CHAPTER 18—PATENT RIGHTS IN INVENTIONS MADE WITH FEDERAL ASSISTANCE

Sec.
200. Policy and objective.
201. Definitions.
202. Disposition of rights.
203. March-in rights.
204. Preference for United States industry.
205. Confidentiality.
206. Uniform clauses and regulations.
207. Domestic and foreign protection of federally owned inventions.
208. Regulations governing Federal licensing.
209. Restrictions on licensing of federally owned inventions.
210. Precedence of chapter.
211. Relationship to antitrust laws.

1982 Amendment. Pub. L. 97–256, Title I, § 101(5), Sept. 8, 1982, 96 Stat. 816, redesignated chapter 38, as added by Pub. L. 96–517, § 6(a), Dec. 12, 1980, 94 Stat. 3018, comprising sections 200 to 211, as chapter 18, and transferred chapter 18, as so redesignated, to the end of this part from the end of part IV.

§ 200. Policy and objective

It is the policy and objective of the Congress to use the patent system to promote the utilization of inventions arising from federally supported research or development; to encourage maximum participation of small business firms in federally supported research and development efforts; to promote collaboration between commercial concerns and nonprofit organizations, including universities; to ensure that inventions made by nonprofit organizations and small business firms are used in a manner to promote free competition and enterprise; to promote the commercialization and public availability of inventions made in the United States by United States industry and labor; to ensure that the Government obtains sufficient rights in federally supported inventions to meet the needs of the Government and protect the public against nonuse or unreasonable use of inventions; and to minimize the costs of administering policies in this area.

(Added Pub.L. 96–517, § 6(a), Dec. 12, 1980, 94 Stat. 3019.)

Effective Date. Section effective July 1, 1981, but implementing regulations authorized to be issued earlier, see section 8(f) of Pub.L. 96–517, set out as a note under section 41 of this title.

Legislative History. For legislative history and purpose of Pub.L. 96–517, see 1980 U.S.Code Cong. and Adm.News, p. 6460.

§ 201. Definitions

As used in this chapter—

(a) The term "Federal agency" means any executive agency as defined in section 105 of title 5, United States Code, and the military departments as defined by section 102 of title 5, United States Code.

(b) The term "funding agreement" means any contract, grant, or cooperative agreement entered into between any Federal agency, other than the Tennessee Valley Authority, and any contractor for the performance of experimental, developmental, or research work funded in whole or in part by the Federal Government. Such term includes any assignment, substitution of parties, or subcontract of any type entered into for the performance of experimental developmental, or research work under a funding agreement as herein defined.

(c) The term "contractor" means any person, small business firm, or nonprofit organization that is a party to a funding agreement.

(d) The term "invention" means any invention or discovery which is or may be patentable or otherwise protectable under this title.

(e) The term "subject invention" means any invention of the contractor conceived or first actually reduced to practice in the performance of work under a funding agreement.

(f) The term "practical application" means to manufacture in the case of a composition or product, to practice in the case of a process or method, or to operate in the case of a machine or system; and, in each case, under such conditions as to establish that the invention is being utilized and that its benefits are to the extent permitted by law or Government regulations available to the public on reasonable terms.

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Sec.
207. Domestic and foreign protection of federally owned inventions.
208. Regulations governing Federal licensing.
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(g) The term "made" when used in relation to any invention means the conception or first actual reduction to practice of such invention.

(h) The term "small business firm" means a small business concern as defined at section 2 of Public Law 85–536 (15 U.S.C. 632) and implementing regulations of the Administrator of the Small Business Administration.

(i) The term "nonprofit organization" means universities and other institutions of higher education or an organization of the type described in section 501(c)(3) of the Internal Revenue Code of 1954 (26 U.S.C. 501(c)) and exempt from taxation under section 501(a) of the Internal Revenue Code (26 U.S.C. 501(a)) or any nonprofit scientific or educational organization qualified under a State nonprofit organization statute.

(Added Pub.L. 96–517, § 6(a), Dec. 12, 1980, 94 Stat. 3019.)

Effective Date. Section effective July 1, 1981, but implementing regulations authorized to be issued earlier, see section 8(f) of Pub.L. 96–517, set out as a note under section 41 of this title.

Legislative History. For legislative history and purpose of Pub.L. 96–517, see 1980 U.S.Code Cong. and Adm.News, p. 6460.

§ 202. Disposition of rights

(a) Each nonprofit organization or small business firm may, within a reasonable time after disclosure as required by paragraph (c)(1) of this section, elect to retain title to any subject invention: *Provided, however*, That a funding agreement may provide otherwise (i) when the funding agreement is for the operation of a Government-owned research or production facility, (ii) in exceptional circumstances when it is determined by the agency that restriction or elimination of the right to retain title to any subject invention will better promote the policy and objectives of this chapter or (iii) when it is determined by a Government authority which is authorized by statute or Executive order to conduct foreign intelligence or counter-intelligence activities that the restriction or elimination of the right to retain title to any subject invention is necessary to protect the security of such activities. The rights of the nonprofit organization or small business firm shall be subject to the provisions of paragraph (c) of this section and the other provisions of this chapter.

