and Congress. Increases for research and development have therefore had to come at the expense of other programs in the domestic discretionary component of our federal budget with very strong and vocal constituencies. And since research and development make up one seventh of our domestic discretionary budget -- and about an equal percentage of the defense budget -- they form very large and tempting targets.

In addition to increasing its support of R&D, the Bush Administration has been taking a number of actions to enhance the effectiveness of that support. For example, under an interagency body that I chair known as the Federal Coordinating Council for Science, Engineering, and Technology, it has undertaken special government-wide initiatives in the areas of high performance computing and communications, biotechnology, materials science, global change research, and mathematics and science education.

These initiatives focus the efforts of the entire federal government on high-impact areas of science and technology and foster new and productive partnerships between the federal government, universities, and industry. In particular, with all of the FCCSET initiatives we have worked closely with private industry to integrate their needs into the program. For example, in the High Performance Computing and Communications Program, we have now instituted nearly all of the recommendations that emerged from

the review of the program by the Computer Systems Policy Project.

The initiatives are widely seen, both inside the United States and outside, as models for organizing coherent interagency programs. In fact, one of our leading business schools has put together a case study of one of these initiatives.

For next year's budget, FCCSET has also approved a new interagency program in advanced manufacturing technology. As the President said in his speech in Chicago:

> In next year's budget we will launch a new initiative to increase our investment in R&D into new technologies to advance the manufacturing process. Today's factories face a different set of challenges from those of a generation ago. In the face of fast changing requirements, more flexibility is needed.

In addition to these activities under FCCSET, this Administration has taken many other steps to improve the development and deployment of technology:

- Through the National Technology Initiative, the federal government is seeking to increase greatly the flow of scientific and technological know-how from government and university laboratories to industry. We have over 700 federal laboratories in this country, and together they are an unparalleled resource. But we need to link their efforts more closely to those of industry so that they contribute more directly to our competitive edge.
- In 1990 this Administration published, for the first time ever, a statement of "U.S. Technology Policy" that laid out the dimensions of the federal government's support for technology. That document detailed the many different ways in which federal policies affect technology and the ways in which policies have been adopted to support technology.
- In that document and in a number of other places, this Administration has also made a clear commitment to support the development of generic, precompetitive technologies that are important in both the public and the private sector. In this way, the federal government can leverage the resources of the private sector, helping

The North American Free Trade Agreement and GATT negotiations are clear examples of the mutual benefits that can be gained by reducing trade barriers. The same benefits apply to maintaining free and open communication in science and technology. There is no question that other countries are building on our basic research. But we unquestionably gain much more by maintaining an open system than we could by trying to build barriers.

Furthermore, I am convinced that what is true of basic research is equally true -- with a very few specialized exceptions for national security reasons -- in technology. Rather than restricting access to our technology, we gain by developing capabilities greater and, where possible, more quickly than our competitors.

What we do need to do, however, is to become much better negotiators in our international science and technology interactions. In this way, all of the participants in such negotiations will receive reciprocal benefits, which will ensure that technology is a positive-sum game.

A particularly important consideration in such negotiations is the question of intellectual property rights. As science and technology become the path to prosperity in country after country, those countries will also be making discoveries that they want to protect. The same provisions that we are requiring in our international science and technology agreements will be of great benefit to them.

Conclusion

This area of science, technology, and trade demonstrates one of the many ways in which foreign policy and domestic policy are becoming intertwined. It is no longer possible to separate the two, and that is why this Administration has put together an integrated program that fully recognizes America's position in the world and the opportunities we have to lead the world into a new era of peace.

Science and technology will be an essential part of our leadership. We have long been known for the strength of our science and technology, and the resources that we

companies convert new technologies to new products and expanded market share.

- By establishing the President's Council of Advisors on Science and Technology, which I chair, George Bush has been receiving input from a distinguished group of academics and industrialists on such matters as the economy, education, national security, and scientific research.

- My office is also in the process of reestablishing a council to address intergovernmental science, engineering, and technology issues -- called InterSET -- which will greatly increase the exchange of information between federal, state, and local governments in science and technology.

- Finally, given the tremendous changes that have occurred both nationally and internationally during this Administration, it is now appropriate for us to undertake a completely fresh look at our entire R&D enterprise. For example, we are examining the missions and organization of our federal laboratories to make sure that the country is receiving the best possible return on its substantial investments in them.

International Cooperation in Science and Technology

Of course, many other actions of the federal government, in addition to its policies toward R&D, affect the development and deployment of technology and, through technology, our industrial competitiveness. Let me focus on one of these that would be of particular interest to you -- our international relations in science, technology, and trade.

In my view, science and technology are among the most positive of positive sum games. All countries in the world economy benefit when individual countries develop expertise in science and technology. The trade situation offers a valuable analogy. In the short term, various kinds of trade barriers may seem to offer the prospect of protecting specific industries or gaining a competitive advantage. But in the long term, such barriers lower efficiency, reduce competitiveness, and are as likely to end up hurting as helping the industries involved.

can now apply to maintain that strength are unparalleled anywhere in the world. But we need to remain focused on the fundamentals: on maintaining a strong basic research capability, on building a robust scientific and technological infrastructure, and on the translation of new knowledge into new products and competitive advantage. Those are the areas in which nations will rise or fall in the decades to come. And those are the areas in which this Administration has focused -- and will continue to focus -- its attention.

Let me conclude with a final quotation from Science -- the Endless Frontier, a quotation that remains as accurate today as it was in 1945:

> **On the wisdom with which we bring science to bear against the problems of the coming years depends in large measure our future as a Nation.**

THE NEW YORK TIMES, WE
2/12/92

Frustrated, Chip Group May Disband

By ANDREW POLLACK

A Government advisory panel charged with drafting a strategy to help the American semiconductor industry issued its final report yesterday and prepared to shut itself down, its numerous recommendations having gone largely unheeded.

"I expect that we will go out of business," said Ian Ross, the chairman of the National Advisory Committee on Semiconductors and the former president of Bell Laboratories, the research division of the American Telephone and Telegraph Company. "We don't really see that there is a role for NACS ongoing, under the present circumstances."

Dr. Ross, who spoke at a Washington news conference, could scarcely conceal his disappointment that the committee, which started out with a bang in 1989, is ending with scarcely a whimper. Almost none of its recommendations have been carried out and, in the committee's view, the nation's computer chip industry is still losing ground to Japanese competitors.

Dr. Ross and other industry executives said the group's experience demonstrated how difficult it could be to craft a policy to help a specific industry when the Bush Administration was against "industrial policy" that picks winners or losers.

"Either the stuff they said had no teeth, or the stuff they said was interesting and never had a prayer," said Michael Borrus, a semiconductor industry expert at the University of California at Berkeley who had worked for the committee.

Now, with the economy reeling and an election at hand, the Administration appears to be becoming more receptive to what it calls technology policy. But the committee concluded that it has "done all that it can" in terms of presenting ideas.

First Proposals Were Rejected

The committee, made up of top electronics industry executives and Government officials, was created by the 1988 trade law to advise the Government on a strategy for the semiconductor industry.

Its first report, issued in 1989, contained some bold proposals — chief of which was the establishment of a corporation, perhaps backed by Government loan guarantees, that would make low-cost capital available to help American companies re-enter the consumer electronics business.

The proposal was "opposed by the Administration very openly and very forthrightly," Dr. Ross recalled yesterday. In retrospect, some analysts say, the committee lost credibility with that initial report and never regained it.

The committee also recommended an increase in the financing for Sematech, the semiconductor industry consortium that is partly financed by the Defense Department. Instead the Bush Administration is proposing to cut the Federal contribution to Sematech next year to $80 million from $100 million.

A U.S. advisory group that the U.S. has usually ignored.

Some Accomplishments Cited

The committee more recently proposed Micro Tech 2000, an ambitious undertaking in the tradition of the Apollo moon project, to develop the computer chip manufacturing technology that would allow American companies to leapfrog the Japanese. But no plans were ever put forth as to how to organize, coordinate or finance such a project. That task will now fall to the Semiconductor Industry Association, the chip makers' lobbying group.

