[64] From: Maryanne Bach at NCMC 3/21/91 8:28AM (1510 bytes: 24 ln)
To: William D. Phillips at OSTP, Jules Blake at OSTP, D. Allan Bromley at OSTP, Damar Hawkins at OSTP, Kenneth P. Yale at OSTP
cc: Maryanne Bach, Thomas J. Welch
Subject: amendments to ATP/NIST
---------- Message Contents ----------

TO Dr. Bromley and Dr. Phillips:

I received a call from the Minority in the House last night seeking our support for the objection that the Secretary of Commerce, NIST and OMB will file if the following amendment goes forward: Currently in the House Subcommittee on Technology and Competitiveness there are discussions underway between staff and Congressman Mineta. The amendment would be to the American Technology Preeminence Act (this bill did not pass the Senate last year because of Kasten's hold on it for the product liability amendment) This bill includes the NIST reauthorization for FY92. The amendment would establish lending authority to American industry for up to 100% of the current Hill proposed authorized level of the NIST/Advanced Technology Program (Hill proposes $100m; Administration proposes $36m). I understand DOC is strongly going to oppose it and is working with OMB on the justifications. Minority is looking for us to also strongly oppose this action.

MCBach

DRAFT February 1, 1991

REPORTS REQUIRED BY OSTP OR FCCSET

THE SCIENCE AND TECHNOLOGY REPORT AND OUTLOOK - biennially, to be submitted on January 15 of each odd numbered year. Mandated by P.L. 97-375. (Wells, Ratchford, Maynard, Olson)

FULL REPORT TO THE PRESIDENT ON CRITICAL TECHNOLOGIES - mandated by Defense Authorization Act of 1990. Due in mid-January 1991.

NCMC REPORTS

CRITICAL MATERIALS REPORT - biennially, mandated by P.L. 98-373. Last report was in the summer of 1988, but lack of a Council in the interim has delayed the report until spring of 1991.

ADVANCED MATERIALS RESEARCH PROGRAM PLAN - annually, mandated by P.L. 98-373. Last report was in January of 1989 but lack of a Council has delayed report until the summer of 1991. (Lindstrom, Appleton, Phillips)

NATIONAL ACTION PLAN FOR ADVANCED SUPERCONDUCTIVITY RESEARCH AND DEVELOPMENT - annually for five years, mandated by P.L. 100-697. NCMC and OSTP are to work together to produce and update the Plan.

LONG-RANGE MATERIALS ASSESSMENT - annually, mandated by the National Materials and Minerals Policy Research and Development Act of 1980 (30 U.S.C. 1601). OSTP should produce a long-range assessment of minerals and materials. P.L. 100-697 mandates that NCMC should assist OSTP with such an assessment.

TASKS IN SENATE APPROPRIATION LANGUAGE
FOR OSTP IN FY 1991
(as of February 1, 1991)

*(1) **Rationalizing relationship and shared responsibilities with CEQ.**
Report due by January 31, 1991 (Maynard)

*(2) **Rank civilian R&D sectors by priority in terms of potential contribution to economic competitiveness.**
Report as part of 1992 budget process. (Phillips, Wong)

*(3) **Identify the top 20 science prospects in the country according to the Administrations priorities and show their life cycle costs.** (Erb, Levinson)

(4) **Develop a policy to implement the Packard-Bromley college and university infrastructure rebuilding recommendations from the 1986 WHSC Report on an interagency basis. Report by April 1, 1991 and include the agency funding profiles with OSTP 1992 budget submission.** (Ratchford, Wells)

(5) **Develop a strategy document indicating how the Administration expects to be first in the world in S&M education by 2000; including measurable objectives toward obtaining this goal.**
Draft report to Committee by November 30, 1990. -- Completed --

(6) **Develop a multilevel priority setting framework that will focus, integrate, and where necessary, reassign agency roles in S&M education.**
Report by November 30, 1990. -- Completed --

(7) **Require all Federal agencies with R&D activities to establish education offices in each of the Federal levels. Report by March 15, 1991** (Ratchford).

(8) **Coordinate interagency activities toward developing laboratory-education partnerships. Report by March 15, 1991.** (Ratchford)

*(9) **Move forward in establishing the Critical Technologies Institute.**
Report by February 1, 1991. (Phillips, Van Cleave, Wong)

(10) **Review and respond to the NSF/NAE report on the USGERP.**
Report by February 1, 1991. -- Completed --

(11) **Address key issues in the global change arena, e.g., what is the maximum greenhouse gas level is acceptable and when will such a level be achieved and stabilized. What is the Administration plan for developing an international consensus including implementation strategies and timetables.**
Report by March 1, 1991. (Maynard, CEES, CEQ)

COMMITTEE RECOMENDATIONS

AUTHORIZATION CHANGES

The Committee concurs in the following adjustments made by authorization action:

[Dollars in thousands]

Program	Fiscal Year 1991 request	Committee recommendation	Change from budget
Semitrailer, Tank, 5000G	0	34,000	+34,000
Small Unit Support Vehicle	$27,031	0	−27,031
Passenger Carrying Vehicle	5,570	0	−5,570
General Purpose Vehicle	7,890	0	−7,890
EUCOM Command Centers	7,395	0	−7,395
USAREUR Tactical Command & Control Sys	5,966	0	−5,966
Imagery Processing System	8,625	0	−8,625
Total Package Fielding	10,758	0	−10,753

TACTICAL AND SUPPORT VEHICLES

5,000 GALLON TANKER SEMITRAILER

The Committee recommends $34,000,000 for the procurement of 480 5,000 gallon tanker semitrailers, as recommended by authorization legislation.

SMALL UNIT SUPPORT VEHICLE

The Army budgeted $27,031,000 for procurement of the Small Unit Support Vehicle. The Committee recommends denial of the entire amount based on authorization action.

M915 LINE HAUL TRACTOR

The Army budget included no funds for procurement of the M915 or M916 Line Haul Tractors. The Guard and Reserve Equipment budget included $31,000,000 for procurement of the M916. The Committee is aware of unfilled and unfunded requirements for this equipment. In addition, very attractively priced options are included in the current multiyear contract for these vehicles. The Committee recommends $13,400,000 for the procurement of additional M915 and/or M916 vehicles, the mix of vehicles to be determined by the highest priority requirements. The Army can allocate a portion of this procurement to Guard and Reserve components in accordance with overall priorities.

COMMERCIAL PASSENGER AND GENERAL PURPOSE VEHICLES

The Army budgeted $5,570,000 for procurement of passenger carrying vehicles and $7,890,000 for procurement of general purpose vehicles. The Committee recommends denial of both of these requests based on authorization action.

TRUCK SERVICE LIFE EXTENSION PROGRAM

In April, 1989, the Army released a Tactical Wheeled Vehicle Modernization Plan. One of the elements of this plan is a Service Life Extension Program (SLEP) for the Army's aging fleet of 2½ ton and 5 ton trucks. The original plan called for beginning this program in fiscal year 1993; it has now been postponed to 1995.

The slip in the SLEP program is evidence of the low priority which the Army places on it. It is claimed by some that the Army perceives the SLEP program to be a fiscal threat to the Family of Medium Tactical Vehicles (FMTV). FMTV is a new generation of 2½ ton and 5 ton vehicles. Initial procurement funding is included in the fiscal year 1991 budget. The Committee states its strong support for FMTV and has approved all funding included in the budget. The Committee believes that the linkage that some people make between the FMTV and the SLEP is based on a misguided perception.

The Committee believes that a well managed SLEP program can be a cost-effective way to improve readiness and modernization of the Army. This is particularly true of the reserve components which have some of the oldest trucks in the inventory. The Committee believes that the first thing that needs to be done to increase the priority of SLEP and to manage it effectively is to place program management responsibility under the Program Executive Officer for Combat Support. The Committee strongly urges the Army to do so.

Earlier this year, the Army received responses from industry to a "market survey" for SLEP. The Committee believes that the Army should use these responses to fashion a procurement strategy with the objective of producing SLEP trucks which cost no more than half of an FMTV. The program should be competitive and include prototype testing. In addition to information received from the market survey, the Army should take advantage of experience gained with the Marine Corps SLEP program several years ago and with SLEP programs conducted for foreign military sales.

The Committee believes that the program should begin immediately, with initial procurement funding beginning as early as fiscal year 1992. The Army is directed to use fiscal year 1990 funds in the amount of $10,000,000 to establish a program office, issue a solicitation, and conduct prototype testing prior to source selection and contract award. In order to assure that this happens, the Committee has included bill language which prohibits the award of an FMTV contract until a SLEP solicitation has been released by the Army. The Army is directed to provide the Committee with its procurement strategy and program milestones no later than February 28, 1991.

EXPORT OF FOREIGN LUMBER

The Committee believes that the export taxes, tariffs and restrictions being imposed by Indonesia and Malaysia on the export of tropical hardwoods, in particular on shipping dry Keruing and Kapur lumber, is and will adversely impact the procurement of military vehicles utilizing wood flooring. Examples of such vehicles are flat bed trailers, low boy trailers, HMMWV, M35's, M54's,

(4) Sections 603 through 606, subsections (a) and (b) of section 607, and subsections (a) and (c) of section 608 of the Department of Energy Organization Act (42 U.S.C. 4101 et seq.).

(b) CLARIFICATION OF FREQUENCY OF CERTIFICATION BY EMPLOYEES OF CONTRACTORS.—Not later than 30 days after the date of the enactment of this Act, the regulations implementing section 27(e)(1)(B) of the Office of Federal Procurement Policy Act (41 U.S.C. 423(e)(1)(B)) shall be revised to ensure that a contractor is required to obtain from each officer, employee, agent, representative, and consultant of the contractor only one certification (as described in clauses (i) and (ii) of that section) during the person's employment or association with the contractor and that such certification shall be made at the earliest possible date after the person begins his or her employment or association with the contractor.

PART C—DEFENSE INDUSTRIAL AND TECHNOLOGY BASE

SEC. 821. ANNUAL DEFENSE CRITICAL TECHNOLOGIES PLAN

(a) INCREASED INFORMATION RELATING TO FUNDING.—Section 2508(b) of title 10, United States Code, is amended—

(1) by striking out "and" at the end of paragraph (1);

(2) by striking out the period at the end of paragraph (2) and inserting in lieu thereof a semicolon; and

(3) by inserting at the end the following new paragraphs:

"(3) identify each program element (contained in the budget information submitted to Congress by the Department of Defense in support of the budget submitted by the President pursuant to section 1105(a) of title 31 for the first fiscal year covered by the plan) for which funds are budgeted for the support of the development of any critical technology identified in the plan; and

"(4) for each such program element—

"(A) specify the amount included for each critical technology covered by the program element; and

"(B) include a comparison of that amount with the amount, if any, available to the Department of Defense for development of such critical technology for the fiscal year preceding the first fiscal year covered by the plan.".

(b) APPLICABILITY.—The amendments made by subsection (a) shall apply to annual defense critical technologies plans submitted after March 1, 1991.

SEC. 822. CRITICAL TECHNOLOGIES INSTITUTE

(a) ESTABLISHMENT.—There shall be established a federally funded research and development center to be known as the "Critical Technologies Institute" (hereinafter referred to in this section as the "Institute").

(b) INCORPORATION.—The Institute shall be incorporated as a nonprofit membership corporation.

(c) BOARD OF TRUSTEES.—(1) The Institute shall have a Board of Trustees (hereafter referred to in this section as the "Board") composed of 21 members as follows:

(A) The Director of the Office of Science and Technology Policy, who shall be Chairman of the Board.

(B) The Secretary of Defense, or the Secretary's designee.

(C) The Secretary of Energy, or the Secretary's designee.

(D) The Secretary of Health and Human Services, or the Secretary's designee.

(E) The Secretary of Commerce, or the Secretary's designee.

(F) The Administrator of the National Aeronautics and Space Administration, or the Administrator's designee.

(G) The Director of the National Science Foundation, or the Director's designee.

(H) Four members appointed by the Director of the Office of Science and Technology Policy from among the members of the Federal Coordinating Council on Science, Engineering, and Technology (other than members of such council named in subparagraphs (B) through (G)).

(I) Ten members appointed by the members of the Board referred to in subparagraphs (A) through (H) from among representatives of industry and colleges and universities in the United States.

(2)(A) The term of service of members of the Board appointed under paragraph (1)(H) shall be four years, except that of the four members first appointed, one shall be appointed for a term of one year, one shall be appointed for a term of two years, one shall be appointed for a term of three years, and one shall be appointed for a term of four years, as specified by the Director of the Office of Science and Technology Policy at the time of the appointments.

(B) The term of office for each of the members of the Board appointed under paragraph (1)(I) shall be specified by the appointing members of the Board at the time of appointment.

(C) Members of the Board may be reappointed.

(D) A vacancy in a membership of the Board appointed pursuant to subparagraph (H) or (I) of paragraph (1) shall be filled in the same manner as the original appointment. A member appointed under this subparagraph shall serve for the remainder of the unexpired term of his predecessor.

(3) The Board shall meet at least twice each year.

(4)(A) The Board shall have an executive committee composed of the members referred to in subparagraphs (A) through (G) of paragraph (1) and six of the members appointed pursuant to subparagraph (I) of such paragraph.

(B) The executive committee shall meet at least six times each year.

(5) A member of the Board who is an officer or employee of the United States may not receive pay for service as a member, other than the pay provided for the member's position as an officer or employee of the United States.

(d) DUTIES OF THE INSTITUTE.—The Institute shall—

(1) survey the views of United States industry, colleges, and universities, and Federal and State agencies, involved in research, development, or utilization of critical technologies on—

(A) each critical technology identified in the most recent biennial report of the National Critical Technologies Panel established pursuant to section 601 of the National Science and Technology Policy, Organization, and Priorities Act of 1976 (42 U.S.C. 6681); and

(B) each technology that the Institute considers critical on the basis of its analysis of national and worldwide trends in basic and applied research and development;

(2) on the basis of such views and analysis by Institute personnel—

(A) identify suitable near-term, mid-term, and long-term national objectives for the research, development, and production capability of the United States with respect to such technologies; and

(B) prepare possible strategies for achieving the identified objectives, including a discussion of the appropriate roles of industry, colleges and universities, and Federal and State agencies;

(3) publish reports, as appropriate, discussing—

(A) such national objectives and strategies; and

(B) progress in implementing such strategies and achieving such objectives; and

(4) at the direction of the Director of the Office of Science and Technology Policy, provide technical support and assistance regarding policy formulation to the committees and panels of the Federal Coordinating Council for Science, Engineering, and Technology that are responsible for planning and coordinating Federal Government activities that advance the development of critical technologies and sustain and strengthen the science and technology base of the United States.

(e) SPONSORSHIP.—(1) The Director of the Office of Science and Technology shall be the sponsor of the Institute.

(2) The Director and the Board shall enter into a sponsor agreement consistent with the requirements prescribed by the Administrator for Federal Procurement Policy that are generally applicable to sponsor agreements.

(3) The sponsor agreement shall—

(A) require the Institute to perform such functions for the Office of Science and Technology Policy as the Director of that office may specify consistent with the requirements of subsection (d); and

(B) permit the Institute, subject to the concurrence of the Director, to perform functions for the member agencies of the Federal Coordinating Council on Science, Engineering, and Technology Policy.

(f) DEADLINE FOR CERTAIN ACTIONS.—The Director of the Office of Science and Technology Policy shall take such actions as may be necessary to ensure that, not later than 90 days after the date of the enactment of this Act—

(1) the articles of incorporation for the Institute have been appropriately filed;

(2) the corporate bylaws have been adopted;

(3) the Board members have been identified or appointed, as appropriate;

(4) the initial officers of the Institute have been elected;

(5) the first regular business meeting of the Board has been conducted; and

(6) the sponsor agreement referred to in subsection (e) has been entered into.

(g) FUNDING.—(1) Subject to such limitations as may be provided in appropriation Acts, the Secretary of Defense shall make available to the Director of the Office of Science and Technology Policy, out of funds available for the Department of Defense, $5,000,000 for funding the activities of the Institute in the first fiscal year in which the Institute begins operations.

(2) There is authorized to be appropriated for the Institute for each fiscal year after the fiscal year referred to in paragraph (1) such sums as may be necessary for operation of the Institute.

SEC. 823. MANUFACTURING TECHNOLOGY

(a) IN GENERAL.—Title 10, United States Code, is amended—

(1) by redesignating chapter 149 as chapter 150;

(2) by redesignating section 2511 as section 2521; and

(3) by inserting after chapter 148 the following new chapter:

"CHAPTER 149—MANUFACTURING TECHNOLOGY

"§ 2511. Definitions

"In this chapter:

"(1) The term 'manufacturing technology' means development of techniques and processes designed to improve manufacturing quality, productivity, and practices, including quality control, shop floor management, inventory management and worker training, as well as manufacturing equipment and software.

"(2) The term 'manufacturing extension programs' means publicly-chartered organizations and services to transfer technology and help modernize small manufacturers through research, education and training, and outreach activities.

"§ 2512. Management and planning

"The Secretary of Defense, acting through the Under Secretary of Defense for Acquisition, shall—

"(1) provide centralized Department of Defense policy guidance and direction to the military departments and the Defense Agencies on all matters relating to manufacturing technology; and

"(2) direct the development and implementation of Department of Defense plans, programs, projects, and policies that promote the development and application of advanced technologies to manufacturing processes, tools, and equipment.

"§ 2513. National Defense Manufacturing Technology Plan

"(a) The Secretary of Defense, in coordination with the Secretary of Commerce and the Secretary of Energy, shall develop and implement a National Defense Manufacturing Technology Plan (hereafter in this section referred to as the 'Plan'). Subject to the authority, di-

strengthen U.S. economic interests in both areas, and how efforts in both areas will enhance U.S. civilian research capabilities. Also, the OSTP shall identify the top 20 civilian science projects in the Federal budget, ranked according to the administration's priority, and show their life-cycle cost projections.

The Committee is deeply concerned about the tremendous need for funds for the modernization and rehabilitation of the Nation's academic research facilities. The 1986 Bromley-Packard report, done at the request of the OSTP, estimated that the current backlog of facilities' modernization needs, just for those institutions of higher education dealing with the National Science Foundation, was a staggering $10,000,000,000, and that a $500,000,000 a year Federal investment, matched by an equal amount from non-Federal sources, was need to reduce this shortfall over the next decade. Unfortunately, this 1986 report, whose results have since been confirmed by additional studies by the National Science Foundation, has not led to the development of a Federal strategy on academic research facilities. Only the National Science Foundation, with a modest $20,000,000 a year program, has attempted to address this glaring deficiency in higher education. As a result, the Committee directs OSTP to develop a policy on academic research facilities modernization that includes all Federal research and development agencies and a 5-year funding projection of the Federal contribution to this effort. This interagency policy should be submitted to the Committee by April 1, 1991, and its funding profile should be clearly identified in the fiscal year 1992 budget submission for all agencies.

The Committee applauds the establishment of the Federal Coordinating Council on Science, Engineering, and Technology [FCCSET] interagency Committee on Science Education and Human Resources. The Committee requests that this FCCSET committee prepare and submit a strategy document with its 1992 budget request that will describe how the President intends the Nation will achieve the objective that by the year 2000, U.S. students will be first in the world in science and mathematics achievements. The Committee expects that the report will be modeled after the strategy document prepared by the FCCSET Committee on Earth Sciences, and it shall include measurable objectives supporting the national goals.

In addition, it shall include a multilevel priority-setting framework that will focus, integrate, and where necessary, reassign agency roles and responsibilities, along with the requisite program development and budget proposals. The Committee requests that this report specifically include milestones and assessment methods that will be used to chart the Nation's progress in meeting the objectives. The OSTP should provide a draft report to the Committee by November 30, 1990.

The Committee directs the OSTP to guide the mission agencies in establishing and restructuring their offices of education to support science and mathematics education and to make the agencies fully responsive to the FCCSET Education Committee's plan. Also, OSTP shall ensure that each agency's office of education has programs directed at student and teacher segments from K through graduate school.

The Committee strongly encourages efforts within the Federal Government to strengthen the educational activities of Federal research laboratories. Further, the Committee believes that the OSTP should require all Federal agencies with research and development activities to establish education offices at each particular Federal laboratory under its control. The goal of such an effort is to improve internal Federal agency science, mathematics and engineering education programs, as well as foster education partnerships between various Federal labs and schools and academic institutions which are located near them. The Committee notes there is a need to coordinate and disseminate information on these programs among the various Federal mission agencies, as well as between the National Science Foundation [NSF] and the Department of Education. Therefore, the Committee directs OSTP to work with the NSF, the Department of Education, and Federal mission agencies to coordinate agency efforts to improve math, science, and engineering education, particularly in the area of developing laboratory education partnerships. The OSTP shall report the status of this effort and the agencies' funding needs for this activity to the Committee by March 15, 1991.

Last year the Congress authorized funds for OSTP to establish the national critical technologies panel, and a Critical Technologies Institute, a federally funded research and development center under the OSTP, to support it. The Congress took this step in the belief that there was a need for the Federal Government to help focus the Nation's efforts in developing precompetitive technologies to support our knowledge-based economy, without picking winners and losers in the marketplace. The Committee notes its strong support for this investment, and directs the OSTP to move forward in establishing the Critical Technologies Institute, and to report to the Committee on its efforts in this area by February 1, 1991.

The Committee is aware that a recent study by the National Academy of Sciences Council strongly endorsed the U.S. Global Change Research Program [USGCRP]. At the same time, the Academy's review raised concerns about the program which are shared by the Committee. The Committee directs the OSTP to respond to the review by February 1, 1991, with an emphasis on providing stronger program management to: (a) use extramural advisory expert panels for defining and evaluating the USGCRP's various programs and the products they are designed to develop; (b) focus agencies to produce research results specifically agreed upon by the USGCRP interagency committee; (c) assure greater interagency cooperation; (d) broaden involvement at the project level by the academic community, local, and State governments, and other nations; and (e) schedule and report interim assessments of the USGCRP in public forums.

Despite the Committee's strong support for the current global climate research program, the Committee believes that additional global climate policy action needs to take place. In that light, the Committee directs the OSTP to submit to it a report by March 1, 1991, that addresses several key issues. First, what the OSTP considers to be the maximum concentration of greenhouse gases which is acceptable, and the date by which those concentrations will be reached and stabilized. Second, what is the U.S. contribution to the

National Defense Research Institute [NDRI]; Institute for Defense Analyses [IDA]; Consolidated DOD software initiative—Software Engineering Institute [SEI]; Logistics Management Institute [LMI].—As part of its initiative to eliminate exorbitant growth in funding for defense federally funded research and development centers [FFRDC's], the Committee recommends budget reductions for the defense agencies four FFRDC's. The reductions are the shares each organization should absorb as part of the Committee's overall recommendation to return total defense FFRDC funding to the fiscal year 1987 level, as adjusted for inflation. Fiscal year 1987 was the peak year of defense RDT&E funding during the last decade.

Full justification and direction for implementing this recommendation are contained in the introduction to the RDT&E section of the report. Although for accounting purposes, the recommendation is assessed against defense agencies RDT&E program elements and funding, the Committee intends that the reductions be applied against total fiscal year 1991 funding for each of the FFRDC's. The total funding for each organization includes direct appropriations through RDT&E program elements (in two cases) plus additional Defense Department contract funds.

The recommended funding for each FFRDC is: (*a*) $17,338,000 for the Rand Corp.'s National Defense Research Institute, a reduction of $3,580,000; (NDRI's total fiscal year funding was requested at $29,500,000); (*b*) $86,110,000 for the Institute for Defense Analyses, a reduction of $11,890,000 to the request; (*c*) $19,770,000 for Logistics Management Institute, a reduction of $2,730,000; and (*d*) $31,172,000 for the consolidated DOD software initiative--Software Engineering Institute, a reduction of $3,400,000.

AIM-9 consolidated program.—The Committee recommends $30,000,000 in a new defense agencies program element to fund a joint Air Force-Navy program to develop enhancements to the AIM-9 Sidewinder short-range missile. Such a consolidation already has been approved by the full Senate. Recommendations in the Navy and Air Force RDT&E accounts eliminate separate funding for the duplicative, AIM-9 missile upgrade programs each service was requesting for fiscal year 1991.

