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November 23, 1993

CRITICAL TECHNOLOGIES SUBCOUNCIL
ADDRESS LIST

CHAIRMAN

Mr. Erich Bloch — 202-785-3990
Distinguished Fellow — 202-785-3998 Fax
Council on Competitiveness
900 17th Street, N.W.
Suite 1050
Washington, D.C. 20006

Staff Director
Mr. David W. Cheney — 202-785-3990
Senior Associate — 202-785-3998 Fax
Council on Competitiveness
900 17th Street, N.W. Suite 1050
Washington, D.C. 20006
email: 74230.534@compuserve.com

MEMBERS

Dr. Eleanor Baum — 212-353-4285
Dean — 212-353-4341 Fax
Albert Nerken School of Engineering
Cooper Union for the Advancement of Science and Art
51 Astor Place
New York, New York 10003

Dr. Frederick M. Bernthal — 202-357-7748
Acting Director — 202-357-9725 Fax
National Science Foundation
1800 G Street, N.W.
Washington, D.C. 20550

The Honorable — 202-225-3665
Sherwood L. Boehlert — 202-225-1891 Fax
US House of Representatives
1127 Longworth House Office Building
Washington, DC 20515-3225
cc: Daniel Pearson — 202-225-3641
Science, Space and Technology Committee
Annex One
Room 822
Washington, D.C. 20515

Mr. Michael G. Borrus
Co-Director
BRIE
University of California, Berkeley
2234 Piedmont Avenue, 2nd Floor
Berkeley, California 94720
email: Mborrus@violet.berkeley.edu

510-642-3067
510-643-6617 Fax
415-928-5356 Home
415-673-2133 Home Fax
(Sec'y Rita Maran)

Home:
1739 Vallejo
San Francisco, CA 94123

The Honorable
Rick Boucher
U.S. House of Representatives
2245 Rayburn House Office Building
Washington, D.C. 20515
(Staff: Barry Gold)
(Scheduler: Kristen Dunne)

202-225-3861
202-225-0442 Fax
202-225-2626

Dr. Lewis M. Branscomb
Director of Science Technology & Public Policy Program
Kennedy School of Government
Harvard University
79 John F. Kennedy Street
Cambridge, Massachusetts 02138

617-495-1853
617-495-5776 Fax

Mr. Dan Burton
Executive Vice President
Council on Competitiveness
900 17th Street, N.W.
Suite 1050
Washington, D.C. 20006

202-785-3990
202-785-3998 Fax

Dr. Dennis Chamot
Executive Assistant to the President
Department of Professional Employees
AFL-CIO
815 16th Street, N.W.
Washington, D.C. 20006

202-638-0320
202-628-4379 Fax

Mr. Gary L. Cowger
Executive-in-Charge
North American Operations
Manufacturing Aid Building
General Motors Corporation
30300 Mound Road
MD-09
Warren, Michigan 48090-9040

313-947-0601
313-986-8591 Fax

Dr. Craig I. Fields
President and CEO
Microelectronics
and Computer Technology Corporation
3500 West Balcones Center Drive
Austin, Texas 78759
512-343-0978
512-338-3888 Fax

Dr. Edward B. Fort
Chancellor
North Carolina Agricultural and Technical
State University
1601 E. Market Street
Greensboro, North Carolina 27411
919-334-7940
919-344-7082 Fax

Dr. John S. Foster
TRW Inc.
One Space Park - Bldg. E-2
Redondo Beach, California 90278
(Sec'y June Shufford)
310-812-1846
310-814-4615 Fax

Mr. Joseph S. Hezir
Managing Partner
The EOP Group
1725 DeSalle Street N.W.
Washington, D.C. 20036
202-833-8940
202-833-8945 Fax

Thomas Kalil
Director to the National
Economic Council
Office of Economic Policy
Old Executive Office Building
17th St & Pennsylvania Ave, NW
Room 423
Washington, DC 20500
202-456-2801
202-456-2223 Fax

Dr. Ruth Kirschstein
Acting Director
National Institutes for Health
9000 Rockville Pike
Room 126
Bethesda, MD 20892
301-496-2433
301-402-2700 Fax

Martha Krebs
Director of Energy Research
U.S. Department of Energy
Forrestal Building
1000 Independence Avenue, SW
Room 7B058
Washington, DC 20585
202-586-5430
202-586-9520 Fax

Dr. Richard K. Lester
Professor of Nuclear Engineering
Director, Industrial Performance Center
Massachusetts Institute of Technology
One Amherst Street, E40-423
Cambridge, Massashusetts 02139-4307
email: rklester@eagle.mit.edu
(Betty Sheridan)
email: bbs@eagle.mit.edu
617-253-7704
617-253-7570 Fax
617-253-7570

Mr. Daniel P. McCurdy
Director - Business Development
International Business Machines Research Center
P.O. Box 218
Yorktown Heights, NY 10598
914-945-1215
914-945-2141 Fax
or: Route 134
Yorktown Heights, NY 10598

Dr. Joseph G. Morone
The Andersen Consulting Professor of Management
School of Management
Rensselaer Polytechnic Institute
Troy, New York 12180
518-276-8710
518-276-8661 Fax
(Sec'y Jan: 518-276-6497)

Dr. Al Narath
President
Sandia National Laboratories
1515 Eubank Boulevard, SE
Albuquerque, New Mexico 87123
505-844-7261
505-844-1120 Fax
or: P.O. Box 5800
Albuquerque, NM 87185

Dr. Richard R. Nelson
Columbia University
School of International & Public Affairs
420 West 118th Street
New York, New York 10027
212-854-8720
212-222-0598 Fax
508-896-5965 (summer)

Dr. Arati Prabhaker
Director
National Institute of Standards and Technology
Administration Building A
Quince Orchard & Clopper Roads
Room 1134
Gaithersburg, Maryland 20899
301-975-2300
301-869-8972 Fax

Ms. Lois D. Rice
Guest Scholar in Economics
The Brookings Institution
1775 Massachusetts Avenue, N.W. Room 725
Washington, D.C. 20036-2188
202-797-6000
202-797-6004 Fax

Nathan Rosenberg
Professor of Economics
Director of Program for Technology
& Economic Growth
Stanford University
Stanford, CA 94305

415-723-1902
415-725-5702 Fax
415-858-2573 home

Mr. Howard D. Samuel
Senior Fellow
Council on Competitiveness
900 17th Street, NW, Suite 1050
Washington, D.C. 20006

202-785-3990/3992
202-785-3998 Fax

Dr. Hubert J.P. Schoemaker
Chairman and CEO
Centocor, Inc.
200 Great Valley Parkway
Malvern, Pennsylvania 19355-1307

215-889-4501
215-889-0895 Fax
215-651-6000 s/b

Dr. Charles Shanley
Director of Technology Planning
Motorola Inc.
1303 E. Algonquin Road
Schaumburg, Illinois 60196-1085
email: Shanley@cadsun.corp.mot.com

708-538-2438
708-576-5292 Fax

Dr. Richard H. van Atta
Research Staff Member
Institute for Defense Analyses
Science and Technology Division
1801 N. Beauregard Street
Alexandria, Virginia 22311

703-578-2814
703-578-2877 Fax

Dr. Robert M. White
Professor and Department Head
Electrical and Computer Engineering
Carnegie Mellon University
Pittsburgh, PA 15213-3890

412-268-7400
412-268-5787 Fax

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CRITICAL TECHNOLOGIES SUBCOUNCIL

OF THE

COMPETITIVENESS POLICY COUNCIL

BACKGROUND MATERIAL

JULY 6, 1993
(10:00 a.m. - 4:00 p.m.)

Eighth Floor - Conference Center
11 Dupont Circle, NW
Washington, D.C.

COMPETITIVENESS POLICY COUNCIL

Washington, DC

July 1, 1993

To: Members of the Critical Technologies Subcouncil

From: Erich Bloch and David Cheney

Re: Materials for the July 6 Meeting

As background for the July 6 meeting, please find enclosed the following:

- An agenda for the meeting;
- Technology for America's Economic Growth, A New Direction to Build Economic Strength;
- Erich Bloch and David Cheney, " Technology Policy Comes of Age", forthcoming in *Issue in Science and Technology,* Summer, 1993;
- Comparison of the recommendations of the Critical Technology Subcouncil and the Clinton Administration's technology program and major pieces of legislation;
- A brief analysis of the FY94 R&D budget;

The focus of this meeting will be to review the progress made in implementing the Subcouncil's original recommendations and to determine actions that can speed their implementation.

The meeting will be held on the eighth floor of 11 Dupont Circle, Washington, DC, beginning at 10:00 a.m. and ending by 4:00 p.m. We look forward to seeing you there.

11 Dupont Circle, N.W., Suite 650, Washington, DC 20036-1207
(202) 387-9017 FAX (202) 328-6312

Critical Technologies Subcouncil
Competitiveness Policy Council

July 6, 1993
11 Dupont Circle
Eighth Floor - Conference Center

Agenda

10:00-10:30	Introductions: Goals and activities of the CPC and the Subcouncil C. Fred Bergsten Erich Bloch
10:30-12:00	Status of technology policy implementation views from the Administration and Congress
12:00-1:00	Working lunch
1:00-3:00	Discussion of differences between the Subcouncil recommendations, the Administration's agenda, and major legislation
3:00-4:00	Future actions of the Subcouncil

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Technology for America's Economic Growth, A New Direction to Build Economic Strength

President William J. Clinton
Vice President Albert Gore, Jr.

February 22, 1993

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Technology for America's Economic Growth: A New Direction to Build Economic Strength

A New Direction

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

American technology must move in a new direction to build economic strength and spur economic growth. The traditional federal role in technology development has been limited to support of basic science and mission-oriented research in the Defense Department, NASA, and other agencies. This strategy was appropriate for a previous generation but not for today's profound challenges. We cannot rely on the serendipitous application of defense technology to the private sector. We must aim directly at these new challenges and focus our efforts on the new opportunities before us, recognizing that government can play a key role helping private firms develop and profit from innovations.

We must move in a new direction:

- Strengthening America's industrial competitiveness and creating jobs;
- Creating a business environment where technical innovation can flourish and where investment is attracted to new ideas;
- Ensuring the coordinated management of technology all across the government;
- Forging a closer working partnership among industry, federal and state governments, workers, and universities;
- Redirecting the focus of our national efforts toward technologies crucial to today's businesses and a growing economy, such as information and communication, flexible manufacturing, and environmental technologies; and,
- Reaffirming our commitment to basic science, the foundation on which all technical progress is ultimately built.

For the American People

Our most important measure of success will be our ability to make a difference in the lives of the American people, to harness technology so that it improves the quality of their lives and the economic strength of our nation.

We are moving in a new direction that recognizes the critical role technology must play in stimulating and sustaining the long-term economic growth that creates high-quality jobs and protects our environment.

We are moving in a new direction to create an educational and training system that challenges American workers to match their skills to the demands of a fast-paced economy and challenges our students to reach for resources beyond their classrooms.

We are moving in a new direction to dramatically improve our ability to transmit complicated information faster and further, to improve our transportation systems, our health care, our research efforts, and even the ability of our military to respond quickly and decisively to any threat to our nation's security.

In these times, technology matters as well to an efficient farm, food processing, and food retailing industry that delivers a variety of low-cost, wholesome foods; to a construction industry that builds high-quality, affordable housing; and to an energy sector that balances energy efficiency with clean, affordable and efficient energy sources.

New Criteria

We will hold ourselves to tough standards and clear vision. The best technology policy unleashes the creative energies of innovators throughout the economy by creating a market that rewards invention and enterprise. We are moving to accelerate the development of civilian technology with new criteria:

- Accelerating the development of technologies critical for long-term economic growth but not receiving adequate support from private firms, either because the returns are too distant or because the level of funding required is too great for individual firms to bear;

- Encouraging a pattern of business development that will likely result in stable, rewarding jobs for large numbers of workers;

- Accelerating the development of technologies that could increase productivity while reducing the burden of economic activity on the local, regional, or global environment;

- Improving the skills offered by American workers by increasing the productivity and the accessibility of education and training;

- Reflecting the real needs of American businesses as demonstrated by their willingness to share the cost of research or participate in the design of initiatives;

- Supporting communities or disadvantaged groups in the U.S. or abroad who have not enjoyed the benefits of technology-based economic growth;

- Contributing to U.S. access to foreign science and technology, enhancing cooperation on global problems or U.S. successes in technology-related foreign markets.

Reaching Our Technology Goals

The challenge we face demands that we set and keep focused on our goals:

- **LONG TERM ECONOMIC GROWTH THAT CREATES JOBS AND PROTECTS THE ENVIRONMENT**

- **A GOVERNMENT THAT IS MORE PRODUCTIVE AND MORE RESPONSIVE TO THE NEEDS OF ITS CITIZENS**

- **WORLD LEADERSHIP IN BASIC SCIENCE, MATHEMATICS, AND ENGINEERING.**

We have the means to stimulate innovations that will bring economic growth and help us reach our goals and other important objectives. Foremost is a sound fiscal policy that reduces the federal deficit and lowers interest rates. But that is not always enough. We must also turn to:

- Research and experimentation tax credits and other fiscal policies to create an environment conducive to innovation and investment;

- A trade policy that encourages open but fair trade;

- A regulatory policy that encourages innovation and achieves social objectives efficiently;

- Education and training programs to ensure continuous learning opportunities for all Americans;

- Support for private research and development through research partnerships and other mechanisms to accelerate technologies where market mechanisms do not adequately reflect the nation's return on the investment;

- Support for contract R & D centers and manufacturing extension centers that can give small businesses easy access to technical innovations and know-how;

- Support for a national telecommunications infrastructure and other information infrastructures critical for economic expansion;

- Department of Defense and other federal agency purchasing policies designed to foster early markets for innovative products and services that contribute to national goals;

- Strong and sustained support for basic science to protect the source of future innovations;

- International science and technology cooperative projects that enhance U.S. access to foreign sources of science and technology, contribute to the management of global problems, and provide the basis for marketing U.S. goods and services;

- Dual-use Defense Department research and development programs;

- National user facilities that make sophisticated research tools, such a synchrotron radiation and neutron beam tools, available to a variety of research organizations.

Managing Technology for Economic Growth

Redirecting America's programs in science and technology will require major changes in the way we manage our efforts. Tight management is essential to ensure the highest possible return our investments and to ensure that tax, regulatory and other efforts reinforce instead of frustrate our work.

We are making major changes:

- Working with Vice President Gore, a reinvigorated Office of Science and Technology Policy will lead in the development of science and technology policy and will use the Federal Coordinating Council on Science, Engineering, and Technology, along with other means, to coordinate the R & D programs of the federal agencies;

- The new National Economic Council will monitor the implementation of new policies and provide a forum for coordinating technology policy with the policies of the tax, trade, regulatory, economic development, and other economic sectors.