Still, Dr. Ross pointed to some accomplishments of the group. A proposal to accelerate depreciation for semiconductor manufacturing equipment is now in a bill before Congress. The committee also made many more generic recommendations, such as calling for improved education and improved tax credits for research and development — measures that have also been suggested by many other parties and which the Administration is trying to implement.

In the last two or three years, American computer chip manufacturers seemed to have stopped losing market share and the Japanese appeared to have stopped gaining ground. But Dr. Ross said he believed this was more an anomaly tied to steep price declines in Japanese memory chips than a true turnaround.

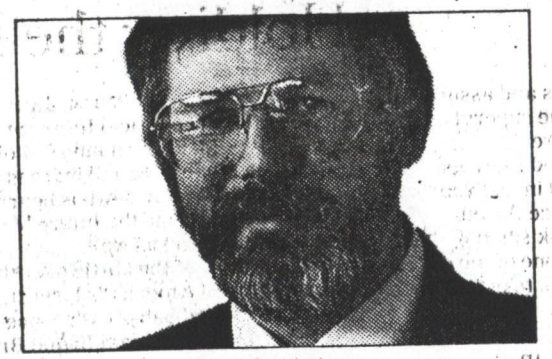
A Final Warning

In its final report, entitled "Attaining Pre-eminence in Semiconductors," the committee warns that Japanese companies are still heavily outspending American ones on research and new equipment. It also says that American market share of electronics equipment, such as computers and televisions, dropped by 14 percentage points between 1985 and 1990.

The report recommends steps to encourage industrial investment. It also recommends that the Government help spur the formation of electronics consortiums, among other things by allowing rival companies to cooperate in manufacturing in nascent areas, such as flat-panel displays.

It also recommends that the Government stimulate manufacturing of electronic products that could be big users of semiconductors, such as by supporting the development of high-speed communications networks and "smart" highways and vehicles, which use electronics to speed traffic flow and reduce accidents.

Collaborating Is the Key to Competing



By EDWARD MILLER

THE shocking news that American research and development spending is falling for the first time in 20 years — and may even be less than Japan's in absolute terms — means that our existing national research and development strategy is not working.

The United States needs a new approach to research and development built around support for collaborative research between companies. To become more competitive, the United States also needs to create a nationwide network of teaching factories paid for by shifting government research funds from military to industrial uses.

Edward Miller is president of the National Center for Manufacturing Sciences, a research consortium with 130 corporate members, in Ann Arbor, Mich.

A number of American companies have already joined together in collaborative research and development projects. Such projects leverage their research dollars, permit broader and longer-term research and allow for the quicker diffusion of technological breakthroughs.

But while collaborative research works, the 2,100 companies presently engaging in it represent only a tiny share of American industry. The reason why so few companies collaborate is that most companies have yet to develop a culture of cooperation like their Asian competitors. In addition, the recession has reduced their overall research commitments.

Companies need significant incentives to join in research consortiums, particularly military contractors, which require targeted help to retrain engineers and help them shift to civilian production. Industry needs a research and development tax credit of the sort introduced last year by Representative Sander Levin, Democrat of Michigan, and Senator Joseph Lieberman, Democrat of Connecticut, which would provide a 50 percent credit to companies engaging in collaborative research. In addition, more Federal research and development spending should be devoted to supporting research consortiums.

America also needs to establish a nationwide network of teaching factories, particularly to help small manufacturing firms. Companies with less than 100 employees are 98.5 percent of all American manufacturing businesses. They need help to compete against their far-larger Japanese rivals. Teaching factories, run as nonprofit institutions by qualified universities and other groups, would give companies with state-of-the-art experience on the most modern production equipment.

Teaching factories would also be critical to converting military industries to civilian uses. They would provide facilities to retrain engineers and could help military contractors with the transition to civilian manufacturing. Teaching factories, several of which are already in place, combine instruction with hands-on production experience. Their most critical feature would be the ability to undertake full production.

A $500 million network of 150 teaching factories built over the next five years could have a significant impact on national industrial performance. Not only would they upgrade American manufacturing; they would also serve as a focal point for a new research approach linking businesses, universities, national laboratories, state industrial extension programs and the Federal research programs of the Commerce Department, National Aeronautics and Space Administration and other agencies.

Funds for these efforts need not increase the Federal budget deficit. Out of a proposed $76.6 billion requested for research in the 1993 budget, the Administration targeted only 8.5 percent, or $6.5 billion, for industrial technologies. By shifting funds from less important military projects to industrial research; and then using those funds for collaborative projects, we can meet the nation's needs for teaching factories and research consortiums out of our existing national budget.

It is time to act. There can be an industrial renaissance in America if industry, academia and government collaborate to make it happen. ■

Todd

Document Originally
Attached to
Following Page

6. ENHANCING RESEARCH AND DEVELOPMENT AND EXPANDING THE HUMAN FRONTIER

LEGISLATIVE STATUS

Applied Research

High Performance Computing and Communications:

The President's budget requests $803 million, an increase of $148 million above 1992. Congressional appropriations activities to date have cut $82 million from the request. The cuts are the result of House actions on Energy, National Science Foundation, and NASA appropriations in the Energy and Water Appropriations bill, which passed the House on June 17th, and the VA-HUD and Independent Agencies Appropriations bill, which was reported by the Subcommittee on June 25th. The result of these cuts would be a significant delay in the development of advanced computers, the application of Grand Challenges, the deployment of high speed networks, and the initiation of educational activities.

Advanced Materials and Processing:

The budget requests $1,821 million, an increase of $162 million above 1992. The House VA-HUD and Independent Agencies Appropriations Subcommittee has recommended that NSF research activities be frozen at the 1992 level, eliminating NSF's proposed $53 million increase. The House VA-HUD and Independent Appropriations Subcommittee recommendation may have effectively eliminated NASA's proposed $29 million increase above it's 1992 materials research funding level of $125 million. The House passed Energy and Water Appropriations bill includes a reduction of about 7% in the programs that include the bulk of DOE's funding for materials. This would result in a cut of about $25 million from DOE's $678 million request.

Biotechnology Research:

The budget requests $4,030 million, an increase of $271 million above 1992. The House VA-HUD and Independent Agencies Appropriations Subcommittee has recommended that NSF research activities be frozen at the 1992 level, eliminating NSF's proposed $32 million increase of $174 million. The House Energy and Water Appropriations bill reduced DOE's contribution of $243 million by roughly $12 million.

Energy R&D:

The budget requests $914 million for National Energy Strategy energy-related R&D, an increase of $140 million over 1992. House action to date has included in appropriations $868 million in these areas. Most of the variations are minor, but House action does make two significant cuts: it provides zero funding for magnetic levitation transportation research, and it imposes a 40 percent cut in natural-gas research. Increased production and use of natural gas are important components of the National Energy Strategy.

Moving Fusion Energy from Science to Engineering:

The budget requests $360 million, an increase of $23 million or 7 percent for the development of energy from nuclear fusion. The House Energy and Water Appropriations bill, passed on June 17th, provided $340 million, a cut of roughly $20 million.

Advanced Manufacturing R&D (non-defense):

The budget requests over $1 billion for R&D on advanced manufacturing technologies, including a 27 percent increase over the 1992 level for non-defense related manufacturing R&D. The House Energy and Water Appropriations bill cut $56 million from these activities, including a $30 million reduction in uranium enrichment technologies and the cancellation of the Superconducting Super Collider. In addition, the House VA-HUD and Independent Agencies Appropriations Subcommittee recommendation cuts $25 million from NSF's proposed $105 million new initiative in manufacturing research.