(b)(1) Any determination under (ii) of paragraph (a) of this section shall be in writing and accompanied by a written statement of facts justifying the determination. A copy of each such determination and justification shall be sent to the Comptroller General of the United States within thirty days after the award of the applicable funding agreement. In the case of determinations applicable to funding agreements with small business firms copies shall also be sent to the Chief Counsel for Advocacy of the Small Business Administration.

(2) If the Comptroller General believes that any pattern of determinations by a Federal agency is contrary to the policy and objectives of this chapter or that an agency's policies or practices are otherwise not in conformance with this chapter, the Comptroller General shall so advise the head of the agency. The head of the agency shall advise the Comptroller General in writing within one hundred and twenty days of what action, if any, the agency has taken or plans to take with respect to the matters raised by the Comptroller General.

(3) At least once each year, the Comptroller General shall transmit a report to the Committees on the Judiciary of the Senate and House of Representatives on the manner in which this chapter is being implemented by the agencies and on such other aspects of Government patent policies and practices with respect to federally funded inventions as the Comptroller General believes appropriate.

(c) Each funding agreement with a small business firm or nonprofit organization shall contain appropriate provisions to effectuate the following:

(1) A requirement that the contractor disclose each subject invention to the Federal agency within a reasonable time after it is made and that the Federal Government may receive title to any subject invention not reported to it within such time.

(2) A requirement that the contractor make an election to retain title to any subject invention within a reasonable time after disclosure and that the Federal Government may receive title to any subject invention in which the contractor does not elect to retain rights or fails to elect rights within such time.

(3) A requirement that a contractor electing rights file patent applications within reasonable times and that the Federal Government may receive title to any subject inventions in the United States or other countries in which the contractor has not filed patent applications on the subject invention within such times.

(4) With respect to any invention in which the contractor elects rights, the Federal agency shall have a nonexclusive, nontransferable, irrevocable, paid-up license to practice or have practiced for or on behalf of the United States any subject invention throughout the world, and may, if provided in the funding agreement, have additional rights to sublicense any foreign government or international organization pursuant to any existing or future treaty or agreement.

(5) The right of the Federal agency to require periodic reporting on the utilization or efforts at obtaining utilization that are being made by the contractor or his licensees or assignees: *Provided*, That any such information may be treated by the Federal agency as commercial and financial information obtained from a person and privileged and confidential and not subject to disclosure under section 552 of title 5 of the United States Code.

(6) An obligation on the part of the contractor, in the event a United States patent application is filed by or on its behalf or by any assignee of the contractor, to include within the specification of such application and any patent issuing thereon, a statement specifying that the invention was made with Government support and that the Government has certain rights in the invention.

(7) In the case of a nonprofit organization, (A) a prohibition upon the assignment of rights to a subject invention in the United States without the approval of the Federal agency, except where such assignment is made to an organization which has as one of its primary functions the management of inventions and which is not, itself, engaged in or does not hold a substantial interest in other organizations engaged in the manufacture or sale of products or the use of processes that might utilize the invention or be in competition with embodiments of the invention (provided that such assignee shall be subject to the same provisions as the contractor); (B) a prohibition against the granting of exclusive licenses under United States Patents or Patent Applications in a subject invention by the contractor to persons other than small business firms for a period in excess of the earlier of five years from first commercial sale or use of the invention or eight years from the date of the exclusive license excepting that time before regulatory agencies necessary to obtain premarket clearance unless, on a case-by-case basis, the Federal agency approves a longer exclusive license. If exclusive field of use licenses are granted, commercial sale or use in one field of use shall not be deemed commercial sale or use as to other fields of use, and a first commercial sale or use with respect to a product of the invention shall not be deemed to end the exclusive period to different subsequent products covered by the invention; (C) a requirement that the contractor share royalties with the inventor; and (D) a requirement that the balance of any royalties or income earned by the contractor with respect to subject inventions, after payment of expenses (including payments to inventors) incidental to the administration of subject inventions, be utilized for the support of scientific research or education.

(8) The requirements of sections 203 and 204 of this chapter.

(d) If a contractor does not elect to retain title to a subject invention in cases subject to this section, the Federal agency may consider and after consultation with the contractor grant requests for retention of rights by the inventor subject to the provisions of this Act and regulations promulgated hereunder.

(e) In any case when a Federal employee is a coinventor of any invention made under a funding agreement with a nonprofit organization or small business firm, the Federal agency employing such coinventor is authorized to transfer or assign whatever rights it may acquire in the subject invention from its employee to the contractor subject to the conditions set forth in this chapter.