As we move from traditional, mission-oriented R & D to investments designed specifically to strengthen America's industrial competitiveness and create jobs, considerable

care must be taken to set priorities. In many cases, it will be essential to require cost-sharing on the part of private partners. In all cases, it will be essential for our government to work closely with business and labor.

Our initiative in advanced manufacturing, for example, will not be successful without direct input from the private sector about which technical areas are most important. We will conduct a review of laws and regulations, such as the Federal Advisory Committee Act and conflict-of-interest regulations to determine whether changes are needed to increase government-industry communication and cooperation.

We also will work closely with Congress to prevent 'earmarking' of funds for science and technology. Peer review and merit-based competition are critical to the success of any science and technology policy.

Effective management of technology policy also requires an effective partnership between federal and state governments. The states have pioneered many valuable programs to accelerate technology development and commercialization. Our efforts should build on these programs.

And, every federal technology program, including those of long-standing, will be regularly evaluated against pre-established criteria to determine if they should remain part of a national program. Major changes facing our nation's economy demand a searching re-examination of technology programs, particularly now as we move toward new efforts and a new emphasis in our technology for America's economic growth.

Building America's Economic Strength: New Initiatives

The challenges we face -- from our competitors abroad and from our people at home -- demand dramatic innovation and bold action that will not just revive our economy now but also ensure our economic growth well into the future. Building America's economic strength through technology demands new initiatives that confront these challenges effectively, efficiently, and creatively.

- PERMANENT EXTENSION OF THE RESEARCH AND EXPERIMENTATION TAX CREDIT to sustain incentives for the R&E work so essential to new developments;

- INVESTMENT IN A NATIONAL INFORMATION INFRASTRUCTURE and establishment of a task force working with the private sector to design a national communications policy that will ensure rapid introduction of new communication technology;

- ACCELERATED INVESTMENT IN ADVANCED MANUFACTURING TECHNOLOGIES that promote U.S. industrial competitiveness and that build on, rather than minimize, worker skills;

- RE-ESTABLISHING TECHNOLOGICAL LEADERSHIP AND COMPETITIVENESS OF THE U.S. AUTOMOBILE INDUSTRY through a major new program to help the industry develop critical new technology that can all but eliminate the environmental hazards of automobile use and operate from domestically produced fuels and facilitate the development of a new generation of automobiles;

- IMPROVE TECHNOLOGY FOR EDUCATION AND TRAINING by supporting the development and introduction of computer and communications equipment and software that can increase the productivity of learning in formal school settings, a variety of business training facilities and in homes.

- INVESTMENTS IN ENERGY-EFFICIENT FEDERAL BUILDINGS to reduce wasteful energy expenses and encourage the adoption of innovative, energy-efficient technology.

GOAL: LONG-TERM ECONOMIC GROWTH THAT CREATES JOBS AND PROTECTS THE ENVIRONMENT

Technology is the engine of economic growth. In the United States, technological advance has been responsible for as much as two-thirds of productivity growth since the Depression. Breakthroughs such as the transistor, computers, recombinant DNA and synthetic materials have created entire new industries and millions of high-paying jobs.

International competitiveness depends less and less on traditional factors such as access to natural resources and cheap labor. Instead, the new growth industries are knowledge based. They depend on the continuous generation of new technological innovations and the rapid transformation of these innovations into commercial products the world wants to buy. That requires a talented and adaptive work force capable of using the latest technologies and reaching ever-higher levels of productivity.

Modern production systems also make much more efficient use of energy and materials. Advances in technology can lead to enormous reductions in the environmental emissions associated with automobiles, buildings, and factories. And because pollution always signals inefficiencies and, because wasteful energy costs raise the price of doing business, these technology advances can also lead to increased profits.

We can promote technology as a catalyst for economic growth by:

- directly supporting the development, commercialization, and deployment of new technology;
- fiscal and regulatory policies that indirectly promote these activities;
- investment in education and training; and,
- support for critical transportation and communication infrastructures.

Technology Development, Commercialization and Use

Since World War II, the federal government's de facto technology policy has consisted of support for basic science and mission-oriented R&D -- largely defense technology. Compared to Japan and our other competitors, support for commercial technology has been minimal in the U.S.. Instead, the U.S. government has relied on its investments in defense and space to trickle down to civilian industry.

Although that approach to commercial technology may have made sense in an earlier era, when U.S. firms dominated world markets, it is no longer adequate. The nation urgently needs improved strategies for government/industry cooperation in the support of industrial technology. These new approaches need not jeopardize agency missions: In many technology areas, missions of the agencies coincide with commercial interests or can be accomplished better through close cooperation with industry.

This Administration will modify the ways federal agencies do business to encourage cooperative work with industry in areas of mutual interest. President Eisenhower undertook a similar policy change in 1954, when he issued an executive order directing federal agencies to support basic research. This new policy will result in significantly more federal R&D resources going to (pre-competitive) projects of commercial relevance. It will also result in federal programs that go beyond R&D, where appropriate, to promote the broad application of new technology and know-how.

R&D. At the level of technology development, the fundamental mechanism for carrying out this new approach is the cost-shared R&D partnership between government and industry. All federal R&D agencies (including the nation's 726 federal laboratories) will be encouraged to act as partners with industry wherever possible. In this way, federal investments can be managed to benefit both government's needs and the needs of U.S. businesses.

This reorientation is particularly urgent for the Department of Defense, which accounts for 56 percent of all federal R&D. A significant portion of DoD's research and development budget is already focused on dual-use projects -- particularly projects supported by the Defense Advanced Research Projects Agency (DARPA). Since a growing number of defense needs can be met most efficiently by commercial products and technology in the years ahead, this fraction will increase. DoD is developing a strategy to improve the integration of defense and commercial technology development.

All federal support for technology development is being reviewed to ensure that research priorities are in line with contemporary needs of industry and to ensure that strategies for working with industry are consistent.

To strengthen industry-government cooperation and to provide more federal support for commercial R&D:

- **The ratio of civilian and dual-use R&D to purely military R&D is significantly higher in President Clinton's economic plan.** This is a first step toward balancing funding levels for these two categories. In 1993, the civilian share of the total federal R&D budget was approximately 41% . Under President Clinton's plan, the civilian share will be more than 50% by 1998. Total spending for civilian R&D will rise from $27.9 billion to 36.6 billion during this period.

- **The Commerce Department's Advanced Technology Program is expanded significantly.** Established in 1990, the ATP shares the costs of industry-defined and industry-led projects selected through merit-based competitions.

- **The Defense Advanced Research Projects Agency (DARPA) will be renamed the Advanced Research Projects Agency (ARPA)** -- as the agency was known before 1972. The ARPA program in dual use will be expanded in

ways that increase the likelihood that defense research can lead to civilian product opportunities.

- **New Department of Energy programs designed to increase the productivity of energy use in industry, transportation, and buildings as well as renewable energy programs** will ensure that the goals of environmental protection are fully consistent with other business objectives. DoE, working with other agencies, will encourage industry R&D consortia in an effort directed at reducing pollution and manufacturing waste.

- **Manufacturing R&D will receive particular attention from ATP, ARPA and other federal agencies.** SEMATECH, an industry consortium created to develop semiconductor manufacturing technology, will receive continued matching funds from the Department of Defense in FY94. This consortium can serve as a model for federal consortia funded to advance other critical technologies. Programs will be encouraged in the development of a new automobile, new construction technologies, intelligent control and sensor technologies, rapid prototyping, and environmentally-conscious manufacturing.

- **All laboratories managed by the Department of Energy, NASA, and the Department of Defense that can make a productive contribution to the civilian economy will be reviewed with the aim of devoting at least 10-20 percent of their budgets to R&D partnerships with industry.**

- **Agencies will make it a priority to remove obstacles to Cooperative R&D Agreements (CRADAs) and to facilitate industry-lab cooperation through other means.**

- **The Federal Coordinating Council for Science, Engineering, and Technology (FCCSET) will be strengthened.** Initiatives are currently underway in the following six areas: improving our understanding of the climate system, advanced supercomputers and computer networks, math and science education, materials processing, biotechnology, and advanced manufacturing.

Commercialization. Although U.S. firms remain relatively strong in the invention of new technologies, foreign competitors are often first to commercialize and bring new products to market. The reorientation of federal R&D can play an important role. Cooperative research is a powerful way to get technology and know-how into the hands of businesses that are in a position to put them quickly to work. The tax, regulatory, and other reforms described later also play a key role by creating a favorable investment environment for innovation. But in many cases additional programs are needed, such as:

- **Regional Technology Alliances** explicitly designed to promote the commercialization and application of critical technologies in which there are regional clusters of strength to encourage firms and research institutions within a

particular region to exchange information, share and develop technology, and develop new products and markets.

- **Agile Manufacturing programs** expanded to allow temporary networks of complementary firms to come together quickly to exploit fast-changing market opportunities. These programs support the development and dissemination of information technology and technical standards to make such networks possible.

Access and Use. In addition to support for the development and adoption of new technologies, programs are needed to ensure that all American businesses have easy access to existing technology and best practices. The Agriculture Department has historically devoted half of its R&D budget to the active dissemination of research results. The extraordinary productivity gains in American farming throughout this century owe a great deal to the close links between individual farmers and county extension agents.

American manufacturing also needs an effective system. New manufacturing technologies and approaches are available that can lead to dramatic improvements in product quality, cost, and time-to-market. But relatively few U.S. businesses have taken advantage of these new technologies and best practices. The problem is particularly acute among the 360,000 small and medium-sized manufacturers, many of whom are still using 1950s technology.

Workers should play a significant role in the use and spread of manufacturing technology. Workplace experience makes clear that new technologies are implemented most effectively when the knowledge and concerns of workers are included in the process.

To enhance the use of and access to technology, we will:

- **Create a national network of manufacturing extension centers.** Existing state and federal manufacturing extension centers managed through the Department of Commerce provide assistance to a small number of businesses, but service must be greatly expanded to give all businesses access to the technologies, testing facilities, and training programs they need. Federal funds (to be matched by state and local governments) will support and build on existing state, local, and university programs, with the goal of creating a nation-wide network of extension centers.

- **Expand the Manufacturing Experts in the Classroom program** to support manufacturing specialists from industry and labor teaching in technical and community colleges. The goal is to strengthen the capacity of such institutions to serve regional manufacturing firms.

- **Work through the Department of Labor to assist US firms in implementing the principles of high performance work organization.** DOL will coordinate assistance in workforce literacy, technical training, labor management relations,

and the restructuring of management and work processes. Implementation will occur in part through the network of manufacturing extension centers.

A World-Class Business Environment For Innovation and Private Sector Investment

Increasing investment in civilian technologies is only one element of a strategy to restore America's industrial and technological leadership, and to create high-wage, high-skill jobs. The United States must also ensure that its tax, trade, regulatory and procurement policies encourage private sector investment and innovation. In a global where capital and technology are increasingly mobile, the United States must make sure that it has the best environment for private sector investment and job creation.

To improve the environment for private sector investment and create jobs, we will:

1. **Make Permanent the Research and Experimentation (R&E) Tax Credit:** The need for additional U.S. investment in R&D is clear. Currently, the United States invests 1.9 percent of GDP in non-defense R&D, as compared to 3.0 percent in Japan and 2.7 percent in West Germany. We will increase private R&E expenditures by making the Research and Experimentation tax credit permanent. In the past, the effectiveness of this credit has been undermined by a series of six and nine-month temporary extensions. The credit cannot induce additional R&E expenditures unless its future availability is known when the businesses are planning R&E projects and projecting costs. R&E activity, by its nature, is long term and businesses should be able to plan their research activity knowing that the credit will be available when the research is actually undertaken. Thus if the R&E credit is to have the intended incentive effect, it should be permanent.

2. **Create incentives for long-term investments in small businesses:** The Administration will send legislation to Congress designed to provide incentives for those who make high-risk, long-term venture capital investments in startups and other small enterprises. These companies are the major source of job creation, economic growth, and technological dynamism in our economy.

3. **Create incentives for investment in equipment:** Currently, America's chief economic competitors are investing twice as much in plant and equipment (as a percentage of GDP) as the United States. Furthermore, studies show a high correlation between investment in new equipment and productivity -- since new technologies are often embodied in capital equipment. To stimulate additional investment in equipment, the Administration will propose a temporary incremental investment tax credit for large businesses and a permanent credit for small businesses.

4. **Reform antitrust laws to permit joint production ventures:** The Administration will forward legislation to Congress which would extend the National Cooperative Research Act of 1984 to cover joint production ventures. Increasingly, the escalating cost of state-of-the-art manufacturing facilities will require firms to share costs and pool risks.

5. **Ensure that U.S. trade policy strengthens high technology industries:** To remain competitive, America's high-tech industries need full access to overseas markets and effective protection of intellectual property rights. The Administration is committed to

multilateral and bilateral negotiations, and enforcement of existing agreements, that will accomplish these objectives. The trade policy must also be consistent with a vigorous public research and development program.

6. **Review proposals to increase the supply and availability of patient capital:** A number of proposals have been made to increase the time-horizon of investments. For example, the National Academy of Science has proposed creating a publicly-funded, privately run Civilian Technology Corporation. The private-sector Council on Competitiveness has proposed a sweeping set of reforms to improve corporate governance and encourage long-term asset ownership. The Administration will review these and other proposals in an effort to improve the environment for long-term investments.

7. **Ensure that federal regulatory policy encourages investment in innovation and technology development that achieve the purposes of the regulation at the lowest possible cost:** Regulatory policy can have a significant impact on the rate of technology development in energy, biotechnology, pharmaceuticals, telecommunications, and many other areas. The caliber of the regulatory agencies can affect the international competitiveness of the industries they oversee. At the same time, skillful support of new technologies can help businesses reduce costs while complying with ambitious environmental regulations. A well designed regulatory program can stimulate rather than frustrate attractive directions for innovation. We will review the nation's regulatory "infrastructure" to ensure that unnecessary obstacles to technical innovation are removed and that priorities are attached to programs introducing technology to help reduce the cost of regulatory compliance.

Education and Training

Technology policy can play a key role in supporting our commitment to improving the education and training opportunities for all Americans.

First, it is essential that priorities in research, regulatory, and other policies designed to encourage innovation and investment in the economy reflect the need to create high-performance workplaces -- workplaces which offer all workers skilled, rewarding jobs with opportunities for growth. These priorities are reflected in the design of the initiatives described earlier. Our plan ensures that economic growth works to the advantage of all Americans in the workforce, not just an elite group of well-educated workers who have easy access to training in new skills.

Secondly, it is essential that all Americans have access to the education and training they need and that the teaching enterprise itself become a high-performance workplace. Our initiatives in education and training follow four central themes: restructuring primary and secondary schooling, using youth apprenticeships and other programs to facilitate the transition from school to work for people who do not expect to go to college, making training accessible and affordable to all workers who need to upgrade their skills to keep pace with a rapidly

changing economy, and programs specifically targeted to help workers displaced by declining defense budgets or increased international trade.