Transportation R&D:

The House VA-HUD and Independent Appropriations Subcommittee has cut $10 million from the President's budget for a new state-of-the-art supercomputer in NASA for aeronautics research. Although the House Defense Appropriations bill contains full funding for Defense's request for NASP, the House VA-HUD and Independent Agencies Appropriations Subcommittee has cut all $80 million requested for NASA's portion of the NASP program. A cut of that magnitude would severely delay the completion of the technology development of the program and result in significant industry layoffs.

Protecting the Public Health:

The House has not yet acted upon the President's request for increases in biomedical and behavioral research funding. The Congress has, however, passed the President's proposal to add three research institutes at the National Institutes of Health (NIH). This proposal was signed into law on July 14, 1992. Through this reorganization, research into mental health and addictive disorders will be assured the attention it deserves.

Expanding R&D at the National Institute of Standards and Technology:

The President's requests $311 million for R&D at NIST, a 26 percent increase over 1992. No legislative action has been reported to date.

Space Technology:

In reporting its 1993 bill on June 25th, the House VA-HUD and Independent Agencies Appropriations Subcommittee provided $267 million of the $332 million requested for Space Technology (including exploration-related). This is $65 million (20 percent) below the President's request and $37 million (12 percent) below the 1992 level. The House authorized $312 million, which is $20 million (6 percent) below the President's request. The Senate Commerce Committee authorized $295 million, which is $37 million (11 percent) below the request. In addition, the House Energy and Water Appropriations bill provided no funds for DOE's requested $10 million contribution to the Space Exploration initiative.

Basic Research

Doubling the NSF Budget by 1994:

The bill reported on June 25th by the House VA-HUD and Independent Agencies Appropriations Subcommittee recommended $2,723 million for the NSF 1993 funding level, a $304 million or 10 percent decrease below the President's request. The Subcommittee has frozen NSF's investments in basic research and education activities at the 1992 level, a $347 million or 13 percent decrease below the President's request. This substantially curtails the proposed initiative to improve our nation's competitive advantage through the creation of new knowledge and technology and the training of the next generation of scientists and engineers.

Support for Individual Investigators (HHS, NSF, DOE):

The House VA-HUD and Independent Agencies Appropriations Subcommittee has recommended that NSF's support for individual investigators located primarily at universities and colleges be frozen at the 1992 funding level. The President had recommended roughly $8 billion in the NSF, the Department of Health and Human Services, and the Department of Energy to support individual investigators, a $666 million or 9 percent increase over the 1992 level. The House's NSF recommendation would be a $230 million or 35 percent decrease below the President's request. Legislative action on HHS activities has not yet occurred.

Human Genome Project:

The budget requests $175 million for the Human Genome Project in DOE ($65 million) and HHS ($110 million), an increase of $11 million or 7 percent above 1992. The House has not yet reported its actions on HHS's contribution to the Human Genome Project. The House Energy and Water Appropriations bill reduced DOE's contribution by $7 million.

Superconducting Super Collider:

The budget requested $650 million for the SSC, a $166 million increase over 1992. The House Energy and Water Appropriations bill provided $34 million to terminate the project. This action would have highly adverse consequences for America's competitive position not only in science but in a number of important energy technologies. SSC-related research has spawned, and will continue to spawn, advances in many fields of technology including accelerators, cryogenics, superconductivity, and computing. SSC-related work would support nearly 7,900 jobs in the United States.

U.S. Global Change Research Program:

The budget requests $1.4 billion for the U.S. Global Change Research Program (USGCRP), an increase of $262 million or 24 percent increase over 1992. In the 1993 Appropriations bill for VA-HUD and Independent Agencies, reported by the Subcommittee on June 25th, NASA and NSF contributions were cut by roughly $130 million. The House Energy and Water Appropriations bill cuts $8 million from DOE's $113 million contribution to the USGCRP. Legislative action on DOC's USGCRP activities has not yet taken place.

Astronomy and Astrophysics:

NASA, NSF, and the Smithsonian Institution make up the President's $890 million astronomy and astrophysics request, a $54 million or 6 percent increase over 1992. NSF's contribution of $13 million to this increase has been eliminated by the House VA-HUD and Independent Agencies Subcommittee freezing NSF's research activities at the 1992 level. The same subcommittee recommended general reductions to NASA's science program which may impact their contribution to these activities.

National Research Initiative:

The House passed a bill holding the National Research Initiative (NRI) competitive grants program to the 1992 enacted level of $98 million, $52 million below the Administration's request. Preferring to allocate agricultural research funds through earmarks rather than through a competitive process, the House bill includes $36 million for 85 earmarked research grants, not requested by the President and not peer-reviewed, and targeted to specific universities. Research to discover new uses for agricultural commodities was one area of research that was to be emphasized in 1993 with an expanded NRI. Finding new non-food, non-feed uses for agricultural commodities is important for the future of agriculture.

Maintaining National Security: Defense R&D

Defense:

[No action has taken place in the Senate to date on Defense appropriations bills.] On July 2nd, the House passed the 1993 DOD Appropriations bill, and there are significant changes to the DOD R&D program in the bill which reduces defense budget authority for 1993 by over $8 billion below the President's request—or over $21 billion below the 1992 level.

Energy:

On March 20, 1992, the President announced plans to redirect $50 million in 1992 funds appropriated for nuclear weapons production to cooperative R&D at the weapons laboratories on dual use technologies. In addition, in July the Administration sent Congress amendments to the Department of Energy's 1993 budget request that would further increase funding for cooperative activities by an additional $50 million.

S

Expanding the Geographic Frontier

Improving Access to Space:

The House VA-HUD Independent Agencies Appropriations Subcommittee provided $5.5 billion for Improving Access to Space. This is $50 million (1 percent) above the President's request and $150 million (3 percent) above the 1992 level. However, this increase is due to addition of $480 million in unrequested funds to continue the Space Shuttle's Advanced Solid Rocket Motor (ASRM), which the Administration proposes to cancel. Excluding ASRM, the provided level is $264 million (5 percent) below the President's request, including a $215 million reduction elsewhere in the Space Shuttle program. The Appropriations Subcommittee provided only $10 million of the $125 million requested for NASA's half of the New Launch System program, but provided $250 million (twice the request) for DOD's share of this program.

Space Exploration:

The budget requests $2.8 billion for programs leading to exploration of the Moon and the planets, an increase of $190 million above 1992. The House VA-HUD and Independent Agencies Appropriations Subcommittee has provided less than $2.3 billion. This is at least $575 million (20 percent) below the request and at least $385 million (15 percent) below the 1992 level.

The subcommittee cut $525 million from the President's request for the Space Station Freedom. The Subcommittee estimates that the cut would delay the first element launch by about 6 to 9 months and the permanent manned capability by 12 to 18 months. A more immediate consequence of the reduction would be the layoff of a large number of contractor personnel.

The House VA-HUD and Independent Agencies Appropriations Subcommittee provided none of the funding requested to begin building two small, unmanned lunar exploration spacecraft that were proposed in the President's budget. The Senate Commerce Committee also authorized no funding for these spacecraft, but the House authorized the requested $32 million for these two spacecraft conditional on the total NASA budget exceeding $14.3 billion.

R&D Investment Incentives

Permanent R&D Credit:

Stable tax laws that encourage research allow taxpayers to undertake research with greater assurance of the future tax consequences. A permanent R&E tax credit could expand out nation's investment in important and international competitive research acitivities. The budget proposes to make the Research and Experimentation tax credit permanent. The Congress has permitted the R&E tax credit to expire in June. An 18 month extension is included in H.R. 11, which has been reported by the Ways and Means Committee and is awaiting full House and Senate action.

Section 861 R&D Allocation Rules:

On June —, the Administration published a rule that will provide administratively for an 18 month extension for so-called section 861 R&D allocation rules. These have the effect of encouraging greater R&D investment by U.S. multinational firms.