(f)(1) No funding agreement with a small business firm or nonprofit organization shall contain a provision allowing a Federal agency to require the licensing to third parties of inventions owned by the contractor that are not subject inventions unless such provision has been approved by the head of the agency and a written

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justification has been signed by the head of the agency. Any such provision shall clearly state whether the licensing may be required in connection with the practice of a subject invention, a specifically identified work object, or both. The head of the agency may not delegate the authority to approve provisions or sign justifications required by this paragraph.

(2) A Federal agency shall not require the licensing of third parties under any such provision unless the head of the agency determines that the use of the invention by others is necessary for the practice of a subject invention or for the use of a work object of the funding agreement and that such action is necessary to achieve the practical application of the subject invention or work object. Any such determination shall be on the record after an opportunity for an agency hearing. Any action commenced for judicial review of such determination shall be brought within sixty days after notification of such determination.

(Added Pub.L. 96–517, § 6(a), Dec. 12, 1980, 94 Stat. 3020.)

References in Text. This Act, referred to in subsec. (d), means Pub.L. 96–517 which enacted chapters 18 (sections 200 to 211) and 30 (sections 301 to 307) of this title, amended sections 41, 42 and 154 of this title and sections 1113 of Title 15 and 2186, 2457 and 5908 of Title 42, and enacted provisions set out as a note under section 41 of this title.

Effective Date. Section effective July 1, 1981, but implementing regulations authorized to be issued earlier, see section 8(f) of Pub.L. 96–517, set out as a note under section 41 of this title.

Legislative History. For legislative history and purpose of Pub.L. 96–517, see 1980 U.S.Code Cong. and Adm.News. p. 6460.

Library References

Patents ⇐90(1), 221.
C.J.S. Patents §§ 84 et seq., 280.

§ 203. March-in rights

With respect to any subject invention in which a small business firm or nonprofit organization has acquired title under this chapter, the Federal agency under whose funding agreement the subject invention was made shall have the right, in accordance with such procedures as are provided in regulations promulgated hereunder to require the contractor, an assignee or exclusive licensee of a subject invention to grant a nonexclusive, partially exclusive, or exclusive license in any field of use to a responsible applicant or applicants, upon terms that are reasonable under the circumstances, and if the contractor, assignee, or exclusive licensee refuses such request, to grant such a license itself, if the Federal agency determines that such—

(a) action is necessary because the contractor or assignee has not taken, or is not expected to take within a reasonable time, effective steps to achieve practical application of the subject invention in such field of use;

(b) action is necessary to alleviate health or safety needs which are not reasonably satisfied by the contractor, assignee, or their licensees;

(c) action is necessary to meet requirements for public use specified by Federal regulations and such requirements are not reasonably satisfied by the contractor assignee, or licensees; or

(d) action is necessary because the agreement required by section 204 has not been obtained or waived or because a licensee of the exclusive right to use or sell any subject invention in the United States is in breach of its agreement obtained pursuant to section 204.

(Added Pub.L. 96–517, § 6(a), Dec. 12, 1980, 94 Stat. 3022.)

Effective Date. Section effective July 1, 1981, but implementing regulations authorized to be issued earlier, see section 8(f) of Pub.L. 96–517, set out as a note under section 41 of this title.

Legislative History. For legislative history and purpose of Pub.L. 96–517, see 1980 U.S.Code Cong. and Adm.News, p. 6460.

Library References

Patents ⇐221.
C.J.S. Patents § 280.

§ 204. Preference for United States industry

Notwithstanding any other provision of this chapter, no small business firm or nonprofit organization which receives title to any subject invention and no assignee of any such small business firm or nonprofit organization shall grant to any person

the exclusive right to use or sell any subject invention in the United States unless such person agrees that any products embodying the subject invention or produced through the use of the subject invention will be manufactured substantially in the United States. However, in individual cases, the requirement for such an agreement may be waived by the Federal agency under whose funding agreement the invention was made upon a showing by the small business firm, nonprofit organization, or assignee that reasonable but unsuccessful efforts have been made to grant licenses on similar terms to potential licensees that would be likely to manufacture substantially in the United States or that under the circumstances domestic manufacture is not commercially feasible.

(Added Pub.L. 96–517, § 6(a), Dec. 12, 1980, 94 Stat. 3023.)

Effective Date. Section effective July 1, 1981, but implementing regulations authorized to be issued earlier, see section 8(f) of Pub.L. 96–517, set out as a note under section 41 of this title.

Legislative History. For legislative history and purpose of Pub.L. 96–517, see 1980 U.S.Code Cong. and Adm.News, p. 6460.

Library References

Patents ⇐221.
C.J.S. Patents § 280.

§ 205. Confidentiality

Federal agencies are authorized to withhold from disclosure to the public information disclosing any invention in which the Federal Government owns or may own a right, title, or interest (including a nonexclusive license) for a reasonable time in order for a patent application to be filed. Furthermore, Federal agencies shall not be required to release copies of any document which is part of an application for patent filed with the United States Patent and Trademark Office or with any foreign patent office.