Strategic technology; high performance computing.—The Committee recommends $115,249,000, a net reduction of $92,500,000, to this program element of several projects in the Defense Advanced Research Projects Agency. This recommendation reflects: (*a*) the transfer of the $108,000,000 requested for DARPA strategic computing activities to a new high-performance computing program element; (*b*) the transfer of $9,500,000 requested for high-definition display technologies to a consolidated program within the integrated command and control technology program element; and, (*c*) the addition of $25,000,000 for the third year of the DARPA initiative in concurrent engineering [DICE]. DICE is a manufacturing technology effort to combine computer-aided techniques and artificial intelligence to design improved logistics technologies into products from their inception.

The Committee recommends $128,000,000 for the new high-performance computing program element in DARPA. This amount represents an increase of $20,000,000 to the budget request to accel-

erate research in this critical technology. The separate program element is intended to highlight the importance of DARPA's strategic computing efforts and to improve congressional oversight. DARPA, a national leader in high-performance computing, has been assigned a leading role in the country's high-performance computing initiative.

Critical Technology Institute.—As approved by the full Senate, the Committee adds $5,000,000 to the budget for a Critical Technology Institute. The Institute is intended to assist the White House Office of Science and Technology Policy in planning and implementing development of critical technologies related to national security and global economic competitiveness. The Committee expects that funds for continuing the Critical Technology Institute in fiscal year 1992 and later years will be budgeted for outside the Defense Department.

Strategic environmental research program [SERP].—As approved by the full Senate, the Committee recommends adding $200,000,000 to the budget request for a strategic environmental research program to increase the Defense Department's contributions to countering major environmental threats facing the Nation and the global environment.

The Committee supports the goals and general direction of this initiative, but believes that it fails to address certain concerns central to a balanced environmental protection and restoration effort. These concerns include technical support for species conservation activities on Defense Department lands and sufficient emphasis on the development of renewable energy resources.

Consistent with the priorities described in the report accompanying the Fiscal Year 1991 Defense Authorization Act establishing the Strategic Environmental Research Program, the Committee also believes that the issue of global environmental change is important to the mission of the SERP. To address this component of the initiative, the Committee directs that $25,000,000 of the funds appropriated for this initiative shall be available only for the establishment of an Arctic region supercomputing center to support research by the Department of Defense and other Federal agencies and the academic community.

The acquisition of one supercomputer, with ownership to be retained by the Department of Defense, will commence this effort. The new supercomputing center should be established at an institution engaged in Department of Defense research located within the Arctic region. The supercomputing capabilities should be available to all qualified Federal and academic research activities engaged in environmental studies.

The supercomputing center should also be available to support other Department of Defense research initiatives, including the possible exploitation of the auroral ionospheric electrojet for nonpolluting power generation.

The Committee expects the Joint Strategic Environmental Research Program Council to report to the House and Senate Committees on Appropriations no later than March 15, 1991, on the specific timetable and implementation plan to establish the Arctic region supercomputing center. This report should address the ac-

"(1) To address environmental matters of concern to the Department of Defense and the Department of Energy through support for basic and applied research and development of technologies that can enhance the capabilities of the departments to meet their environmental obligations.

"(2) To identify research, technologies, and other information developed by the Department of Defense and the Department of Energy for national defense purposes that would be useful to governmental and private organizations involved in the development of energy technologies and of technologies to address environmental restoration, waste minimization, hazardous waste substitution, and other environmental concerns, and to share such research, technologies, and other information with such governmental and private organizations.

"(3) To furnish other governmental organizations and private organizations with data, enhanced data collection capabilities, and enhanced analytical capabilities for use by such organizations in the conduct of environmental research, including research concerning global environmental change.

"(4) To identify technologies developed by the private sector that are useful for Department of Defense and Department of Energy defense activities concerning environmental restoration, hazardous and solid waste minimization and prevention, hazardous material substitution, and provide for the use of such technologies in the conduct of such activities.

"§ 2902. Strategic Environmental Research and Development Program Council

"(a) There is a Strategic Environmental Research and Development Program Council (hereinafter in this chapter referred to as the 'Council').

"(b) The Council is composed of nine members as follows:

"(1) The Assistant Secretary of Defense responsible for matters relating to production and logistics.

"(2) The Director of Defense Research and Engineering.

"(3) The Vice Chairman of the Joint Chiefs of Staff.

"(4) The Assistant Secretary of the Air Force responsible for matters relating to space.

"(5) The Assistant Secretary of Energy for Defense programs.

"(6) The Director of the Department of Energy Office of Environmental Restoration and Waste Management.

"(7) The Director of the Department of Energy Office of Energy Research.

"(8) The Administrator of the Environmental Protection Agency.

"(9) The Executive Director of the Council (appointed pursuant to section 2903 of this title), who shall be a nonvoting member.

"(c) The Secretary of Defense shall designate a member of the Council as chairman for each odd numbered fiscal year. The Secretary of Energy shall designate a member of the Council as chairman for each even-numbered fiscal year.

"(d) The Council shall have the following responsibilities:

"(1) To prescribe policies and procedures to implement the Strategic Environmental Research and Development Program.

"(2) To enter into contracts, grants, and other financial arrangements, in accordance with other applicable law, to carry out the purposes of the Strategic Environmental Research and Development Program.

"(3) To prepare an annual five-year strategic environmental research and development plan that shall cover the fiscal year in which the plan is prepared and the four fiscal years following such fiscal year.

"(4) To promote the maximum exchange of information, and to minimize duplication, regarding environmentally related research, development, and demonstration activities through close coordination with the military departments and Defense Agencies, the Department of Energy, the Environmental Protection Agency, the National Oceanic and Atmospheric Administration, the National Aeronautics and Space Administration, other departments and agencies of the Federal Government or any State and local governments, including the Federal Coordinating Council on Science, Engineering, and Technology, and other organizations engaged in such activities.

"(5) To ensure that research and development activities under the Strategic Environmental Research and Development Program do not duplicate other ongoing activities sponsored by the Department of Defense, the Department of Energy, the Environmental Protection Agency, the National Oceanic and Atmospheric Administration, the National Aeronautics and Space Administration, or any other department or agency of the Federal Government.

"(6) To ensure that the research and development programs identified for support pursuant to policies and procedures prescribed by the council utilize, to the maximum extent possible, the talents, skills, and abilities residing at the Federal laboratories, including the Department of Energy multiprogram and defense laboratories, the Department of Defense laboratories, and Federal contract research centers. To utilize the research capabilities of institutions of higher education and private industry to the extent practicable.

"(e) In carrying out subsection (d)(1), the Council shall prescribe policies and procedures that—

"(1) provide for appropriate access by Federal Government personnel, State and local government personnel, college and university personnel, industry personnel, and the general public to data under the control of, or otherwise available to, the Department of Defense that is relevant to environmental matters by—

"(A) identifying the sources of such data;

"(B) publicizing the availability and sources of such data by appropriately-targeted dissemination of information to such personnel and the general public, and by other means; and

"(C) providing for review of classified data relevant to environmental matters with a view to declassifying or preparing unclassified summaries of such data;

"(2) provide governmental and nongovernmental entities with analytic assistance, consistent with national defense missions, including access to military platforms for sensor deployment and access to computer capabilities, in order to facilitate environmental research;

"(3) provide for the identification of energy technologies developed for national defense purposes (including electricity generation systems, energy storage systems, alternative fuels, biomass energy technology, and applied materials technology) that might have environmentally sound, energy efficient applications for other programs of the Department of Defense and the Department of Energy national security programs, particularly technologies that have the potential for industrial, commercial, and other governmental applications, and to support programs of research in and development of such applications;

"(4) provide for the identification and support of programs of basic and applied research, development, and demonstration in technologies useful—

"(A) to facilitate environmental compliance, remediation, and restoration activities of the Department of Defense and at Department of Energy defense facilities;

"(B) to minimize waste generation, including reduction at the source, by such departments; or

"(C) to substitute use of nonhazardous, nontoxic, nonpolluting, and other environmentally sound materials and substances for use of hazardous, toxic, and polluting materials and substances by such departments;

"(5) provide for the identification and support of research, development, and application of other technologies developed for national defense purposes which not only are directly useful for programs, projects, and activities of such departments, but also have useful applications for solutions to such national and international environmental problems as climate change and ozone depletion;

"(6) provide for the Secretary of Defense, the Secretary of Energy, and the Administrator of the Environmental Protection Agency, in cooperation with other Federal and State agencies, as appropriate, to conduct joint research, development, and demonstration projects relating to innovative technologies, management practices, and other approaches for purposes of—

"(A) preventing pollution from all sources;

"(B) minimizing hazardous and solid waste, including recycling; and

"(C) treating hazardous and solid waste, including the use of thermal, chemical, and biological treatment technologies;

"(7) encourage transfer of technologies referred to in clauses (2) through (6) to the private sector under the Stevenson-Wydler Technology Innovation Act of 1980 (15 U.S.C. 3701 et seq.) and other applicable laws;

"(8) provide for the identification of, and planning for the demonstration and use of, existing environmentally sound, energy-efficient technologies developed by the private sector that could be used directly by the Department of Defense;

"(9) provide for the identification of military specifications that prevent or limit the use of environmentally beneficial technologies, materials, and substances in the performance of Department of Defense contracts and recommend changes to such specifications; and

"(10) to ensure that the research and development programs identified for support pursuant to the policies and procedures prescribed by the Council are closely coordinated with, and do not duplicate, ongoing activities sponsored by the Department of Defense, the Department of Energy, the Environmental Protection Agency, the National Aeronautics and Space Administration, the National Oceanic and Atmospheric Administration, or other Federal agencies.

"(f)(1) To assist the Council in preparing the five-year strategic environmental research and development plan under subsection (d)(3), the Secretary of Defense and the Secretary of Energy may each submit to the Council a proposal for conducting environmental research under this chapter. The Secretary of each department shall ensure that the environmental research proposal of the department includes—

"(A) short- and long-term, cooperative, basic, and applied research systems engineering and development programs in environmental research;

"(B) short- and long-term, basic research in environmental restoration at the respective laboratories of each department; and

"(C) participation by industry and institutions of higher education.

"(2) The Secretary of each department shall ensure that, in the development of its environmental research proposal, consideration is given to—

"(A) the need for increased research in basic science, including basic materials, physics, molecular structures, chemistry, and biology related to environmental research at that Department's defense operations, production, research, and maintenance facilities; and

"(B) ways to identify and conduct research and development on technologies for environmental restoration, remediation and waste cleanup activities, waste minimization, and hazardous and toxic materials substitution potential in defense production and maintenance activities.

"(3) The Secretary of each department shall transmit the proposal to the Council not later than July 1 of each year.

"(g) The Council shall be subject to the authority, direction, and control of the Secretary of Defense in prescribing policies and procedures under subsection (d)(1).

"(h)(1) Not later than February 1 of each year, the Council shall submit to the Secretary of Defense an annual report on the annual five-year strategic environmental research and development plan prepared pursuant to subsection (d)(3).

"(2) The report shall contain the following:

"(A) A description of the actions to be taken during the five-year period covered by the plan in order to prevent duplication

of research and development activities referred to in the policies and procedures prescribed pursuant to subsection (d)(1).

"(B) A description of the involvement with Federal interagency coordinating entities such as the Federal Coordinating Council on Science, Engineering, and Technology.

"(C) A description of each project selected or recommended by the Council for support and funding, including the duration of, and the total estimated or (if known) actual cost of—

"(i) each such project supported during the fiscal year in which the plan is submitted and the preceding fiscal year; and

"(ii) each such project proposed for funding during the fiscal year in which the annual report is submitted and the following four fiscal years.

"(D) The amounts requested, in the budget submitted to Congress pursuant to section 1105(a) of title 31 for the fiscal year following the fiscal year in which the annual report is submitted, for the programs, projects, and activities of the Strategic Environmental Research and Development Program and the estimated expenditures under such programs, projects, and activities during such following fiscal year.

"(E) The amount requested in such budget for each Federal laboratory, including each Department of Defense and Department of Energy laboratory.

"(F) The amount made available, for the fiscal year in which the annual report is submitted, to each Federal laboratory, including each Department of Defense and Department of Energy laboratory.

"(G) A description of any changes in military specifications recommended by the Council, actions to be taken to effectuate any such recommended changes on an expedited basis, and the projected date for each such change.

"(H) A description of all contracts, agreements, or other documents for cooperative research and development activities entered into pursuant to the Stevenson-Wydler Technology Innovation Act of 1980 (15 U.S.C. 3701 et seq.) during the fiscal year preceding the fiscal year in which the annual report is submitted.

"(I) Plans for transferring technology and information to other governmental agencies and to nongovernmental organizations involved in environmental research and related matters.

"(J) A description of plans to increase access to data described in subsection (e)(1).

"(K) Such additional recommendations or proposals, including proposals for legislation, relating to the Strategic Environmental Research and Development Program as the Council considers appropriate.

"(3) The Council shall make a draft of the five-year strategic environmental research and development plan covered by each report available for public comment for a period of at least 30 days.

"(4) Not later than March 15 of each year the Secretary of Defense and the Secretary of Energy shall transmit the annual report to the Congress. The Secretary of Defense and the Secretary of Energy may

submit such comments on the annual report as each Secretary considers appropriate.

"§ 2903. Executive Director

"(a) There shall be an Executive Director of the Council appointed by the Secretary of Defense after consultation with the Secretary of Energy.

"(b) Subject to the authority, direction, and control of the Secretary of Defense, the Executive Director is responsible for the management of the Strategic Environmental Research and Development Program in accordance with the policies established by the Council.

"(c) The Executive Director may enter into contracts or other agreements in accordance with applicable law, except that the Executive Director shall first obtain the approval of the Council for any contract or agreement in an amount equal to or in excess of $500,000 or such lesser amount as the Council may prescribe.

"(d)(1) The Executive Director, with the concurrence of the Council, may appoint such professional and clerical staff as may be necessary to carry out the responsibilities and policies of the Council.

"(2) The Executive Director, with the concurrence of the Council and without regard to the provisions of chapter 51 of title 5 and subchapter III of chapter 53 of such title, may establish the rates of basic pay for professional, scientific, and technical employees appointed pursuant to paragraph (1). The authority provided in the preceding sentence shall expire two years after the date of the enactment of the National Defense Authorization Act for Fiscal Year 1991.

"§ 2904. Strategic Environmental Research and Development Program Scientific Advisory Board

"(a) The Secretary of Defense and the Secretary of Energy, in consultation with the Administrator of the Environmental Protection Agency, shall jointly appoint a Strategic Environmental Research and Development Program Scientific Advisory Board (hereafter in this section referred to as the 'Advisory Board') consisting of not less than six and not more than 13 members.

"(b)(1) The Science Advisor to the President, or his designee, shall be a permanent member of the Advisory Board.

"(2) Other members of the Advisory Board shall be appointed from among persons eminent in the fields of basic sciences, engineering, ocean and environmental sciences, education, research management, international and security affairs, health physics, health sciences, or social sciences, with due regard given to the equitable representation of scientists and engineers who are women or who represent minority groups. At least one member of the Advisory Board shall be a representative of environmental public interest groups and one member shall be a representative of the interests of State governments.

"(3) The Secretary of Defense and the Secretary of Energy, in consultation with the Administrator of the Environmental Protection Agency, shall request—

"(A) that the head of the National Academy of Sciences, in consultation with the head of the National Academy of Engineering and the head of the Institutes of Medicine of the Na-

tional Academy of Sciences, nominate persons for appointment to the Advisory Board;

"(B) that the Council on Environmental Quality nominate for appointment to the Advisory Board at least one person who is a representative of environmental public interest groups; and

"(C) that the National Association of Governors nominate for appointment to the Advisory Board at least one person who is representative of the interests of State governments.

"(4) Members of the Advisory Board shall be appointed for terms of three years.

"(c) A member of the Advisory Board who is not otherwise employed by the Federal Government shall not be considered to be a Federal employee, except for the purposes of chapter 81 of title 5 (relating to compensation for work-related injuries) and chapter 171 of title 28 (relating to tort claims).

"(d) The Advisory Board shall prescribe procedures for carrying out its responsibilities. Such procedures shall define a quorum as a majority of the members, provide for annual election of the Chairman by the members of the Advisory Board, and require at least four meetings of the Advisory Board each year.

"(e) The Council shall refer to the Advisory Board, and the Advisory Board shall review, each proposed research project including its estimated cost, for research in and development of technologies related to environmental activities in excess of $1,000,000. The Advisory Board shall make any recommendations to the Council that the Advisory Board considers appropriate regarding such project or proposal.

"(f) The Advisory Board may make recommendations to the Council regarding technologies, research, projects, programs, activities, and, if appropriate, funding within the scope of the Strategic Environmental Research and Development Program.

"(g) The Advisory Board shall assist and advise the Council in identifying the environmental data and analytical assistance activities that should be covered by the policies and procedures prescribed pursuant to section 2902(d)(1) of this title.

"(h) Not later than March 15 of each year, the Advisory Board shall submit to the Congress an annual report setting forth its actions during the year preceding the year in which the report is submitted and any recommendations, including recommendations on projects, programs, and information exchange and recommendations for legislation, that the Advisory Board considers appropriate regarding the Strategic Environmental Research and Development Program.

"(i) Each member of the Advisory Board shall be required to file a financial disclosure report under title I of the Ethics in Government Act of 1978 (5 U.S.C. App.).".

(2) The tables of chapters at the beginning of subtitle A of title 10, United States Code, and at the beginning of part IV of such subtitle, are each amended by inserting after the item relating to chapter 171 the following:

"172. Strategic Environmental Research and Development Program..... 2901".

(b) INITIAL APPOINTMENTS OF ADVISORY BOARD MEMBERS.—(1) The Secretary of Defense and the Secretary of Energy shall make

the appointments required by section 2904(a) of title 10, United States Code (as added by subsection (a)(1)), not later than 60 days after the date of the enactment of this Act.

(2) Up to one-half of the members originally appointed to the Strategic Environmental Research and Development Program Scientific Advisory Board established under section 2904 of title 10, United States Code, as added by subsection (a)(1), may be appointed for terms of not more than six and not less than two years in order to provide for staggered expiration of the terms of members. The Secretary of Defense and the Secretary of Energy, in consultation with the Administrator of the Environmental Protection Agency, shall designate the members appointed for terms authorized under this paragraph and shall specify the terms for which such members are appointed.

(c) FIRST ANNUAL REPORT OF THE STRATEGIC ENVIRONMENTAL RESEARCH AND DEVELOPMENT PROGRAM COUNCIL.—(1) The first annual report required by section 2902(h) of title 10, United States Code, as added by subsection (a)(1), shall be submitted to the Secretary of Defense, the Secretary of Energy, and the Administrator of the Environmental Protection Agency not later than February 1, 1992.

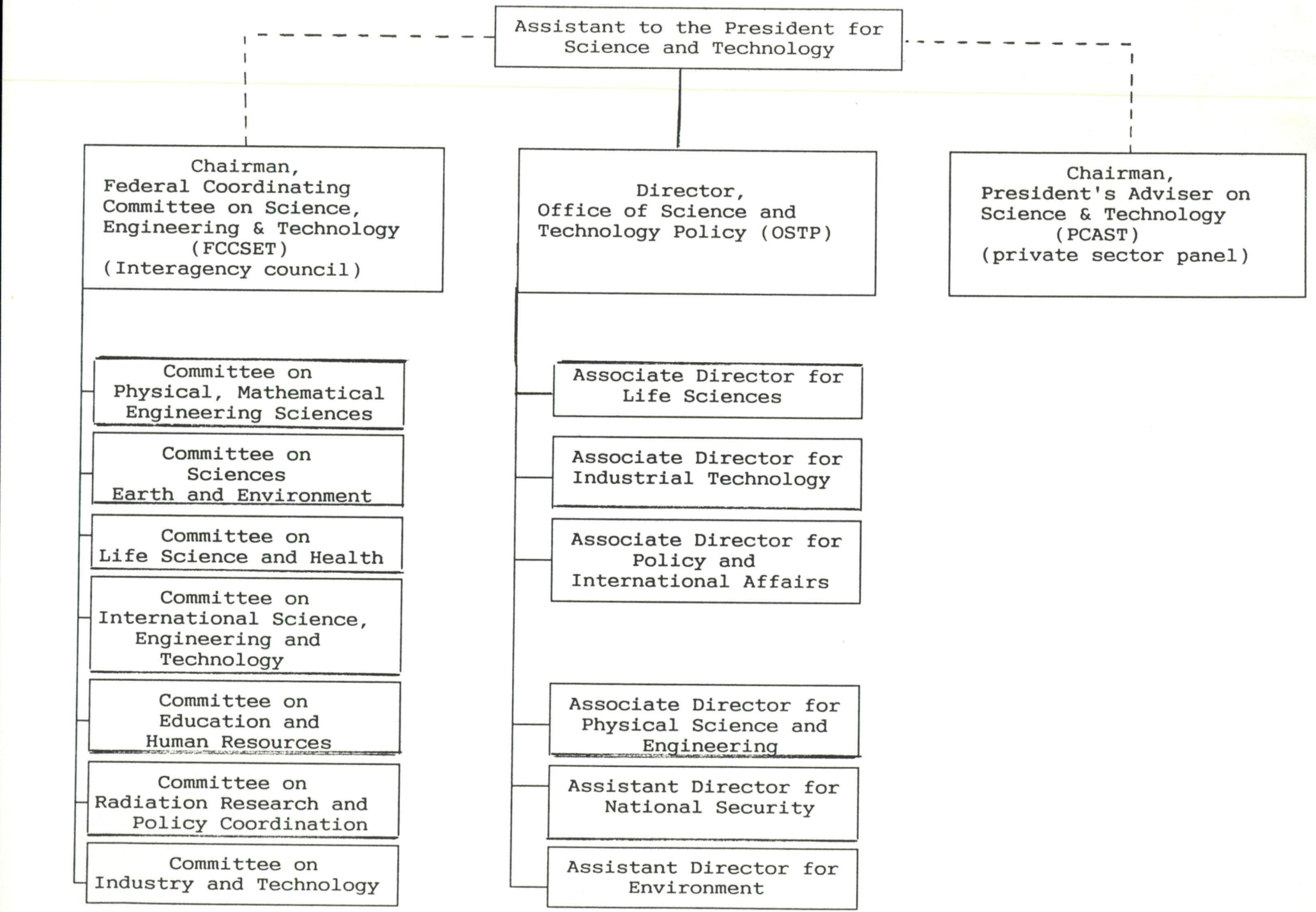
(2) The Strategic Environmental Research and Development Program Council shall conduct and include as part of the first annual report required pursuant to section 2902(h) of title 10, United States Code, as added by subsection (a)(1), an assessment of the advisability of, and various alternatives to, charging fees for information released, as required pursuant to sections 2901(b)(3), 2902(e) (1) and (2), and 2902(g)(2)(I) of such title (as so added), to private sector entities operating for a profit.

(3) The Secretary of Defense, the Secretary of Energy, and the Administrator of the Environmental Protection Agency shall submit to the Congress, with the annual report referred to in paragraph (1), any recommendations for changes in the structure or personnel of the Council that the Secretaries and the Administrator consider necessary to carry out the environmental activities of the strategic environmental research and development program.

(d) FIRST ANNUAL REPORT OF THE STRATEGIC ENVIRONMENTAL RESEARCH AND DEVELOPMENT PROGRAM SCIENTIFIC ADVISORY BOARD.--The first annual report of the Strategic Environmental Research and Development Program Scientific Advisory Board required by section 2904(h) of title 10, United States Code, as added by subsection (a)(1), shall be submitted not later than March 15, 1992.

SEC. 1802. AVAILABILITY OF FUNDS

Of the amounts authorized to be appropriated pursuant to section 201, $200,000,000 shall be available for the Strategic Environmental Research and Development Program established under chapter 172 of title 10, United States Code, as added by section 1001. To the extent provided in appropriation Acts, the amount made available by this section shall remain available until expended.