Technology policy can and must support all of these objectives.

1. Public investment will be provided to support technology that can increase the productivity of learning and teaching in formal school settings, in industrial training, and even at home. New information technologies can give teachers more power in the classroom and create a new range of employment opportunities. Schools can themselves become high-performance workplaces.

2. Public investment will also be increased for programs designed to provide needed skills in mathematics, science, and engineering. Programs will be supported in primary, secondary, college, post-graduate schools and in a range of industrial training facilities. Particular attention will be paid to increasing participation by minorities and women.

3. Defense capabilities in education and training represent an important resource. New programs will accelerate transfer of this experience to civilian institutions. The Department of Defense and NASA have invested heavily both in the hardware and software needed for advanced instructional systems, they have accumulated valuable experience in how to use the new technologies in practical teaching situations. The Navy Training Systems Center and the Army Simulation, Training and Instrumentation Command together spend about $1 billion a year on training systems. There are over 150 defense simulation and training companies serving these needs in central Florida alone.

Specific initiatives include the following:

A. **Access to the Internet and developing NREN will be expanded** to connect university campuses, community colleges, and K-12 schools to a high-speed communications network providing a broad range of information resources. Support will be provided for equipment allowing local networks in these learning institutions access to the network along with support for development of high-performance software capable of taking advantage of the emerging hardware capabilities.

B. **An interagency task force will be created** from appropriate federal agencies to (i) establish software and communication standards for education and training, (ii) coordinate the development of critical software elements, (iii) support innovative software packages and curriculum design, and (iv) collect information resources in a standardized format and make them available to schools and teaching centers throughout the nation through both conventional and advanced communication networks. This task force will provide specific assistance to the interagency task force on worker displacement.

C. **Programs in the Federal Coordinating Council for Science, Engineering, and Technology (FCCSET) Committee on Education and Human Resources programs will be enhanced.** These programs are designed to improve the teaching of science, mathematics, and engineering at all levels. In K-12 schools, primary emphasis will be placed on teacher preparation, comprehensive organizational reform, and curriculum development. Programs for undergraduate education emphasize faculty preparation and organization and curriculum reforms but place heaviest emphasis on student incentives. At the graduate level, most funding is directed for fellowships.

D. **Proposals will be encouraged for an industry consortia or regional alliance designed to develop new teaching systems** (hardware and software) and work with training organizations throughout the nation to develop, install, and maintain state-of-the art systems. Firms now providing similar services to defense training organizations are likely to participate.

E. **Promote Manufacturing Engineering Education.** Traditional engineering education, with its focus on product design and analysis, has seriously neglected the management and operation of manufacturing activities. This program provides matching funds for graduate or undergraduate programs in manufacturing engineering.

New Options offered by Information Technology in Education and Training

- Computers can create an unprecedented opportunity for learning complex ideas, creating an environment that can closely approximate real work environments or experimental apparatus.
- Interconnected systems can help students work together as parts of a team even if the members of the team are separated geographically.
- Training can be embedded as a part of new equipment. Complex machine tools or software packages can be purchased with tutorials that bring new operators up to speed quickly, that provide quick refreshers for unusual events, and that allow operators to build new competencies during off-hours.
- Advanced systems permit instruction tailored to the learning needs of individuals. This is particularly important for retraining adults that reenter a training environment with a great variety of learning needs and learning abilities. And it is important in ensuring that minorities, women, people with disabilities, and others that may be disadvantaged by traditional approaches to instruction.
- Communication technologies can bring a rich education and training environment to people isolated because they live in remote areas or because of the demands of work and family responsibilities.
- Technology can reduce the burden of record-keeping and other paperwork that consumes so much teacher time in today's classrooms. It can also bring teachers and schools together in ways that facilitate the exchange of ideas and build a sense of community.

" Information Superhighways"

Efficient access to information is becoming critical for all parts of the American economy. Banks, insurance companies, manufacturing concerns, and many other business operations now depend on high-speed communication links. Many more businesses can take advantage of such systems if they are reliable, easy to use, and inexpensive. Such systems would also be of enormous value to schools, hospitals, and other public organizations. Even the most remote school could be connected to state-of-the art information. Hospitals could call in experts for consultation even if the expert is far from the patient.

Accelerating the introduction of an efficient, high-speed communication system can have the same effect on US economic and social development as public investment in the railroads had in the 19th century. It would provide a critical tool around which many new business opportunities can develop.

Specific new programs include :

A. **Implementation of the High-performance Computing and Communications Program** established by the High-Performance Computing Act of 1991 introduced by Vice President Gore when he served in the Senate. Research and development funded by this program is creating (1) more powerful super computers, (2) faster computer networks and the first national high speed network, and (3) more sophisticated software. This network will be constructed by the private sector but encouraged by federal policy and technology developments. In addition, it is providing scientists and engineers with the tools and training they need to solve "Grand Challenges", research problems--like modeling global warming--that cannot be solved without the most powerful computers.

B. **Create a Task Force on Information Infrastructure.** Government telecommunication and information policy has not kept pace with new developments in telecommunications and computer technology. As a result, government regulations have tended to inhibit competition and delay deployment of new technology. For instance, without a consistent, stable regulatory environment, the private sector will hesitate to make the investments necessary to build the high-speed national telecommunications network that this country needs to compete successfully in the 21st Century. To address this problem and others, we will create a high-level inter-agency task force within the National Economic Council which will work with Congress and the private sector to find consensus on and implement policy changes needed to accelerate deployment of a national information infrastructure.

C. **Create an Information Infrastructure Technology Program** to assist industry in the development of the hardware and software needed to fully apply advanced computing and networking technology in manufacturing, in health care, in life-long learning, and in libraries.

D. **Provide funding for networking pilot projects** through the National Telecommunications and Information Administration (NTIA) of the Department of Commerce. NTIA will provide matching grants to states, school districts, libraries, and other non-profit entities so that they can purchase the computers and networking connections needed for distance learning and for hooking into computer networks like the Internet. These pilot projects will demonstrate the benefits of networking to the educational and library communities.

E. **Promote dissemination of Federal information.** Every year, the Federal government spends billions of dollars collecting and processing information (e.g. economic data, environmental data, and technical information). Unfortunately, while much of this information is very valuable, many potential users either do not know that it exists or do not know how to access it. We are committed to using new computer and networking technology to make this information more available to the taxpayers who paid for it. In addition, it will require consistent Federal information policies designed to ensure that Federal information is made available at a fair price to as many users as possible while encouraging growth of the information industry.

Transportation and other Infrastructure

A competitive, growing economy requires a transportation system that can move people, goods and services quickly and efficiently. To meet this challenge, each transport sector must work effectively both by itself and as part of a larger, interconnected whole. With nearly one out of every six dollars of GDP now spent in transportation related activities, technologies that increase the speed, reliability, and cost-effectiveness of the transportation sector will also increase the economy's competitiveness and ability to create jobs.

One of the greatest challenges we face is to rehabilitate and properly maintain the huge stock of infrastructure facilities already in place. With this in mind, the Administration will consider establishing an integrated program of research designed to enhance the performance and longevity of the existing infrastructure. Among other things, this program would systematically address issues of assessment technology and renewal engineering. A strategic program to develop new technologies for assessing the physical condition of the nation's infrastructure, together with techniques to repair and rehabilitate those structures, could lead to more cost-effective maintenance of the infrastructure necessary to economic growth.

Providing a world class transportation sector will require the nation to meet the challenges posed both by increased congestion in many parts of the transportation system, and by the need to rebuild and maintain a public capital stock valued at more than $2.4 trillion. To meet these challenges, the Administration's program includes increased investment in a number of areas:

A. **Upgrading the nation's highways and transit systems by providing additional funding authorized by the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA).** Improve mass transit services and facilities by investing an additional $600 million in 1994 and $1 billion each year from 1995 to 1998 in transit capital projects.

B. **Investing in magnetic levitation (maglev) transportation and high-speed rail** by providing funds for a maglev prototype and for start-up of private or state/local high-speed rail projects.

C. **Increasing research on new technologies that could lead to the development of "smart highways".** These efforts range from technologies that provide in-route planning and traffic monitoring, to those that would support a fully automated system.

D. **Increasing research on civil aviation technologies**, including an examination of the economic, market, safety, and noise aspects of advanced aircraft. We will also support advanced in-flight space and ground-based command, navigation, weather prediction, and control systems. US aeronautical, research and development facilities infrastructure such as wind tunnels will also be revitalized.

E. **Increasing research on new materials** that will allow the construction of infrastructure facilities that are more durable, minimizing the frequency of costly reconstruction with its attendant disruption of traffic.

F. **Exploring new assessment technologies for more accurately assessing the expected life of existing public infrastructure.** A number of new technologies from a variety of industries, including electronic, medical, space, defense, and manufacturing sectors, could be used to develop more-reliable, nondestructive methods for evaluating the condition of existing structures. Since current assessment techniques are so unreliable, engineering decisions must include significant room for error and costly fail-safe features. The data made available by nondestructive evaluation and monitoring could be used to schedule better an ongoing program of cost-effective maintenance and rehabilitation.

G. **Supporting renewal engineering programs which target materials and construction methods that would lower the cost of rehabilitating and repairing structures.**

GOAL: MAKING GOVERNMENT MORE EFFICIENT AND MORE RESPONSIVE

The federal government must use technology to improve the efficiency of its own operations. Many private businesses have used advanced communication systems to improve the efficiency of their operations and to make their businesses more sensitive to the needs of individual customers and clients. The federal government must move actively to take advantage of these new opportunities. Similarly, the federal government is one of the nation's largest consumers of energy yet many of its buildings are far less efficient than structures owned by private firms and taxpayers are paying the bill.

The enormous purchasing power of the federal government can be used to stimulate markets for innovative products in many areas. This power should be exercised in a way that is consistent with overall national technology objectives. President Clinton is committed to reinventing government, to make government work better, harder, and smarter. Technology can help us achieve that goal.

Information Technology

Information technology will be used to dramatically improve the way the Federal Government serves the people. Government will become more cost-effective, efficient, and "user-friendly." In particular, we will use technology to improve the quality and timeliness of service, to provide new ways for the public to communicate with their government, and to make government information available to the public in a timely and equitable manner.

Fast communication makes it possible for teams to work closely on a project even if the team members are physically distant from each other. Information technology presents an opportunity to flatten existing organizational structures, form effective cross-disciplinary problem-solving groups, and expand the definition of the workplace and workforce via telecommuting. But business organizations in many sectors have found that automating existing work processes based on a tradition of processing paper does not always provide the greatest benefits from investment in automation. Efficiency gains from the new technology often can only be captured if changes are made in the structure of their organizations and the way they are managed. The administration will undertake a careful review of government management with a view to making the most efficient possible use of new information technologies.

Improved quality and timeliness of service. Information technology will eliminate errors generated in routine paper processes while reducing processing time. For example, the Internal Revenue Service (IRS)'s electronic filing program is reducing error rates on tax returns from 16 percent to less than 3 percent, while speeding up the delivery of refunds by as much as four weeks. Agencies are moving forward to convert many other paper processes to electronic form.

Information on paper is hard to retrieve. Automation is allowing the Social Security Administration to provide beneficiaries with "one-stop" service anywhere in the country from

an 800 number. Better connections among Federal offices, in a manner that safeguards the privacy of individuals, will make it easier to get answers from the government.

New ways to communicate. In the past, citizens typically had to go to a federal office during business hours to receive benefits or services. A government that uses technology to expand its hours of service and communicate with the public electronically will deliver services and benefits where people need them, not where the government provides them. We will make it possible for people to communicate with a Federal agency using electronic as well as conventional mail. Automated terminals may be placed in public locations such as shopping centers or post offices that could provide in-hours access to a variety of government services.

Access to government information. Government information is a public asset. Markets depend on sound and timely economic decisions. Federal geographic and climatological information allows farmers to apply fertilizer more efficiently, local governments to formulate environmental policy, and public safety officials to prepare for natural disasters. The government will promote the timely and equitable access to government information via a diverse array of sources, both public and private, including state and local governments and libraries. The development of public networks such as the Internet and the National Research and Educational Network (NREN) will contribute significantly to this diversity, enabling government information to be disseminated inexpensively to a broad range of users.

Policy and technology infrastructure. Many of the government's policies in such areas as privacy, information security, records management, information dissemination, and procurement will be updated to take into account the rapid pace of technological change. In addition, the government must apply the economic principle of maximizing return on investment when acquiring information technology, and be able to acquire commercial, off-the-shelf technology quickly and easily.

In addition, resources are needed to provide a technology infrastructure to support these service delivery improvements. The support for the IRS Tax System Modernization in the stimulus package, along with requests elsewhere for resources to support information technology, are examples of the government investing in technology to put people first.

Energy Efficiency

The federal government is wasting tax dollars by operating inefficient buildings. More than $2 billion could be invested in energy retrofits in federal buildings with average payback times less than 3-4 years. California, Texas, Iowa, and several other states have successful programs which have profitably invested in state buildings during the past several years. The programs have both increased the efficiency of state structures and stimulated the local construction industry.

HUD spends approximately $3-4 billion a year subsidizing the energy bills of about 5 million low income households. At least $3 billion could be invested in energy retrofits with a payback less than five years.

We are introducing a multi-year program designed to capture the economic benefits of energy retrofits, create new jobs in the construction industry, and to foster innovation in efficient building components and in the construction industry itself.

Procurement Policy

The federal government, particularly the Department of Defense and NASA, is a gigantic customer for high technology products. Historically, it played an important role in helping assure an early market for high-risk commercial technologies that were extremely expensive to develop. For example, the defense-space share of the U.S. computer hardware market was 100 percent in 1954, and it exceeded 50 percent until 1962. Semiconductors, jet aircraft, and pharmaceuticals also benefited from this government investment.

In recent years, DoD has ceased to be an influential "first customer" for commercial technology. By and large, this is not due to differing technical requirements: today's commercial capabilities often equal or surpass DoD requirements. Rather the problem is a growing morass of procurement laws and regulations. Many commercial manufacturers refuse to do business with DoD altogether, and those that do often wall off their defense production. As a result, the military and commercial worlds have grown increasingly segregated from one another.

The cost of this segregation both to DoD and the nation is high, as a 1991 report by the Center for Strategic and International Studies plainly stated:

> "[It] results in higher prices to DoD (even when lower-cost commercial alternatives exist for the same requirements), loss of a broad domestic production base that could be available to defense for peacetime and surge demands, and lack of access to commercial state-of-the-art technologies. Additionally, the wall between engineers and scientists engaged in commercial and military work impedes the kind of shoulder-to-shoulder contact that is the essence of technology transfer and that is basic to achieving greater job stability and growth opportunities for the U.S. work force."