(Added Pub.L. 96–517, § 6(a), Dec. 12, 1980, 94 Stat. 3023.)

Effective Date. Section effective July 1, 1981, but implementing regulations authorized to be issued earlier, see section 8(f) of Pub.L. 96–517, set out as a note under section 41 of this title.

Legislative History. For legislative history and purpose of Pub.L. 96–517, see 1980 U.S.Code Cong. and Adm.News, p. 6460.

§ 206. Uniform clauses and regulations

The Office of Federal Procurement Policy, after receiving recommendations of the Office of Science and Technology Policy, may issue regulations which may be made applicable to Federal agencies implementing the provisions of sections 202 through 204 of this chapter and the Office of Federal Procurement Policy shall establish standard funding agreement provisions required under this chapter.

(Added Pub.L. 96–517, § 6(a), Dec. 12, 1980, 94 Stat. 3023.)

Effective Date. Section effective July 1, 1981, but implementing regulations authorized to be issued earlier, see section 8(f) of Pub.L. 96–517, set out as a note under section 41 of this title.

Legislative History. For legislative history and purpose of Pub.L. 96–517, see 1980 U.S.Code Cong. and Adm.News, p. 6460.

Library References

Patents ⇐220.
C.J.S. Patents § 275 et seq.

§ 207. Domestic and foreign protection of federally owned inventions

Each Federal agency is authorized to—

(1) apply for, obtain, and maintain patents or other forms of protection in the United States and in foreign countries on inventions in which the Federal Government owns a right, title, or interest;

(2) grant nonexclusive, exclusive, or partially exclusive licenses under federally owned patent applications, patents, or other forms of protection obtained, royalty-free or for royalties or other consideration, and on such terms and conditions, including the grant to the licensee of the right of enforcement pursuant to the provisions of chapter 29 of this title as determined appropriate in the public interest;

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(3) undertake all other suitable and necessary steps to protect and administer rights to federally owned inventions on behalf of the Federal Government either directly or through contract; and

(4) transfer custody and administration, in whole or in part, to another Federal agency, of the right, title, or interest in any federally owned invention.

(Added Pub.L. 96–517, § 6(a), Dec. 12, 1980, 94 Stat. 3023.)

Effective Date. Section effective July 1, 1981, but implementing regulations authorized to be issued earlier, see section 8(f) of Pub.L. 96–517, set out as a note under section 41 of this title.

Legislative History. For legislative history and purpose of Pub.L. 96–517, see 1980 U.S.Code Cong. and Adm.News, p. 6460.

Library References
Patents ⇐90(1), 221.
C.J.S. Patents §§ 84 et seq., 280.

§ 208. Regulations governing Federal licensing

The Administrator of General Services is authorized to promulgate regulations specifying the terms and conditions upon which any federally owned invention, other than inventions owned by the Tennessee Valley Authority, may be licensed on a nonexclusive, partially exclusive, or exclusive basis.

(Added Pub.L. 96–517, § 6(a), Dec. 12, 1980, 94 Stat. 3024.)

Effective Date. Section effective July 1, 1981, but implementing regulations authorized to be issued earlier, see section 8(f) of Pub.L. 96–517, set out as a note under section 41 of this title.

Legislative History. For legislative history and purpose of Pub.L. 96–517, see 1980 U.S.Code Cong. and Adm.News, p. 6460.

Library References
Patents ⇐220.
C.J.S. Patents § 275 et seq.

§ 209. Restrictions on licensing of federally owned inventions

(a) No Federal agency shall grant any license under a patent or patent application on a federally owned invention unless the person requesting the license has supplied the agency with a plan for development and/or marketing of the invention, except that any such plan may be treated by the Federal agency as commercial and financial information obtained from a person and privileged and confidential and not subject to disclosure under section 552 of title 5 of the United States Code.

(b) A Federal agency shall normally grant the right to use or sell any federally owned invention in the United States only to a licensee that agrees that any products embodying the invention or produced through the use of the invention will be manufactured substantially in the United States.

(c)(1) Each Federal agency may grant exclusive or partially exclusive licenses in any invention covered by a federally owned domestic patent or patent application only if, after public notice and opportunity for filing written objections, it is determined that—

(A) the interests of the Federal Government and the public will best be served by the proposed license, in view of the applicant's intentions, plans, and ability to bring the invention to practical application or otherwise promote the invention's utilization by the public;

(B) the desired practical application has not been achieved, or is not likely expeditiously to be achieved, under any nonexclusive license which has been granted, or which may be granted, on the invention;

(C) exclusive or partially exclusive licensing is a reasonable and necessary incentive to call forth the investment of risk capital and expenditures to bring the invention to practical application or otherwise promote the invention's utilization by the public; and

(D) the proposed terms and scope of exclusivity are not greater than reasonably necessary to provide the incentive for bringing the invention to practical application or otherwise promote the invention's utilization by the public.