TODD

12. MODERNIZING THE FINANCIAL SERVICES SECTOR

LEGISLATIVE STATUS

- Shortly after the budget was sent to Congress, the Administration reaffirmed its support for legislation that would help banks become better capitalized and able to make more loans. Specifically, the legislation would improve the competitive position and profitability of banks by 1) permitting them to expand nationally either by merging with, or acquiring, out-of-state institutions or by branching; and 2) authorizing banks to engage in an expanded line of financial services. This legislation was introduced in both Houses. Congress has taken no further action on these proposals.
- On June 24th, the Administration sent Congress the Credit Availability and Regulatory Relief Act, which proposes to repeal or delay a number of provisions in last year's banking legislation that imposed numerous micromanagement and regulatory expenses on banks. The legislation was introduced in both Houses of Congress on July 2nd.
- To support additional small business lending, the Administration requested additional support for the Small Business Administration's General Business Loan Guarantee Program. In the supplemental appropriations bill passed on June 22nd, Congress provided an additional $1.45 billion, bringing the total lending in 1992 to over $6 billion. The Administration also requested and Congress provided, increased resources for the SBA disaster lending program, permitting SBA to make up to $950 million in new disaster loans this year.
- The Senate voted to approve additional funding for the Resolution Trust Corporation on March 26th. The House defeated similar legislation on April 1. Additional funds are urgently needed to allow the RTC to protect deposits of thousands of individuals. Continued delays will add further costs to the already enormous Federal expenditures on the savings and loan rescue.

REGULATORY ACTIONS

- The Administration announced a series of steps to reduce regulatory barriers to new lending by financial institutions. These actions are expected to save at least $1.5 billion annually. Among the most significant such anti-"credit crunch" actions are the following:
  - —The four primary banking agencies agreed to undertake a uniform regulation initiative designed to reduce overlapping regulatory requirements and curtail the excessive paperwork and compliance costs currently imposed on banks.
  - —The Adminstration issued a final rule clarifying the application of Federal Superfund law to banks and assuring that they can undertake new lending to existing and new companies without fear of environmental liability.
  - —The Administration issued a rule permitting Federal thrifts to diversify through interstate branching.
  - —The Administration acted to stimulate real estate lending by increasing the threshold for requiring appraisals on loans secured by real estate and reducing the amount of capital required to be held against loans to finance the construction of homes that are pre-sold.

MORE SPINOFFS FROM DEFENSE

Despite the billions invested, military technology hasn't delivered much to the marketplace lately. Here's how to squeeze more competitive clout from the Pentagon. ■ *by Nancy J. Perry*

DECISIVE VICTORY in the six-week Persian Gulf war gave America a jolt of confidence. It showed that, on the battlefield at least, the U.S. is still a world beater in high technology. But just three weeks after the cease-fire, the Council on Competitiveness, a blue-ribbon panel of industry and academic leaders, shot down the celebratory balloon. America's technology edge is eroding at an alarming pace, the report warned. A prime culprit: too much spending on defense.

The weapons industry no longer acts as the most important technology driver. In 1960, U.S. military research and development accounted for one-third of all the money spent on R&D in Japan and the West, vs. about one-seventh today. Even so, defense still captures a huge share of the nation's research dollars. Of the estimated $145 billion the U.S. spent on research and development in 1990, 44% came from the federal government; almost two-thirds of that was defense-related (see chart). All told, that's a lot of research dollars going to support just 5.5% of GNP.

To retain its world leadership in high technology, the competitiveness council says, the U.S. must shift spending away from defense-only research and focus more on commercial projects. Is President Bush likely to rob the Pentagon to play commercial ball? No. Can the U.S. do a better job of leveraging its research dollars by actively looking for and exploiting defense technology that might have commercial applications? Unequivocally, yes.

As federal and corporate budgets tighten and foreign competition increases, pressure is on the defense industry as never before.

REPORTER ASSOCIATE *Temma Ehrenfeld*

How to get more from each research dollar? Three main ways:

- Encourage scientists and engineers to watch out for commercial applications throughout the R&D process.
- Push industry to take advantage of the ideas, technology, and talent hidden away in federal labs and universities.
- Break down the barriers that prevent weapons makers from buying commercially available products, such as chips, computers, and communications equipment. They are cheaper—and often better—than their military counterparts, and the money saved could go for more research.

Since World War II, defense industry research has accelerated the development of revolutionary technologies, from semiconductors to jet aircraft, that have given rise to multibillion-dollar industries. A major—and largely unsung—catalyst in that process has been the Pentagon's Defense Advanced Research Projects Agency, or Darpa, created in 1958 (see box, page 65). Today, though, commercial technology has in many cases leapfrogged the military. The Semiconductor Industry Association spells out the situation with childlike simplicity: Soon we could see microprocessors in Nintendo games that are more sophisticated than those in the latest generation of military equipment.

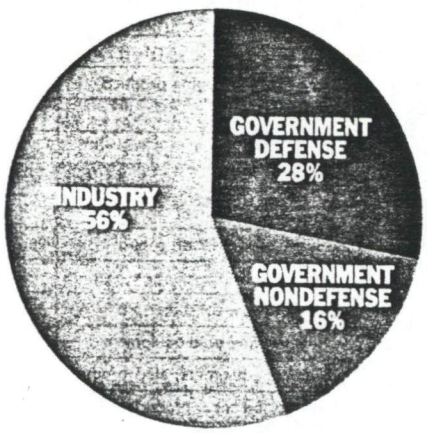
As consumer product cycles shorten and weapons development stretches over more than a decade, commercial companies increasingly consider military technology outdated—in the weapons used in the Gulf, most of it goes back to the 1960s and 1970s—and irrelevant to consumer wants. Who, after all, needs a stealth toaster? Notes Gordon Adams, director of the Defense Budget Project: "Some say military technology is arcane. Others see lots of spinoffs. The truth lies in the middle."

Some of the greatest returns on military spending come in the form of indirect technology transfers, such as improved manufacturing processes. For instance, in 1965, Lockheed invented computer-aided design and manufacturing (CAD-CAM) technology, which later found its way into civilian industry. Says Army official Cliff Lanham, who licenses military technology to the private sector: "We're all looking for new products. But where the real dollar value to the country is going to come is from relationships that ensure the flow of process technology from labs to industry."