The federal government will make it a priority to thoroughly review and reform its procurement policy, particularly (but not exclusively) defense procurement policy. It will begin by reviewing the recommendations of the congressionally-mandated "Section 800 Panel" (after Section 800 of the FY1991 Defense Authorization Act), which recently completed a detailed study of DoD procurement practices.

More specifically, the federal government will begin steps necessary to achieve the following reforms:

- Government purchases or government-contracted development should give priority to commercial specifications and products.

- Agencies should invest in and procure advanced technologies, where it is economically feasible, in order to facilitate their commercialization.

- Agencies should experiment with a portion of their procurement budget to allow them to procure innovative products and services incorporating leading-edge technologies.

- Agencies should evaluate bids based on their ability to minimize life-cycle cost rather than acquisition cost, including environmental, health and safety costs borne by the public.

- Agencies should obtain rights in technologies developed under government contracts only to the extent necessary to meet the agencies' needs, leaving contractors with the rights necessary to encourage private sector investment in the development of commercial applications.

- Agencies should use performance-based contracting strategies that give contractors the design freedom and financial incentive to be innovative and efficient.

BUILDING AMERICA'S ECONOMIC STRENGTH: NEW INITIATIVES

- **Permanent Extension Of The Research And Experimentation Tax Credit**
- **Invest In A National Information Infrastructure**
- **Advanced Manufacturing Technology**
- **Facilitate Private Sector Development of a New Generation of Automobiles**
- **Improve Technology For Education And Training**
- **Investments In Energy-Efficient Federal Buildings**

PERMANENT EXTENSION OF THE RESEARCH AND EXPERIMENTATION TAX CREDIT

Objectives

The success of U.S. businesses depends on their ability to compete both in the development of innovative products and production processes and in their ability to bring new products to the market quickly and efficiently. Unfortunately, the U.S. has fallen behind many of its foreign competitors in civilian research. Currently the U.S. invests 1.9 percent of GDP in non-defense R&D compared to 3.0 percent in Japan and 2.7 percent in Germany. US investment in research and experimentation can be increased through a tax credit for R&E that can provide a stable basis for business planning.

Increasing investment in research is important to foster economic growth and technological development and to improve international competitiveness. But many of the benefits of research cannot be captured by the businesses making the investments. Instead, these benefits redound to competitors and to the public. In the absence of an incentive for research, businesses simply might not invest in research the way our economic goals demand. The research and experimentation credit should be permanently extended to foster economic growth and technological development, create jobs, and improve international competitiveness. R&D activity, by its nature, is long-term, and taxpayers should be able to plan their research activity knowing that the credit will be available when the research is actually undertaken.

Actions

The Administration will propose that the Research and Experimentation Tax Credit be made permanent. The credit would apply to qualified research expenditures by businesses and businesses expenditures for university basic research paid or incurred after June 30, 1992. The proposal also provides a basis for start-up businesses to qualify for the credit.

INVEST IN AN INFORMATION INFRASTRUCTURE

Objectives

Today's "Information Age" demands skill, agility and speed in moving information. Where once our economic strength was determined solely by the depth of our ports or the condition of our roads, today it is determined as well by our ability to move large quantities of information quickly and accurately and by our ability to use and understand this information. Just as the interstate highway system marked a historical turning point in our commerce, today "information superhighway" – able to move ideas, data, and images around the country and around the world – are critical to American competitiveness and economic strength.

This information infrastructure – computers, computer data banks, fax machines, telephones, and video displays – has as its lifeline a high-speed fiber-optic network capable of transmitting billions of bits of information in a second. Imagine being able to transmit the entire Encyclopedia Brittanica in one second.

The computing and networking technology that makes this possible is improving at an unprecedented rate, expanding both our imaginations for its use and its effectiveness. Through these technologies, a doctor who needs a second opinion could transmit a patient's entire medical record – x-rays and ultrasound scans included – to a colleague thousands of miles away, in less time than it takes to send a fax today. A school child in a small town could come home and through a personal computer, reach into an electronic Library of Congress – thousands of books, records, videos and photographs, all stored electronically. At home, viewers could choose whenever they wanted from thousands of different television programs or movies.

Efficient access to information is becoming increasingly more important for all parts of our economy. Banks, insurance companies, manufacturing concerns, and many other businesses now depend on high speed communication networks. These networks have become a critical tool around which many new business opportunities are developing.

And, by harnessing the power of supercomputers able to transform enormous amounts of information to images or solve incredible complex problems in record time, and share this power with an ever-expanding audience of scientists, businesses, researchers, students, doctors and others, the potential for innovation and progress multiplies rapidly. Supercomputers help us develop new drugs, design new products, predict dangerous storms and model climate changes. They help us design better cars, better airplanes, more efficient manufacturing processes. Accelerating the introduction of an efficient, high-speed communication network and associated computer systems would have a dramatic impact on every aspect of our lives. But this is possible only if we adopt forward-looking policies that promote the development of new technologies and if we invest in the information infrastructure needed for the 21st Century.

Actions

A. **Implementation of the High-performance Computing and Communications Program** established by the High-Performance Computing Act of 1991 introduced by Vice President Gore when he served in the Senate. Research and development funded by this program is creating (1) more powerful super computers, (2) faster computer networks and the first national high speed network, and (3) more sophisticated software. This network will be constructed by the private sector but encouraged by federal policy and technology developments. In addition, it is providing scientists and engineers with the tools and training they need to solve "Grand Challenges", research problems--like modeling global warming--that cannot be solved without the most powerful computers.

B. **Create a Task Force on Information Infrastructure.** Government telecommunication and information policy has not kept pace with new developments in telecommunications and computer technology. As a result, government regulations have tended to inhibit competition and delay deployment of new technology. For instance, without a consistent, stable regulatory environment, the private sector will hesitate to make the investments necessary to build the high-speed national telecommunications network that this country needs to compete successfully in the 21st Century. To address this problem and others, we will create a high-level inter-agency task force within the National Economic Council which will work with Congress and the private sector to find consensus on and implement policy changes needed to accelerate deployment of a national information infrastructure.

C. **Create an Information Infrastructure Technology Program** to assist industry in the development of the hardware and software needed to fully apply advanced computing and networking technology in manufacturing, in health care, in life-long learning, and in libraries.

D. **Provide funding for networking pilot projects** through the National Telecommunications and Information Administration (NTIA) of the Department of Commerce. NTIA will provide matching grants to states, school districts, libraries, and other non-profit entities so that they can purchase the computers and networking connections needed for distance learning and for hooking into computer networks like the Internet. These pilot projects will demonstrate the benefits of networking to the educational and library communities.

E. **Promote dissemination of Federal information.** Every year, the Federal government spends billions of dollars collecting and processing information (e.g. economic data, environmental data, and technical information). Unfortunately, while much of this information is very valuable, many potential users either do not know that it exists or do not know how to access it. We are committed to using new computer and networking technology to make this information more available to the taxpayers who paid for it. In addition, it will require consistent Federal information policies designed

to ensure that Federal information is made available at a fair price to as many users as possible while encouraging growth of the information industry.

PROMOTE ADVANCED MANUFACTURING TECHNOLOGY

Objectives

Manufacturing remains the foundation of the American economy. Although the United States was the unchallenged world leader in manufacturing for many years, our performance has slipped badly in recent decades. American firms still excel at making **breakthroughs**, such as IBM's discovery of high-temperature superconductivity, but foreign firms are often better at **follow through**: namely, turning technology into new products and processes both quickly and cheaply.

Both American industry and government under-invest in manufacturing. In contrast to their foreign competitors, U.S. firms neglect process-related R&D within their overall R&D portfolio. And the federal government allocated only two percent of its $70 billion R&D budget to manufacturing R&D in FY92.

We have also neglected the dissemination of **existing** technology and know-how. New manufacturing technologies and approaches are available that can lead to dramatic improvements in product quality, cost, and time-to-market. Although a few U.S. firms have begun to adopt these technologies and approaches, most firms still lag. The problem is most acute among the 360,000 small and medium-sized manufacturers, who employ 8 million workers, but too often lack the resources or ability to gain access to the technologies that will help them grow, increase their profits, and create jobs.

Finally, investments in manufacturing have not reflected the concerns and the knowledge of factory employees. Firms should use technology to build on rather than reduce worker skills.

Actions:

A. **Provide increased funding for advanced manufacturing R&D.** SEMATECH, an industry consortium to develop semiconductor manufacturing technology, will receive continued matching funds from the Department of Defense in FY94. Industry consortia (including universities and government laboratories, where appropriate) will be the preferred performers of such R&D, to assure its commercial relevance. Programs will be encouraged in the development of a new automobile, new construction technologies, intelligent control and sensor technologies, rapid prototyping, and environmentally-conscious manufacturing.

B. **Support Agile Manufacturing.** The new Agile Manufacturing Program (also known as "Enterprise Integration") is designed to capitalize on the emerging shift from mass production to flexible or "agile" manufacturing. Agile manufacturing allows independently-owned companies to form instantaneous partnerships with firms that have complementary capabilities in order to exploit market opportunities. These partnerships -- called "virtual enterprises" or "virtual corporations" -- will leverage our nation's strengths in information technology. This program supports both the development and dissemination of such technology for enterprise integration.

C. **Create a national network of manufacturing extension centers.** Many small and medium-sized manufacturing firms in the U.S. have not taken advantage of new technologies and best practices, either because they are unaware of them or because they cannot afford them. Existing state and federal manufacturing extension centers provide assistance to a small number of firms, but service must be greatly expanded to give all firms access to the technologies, testing facilities, and training programs they need. Federal funds (to be matched by state and local governments) will go to support and build on existing state, local, and university programs, with the goal of creating a nation-wide network of extension centers.

D. **Seed Regional Technology Alliances.** Manufacturing industries tend to cluster geographically, and the strength of these technology clusters is fast becoming a key to international competitiveness. This new program is designed to encourage firms and research institutions in a particular region to exchange information, share and develop technology, and develop new products and markets. Federal funds (to be matched by alliance members) will go to support applied R&D and a range of technology services oriented particularly to smaller firms (test facilities for new products and prototypes, design and management assistance, start-up incubators, education and training, export promotion and market monitoring, and quality testing and standards certification).

E. **Promote Manufacturing Engineering Education.** Traditional engineering education, with its focus on product design and analysis, has seriously neglected the management and operation of manufacturing activities. This program provides matching funds for graduate or undergraduate programs in manufacturing engineering.

F. **Promote Environmentally-Conscious Manufacturing.** The Departments of Commerce, Energy, Defense, and a number of other federal organizations will incorporate environmental goals in research and development consortia for manufacturing. In addition, NIST, working with EPA, DoE, and state agencies, will undertake a technical support program in energy and environmental waste minimization for small and medium-sized firms.

FACILITATE PRIVATE SECTOR DEVELOPMENT OF A NEW GENERATION OF AUTOMOBILES

Objectives:

The automobile plays a central role in U.S. manufacturing capabilities, in America's economy, and in the lives of most Americans. If America's auto industry is to remain competitive and strong in the 21st century, preserving jobs, sustaining economic growth, and expanding its business, it must continue its exploration of new technologies that encourage the industry's growth and protect the environment. Increasingly stringent environmental concerns both here and abroad make this effort increasingly more essential and the need for innovation and new ideas even greater.

New fuels and new propulsion systems developed during the last decade offer promise as eventual replacements for the combination of gasoline and the internal combustion engine that have served so well for generations. Given adequate investment in research and development, and adequate incentives for U.S. producers to invest in these technologies, a new generation of vehicles could be on the market -- preserving jobs, expanding growth -- that would be safe and perform as well, if not better than existing automobiles, cost no more to drive than today's automobiles, consume only domestic fuels such as natural gas and renewables, and produce little or no pollution.

While the basic technology needed to achieve this goal is available, converting it to a practical vehicle represents an historic challenge. The potential can only be captured under the leadership of the U.S. business community and the industry itself. Success must be defined by their ability to develop a vehicle that can be built and sold successfully in private markets. They must play a central role in designing an efficient government-industry partnership in which the industry plays a leadership role in establishing priorities.

If U.S. producers lead the world in introducing such a vehicle, the domestic industry would be able to meet expanding domestic and international markets with a machine that significantly reduces pollution and operates from domestic fuel sources.

This initiative represents a bold and dramatic step toward a more profitable, and more environmentally sound future for one of America's most important industries.

Actions

A. **Establish a "clean car" task force linking research efforts of relevant agencies with those of U.S. auto manufacturers.** This task force will immediately establish an advisory group consisting of technology leaders in the principle US automobile manufacturers, their principal suppliers, and US fuel suppliers. It will oversee the establishment of cooperative research ventures in (i) fuel-cells and the control and other systems required for practical fuel-cell hybrid vehicle designs, (ii) advanced batteries, ultra-capacitors, advanced gas storage & delivery systems, and (iii) production of methanol and hydrogen from natural gas, municipal waste and other waste products, energy crops, and the electrolysis of water

B. **The task force will establish a special advisory group** consisting of key state officials and representatives of the participating Departments to (i) design a program for using the authority already present in the Clean Air Act revision of 1991 and the National Energy Act of 1992 to encourage introduction of prototype vehicles consistent with the objectives of this program, (ii) coordinate state regulatory programs designed to require low or zero emission vehicles, and (iii) propose federal regulations needed to supplement state efforts. It will also design programs for managing federal vehicle procurement.

C. **Working with its private sector and state advisory groups, the task force will prepare a list of development requirements and conduct a systematic search for capabilities in national laboratories and defense facilities.** Capabilities identified will be integrated rapidly into the research teams.

IMPROVE TECHNOLOGY FOR EDUCATION AND TRAINING

Objectives

This project will support the development and introduction of computer and communications equipment and software that can increase the productivity of learning in formal school settings, a variety of business training facilities, and in homes.

Actions

A. **Access to the Internet and developing high-speed National Research and Educational Network (NREN) will be expanded** to connect university campuses, community colleges, and K-12 schools to a high-speed communications network providing a broad range of information resources. Support will be provided for equipment allowing local networks in these learning institutions access to the network along with support for development of high-performance software capable of taking advantage of the emerging hardware capabilities.

B. **An interagency task force will be created** from appropriate federal agencies to (i) adopt software and communication standards for education and training, (ii) coordinate the development of critical software elements, (iii) support innovative software packages and curriculum design, and (iv) collect information resources in a standardized format and make them available to schools and teaching centers throughout the nation through both conventional and advanced communication networks. This task force will provide specific assistance to the interagency task force on worker displacement.

C. **Programs in the Federal Coordinating Council for Science, Engineering, and Technology (FCCSET) Committee on Education and Human Resources programs will be enhanced.** These programs are designed to improve the teaching of science, mathematics, and engineering at all levels. In K-12 schools, primary emphasis will be placed on teacher preparation, comprehensive organizational reform, and curriculum development. Programs for undergraduate education emphasize faculty preparation and organization and curriculum reforms but place heaviest emphasis on student incentives. At the graduate level, most funding is directed for fellowships.