(2) A Federal agency shall not grant such exclusive or partially exclusive license under paragraph (1) of this subsection if it determines that the grant of such license

will tend substantially to lessen competition or result in undue concentration in any section of the country in any line of commerce to which the technology to be licensed relates, or to create or maintain other situations inconsistent with the antitrust laws.

(3) First preference in the exclusive or partially exclusive licensing of federally owned inventions shall go to small business firms submitting plans that are determined by the agency to be within the capabilities of the firms and equally likely, if executed, to bring the invention to practical application as any plans submitted by applicants that are not small business firms.

(d) After consideration of whether the interests of the Federal Government or United States industry in foreign commerce will be enhanced, any Federal agency may grant exclusive or partially exclusive licenses in any invention covered by a foreign patent application or patent, after public notice and opportunity for filing written objections, except that a Federal agency shall not grant such exclusive or partially exclusive license if it determines that the grant of such license will tend substantially to lessen competition or result in undue concentration in any section of the United States in any line of commerce to which the technology to be licensed relates, or to create or maintain other situations inconsistent with antitrust laws.

(e) The Federal agency shall maintain a record of determinations to grant exclusive or partially exclusive licenses.

(f) Any grant of a license shall contain such terms and conditions as the Federal agency determines appropriate for the protection of the interests of the Federal Government and the public, including provisions for the following:

(1) periodic reporting on the utilization or efforts at obtaining utilization that are being made by the licensee with particular reference to the plan submitted: *Provided*, That any such information may be treated by the Federal agency as commercial and financial information obtained from a person and privileged and confidential and not subject to disclosure under section 552 of title 5 of the United States Code;

(2) the right of the Federal agency to terminate such license in whole or in part if it determines that the licensee is not executing the plan submitted with its request for a license and the licensee cannot otherwise demonstrate to the satisfaction of the Federal agency that it has taken or can be expected to take within a reasonable time, effective steps to achieve practical application of the invention;

(3) the right of the Federal agency to terminate such license in whole or in part if the licensee is in breach of an agreement obtained pursuant to paragraph (b) of this section; and

(4) the right of the Federal agency to terminate the license in whole or in part if the agency determines that such action is necessary to meet requirements for public use specified by Federal regulations issued after the date of the license and such requirements are not reasonably satisfied by the licensee.

(Added Pub.L. 96–517, § 6(a), Dec. 12, 1980, 94 Stat. 3024.)

References in Text. Antitrust laws, referred to in subsecs. (c)(2) and (d), are classified generally to chapter 1 (section 1 et seq.) of Title 15, Commerce and Trade.

Effective Date. Section effective July 1, 1981, but implementing regulations authorized to be issued earlier, see section 8(f) of Pub.L. 96–517, set out as a note under section 41 of this title.

Legislative History. For legislative history and purpose of Pub.L. 96–517, see 1980 U.S. Code Cong. and Adm.News, p. 6460.

Library References

Patents ⇐221.
C.J.S. Patents § 280.

§ 210. Precedence of chapter

(a) This chapter shall take precedence over any other Act which would require a disposition of rights in subject inventions of small business firms or nonprofit organizations contractors in a manner that is inconsistent with this chapter, including but not necessarily limited to the following:

(1) section 10(a) of the Act of June 29, 1935, as added by title I of the Act of August 14, 1946 (7 U.S.C. 427i(a); 60 Stat. 1085);

(2) section 205(a) of the Act of August 14, 1946 (7 U.S.C. 1624(a); 60 Stat. 1090);

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of commerce to which the technology to be licensed
tain other situations inconsistent with antitrust laws.

ill maintain a record of determinations to grant exclu-
nses.

shall contain such terms and conditions as the Federal
te for the protection of the interests of the Federal
ncluding provisions for the following:
n the utilization or efforts at obtaining utilization that
ensee with particular reference to the plan submitted:
information may be treated by the Federal agency as
information obtained from a person and privileged and
ject to disclosure under section 552 of title 5 of the

deral agency to terminate such license in whole or in
the licensee is not executing the plan submitted with
and the licensee cannot otherwise demonstrate to the
al agency that it has taken or can be expected to take
effective steps to achieve practical application of the

deral agency to terminate such license in whole or in
reach of an agreement obtained pursuant to paragraph

leral agency to terminate the license in whole or in part
that such action is necessary to meet requirements for
ederal regulations issued after the date of the license
re not reasonably satisfied by the licensee.

. 12, 1980, 94 Stat. 3024.)

s, referred to
fied generally
itle 15, Com-

July 1, 1981,
orized to be
ib.L. 96-517,
of this title.

Legislative History. For legislative history and purpose of Pub.L. 96-517, see 1980 U.S. Code Cong. and Adm.News, p. 6460.