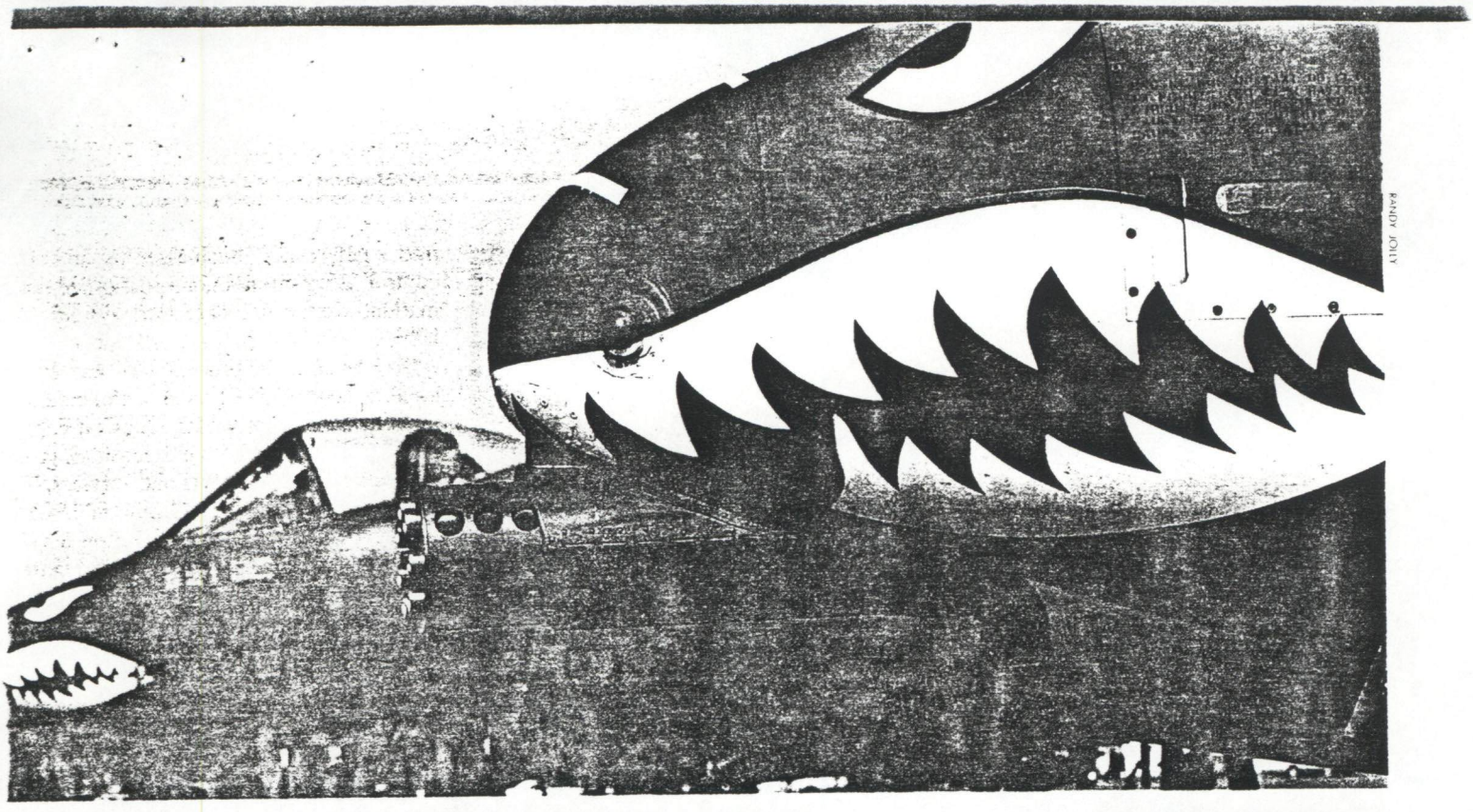
In trying to turn swords into plowshares, the first place to look is the defense plants, where the bulk of the country's military research and development is carried out. According to the National Science Foundation, of the $40.7 billion spent for military R&D in 1990, roughly two-thirds went to industry. Much of it funded development of technologies for such products as sensors, advanced composite materials, jet engines, and fiber

HOW THE U.S. SPENDS ITS R&D DOLLARS

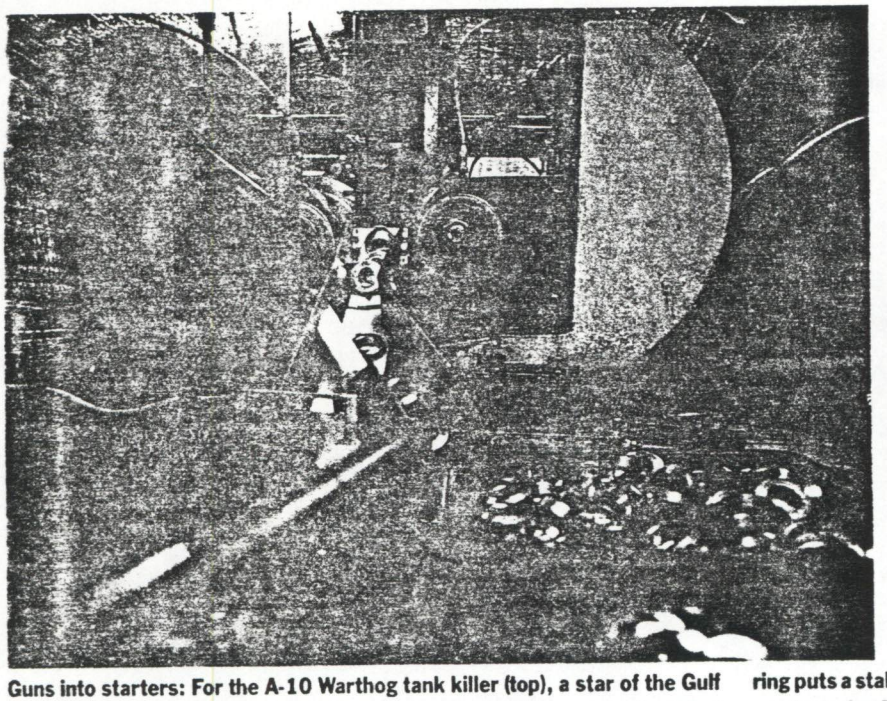
1990 outlay: $145 billion

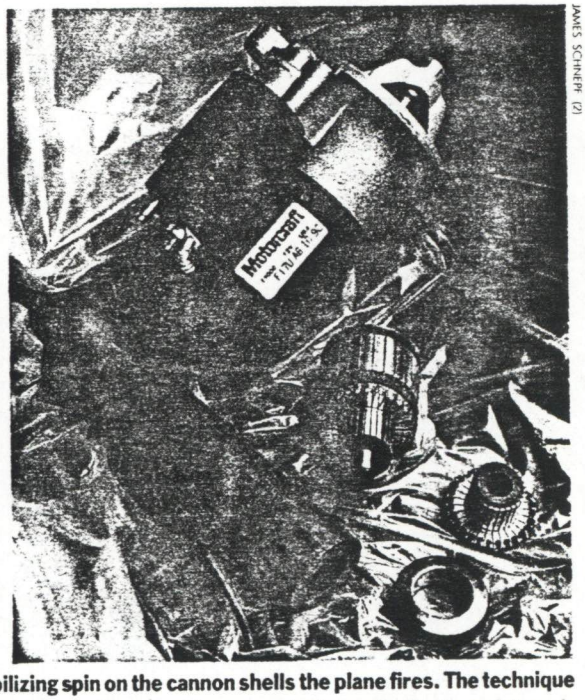


FORTUNE CHART / SOURCE: NATIONAL SCIENCE FOUNDATION



ANDY JOLLY





JAMES SCHNEPF (2)

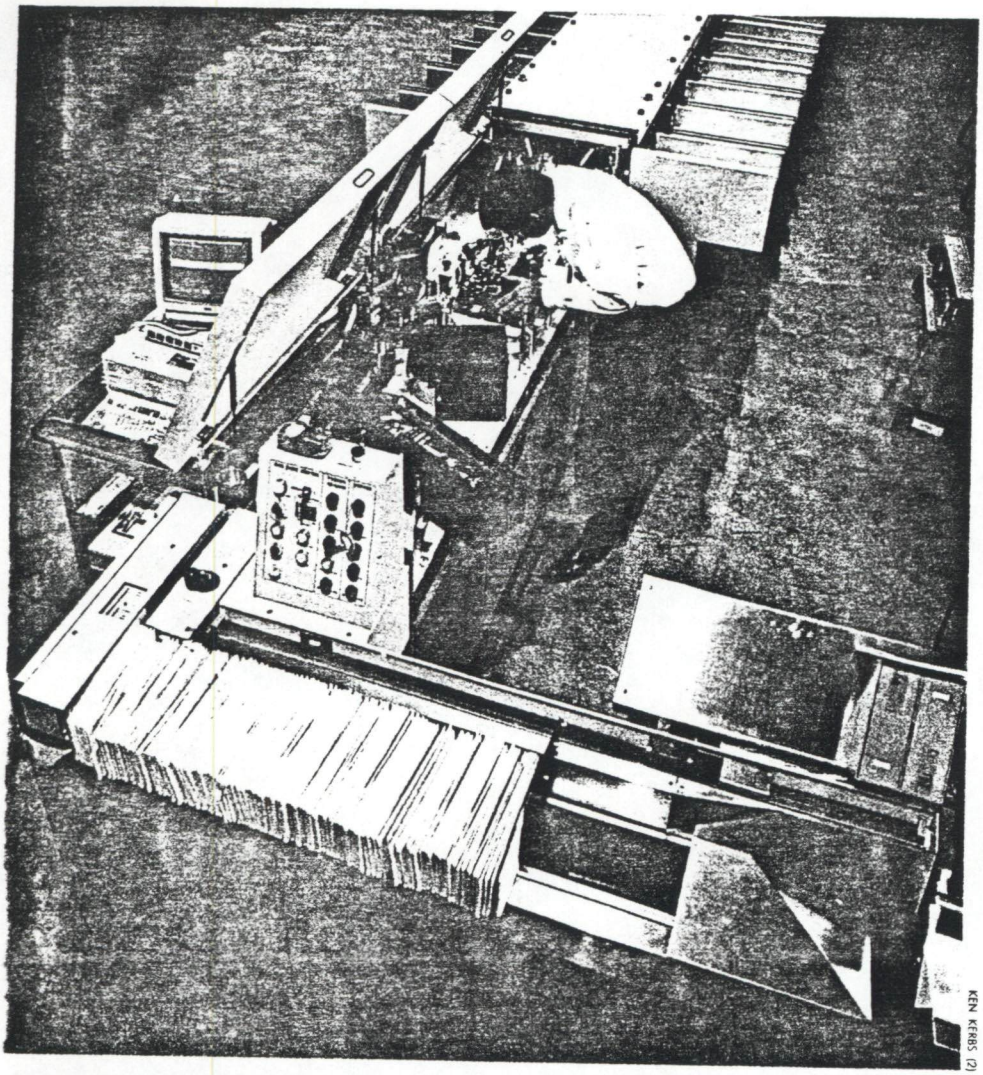
Guns into starters: For the A-10 Warthog tank killer (top), a star of the Gulf war, Kinefac Corp. found a better way to make the rotating copper ring. That ring puts a stabilizing spin on the cannon shells the plane fires. The technique was just what Ford needed for a part for a new starter motor (bottom pictures).