Assistant to the President for Science and Technology
Chairman, Federal Coordinating Committee on Science, Engineering & Technology (FCCSET) (Interagency council)
Director, Office of Science and Technology Policy (OSTP)
Chairman, President's Adviser on Science & Technology (PCAST) (private sector panel)
Committee on Physical, Mathematical Engineering Sciences
Committee on Sciences Earth and Environment
Committee on Life Science and Health
Committee on International Science, Engineering and Technology
Committee on Education and Human Resources
Committee on Radiation Research and Policy Coordination
Committee on Industry and Technology
Associate Director for Life Sciences
Associate Director for Industrial Technology
Associate Director for Policy and International Affairs
Associate Director for Physical Science and Engineering
Assistant Director for National Security
Assistant Director for Environment

MAJOR OSTP ISSUES AND ACTIVITIES 1989-1990

- Develop High Performance Computing Initiative
- Participate in Federal Budget Process on R&D
- Coordinate Administration's Scientific Work on Global Climate Change
- Formulate Math/Science Education Goals of Agencies with respect to R&D
- Establish FCCSET Structure

PROPOSED AGENDA FOR S&T WORKING GROUP

- Review Pending Legislation on Technology Policy
  - American Technology Preeminence Act
  - High Performance Computing Initiative
  - Prospective Critical Technologies Legislation
- Develop Guidelines Regarding Industry/Government Cost Sharing and Joint R&D
  - Initial focus: electric car consortium in the National Energy Strategy
- Develop Plan for the National Critical Technologies Institute
- Develop position on Uruguay Round disciplines on Government support for R&D (perhaps better suited as TPRG issue)

Document Originally
Attached to
Following Page

Assistant Secretary for Technology Policy

DATE: March 20, 1991

FROM THE DESK OF:

Deborah L. Wince-Smith

TO: Olin Wethington

☐ Per our conversation.

☒ For your information.

☐ For appropriate action.

☐ For draft of an appropriate reply for my signature.

☐ Please answer directly.

☐ Let's discuss.

☐ Please return with your comments.

Attached is the CISET I.P.R. papers. These have been approved by the CISET, however the attorneys are now reviewing them for final approval.

Withdrawal/Redaction Sheet
(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
01a. Memo	Working Group on Intellectual Property Rights (IPR) to Committee on International Science, Engineering and Technology (CISET) Re: An Alternative Intellictual Property Allocation Provision for Use with Institutions of the European Community and Member Sta (2 pp.)	2/25/91	(b)(1)	

Collection:

Record Group: Bush Presidential Records
Office: Economic Policy Council (EPC)
Series: Wethington, Olin, Files
Subseries: Subject Files
WHORM Cat.:
File Location: Science & Technology [2]

Date Closed:	1/5/2010	**OA/ID Number:**	04295-017
FOIA/SYS Case #:	2005-0336-F	**Appeal Case #:**	
Re-review Case #:		**Appeal Disposition:**	
P-2/P-5 Review Case #:		**Disposition Date:**	
AR Case #:		**MR Case #:**	
AR Disposition:		**MR Disposition:**	
AR Disposition Date:		**MR Disposition Date:**	

RESTRICTION CODES

Presidential Records Act - [44 U.S.C. 2204(a)]

P-1 National Security Classified Information [(a)(1) of the PRA]
P-2 Relating to the appointment to Federal office [(a)(2) of the PRA]
P-3 Release would violate a Federal statute [(a)(3) of the PRA]
P-4 Release would disclose trade secrets or confidential commercial or financial information [(a)(4) of the PRA]
P-5 Release would disclose confidential advice between the President and his advisors, or between such advisors [a)(5) of the PRA]
P-6 Release would constitute a clearly unwarranted invasion of personal privacy [(a)(6) of the PRA]

C. Closed in accordance with restrictions contained in donor's deed of gift.

PRM. Removed as a personal record misfile.

Freedom of Information Act - [5 U.S.C. 552(b)]

(b)(1) National security classified information [(b)(1) of the FOIA]
(b)(2) Release would disclose internal personnel rules and practices of an agency [(b)(2) of the FOIA]
(b)(3) Release would violate a Federal statute [(b)(3) of the FOIA]
(b)(4) Release would disclose trade secrets or confidential or financial information [(b)(4) of the FOIA]
(b)(6) Release would constitute a clearly unwarranted invasion of personal privacy [(b)(6) of the FOIA]
(b)(7) Release would disclose information compiled for law enforcement purposes [(b)(7) of the FOIA]
(b)(8) Release would disclose information concerning the regulation of financial institutions [(b)(8) of the FOIA]
(b)(9) Release would disclose geological or geophysical information

Withdrawal/Redaction Sheet
(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
01b. Report	Re: An Alternative Intellectual Property Allocation Provision for Use with Institutions of the European Community and Member States (2 pp.)	n.d.	(b)(1)	

Collection:

Record Group: Bush Presidential Records
Office: Economic Policy Council (EPC)
Series: Wethington, Olin, Files
Subseries: Subject Files
WHORM Cat.:
File Location: Science & Technology [2]

Date Closed:	1/5/2010	**OA/ID Number:**	04295-017
FOIA/SYS Case #:	2005-0336-F	**Appeal Case #:**	
Re-review Case #:		**Appeal Disposition:**	
P-2/P-5 Review Case #:		**Disposition Date:**	
AR Case #:		**MR Case #:**	
AR Disposition:		**MR Disposition:**	
AR Disposition Date:		**MR Disposition Date:**	

RESTRICTION CODES

Presidential Records Act - [44 U.S.C. 2204(a)]

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P-3 Release would violate a Federal statute [(a)(3) of the PRA]
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PRM. Removed as a personal record misfile.

Freedom of Information Act - [5 U.S.C. 552(b)]

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Withdrawal/Redaction Sheet
(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
01c. Attachment	Re: Joint Management Allocation Provision (1 pp.)	n.d.	(b)(1)	

Collection:

Record Group: Bush Presidential Records
Office: Economic Policy Council (EPC)
Series: Wethington, Olin, Files
Subseries: Subject Files
WHORM Cat.:
File Location: Science & Technology [2]

Date Closed:	1/5/2010	**OA/ID Number:**	04295-017
FOIA/SYS Case #:	2005-0336-F	**Appeal Case #:**	
Re-review Case #:		**Appeal Disposition:**	
P-2/P-5 Review Case #:		**Disposition Date:**	
AR Case #:		**MR Case #:**	
AR Disposition:		**MR Disposition:**	
AR Disposition Date:		**MR Disposition Date:**	

RESTRICTION CODES

Presidential Records Act - [44 U.S.C. 2204(a)]

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Freedom of Information Act - [5 U.S.C. 552(b)]

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Withdrawal/Redaction Sheet
(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
01d. Attachment	Re: Standard IPR Annex (3 pp.)	n.d.	(b)(1)	

Collection:

Record Group: Bush Presidential Records
Office: Economic Policy Council (EPC)
Series: Wethington, Olin, Files
Subseries: Subject Files
WHORM Cat.:
File Location: Science & Technology [2]

Date Closed:	1/5/2010	**OA/ID Number:**	04295-017
FOIA/SYS Case #:	2005-0336-F	**Appeal Case #:**	
Re-review Case #:		**Appeal Disposition:**	
P-2/P-5 Review Case #:		**Disposition Date:**	
AR Case #:		**MR Case #:**	
AR Disposition:		**MR Disposition:**	
AR Disposition Date:		**MR Disposition Date:**	

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AGENDA FOR MEETING OF THE

INTERAGENCY COMMITTEE FOR FEDERAL TECHNOLOGY TRANSFER

April 2, 1991 at 10:00 a.m.

ROOM 4830, DEPARTMENT OF COMMERCE

Agenda

- Opening remarks

  --Deborah Wince-Smith, Assistant Secretary for Technology Policy, Department of Commerce

- Discussion of important technology transfer issues under consideration by the Committee on Industry and Technology of the Federal Coordinating Council for Science, Engineering and Technology

  --Dr. William Phillips, Associate Director for Industrial Technology, Office of Science and Technology Policy, the White House

- Discussion of proposed changes in GATT Subsidy Code (possible countervailing duties on products from labs) and Procurement Code (opening government contracts to international competition)

FCCSET Com'n on Industry & Tech. Wm. Phillips

mission: enhance applic. of fed. R+D to industry -- thrust is to make more useful to industry

strategy: obtain private sector input for fed R&D planning
on implem. of critical tech

Nat'l Critical Tech Report

activities: • x-cut on advanced materials + processing
• inventories of critical technologies — these inventories are mini-x cuts
- advanced manuf. → based on existing OMB inventory
- advanced software
- info + communication hardware
- biotechnology

Bill Phillips: "unclear how far can take this"

identify areas of greatest applic. of fed. R+D
conference w/ private sector

D.W.S: how get industry involved in fed. R+D
bring design/process into fed R+D
issue is who uses tech. first, not who created it

Competitiveness Council

- implic. of FOIA
- conflict of interest as it affects tech transfer -- no uniform policy on conflicts of interest
- how implement initiatives (e.g. NEES) remove conf. of int'l as an impediment

I want to thank you for the information on your agency's technology transfer activities that you provided for the Secretary's biennial report to the President and Congress. Please bring any additional recommendations for ideas that you want included in the report.

I look forward to seeing you and hearing your views on these important issues. Please RSVP to Regina Horton at 202-377-8100.

Sincerely,

Deborah L. Wince-Smith

Deborah L. Wince-Smith

Enclosure

Gov't R+D under GATT Subsidies Code / Uruguay R.

- put gov't R+D in green zone?
- how draw line between permissible & impermissible?
- should gov't R+D contracts go under procurement code?

EC Ag '90 offer: expand P.O. to telcom/energy/services

U.S. counter: open services contracts (with reciprocity)
TPRG not provide explicit mandate to include R&D
TPRG to consider further

signif. exclusions in offer: natl security transp fed. mktg telecom NASA (?)

issue of coverage of sub national entities (e.g. states) and non-gov't entities (regional telcos/private utilities)

problem of J. shadow labs

NIH
- research grants to universities... not now open to foreign

GATT gov't proc code will not cover grants

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

MAR 21 1991

Mr. Olin Wethington
Special Assistant to the President
and Executive Secretary of the Economic
Policy Council
Room 228, Old Executive Office Building
Washington, D.C. 20500

Dear Mr. Wethington:

This is to invite you to the first 1991 meeting of the Interagency Committee for Federal Technology Transfer. The meeting will be held on April 2, at 10:00 a.m. in room 4830 of the Department of Commerce. An agenda is attached.

As you know, this Committee was established to expedite the transfer and commercialization of technology from Federal laboratories under the Federal Technology Transfer Act of 1986. However, as the Administration expanded its attention to technology commercialization, it has become apparent that there are many related issues that should be reviewed. Several of these will be considered at this meeting.

After my introductory remarks, Dr. William Phillips of the White House's Office of Science and Technology Policy will discuss issues on the agenda of the new Committee on Industry and Technology of the Federal Coordinating Council on Science, Engineering, and Technology (FCCSET/CIT). Our committee will be working closely with both the FCCSET/CIT and the President's Council on Competitiveness Working Group on the Commercialization of Government R&D.

Two issues of immediate importance to our commercialization efforts relate to the ongoing GATT negotiations. In the Subsidies Code negotiations, there is a proposal to treat government support for R&D which ultimately produces a commercial product as potentially subject to countervailing duties. In the Procurement Code negotiations, the United States is considering whether to include government R&D contracts as procurement within the Code, opening them to international competition. Both of these issues are on a <u>fast track</u> and it is important that you take this opportunity to hear from our trade officials on these sensitive issues and to provide your agency's views to them.

Although this committee and its working group have already considered a number of issues related to federal technology transfer, some barriers to commercialization remain. In order to further stimulate your thinking on this subject, I am enclosing a paper prepared by the Federal Laboratory Consortium that presents a brief discussion of issues that laboratory technology managers believe still need resolution at the policy level.

April 2, 1991

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1 of 3

file: Technology

EMERGING TECHNOLOGIES

A Survey of Technical and Economic Opportunities

Technology Administration
U.S. Department of Commerce

Spring 1990

EMERGING TECHNOLOGIES

A Survey of Technical and Economic Opportunities

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U.S. Department of Commerce

Spring 1990

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FOREWORD

Emerging technologies have the potential to create a multitude of new products and services and to substantially advance productivity and quality. This report identifies 12 emerging technologies in four major categories that feature a combined U.S. market potential of about $350 billion in annual product sales by the year 2000 and a world market approaching $1 trillion. If the United States takes maximum advantage of this economic potential of emerging technologies, further growth in the U.S. standard of living should result.

However, competition from the world's other two economic power centers, Japan and the European Community (EC), is strong. If current trends continue, this study indicates that, before the year 2000, the United States could lag behind Japan in most emerging technologies and trail the EC in several of them.

Based on knowledge of U.S. industry and overseas efforts, this report identifies 13 areas of opportunity for enhancing the likelihood of U.S. success in international competition. Changes and actions in these and other areas could improve the climate for economic development of *all* emerging technologies, including future additions from the U.S. science base.

The purpose of this report is to provide a source of information to be used by industry, labor, government and academe as programs and policies are developed to exploit new, emerging technologies. The report is *not* intended to set out a limited set of technologies which the government has pre-selected for support. Rather, it reflects the new international science and technology community's agenda of promising fields with large potential economic impact.

I believe that the information this report contains will facilitate a continuing dialogue in order to maximize the benefits that we can derive, as a nation, from the opportunities offered by emerging technologies. The goals of such dialogue are refined views, additional information, and—most importantly—consensus on what is worth doing and what are the appropriate roles for industry, government, labor and academe. Assuring U.S. industries' global competitiveness is foremost among the benefits that would accrue from exploiting emerging technologies. In turn, our economic security is a prerequisite for a strong U.S. defense posture and for maintaining and advancing the well-being of every citizen. I encourage your comments and suggestions on this important topic.

Robert A. Mosbacher
Secretary of Commerce

EXECUTIVE SUMMARY

This report identifies 12 emerging technologies that feature a combined U.S. market potential of $356 billion in annual product sales by the year 2000. The report discusses competition from the world's other two economic power centers, Japan and the European Community (EC). This study indicates that, if current trends continue, before the year 2000, the United States will lag behind Japan in most emerging technologies and will trail the EC in several of them.

Based on contacts with U.S. industry and information about activities abroad, this report identifies 13 areas of opportunity for improving the climate for economic development of all emerging technologies. The purpose of this report is that of an information base to facilitate discussions between industry, government, labor and academia. In this role, the report should be viewed as a living document subject to revision, updates and expanded coverage, moving along with the process of national consensus formation.

The following figures summarize the content of this document:

•***Emerging Technologies and Markets*** is a tabulation of the emerging technologies together with their market potential. Twelve technologies are covered because they offer substantial economic benefits for U.S. industry by the year 2000. They are grouped into four major categories: Materials, Electronics and Information Systems, Manufacturing Systems, and Life Sciences Applications. The potential product markets are depicted in bar-graph-format: Annual sales in the U.S. market by the year 2000.

Source: Technical knowledge of staff of the U.S. Department of Commerce, in particular scientists and engineers of the National Institute of Standards and Technology; based on interviews with U.S. international science, engineering, and industrial experts.

•***U.S. Versus Japan and the European Community*** depicts the current standing and the trends observed for the major categories of emerging technologies. Trend lines show the comparison to the world's other great economic powers; the horizontal dividing line indicates parity. Concern about the U.S. position increases with the steepness of the drop of a trend line. The two associated tables entitled ***U.S. Report Card*** give a more detailed view of current status and trends in world competition for all 12 emerging technologies.

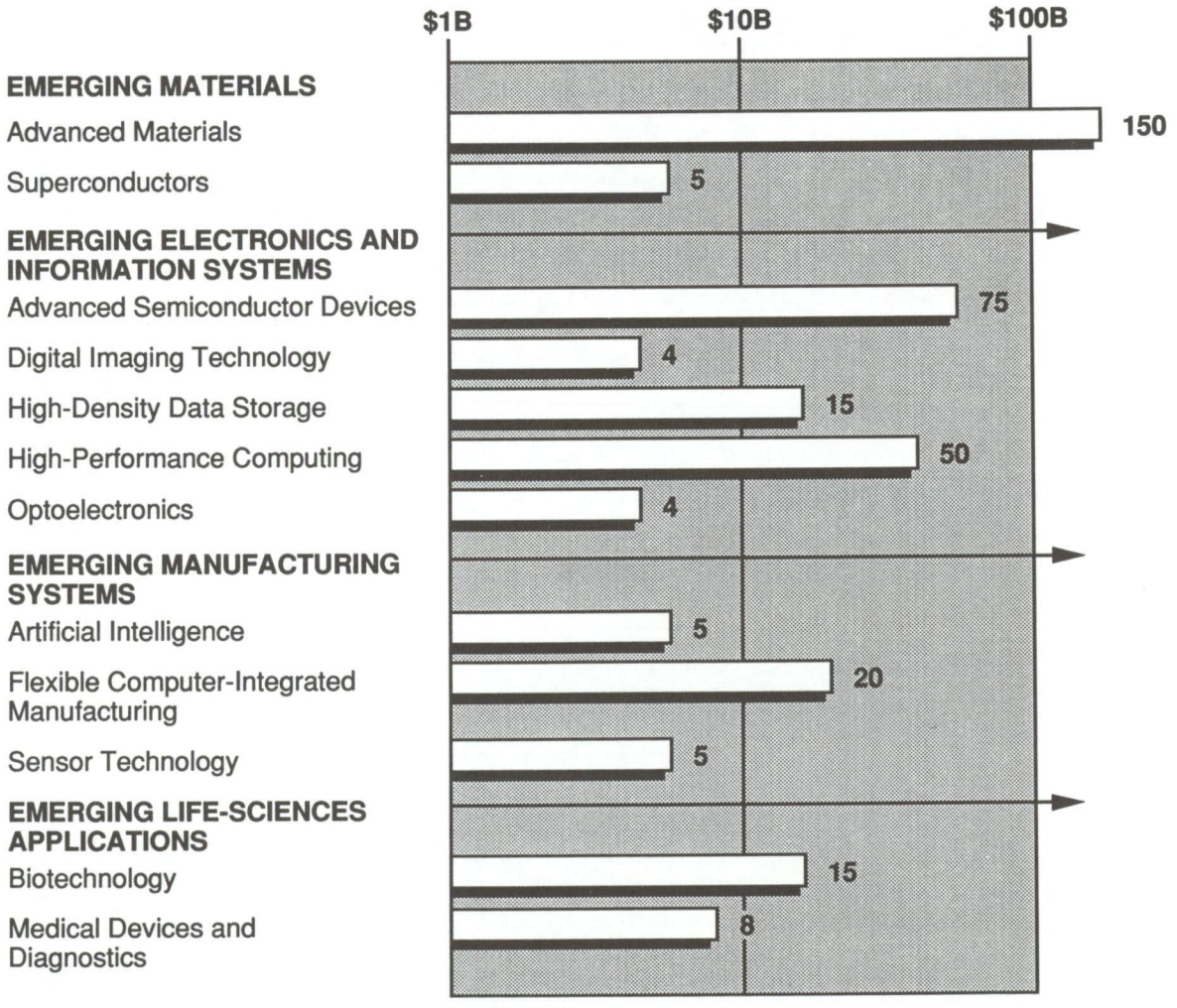
Source: Compiled from the knowledge residing within the Department of Commerce, mostly from contributors within the National Institute of Standards and Technology and the International Trade Administration.

•The four groupings of ***Opportunities*** tabulate 13 areas where actions could be defined and implemented toward improving the climate and capabilities for competitive economic development of all emerging technologies; these 13 areas are not meant to be comprehensive. The four groupings reflect varying degrees of government-industry interaction.

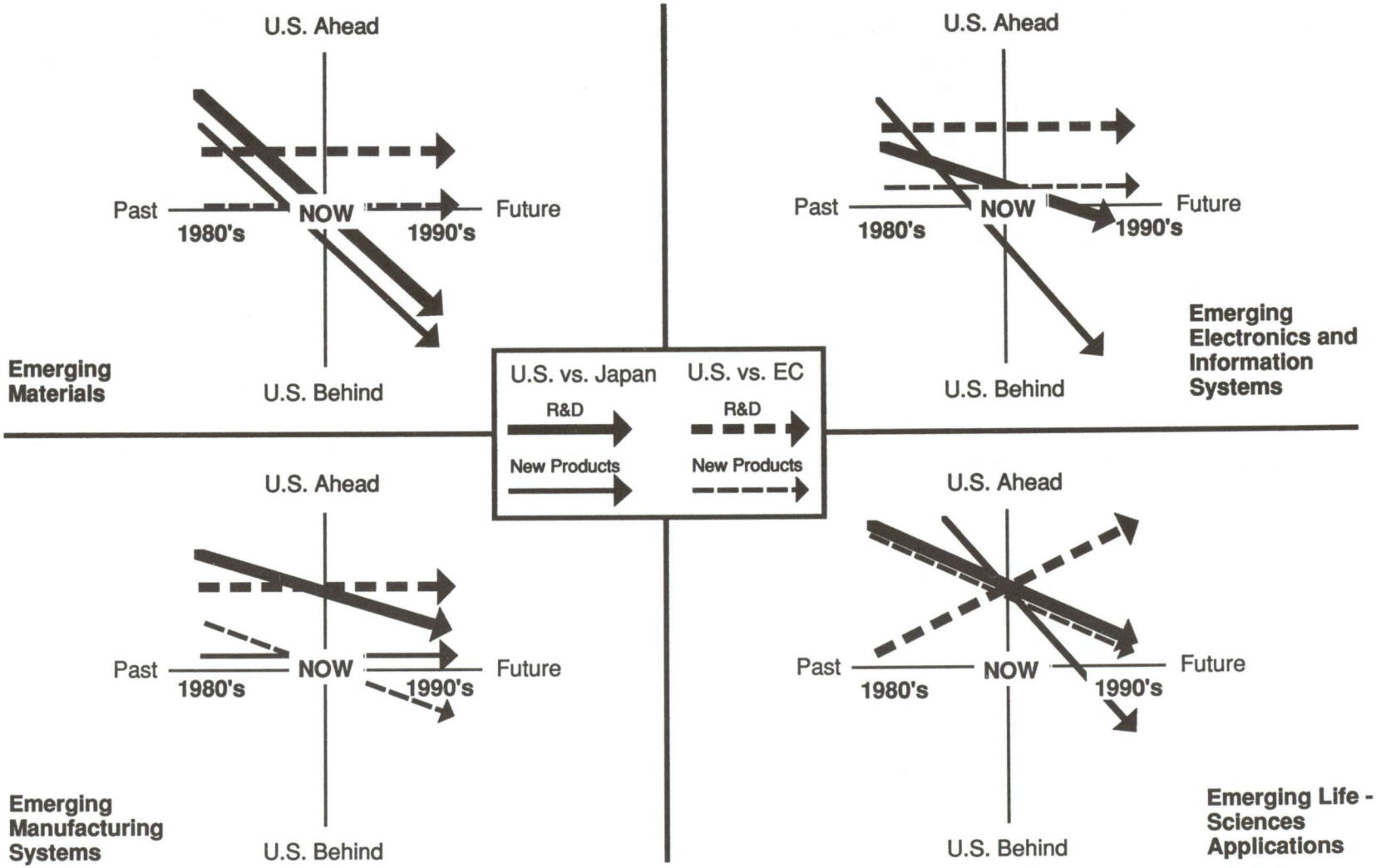
Source: Compiled from the knowledge residing within the Department of Commerce.