D. **Proposals will be encouraged for an industry consortia or regional alliance designed to develop new teaching systems** (hardware and software) and work with training organizations throughout the nation to develop, install, and maintain state-of-the art systems. Firms now providing similar services to defense training organizations are likely to participate.

E. **Promote Manufacturing Engineering Education.** Traditional engineering education, with its focus on product design and analysis, has seriously neglected the management and operation of manufacturing activities. This program provides matching funds for graduate or undergraduate programs in manufacturing engineering.

MAKE ENERGY EFFICIENCY INVESTMENTS IN FEDERAL BUILDINGS

Objectives

This project would increase the efficiency of government by making cost-effective investments in buildings where the energy bills are paid by the taxpayers. The project would create a significant number of jobs in urban areas, create new businesses and job skills, stimulate markets for innovative energy efficiency equipment, and reduce the impact of the federal government on the environment.

Actions

In the case of federal building retrofits, funding will be provided to the Department of Energy which will be responsible for managing the program.

In the case of funds for federally subsidized housing, funds will be provided to HUD which will manage the fund with DoE providing technical guidance.

A. **Create an advisory group** of key officials from states with successful state building retrofit programs, representative building facility managers from federal buildings, and utility managers of successful "demand-side management" programs. This group will ensure that the federal program is designed with the advantage of their experience and provide periodic evaluation and guidance.

B. **The managers of the funds will provide funding for preliminary "walk through" audits**, following the experience in the Texas program. Based on these preliminary studies, funding will be provided for more extensive audits. Proposals made in these audits will be funded using the following criteria:
   - technical merit of the proposal;
   - extent to which all cost-effective savings (i.e. justified on a 10% real discount rate) have been captured;
   - cost-sharing by the agency, utility, or other source of financing;
   - in the case of federally subsidized housing, state and other non- program cost-sharing will be considered, including use of Low-Income Home Energy Assistance Program (LIHEAP) and other funds -- at least a 1:1 match should be expected; and
   - the extent to which contractors invest in hiring and training new workers.

   In each proposal, at least 6% of the program cost will be set aside for monitoring and evaluation using regional centers that follow an agreed protocol established by a lead center

   Up to 10% of the program funds should be spent to create early markets for innovative technologies which represent a significant advance over existing systems and have the potential for large future applications.

THE WHITE HOUSE
OFFICE OF THE PRESS SECRETARY

FOR IMMEDIATE RELEASE MONDAY, FEBRUARY 22, 1993

PRESIDENT OUTLINES COMPREHENSIVE NEW TECHNOLOGY INITIATIVE:

Technology to Create Jobs, Protect the Environment, Improve Government
Bold Changes Proposed to Redirect, Focus U.S. Efforts

SAN JOSE, CA – Offering bold and dramatic changes to harness technology to drive economic growth and job creation, President Bill Clinton and Vice President Al Gore today (2/22) unveiled a comprehensive new technology initiative to move America forward to a stronger economy, a cleaner environment, more competitive businesses, more effective government, better educational programs and technological leadership in critical fields.

"In order to revitalize our economy, it is time for a dramatically new approach that recognizes the strength and potential of America's scientific and technological resources to change and improve the quality of our lives," President Clinton said.

The new initiative: Technology for America's Economic Growth, A New Direction to Build Economic Strength offers a comprehensive blueprint to focus American technology around three central goals:

- Long-term economic growth that creates jobs and protects the environment;
- Making government more efficient and more responsive;
- World leadership in basic science, mathematics, and engineering.

"We face new challenges, from our competitors around the world and from the people we serve here at home, that demand new solutions and creative thinking. Technology offers new opportunities for jobs, for a cleaner environment, for better schools, for high-quality health care and for scores of other advances. We must move to seize these opportunities," said Vice President Gore, who the President has asked to play a leadership role in implementing these new initiatives.

President Clinton and Vice President Gore returned to California's Silicon Valley to unveil the initiative, where the President last year detailed his commitment to a new direction in U.S. technology policy, a commitment which was endorsed by leaders throughout the technology community.

Technology for America's Economic Growth recognizes that new investments in technology will help the private sector create high-wage, high-skill jobs. It offers ground-breaking proposals to:

- Develop a national network of manufacturing extension centers to help small and medium-sized businesses gain access to technology;
- Invest in applied R & D in fields such as advanced manufacturing, aerospace, biotechnology, and advanced materials;
- Increase partnerships between industry and the national laboratories;
- Develop a partnership with the American auto industry to enable the development of a "clean car," creating jobs and protecting the environment; and
- Expand the Commerce Department's Advanced Technology Program to provide matching grants for industry-led R & D consortia.

A major priority of the package will be developing a National Information Infrastructure and the "information superhighways" created by legislation introduced and steered to passage by Vice President Gore when he served in the Senate. Technology for America's Economic Growth includes:

- Support for the High-Performance Computing and Communications Initiative that is developing new technologies for our most powerful computers, supercomputers that are able to rapidly process enormous quantities of information and for a national, high-speed network ("information superhighways") to make this high-performance computing more accessible.
- Developing new applications for high-performance computing and networking in health care, lifelong learning, and manufacturing.
- Creating pilot projects to demonstrate these technologies in schools and other nonprofit entities.
- A task force of the National Economic Council which will work with the Congress and the private sector to develop policies needed to accelerate the deployment of a National Information Infrastructure.

America's technology policy also will be used to help meet other important national goals:

- The federal government will use technology to cut its costs, improve energy efficiency, and improve the quality and timeliness of service.
- The government will work with industry to develop technologies (software, computer and communications equipment) that increase the productivity of learning in our schools, our homes, and our work places.

The plan will improve the environment for private sector investment and innovation in a variety of ways:

- Making the Research and Experimentation tax credit permanent.
- Reducing capital gains for long-term investments in small businesses.
- Reforming our antitrust laws to permit joint production ventures.

Technology for America's Economic Growth recognizes as well that our policy goals require a continued commitment to U.S. leadership in basic research. The initiative includes substantial increases in funding for the National Science Foundation.

And, Technology for America's Economic Growth improves the management of U.S. technology policy with:

- High-level leadership and coordination by the Vice President, the Office of Science and Technology Policy, and the National Economic Council.
- Developing a true partnership between the federal government and industry, labor, academia, and the states.
- Regular evaluation of programs to determine whether they should remain part of the national investment in technology.

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COPIES OF TECHNOLOGY FOR AMERICA'S ECONOMIC GROWTH ARE AVAILABLE.

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ERICH BLOCH
DAVID CHENEY

Technology Policy Comes of Age

Now that President Clinton has put federal technology programs on center stage, we must work hard to review, refine, and improve them.

When President Clinton and Vice President Gore issued "Technology for America's Economic Growth: A New Direction to Build Economic Strength" only a month after taking office, it introduced a new period in U.S. science and technology policy. As indicated by the administration's high-profile release of the document, coupled with its supporting budget request to Congress for fiscal year 1994, technology policy is now at the center of the national economic policy agenda. Still, successfully implementing the new policy will require the administration to do some fine tuning and to explain more fully just why the policy is critical to the nation's economic future.

The administration's proposed programs and projects comprise an agenda that many people in technology policy circles have recommended for some time. These recommendations have been articulated by such broad-based groups as the Council on Competitiveness, the National Academy of Engineering, and the Competitiveness Policy Council, as well as by more specialized groups such as the Computer Systems Policy Project and the National Coalition for Advanced Manufacturing. To summarize, the basic thrust of the collective recommendations is to:

- Shift federal R&D funds from defense to civilian applications, especially those with the strongest links to industry (for example, programs in which industry shares in the planning, conduct, or funding of the R&D), and make government R&D institutions, especially federal laboratories, work more closely with industry.
- Provide tax incentives for private-sector investment in technology and equipment.
- Improve the infrastructure for technology development by helping small manufacturers to modernize, improving education and training, and improving the nation's information infrastructure.
- Use federal procurement and regulations to help create markets for innovative technologies.

Erich Bloch, the former director of the National Science Foundation, is a distinguished fellow and David Cheney is a senior associate at the Council on Competitiveness. Bloch was chairman and Cheney was staff director of the Critical Technologies Subcouncil of the Competitiveness Policy Council.

These recommendations, tactical in nature, are first of all the outgrowth of changes in the nation's geopolitical environment, moving from the confrontation and containment of the Cold War to more focus on economic competitiveness. In essence, they redirect federal science and technology policy to meet the new challenge of international competition rather than the military competition with the Soviet Union. They also stem from widespread recognition that the nation lags in the transition from technology to products in the marketplace, not in the generation of discoveries and inventions. Moreover, it has become increasingly apparent that we do not sufficiently utilize our national resources and do not provide a climate that fosters investment in education, capital, and small companies.

Although the administration has proposed a credible program, its public pronouncements have been mute on explaining the underlying policies. Beyond stating that technology is important for economic growth and meeting other goals, such as a cleaner environment, the administration has neither clearly defined the problems being addressed nor explained the logic behind its proposals. Left unanswered is what the appropriate roles of the government and private sector are, and, specifically, why the actions proposed are the right ones.

Because of the fundamental nature of the change in policy, it is important to communicate the underlying reason for the changes. Indeed, in the months since the administration released its technology policy, it has become clear that implementation of the agenda is not guaranteed. Several problems have arisen. First, the proposals for many new actions and programs without an overarching strategy or rationale have made it all too easy for critics to label the programs as Democratic big spending and as pork. Second, the lack of supporting arguments has done little to expand the base of support to a broader and more diverse constituency outside of the technology policy community. Third, the proposed actions have raised the specter of "industrial policy" or inappropriate government involvement into private-sector decisionmaking—an issue that paralyzed the previous administration. In particular, although much of the private sector supports closer industry-government partnerships in technology, much of its support is tentative and even skeptical. Many in the private sector will endorse a more active government role in technology policy only if the government role is that of a catalyst, and its management role limited.

Sound foundation

Although effective communication has lagged, there is, in fact, a solid policy rationale behind the general direction of the Clinton agenda. As already noted, the programs follow from many earlier recommendations of bipartisan coalitions. We will focus on efforts by the Subcouncil on Critical Technologies of the Competitiveness Policy Council, with which we were both involved. The subcouncil's goal was to lay out a comprehensive strategy for enhancing the contribution of technology to America's economic welfare, building on the wealth of previous studies of critical technologies and technology policies. This work culminated in the report "Technology Policy for a Competitive America." Our recommendations, which were formulated before the election without regard to the likely winner, are generally in strong accord with the recommendations of the new administration. These similarities are not coincidental: They reflect the extent of the evolving consensus on technology policy as well as links between the subcouncil membership and the administration's technology team.

Despite the similarities, however, there are notable differences in goals and focus, in the rationale, and in the role of government in the actions proposed by the administration and by the subcouncil. We want to summarize our conclusions and highlight where they agree with the president's proposals and where they seem to differ.

The goal of our subcouncil is straightforward: leadership in the development and application of technology to promote industrial competitiveness, productivity increases, and an improved standard of living. This does not mean that the nation should diminish or replace its long-standing emphasis on science policy. Strong support of science should continue undiminished, but it should be augmented by an equally aggressive and thoughtful technology policy.

There are several fundamental realities that underlie this need. These realities may seem obvious to many people, but the existing technology policies, rooted in the Cold War rather than the need to improve economic performance, are not consistent with them.

The economic benefits of technology are almost exclusively provided by the application of technology. Technology that remains in the lab provides almost no economic benefits. Technology that is applied only to government markets, such as defense, provides much smaller economic benefits than technologies that contribute to success in the much larger commercial markets, and especially in the ever more important global markets. Conversely, national strength in technology depends on applying technology successfully in commercial markets. In the United States, slightly over half of all R&D is funded by the private sector; in Japan and Germany, 70 percent to 80 percent of R&D is funded by the private sector. It is success in commercial markets that provides the funds for this R&D.

President Clinton has neither clearly defined the problems being addressed nor explained the logic behind his proposals.

In addition, today, in contrast to the 1950s and 1960s when our science policy was formulated, the competitive pressures of the commercial markets drive innovation. One has to consider only biotechnology, displays, or computers, which are being driven by the demands of the private sector, not those of defense. As illustrated by the difficulty that high-technology defense contractors have in competing in commercial markets (not to mention the failed technological performance of the former Soviet Union), it is nearly impossible to stay at the leading edge of technology without being successful at applying technology commercially. This means that technology policy should be focused on promoting the commercial application of technology, not just on promoting technology for government missions.

Technology has global and local aspects, and policies must recognize the distinction to be effective. Technological information is now generated in many places and moves rapidly around the globe; nations that can effectively access and apply this information can gain economic advantage. On the other hand, many key factors needed to capture the economic benefits of technology do not move quickly around the globe. Skilled researchers and workers, efficient organizations, research and testing facilities, and manufacturing infrastructure move slowly. The location of these will influence where technology is developed and deployed, and where the benefits from technology development will accrue. Technology policy must focus on building the domestic capabilities that are necessary to absorb and apply the technical information that flows around the world.

Many of the benefits of technology accrue to the places that provide the most favorable environment for private investment in technology development and manufacturing. The factors that determine this risk-and-reward equation for corporate investment are complex, involving, among other things, the cost of capital, access to markets, access to skilled people and technology, and availability of quality subcontractors. To be effective, policies must work to ensure that the combination of these factors encourages investment in the United States. To a large extent, these factors are more important than the traditional factors of production—low-cost energy, raw materials, and labor—to which public policies still pay more attention.

Other nations have demonstrated that they have learned how to prosper in this new environment. Nations such as Japan have developed sophisticated policies to encourage private-sector investment in technology and manufacturing through low-cost financing, cooperative R&D, and sheltered markets—all with less government funding of R&D than here. To a great extent, this accounts for the increasing technological strength of their companies, as evidenced by their increasing success in high-technology markets. Although we do not advocate sheltered markets, we do advocate a change from the outdated idea of a laissez-faire regime to one that demands reciprocity and symmetry in market access.

Although policies developed overseas may not be applicable here, there is strong evidence that more effective, uniquely American policies can be developed to make better use of U.S. strengths and resources. The historic U.S. policy of supporting only basic research and defense is no longer compatible with these realities. The new policies must focus more

on accelerating the application of technology in the private sector and on providing the environment that encourages private-sector investment in technology development and manufacturing in the United States.

Careful consideration of these realities leads to some important recommendations that focus on improving the commercialization of technology and making the United States a more attractive place to conduct R&D and high-value-added manufacturing. The recommendations fall into four categories:

Increase R&D in areas with the greatest benefits to commercial markets. Because privately funded R&D is most relevant to commercial markets, we support and would expand tax credits for private R&D. We also recommend reprioritizing federal R&D to shift funds from programs with weak links to commercial markets (such as defense development and testing) to programs with closer links to industry and markets (such as the Advanced Technology Program at the National Institute of Standards and Technology and the National Science Foundation's Engineering Research Centers). This would result in a balance between defense and civilian technology funding. We also seek to strengthen the links between other federal R&D, especially that conducted in federal labs and industry.