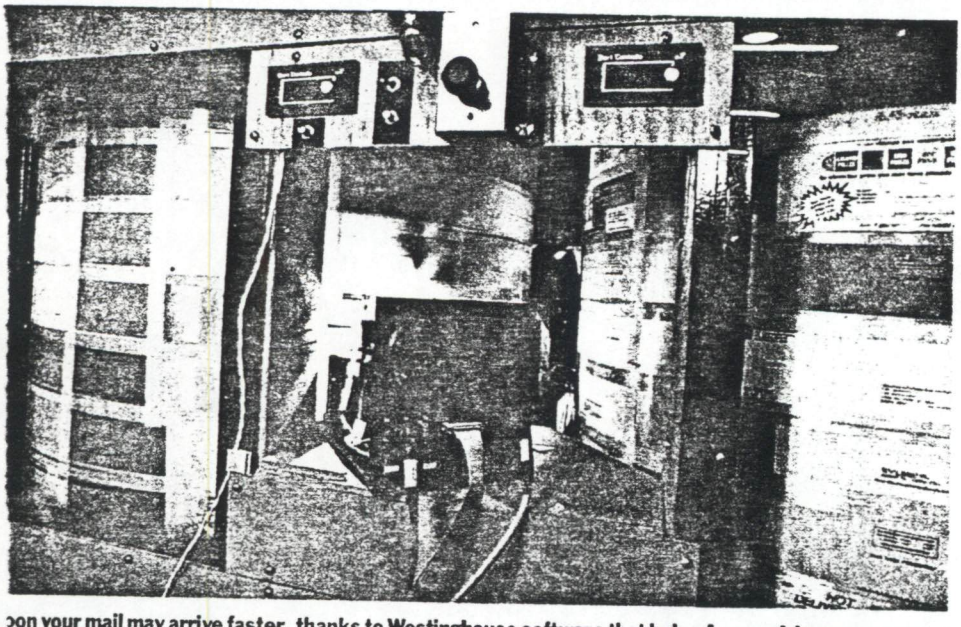
optics, which are as important to civilian enterprise as to the military machine.

The challenge: getting the twain to meet. A snapshot of the defense industry in 1987 showed that among the top 100 military prime contractors, the defense work of the ten largest companies amounted to only 2.6% of total sales. Says former IBM executive Lewis Branscomb, who uncovered that statistic while researching a book called *Beyond Spinoffs*: "In those companies there is a huge wall between the commercial and military sides. So commercial firms benefit only slightly from their military work."

An exception is the jet engine business. The world's best-selling commercial jet engine, General Electric's CFM 56, grew directly out of the company's work on the B-1 bomber engines. GE wants to duplicate that commercial success with the $1 billion engine it developed for the Advanced Tactical Fighter. The company lost out to Pratt & Whitney, but considers the money well spent because it led to innovations in composite materials, ceramics, electronic controls, and other advanced technologies that will show up in next-generation military and commercial jet engines.

In most other areas, though, the barriers between the two worlds remain formidable. Westinghouse Electric is the nation's 12th-largest defense contractor—and military work comprises 18% of sales. In recent years, to offset declining defense business, the company has started looking for military technology with commercial potential. Dick Linder, president of Westinghouse's $3-billion-a-year electronics systems group, which builds radar for F-16s and Awacs, says there is plenty at Westinghouse. His plan is to draw on the group's expertise in military sensors and image processing to expand





KEN KERBS (2)

oon your mail may arrive faster, thanks to Westinghouse software that helps Awacs airborne command enters spot targets against a complex background. Unlike today's postal scanners, the one being sted on a sorting line (top) and on colored paper (bottom) reads bar codes anyplace on an envelope.

into such related businesses as air-traffic control, drug interdiction, post-office automation, and crime-detection systems for homes, airports, and industrial sites.

To formalize the process, last year Linder announced the formation of commercial systems divisions that would focus on continued diversification of the electronics group into nondefense products and services. The divisions recently won a $1 million development contract from the U.S. Postal Service aimed at speeding mail delivery and cutting its cost. About 60% of mail must be hand-sorted because optical character readers have trouble with smudges and poor handwriting. Westinghouse is working to reduce that to 20% with software used by Awacs to pick out targets against a cluttered background. Says Linder, who hopes to increase the group's nondefense businesses from 27% of sales to 50% by 1995: "There is no question that turning defense technology into commercial products is doable. We've been doing it for some time."

SO HAVE THE FOLKS at General Motors. When GM bought Hughes Aircraft five years ago, it took possession of a technical treasure-trove. Hughes has 19,000 scientists and engineers, 1,500 of them with doctorates. Says a GM spokesman: "That's a brainpower pool that would be the envy of many countries." To tap it, the carmaker created GM Hughes Electronics, a subsidiary that brings together the military technology of Hughes with the automotive experience of GM's Delco Electronics.

To ease the flow of technology between Hughes and GM, Hughes assigned vice president Gerald Slocum to work full time on determining GM's needs and identifying Hughes technology that might meet them. Both sides benefit: GM improves its cars and trucks, and Hughes, which wants to increase its nondefense business from 25% of sales to 40%, ends up with salable commercial products. Currently, 150 technology transfer projects are under way.

Several products are already on the market. GM Hughes has taken holographic "heads up" display technology, which allows fighter pilots to see flight information in front of their windshields, and converted it into a $250 option for the Pontiac Grand Prix. Without taking their eyes off the road, drivers can now see speed, turn signal indicators, and low-fuel warnings projected ahead of the driver. Infrared sensors that let motorists see better at night and

fog or smoke are also in the works.

Hughes's most impressive technical treasures are not likely to show up in dealers' showrooms, however. Instead, they are being used on the shop floor to cut costs and improve quality. For example, an infrared sensor technology known as Probeye, originally developed for military night vision, is at work in GM factories checking for such things as engine defects and improperly applied paint.

Ed Miller, president of the National Center of Manufacturing Sciences, an industrial research group, says the defense business is full of "nuggets and gems" that have commercial applications. He points to Ford Motor and Kinefac Corp. as an example. Two years ago, Ford was looking for a more efficient way to roll and cut ten-foot sections of heavy copper tubing, two inches in diameter, into pencil-thin rings for a new starter.