EMERGING TECHNOLOGIES AND MARKETS

Annual Sales of $356 Billion in the U.S. by the Year 2000



U.S. VERSUS JAPAN AND THE EC



U.S. REPORT CARD: STATUS 1989

	Versus Japan	Versus Europe
Behind	Advanced Materials Advanced Semiconductor Devices Digital Imaging Technology High-Density Data Storage Optoelectronics	Digital Imaging Technology
Even	Superconductors	Flexible Computer-Integrated Manufacturing Superconductors
Ahead	Artificial Intelligence Biotechnology Flexible Computer-Integrated Manufacturing High-Performance Computing Medical Devices and Diagnostics Sensor Technology	Advanced Materials Advanced Semiconductor Devices Artificial Intelligence Biotechnology High-Density Data Storage High-Performance Computing Medical Devices and Diagnostics Optoelectronics Sensor Technology

U.S. REPORT CARD: TRENDS

	Versus Japan	Versus Europe
Losing Badly	Advanced Materials Biotechnology Digital Imaging Technology Superconductors	Digital Imaging Technology Flexible Computer-Integrated Manufacturing
Losing	Advanced Semiconductor Devices High-Density Data Storage High-Performance Computing Medical Devices and Diagnostics Optoelectronics Sensor Technology	Medical Devices and Diagnostics
Holding	Artificial Intelligence Flexible Computer-Integrated Manufacturing	Advanced Materials Advanced Semiconductor Devices High-Density Data Storage Optoelectronics Sensor Technology Superconductors
Gaining		Artificial Intelligence Biotechnology High-Performance Computing

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- Federal Budget
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- Disregard for Intellectual Property and Non-Symmetrical Access to R&D

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- Availability of Methods, References and Data
- Industry Access to Government Facilities

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- Promote International Consideration of U.S. Technical Advances

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- Enhance Export Opportunities
- Put to Use Technology and Innovation From Abroad

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- Quality Through Process Design

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- Team Work and Process Orientation
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Report on
EMERGING TECHNOLOGIES
A Survey of Technical and Economic Opportunities

1. Purpose of the Report

For most of the period following World War II, the United States was dominant internationally and nearly self-sufficient in science and technology. Our university, industry, and government laboratories were the sources of the ideas for new products and processes which were produced by American factories using American workers and equipment and financed by American investors. Although in some instances U.S.-based multinational corporations operated overseas, this was generally to be close to raw materials or markets and to take advantage of lower labor costs. Products generally were based on technologies developed in the United States.

This dominance has eroded in recent years, and U.S. supremacy has been challenged. Many other countries have attained world-class capabilities in critical technologies and have focused on the timely commercialization of high-quality, cost-efficient products in the international marketplace. Many foreign governments have used subsidies and various other mechanisms to encourage development of specific advanced technologies and their commercial applications.

To remain competitive in this rapidly evolving international economic community, U.S. industry must match these developments by increasing emphasis on research and development of new products and emerging technologies and then on product commercialization and market share.

The purpose of this report is to provide a source of information to be used by industry, government and academia as programs and policies are developed to exploit new, emerging technologies. The report is *not* intended to set out a limited set of technologies which the government has pre-selected for support. Rather, it reflects the new international science and technology community's agenda of promising fields with large potential economic impact. It provides (1) a list and brief description of emerging technologies anticipated to be of major economic importance by the year 2000; (2) a comparison of these technologies with those considered important by major international competitors; and (3) an outline of some opportunities for policies, practices, and procedures that would help U.S. industry to introduce and gain market share from emerging technologies more effectively. Specific recommendations for improvements can result only from extensive deliberations involving industry, academia, labor, and government. However, it is hoped that this document constitutes at least a partial agenda for further discussions.

2. Economic Importance of Emerging Technologies

For purposes of this report, emerging technologies are broadly defined as follows:

> *An emerging technology is one in which research has progressed far enough to indicate a high probability of technical success for new products and applications that might have substantial markets within approximately 10 years.*

In large developed economies such as the United States, economic growth requires that a substantial number of emerging technologies be under development simultaneously to diversify risk and broaden the future industrial base. Just as a mutual fund manager diversifies risk through a large portfolio of investments (expecting some failures), a country with a large diversified economy ought to take advantage of a large science base and rich technological resources to pursue development of as many emerging technologies as possible; this would assure maximum flexibility to capture the economic benefits from those technologies which eventually prove successful in the global marketplace.

This portfolio approach is a very different concept from the "targeted industry" strategy of some countries. In this approach, a few technologies or industries are singled out for intensive government support. Such a strategy might be appropriate for a developing country with limited technological resources, but it is probably not desirable for the United States.

Industry and government strategies for developing and exploiting emerging technologies depend to a great extent on assessments of the nature and magnitude of their economic potential. Emerging technologies must be viewed as having the potential to either

- *create new products and industries with markets of substantial size, or*

- *provide large advances in productivity or in the quality of products produced by existing industries which supply large, important markets.*

Some emerging technologies—usually self-contained products, such as new medicines, or processes, such as x-ray lithography—have important but focused impacts. Others substantially affect the economy by advancing the technical infrastructure or by improving the quality and efficiency of the manufacturing process. Examples are components of a computer-integrated manufacturing system, such as robots or machining centers or the factory control system itself.

Emerging technologies are also important because they will drive the next generation of R&D and spin-off applications. When an industry uses a new technology to design or improve a product and successfully carries it to the commercial marketplace, that new or improved product becomes the starting point for development of the next generation of products or services. Hence, leadership in an emerging technology provides the basis to become a major player in developing or commercializing successive generations of breakthroughs in that or a related technology.

In addition to their economic impact, their influence on next-stage technology and their relevance to national defense (Appendix C and D), emerging technologies affect social and political systems. Advances in computers and communications, for example, are changing work practices and the work environment itself; the removal of geographical limitations on work locations and the increased capability for communicating large quantities of information have affected social and political behavior.

3. The Emerging Technologies

Emerging technologies expected to be of economic importance by the year 2000 are listed in table 1. A more detailed explanation of what these technologies encompass, how they are rooted in science, and how they affect the markets is presented in Appendix A. Their potential impact on national defense is also presented in Appendix A by cross reference to the 1989 *DOD Critical Technologies Plan* and summarized in Appendix C. Market estimates are solely intended to provide rough guidance and to indicate current perception of economic potential.

The list of emerging technologies was generated using published material (see list of References), knowledge residing within the Department of Commerce which reflects strong interactions with U.S. industry and the international scientific and technical community, and extensive iteration involving the many technical experts contributing to this report. The selected emerging technologies cover the full range from post-basic-research to post-early-commercialization. All entries are projected to have substantial economic impact and to exhibit rapid rates of technical progress. A comparison of this list to the 1987 report of the Department of Commerce[1] is given in Appendix B.

These 12 emerging technologies can be aggregated[2] into four major categories:

Emerging Materials
Emerging Electronics and Information Systems
Emerging Manufacturing Systems
Emerging Life Sciences Applications

Technologies in these four categories are likely to have not only substantial economic impact but also very large indirect infrastructure and social impact. Many also will have substantial national security impact. Furthermore, they each affect several industry sectors and a multitude of products, processes, and services.[3] Finally, it must be noted that three of these categories already are being aggressively pursued by Japan and Europe (see table 4) with ambitious proposals to establish extensive programs in the fourth (Manufacturing Systems).

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[1] National Bureau of Standards Internal Report 87-3671, June 1987.

[2] Several of these emerging technologies support more than one category; they were listed where they likely will make their primary beneficial contributions.

[3] Most of the emerging technologies are also dependent on each other. For example, advances in materials, semiconductor devices, and computing affect nearly all of the other emerging technologies.

The emerging technologies of table 1 represent only a subset of all the critical and important technologies. Technologies that are still just scientific opportunities were not listed; also excluded were technologies which have already fully entered the marketplace.

An example of the former is *Nanotechnology*. Although molecular manipulation, nanolithography, and molecular electronics offer exciting prospects for extremely dense electronics, custom-designed materials, and novel pharmaceuticals, unresolved scientific questions make market development by the year 2000 extremely unlikely.

Among the important technologies with a well-established market are those expected to expand and/or restructure by the year 2000. These technologies will benefit not only from some of the emerging technologies but also, significantly, from the introduction of well-known technologies in use elsewhere. For these reasons, they are summarized below:

Building Technology: Major development is now occurring in the areas of flexible and modular manufacturing, intelligent buildings, facilities diagnostics, construction quality assurance, use of new materials, and earthquake and geotechnical engineering. Buildings and other facilities are being equipped with sensors, data processors and actuators to monitor the environment and provide security, safety, air quality, thermal and lighting control, and dynamic structural response.

Chemical Catalysis Technology: Approximately 20 percent of the U.S. gross national product is generated through the use of catalytic processes. Continuing development of catalysts with improved reactivity, selectivity, and stability will permit the manufacture of new materials, reduce the cost of existing products, and increase yields. Significant advances are occurring in the areas of computer modeling of complex catalytic reactions, creation of catalysis designed at the molecular level, and highly specific catalysis that produces few undesirable reactions.

Energy Technology: Environmentally acceptable and economically viable generation, control and transmission of electric power is a prerequisite for a technology-based society. New insulating materials, advanced instrumentation and sensors as well as modern computing and communication technologies will help assure efficient and reliable transmission systems. The depletion of resources, dependence on oil imports, and world environmental concerns (greenhouse effect) will be strong incentives towards the realization of both clean and ultra-safe nuclear power generation which will require full use of existing technologies, many of the emerging technologies, and the development of new standards.

Fire Safety Technology: Significant advances have been made in the area of polymer thermal degradation, advanced sensing and extinguishment techniques, and risk prediction, management, and control. These new abilities to predict and prevent fires cost-effectively have potentially very favorable economic and competitive consequences for a wide array of industries including not only the construction industry but also transportation, aircraft, plants and facilities.

Table 1. The Emerging Technologies

EMERGING TECHNOLOGY	MAJOR TECHNOLOGY ELEMENTS[a]
Emerging Materials	
Advanced Materials	Structural and Functional Ceramics, Ceramic and Metal Matrix Composites, Intermetallic and Lightweight Alloys, Advanced Polymers, Surface-Modified Materials, Diamond Thin Films, Membranes, Biomaterials
Superconductors	High-Temperature Ceramic Conductors, Advanced Low-Temperature Conductors
Emerging Electronics and Information Systems	
Advanced Semiconductor Devices	Silicon, Compound Semiconductors (GaAs), ULSI, Memory Chips, X-ray Lithography
Digital Imaging Technology	High Definition Systems, HDTV, Large Displays, Data Compression, Image Processing
High-Density Data Storage	High-Density Magnetic Storage, Magneto-Optical Storage
High-Performance Computing	Modular/Transportable Software, Numerical Simulation, Neural Networks
Optoelectronics	Integrated Optical Circuitry, Optical Fibers, Optical Computing, Solid-State Lasers, Optical Sensors
Emerging Manufacturing Systems	
Artificial Intelligence	Intelligent Machines, Intelligent Processing of Materials and Chemicals, Expert Systems
Flexible Computer-Integrated Manufacturing	CAD, CAE, CALS, CAM, CIM, FMS, PDES, Integrated Control Architectures, Adaptive-Process Control
Sensor Technology	Active/Passive Sensors, Feedback and Process Control, Nondestructive Evaluation, Industrial and Atmospheric Environmental Monitoring & Control
Emerging Life Sciences Applications	
Biotechnology	Bioprocessing, Drug Design, Genetic Engineering, Bioelectronics
Medical Devices and Diagnostics	Cellular-Level Sensors, Medical Imaging, In-Vitro and In-Vivo Analysis, Targeted Pharmaceuticals, Fiber Optic Probes

[a] An explanation of acronyms can be found in Appendix A.

Source: Technical knowledge of staff of the U.S. Department of Commerce, in particular scientists and engineers of the National Institute of Standards and Technology; based on interviews with U.S. international science, engineering, and industrial experts.

Microwave Technology: Individual microwave components and antennas, and integrated systems containing these components are finding new and expanded applications in areas such as radar for robot vision, collision avoidance, and wind shear detection as well as communications for direct satellite broadcast, personal communications, and worldwide position determination. Further development of microwave technology strongly depends on advances in materials processing and the design and fabrication of integrated circuitry for very high frequencies.

Radiation Processing Technology: Accelerators and radionuclide sources are being used in sterilization of foods and materials, curing of polymers (especially in the electronics industry), radiation-induced catalysis, and waste processing. Entirely new products with unique mechanical, electrical, and temperature resistance properties are possible. The use of toxic materials and heat is avoided when these approaches are substituted for conventional techniques.

4. Emerging Technologies in the International Context

In today's global economy, a multitude of national economies interact with each other through trade. The role that governments have assumed in supporting research, technology, and its applications varies over a wide spectrum of activities (see also Appendix E). For example, in Japan, emphasis is placed on reducing ideas to practice; efforts are coordinated and sponsored by a variety of organizations, led by the Ministry of International Trade and Industry (MITI). The governments of the countries forming the European Community (EC) address issues across the board, ranging from basic research to prototype products with strong emphasis on full EC-wide coordination by 1992. The debate in the United States centers on to what degree, if any, should the United States deviate from the approach that has served its economy well in the past, i.e., the traditional focus of Government support of basic research, defense technology, and agency mission-oriented R&D.

If foreign firms develop products based on emerging technologies faster and more effectively than U.S. companies, then the price, performance and quality of foreign products may surpass U.S. offerings. In contrast, comparative success by U.S. firms in bringing emerging technologies to market will stimulate more and better quality jobs, increase exports, reduce imports, and contribute directly to material wealth. Not only will such success improve the U.S. civilian industrial base, but it will foster improved national security directly through dual-use technologies and indirectly by advancing the country's economic strength. Furthermore, it will enhance the ability of the United States to spawn the next generation of technology advances: the emerging technologies of the future.

Table 2 summarizes the driving forces that have created the new competitive realities. Table 3 provides a summary of the relative standing of the United States, Japan, and the European Community in R&D and product introduction. The information contained in table 3 was compiled from the knowledge residing within the Department of Commerce, mostly from contributors within the International Trade Administration and the National Institute of Standards and Technology. Other experts and organizations might not agree with every detail of this information but it represents the best estimates based on the Department's extensive experience; further discussions are needed to refine our knowledge and to analyze the driving forces and causes for the status and trends depicted by table 3. Table 4 compares the categories of important emerging technologies made in this report, with those in Japan and the European Community.

Table 2. Past versus Present: The New Environment for Emerging Technologies

Acceleration and globalization of the generation of technology:

Today, technology is generated at an accelerating pace in many industrialized countries. Rapid information exchange and mobility of people often make new technical ideas quickly available on a global scale. It can no longer be taken for granted that the country originating a new idea will be the country most likely to reap its economic benefits.

Differentials in the cost-of-capital:

Higher interest rates, cultural practices, and tax laws combine to make the effective cost of capital funds for U.S. firms more than twice as high as for their Japanese competitors and substantially higher than for European firms.

Globalization of industries:

Multinational corporations (based in the U.S. or abroad) decide what to produce and in which country. These decisions are based on sophisticated analyses of the manufacturing costs and of the capabilities of modern laboratories and factories anywhere in the world.

Integration of the manufacturing process:

Japanese manufacturers have pioneered the integration of the manufacturing process which has resulted in substantial time savings in product introduction as well as in superior product quality. Research shows Japanese firms generally introduce manufactured products twice as fast as U.S. firms.

Increased cost of prototype production:

The complex, multidisciplinary nature of emerging technologies, as well as the need to establish special test and/or process facilities and demonstration projects, often makes it prohibitively expensive for even large corporations to go it alone. Investment requirements can exceed hundreds of millions of dollars.

Expanded scope of benefits from emerging technologies:

The potential benefits from an emerging technology easily transcend the scope (i.e. the product portfolio) of most, if not all, U.S. corporations. Thus, return on investment for an individual firm is either unattractive or, if adequate, misses out on opportunities to exploit applications in other industries.

Source: Compiled from the knowledge residing within the Department of Commerce, mostly from contributors within the International Trade Administration and the National Institute of Standards and Technology.

Table 3. Relative Standing in Emerging Technologies: U.S. versus Japan and EC

	JAPAN		EUROPEAN COMMUNITY	
	R&D	Product Introduction	R&D	Product Introduction
Advanced Materials	o ↓	− ↓	+ ↔	o ↔
Advanced Semiconductor Devices	o ↔	− ↓	+ ↔	o ↔
Artificial Intelligence	+ ↔	+ ↔	+ ↑	+ ↔
Biotechnology	+ ↓	+ ↓	+ ↑	+ ↔
Digital Imaging Technology	o ↓	− ↓	o ↓	− ↓
Flexible Computer-Integrated Manufacturing	+ ↔	o ↔	+ ↓	− ↓
High-Density Data Storage	o ↔	− ↓	+ ↔	o ↔
High-Performance Computing	+ ↔	+ ↓	+ ↑	+ ↑
Medical Devices and Diagnostics	+ ↔	+ ↓	+ ↔	+ ↓
Optoelectronics	o ↔	− ↓	o ↔	+ ↔
Sensor Technology	+ ↓	o ↔	+ ↔	o ↔
Superconductors	o ↓	o ↓	o ↔	o ↔

Current Status:
+ = U.S. Ahead
o = U.S. Even
− = U.S. Behind

Trend:
↑ = U.S. Gaining
↔ = U.S. Holding
↓ = U.S. Losing

} (as compared to Japan/EC)

Source: Compiled from the knowledge residing within the Department of Commerce, mostly from contributors within the National Institute of Standards and Technology and the International Trade Administration.

Table 4. Comparison of Emerging Technology Categories: Japan, EC and U.S.

JAPAN[a]	EUROPEAN COMMUNITY[b]	U.S.[c]
New Materials	New Materials	Emerging Materials
Biotechnology Biomaterials	Biotechnology	Emerging Life Sciences Applications
Software Engineering Electronics	Information Technology	Emerging Electronics and Information Systems
–	–	Emerging Manufacturing Systems
–	Energy	–

[a] MITI White Paper, *Trends and Future Tasks in Industrial Technologies.*
[b] *First Report on the State of Science and Technology in Europe.*
[c] This report.

5. Opportunities for Change

In this chapter many of the factors that affect emerging technologies are discussed. Together they form an environment that significantly influences the effectiveness and speed of new product or process introduction as well as the likelihood that significant shares of the global market can be attained and sustained. These phenomena are often thought of as barriers that must be overcome. This discussion concentrates on areas (summarized in table 5) where opportunities may be found to modify the environment so as to lower the generic barriers to the effective development and commercialization of emerging technologies. Appendix B compares this list to the 1987 DOC report (see footnote 1 on page 7). The factors identified are preliminary, based on initial thoughts, and do not cover all areas comprehensively.

Table 5. Opportunities for Change

The Cost of Research and Market Introduction
Engineering Training and Education
Integration of R&D, Design and Manufacturing
Improving the Quality of Products and Services
Improving the Technology Infrastructure
Product and Interface Standards
Dependence on Domestic Technologies and Markets
Industrial Cooperation
Protecting Intellectual Property Rights
Laws of Product Liability
Regulatory Constraints
Export Policy
Restrictive Foreign Trade Practices

Source: Compiled from the knowledge residing within the Department of Commerce.

The Cost of Research and Market Introduction

Low capital cost can facilitate the development and commercialization of new products in at least two ways. First, projects are less expensive, thus decreasing risk for large companies and making it easier for small enterprises to enter the market. Second, the required rate of return can be correspondingly smaller, and higher risk or longer term projects are much more likely to be undertaken. Such considerations would therefore encourage longer business horizons.

In the early stages of the R&D process, commercialization is an uncertain and relatively distant event, and thus the investment risk is relatively high. Although investments at this early stage can yield large payoffs, the rewards may be too far in the future to be acceptable, even though the generic technology often can be applied to a number of distinct markets. Once the generic technology is developed and applications begin to enter the marketplace, the time to payoff is reduced, but the cost may be larger for late entrants to the field who must first catch up in technical expertise. For example, generic ceramics technology may have applications in such diverse markets as automobile engines, medical implants, machine tools, optoelectronic devices, and electronic capacitors.

It is very difficult to compare capital costs in different countries, and even the most sophisticated analyses are only estimates. Recent studies show, however, that capital costs in the United States are substantially higher than in some European countries and have been perhaps two to four times the costs in Japan. Prevailing interest rates play a fundamental role in the cost of capital, especially for small entrepreneurial companies. These rates are influenced by many factors, including the size of the public-sector debt and the rate of individual savings.

For larger firms, which may support research using income from other products, the impact of tax laws may be just as important. At a time when foreign countries continue to employ a variety of incentives to encourage the exploitation of emerging technologies, recent changes and uncertainties in the U.S. tax laws have had the effect of reducing the availability of funding for research and development by U.S. firms.

The research and experimentation tax credit, for example, was originally enacted in 1981 with an expiration date of December 31, 1985. The credit, which has subsequently been extended repeatedly, is presently scheduled to expire on December 31, 1990. The Bush Administration is actively seeking to make the credit permanent. Since 1984 the business community has not known whether the R&D tax credit will continue from one year to the next, creating great uncertainty. This has undermined to some extent the original intent of the legislation, namely that the credit become a factor in encouraging U.S. business to engage in long-term planning for R&D.

Engineering Training and Education

Success in global competition depends upon the availability of a well-educated and highly skilled work force. It depends equally upon the effective management and motivation of the work force. Design engineering, manufacturing engineering, and the management of technology are three areas of particular importance for the success of emerging technologies.

Design engineering involves an appreciation of the importance of the relationship between design and productivity. Designing for manufacturability is very important to assure product quality and cost-effective production. Furthermore, everyone connected to a product manufacturing line plays an important role in feeding information on the manufacturing process back to the designers. These concepts are key ingredients in productivity improvement and are widely practiced particularly by Japan.

Manufacturing engineering requires a full appreciation of the interdisciplinary nature of modern production methods. Accordingly, manufacturing engineers are trained in a broad program with contributions from many disciplines. Decades ago, American engineering schools moved away from the curriculum of engineering practice into a curriculum of engineering sciences. This resulted in a shortage of adequately trained manufacturing engineers; current emphasis is on reversing this situation.

Management of technology requires a broadly based, generalist engineer/business graduate to create an integrated, interdisciplinary team approach to the manufacturing enterprise. The required skills span fields such as basic engineering concepts, business knowledge, systems analysis, operations research, and computing. If this need is to be met by new graduates, it may take many years before they could expect to have a substantial impact in industry. Therefore, a good understanding of technical factors by existing managers is very important. It is also important to transmit the knowledge base on management technology from industrial and governmental organizations to the schools.

Integration of R&D, Design, and Manufacturing

In the current global competitive market, rapid transformation of emerging technologies and product improvements into commercial products is critical, but this transformation is often hampered by inadequate integration of R&D, design, production, and marketing. With tighter integration, Japanese firms often can transform an emerging technology into a commercial product twice as fast as U.S. firms.

Integration removes formal barriers between R&D, design, manufacturing, and marketing. Each phase is continuously alert for problems that might be encountered in later stages. In its ultimate realization, research, development, design, prototype production, and marketing progress nearly simultaneously.

Integration, including concepts such as concurrent engineering, total quality, and just-in-time production, require new tools to manage and disseminate information within an organization. Information about all aspects of the manufacturing process must be made readily available to everyone involved in production. Technology itself, in the form of advanced computer systems and new concepts in information management, has proven to be an effective facilitator.

Improving the Quality of Products and Services

Poor product quality often results from decisions and actions that preceded actual production, particularly in the design phase or in purchasing parts and materials. Improvements in the quality of the finished product must, therefore, focus on all aspects of the production process, with special emphasis on the early design phases and on sensing and process control. Adequate attention in these early stages may also lessen the time needed to produce a commercial product. Being first to market is not enough if the quality of the product is inadequate, especially if higher quality products also enter the market.

Beyond the many definitions of quality for performance, appearance, reliability, after-sale service, form, fit, and function, quality ultimately refers to how well customers' expectations are met in a competitive environment. This definition implies that there can never be an absolute determination of product quality; it has to be evaluated in terms of other products and the expectations of the user. This evaluation is especially important for a product sold on the international market because the preferences and expectations of users may vary from country to country. In 1987 the United States took a major step to focus attention on the importance of excellence in quality management by establishing the Malcolm Baldrige National Quality Award. Since 1988, five U.S. companies have received this award from the President of the United States.

In other countries, most notably Japan, techniques and processes for achieving consistently high quality have progressed much more rapidly and have been more widely adopted than in the United States. In contrast to the Japanese method of incorporating quality control in all phases of the design and manufacturing process, U.S. firms (and the U.S. government) often limit quality control to "inspecting quality in." Thus there is often no incentive for suppliers to invest in advanced, comprehensive methods.

