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ABSTRACT

Investing in technology is investing in America's future. U.S. technology must move in a new direction to build economic strength and spur economic growth. The traditional roles of support of basic science and mission-oriented technological research must be expanded, so that the federal government plays a key role in helping private firms develop and profit from innovations. The development of civilian technology must be accelerated with new criteria for creating a market that rewards invention and enterprise. The challenge demands that we focus on the following goals: (1) long-term economic growth that creates jobs and protects the environment; (2) a government that is more productive and responsive to the needs of its citizens; and (3) world leadership in basic science, mathematics, and engineering. Fiscal policies that support research and development in education and industry are required. Technology must be managed for economic growth, with the aid of a reinvigorated Office of Science and Technology Policy and the new National Economic Council. The new initiatives that will build our economic strength include extension of the research and experimentation tax credit, and investment in a national information infrastructure and advanced manufacturing technologies. Boosting the automotive industry, improving education technology and training, and investing in energy efficient federal buildings are other strategies that must be adopted. (SLD)

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

President William J. Clinton
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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.

GOAL: WORLD LEADERSHIP IN BASIC SCIENCE, MATHEMATICS, AND ENGINEERING.

It is essential to recognize that technical advances depend on basic research in science, mathematics, and engineering. Scientific advances are the wellspring of the technical innovations whose benefits are seen in economic growth, improved health care, and many other areas. The federal government has invested heavily in basic research since the Second World War and this support has paid enormous dividends. Our research universities are the best in the world; our national laboratories and the research facilities they house attract scientists and engineers from around the globe. In almost every field, United States researchers lead their foreign colleagues in scientific citations, in Nobel Prizes, and most other measures of scientific excellence.

This administration will both ensure that support for basic science remains strong, and that stable funding is provided for projects that require continuity. We will not allow short-term fluctuations in funding levels to destroy critical research teams that have taken years to assemble.

But stable funding requires setting clear priorities. In recent years, rather than canceling less important projects when research budgets have been tight, Federal agencies have tended to spread the pain, resulting in disruptive cuts and associated schedule delays in hundreds of programs. We will improve management of basic science to ensure that high-priority programs receive sustained support.

University Research. The National Science Foundation and the National Institutes of Health provide the vast majority of Federal funding for university research. Since universities play dual roles of research and teaching, the long-term scientific and technological vitality of the U.S. depends upon adequate and sustained funding for university research grant programs at NSF, NIH, and other research agencies.

National Laboratories. In fields like high-energy physics, biomedical science, nuclear physics, materials sciences, and aeronautics, the national laboratories provide key facilities used by researchers in academia, Federal labs, and industry. In addition, in many fields, researchers at Federal labs are world leaders. We will ensure that Federal laboratories continue their key role in basic research and will encourage more cooperative research between the laboratories and industry and universities. And we will develop new missions for our federal labs to make full use of the talented and experienced men and women working there in today's post-cold war era.

Space Science and Exploration. The resources needed for space exploration and research make government funding essential. We will continue to work with foreign partners to design missions needed to explore our solar system and the universe beyond. Research on micro-gravity and life-sciences as applied to the human in space program will also be supported.

Environmental Research. In FY93, the Federal government will invest in research to better understand global warming, ozone depletion, and other phenomena important to local, regional, and global environments. This research is essential if we are to fully assess the damage mankind is doing to our planet and take effective action to address it. Vital research on local and regional environmental problems will also be strongly supported at EPA, NOAA, NASA, DoD, DOL, USDA, and other agencies.

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 skili, 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.