Promote the commercialization of technology. We support several government actions to make private-sector investments to commercialize technology more attractive. Cooperative funding of R&D by industry and government can help bridge the gap between where publicly funded university and laboratory research leaves off and private-sector investment picks up. Government regulations and procurement can be revised to provide better early markets for new technologies. And in some limited cases, the government should help finance the commercialization of technology.

Continually improve the technology infrastructure. We support several recommendations to ensure an adequate supply of well-trained people, build networks and extension systems to aid the flow of technical information, especially to small manufacturers, and improve the access of industry to specialized research and testing facilities. These are essential to making the United States an attractive place for R&D and manufacturing.

Organize for results. To make these policy changes work, it is essential to develop more effective methods of getting private-sector input to the policymaking process. It is also essential to develop better analyses of industry's needs, and better mechanisms to manage technology policy.

New role for government

We are greatly encouraged that the bulk of actions proposed by the administration are consistent with our recommendations. The administration has proposed dramatically increasing funding for industry-driven R&D programs such as the Advanced Technology Program, and has proposed steps to make the federal laboratories work more closely with industry. It has proposed expanding support for manufacturing extension centers to strengthen small manufacturers and has put high priority on improving the nation's information infrastructure. Equally important, it has resisted the temptation to radically reorganize the government's technology apparatus, which would likely take years to implement and additional years to become effective.

Nevertheless, there are several important differences between the administration's proposals and what we believe is the correct national technology strategy.

The recommendations that we outline require a new role for government. We support a strong and even activist government, but one that facilitates and does not substitute for private-sector action. Government should be active in creating an environment that allows the private sector to invest in technologies in the United States. The role is to lay the groundwork for industry to develop new products and processes based on knowledge generated here as well as abroad. The role of government should not be primarily to develop new technologies that will be magic bullets in international competitiveness.

The role of government that we recommend differs markedly from either laissez-faire economics or the stereotyped "industrial policy" model of strong government intervention. Laissez faire does not work in a world where governments around the globe are working to give their domestically based production a competitive advantage. Witness the enduring U.S. trade deficits in industries targeted by others, despite the falling value of the dollar. Industrial policy, on the other hand, meaning government channeling of resources to targeted industrial sectors, does not work well at fostering industries

of the future, particularly when the country is already at the leading edge and there is considerable uncertainty about the future direction of the industry. The government in our strategy is a partner with industry, but not a dominant partner.

It is in this crucial area where the statements of the Clinton administration are ambiguous. It is not clear whether the administration's focus is on new federal R&D programs or on helping the private sector invest in technology. And it is for this reason that bipartisan support for the administration's technology policy is weak, and the private sector remains cautious and skeptical.

We advocate R&D tax credits for industry-funded university R&D and to facilitate the startup of new R&D consortia.

Several of the specific differences between our recommendations and the Clinton plan reflect the differences in the emphasis on the role of government. We propose stronger incentives to enhance private-sector R&D than does the administration. The R&D tax credit, in addition to being made permanent, as the administration proposes, should also be extended to R&D "after the first article of production"—to allow the credit for R&D on improvements to existing products and processes instead of limiting it to the completely new. We also advocate an additional credit for industry-funded university R&D, which will further strengthen bridges between industry and universities, and an additional credit to facilitate the startup of new R&D consortia. Industry-funded R&D in universities and consortia can be expected to provide broader social benefits than corporate internal R&D because the results will quickly diffuse to other companies.

The Clinton plan, by contrast, puts greater emphasis on new government technology programs and on technology for the government's use. Its major new highlighted initiatives—in information infrastructure and automotive, education, and transportation technology—look much like traditional government technology programs that have had poor results in the past. Many such programs—the supersonic transport, the synfuels program, and the breeder reactor program, to name a few—have been unsuccessful. Such programs are not doomed to failure, but can succeed only if the past failures are understood and avoided. For example, demonstration programs can succeed if the private sector is involved from the early stages, participates financially, and takes increasing leadership and makes increasing investment as the program evolves.

Our recommendations also put greater emphasis on creating better mechanisms for private-sector input to government policy-making in technology, such as through an expanded President's Council of Advisers on Science and Technology (PCAST) with the authority to create subcouncils to get private-sector input on detailed issues. Clinton's plan is noncommittal on this issue and the administration has tended to rely on informal communication. Informal channels of communication, while important, may not survive the changes in personnel that inevitably will occur.

The next step

The Clinton administration's technology policy has launched the country on a new course. At a minimum, it has clearly established technology policy as an element of economic policy, and has legitimized the government role in technology policy. It has also properly increased the emphasis on manufacturing as a key element in technology policy.

The agenda now is to build support for, and to implement through legislation, the actions proposed by the administration, and to work to ensure that their implementation is consistent with the correct rationale for the recommendations. This suggests a set of priorities for the administration and the private sector.

To go forward, we believe that the administration needs to do three things. First, it needs to better articulate its conception of industry-government-university relations and the rationale for its initiatives. This is necessary to build broader support for the initiatives, particularly in the private sector and among those wary of a greater role for government.

Second, it needs to push for the implementation and institutionalization of the new directions. Producing a longlasting effect will require changes in organizations to reflect the new thinking. For example, in

the executive branch, the Federal Council on Science and Technology (FCCSET) played a major role during the Bush administration in planning and implementing cross-agency initiatives in critical areas such as biotechnology and high-performance computing. Unfortunately, FCCSET is ill-prepared to manage the programs, react effectively to new developments, or assess progress convincingly. It must be strengthened to give it these capabilities.

The federal government also needs to establish a more effective mechanism for interacting with industry. Business leaders have specialized knowledge that is essential to effectively implement technology policies. But because industry has a financial stake in the outcome of these policies, complex rules have been established to prevent inappropriate influence by special interests. Although these rules are well-intended, their implementation has made it almost impossible for business leaders to participate effectively in government affairs. Although this is a sensitive issue, there is no doubt that we can foster a more productive relationship between government and industry built on the understanding that they are allies, not adversaries, in promoting the nation's economic health.

The evolution toward a coherent and integrated national technology policy has highlighted the problem of fragmentation of responsibility that exists in Congress. Not only is there no way for Congress to consider the overall federal R&D program, but the R&D budget is distributed across nine appropriation bills and is the work of more than two dozen authorization and appropriation committees with a variety of concerns. The result is that trade-offs are made not among R&D programs but between R&D and housing subsidies or veterans' benefits. It is too much to hope that Congress will establish rational boundaries among its appropriation and authorization committees. But at a minimum, Congress must find a way—perhaps through a joint R&D committee or an R&D budget resolution—to pass judgment on the priorities and scope of the total R&D budget.

Third, the administration needs to demonstrate that it can make new programs work effectively and make old programs work better. Each major program needs to have specific goals and ways of measuring how well it achieves the goals. These steps are essential, not only to have effective programs, but also to build support for the programs in the private sector. The measures of success should include industry participation in terms of human resources, equipment, and financial investment. Output parameters could include patents, publications, and licensing actions. Although qualitative assessments are difficult, it is important to try to measure the effect of programs on the strength of participating industry sectors and companies. Particular attention should be paid to market share and international trade balance, as well as to new U.S. entries into specific industries.

The new agenda for the private sector is, first and foremost, to learn to be a constructive partner with government; it needs to be engaged and critical, but not antagonistic. It needs to work to ensure that government technology policy is implemented in a way consistent with industry's needs. Companies also need to learn how to cooperate with one another while still competing, as well as how to take better advantage of the resources in the federal laboratories and universities.

The Clinton administration's technology proposal is an important step forward toward creating an effective technology policy. But the hard work of implementing, refining, and institutionalizing the policy—and ensuring that it is effective—still lies ahead.

Recommended reading

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Divider Title: _____

Critical Technology Recommendations	Clinton's Technology Plan and Economic Vision

R&D for U.S. Leadership in Civilian Technology

Civilian/Defense Ratio	
· Shift R&D resources to create a balance between defense and civilian goals by 1995 (keep total constant)	· Increase the ratio of civilian and dual-use R&D to purely military R&D to more than fifty percent by 1998
ATP	
· Expand the ATP to $750 million by 1995	· Increase the ATP by $138 million in 1994, expanding to $680 million by 1997
Federal Laboratories	
· Reallocate at minimum 10-20% of DOE and NASA lab R&D to support jointly planned and funded industry/government R&D with the stipulation that the funding will be cut if it is not adequately refocused on industry needs.	· All labs managed by DOE, NASA and DOD will be **reviewed** with the aim of devoting at least 10-20% of their budgets to R&D partnerships with industry
· Continue to establish model CRADAs and give directors of government-owned, contractor operated labs the authority to negotiate, sign, execute and fund cooperative R&D ventures	· Agencies should make it a priority to remove obstacles to CRADAs and facilitate industry-lab cooperation through other means
R&D Tax Credit	
· Make the incremental R&D tax credit permanent Extend the tax credit to include R&D on existing processes	· Make the R&E tax credit permanent

· Establish an additional 25% credit for industry sponsored academic R&D

· Establish a 10 % tax credit for the first two years of new R&D consortia

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FCCSET

· Strengthen FCCSET

· Increase FCCSET funding and encourage more private sector participation

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Agency Funding of Civilian and Dual-use R&D

· Rename DARPA to ARPA, expand ARPA program in dual-use R&D in ways that increase likelihood that defense R&D leads to civilian opportunities

· Increase support for industry/government cooperative programs in NIH and DARPA

· Support adequate and sustained funding of university research through grant programs at NSF, NIH, and other research agencies

· Increase NSF Engineering Research Centers and Industry/University Cooperative Research Centers

· Double the amount of R&D performed in NIST labs by 1998

· Double the NIST budget for intramural R&D by 1995

· Provide increased funding for manufacturing R&D-- industry consortia, such as SEMATECH, will be the preferred performers

· Expand cooperative R&D through direct government funding of R&D consortia, such as SEMATECH or the advanced battery consortium

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Summary

Clinton's proposals to stimulate R&D and promote world leadership in basic science, mathematics and engineering track closely with the recommendations of the Critical Technologies Subcouncil. The primary difference between the two strategies is time frame--Clinton plans to balance civilian and defense R&D, significantly expand ATP and double NIST's R&D budget by 1998. The strategy of the Critical Technologies Subcouncil is more aggressive, calling for the same fundamental changes by 1995. The R&D tax credits proposed by the Critical Technologies recommendations are also more extensive than those endorsed by the Clinton plan. In addition to making the R&D tax credit permanent, the Subcouncil calls for an extension to cover R&D on existing processes, and two new tax credits for R&D consortia and industry-sponsored R&D at universities.

Support for Technology Commercialization

Government Procurement

· Modify procurement regulations to give priority to commercial specifications and products

· Government purchases or government-contracted development should give priority to commercial specifications and products

· Base government procurement on performance standards and evaluate selection criteria for bids to minimize life-cycle cost

· Agencies should evaluate bids based on their ability to minimize life-cycle costs rather than acquisition costs, including environmental, health and safety costs borne by the public

· Experiment with a modest percentage of each agency's procurement budget to give them the opportunity to flexibly procure leading edge technologies

· Agencies should experiment with a portion of their procurement budget to allow them to procure innovative products and services incorporating leading edge technologies

· Base Government procurement on performance standards and allow competitive awards to be made to the most cost effective realization of stated performance objectives

· Agencies should use performance-based contracting strategies that give contractors the design freedom and financial incentive to be innovative and efficient

· Agencies should obtain rights in technologies developed under government contracts only to the extent necessary to meet the agencies' needs to encourage private sector investment in the development of commercial applications

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Technology Programs/Pilot Projects

· Expand the Administration's HPCCI to provide the foundation for a new national communications infrastructure

· Support/ establish programs to build an "Information Superhighway":

- Implement HPCC
- Create a task force on information infrastructure
- Provide funding for networking pilot projects through NTIA
- Promote dissemination of Federal information (economic data,

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environmental data, technical information, etc.)

· Establish projects which encourage the development and use of advanced technologies to improve the efficiency of transportation systems (IVHS, MAGLEV)

· Support/establish transportation and other infrastructure progrms:

- Invest an additional $600 million in 1994 and $1 billion each year from 1995 to 1998 in transit capital projects (ISTEA)

- Invest in maglev transporation (provide funds for prototype) and high-speed rail (provide start-up funds for private or state/local projects)

- Increase research in the following: new technologies to develop "smart highways", civil aviation technologies, and new materials

- Explore new assessment technologies for more accurately determining the expected life of existing public infrastructure, support renewal engineering programs for materials and construction methods to lower cost of rehabilitating and repairing structures

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· Establish projects in environmentally conscious manufacturing

· Support/establish programs for improved energy efficiency and environmentally conscious manufacturing ($1.5 billion over 5 years)

- DOC, DOE and DOD will incorporate environmental goals in manufacturing R&D consortia

- NIST will work with EPA, DOE and state agencies to establish a technical support program in energy and environmental waste minimization for small and medium-sized firms

- New DOE programs to increase the productivity of energy use in industry, transportation, and buildings

- Invest $19 million to increase energy efficiency in Federal buildings

· Establish programs/projects to facilitate private sector development of a new generation of automobiles:

- Establish a **"clean car" task force** linking research efforts of

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relevant agencies with those of U.S. auto manufacturers. The task force will prepare a list of development requirements and conduct a systemmatic search for capabilities in national labs and defense facilities

- Establish a special advisory group to design a program for using authority present in the 1991 Clean Air Act revision and the National Energy Act of 1992

Financing Commercialization

· Give DARPA, ATP, and NIH the authority to purchase equity or extend loans/loan guarantees to facilitate commercialization of promising technologies generated through their R&D contracts

· Add an additional phase to the SBIR program to provide loans for commercialization.

· Review proposals to increase the supply and availability ofo patient capital

· Create incentives for long-term investment in small business

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Summary

Clinton's strategy for promoting industry commercialization of technology is almost identical to that of the Subcouncil in the area of government procurement. Both plans recognize the role government procurement can play in driving new technology development and application. Recommendations include modification of procurement regulations to give priority to commercial specifications and products, evaluation of bids based on life cycle costs, and award of contracts based on performance standards. Clinton's proposals for "Information Superhighways", increased energy efficiency, environmentally conscious manufacturing, improved transportation and infrastructure, etc. correspond to areas that the Subcouncil has identified as appropriate for joint industry/government/university pilot development and demonstration projects. Clinton's plan includes numerous programs and projects in each area, but the recommendations are not as strong in their reference to industry/government cooperation. Explicit provisions for joint planning and funding , industry input, etc. would more effectively emphasize the importance of cooperation in technology areas of mutual interest. In terms of direct financial assistance for industry commercialization, the Clinton plan is non-committal, calling for review of existing proposals to increase the supply and availability of patient capital. The Subcouncil strategy is more concrete, recommending that selected agencies be given the authority to grant loans and loan guarantees for commercialization of promising technologies developed within their R&D programs..