Improving the Technology Infrastructure

The technology infrastructure consists of the science, engineering, and other technical resources that private industry needs to produce and market products and services competitively. For example, industry draws upon externally provided generic technologies, technical information, and research and test facilities.

In many cases, the development of an emerging technology by industry can be accelerated by joint efforts which may involve government laboratories, universities, and university research centers. These joint efforts are especially important in addressing elements of the generic technology where no single industry has the resources or the focus to undertake the research and where underinvestment in the generic technology would otherwise result.

Other important aspects of the technology infrastructure are methods that enhance the productivity of both the R&D and production phases and the efficiency of market development. They include measurement and test methods, interface standards, quality assurance models and methods, critically evaluated reference data and research, other technical and economic data, and test facilities. Increased use of capital-intensive research and test facilities, for which industry pays only the operating costs, would greatly facilitate research and product development.

Product and Interface Standards

Standards play an essential role in domestic commerce and international trade by providing written descriptions of products or services that can be used in transactions to assure equity between buyers and sellers. Increasing worldwide emphasis on the development and adoption of international standards by national standards organizations and governmental bodies has the potential to reduce protectionism. It is, therefore, vital to promote free-trade concepts in international arenas, especially for newly emerging technologies.

Influence on the international standardization process can be exerted best by strong participation in domestic standards committees and technical advisory groups to international committees and by concentrated efforts to maintain a vigorous presence in international fora especially holding secretariats in international committees and working groups.

One of the major impacts of EC 1992, the European Community's agreement to establish a single internal market by the end of 1992, will be European adoption of international standards, where available. This policy underscores the need to have good international standards in place early on. Lacking them, the European regional standards organizations, CEN and CENELEC, will develop their own standards to implement EC directives. The United States, lacking the right to participate in the European regional bodies, will have to promote European consideration of U.S. technical advances. Similarly, to the degree the United States works closely with developing countries, the promulgation of standards compatible with those in the United States will be encouraged.

Dependence on Domestic Technologies and Markets

The size and ready availability of the U.S. market to new products and services often results in a complacent attitude in domestic companies, which do not fully appreciate the need for competing with foreign firms. Especially in emerging technologies, where entrepreneurial (often small) firms dominate, a narrow focus on the U.S. market can prove to be a costly mistake. American companies, separately and in joint ventures, increasingly should seek export opportunities abroad and anticipate challenges in the United States from new foreign competitors.

A special challenge lies in overcoming the mind set of technical and management staff, which has often been called the "not invented here" syndrome. More aggressive pursuit of technology developed overseas is imperative for U.S. industry to exploit the emerging technologies. An increased awareness and acceptance of technological innovation occurring abroad would help U.S. industry to design and manufacture advanced products and use the most modern processes. New legislation and international agreements have paved the way for improved U.S. access to foreign government supported R&D.

Industrial Cooperation

Cooperative arrangements among nonaffiliated firms in the private sector are often essential for successful technological innovation and commercialization. For some tech-

nologies, cooperative efforts may be the only way of reducing the risk of developing innovative product options. The required facilities are expensive to build and will only become available to many U.S. firms if they are able to share the cost and risk of design and construction.

The substantive principles of U.S. antitrust law have generally been regarded as reasonable and as supporting efficient industry activity and low prices for goods and services. Also, through increasingly sophisticated analysis, U.S. antitrust enforcement agencies and courts have improved in their ability to differentiate between anticompetitive and benign business arrangements. However, for U.S. firms in particular, uncertainty about the applicability of the antitrust laws to such arrangements may chill a significant amount of potentially beneficial industry activity. The antitrust legal process is extremely lengthy and expensive, and business uncertainty as to its outcome remains a significant problem.

Traditional approaches to reducing antitrust uncertainty include issuance by the Justice Department of "business review letters," which indicate that agency's enforcement intentions with respect to particular proposed conduct. More recently, enforcement guidelines have been issued, and laws to provide clarity or "safe harbors" in specific areas have been proposed by the Executive Branch and passed by the Congress. Key enactments were the Export Trading Company Act and the National Cooperative Research Act.

The Bush Administration is seeking to reduce antitrust uncertainty in the especially important area of industry cooperation in the production of goods. It proposes to broaden the National Cooperative Research Act to cover joint production ventures in addition to the joint R&D ventures presently covered by that Act. Joint production ventures registered under the provisions of this legislation would be protected against treble damages in private suits. They would also be assured that their arrangements cannot be judged *per se* illegal, but will instead be evaluated under a "rule of reason" framework which is sensitive to actual, rather than presumed, competitive effects.

Regardless of legislative restrictions, cooperative ventures in the United States are less common than in other industrial countries (Appendix E). To some extent this is a result of custom and attitude. For example, instead of working together, domestic firms often push to have their own solutions accepted as a national standard because this strategy will often confer a short-term advantage in the domestic market. Such a strategy might not be optimal in the longer term, however, because it increases the vulnerability of domestic producers to foreign competition.

There also may be advantages in vertical linkages between a producer and its suppliers and customers. Such agreements might violate restraint-of-trade laws under certain circumstances. These vertical linkages can be conduits for technological innovation and are often exploited by foreign industry; it is less common for U.S. companies to do so. The strong working relationship between U.S. airplane manufacturers and commercial airlines is an exception and demonstrates the power of such relationships. Customer demand for advances in speed, payload, fuel efficiency, and range encouraged manufacturers to develop new airfoil designs, materials, engines, and wide-bodied airplanes.

Vertical linkages may have other advantages as well. U.S. producers (e.g., of semiconductors) are often relatively small, highly entrepreneurial, individual companies. Many lack the financial strength to fund expensive product development projects and to tide them over during cyclical downturns in the business cycle. Others must raise short-term capital by licensing new technology to other companies that often then become competitors. Their Japanese counterparts, on the other hand, are large, diversified, and vertically integrated. They can afford to be much more patient, to take a longer term view of the development cycle, and to give support to other segments of the company. The downstream product lines of the company also provide a stable internal market for the new products and feedback on outside consumer demand.

Furthermore, Japan is well positioned to capture the significant "economies of scope," or the multiple applications of emerging technologies, because of the way Japanese industry is organized. Extensive interindustry and interfirm cooperative relationships, including vertically integrated networks under common control, allow the introduction of new materials and components simultaneously in many different applications and markets.

Protecting Intellectual Property Rights

U.S. businesses rely upon strong intellectual property protection to realize the benefits of emerging technologies. In fact, the rate of development of emerging technologies may well depend upon patents as security for R&D and marketing investment and upon trademarks to build and protect reputations for quality. Barriers exist where laws, regulations, or enforcement procedures are inadequate. When innovation is neither rewarded nor encouraged, markets are either forfeited, left untapped, or are underdeveloped.

Examples of domestic barriers include (1) the inadequacy of the statutory 17-year patent term for certain agricultural and pharmaceutical products subject to extensive premarket testing, (2) the uncertain rules concerning the protection of software, (3) the difficulty in patenting biological inventions (plants and animals), and (4) the absence of effective protection for process patent holders against imports of products made abroad illegally using the patented process.

The Omnibus Trade and Competitiveness Act of 1988 directs the U.S. Trade Representative to identify those foreign countries that deny adequate and effective protection of intellectual property rights to U.S. firms or that deny fair and equitable market access to U.S. firms relying on intellectual property protection. This would include, for example, a nation's outright appropriation of foreign-owned technologies or of creative and artistic works. Other problems include the needs for international harmonization of patent laws and for measures to address counterfeiting, piracy, and the protection of industrial property.

Laws of Product Liability

It is important to evaluate the effect that U.S. product liability and tort laws have on innovation, emerging technologies, and the general ability of domestic companies to com-

pete in the international market. In particular, the following issues have often been cited:

- The U.S. has a patchwork of 50 different sets of State laws on product liability. Cases based on similar facts, but tried in different States, can produce strikingly different and contradictory results.

- The transaction costs for all parties involved in litigation are enormous.

- The costs of insurance for product-liability-related protection are particularly high.

The Bush Administration has announced an initiative to seek significant reform of the product liability system. The Administration has placed its strong support behind bipartisan product liability legislation. The Administration will develop additional reform provisions including fault-based manufacturer defenses to liability ("state-of-the-art defense"), limits on punitive damages, extension of the limit on joint and several liability, and a time limit that a product is subject to liability. The purpose of the Administration initiative is to help preserve the U.S. competitive posture, while at the same time safeguarding consumer interests.

Regulatory Constraints

Government regulations significantly affect the vast majority of new technologies and products. Somewhere in the cycle of research and development, production and marketing, most new products will face testing, evaluation or approval for health, safety or environmental reasons. The processes by which products are developed are equally regulated—from traditional operations like the mining, transporting and smelting of ores to "gene-splicing" or the irradiation of foods.

Federal regulations alone impose costs of over $100 billion annually on the U.S. economy. Our stringent health, safety and environmental standards entail unusually high costs which must be reflected in the prices charged for U.S. goods and services. Regulatory costs and uncertainties sometimes deter investment in regulated activities, which can mean reduced innovation and slower productivity growth. Smaller-scale businesses in highly competitive industries are especially disadvantaged by regulatory burdens.

The international competitive effects of regulation are difficult to measure because they tend to be masked by externalities such as shifts in currency values, foreign government subsidies, and dumping. Recent studies appear to demonstrate that regulatory costs significantly affect capital formation.

Continuing the regulatory reform policies of the previous Administration, the Bush Administration is committed to reducing regulatory burdens and costs on industry wherever possible without endangering health, safety, or the environment. To that end, particular stress is being placed on streamlining regulatory procedures and harnessing market incentives to serve regulatory goals.

Export Policy

U.S. exports are controlled for national security purposes. Such controls do not serve their intended purpose if they inhibit the sale of goods and technology that are no longer strategic or are available from foreign competitors.

Unnecessary restrictions have three effects: First, the controls significantly limit U.S. industry's access to foreign markets. Even if such access is not precluded, the cost of doing business in those markets is increased. Second, the U.S. Government exercising control over the re-export of foreign products incorporating U.S. parts and components has led a number of foreign manufacturers to redesign their products so that they do not contain U.S. components. Third, limiting sales to the domestic market reduces the profitability and increases the cost of the product. In the long run, this contributes to the erosion of the industrial base for defense-related products.

There are currently two export control processes that relate to security interests of the United States. Products that are weapons systems, or primarily of military use, are included on the Munitions List provided for in the Arms Export Control Act (AECA) and issued by the State Department's Office of Munitions Control (OMC). The Department of State, in consultation with the Department of Defense, reviews license applications for exporting such goods.

Dual-use items are placed on the Commodity Control List requested by the Export Administration Act (EAA); the review process for license applications is administered by the Commerce Department, which can consult with DOD.

The EAA generally stipulates that an export license not be required for reasons of national security, for a product if there are similar products of comparable quality available on the international market from foreign sources in quantities sufficient to render the U.S. control ineffective. The AECA, however, contains no such "foreign availability" clause, and industry often finds export license applications rejected only to see a potential customer turn to an alternative foreign supplier, thereby hurting the U.S. competitive posture in the world market.

In addition to these national security controls, some U.S. exports are controlled by the Commerce Department for foreign policy reasons, such as nonproliferation (nuclear, missile, chemical weapons precursors), anti-apartheid, and anti-terrorism. These controls are imposed to achieve U.S. objectives to distance the United States from objectionable activities of certain governments or to support international agreements with other nations. Unlike national security controls, foreign policy controls are not automatically removed due to foreign availability, although it is taken into consideration.

The Omnibus Trade and Competitiveness Act of 1988 made some very substantive changes in the Export Administration Act. One change virtually eliminates re-export controls on foreign products which contain less than 25 percent U.S. parts and components, and on all products being re-exported into COCOM countries. (COCOM = Coordinating Committee consisting of the U.S., Canada, a number of Western European countries, Australia, and Japan.) Another provision of the act eliminated U.S. licensing authority

over many products exported to a COCOM country. Since COCOM destinations represent a large market for U.S. firms, the reduction in licensing burden will be dramatic. Further study of export policy may be appropriate after the effects of these changes in the law become clearer.

Restrictive Foreign Trade Practices

Restrictive trade practices take many forms—laws, regulations, and practices—with the objective of protecting a home market from foreign products. The following are some of the more frequently encountered practices:

- Tariffs and other import duties designed to protect a foreign country's domestic market rather than to raise revenues.
- Import licensing intended only to create uncertainty, delays, and discrimination for imported products.
- Procurement policies by foreign governments; e.g., requirements to buy preferentially national products.
- Export subsidies programs.
- Local or domestic content requirements (e.g., rules of origin) that prevent the import of new products.
- Nonsymmetrical access to government supported R&D.
- Market reserve policies that designate certain markets for domestic products only.
- Disregard of intellectual property rights by foreign governments which undermines the ability to exploit markets with new products.

Although most actions are sponsored by governments, business practice and social mores also may be significant. If they differ from those of the United States, they may act as significant trade barriers, especially if they are institutionalized. Emerging technologies are a particularly easy target because markets are not yet fully established and the protecting country thus has little to lose by erecting barriers to the introduction of new products.

6. Outlook

Emerging technologies offer the potential for substantial economic benefits. The economic growth of many nations, especially that of the United States, has been based on the development and successful introduction of emerging technologies (Appendix F). Lately, U.S. industry has been unsuccessful in capturing the majority of benefits from emerging technologies; at the same time, U.S. trading partners have demonstrated substantial economic growth through the marketing of products based on U.S.-developed technologies.

As a result, the present outlook for the success of U.S. high-technology industry in the global marketplace is of concern to many. This issue is receiving attention at the highest levels in industry, academia, and government.[1] A number of conferences, studies, and reports on this subject have generated considerable material but consensus on actions has not been reached as yet.

Nevertheless, there appears to be a strong interest in taking action to improve U.S. competitiveness. This report is intended to facilitate this process. New strategies can best emerge from a continuing dialogue among representatives from industry, labor, academia, and government. It is hoped that the information this report contains will serve to stimulate and assist in this dialogue. An in-depth exchange of ideas and information between all segments of our economic and technical community is a prerequisite for developing concerted actions. Actions are needed to maximize the benefits that we can derive, as a nation, from the opportunities offered by emerging technologies. If we succeed in stimulating improved competitiveness, then the outlook is good because this country remains strong in the generation of new science and technology options.

[1] Current administration policy supports a Federal role in fostering and promoting R&D related to civilian technologies that may have major impact on the U.S. economy and its international competitiveness. As an illustration of this policy, the *National Action Plan on Superconductivity Research and Development*, prepared by the White House's Executive Office of the President, December 1989, states, "Superconductivity, along with other enabling technologies...will not be industry specific and, thus, warrants assistance where feasible and appropriate from the Government. The multidisciplinary nature of the technology and the fact that the benefits from commercialization will accrue over such a long term make it difficult for individual firms to justify capitalizing the basic R&D expenses for commercialization...With fierce international competition, time will be critical in transferring the technology into marketable products...The vertically integrated industrial entities that can spread the costs of R&D investments have a strategic advantage in capturing future markets."

APPENDICES

A Detailed List of Emerging Technologies

B Comparison of the 1990 and 1987 DOC Emerging Technologies Reports

C Comparison of the Emerging Technologies with the Critical Technologies of the Department of Defense

D National Security Concerns

E Investment in R&D and Consortia by Japan, EC and U.S.

F Comparison of Industry Growth Rates

G Bibliography

Appendix A Detailed List of Emerging Technologies

The following pages, one for each emerging technology, give more detailed technical and market information on the technologies. The name selected for each of the emerging technologies is one in general use, which is recognizable by the informed public. The specific item headings and their contents are of a more technical nature and are briefly described below.

Major Technology Elements:

A listing of the more specific technology areas that describe the emerging technology. In most cases, more than one area is listed for each emerging technology since the advances tend to occur in several narrow fields at the same time.

What It Is:

A brief nontechnical description of the emerging technology and its importance.

Underlying Sciences:

A listing of the specific scientific or engineering competencies felt to be of critical importance for the development and marketing of products based on the emerging technology. Capability in the basic scientific areas, such as physics, chemistry, materials science, computer science, and engineering, is obviously required for all of the emerging technologies.

Engineering Barriers:

A listing of those technical impediments that must be eliminated or circumvented before products can be marketed based on the emerging technology.

What Is New or Better:

The specific improvements in processes, procedures, devices, or products that result from the introduction of the emerging technology.

Impact on What Products or Processes:

A listing of product and/or manufacturing areas that will directly benefit from the emerging technology.

Likely Markets or Industries:

A listing of those major market areas that will directly benefit from the emerging technology.

DOD Critical Technologies Comparison:

A listing of the DOD Critical Technologies thought to benefit directly by the development of the emerging technology. Using the DOD sequence numbering, the DOD list is taken from the Department of Defense Critical Technologies Plan (see Bibliography). This comparison is summarized in Appendix C.

Annual Sales by Year 2000:

An estimate of the total U.S. and world market size directly resulting from the emerging technology. The figures are taken from published studies, if a specific market study is available, and the reference given. If a market study does not exist, estimates were developed as follows: the U.S. Department of Labor Projections 2000 (Bulletin 2302, March 1988) was used as the source for a projected U.S. market size in the year 2000, medium estimate, at the 4-digit SIC code level. An adjustment to this projection was made by an estimate of the fraction of the total market resulting from the specific emerging technology.

ADVANCED MATERIALS

Major Technology Elements:

Structural and Functional Ceramics, Ceramic and Metal Matrix Composites, Intermetallic and Lightweight Alloys, Advanced Polymers, Surface-Modified Materials, Diamond Thin Films, Membranes, Biomaterials.

What It Is:

Advanced metals and alloys, ceramic and polymeric materials, and composites of these constituents used to produce devices and structures having improved performance characteristics and special functional attributes.

Underlying Science:

Solid-state physics and chemistry, interface and surface science, mechanics, fluid dynamics.

Engineering Barriers:

Rapid and reliable processing methods are needed; complex failure mechanisms need to be understood and related to processing and service-produced microstructures.

What Is New or Better:

Improved functional and structural properties like high-temperature strength, creep resistance, and corrosion resistance for ceramics and intermetallic alloys; composites offer high strength and stiffness combined with low weight, corrosion resistance, high dimensional stability; technology for controlling composition and processing that allows "designed in" properties.

Impact on What Products or Processes:

Devices and structures used at very high temperatures or special service applications; aircraft, aerospace, transportation, electronics, construction, wear resistant items.

Likely Markets and Industries:

Aerospace, construction, engines, electronics, manufacturing, energy.

DOD Critical Technologies Comparison:

20. High-Temperature/High-Strength/Lightweight Composite Materials

Annual Sales by Year 2000:

U.S.: $150B
World: $400B

ADVANCED SEMICONDUCTOR DEVICES

Major Technology Elements:

Silicon, Compound Semiconductors (GaAs), ULSI, Memory Chips, X-ray Lithography.

What It Is:

Improved materials, fabrication techniques, and advanced components and devices for use in electronic equipment of all kinds.

Underlying Science:

Solid-state physics and chemistry, surface and separation science, electrical and electronics engineering, electrical properties of materials. Optical, x-ray, ion-beam fabrication methods.

Engineering Barriers:

Difficulties in manufacturing at high volume, yield and quality but low cost. Must control contaminants and prepare high-purity gases and liquids.

What Is New or Better:

Improved speed, higher operating frequencies, reduced size, higher density, and multiple functions, lower cost, heat dissipation.

Impact on What Products or Processes:

Integrated circuits, smart power transistors, semiconductor materials, micromachines, solar cells, memory chips, microprocessors.

Likely Markets and Industries:

Electronics, television manufacturing, communications, computers, recording devices, medical and manufacturing equipment, toys and tools, aerospace—any area which requires significant use of electronics.

DOD Critical Technologies Comparison:

1. Microelectronic Circuits and Their Fabrication.
2. Preparation of Gallium Arsenide (GaAs) and Other Compound Semiconductors.

Annual Sales by Year 2000:

U.S.: $75B
World: $200B

ULSI = Ultra large-scale integration
GaAs = gallium arsenide

ARTIFICIAL INTELLIGENCE

Major Technology Elements:

Intelligent Machines, Intelligent Processing of Materials and Chemicals, Expert Systems.

What It Is:

Electronic and electromechanical systems incorporating knowledge-based control systems.

Underlying Science:

Data structures, data management systems, software engineering, servo engineering, biological and cognitive sciences and engineering, numerical analysis, statistical physics.

Engineering Barriers:

Size of databases, computational speed, lack of formal tools for knowledge representation.

What Is New or Better:

Improved performance over current systems which are at most capable of a limited number of responses to events fully anticipated in advance. Improved graphical representation of results.

Impact on What Products or Processes:

Manufacturing of machine tools, robots, construction equipment. Materials and chemical processing; computer-aided design; signal and image processing. Analysis of medical tests or symptoms.

Likely Markets and Industries:

Manufacturing, mining, security, health care, construction, materials processing, communication and financial services.

DOD Critical Technologies Comparison:

5. Machine Intelligence/Robotics
9. Sensitive Radars
11. Automatic Target Recognition
13. Data Fusion

Annual Sales by Year 2000:

U.S.: $5B
World: $12B

BIOTECHNOLOGY

Major Technology Elements:

Bioprocessing, Drug Design, Genetic Engineering, Bioelectronics.

What It Is:

Production of high value-added biological products on a commercial scale. Modify the genetic machinery of living cells to produce useful biochemicals.

Underlying Science:

Genetic engineering, molecular biology, chemical engineering, biochemistry, biophysics.

Engineering Barriers:

Difficulty in controlling processes in large-scale bioreactors and making economical large-scale separations. Lack of measurement tools, data and knowledge to control cellular processes and to elucidate protein structure/function relationships for intelligent product and process design.

What Is New or Better:

Biosensors for on-line, real-time control; new and efficient separation and purification methods. New or better techniques to produce natural and/or new biochemicals; more efficient bioprocesses.

Impact on What Products or Processes:

Production of high value-added chemical products and new engineered chemicals.

Likely Markets and Industries:

Pharmaceutical and related products; foods, flavors, and fragrances; agrichemicals, commodities and fuels, pollution abatement.

DOD Critical Technologies Comparison:

22. Biotechnology Materials and Processing

Annual Sales by Year 2000:

U.S.: $15–40B (1989 U.S. Industrial Outlook, DOC, Jan. 1989)
World: $40B

DIGITAL IMAGING TECHNOLOGY

Major Technology Elements:

High Definition Systems, HDTV, Large Displays, Data Compression, Image Processing.

What It Is:

Use of digital technology to store, display, process, analyze and transmit images.

Underlying Science:

Electronics, artificial intelligence, communications engineering, surface science, solid state physics and chemistry.

Engineering Barriers:

Large, high-resolution (flat) displays, storage requirements for digital information, effective utilization of bandwidth, computer speed and memory, ability to recognize characteristic features in complex images.

What Is New or Better:

Advances in digital cameras, high-volume information storage and retrieval, high-speed computing (including parallel processing), higher resolution video display.

Impact on What Products or Processes:

Industrial processes in which the human eye or other detectors are used for inspection and monitoring, photography, printing, television, computer manufacture, process control systems, telecommunications.

Likely Markets and Industries:

Electronics, computers, process control and inspection, medical diagnostics, consumer electronics, telecommunications, broadcast television, satellite broadcast, data storage, defense industries, nondestructive inspection and evaluation.

DOD Critical Technologies Comparison:

9. Sensitive Radars
11. Automatic Target Recognition

Annual Sales by Year 2000:

U.S.: $3.3–4.3B (1989 estimate by the American Electronics Association)
World: $5B

HDTV = high-definition television

FLEXIBLE COMPUTER-INTEGRATED MANUFACTURING

Major Technology Elements:

CAD, CAE, CALS, CAM, CIM, FMS, PDES, Control Architectures, Adaptive-Process Control.

What It Is:

A new approach to manufacturing and construction requiring not only technology but management and engineering adjustments. Use of computers, robots, and intelligent machines in the total manufacturing and construction enterprise. Integration of both the materials handling and processing systems as well as the planning, logistics, and business systems.