Kinefac, a machine-tool maker in Worcester, Massachusetts, had undertaken a similar assignment for Honeywell, which made the ammunition for the 30-mm cannons on the A-10 Warthog tank-killer airplane. Four years ago Honeywell asked Kinefac to find a better way to make the rotating copper ring that causes the bullet to spin as it leaves the gun barrel. Kinefac did, and told Ford, a longtime customer, about the process. Kinefac eventually modified it for Ford for less than $1 million.

Bruce Jacobson, Ford's manager of starter engineering, estimates that by reducing labor and scrap, Kinefac's rolling machine is saving him up to 15 cents per piece, or some 500,000 a year. Says Jacobson: "If you look at the A-10 and say, 'How am I going to apply that to the commercial sector?'—well, there's probably not a big market for an attack aircraft. But if you go a few levels deeper and look at the steps to make it, you'll find a lot of untapped potential."

IN THE QUEST for commercial spinoffs, companies seldom tap another promising fount: the colleges that do most of the Defense Department's basic research. Of the $976 million the military spent on basic research last year, about half went to universities. Says Ed MacCordy, associate vice chancellor for research at Washington University in St. Louis: "If universities promote their research to industry, that's called technology push. The alternative is market pull. That's when industry comes to universities looking for research that will satisfy their market objectives. We need industry to pull that technology along."

continued

SOME PLOWSHARES FROM THE PAST

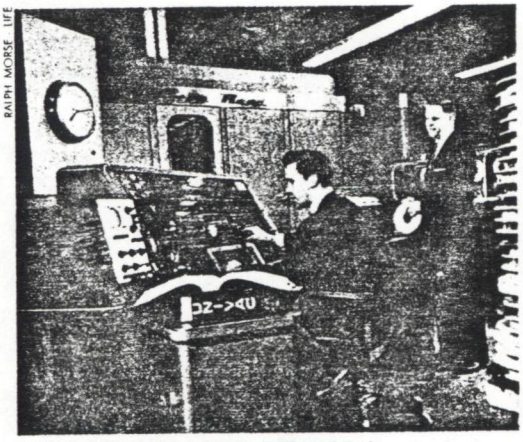
The World War II era gave us—among other things—computers, radar, jet engines, and nuclear energy. Dozens of vital technologies taken for granted today began life as defense projects. The sampling below identifies some civilian products that had their origins in research sponsored by either the Pentagon or NASA. The captions give the year the civilian application appeared and the original military use or source of the technology. The high-tech hull coating helped *Stars & Stripes* win the America's Cup in 1987.

MICROWAVE OVEN (1947)
Origin: radar

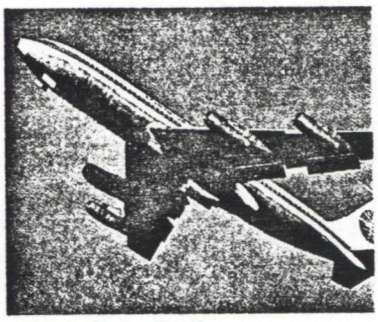
FOSTER GRANT

SCRATCH-RESISTANT SUNGLASSES (1983)
Origin: visors for space helmets

RALPH MORSE LIFE

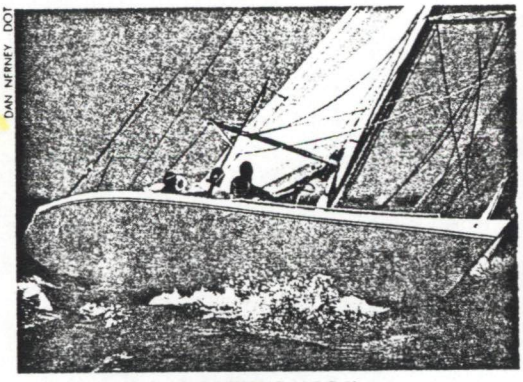


UNIVAC DIGITAL COMPUTER (1951)
Origin: calculating artillery trajectories



BOEING 707 (1957)
Origin: B-47 and B-52 bombers

DAN NERNEY DOT



ANTI-DRAG HULL COATING (1984)
Origin: NASA aircraft research

TRW

AIR BAGS (1974)
Origin: Air Force ejection seats

Until recently, however, industry hasn't been in much of a pulling mood. If technology was "not invented here," most companies seemed to believe, it might as well not have been invented at all. Says MacCordy: "The general feeling in universities is that American industry doesn't take advantage of our research." Now, with corporate budgets shrinking and Japanese-owned patents proliferating, U.S. companies are going after technology wherever they can get it. Robert Cattoi, senior vice president of research and engineering at Rockwell International, says, "We're hungry."

TO FEED its vast appetite for new technology, Rockwell has adopted what Cattoi calls "unique and very effective approaches" to working with universities. One is to build satellite research laboratories near campuses. An artificial intelligence lab just outside the gates of Stanford University is up and running. Rockwell has identified that technology as critical for both its military and commercial businesses. The company's Allen-Bradley subsidiary is interested in artificial intelligence for automated manufacturing, while the military side of the house wants to build smart cockpits to reduce pilot workload.

By opening a research lab near Stanford, which has a respected artificial intelligence center, Rockwell has been able to hire faculty and graduate students on a part-time basis to supplement its own pool of scientists. At the Stanford facility, where there are roughly as many university researchers as full-time Rockwell employees, the exchange of ideas and information is continuous. Says Cattoi: "That kind of interaction allows for the flow of technology we want."

In 1986, Congress passed the Technology Transfer Act, giving inventors at the government's 700 national labs the right to some royalties and allowing the labs to enter into cooperative research agreements. The idea was to encourage the labs, which employ one-sixth of the country's researchers and eat up $17 billion a year in government funds, to start transferring their technology to the private sector via licensing arrangements. Since their heyday in the 1960s—when NASA was flying high, the Vietnam war was going strong, and the Cold War was icy—the nation's defense labs have generated less and less research and more and more overhead. Now the main function of most defense labs is to manage contracts.

Some defense labs are beginning to get serious about commercialization. Wendell Banks, who is responsible for transferring technology from a laboratory at Wright-Patterson Air Force Base in Ohio, recently sent a list of 100 Air Force patents to Miami University of Ohio, which identified five as having commercial potential. The next step is zeroing in on specific markets. Says Banks, who has had this assignment for four months: "We have a whole stack of patents here. But unless a guy like me comes along, they never get out."