Support for the Technology Base

R&D Facilities

· Increase funding for government owned R&D facilities and equipment and allocate 10-20% of their use to the private sector

· Develop new missions for federal labs to make full use of their facilities and the expertise of their researchers

· Support national user facilities that are available to a variety of research organizations (synchotron radiation and neutron beam tools)

Manufacturing Technology/Capabilities

· Extend the National Cooperative Research Act (NCRA) to cover U.S.-based joint production ventures

· Establish an investment tax credit for plant and equipment (refer to the Manufacturing Subcouncil for details on the credit).

· Provide $ 300 million in federal funding (matched by state and local governments) to build on and support existing state and local manufacturing extension programs.

· Reform antitrust laws to permit joint production ventures

· Establish a temporary incremental investment tax credit for large businesses, and a permanent one for small businesses

· Create a national network of manufacturing extension centers

· Provide increased funding for advanced manufacturing R&D--industry consortia will be preferred performers to ensure commercial relevance

· Establish Regional Technology Alliances to promote the commercialization and application of critical technologies (exchange information, share and develop technology, and develop new products and markets)

· Expand Agile Manufacturing programs for enterprise integration

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Human Resources

· Fund fellowship programs to encourage 1) graduate and post-doctoral scientists and engineers to spend time within industry, university and government labs; and 2) movement of industrial scientists and engineers to academia.

· Fund curriculum development for graduate programs that combine concepts from engineering and management in the training of future managers.

· Establish a training tax credit or pay-or-play programs to encourage workforce training

· Create an apprenticeship and training program that offers an alternative to a college education that is recognized and respected by industry

· Expand the Manufacturing Experts in the Classroom program and provide matching funds for graduate or undergraduate programs in manufacturing engineering

· Expand access to Internet and the developing NREN

· Create an interagency task foce to: 1) establish software and communications standards for education and training; 2) coordinate the development of critical software elements; 3) support innovative software packages and curriculum design; and 4) collect and make availabel information resources in a standardized format

· Encourage proposals for an industry consortia or regional alliance to develop, install, and maintain new state-of-the-art teaching systems

· Enhance FCCSET education and human resource programs and make DOL responsible for helping firms implement the principles of a high performance workplace

· Allocate $1.2B from 1994-1997 for development of a youth apprenticeship program

· Establish an improved labor/dislocated workers program requiring an additional $4.6 billion over 4 years

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Summary

The Clinton plan contains numerous programs and policies to promote the development and use of advanced manufacturing technology, improve access to government R&D facilities and equipment, and strengthen education and workforce training. These recommendations are consistent with those of the Subcouncil, particularly those programs designed to build a national system of manufacturing extension for small and medium sized businesses. The Critical Technologies Subcouncil did not go into as much detail in these areas (they were explicitly addressed by the Education, Manufacturing and Training Subcouncils) but it endorses them as key components of a strong technology base.

Organize U.S. Institutions for Results

Administration

· Create a White House Council on Science, Technology, and Environmen tal Policy, chaired by the Vice President, to set directions and policy

· Enlarge OSTP structure to provide advice to the President on Science, Technology, and Manufacturing; manage the FCCSET Planning and Budget Process; and manage cross agency presidential initiatives using a matrix management model

· Change PCAST to President's Committee of Advisors on Science, Technology, and Manufacturing and make it responsible for private sector input and joint industry, academic, and government prioritization of the R&D budget

· Enhance the capabilities of the Technology Administration and make it responsible for analyzing industries and their technological needs; gathering, analyzing, and disseminating U.S. and international technical information; and facilitating domestic and international technological cooperation

· Create a National Economic Council to monitor implementation of new policies and provide a forum for coordinating technology policy with tax, trade, regulatory and economic development policies.

· Reinvigorate OSTP to lead in the development of science and technology policy and use FCCSET to coordinate the R&D programs of other agencies

· Ensure that U.S. trade policy strengthens high techology industries

· Ensure that Federal regulatory policy encourages investment in innovation and technology development to achieve the purposes of regulation and the lowest possible cost

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Congress

· Establish an R&D oversight committee to allow for joint hearings and encourage informed trade-offs among competing technology programs.

· Create a commission to periodically review major R&D programs and assure that government research and government sponsored research within universities and industry is relevant to national priorities, especially economic competitiveness.

Summary

The Clinton and Critical Technologies Subcouncil strategies both highlight the need for better coordination between technology policy and economic, regulatory, trade and environmental policy. Clinton recommends that a National Economic Council be created to carry out this objective, while the Subcouncil recommends a White House Council on Science, Technology and Environmental Policy to serve a similar function. Both plans also recommend significant expansion of OSTP and the FCCSET process. Three areas that are not addressed by Clinton's plan are the roles of PCAST and DOC's Technology Administration and Congressional oversight of the R&D budget. The Subcouncil identifies PCAST as a focal point for private sector input and recommends that the Technology Administration be expanded and become the focal point for monitoring, analyzing and dissiminating information on U.S.industrial competitiveness and foreign technical capabilities. These important function is not explicitly included in Clinton's technology plan, although there is mention of a new industry/government partnership and improving access to government sources of information. The Subcouncil also recommends restructuring Congressional appropriation and authorization committees to improve prioritization and more effective implementation of the R&D budget. This is essential if the U.S. is to develop and effectively implement a comprehensive national technology strategy.

CPC	SENATE LEGISLATION	HOUSE LEGISLATION
Civilian/Defense Ratio		
· Shift R&D resources to create a balance between defense and civilian goals by 1995 (keep total constant)	· Not Specifically Addressed	· Not Specifically Addressed
ATP	**S.4/National Competitiveness Act**	**H.R.820/National Competitiveness Act**
· Expand the ATP to $750 million by 1995	· Develop a long-term plan for ATP and expand to $420M by FY95 (including mfrg)	· Develop a long-term plan for ATP and expand to $400M by FY95 (not including mfr)
Federal Laboratories	**S.473/DOE Partnership Act of 1993**	**H.R.1432/DOE Lab Technology Act of 1993**
· Reallocate at minimum **10-20%** of DOE and NASA lab R&D to support jointly planned and funded industry/government R&D with the stipulation that the funding will be cut if it is not adequately refocused on industry needs.	· Allocate not less than **10%** of DOE multi-program lab budgets to cost-shared programs with industry and develop mechanisms for independently assessing the success of on-going DOE partnership activities and multi-year partnerships (continued funding contingent upon successful evaluation) · Develop a multi-year strategy for each technology on the National Critical Technologies Report · Submit an annual report to Congress detailing on-going partnership activities and future cooperative plans	· Establish a Federal Laboratory Mission Evaluation and Coordination Committee within FCCSET to review the missions and activities of all federal labs, coordinate lab activities, and ensure that 10-20% of lab budgets are devoted to collaboration with industry and state/local government · Develop a plan for consolidating nuclear weapons activities at DOE labsand modifying one or more of these labs to civilian missions · Submit an annual report to Congress which provides a mission statement and goals for each lab, explanation for proposed mission changes, a general performance assessment, and a technology tranfer plan

· Create a **Laboratory Partnership Board** to provide advice on implementation of industry-government cooperation; establish an advisory group at each multiprogram lab to evaluate ongoing programs and new initiatives

· Establish a **Career Path Program** to recruit employees of the national labs to serve in DOE positions w/out violating criminal post-Federal employee statues

· Consolidate 3 existing technology transfer offices into an **Office of Technology Devlement** to coordinate the management of all DOE technology transfer efforts

· Establish a **National Technology Partnership Award** for private sector and Government organizations or individuals which have substantially benefitted the economic or social well-being of the U.S. through private sector-government cooperation in technology

· Continue to establish model CRADAs and give directors of government-owned, contractor operated labs the authority to negotiate, sign, execute and fund cooperative R&D ventures

· Require DOE to process joint work statements and CRADAs within 30 days, resubmissions within 15 days.

· Require DOE to process joint work statements and CRADAs within 30 days, resubmissions within 15 days.

· Develop technical milestones and evaluation criteria for CRADAs of over $500K in Federal funding; continued funding will be contingent upon successful evaluation

· Authorize GO-CO labs directors to enter directly into CRADAs of $500K or less

R&D Tax Credit

· Make the incremental R&D tax credit permanent

· Extend the tax credit to include R&D on existing processes

· Establish an additional 25% credit for industry sponsored academic R&D

· Establish a 10 % tax credit for the first two years of new R&D consortia

S.666/The R&D Enhancement Act of 1993

· Make the incremental R&D tax credit permanent

· Allow companies to offset a portion of their alternative minimum tax with the R&D credit

· Allow defense firms to calculate their R&D credit w/out referensing previous defense R&D

· Establish a 20% flat rate credit for R&D consortia

H.R.--/Not Yet Introduced

FCCSET

· Increase FCCSET funding and encourage more private sector participation

· No Current Legislation

· No Current Legislation

Agency Funding of Civilian and Dual-use R&D

· Increase NSF Engineering Research Centers and Industry/University Cooperative Research Centers

· Double the NIST budget for intramural R&D by 1995

· Expand cooperative R&D through direct government funding of R&D consortia, such as SEMATECH or the advanced battery consortium

· Increase support for industry/government cooperative programs in NIH and DARPA

S.4/National Competitiveness Act

· Provide an additional $45M in FY94/95 to support advanced manufacturing at NSF ERCs and I/UCRCs

· Increase the NIST budget for intramural R&D to $300 million by FY95

H.R.820/National Competitiveness Act

· Provide an additional $45M in FY94/94 to support advanced manufacturing at NSF ERCs and I/UCRCs

· Increase the NIST budget for intramural R&D to $300 million by FY95

· Allocate $100 million of ATP's budget to large-scale, industry-driven consortia by FY95

Government Procurement

· Modify procurement regulations to give priority to commercial specifications and products

· Base government procurement on performance standards and evaluate selection criteria for bids to minimize life-cycle cost

· Experiment with a modest percentage of each agency's procurement budget to give them the

· No Current Legislation

· No Current Legislation

opportunity to flexibly procure leading edge technologies

· Base Government procurement on performance standards and allow competitive awards to be made to the most cost effective realization of stated performance objectives

Technology Programs/Pilot Projects

· Expand the Administration's HPCCI to provide the foundation for a new national communications infrastructure

· Establish projects which encourage the development and use of advanced technologies to improve the efficiency of transportation systems (IVHS, MAGLEV)

· Establish projects in environmentally conscious manufacturing

S.4/Nat'l Competitivenss & S.473/DOE bill

· Establish an Information Infrastructure and Technology Program to support the development and application of high-performance computing and high-speed networking to improve education, healthcare, manufacturing, etc.(GORE II included in S.4)

· Amend the 1991 High Performance Computing Act to ensure the widest possible application of high-performance computing and high-speed network and to provide for partnerships which enhance federal and private efforts to deploy and commercialize these technologies (S.473)

· Not Specifically Addressed

Financing Commercialization

· Give DARPA, ATP, and NIH the authority to purchase equity or extend loans/loan guarantees to facilitate commercialization of promising technologies generated through their R&D contracts

· Add an additional phase to the SBIR program to provide loans for commercialization.

S.4/National Competitiveness Act

· Establish the following**Technology Financing Programs:**

- a critical technology loan program for small business, a program to provide financial assistance to critical technology investment companies, and support for state technology development programs.

H.R.820/National Competitiveness Act

· Create a Civilian Technology Loan Program to grant loans and loan guarantees to small and medium sized businesses for upgrading their manufacturing technology base or performing R&D on advanced technologies.

· Create a Civilian Technology Development Program that licenses professionally managed technology development companies to borrow capital for investments in technology ventures.

R&D Facilities

· Increase funding for government owned R&D facilities and equipment and allocate 10-20% of their use to the private sector

S.4/National Competitiveness Act

· Allocate $105 million in FY95 to upgrade NIST facilities.

H.R.820/National Competitiveness Act

· Allocate $62 million in FY94 and $106 million in FY95 to upgrade NIST facilities.

Manufacturing Technology/Capabilities

· Extend the National Cooperative Research Act (NCRA) to cover U.S.-based joint production ventures

· Establish an investment tax credit for plant and equipment (refer to the Manufacturing Subcouncil for details on the credit).

· Provide $ 300 million in federal funding (matched by state and local governments) to build on and support existing state and local manufacturing extension programs.

S.574/National Cooperative Production Act

· Extend the NCRA to allow registered joint ventures to qualify for single damage limitation on civilantitrust liability (ventures must be located in U.S. and participants must be U.S. companies or companies that provide similar antitrust rights to U.S. companies.

S.4/National Competitiveness Act

· Establish an **Advanced Manufacturing Technology Development Program**, managed through ATP, to support industry-led efforts in advanced computer controlled manfuacturing systems.

· Establish a **National Manufacturing Outreach Program** to provide a national system of manufacturing extension centers and technology services to small and medium sized businesses. The program will consists of Manufacturing Outreach Centers, Regional Technology Transfer Centers, NIST's State Technology Extension Program (STEP) and an organization to link/support the centers and operate a Technology Extension Communications Network.

H.R.1313/National Cooperative Production

· Extend the NCRA to allow registered joint ventures to qualify for single damage limitation on civilantitrust liability (ventures must be located in U.S. and participants must be U.S. companies or companies that provide similar antitrust rights to U.S. companies.

H.R.820/National Competitiveness Act

· Establish an a**Advanced Manufacturing Technology Development Program**, managed through ATP, to support industry-led efforts in advanced computer controlled manfuacturing systems.

· Establish a **National Manufacturing Outreach Program** to provide a national system of manufacturing extension centers and technology services to small and medium sized businesses. The program will consists of Manufacturing Outreach Centers, Regional Technology Transfer Centers, NIST's State Technology Extension Program (STEP) and an organization to link/support the centers and operate a Technology Extension Communications Network.

Human Resources

· Fund fellowship programs to encourage 1) graduate and post-doctoral scientists and engineers to spend time within industry, university and government labs; and 2) movement of industrial scientists and engineers to academia.

· Fund curriculum development for graduate programs that combine concepts from engineering and management in the training of future managers.

· Establish a training tax credit or pay-or-play programs to encourage workforce training

· Create an apprenticeship and training program that offers an alternative to a college education that is recognized and respected by industry

S.4/National Competitiveness Act

· Establish cost-shared programs within NSF to 1) develop innovative curricula, courses, and materials for instruction in **TQM**; 2) provide graduate students with **traineeships** to pursue masters or doctoral degrees in manufacturing engineering; and 3) provide **fellowships** to individuals from industry with manufacturing experience to serve for 1 to 2 years as instructors at 2 year community and technical colleges.