Underlying Science:

Control theory; operations research; electrical, mechanical, manufacturing, and industrial engineering; business and management science.

Engineering Barriers:

Need for data structures to describe product and process. Concurrent engineering to integrate design and manufacture. More reliable machines, automated process planning, "smarter" robots, more accurate and inexpensive sensors.

What Is New or Better:

Reduce cost and time to manufacture, improve quality; permit competition by scope and variety of product line; reduce inventory, manufacture to order rather than to plan.

Impact on What Products or Processes:

Manufacturing discrete and batch parts; economical small lot manufacture; continuous and adaptive processes; chemicals, pharmaceuticals, steel, paper, textiles; residential and commercial construction, public works.

Likely Markets and Industries:

High-tech manufacturing, automotive, construction, home appliance, computers, office machines, machine tools, aerospace.

DOD Critical Technologies Comparison:

5. Machine Intelligence/Robotics

Annual Sales by Year 2000:

U.S.: $10–20B
World: $20–40B

CAD = computer-aided design
CAE = computer-aided engineering
CALS = computer-aided logistics support
CAM = computer-aided manufacturing
CIM = computer-integrated manufacturing
FMS = flexible manufacturing systems
PDES = product data exchange specification

HIGH-DENSITY DATA STORAGE

Major Technology Elements:

High-Density Magnetic Storage (including perpendicular recording), Magneto-Optical Storage.

What It Is:

Erasable (read/write) data storage offering several orders of magnitude improvement in information storage density.

Underlying Science:

Optical physics, surface science, magnetics, solid-state physics, mechanical engineering, fluid dynamics (aerodynamics).

Engineering Barriers:

Magnetic disk and tape: interaction between read-write head and magnetic media surface; crosstalk; size of information cells (domains); flatness (of disks); error detection.
Magneto-optical disk: mass of read head that slows access time; relaxation effects; spacing of tracks; tracking; size of information cells.

What Is New or Better:

Magnetic disks with thin-layer technology: steady increases in information density (doubles about every 3 years); reduced access time (mean time to get to data from random location on disk or tape).
Magneto-optical disks: Very high information densities; reduced danger of contact with storage media and lower cleanliness requirement offer potential of high reliability and provide removable media.

Impact on What Products or Processes:

Data storage devices, home and studio audio and video, computers, communications, television, consumer cameras (with magnetic disks instead of film), office information storage systems. Information now stored on paper and film.

Likely Markets and Industries:

Computers (super to PC), office equipment, recording systems, cameras.

DOD Critical Technologies Comparison:

7. Integrated optics

Annual Sales by Year 2000:

U.S.: $15B–100B
World: $30B

(Note: The larger estimate of $100B assumes that a significant portion of the paper and microfilm market is captured.)

HIGH-PERFORMANCE COMPUTING

Major Technology Elements:

Modular/Transportable Software, Numerical Simulation, Neural Networks.

What It Is:

Design and development of architectures for rapid and efficient processing; development of ways to program large systems to perform complex tasks.

Underlying Science:

Software engineering, microelectronics, optoelectronics, data structures and algorithms, numeric and symbolic methods, computational science and technology.

Engineering Barriers:

Reliability, accuracy, and automated development are deficient. Software is difficult to specify and to design; development is costly and time consuming, and it is difficult to test for failures that might occur during use.

What Is New or Better:

High-performance computers can address large problems of numerical and scientific computing such as weather forecasting, hydrodynamics, aerodynamics, weapons research, prototyping of products and facilities, and high-energy physics.

Impact on What Products or Processes:

Computer and communications systems of all sizes, networking, word processing, information retrieval and distribution, database management, manufacturing processes, engineering design, science, research and development in all fields.

Likely Markets and Industries:

Manufacturing, business, service industries, research organizations, product, process, plant prototyping.

DOD Critical Technologies Comparison:

3. Software Producibility
4. Parallel Computer Architectures
6. Simulation and Modeling
13. Data Fusion
15. Computational Fluid Dynamics

Annual Sales by Year 2000:

U.S.: $50–100B
World: $100B

MEDICAL DEVICES AND DIAGNOSTICS

Major Technology Elements:

Cellular-Level Sensors, Medical Imaging, In-Vitro and In-Vivo Analysis, Targeted Pharmaceuticals, Fiber Optic Probes.

What It Is:

Health-care diagnosis and treatment equipment and supplies based on new sensors, biotechnology processes and imaging devices.

Underlying Science:

Immunology, microbiology, biology, electronics engineering.

Engineering Barriers:

Need to design instruments with little or no invasion of the human body. Cellular level devices and diagnostics will require miniaturization, capabilities not presently available.

What Is New or Better:

The capability to detect and understand defects at cellular level. Opportunity to harness biomolecules as sensitive probes. Minimize trauma during treatment and diagnoses. Improved diagnostic and therapeutic systems.

Impact on What Products or Processes:

Diagnostics and treatment equipment, health-care products, including diagnostic instrumentation such as magnetic resonance imaging and CAT scanning, clinical analyzers, radiation treatment.

Likely Markets and Industries:

Health-care, instrumentation, pharmaceutical, medicine.

DOD Critical Technologies Comparison:

22. Biotechnology Materials and Processing

Annual Sales by Year 2000:

U.S.: $8B
World: $16B

CAT = computer-aided tomography

OPTOELECTRONICS

Major Technology Elements:

Integrated Optical Circuitry, Optical Fibers, Optical Computing, Solid-State Lasers, Optical Sensors.

What It Is:

The use of light (visible, IR, UV radiation) as the means to transmit, process, and store information.

Underlying Science:

Optical physics and engineering, solid-state physics, surface science, electronic engineering.

Engineering Barriers:

Device speed; integration of components with electronic devices; laser performance; materials limitations.

What Is New or Better:

Improved information handling capacity and signal quality, reduced sensitivity to interference, increased processing speed and data storage capacity.

Impact on What Products or Processes:

Long-distance and local fiber optic systems; electrical, mechanical, and thermal sensors; computers; chemical and mechanical manufacturing processes.

Likely Markets and Industries:

Telephone, television, teleconferencing, on-demand audio and video programming, telecommunications, electric power, computers, manufacturing, medical diagnostics and therapy.

DOD Critical Technologies Comparison:

7. Integrated Optics
8. Fiber Optics

Annual Sales by Year 2000:

U.S.:	$4.6B	(U.S. Department of Commerce, International
World:	$10.8B	Trade Administration, "International Competitiveness Study of the Fiber Optics Industry," p. 25, September 1988. Optical fiber communication components only – optical sensors alone add $1B worldwide.)

IR = infrared
UV = ultraviolet

SENSOR TECHNOLOGY

Major Technology Elements:

Active/Passive Sensors, Feedback and Process Control, Nondestructive Evaluation, Industrial and Atmospheric Environmental Monitoring and Control.

What It Is:

Devices that provide a signal (generally optical, electrical, or acoustical) that accurately reflects some process parameter in real time.

Underlying Science:

Electronics, nondestructive evaluation, control theory, mechanical and industrial engineering.

Engineering Barriers:

Currently, sensors lack one or more of the following characteristics: range, stability, precision, resistance to harsh environment, selectivity, sensitivity. Integration of sensors and signal processing.

What Is New or Better:

New sensors measure parameters more accurately and in real-time under a wider range of conditions due largely to better materials, fabrication techniques, and more complex electronics and data processing.

Impact on What Products or Processes:

Continuous process industries like materials, food and beverage, pharmaceutical, chemical, biochemical, smelting and refining; waste management, construction, manufacturing.

Likely Markets and Industries:

Chemical smelting and refining, pharmaceutical, food and beverage, electric power, materials.

DOD Critical Technologies Comparison:

5. Machine Intelligence/Robotics
10. Passive Sensors

Annual Sales by Year 2000:

U.S.: $5B
World: $12B

SUPERCONDUCTORS

Major Technology Elements:

High-Temperature Ceramic Conductors, Advanced Low-Temperature Conductors.

What It Is:

(1) Superconducting materials having critical transition temperatures (T_c) above 77 K (boiling point of liquid nitrogen).
(2) Low-temperature superconductors with improved performance characteristics and materials properties.

Underlying Science:

Solid-state physics, ceramic processing science, electronic engineering, surface science.

Engineering Barriers:

Low current densities and strengths in bulk forms. Composition and environmental stability. Integrated circuit fabrication technology. Economical refrigeration techniques.

What Is New or Better:

T_c above 77 K significantly reduces cost by eliminating liquid helium as coolant. Low-temperature superconductors yielding sophisticated integrated devices, even first microprocessors. Powerful magnets for research and medical diagnostics, magnetically levitated trains.

Impact on What Products or Processes:

Electronics; electrical transmission, switching, motors, and controls; electric power generators; medical diagnostic equipment; rail and ship transportation; computers; particle accelerators.

Likely Markets and Industries:

Electronics and data processing, electric power equipment, medical diagnostics, transportation equipment, high-energy physics.

DOD Critical Technologies Comparison:

21. Superconductivity

Annual Sales by Year 2000:

U.S.: $3–5B (1989 U.S. Industrial Outlook, DOC, Jan. 1989)
World: $8–12B

Appendix B Comparison of the 1990 and 1987 DOC Emerging Technologies Reports

Comparison of Emerging Technologies

1990	1987
Advanced Materials	Advanced Materials A. Ceramics B. Polymer Composites C. Metals Thin Layer Technology A. Surfaces & Interfaces B. Membranes
Advanced Semiconductor Devices	Electronics A. Advanced Microelectronics
Artificial Intelligence	Computing B. AI Techniques
Biotechnology	Biotechnology A. Genetic Engineering B. Biochemical Processing
Digital Imaging Technology	(None)
Flexible Computer-Integrated Manufacturing	Automation A. Manufacturing
High-Density Data Storage	Automation C. Technical Services
High-Performance Computing	Computing A. Computing Equipment
Medical Devices and Diagnostics	Medical Technology A. Drugs B. Instruments & Devices
(none)	Electronics C. Millimeter Wave
Optoelectronics	Electronics B. Optoelectronics
Sensor Technology	(None)
Superconductors	(None)
(None)	Automation B. Business & Office Systems

Comparison of 1990 Opportunities for Change and 1987 Barriers

1990	1987
The Cost of Research & Market Introduction	High Cost of Capital/Tax Incentives
Engineering Training and Education	(Not identified separately)
Integration of R&D, Design, and Manufacturing	(Same)
Improving the Quality of Products and Services	(Not identified separately)
Improving the Technology Infrastructure	(Not identified separately)
Dependence on Domestic Technologies and Market	(Same)
Industrial Cooperation	Antitrust restrictions
Protecting Intellectual Property Rights	(Same)
Laws of Product Liability	(Same)
Regulatory Constraints	(Same)
Export Policy	(Same)
Restrictive Foreign Trade Practices	(Same)
Product and Interface Standards	(Not identified separately)

Appendix C Comparison of the Emerging Technologies with the Critical Technologies of the Department of Defense[1]

DOC Emerging Technologies	DOD Critical Technologies
Advanced Materials	(20) High-Temperature/High Strength/Lightweight Composite Materials
Advanced Semiconductor Devices	(1) Microelectronic Circuits & their Fabrication (2) Preparation of GaAs and other Compound Semiconductors
Artificial Intelligence	(5) Machine Intelligence/Robotics (9) Sensitive Radars (11) Automatic Target Recognition (13) Data Fusion
Biotechnology	(22) Biotechnology Materials & Processing
Digital Imaging Technology	(9) Sensitive Radars (11) Automatic Target Recognition
Flexible Computer-Integrated Manufacturing	(5) Machine Intelligence Robotics
High-Density Data Storage	(7) Integrated Optics
High-Performance Computing	(3) Software Producibility (4) Parallel Computer Architectures (6) Simulation and Modeling (13) Data Fusion (15) Computational Fluid Dynamics
Medical Devices and Diagnostics	(22) Biotechnology Materials & Processing
Optoelectronics	(7) Integrated Optics (8) Fiber Optics
Sensor Technology	(5) Machine Intelligence/Robotics (10) Passive Sensors
Superconductors	(21) Superconductivity
	Also Listed: (12) Phased Arrays (14) Signature Control (16) Air Breathing Propulsion (17) High Power Microwaves (18) Pulsed Power (19) Hypervelocity Projectiles

[1] "The Department of Defense Critical Technologies Plan," Department of Defense (DOD), Washington, DC May 1989. The numbers in the table refer to the numbers used in the DOD document.

Appendix D National Security Concerns*

The defense industrial base generally comprises the same manufacturers that produce goods for the general public. Few industries rely primarily or completely on the Department of Defense as their principal market. However, the Department depends on virtually every sector of the manufacturing base for material. Ninety-five percent of the manufactured goods purchased by the Department of Defense come from a broad spectrum of 215 industries. In 1985, the Department spent almost $165 billion within these industries. This represented 4.1 percent of America's total gross national product and 21 percent of the manufacturing gross national product. However, while the Department of Defense is a major purchaser of manufactured goods, we recognize that in many important sectors, such as electronics, we purchase only a small portion of total output. Even so, our market share (even in the electronics industry) can provide us with substantial leverage if properly managed.

In addition to meeting requirements for the production of today's weapon systems, the Department's investment in the industrial base must encourage the research and development for advanced technologies that are key to the next generation of weapon systems. These include technologies such as infrared focal plane arrays, microwave devices, advanced sensors, exotic alloys requiring powdered metallurgy technology, high temperature ceramic composites, and high temperature superconductors. Additionally, advanced manufacturing strategies, such as flexible computer integrated manufacturing, must be developed for and integrated into the entire industrial base.

As a nation and as a continent, we no longer are totally self-sufficient in all essential materials or industries required to maintain a strong national defense. Consequently, we must identify requirements carefully and assess them against our industrial base capabilities. We must develop strategies that enable us to meet security needs with available resources. For those essential products the United States does not manufacture, we must rely on offshore sources or stockpiles. We can, however, offer incentives to establish domestic manufacturing industries for these products.

Clearly, the Department of Defense cannot provide massive financial assistance for every American industry characterized by a lack of international competitiveness, nor can we effectively provide incentives for every manufacturing industry critical to our defense. The issue of competitiveness is one that requires continuing creativity and innovation within the private sector. There are numerous factors that industries themselves must come to grips with if they are to remain competitive in the international market place. There are also national issues, such as our tax code and antitrust laws, that warrant our attention. Our education system has been cited as providing a less than adequate technically trained labor force for the future. To the extent that these and other national issues affect the industrial base, the Department of Defense intends to stimulate, when warranted, appropriate activities throughout the Government to address them.

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*This text is taken from the first part of the summary of *Bolstering Defense Industrial Competitiveness* (see Bibliography).

Within the Department of Defense acquisition process we have identified several areas that are impediments to efficient defense production. Frequent policy changes, emerging technologies, changing military requirements, the defense budgeting process, and program and budget instability make long-term planning difficult. Typically, small volume purchases and program stretch-outs contribute to an environment in which defense contractors have little incentive to make long-term investments in facilities with advanced capabilities that could yield higher quality and more competitive products.

Commercial market rewards for performance are lacking in the defense market. Unit cost reductions, quality improvement, shortened delivery times, etc., neither stimulate demand for additional units nor provide greater market share; nor do unit cost reductions result in increased profit. Emphasis on lowest bid cost may result in inadequate attention to life cycle costs, quality, and past performance.

The Department of Defense reliance upon detailed product and process specifications can be counterproductive. Outdated specifications frequently reduce innovation, inhibit improvements, and result in excessive administrative processes required to implement, monitor, waive, or modify specifications. Procurement processes focus mainly on prime contractors, even though materials and components purchased by prime contractors from lower-tier industries represent 50 to 85 percent of our total expenditures. Historically, the Department has had limited direct influence on the performance of subtier contractors because of considerable administrative difficulty in passing performance incentives through prime contractors to multiple levels of subcontractors and suppliers.

Finally, layers of bureaucracy and somewhat cumbersome contract administration processes add to the costs of doing business with the Department of Defense. Government emphasis on oversight activities can lead business managers to focus more on meeting inspection requirements than on improving quality and productivity.

This Department of Defense report is designed to provide both a strategy and specific initiatives to address this concern. Integral to this strategy is a recognition that the Department's influence is, at the same time, significant and limited. The strategy suggests exploiting the Department's leadership and leverage potential to strengthen the industrial base, but not to the exclusion of other Departmental priorities such as a well equipped force structure. On the other hand, it is neither possible nor desirable for the Department to solve all the ills of the commercial manufacturing sector.

The cornerstone of this effort is cooperation with domestic industry and our allies. The United States could not build fortress America, even if this were a desirable objective. Nor can the Department of Defense reverse worldwide economic trends, such as the internationalization of manufacturing. To maximize domestic industry's potential, cooperative relationships must flourish among the Department of Defense, large corporations, and the lower-tier manufacturing industries that are the foundation of our industrial base.

Appendix E Investment in R&D and Consortia by Japan, EC and U.S.

The intensity and diversity of cooperative research is a reflection of the importance accorded to emerging technologies; the majority of cooperative projects (probably at least 75 percent of total expenditures) deals with emerging technologies.

	R&D as % of GNP (1985)		Gov't. Share of	Consortia As % of	Gov't. Share of
	Total	Civilian	Total	Total	Consortia
JAPAN	2.6%	2.5% (est)	19%	≈4%	≈50%
EC	1.9%	1.4%	45%	≈4%	≈50%
U.S.	2.8%	1.9%	47%	<1%	<20%

JAPAN	Most R&D (>70%) is performed in private industry. Consortia are significant within Government R&D funding (≈10% of total). Focus is on consumer application.
EC	Industry probably carries out less than half of all R&D. Consortia are important within Government R&D funding (≈5% of total). Focus is on civilian applications.
U.S.	Most R&D (>70%) is performed in private industry. Consortia are relatively insignificant within Government R&D funding (<0.5% of total). Focus is on national security.

Listed below are only those projects which have significant involvement by the respective Governments. Privately operated consortia are not listed; for example, the National Cooperative Research Act of 1984 relaxed antitrust provisions for cooperative research ventures. More than 150 such ventures have registered including SEMATECH; most of these do not involve Government funding.

JAPAN	8 large-scale projects (MITI) Friend 21 (MITI) 3 next-generation industry projects 9 ERATO projects (STA) 20 Japan research development corporation projects (STA) 62 key technology center consortia 119 KTC lending projects SIGMA software project 6 superconductivity projects Human frontier science plan International frontier research plan
EC	>200 ESPRIT projects >200 EUREKA projects 100 BRITE projects 50 RACE projects JESSI project (under discussion) EURAM program
U.S.	Variety of cooperative efforts, primarily sponsored by DOD (in particular DARPA). SEMATECH AISI/DOE steel technology program

Sources: *Economic Report of the President*, 1988
First Report on the State of Science and Technology in Europe, 1988
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Appendix F Comparison of Industry Growth Rates

Intensive use of technology and industrial growth are correlated. The table below compares the 10 SIC (Standard Industrial Classification) industries experiencing the highest growth rates over the past 16 years (1972–88) with the 10 industries having the lowest growth rates during this period. The top 10 are all technology-based industries, whereas the last 10 have pursued strategies that are much less technology dependent.

Relative Shipments Growth, 1972–88
(1988 shipments as a percentage of 1972 shipments)
(1982 $)

SIC	TOP 10	RATE	SIC	LAST 10	RATE
3573	Computing Equipment*	8823	3211	Turbine Generator Sets	17
3674	Semiconductor Devices*	6072	2793	Photoengraving	23
3832	Optical Devices/Lenses	940	2121	Cigars	35
3693	X-ray Apparatus	537	2386	Leather/lined Clothing	38
2795	Lithographic Services	394	3743	Railroad Equipment	42
2831	Biological Products	387	2661	Bldg Paper/Board Mills	42
3678	Electronic Connectors	356	3333	Primary Zinc	44
2833	Medicinals & Botanicals	347	3552	Textile Machinery	48
3842	Surgical Appliances	337	3021	Rubber/Plastic Footwear	50
3841	Surgical & Medical Inst	327	2517	Wood TV, Radio Cabinets	50

*The growth rates of these two technologies have been adjusted for technical change as well as price change.
Source: Department of Commerce, *U.S. Industrial Outlook*, 1988

Appendix G Bibliography

The following list is not intended to be comprehensive. Rather, it is meant to provide additional information, complementing and supplementing this report.

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APR 2 1991

Memorandum for Interagency Committee for Federal Laboratory Technology Transfer

From: Deborah L. Wince-Smith KH/DWS

Subject: Federal Research In Progress (FEDRIP)

The purpose of this paper is to give you a quick review of where we were, where we are now, and where we hope to go in the effort to improve FEDRIP, a major Federal database with the potential to serve as a point of entry into the Federal laboratory system.

Background -- Where we were.

At the present time, 10 Federal agencies contribute to the database, compiled by NTIS and containing over 120,000 records. It was first offered to the public on-line via Dialog in 1983. Several Executive Branch agencies as well as private sector users of FEDRIP have suggested that it could be substantially more useful if there were some modifications made to make it reflect a bit more the "real world". One private sector user of FEDRIP stated that if FEDRIP were simply better organized and maintained, it could make a major contribution to technology transfer.

Progress report -- Where we are.

We have convened meetings of lead Federal agencies which either now contribute to FEDRIP or which could make a major contribution if they were to do so. We have also met with representatives of private firms that now use FEDRIP or need to use the kind of information that it could provide. In many cases the latter have been discouraged from using the present system by its difficulty in use.

Dr. Caponio, Walter Finch, Associate Director for Products at NTIS, and his staff, have been very good in helping us to understand what is now in the database and what modifications are practical.

Targeted changes

- *More agencies participating*: We ought to have more agencies in FEDRIP. Ideally, FEDRIP will make it much easier for industry to identify interesting R & D. Participation in FEDRIP can also ensure that agencies are meeting public notification responsibilities.

o *More frequent updates*: National Science Foundation has indicated that effective April '91 it will update its file monthly, instead of twice a year. We would like all agencies to make a similar effort.

o *Simplified format and a few additional pieces of information*: After intensive discussion with private and Federal users, data vendors and NTIS, it seems that much of the information which industry would like to see is already there, it is just that the display formats and search procedures have not been easy to use or interpret. The attached sample record format, developed from all the meetings, shows what many potential users would find most useful on an initial display.

Since NTIS offers FEDRIP to Dialog and other vendors, they are working to get some changes made by Dialog. NTIS also is offering the database to other vendors or users who may be better at implementing the simplified format than DIALOG. One of the new vendors plans to offer FEDRIP in a new, simplified format in Spring of 1991.

Next Steps -- Where we are going.

To make the indicated changes in FEDRIP in FY 91, we need to accelerate through participation at your level. We need the Interagency Committee members to tell their agencies how important it is that they make the results of their work known, through FEDRIP or some other means. For those agencies not participating, we ask you to look again at using FEDRIP. For others, the request may be to try increasing the frequency of update or to be sure to put in the data which would allow the Sample Form to be filled out.

We expect there will be a need for checking with agencies and their technical staff as well as with some of the Senior officers to help implement the changes. NTIS is proposing another follow-up meeting with FEDRIP technical contacts and we stand ready to assist as necessary.

If you could review your agency's participation in FEDRIP as well as the attached form to see some new information proposed and get back to us in two weeks I would appreciate it very much.

Attachment

Federal Research in Progress Display Format

Subject:

Principal investigator/***tech transfer agent***:

Tel. #:
Fax. #:
Level of effort (Funding or ***staff years***):

Start & estimated end date: ***Record date:***

Interested in collaborative effort?:

Performing organization:

ABSTRACT:

Objective of research-

Planned research approach-

Specialized eqpt?: ***May others use it?:***

Progress report summary-

Descriptors:

Accession # (or alternate ID):

[Note: Bold Italic indicates new or variation on extant field of interest. Some of the agencies, like Agriculture, now use at least parts of the suggested abstract headings.]