Library References

Patents ⇐221.
C.J.S. Patents § 280.

er

precedence over any other Act which would require a
ect inventions of small business firms or nonprofit
manner that is inconsistent with this chapter, includ-
d to the following:
Act of June 29, 1935, as added by title I of the Act of
. 427i(a); 60 Stat. 1085);
e Act of August 14, 1946 (7 U.S.C. 1624(a); 60 Stat.

(3) section 501(c) of the Federal Mine Safety and Health Act of 1977 (30 U.S.C. 951(c); 83 Stat. 742);

(4) section 106(c) of the National Traffic and Motor Vehicle Safety Act of 1966 (15 U.S.C. 1395(c); 80 Stat. 721);

(5) section 12 of the National Science Foundation Act of 1950 (42 U.S.C. 1871(a); 82 Stat. 360);

(6) section 152 of the Atomic Energy Act of 1954 (42 U.S.C. 2182; 68 Stat. 943);

(7) section 305 of the National Aeronautics and Space Act of 1958 (42 U.S.C. 2457);

(8) section 6 of the Coal Research Development Act of 1960 (30 U.S.C. 666; 74 Stat. 337);

(9) section 4 of the Helium Act Amendments of 1960 (50 U.S.C. 167b; 74 Stat. 920);

(10) section 32 of the Arms Control and Disarmament Act of 1961 (22 U.S.C. 2572; 75 Stat. 634);

(11) subsection (e) of section 302 of the Appalachian Regional Development Act of 1965 (40 U.S.C.App. 302(e); 79 Stat. 5);

(12) section 9 of the Federal Nonnuclear Energy Research and Development Act of 1974 (42 U.S.C. 5901 [1]; 88 Stat. 1878);

(13) section 5(d) of the Consumer Product Safety Act (15 U.S.C. 2054(d); 86 Stat. 1211);

(14) section 3 of the Act of April 5, 1944 (30 U.S.C. 323; 58 Stat. 191);

(15) section 8001(c)(3) of the Solid Waste Disposal Act (42 U.S.C. 6981(c); 90 Stat. 2829);

(16) section 219 of the Foreign Assistance Act of 1961 (22 U.S.C. 2179; 83 Stat. 806);

(17) section 427(b) of the Federal Mine Health and Safety Act of 1977 (30 U.S.C. 937(b); 86 Stat. 155);

(18) section 306(d) of the Surface Mining and Reclamation Act of 1977 (30 U.S.C. 1226(d); 91 Stat. 455);

(19) section 21(d) of the Federal Fire Prevention and Control Act of 1974 (15 U.S.C. 2218(d); 88 Stat. 1548);

(20) section 6(b) of the Solar Photovoltaic Energy Research Development and Demonstration Act of 1978 (42 U.S.C. 5585(b); 92 Stat. 2516);

(21) section 12 of the Native Latex Commercialization and Economic Development Act of 1978 (7 U.S.C. 178(j) [2]; 92 Stat. 2533); and

(22) section 408 of the Water Resources and Development Act of 1978 (42 U.S.C. 7879; 92 Stat. 1360).

The Act creating this chapter shall be construed to take precedence over any future Act unless that Act specifically cites this Act and provides that it shall take precedence over this Act.

(b) Nothing in this chapter is intended to alter the effect of the laws cited in paragraph (a) of this section or any other laws with respect to the disposition of rights in inventions made in the performance of funding agreements with persons other than nonprofit organizations or small business firms.

(c) Nothing in this chapter is intended to limit the authority of agencies to agree to the disposition of rights in inventions made in the performance of work under funding agreements with persons other than nonprofit organizations or small business firms in accordance with the Statement of Government Patent Policy issued on August 23, 1971 (36 Fed.Reg. 16887), agency regulations, or other applicable regulations or to otherwise limit the authority of agencies to allow such persons to retain ownership of inventions. Any disposition of rights in inventions made in accordance with the Statement or implementing regulations, including any disposition occurring before enactment of this section, are hereby authorized.

(d) Nothing in this chapter shall be construed to require the disclosure of intelligence sources or methods or to otherwise affect the authority granted to the

Director of Central Intelligence by statute or Executive order for the protection of intelligence sources or methods.

(Added Pub.L. 96–517, § 6(a), Dec. 12, 1980, 94 Stat. 3026.)

[1] So in original. Should be "5908".

[2] So in original. Should be "178j".

References in Text. The Act and this Act, referred to in subsec. (a), is Pub.L. 96–517, Dec. 12, 1980, 94 Stat. 3015, which enacted sections 200 to 211 and 301 to 307 of this title, amended sections 41, 42, and 154 of this title, section 1113 of Title 15, Commerce and Trade, sections 101 and 117 of Title 17, Copyrights, and sections 2186, 2457, and 5908 of Title 42, The Public Health and Welfare, and enacted provisions set out as notes under sections 14 and 41 of this title. For complete classification of this Act to the Code, see Short Title of 1980 Amendment note set out under section 41 of this title and Tables volume.