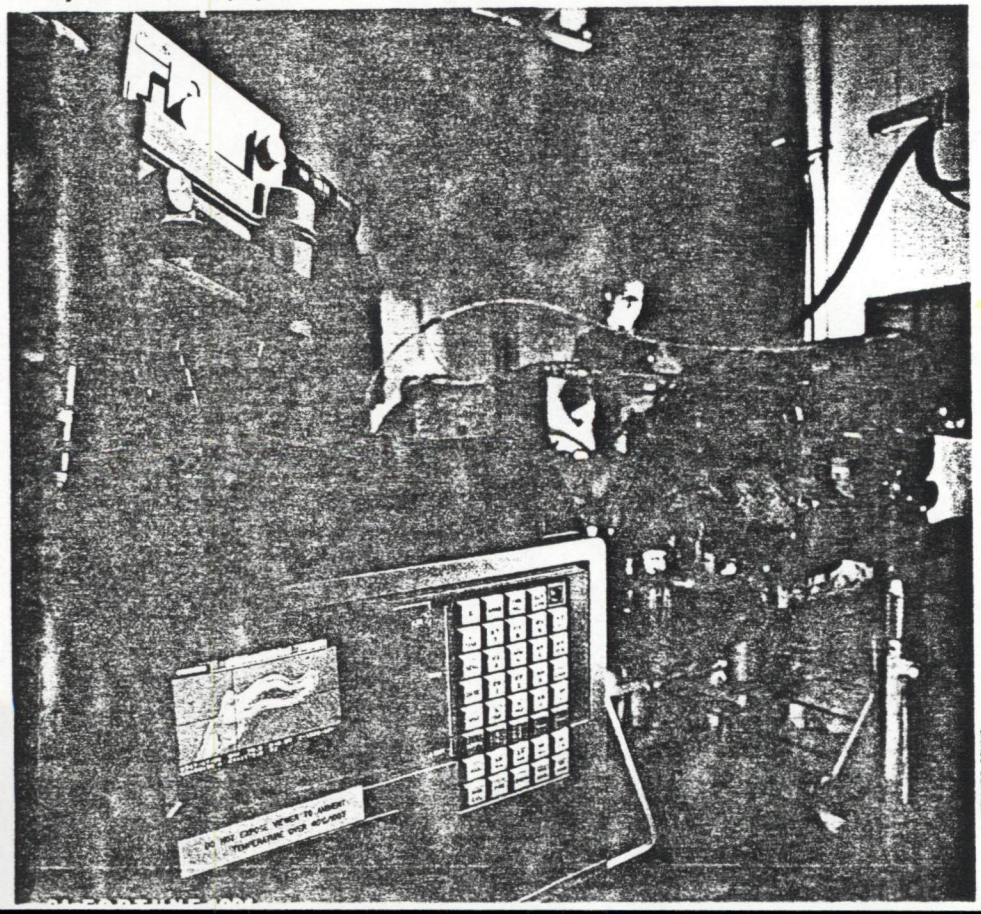
To help business, the state has created the Ohio Technology Transfer Organization, a network of 28 colleges and universities throughout the state. Each has a technology transfer agent who works one on one with businesses in its area. If companies have a manufacturing problem, a technical question, or a marketing idea, the local agent puts them in touch with somebody who can help.

A couple of years ago Wright Brothers Aero, a small supplier of aviation fuel at the Dayton International Airport, called the technology transfer agent at Sinclair Community College to find out how the Air Force at Wright-Patterson ensures aviation fuel quality. The agent got the company together with experts at Wright-Patterson, and Aero subsequently formed a subsidiary that does fuel-quality tests for corporate fleets and small airports. Customers include Northwest and USAir, as well as private and corporate jets that fly in and out of Dayton.

NOT SURPRISINGLY, small companies like Aero have been much quicker than bigger companies to take advantage of the technical resources available at the federal labs. MIT's Lincoln Lab in Lexington, Massachusetts, works on advanced electronics for the Pentagon. Some 90% of the laboratory's licenses go to companies with less than $100 million in sales. That's partly because most large companies assume that defense labs are dinosaurs with nothing new to offer. But that's not always true, as the story of Phoenix Laser Systems illustrates.

Phoenix was founded in 1987 to develop a laser workstation for intricate surgical procedures—primarily eye operations such as refractive surgery to correct near- and farsightedness. The Phoenix challenge: how to keep the laser focused on a moving target, a cell in the eye. Doctors normally use handheld mechanical aiming devices for lasers—

For night vision, pilots and tank commanders use the same kind of infrared imaging that's in this Probeye device. GM employs it in Detroit to check a Cadillac engine (right) for structural defects.



JAMES SCHNEPF

t even when the patient is sedated, subtle
e movements can be too quick for the hu-
an hand to follow.

H. Alfred Sklar, Phoenix's chief scientist,
d several friends at the nearby Lawrence
vermore Lab, not least the venerable phys-
st Edward Teller. Rather than having to
nvent existing technology, Sklar worked
t a contract with Livermore under which
pays a fee to license Livermore image-
ocessing technology—used, for example,
monitoring explosive tests—for research
Phoenix. The entire transfer took only
ur months and saved Phoenix the millions
dollars it would have had to spend to do
e research from scratch.

Last December, Phoenix got FDA ap-
oval to market its workstation for one ba-
ophthalmic application. The company is
clinical trials on more advanced proce-
res, such as precision-guided cataract sur-
ry. According to Arthur D. Little Inc.,
hich did a study for Phoenix, the market
r the company's surgical workstation
uld ultimately total $450 million. Says
lar: "Many laser companies are technol-
ies looking for an application. We are the
posite: We have an application and went
oking for the technology."

Commercializing military R&D will
ver supplant more important ways to im-
ove competitiveness: a reduced budget
ficit, greater commercial R&D invest-
ent, a more highly skilled work force,
d better products. Says Litton Industries
esident Alton Brann: "It's definitely true
at with all the money spent on the mili-
ry, there is commercial fallout, and it is
nificant. But it's like a Lucky Strike Ex-
. I can't imagine the President saying, 'I
ed $300 billion for defense, and $30 bil-
n of it is for some amorphous spillover
commercial.' "

Still, in this intensely competitive, cost-
nscious era, increasing the flow of
owledge in both directions is just plain
mmon sense. A new report by the Cen-
for Strategic and International Studies
s, "Clearly, the Department of Defense
nnot solve the U.S. competitiveness
oblem, but it can make a difference."
ose who remain skeptical might talk to
e folks at Lockheed, which just won a $1
lion contract from Motorola to help
ild 77 satellites for a $2.3 billion global
llular communications system. The pro-
t, which represents one of the largest
mmercial space ventures in history, is a
ect spinoff of Lockheed's military satel-
e business. F

DARPA: A BIG POT OF UNRESTRICTED MONEY

The Defense Advanced Research Projects Agency—Darpa, for short—may have done more for U.S. competitiveness than any other organization. The Pentagon agency started or funded some of the most spectacular high-tech weapons that brought Saddam Hussein to his knees. In the process, Darpa successfully shepherded underlying technologies that have spilled over into the commercial world: supercomputers, graphics workstations, artificial intelligence, composite materials, digital gallium arsenide circuits, and plenty of other products and systems. Even the PC mouse was born in a Darpa project.

SKIP BROWN

Forced out: ex-agency director Craig Fields

Darpa, based in Arlington, Virginia, has no labs of its own. It dispenses an annual budget of $1.5 billion largely through development contracts with universities, private companies, or federal labs. Says former director Robert Cooper: "Darpa probably has the largest pot of unrestricted money in the government or even in industry to do that. That's where its power lies."

In what the Pentagon calls "dual use" technology, valuable in defense and commerce alike, Darpa's contribution to U.S. aviation alone would probably justify the agency's existence. Darpa poured hundreds of millions into complex supercomputer software programs that allow aerodynamic testing of large portions of airframes inside computers, instead of wind tunnels.

One big reason for Darpa's success is that it operates unlike any federal agency. About half its tiny staff of 140 are program directors who act as technical entrepreneurs, not turf-protecting bureaucrats. These scientists and engineers come to Darpa for three years or so from industry, the military, or universities; they leave when their programs are complete.

The agency's gambles on nascent technologies have helped create dozens of outstanding high-tech companies. Support of early research at Stanford led to the creation of such successful pioneers as Silicon Graphics, Sun Microsystems, and MIPS Computer Systems. "We could not have done it without Darpa," says MIPS chief scientist John Hennessy. One payoff for U.S. competitiveness: Silicon Graphics alone earned nearly half its $482 million in revenues last year from overseas sales.

Craig Fields, Darpa's outspoken director from 1989 to 1990, now heads MCC, the information technology consortium in Austin, Texas. He mused recently that a Darpa contract has often served as a "*Good Housekeeping* seal of approval" for the technology, management, and technical staff of struggling startup companies. Fields helped persuade Congress to pass legislation that allowed Darpa to share in a company's future profits. But when he invested $4 million last year in Gazelle Microcircuits, a Silicon Valley gallium arsenide manufacturer, "Sununu went bananas," says Daniel Greenberg, editor of the Washington newsletter *Science & Government Report*. To the Administration, the deal amounted to an industrial policy; soon afterward, Fields was forced out.

Darpa went through some months of turmoil and uncertainty, but now it seems solidly back on course. Concludes Edward E. David Jr., a former Bell Labs executive who served as President Nixon's science adviser: "Among all the outfits that dispense public money, this one has produced the most." **– Gene Bylinsky**