Office of Technology Commercialization
March 30, 1991
Johnson/Mullins

HOUSE GOP SCIENCE NEWS

A Newsletter from the Republican Members of the Science, Space & Technology Committee

January, 1991

Contact: Christopher Wydler, Legislative Director (202-225-6684)

The Republican Members of the House Science, Space and Technology Committee in the 102nd Congress are: Robert S. Walker (PA), Republican Chairman; F. James Sensenbrenner, Jr. (WI); Sherwood L. Boehlert (NY); Tom Lewis (FL); Don Ritter (PA); Sid Morrison (WA); Ron Packard (CA); Paul B. Henry (MI); Harris B. Fawell (IL); D. French Slaughter, Jr. (VA); Lamar Smith (TX); Constance A. Morella (MD); Christopher Shays (CT); Dana Rohrabacher (CA); Steven H. Schiff (NM); Tom Campbell (CA); John J. Rhodes, III (AZ); Joe Barton (TX); Dick Zimmer (NJ); Wayne Gilchrest (MD).

1991 will be a critical year if the Committee on Science, Space and Technology is going to reassert its influence over policy and program priorities. Two major developments lend optimism in this regard.

Of course, the Science Committee has a new Chairman, Congressman George E. Brown, Jr. of California. A very active member of the Committee since 1965, Representative Brown brings genuine interest and leadership to the post. Widely respected by his colleagues for his institutional knowledge and experience on science matters, "George Brown is someone we have worked with very well in the past," attested Republican Chairman **Robert Walker.** "Based on our good relationship, we anticipate hitting the ground running together." Early staff appointments and other actions by the new Chairman have been especially encouraging.

On the matter of authorizations, over 30 measures considered by the Committee in the 101st Congress became law in such areas as NASA, science education, global change and clean air research, hydrogen energy, and earthquake and FAA R&D. However, although all these authorization bills directing and limiting spending and setting policy and program priorities were enacted, they were very often ignored, even violated, in the appropriation process. In response, Congressman Walker has introduced H.R. 432, an innovative new proposal to change the budget process by putting direct funding power in the hands of the authorizers where it belongs.

This proposal would require binding budget resolution functional allocations and revenue projections, consistent with the Gramm-Rudman-Hollings targets, to be made directly to the relevant authorizing committees, as determined by the Parliamentarian, for direct funding or collection. This would eliminate the appropriation process. Supplementals would also have to be reconciled against Gramm-Rudman-Hollings. True continuing resolutions could be recommended by the Budget Committee only if necessary after September 15. Members serving on the Budget Committee could not serve on an authorizing committee.

This process would bring much greater discipline to the system. It would require a theoretically objective, disinterested budget panel to set broad government policy regarding the relative share of available Federal resources that should be dedicated to general purposes (i.e., defense, science, housing, etc.) within overall statutory fiscal constraints. The actual funding decisions would then be in the hands of the people with the greatest expertise on policy and priorities within these general issue areas for the first time. The Science Committee, for instance, would be making all actual spending decisions by rationalizing priorities, against a set pot of money, within its logically comparable jurisdiction (e.g., relative funding for the SSC versus the Space Station, instead of more VA benefits versus the Space Station, as is the case now). This takes the power of the purse out of the hands of a relatively chosen few and spreads it out over the whole Congress, reducing the "insider trading" that often results in pork-barrel, meritless appropriations. No Members would have a hand in all funding decisions as they do now.

The business at hand for the Science Committee, itself, in 1991 is early enactment of fiscally-responsible multi-year authorizations. Many Members support setting a goal of sending all Committee authorizations to the Floor no later than May 15. Major legislative items include:

Technology Bill—At the very end of the 101st Congress, an agreement was reached on a comprehensive emerging technology commercialization bill, but it was not brought up by either House before adjournment. The final agreement: sets the authorization for the advanced technology program (ATP) at $100.0 million annually, with grant payback required, to reduce the marginal cost of capital for developing new technologies by

leveraging the majority funding of competitively selected industry-led joint ventures; establishes a "blue ribbon" National Capital Cost Reduction Commission, chaired by the Vice President with three members appointed by the President, House, and Senate, to make legislative and tax recommendations to Congress within one year; and authorizes the National Institute of Standards and Technology core research program at $211 million in FY 1992 consistent with current Commerce Department planning for initiatives in such areas as superconductivity, advanced materials, fiber optics, etc. It is hoped that this legislation will move through both bodies quickly, provided it is based on the agreement.

NASA Authorization--Although the House passed a multi-year National Aeronautics and Space Administration (NASA) authorization bill, the final agreement with the Senate provided support only through FY 1991 ($15.0 billion). The 102nd Congress will therefore need to provide resources beyond the current fiscal year. As a result of the Report of the Augustine Advisory Committee on the Future of the U.S. Space Program, debate during reauthorization will likely focus on questions of reorganization and reform within NASA, as well as specific project funding.

Space Commercialization Bill--Republican Chairman **Walker** will again introduce legislation designed to bring America's entrepreneurial skills to bear upon the exploration and industrial development of outer space. The bill requires an inventory of federal space launch support facilities which may be surplus to public or national security needs and makes such facilities available for auction to the private sector. Additionally, the bill: creates commercial space zones; offers tax incentives to the private sector for building space zones and for space launches and manufacturing undertaken from or in such zones; requires the government to procure launch services from the private sector when such services are not related to national security or government-sponsored research; includes antitrust exemptions to permit private sector collaboration in space R&D and production; and authorizes non-federal cash awards for persons who have substantially advanced space transportation, manufacturing, or R&D.

NOAA Authorization--Although the House sent two National Oceanic and Atmospheric Administration (NOAA) multi-year reauthorization bills to the Senate during the 101st Congress, neither bill was considered on the Senate floor. The Science Committee is expected to again move a multi-year NOAA authorization measure providing over $1.0 billion annually for "dry" NOAA activities including: stable, long-term support for weather service modernization; the replacement of aging satellites; and global change research. The Science Committee's last NOAA proposal is consistent with current Commerce Department planning and could serve as the basis for early action.

EPA R&D--During the 101st Congress, the Committee passed an Environmental Protection Agency (EPA) R&D bill authorizing $476.9 million in FY 1992 and $555.1 million in FY 1993. Because of jurisdictional claims by the Committee on Energy and Commerce, however, the measure failed to reach the House floor. Legislation is needed to support, among other things: the R&D provisions under the Clean Air Act (P.L. 101-549); pollution prevention technology R&D; and groundwater, indoor air quality and radon research.

Civilian Energy Supply R&D--During the 101st Congress, the Committee only had two Department of Energy (DOE) programs pass: renewables-conservation and the Super Conducting Supercollider (SSC) project. The Committee's jurisdiction over DOE totals more than $5.0 billion, yet in the 101st Congress other authorizing legislation was simply not marked up. During the 102nd Congress, the Committee is expected to be more active in authorizing funding for projects within its jurisdiction (e.g., advanced reactor legislation) based on the President's National Energy Strategy.

Uranium Enrichment--It was proposed in the 101st Congress that the Uranium Enrichment program be allowed to operate as a government corporation. The issue of converting the program into a profitable commercial enterprise with an equitable sharing of existing liabilities that protects the taxpayer will be considered by the Committee.

Software Tech Transfer--Republican Member Connie Morella has introduced H.R. 191, the Technology Transfer Improvement Act. Referred to both the Science and Judiciary Committees, this bill would amend the Stevenson-Wydler Act to grant private sector participants in cooperative research and development agreements with Federal laboratories copyright protection for any new software developed. The government would retain all rights to use the software for the public good, but proprietary use would be exclusive. This would be an added incentive to further develop and commercialize Federal technologies.

FORM CD-403 (REV 12-86)

U.S. DEPARTMENT OF COMMERCE

FACSIMILE TRANSMISSION COVER SHEET

INSTRUCTIONS: Submit original copy of this cover sheet with the document to be transmitted. Fill in all information requested. Do NOT fill in shaded area.

OFFICE/BUREAU	DATE SUBMITTED	DOCUMENT TITLE	NO. OF PAGES
DoC / ITA / S & E	7/13	Semiconductor Equip	12

TO — NAME AND MAILING ADDRESS OF RECIPIENT: Olin Wethington

RECIPIENT'S TELEPHONE NO:

FACSIMILE TELEPHONE NO: 456-7739

PROJECT APPROPRIATION NUMBER:

COMMENTS: FYI

FROM — NAME AND BUILDING ADDRESS OF SENDER: Jack McPhee

TELEPHONE NO: 377-2846

USCOMM DC 88-2150

Withdrawal/Redaction Sheet
(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
02a. Memo	Jack McPhee to Olin Wethington Re: Qs and As (1 pp.)	7/13/90	(b)(1)	

Collection:

Record Group: Bush Presidential Records
Office: Economic Policy Council (EPC)
Series: Wethington, Olin, Files
Subseries: Subject Files
WHORM Cat.:
File Location: Science & Technology [2]

Date Closed:	1/5/2010	**OA/ID Number:**	04295-017
FOIA/SYS Case #:	2005-0336-F	**Appeal Case #:**	
Re-review Case #:		**Appeal Disposition:**	
P-2/P-5 Review Case #:		**Disposition Date:**	
AR Case #:		**MR Case #:**	
AR Disposition:		**MR Disposition:**	
AR Disposition Date:		**MR Disposition Date:**	

RESTRICTION CODES

Presidential Records Act - [44 U.S.C. 2204(a)]

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C. Closed in accordance with restrictions contained in donor's deed of gift.

PRM. Removed as a personal record misfile.

Freedom of Information Act - [5 U.S.C. 552(b)]

(b)(1) National security classified information [(b)(1) of the FOIA]
(b)(2) Release would disclose internal personnel rules and practices of an agency [(b)(2) of the FOIA]
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(b)(7) Release would disclose information compiled for law enforcement purposes [(b)(7) of the FOIA]
(b)(8) Release would disclose information concerning the regulation of financial institutions [(b)(8) of the FOIA]
(b)(9) Release would disclose geological or geophysical information

Withdrawal/Redaction Sheet
(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
02b. Report	Re: [Semi-Conductors] (11 pp.)	n.d.	(b)(1)	

Collection:

Record Group: Bush Presidential Records
Office: Economic Policy Council (EPC)
Series: Wethington, Olin, Files
Subseries: Subject Files
WHORM Cat.:
File Location: Science & Technology [2]

Date Closed:	1/5/2010	**OA/ID Number:**	04295-017
FOIA/SYS Case #:	2005-0336-F	**Appeal Case #:**	
Re-review Case #:		**Appeal Disposition:**	
P-2/P-5 Review Case #:		**Disposition Date:**	
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AR Disposition:		**MR Disposition:**	
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Withdrawal/Redaction Sheet
(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
03. Transmittal Sheet	Deborah Wince-Smith to Olin Wethington (2 pp.)	7/9/90	(b)(1)	

Collection:

Record Group: Bush Presidential Records
Office: Economic Policy Council (EPC)
Series: Wethington, Olin, Files
Subseries: Subject Files
WHORM Cat.:
File Location: Science & Technology [2]

Date Closed:	1/5/2010	**OA/ID Number:**	04295-017
FOIA/SYS Case #:	2005-0336-F	**Appeal Case #:**	
Re-review Case #:		**Appeal Disposition:**	
P-2/P-5 Review Case #:		**Disposition Date:**	
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Withdrawal/Redaction Sheet
(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
04. Talking Points	Re: Talking Points on the Semi-Gas CFIUS Investigation (3 pp.)	7/10/90	(b)(1)	

Collection:

Record Group: Bush Presidential Records
Office: Economic Policy Council (EPC)
Series: Wethington, Olin, Files
Subseries: Subject Files
WHORM Cat.:
File Location: Science & Technology [2]

Date Closed:	1/5/2010	**OA/ID Number:**	04295-017
FOIA/SYS Case #:	2005-0336-F	**Appeal Case #:**	
Re-review Case #:		**Appeal Disposition:**	
P-2/P-5 Review Case #:		**Disposition Date:**	
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RESTRICTION CODES

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FACSIMILE COVER SHEET

NIST-DOC OFFICE
HERBERT C. HOOVER BUILDING, ROOM 4841
Washington, DC 20230
202-377-4844
FAX # - 202-377-4362

TO:

NAME OLIN WETHINGTON

ORGANIZATION _____

TELEPHONE NUMBER _____

RUSH

FROM:

NAME GARY P. CARVER

ORGANIZATION COMMERCE

TELEPHONE NUMBER 377-4596

NUMBER OF PAGES 17 **(INCLUDING COVER SHEET)**

more info to follow

Gary.

DEPARTMENT OF THE TREASURY
WASHINGTON

JUL 6 1990

ASSISTANT SECRETARY

MEMORANDUM FOR THE HONORABLE STEPHEN HADLEY, ASSISTANT SECRETARY FOR INTERNATIONAL SECURITY POLICY, DEPARTMENT OF DEFENSE

THE HONORABLE EUGENE J. MCALLISTER, ASSISTANT SECRETARY FOR ECONOMIC AND BUSINESS AFFAIRS, DEPARTMENT OF STATE

THE HONORABLE MICHAEL SKARZYNSKI, ASSISTANT SECRETARY FOR TRADE DEVELOPMENT, DEPARTMENT OF COMMERCE

THE HONORABLE LINN WILLIAMS, DEPUTY UNITED STATES TRADE REPRESENTATIVE

THE HONORABLE JOHN TAYLOR, MEMBER, COUNCIL OF ECONOMIC ADVISERS

THE HONORABLE JAMES F. RILL, ASSISTANT ATTORNEY GENERAL FOR ANTITRUST, DEPARTMENT OF JUSTICE

MR. PHILLIP DUSAULT, DEPUTY ASSOCIATE DIRECTOR FOR INTERNATIONAL AFFAIRS, OFFICE OF MANAGEMENT AND BUDGET

DR. W. D. PHILLIPS, ASSOCIATE DIRECTOR FOR INDUSTRIAL TECHNOLOGY, OFFICE OF SCIENCE AND TECHNOLOGY POLICY

FROM: John M. Niehuss
Acting Assistant Secretary for
International Affairs

SUBJECT: CFIUS meeting at 9 a.m., Tuesday, July 10, 1990, Room 2127, Main Treasury

There will be a CFIUS meeting at the policy level at the above date/time to develop a recommendation to the President on the Nippon Sanso/Semi Gas transaction. The attached draft will serve as a frame of reference for our discussion.

In as much as the conference room is much smaller than the one we usually use, I would ask that you limit attendees to principal plus one.

Please call Carmen Law or Bobbie Wallman (566-2386) to arrange admittance into the building.

Attachment

Withdrawal/Redaction Sheet
(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
05. Report	Re: Report of the Committee on Foreign Investment in the United States (CFIUS) on the Proposed Acquisition (15 pp.)	7/10/90	(b)(1)	

Collection:

Record Group: Bush Presidential Records
Office: Economic Policy Council (EPC)
Series: Wethington, Olin, Files
Subseries: Subject Files
WHORM Cat.:
File Location: Science & Technology [2]

Date Closed:	1/5/2010	**OA/ID Number:**	04295-017
FOIA/SYS Case #:	2005-0336-F	**Appeal Case #:**	
Re-review Case #:		**Appeal Disposition:**	
P-2/P-5 Review Case #:		**Disposition Date:**	
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RUSH

DEPARTMENT OF THE TREASURY

6556

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(Name) | *(Office Symbol)* | *(Phone #)*

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PAGE 1 OF 1 PAGE(s)

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HERBERT C. HOOVER BUILDING, ROOM 4841
Washington, DC 20230
202-377-4844
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TO:

NAME OLIN WETHINGTON

ORGANIZATION _____

TELEPHONE NUMBER _____

RUSH

FROM:

NAME GARY P. CARVER

ORGANIZATION COMMERCE

TELEPHONE NUMBER 377-4596

NUMBER OF PAGES ~~17~~ → 16 **(INCLUDING COVER SHEET)**

~~more info to follow~~

Here's some addl info. Have a perfect day!

Gary

Withdrawal/Redaction Sheet
(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
06a. Memo	Gary P. Carver to Deborah L. Wince-Smith Re: CFIUS Case on the Acquistion of Semi-Gas by nippon Sanso (3 pp.)	6/29/90	(b)(1)	

Collection:

Record Group: Bush Presidential Records
Office: Economic Policy Council (EPC)
Series: Wethington, Olin, Files
Subseries: Subject Files
WHORM Cat.:
File Location: Science & Technology [2]

Date Closed:	1/5/2010	**OA/ID Number:**	04295-017
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Withdrawal/Redaction Sheet
(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
06b. Memo	Deborah L. Wince-Smith to Michael Skarzynski Re: Nippon Sanso/Semi-Gas CFIUS Invesigation (2 pp.)	7/9/90	(b)(1)	

Collection:

Record Group: Bush Presidential Records
Office: Economic Policy Council (EPC)
Series: Wethington, Olin, Files
Subseries: Subject Files
WHORM Cat.:
File Location: Science & Technology [2]

Date Closed:	1/5/2010	**OA/ID Number:**	04295-017
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AR Case #:		**MR Case #:**	
AR Disposition:		**MR Disposition:**	
AR Disposition Date:		**MR Disposition Date:**	

RESTRICTION CODES

Presidential Records Act - [44 U.S.C. 2204(a)]

P-1 National Security Classified Information [(a)(1) of the PRA]
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PRM. Removed as a personal record misfile.

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SEMICONDUCTOR INDUSTRY ACQUISITIONS "ACQUIRING THE CHAIN"

CHIPS
(ADVANCED MICRO DEVICES)

SILICON WAFERS
(MONSANTO)

MATERIALS AND EQUIPMENT
(MATERIALS RESEARCH CORPORATION)

MASKINGS
(TEXAS INSTRUMENTS)

CAPACITORS
(AVX CORPORATION)

HIGH & ULTRA PURITY POLYSILICON
(UNION CARBIDE)

SEMICONDUCTOR GAS PROCESSING/PURIFICATION
(SEMI-GAS SYSTEMS)

30+ CFIUS NOTIFICATIONS (ACQUISITIONS) HAVE INVOLVED SEMICONDUCTOR-RELATED COMPANIES

Withdrawal/Redaction Sheet
(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
06c. Report	Re: Nippon Sanso (2 pp.)	7/10/90	(b)(1)	

Collection:

Record Group: Bush Presidential Records
Office: Economic Policy Council (EPC)
Series: Wethington, Olin, Files
Subseries: Subject Files
WHORM Cat.:
File Location: Science & Technology [2]

Date Closed:	1/5/2010	**OA/ID Number:**	04295-017
FOIA/SYS Case #:	2005-0336-F	**Appeal Case #:**	
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AUTHOR UNKNOWN

ROUGH DRAFT

THE CHANGING FACE OF COMPETITION IN THE GAS EQUIPMENT INDUSTRY

This draft attempts to capture the major issues of the acquisition of Semi-Gas Systems by Matheson/Nippon Sanso and its impact upon the gas equipment and purification industry.

1. *Loss of American Exports.* Currently Semi-Gas Systems, operating with independence from a gas supplier, is the leading and perhaps the only exporter of gas systems equipment to Europe and the Asia Pacific market place. The suggested operating plan calls for Semi-Gas Systems to reduce its activities in the Asia Pacific market in the very near future resulting in a loss of revenue of approximately $3 million to $5 million per year.

2. *Balance of Trade with Japan and Access to the Japanese Market.* Semi-Gas Systems has been working with several marketers in Japan to expand its market share in the Japanese semiconductor industry. The acquisition brings with it the restriction of independent Semi-Gas sales activity in Japan along with a controlled access to the Japanese market through Nippon Sanso. The Japanese semiconductor equipment market is the largest in the world and the proposed acquisition will deny access to the Japanese market for the only viable U.S. gas systems producer.

3. *Loss of U.S. Technology Leadership.* Currently Semi-Gas has a leading technical position in the gas equipment market based on the automation technologies within its Auto-Purge® family of products and the gas purification technologies in the Nanochem® product family. Nippon Sanso has said that they wished to take both of these technologies to Japan for further development for the Japanese market. This can result in the Japanese semiconductor producers receiving the latest product and technology improvements prior to making those same technologies and improvements available to semiconductor manufacturers in the rest of the world.

4. *Loss of U.S. Income Tax Revenue.* It is alleged that Nippon Sanso was able to offer a substantially higher price for Semi-Gas Systems because their U.S. subsidiary, Matheson, has substantial tax loss carry-forwards. Semi-Gas, on the other hand, has been profitable over the long term and if it remained independent, would expect to pay $1+ million in income taxes over the next several years. In effect, part of the financing of this acquisition has been shouldered by the U.S. taxpayer.

5. *Loss of U.S. Market Share of Gas Equipment.* With ASGT now owned by L'Air Liquide, Airco owned by BOC, and Semi-Gas owned by Nippon Sanso, only Air Products and SCI are viable players in the U.S. specialty gas equipment industry. This means that about 25-30% of the industry capability is U.S. owned.

6. *Focus on Japanese American Customers.* Nippon Sanso's reasons for acquiring Semi-Gas have been stated as, *"desire to have a U.S. based producer to provide equipment to the American factories of Japanese semiconductor producers"*. Currently virtually all of Matheson's equipment sales are to U.S. factories of Japanese producers.

7. *Loss of Independence.* Currently Semi-Gas Systems, as a non-aligned equipment supplier, is able to work with all gas companies, world wide, without fear of conflicts and cross purposes. The acquisition will lead to the end Semi-Gas' relationships with Linde and BOC, which could dramatically lower the sales success ratio of Semi-Gas.

8. *Loss of Sematech.* Semi-Gas Systems, as the first member of SEMI/Sematech and as a key contributor to the gas team at Sematech, has been able to focus its product improvement and product development strategies to rapidly develop improved products to meet the needs of the industry. The close working relationship between Semi-Gas and Sematech will be severed as a result of this acquisition and it is very likely that Semi-Gas will find it difficult to remain current with the needs of the semiconductor industry.

STRATEGIC IMPORTANCE OF SEMI-GAS' AUTOMATION TECHNOLOGY

As the semiconductor industry moves to larger size chips and finer line widths, the purity of the gases used in chip fabrication becomes ever more important. Gas purity is a function of chemical technology in the creation and purification of gases, the inherent cleanliness of the valves and piping systems containing those gases, and the procedures by which the gas systems are operated.

The most common operating procedure is the exchange of empty cylinders for full cylinders of process gas. During this process a technique known as "purging" is used to eliminate unwanted or undesirable chemical contamination. The automation of these procedures has proven to greatly reduce chemical contamination of semiconductor process gases.

Semi-Gas has developed a micro-processor based, automated gas control system known as *Auto-Purge®*. It is important to note that Semi-Gas Systems has approximately 80% of the market for automated gas systems within this country.

Automation of gas systems has been fairly common in the United States for the past several years and has recently become a subject of interest to semiconductor manufacturers outside of this country. The technology for the automation of gas systems in both Japan and Europe substantially lags that of Semi-Gas Systems, the market leader in the U.S. It is also important to realize that Semi-Gas Systems has generated substantial numbers of export dollars in selling its automated gas systems to the world wide semiconductor industry. (A list of customers is attached.)

In discussions with a potential Japanese acquirer, it has been clearly indicated that one of their primary interest in Semi-Gas is the acquisition of the gas systems automation technology. They have also stated that it would be their desire to import the technology to Japan, to fabricate the automation modules in Japan, and to supply the Japanese semiconductor industry from their existing systems business unit which is a current competitor to Semi-Gas Systems.

The result is likely to be that another U.S. developed technology, key to the production of advanced semiconductor devices, moves into the hands of a large Japanese supplier and competitor to U.S. companies.

STRATEGIC IMPORTANCE OF SEMI-GAS/HERCULES PURIFICATION TECHNOLOGY

As the semiconductor industry moves to larger size chips and finer line widths, the purity of the gases used in chip fabrication becomes ever more important. Gas purity is a function of chemical technology in the creation and purification of gases, and inherent cleanliness of the valves and piping systems containing those gases, and the procedures by which the gas systems are operated.

For a variety of technical reasons, the purification of a process gas used in the semiconductor industry, has proven to be an enabling technology. Purification, the removal of unwanted chemical contaminants, allows processes critical to the development of advanced semiconductors to be developed. Currently throughout the United States there are substantial numbers of semiconductor research projects underway to implement and fine tune these processes to enable the future technical success of the U.S. semiconductor industry. Within the last 18 months, some of these processes have moved to the production floor and are benefiting semiconductor fabricators with enhanced yields and higher quality devices of greater size and finer line widths.