Effective Date. Section effective July 1, 1981, but implementing regulations authorized to be issued earlier, see section 8(f) of Pub.L. 96–517, set out as a note under section 41 of this title.

Legislative History. For legislative history and purpose of Pub.L. 96–517, see 1980 U.S.Code Cong. and Adm.News, p. 6460.

§ 211. Relationship to antitrust laws

Nothing in this chapter shall be deemed to convey to any person immunity from civil or criminal liability, or to create any defenses to actions, under any antitrust law.

(Added Pub.L. 96–517, § 6(a), Dec. 12, 1980, 94 Stat. 3027.)

References in Text. Antitrust laws and antitrust law, referred to in the catchline and text, are classified generally to chapter 1 (section 1 et seq.) of Title 15, Commerce and Trade.

Effective Date. Section effective July 1, 1981, but implementing regulations authorized to be issued earlier, see section 8(f) of Pub.L. 96–517, set out as a note under section 41 of this title.

Legislative History. For legislative history and purpose of Pub.L. 96–517, see 1980 U.S.Code Cong. and Adm.News, p. 6460.

Public Law 93-400

August 30, 1974
[S. 2510]

AN ACT

To establish an Office of Federal Procurement Policy within the Office of Management and Budget, and for other purposes.

Office of Federal Procurement Policy Act.
41 USC 401 note.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That this Act may be cited as the "Office of Federal Procurement Policy Act".

DECLARATION OF POLICY

41 USC 401.

SEC. 2. It is declared to be the policy of Congress to promote economy, efficiency, and effectiveness in the procurement of property and services by and for the executive branch of the Federal Government by—

(1) establishing policies, procedures, and practices which will require the Government to acquire property and services of the requisite quality and within the time needed at the lowest reasonable cost, utilizing competitive procurement methods to the maximum extent practicable;

(2) improving the quality, efficiency, economy, and performance of Government procurement organizations and personnel;

(3) avoiding or eliminating unnecessary overlapping or duplication of procurement and related activities;

(4) avoiding or eliminating unnecessary or redundant requirements placed on contractor and Federal procurement officials;

(5) identifying gaps, omissions, or inconsistencies in procurement laws, regulations, and directives and in other laws, regulations, and directives, relating to or affecting procurement;

(6) achieving greater uniformity and simplicity, whenever appropriate, in procurement procedures;

(7) coordinating procurement policies and programs of the several departments and agencies;

(8) minimizing possible disruptive effects of Government procurement on particular industries, areas, or occupations;

(9) improving understanding of Government procurement laws and policies within the Government and by organizations and individuals doing business with the Government;

(10) promoting fair dealing and equitable relationships among the parties in Government contracting; and

(11) otherwise promoting economy, efficiency, and effectiveness in Government procurement organizations and operations.

FINDINGS AND PURPOSE

41 USC 402.

SEC. 3. (a) The Congress finds that economy, efficiency, and effectiveness in the procurement of property and services by the executive agencies will be improved by establishing an office to exercise responsibility for procurement policies, regulations, procedures, and forms.

(b) The purpose of this Act is to establish an Office of Federal Procurement Policy in the Office of Management and Budget to provide overall direction of procurement policies, regulations, procedures, and forms for executive agencies in accordance with applicable laws.

DEFINITION

SEC. 4. As used in this Act, the term "executive agency" means an executive department, a military department, and an independent establishment within the meaning of sections 101, 102, and 104(1), respectively, of title 5, United States Code, and also a wholly owned Government corporation within the meaning of section 101 of the Government Corporation Control Act (31 U.S.C. 846). 41 USC 403.

OFFICE OF FEDERAL PROCUREMENT POLICY

SEC. 5. (a) There is established in the Office of Management and Budget an office to be known as the Office of Federal Procurement Policy (hereinafter referred to as the "Office"). Establishment. 41 USC 404.

(b) There shall be at the head of the Office an Administrator for Federal Procurement Policy (hereinafter referred to as the "Administrator"), who shall be appointed by the President, by and with the advice and consent of the Senate.

AUTHORITY AND FUNCTIONS

SEC. 6. (a) The Administrator shall provide overall direction of procurement policy. To the extent he considers appropriate and with due regard to the program activities of the executive agencies, he shall prescribe policies, regulations, procedures, and forms, which shall be in accordance with applicable laws and shall be followed by executive agencies (1) in the procurement of— 41 USC 405.

(A) property other than real property in being;

(B) services, including research and development; and

(C) construction, alteration, repair, or maintenance of real property;

and (2) in providing for procurement by recipients of Federal grants or assistance of items specified in clauses (A), (B), and (C) of this subsection, to the extent required for performance of Federal grant or assistance programs.