· Amend the **Malcolm Baldridge Award** to include educational institutions.

· Establish **American Workforce Quality Partnerships** to train industrial employees in TQM techniques and current best practices.

H.R.820/National Competitiveness Act

· Establish cost-shared programs within NSF to 1) develop innovative curricula, courses, and materials for instruction in **TQM**; 2) provide graduate students with **traineeships** to pursue masters or doctoral degrees in manufacturing engineering; and 3) provide **fellowships** to individuals from industry with manufacturing experience to serve for 1 to 2 years as instructors at 2 year community and technical colleges.

· Amend the **Malcolm Baldridge Award** to include educational institutions.

· Establish **American Workforce Quality Partnerships** to train industrial employees in TQM techniques and current best practices.

Administration

· Create a White House Council on Science, Technology, and Environmental Policy, chaired by the Vice President, to set directions and policy

· Enhance the capabilities of the Technology Administration and make it responsible for analyzing industries and their technological needs; gathering, analyzing, and disseminating U.S. and international technical information; and facilitating domestic and international technological cooperation

S.4/National Competitiveness Act

· Establish a **Commerce Technology Advisory Board** to provide advice on ways to strengthen Technology Administration programs and promote development and rapid application of commercial technology.

· Create an Office of **Technology Monitoring and Competitiveness Assessment** within the Technology Administration to collect, evaluate and disseminate information on foreign science and technology capabilities and policies.

H.R.820/National Competitiveness Act

· Establish a **Commerce Technology Advisory Board** to provide advice on ways to strengthen Technology Administration programs and promote development and rapid application of commercial technology.

· Establish DOC as the focal point for benchmarking science and technology.

· Provide funds to the Technology Administration for competitiveness assessments and evaluations of federal programs.

· Enlarge OSTP structure to provide advice to the President on Science, Technology, and Manufacturing; manage the FCCSET Planning and Budget Process; and manage cross agency presidential initiatives using a matrix management model

· Change PCAST to President's Committee of Advisors on Science, Technology, and Manufacturing and make it responsible for private sector input and joint industry, academic, and government prioritization of the R&D budget

<u>Congress</u>

· Establish an R&D oversight committee to allow for joint hearings and encourage informed trade-offs among competing technology programs.

· Create a commission to periodically review major R&D programs and assure that government research and government sponsored research within universities and industry is relevant to national priorities, especially economic competitiveness.

· No Current Legislation

· No Current Legislation

Clinton Presidential Records
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Divider Title: _____

A Competitiveness Assessment of the President's FY 1994 Federal R&D Budget

Council
on
Competitiveness

A POSITIVE START

The Clinton Administration's FY 1994 budget request provides the financial information needed to evaluate the Clinton technology plan that was released in February. Building on the technology plan, the President's budget request marks an important step forward in the effort to improve the effectiveness of federal R&D programs.

The budget signals a significant reorientation of federal technology policy, very much in line with recommendations made by the Council on Competitiveness during the past few years. The following features are particularly noteworthy:

- The government will be an important source of funding for precompetitive technologies, not just basic research or mission-oriented research;
- The importance of spillovers from defense R&D to the civilian sector is declining; dependence on dual-use and commercial technologies for defense needs will be the strategy of the future;
- Impact on competitiveness and commercial relevance will be major criteria for Federal funding;
- Cooperative strategies and cost-sharing between the private and public sectors will be expanded significantly;
- Infrastructure development in transportation, information, manufacturing and the environment is a high priority.

The Council is especially pleased to see continued and increased emphasis on the following: cross-cutting initiatives; manufacturing R&D, deployment and outreach; the Advanced Technology Program; funding increases for key technology agencies, such as the National Institute of Standards and Technology and the National Science Foundation; and the reorientation of the federal labs to better meet civilian technology needs.

The following assessment summarizes the highlights of the Clinton Administration's technology plan and budget. It concludes with a brief discussion of important next steps.

POLICY DIRECTIONS AND CHANGE

The Administration's technology plan and FY 1994 budget advocate a number of important policy trends, including increased funding for federal R&D, balancing of civilian and defense R&D, and increased support for cost-shared, precompetitive projects with the private sector.

Increased Federal R&D: The Administration's goal of expanding federal R&D is reflected by a 3 percent increase over FY 1993 levels. This continues the current trend. In light of the decrease in total federal discretionary spending, the growth in federal R&D is an important indicator of the new Administration's priorities:

	FY 1992	FY 1993	FY 1994
R&D Budget	$72 billion	$74 billion	$76 billion
% Increase		2%	3%

Balancing Defense and Civilian R&D: More important than the overall growth in federally funded R&D is the shift from defense to civilian priorities. The Administration intends to balance civilian and defense R&D by 1998, eventually resulting in a transfer of $8 billion dollars to fund civilian technology programs. The FY 1994 budget moves in that direction, albeit slowly, increasing the percentage of civilian R&D from 41 percent in FY 1993 to 42 percent in FY 1994. This is not a new trend, but continues the trend begun during the Bush Administration:

	FY 1989 Budget	FY 1993 Budget	FY 1994 Budget
Civilian R&D	35%	41%	42%
Defense R&D	65%	59%	58%

While the civilian R&D share of the budget only increased by 1 percent, the civilian R&D budget itself grew 5 percent over FY 1993 levels. The majority of this increase (73 percent) goes to civilian applied R&D. The added emphasis on civilian applied R&D will be augmented by development of technologies with both military and civilian applications. In FY 1994, approximately 4 percent of DOD's R&D budget ($1.7 billion) will support dual-use initiatives. These are important provisions since the trend toward decreasing defense R&D requires that a growing number of defense needs be met through dual-use initiatives and commercial technology deployment.

Promoting Cooperation and Cost-Sharing for Precompetitive Technology: The Administration places high priority on cooperative, cost-shared projects that have commercial relevance. The cooperative activities and programs singled out for increases typically focus on development of precompetitive or generic technologies. These include the Advanced Technology Program (ATP), national laboratory Cooperative Research and Development Agreements (CRADAs), R&D consortia, research at the National Institutes of Health (NIH) and National Science Foundation (NSF), and cross-agency initiatives. Many of the specifics are not spelled out in the FY 1994 budget, but should come into focus as the Administration and the agencies work out programmatic details. A plan for the cross-agency initiatives of the Federal Coordinating Council on Science, Engineering and Technology (FCCSET) is also expected to be released soon and could add insight.

MAJOR COOPERATIVE, CROSS-AGENCY INITIATIVES

The FY 1994 budget request proposes significant increases in R&D to support many of the broad national initiatives that were outlined in the White House technology plan. These initiatives are summarized in the table below.

INITIATIVE	Approximate Budget for FY 1994	% Increase Over FY 1993
Manufacturing R&D and Outreach	$1.5 billion	Over tenfold
Information Superhighways	$1.0 billion	26%
Civil Transportation Infrastructure	$2.0 billion	29%
University Research	$11.0 billion	*
Space Science and Exploration	$7.0 billion	6%
Environmental Research	$3.0 billion	**

* See individual agencies for details (NSF, NIH, DOE, NASA).

** It is not possible to accurately determine the increase in environmental research from information available in the 1993 and 1994 budgets.

- **Manufacturing R&D and Outreach.** The manufacturing initiative consists of departmental support for advanced manufacturing technology development and application, as well as cost-shared development of a national network of manufacturing deployment centers that build on existing state and local extension services.

- **Information Superhighways.** Funding for "information superhighways" includes $14.1 million for the National Institute of Standards and Technology (NIST) to conduct R&D in high-performance computing and high-speed networking for manufacturing applications, $115 million for development of broad-band interactive networks and information infrastructure grants within the National Telecommunications and Information Administration (NTIA) and more than $200 million for NIH to develop advanced computer applications in healthcare.

- **Civil Transportation Infrastructure.** This initiative provides funding to maintain the nation's transportation system and increase R&D in magnetic levitation transportation, high-speed rail, "smart highway" technology and civilian aviation.

- **University Research.** The majority of R&D at universities is funded by the Department of Energy (DOE), the Department of Defense (DOD), the National Aeronautics and Space Administration (NASA), the National Science Foundation (NSF), and the National Institutes of Health (NIH).

- **Environmental Research.** This initiative consists of support for R&D within agencies such as DOE and the Environmental Protection Agency (EPA), as well as a 13 percent increase in funding for the interagency U.S. Global Change Research Program (USGCRP).

- **Space Science and Exploration.** The budget for space science and exploration provides resources to be used cooperatively with other nations to explore the solar system and universe.

The FCCSET initiatives and cost-shared national lab CRADAs with industry are also singled out for expansion. The budget request does not present a cumulative funding level for these activities, but examples of support can be found in many of the key technology agency budgets. The Administration's stimulus and investment proposals, for example, target increased DOE, NIH, NSF and NASA funding of the FCCSET initiatives and request a total of $78 million for CRADAs within DOE's energy supply R&D program.

In addition, the $50 million that was appropriated for DOE "weapons activities" in FY 1993 will be redirected to cost-shared CRADAs with industry. This funding for DOE CRADAs is roughly 2.5 percent of the total budget for DOE labs. The goal of the Administration is to devote 10 percent of the lab budgets to industry-relevant activities.

AGENCY/PROGRAM HIGHLIGHTS

The Council has continually advocated increased funding for key technology agencies and programs. The FY 1994 budget request takes important steps in this direction (see the table below). The budget figures include baseline funding levels, stimulus and supplemental proposals proposals submitted to Congress on February 22, 1993, and investment proposals outlined in President Clinton's economic vision statement. Although the stimulus proposals are intended to be implemented over a three-year period, they fall under FY 1993 budget authority. In the case of ATP, this causes the budget to appear to decrease in FY 1994, even though an estimated $48.5 million will be carried over into FY 1994. It should be noted, however, that as of this writing, the prospects for the President's stimulus package do not appear good.

PROGRAM	FY 1992	FY 1993	FY 1994	% increase 1992-1994
		($ in millions)		
NIST Total	**247**	**498**	**535**	**117%**
ATP	40	214*	198	390%
Manufacturing Extension & Quality	17	21	33	94%
NSF Total	**2573**	**2940**	**3180**	**24%**
NSF Research and Related Activities	1872	2056	2205	18%
DOE Total	**17206**	**17342**	**17301**	**1%**
Atomic Energy Defense	11968	12119	11521	4%
Energy Programs	6440	6348	7558	17%
NIH Total	**8927**	**10341**	**10674**	**20%**

Note: The total budgets for FY 1993 and FY 1994 are contingent upon enactment of the FY 1993 stimulus proposals and the FY 1994 investment proposals.

* The actual allocation for ATP in FY 1993 was $67.9 million. The FY 1994 budget assumes that the President's full stimulus package will be passed, which includes an additional $146 million in funding for ATP, bringing total FY 1993 levels to $214 million.

As indicated in the table, the NIST budget will increase 117 percent over 1992 levels. This represents growth in a number of different areas. The Advanced Technology Program will be increased to close to $200 million. This is intended to support large-scale, industry-led consortia modelled after SEMATECH, as well as individual companies and smaller joint ventures. NIST intramural R&D will increase by 29 percent as part of the Administrations plan to double R&D in this area by FY 1997. NIST Manufacturing Extension Partnerships and Quality Programs are also targeted for significant growth as part of the Administration's plan to create a national network of extension services for small and medium sized businesses.

The NSF budget will grow 24 percent over FY 1992 levels. Most of the increase falls under NSF's "research and related activities". Stimulus and investment proposals totalling $568 million are earmarked for the FCCSET initiatives and for individual investigators doing research in areas such as civil infrastructure systems, the environment and intelligent systems.

The DOE budget remains relatively flat, but as mentioned previously, $128 million will be devoted to CRADAs with industry. In addition, almost $300 million will be devoted to federal energy management and development of energy-efficient technologies and alternative fuel vehicles.

The NIH budget shows an increase of 20 percent, with the majority of new budget authority targeting FCCSET initiatives, such as biotechnology and the development of advanced computer applications for healthcare.

Funding for the Advanced Research Projects Agency (ARPA, formerly DARPA) is missing since it is not a line item at this level of budget detail. However, Congressional action during the past year has increased investment for defense conversion through an ARPA-led, multi-agency initiative. In addition, the Administration's investment proposal allocates $234 million for advanced technology development within DOD's budget for Research, Development, Test and Evaluation (R,D,T&E). A significant portion of this can be expected to fund dual-use technologies.

NEXT STEPS

Now that the Administration has signalled a reoriention of federal technology policy, the Council must work to ensure that the new strategy has maximum impact on U.S. competitiveness. We must continue to push for:

- significantly increased private sector input into development and implementation of federal technology policy;
- more effective management of federal technology programs and the development of criteria to measure the success of those programs; and
- more analysis and integration of federal economic, tax and regulatory policy to support U.S. firms' ability to commercialize technology quickly and compete successfully in world markets.

These provisions will help guarantee effective use of resources and keep the government focused on private sector needs.

The Council will work with the President's Science and Technology Advisor, the Office of Management and Budget (OMB), the National Economic Council (NEC), and the individual agencies to make our positions known and to ensure that these priorities are carried out.

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About the Council on Competitiveness

Founded in 1986, the Council on Competitiveness is a nonprofit, nonpartisan organization of chief executives from business, higher education and organized labor who have joined together to pursue a single overriding goal: to improve the ability of American companies and workers to compete more effectively in world markets, while building a rising standard of living at home.

To build consensus within the public and private sectors on the actions needed to help Americans compete, the Council pursues a three-part agenda: increase public awareness of the breadth and severity of America's economic problems; mobilize the political will required to set the United States on a positive economic course; and assist in the development of specific public policies and private-sector initiatives. To that end, the Council focuses on issues in the areas of fiscal policy, science and technology, international economics and trade, and human resources.

The Council is governed by an executive committee and draws on the resources of its national affiliates — over forty trade associations, professional societies and research organizations — to help analyze issues and develop consensus. The Council is privately supported through contributions from its members, foundations and other granting institutions.

The Council has been especially active in the area of technology policy. Its 1990 report, *Gaining New Ground: Technology Priorities for America's Future* is widely credited with helping to refocus the policy debate about American science and technology policy. It built on the recommendations of a 1988 Council report, *Picking up the Pace*. Since 1990, the Council has published a number of smaller reports comparing U.S. technology practices to those of Japan and Germany and helped develop the technology paper for the Clinton presidential campaign.

The Council currently has two major technology-related projects underway. The first focuses on the linkages between trade, technology and investment policies and is based on a detailed review of eight high-tech trade cases. The final report will be released in the summer of 1993. The second project focuses on 21st century U.S. information infrastructure. Its purpose is to develop a consensus vision for an advanced information infrastructure and to outline a policy program to realize that vision. The vision statement will be released on May 12, 1993.

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