World wide there are four firms involved in point-of-use gas purification development. They are:

Competitors	Home Country
Semi-Gas/Hercules	United States
ATM/Millipore	United States
SAES	Italy
Nippon Pionics	Japan

Currently Semi-Gas has the major market share in the U.S. and a rapidly increasing world wide customer base. In Japan, Nippon Pionics is the leading supplier of purifiers while in Europe and the rest of the world purification is new to the semiconductor market place.

In the divestuture of Semi-Gas Systems, Hercules proposes to license to the acquirer the world wide rights to market their Nanochem® gas purification technology and materials. If a Japanese firm acquires Semi-Gas Systems they therefore will have the world wide lock on key technology to enable advanced semiconductor process development. This event could make most semiconductor maufacturers in the U.S., and perhaps the world, dependent upon technology that is resident in one country outside of the U.S. This purification technology has been proven by numerous researchers in the U.S., and Dr. Tadahiro Ohmi, a well known Japanese semiconductor process researcher, has claimed Nanochem to be "most nearly perfect".

If this purification technology falls into the hands of a supplier who does not have the interest of the U.S. semiconductor industry in mind, another key element in the production of advanced semiconductor devices moves into the control of an offshore company.

Q.9.C
MILLION $$ OF CABNTS & PURGE MNFLDS PRODUCED IN THE USA (NO IMPORTS)
country of majority ownership in parenthesis ()

		87	88	89	90	90 MARKET SHARE %	91 ESTIMATED	92 SALES	93	94	94 MARKET SHARE %
SEMIGAS SYSTEMS	(usa)	10.00	12.70	16.90	20.10	46.10	24.20	28.20	32.40	39.00	42.86
AIR PRODUCTS	(usa)	4.00	5.00	8.00	10.50	24.08	12.00	13.30	14.00	15.00	16.48
AIRCO/ BOC	(britain)	1.00	1.20	2.40	1.50	3.44	1.50	1.80	2.50	4.00	4.40
ASGT /AIR LIQUIDE	(france)	1.20	1.70	3.50	1.50	3.44	2.40	3.00	3.50	5.00	5.49
CAPCO	(usa)	1.00	.00	.00	.00	0	.00	.00	.00	.00	0
CREATIVE PATHWAYS	(usa)	.00	.00	.10	.20	.46	.30	.20	.10	.00	0
FLOCON	(usa)	.50	.30	.00	.00	0	.00	.00	.00	.00	0
FLOPURE/UNION CARBIDE	(usa)	.30	.70	2.00	1.50	3.44	2.50	4.00	6.00	7.00	7.69
MG SCIENTIFIC GASES	(usa)	.30	.20	.00	.00	0	.00	.00	.00	.00	0
MATHESON/NIPPON SANSO	(japan	.40	.60	.80	3.00	6.88	4.00	9.00	13.00	15.00	16.48
PRECISION FLOW DEVICES		.10	.00	.00	.00	0	.00	.00	.00	.00	0
PROCESS & CRYOGENICS	(usa)	1.00	1.00	.70	.50	1.15	.40	.00	.00	.00	0
SCI	(usa)	1.00	2.00	4.00	4.50	10.32	3.50	5.00	6.50	6.00	6.59
SCIENTIFIC GAS PRODS	(usa)	.50	.40	.30	.10	.23	.15	.00	.00	.00	0
SILSCO	(usa)	.30	.30	.20	.20	.46	.30	.30	.00	.00	0
SSE	(usa)	.10	.00	.00	.00	0	.00	.00	.00	.00	0
VSM	(usa)	.10	.00	.00	.00	0	.00	.00	.00	.00	0
VERIFLO	(usa)	.50	.30	.00	.00	0	.00	.00	.00	.00	0
TOTAL USA		22.30	26.40	38.90	43.60	100.00	51.25	64.80	78.00	91.00	100.00

Q.9.C
MILLIONS $$ CABNTS & PURGE MANIFOLDS
PRODUCED IN EUROPE (NO EXPORTS)

		87	88	89	90	90 MARKET SHARE %	91 ESTIMATED	92 SALES	93	94	94 MARKET SHARE %
SEMIGAS SYSTEMS LTD.	(britai	1.70	1.20	1.70	2.80	19.31	3.50	5.00	6.50	7.00	25.41
AIR PRODUCTS	(usa)	1.50	2.00	2.20	2.60	17.93	3.50	5.00	5.70	6.70	24.32
DRAEGGER	(germany)	.00	.00	.00	.20	1.38	.20	.00	.00	.00	0
P.K. MUELLER	(germany)	1.00	1.10	1.30	1.40	9.66	1.00	.50	.20	.00	0
BOC	(britain)	2.00	2.00	2.20	2.60	17.93	3.70	5.60	5.10	6.10	22.14

Withdrawal/Redaction Sheet
(George Bush Library)

Document No. and Type	Subject/Title of Document	Date	Restriction	Class.
07a. Memo	Deborah L. Wince-Smith to Michael Skarzynski Re: Nippon Sanso/Semi-Gas CFIUS Invesigation (2 pp.)	7/9/90	(b)(1)	

Collection:

Record Group: Bush Presidential Records
Office: Economic Policy Council (EPC)
Series: Wethington, Olin, Files
Subseries: Subject Files
WHORM Cat.:
File Location: Science & Technology [2]

Date Closed:	1/5/2010	**OA/ID Number:**	04295-017
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07b. Report	Re: Nippon Sanso (2 pp.)	7/9/90	(b)(1)	

Collection:

Record Group: Bush Presidential Records
Office: Economic Policy Council (EPC)
Series: Wethington, Olin, Files
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parent company that intends to sell Semi-Gas to Nippon Sanso and this corporation refused a buy-out offer from Semi-Gas management. Hercules denigrated the quality of Semi-Gas technology and characterized it as soon-to-be obsolete. Credible opposing technical views state this is not true and these views were not considered.

(b) Testimony from SEMATECH, which has an ongoing R&D effort with Semi-Gas that may have to be discontinued, was discounted as lacking credibility and being ridiculous. SEMATECH represents a significant fraction of the U.S. semiconductor industry. It receives $100M, one half its annual budget, from DARPA; this is because the semiconductor industry has been judged to be important to national security. Yet SEMATECH's claims that were judged incredible were not separately investigated. Neither were the effects of any setback in SEMATECH's efforts evaluated in relation to their impact on the capabilities of member firms engaged in military systems development.

There are a number of other concerns, including the thoroughness of the investigation, the adequacy of the technical qualifications of those involved in the review, and the objectivity of the review, that raise questions that perhaps should not be ignored by Commerce. This is especially true if we are to conscientiously carry out our responsibilities.

There are important issues here that are larger than the CFIUS process. It is appropriate for Commerce to go on record as opposing this sale on the basis of the cumulative impact of sales of leading semiconductor materials and process technology. Semiconductor technology is necessary for a capability in electronics, on which virtually all defense weapon systems communication systems, command and control systems, and other systems such as SDI depend. This is recognized by others, which explains why this case has attracted attention in the press.

I urge you to consider voting against approval of the final CFIUS recommendations in this case, activating available mechanisms in the CFIUS process to document Commerce concerns related to the cumulative trends in foreign acquisitions of U.S. enabling technology firms, and working with me to develop a forum on such issues as the relation among national security, economic security, enabling technology, and competitiveness.

cc: Wayne Berman
Juan Benitez
D/S Murrin
U/S White

Table 1

Japanese Investments in Selected U.S. Electronics Industries
(Number of Transactions from 1980 to April 1990)

Industry	Equity	Acquisitions	Joint Ventures	Total
Semiconductor Materials	3	21	2	26
Semiconductor Mfg. Equipment	10	8	7	25
Semiconductors	24	15	2	41
Telecom Equip.	6	9	1	16
Computer Systems	16	-	-	16
Computer Parts and Peripherals	15	16	3	34
Computer Software	10	1	-	11
Total Japanese Investments	84	70	19	169

Sources: Selected publications of the Office of Trade and Investment Analysis, ITA, U.S. Department of Commerce, the Japan Economic Institute, and the American Electronics Association, Japan Office.

Table 2

Japanese Investments in Selected U.S. Electronics Industries
(Number of Transactions)

Industry	1980-1984	1985-1989	4 Mths 1990	Total
Semiconductor Materials	3	22	1	26
Semiconductor Mfg. Equipment	1	21	3	25
Semiconductors	3	34	4	41
Telecom Equipment	3	11	2	16
Computer Systems	1	13	2	16
Computer Parts and Peripherals	6	24	4	34
Computer Software	1	7	3	11
Total Japanese Investments	18	132	19	169

Sources: Selected publications of the Office of Trade and Investment Analysis, ITA, U.S. Department of Commerce, the Japan Economic Institute, and the American Electronics Association, Japan Office.

Japanese Investments in Selected U.S. Electronics Industries

1. *Semiconductor Materials*

Japanese Investor	U.S. Company	Investment Type		Industry
Tama Chemicals	Moses Lake Chemicals	Acquisition	(1985)	Hi purity chemicals
Asahi Diamond	Genasystems	50/50 JV with GE	(1989)	Thin-film coatings for semicond.
Shin-Etsu Handotai	Huls America	Equity	(1989)	Photoresists
Nippon Sanso	Matheson Gas Products	Acquisition	(1989)	Specialty Gases
Nippon Gaishi	Cabot Beryllium	Acquisition		Semi. mat.
Toshiba Ceramics	Quartz Internat'l	Acquisition	(1986)	Quartz/ pyrex mat.
Tosoh	Weiss Scientific	Acquisition	(1989)	Borosilicate/ quartz glass
Mitsui Mining	Allied Signal	50/50 JV	(1978)	Copper foil for ICs
Nippon Mining	Gould	Acquisition	(1988)	Copper foil for ICs
Furakawa Electric	Square D Yates Division	Acquisition	(1989)	Copper foil for ICs
Mitsui Hi-tec	International Leadframe Corp.	Acquisition	(1980)	Leadframes for ICs
Nissnin Steel	Thinsheet Metals	Acquisition	(1985)	Leadframes
Nippon Mining	Koltron	Equity-33%	(1986)	Leadframes
Kyocera	Ceradyne	Acquisition	(1978)	Ceramic mat.
Hitachi	Ceraclad	Acquisition	(1989)	Ceramic mat.
Asahi Glass	Olin	50/50 JV	(1986)	Ceramic substrates
Kyocera	AVX	Acquisition	(1989)	Ceramic substrates

Japanese Investor	U.S. Company	Investment Type		Industry
Tokuyama Soda	General Ceramic	Acquisition	(1989)	Ceramic packages
Shin-Etsu Handotai/ Mitsubishi Metal	Hemlock Semicond.	Equity-25%	(1984)	Polycryst. Silicon
	.....	Equity-12%		
Nippon Kokan	Great Western (GE subsidiary)	Acquisition	(1985)	Polycryst. silicon
Komatsu	Union Carbide Division	Acquisition	(1990)	Polycryst. silicon
Mitsubishi Metal	Siltec	Acquisition	(1986)	Silicon/ wafers
Showa Musen Kogyo	T.A. Hand	Acquisition	(1981)	Silicon wafers
Kawasaki Steel	NBK	Acquisition	(1985)	Silicon wafers
Osaka Titanium	U.S. Semiconductor	Acquisition	(1987)	Epitaxial wafers
Osaka Titanium	Cincinnati Milac. Semiconductor Mat.	Acquisition	(1989)	Silicon wafers
Tosoh	Varian Specialty Metals	Acquisition	(1988)	Sputtering targets
Sony	Materials Research	Acquisition	(1989)	Sputtering targets

2. Semiconductor Manufacturing Equipment

Japanese Investor	U.S. Company	Investment Type		Industry
Tokuda Works	Tylan Corporation	50/50 JV	(1986)	Etchers
Sumitomo	Lam Research	Equity-20%	(1989)	Plasma etch systems
Marubeni Hytech	Ion Beam Tech.	Equity-12%	(1986)	Ion beam Equipment
Sumitomo Heavy Industries	Radiation Dynamics	Acquisition	(1986)	E beam accelerators
Canon	Lepton	Equity	(1987)	E beam patt. gen.
Fuji Electric	PPC	Equity-34%		E beam equip.
Sumitomo Heavy	Eaton Implant	J.V.		Implant Equipment
Hoya	Micro Mask	Acquisition	(1989)	Photomasks
Topan	Texas Instruments Photomask Div.	Acquisition	(1989)	Photomasks
Uemura Industry	Automated Semiconductor	Acquisition	(1989)	IC plating
Ulvac	BTU Internat'l	50/50 JV	(1989)	Wafer proc. systems
Tokyo Electron	Thermo	J.V.		SME*
Tokyo Electron	Lam	J.V.		SME
NEC	Anelva (Varian subsidiary)	Acquisition	(1985)	SME
Samco	March	50/50 JV	(1986)	SME
Sumitomo	GCA	Equity	(1987)	SME

* SME- Semiconductor manufacturing equipment.

Japanese Investor	U.S. Company	Investment Type		Industry
Seki	Novellus Systems	Acquisition	(1988)	SME
Tokyo Electron	Varian	50/50 JV	(1989)	SME
Nippon Sanso	Semi-Gas Systems	Acquisition	(1990)	SME (Pend.)
Hamamatsu Photonics	Inspex	Equity-80%	(1978)	Wafer insp. eq.
Nippon Steel	Holon	Equity	(1987)	Wafer insp. eq.
Mitsubishi	Si Scan Systems	Equity-25%	(1985)	Semi. test equipment
Advantest	Integrated Circuit Testing	Equity-38%		IC testers
Advantest	Sym-Tek Systems	Equity-10%	(1988)	IC testers
Sumitomo	LTX	Equity	(1990)	IC testers
Advantest	Aehr Test	Acquisition	(1990)	IC testers (pending)

3. Semiconductors

Japanese Investor	U.S. Company	Investment Type		Industry
Sony	Vitelic	Equity	(1985)	CMOS DRAMs
Kyocera	Vitelic	Equity-10%	(1987)	CMOS DRAMs
Oki	Vitelic	Equity	(1989)	CMOS DRAMS
Exar (Rohm)	Excel	Acquisition	(1986)	EEPROMs
New Japan Steel	Simtek	Equity-25%	(1987)	EEPROMs
Sumitomo Metal	Standard Micro	Equity-20%	(1986)	ASICs
Yamaha	Chips & Technol.	Equity	(1987)	ASICs
TDK Corp.	Silicon Systems	Acquisition	(1989)	ASICs
Fuji Electric	Barvon BICMOS	Equity	(1988)	ASICS
Toshiba/Mitsui	International CMOS Systems	Acquisition	(1989)	ASICs
Toshiba	Integrated CMOS	Equity-14%	(1990)	ASICs
Kubota	MIPS Computer	Equity-20%	(1987)	RISC MPUs
Fujitsu	VIA Technologies	Equity	(1989)	RISC chip sets
ASCII	Tera Microsystems	Equity-5%		RISC chip sets
NTT Mitsubishi Batelle (U.S.)	Photonic Integrat. Research (New co.)	Equity-49% Equity-41% Equity-10%	(1987)	Optoelectron. ICs
Nippon Sheet Glass	Epitaxx	Acquisition	(1990)	Optoelectron. ICs
Mitsui	Gain Electronics	Equity-40%	(1986)	GaAS ICs
Nippon Mining	Menlo Technologies	Equity-30%	(1989)	GaAS microwave telecom ICs
Shin-Etsu Chem.	Brooktree	Equity	(1987)	Graphics ICs
Rohm	Xetel	Equity-63%	(1986)	IC design
Asahi Chemical	Crystal Semi.	Equity-8%	(1987)	Analog ICs
Rohm	Exar	Acquisition	(1971)	ICs

Japanese Investor	U.S. Company	Investment Type		Industry
Seiko Epson	Micro Power	Acquisition	(1973)	ICs
Toshiba	Marumon	Acquisition	(1980)	ICs
Seiko Epson	SMOS Systems	Acquisition	(1983)	ICs
Furukawa Electric	Bell's Computer Memory Division	Acquisition	(1988)	ICs
Asahi Glass	Aegis, Inc.	Equity-49%	(1987)	Parts for ICs
Mitsubishi Chem.	EXXON Optical Info Systems Division	Acquisition	(1981)	Semi. laser devices
Kobe Steel	GCA Laser Division	Equity	(1986)	Semi. laser devices
Mitsui	Zoran	Equity-5%	(1987)	Signal proc. chips
Shizuki Electric	TRW Capacitor Div.	Acquisition		Capacitors
Koa Denko	Speer Electronics	Equity-51%		Resistors
Fuji Kobunshi Kogyo	Technical Wire Prod. Division	Acquisition	(1989)	Liq. cryst. connectors
Kyocera	Elco	Equity		Connectors
Mitsubishi	Powerex	Equity-33%	(1985)	Discrete devices
Mitsubishi	Semicon	Acquisition	(1986)	Disc. dev./ PCBs
Sumitomo Bakelite	Sheldahl	Acquisition	(1987)	PCBs
Ricoh	Panatech Research	Acquisition		Semiconduct.
Toppan Printing	Industrial Circ.	Acquisition		Semiconduct.
Toshiba	Westinghouse	50/50 JV	(1988)	PCBs
Oki Electric	Hewlett Packard	50/50 JV	(1989)	PCBs
Joppa	Prostar	Equity	(1990)	PCBs
Hitachi	Kollmorgen Division	Acquisition	(1990)	PCBs

4. Telecommunications Equipment

Japanese Investor	U.S. Company	Investment Type		Industry
Fujitsu	Burroughs Imaging Systems Div.	Acquisition	(1986)	Facsimiles
Fujitsu	GTE Business Systems Div.	Equity-80%	(1988)	PBXs
NEC	Tel Plus	Acquisition	(1989)	PBXs
Mitsubishi Elec. Mitsubishi	Astronet Corp.	Equity-25% -24%	(1984)	Cellular telephones
Kenwood	Hughes Network System	50/50 JV	(1989)	2-way mobile satellite commun. eq.
Uniden	Magellan Systems	Equity-25%	(1989)	Satellite commun. eq.
AWA	UVC	Equity-50%	(1990)	Video communic.
Fujitsu	American Telecom	Acquisition	(1980)	Telephone equipment
Fujitsu	TRAN Telecom.	Acquisition	(1980)	Telephone equipment
NEC	AIM Telephones	Equity-10%		Telephone equipment
NEC	API Telephone Systems	Acquisition	(1988)	Telephone equipment
Sony	CXC Corporation	Acquisition	(1988)	Telephone equipment
Asahi	Phonemate	Acquisition	(1989)	Telephone equipment
NEC	MTI Business Commun. Systems	Equity-40%	(1989)	Telecom equipment
Sharp	Hycom	Acquisition	(1989)	Telecom equipment
Anritsu	Wiltron	Acquisition	(1990)	Microwave test equip.

5. Computer Systems

Japanese Investor	U.S. Company	Investment Type		Industry
Mitsui	Stellar	Equity		Graphics supercomp.
Kubota	Ardent	Equity-25%	(1987)	Graphics supercomp.
		Equity-44%	(1989)	
Kubota	Stardent (merger of Ardent and Stellar)	Equity-22%	(1989)	Graphics supercomp.
Yokogawa Electric	Supertek	Equity-16%	(1989)	Minisuper.
Fujitsu	Amdahl	Equity-46%	(1973)	Mainframes/ lge disk storage
		Equity-49%	(1983)	
Hitachi	National Advanced	Equity-80%	(1989)	Mainframes
Sanyo Electric	Icon	Equity-40%	(1987)	Supermini
Kyocera	Counterpoint	Equity	(1986)	Workstations
Kubota	MIPS Computer	Equity-20%	(1987)	Workstations
Matsushita	Solbourne	Equity-52%	(1988)	Workstations
Canon	NEXT Computer	Equity-17%	(1989)	Workstations
Nippon Kokan	Silicon Graphics	Equity-5%	(1990)	Workstations
Fujitsu	Poquet	Equity-38%	(1989)	Sub-laptop computers
Toshiba	Dynabook	Equity	(1989)	Sub-laptop computers
Nippon Steel	Synergy Computer Graphics Corp.	Equity	(1990)	CAD/CAM systems

6. Computer Components and Peripherals

Japanese Investor	U.S. Company	Investment Type		Industry
Minebea	Hi-tek Corp.	Acquisition	(1983)	Keyboards
Minebea	Keytronic	Equity-30%	(1986)	Keyboards
Gunze	Graphics Tech.	Equity-50%	(1989)	Touch panels
Toshiba	Toshiba-Westinghse	50/50 JV with Westinghouse		CRTs
Nippon Chemi-Con	Data Ray	Acquisition	(1983)	Hi res. video display
TDK	Display Components (IBM/DEC supplier)	Acquisition	(1987)	Components for hi res. displays
Furukawa Electric	Internat'l Compon. Technology	Acquisition	(1988)	Alum disk blanks
Marubeni	Komag	Equity-5%	(1985)	Thin-film disks
Kubota	Akashic Memories	Acquisition	(1987)	Thin-film disks
Asahi Glass	Komag	Equity-20%	(1988)	Thin-film disks
Kobe Steel	Komag	Equity-20%	(1990)	Thin-film disks
Hitachi	Trimedia	Acquisition		Thin-film disks
Mitsubishi	Verbatim	Acquisition	(1990)	Floppy disks
Hitachi Metal	Systems Magnetic	Acquisition	(1984)	Voice coil motors for disk drives
Minebea	UMC Corp.	Acquisition	(1984)	D.C. motors
Minebea	IMC Magnetics	Acquisition	(1985)	Power supplies

Japanese Investor	U.S. Company	Investment Type		Industry
Taiyo Yuden	Xentek	Equity-80%		Power supplies
Minebea	Harris Miami Lakes Division	Acquisition	(1985)	Switching regulators
Fujitsu	Intelligent Storage	Acquisition		Storage systems
Dai-Ichi Kangyo	Racet	Equity-30%	(1984)	Mass storage
Kobe Steel	Racet	Equity-10% Equity-51%	(1987) (1989)	Mass storage systems
Japan Assoc. Finance	Syquet Tech.	Equity	(1984)	Winchester disk drives
Kyocera	LaPine Technology	Acquisition	(1987)	Magnetic disk drives
Kubota	Maxtor	Equity		Magnetic disk drives
Kubota	Maxoptic	25% JV with Maxtor	(1989) (U.S.)	Optical disk drives
Kawasaki Steel	Literal	21% JV with Kodak and Olivetti (Italy)	(1990)	Optical disk drives
Kubota	Exabyte	Equity-8%	(1987)	Cartridge tape drives
Nakamichi Corp.	Mountain Computer	Acquisition	(1988)	Cartridge tape drives
Mitsubishi	Amtech	Equity-10%		Recognition systems
Nippon Steel	GTX Corporation	Equity-21%	(1987)	Automatic drawing recog. syst.
Hitachi	Dataproducts	Acquisition	(1990)	Printers (pending)
Graphtec	Precision Image	Equity-41%	(1988)	Color plotters
Kao Corporation	Sentinel Tech.	Acquisition	(1988)	Computer peripherals

7. Computer Software

Japanese Investor	U.S. Company	Investment Type		Industry
Mitsubishi	Microrim	Equity-5%	(1983)	RDBMS for PCs
Computer Software	Foothill Research	Equity-50%	(1986)	Software
Kubota	Synthesis Software	Equity-5%	(1988)	Software for RISC systems
Yamaichi Univen	Integrated Systems	Equity	(1989)	Software
Nikkei Info. Sys.	Excalibur Tech.	Equity	(1989)	AI software
Sony	Information Presentation Tech.	Equity-20%	(1989)	Network software
Chikyu Kagaku Sogo Kenkyujo	Telemar Resources	Equity	(1989)	Image proc. software
Kubota	Rasna	Equity-15%	(1989)	CAE software
Mutoh	Kurta	Acquisition	(1990)	CAD/CAM software
Advantest	Knight's Tech.	Equity-15%	(1990)	CAD software
Dai Nippon Screen	Island Graphics	Equity-79%	(1990)	Graphics software