(b) Nothing in subsection (a)(2) shall be construed—

(1) to permit the Administrator to authorize procurement or supply support, either directly or indirectly, to recipients of Federal grants or assistance; or

(2) to authorize any action by recipients contrary to State and local laws, in the case of programs to provide Federal grants or assistance to States and political subdivisions.

(c) The authority of the Administrator under this Act shall apply only to procurement payable from appropriated funds: *Provided*, That the Administrator undertake a study of procurement payable from nonappropriated funds. The results of the study, together with recommendations for administrative or statutory changes, shall be reported to the President of the Senate and the Speaker of the House of Representatives at the earliest practicable date, but in no event later than two years after the date of enactment of this Act. Procurement study. Report to President of the Senate and Speaker of the House.

(d) The functions of the Administrator shall include—

(1) establishing a system of coordinated, and to the extent feasible, uniform procurement regulations for the executive agencies;

(2) establishing criteria and procedures for an effective and timely method of soliciting the viewpoints of interested parties in the development of procurement policies, regulations, procedures, and forms;

(3) monitoring and revising policies, regulations, procedures, and forms relating to reliance by the Federal Government on the private sector to provide needed property and services;

(4) promoting and conducting research in procurement policies, regulations, procedures, and forms;

(5) establishing a system for collecting, developing, and disseminating procurement data which takes into account the needs of the Congress, the executive branch, and the private sector;

(6) recommending and promoting programs of the Civil Service Commission and executive agencies for recruitment, training, career development, and performance evaluation of procurement personnel.

Consultation with executive agencies and SBA.

(e) In the development of policies, regulations, procedures, and forms to be authorized or prescribed by him, the Administrator shall consult with the executive agencies affected, including the Small Business Administration and other executive agencies promulgating policies, regulations, procedures, and forms affecting procurement. To the extent feasible, the Administrator may designate an executive agency or agencies, establish interagency committees, or otherwise use agency representatives or personnel, to solicit the views and the agreement, so far as possible, of executive agencies affected on significant changes in policies, regulations, procedures, and forms.

(f) The authority of the Administrator under this Act shall not be construed to—

(1) impair or interfere with the determination by executive agencies of their need for, or their use of, specific property, services, or construction, including particular specifications therefor; or

(2) interfere with the determination by executive agencies of specific actions in the award or administration of procurement contracts.

Restriction.

(g) Except as otherwise provided by law, no duties, functions, or responsibilities, other than those expressly assigned by this Act, shall be assigned, delegated, or transferred to the Administrator.

ADMINISTRATIVE POWERS

41 USC 406.

SEC. 7. Upon the request of the Administrator, each executive agency is directed to—

(1) make its services, personnel, and facilities available to the Office to the greatest practicable extent for the performance of functions under this Act; and

(2) except when prohibited by law, furnish to the Administrator and give him access to all information and records in its possession which the Administrator may determine to be necessary for the performance of the functions of the Office.

RESPONSIVENESS TO CONGRESS

41 USC 407.

SEC. 8. (a) The Administrator shall keep the Congress and its duly authorized committees fully and currently informed of the major activities of the Office of Federal Procurement Policy, and shall submit a report thereon to the President of the Senate and the Speaker of the House of Representatives annually and at such other times as may be necessary for this purpose, together with appropriate legislative recommendations.

Report to President of the Senate and Speaker of the House.

Report to congressional committees.

(b) At least 30 days prior to the effective date of any major policy or regulation prescribed under section 6(a), the Administrator shall

transmit to the Committees on Government Operations of the House of Representatives and of the Senate a detailed report on the proposed policy or regulation. Such report shall include—

(1) a full description of the policy or regulation;

(2) a summary of the reasons for the issuance of such policy or regulation; and

(3) the names and positions of employees of the Office who will be made available, prior to such effective date, for full consultation with such Committees regarding such policy or regulation.

(c) In the case of an emergency, the President may waive the notice requirement of subsection (b) by submitting in writing to the Congress his reasons therefor at the earliest practicable date on or before the effective date of any major policy or regulation.

Notice requirement waiver, submittal to Congress.

EFFECT ON EXISTING LAWS

SEC. 9. The authority of an executive agency under any other law to prescribe policies, regulations, procedures, and forms for procurement is subject to the authority conferred in section 6 of this Act.

41 USC 408.

EFFECT ON EXISTING REGULATIONS

SEC. 10. Procurement policies, regulations, procedures, or forms in effect as of the date of enactment of this Act shall continue in effect, as modified from time to time, until repealed, amended, or superseded by policies, regulations, procedures, or forms promulgated by the Administrator.

41 USC 409.

AUTHORIZATION OF APPROPRIATIONS

SEC. 11. There are authorized to be appropriated to carry out the provisions of this Act, and for no other purpose—

(1) not to exceed $2,000,000 for the fiscal year ending June 30, 1975, of which not to exceed $150,000 shall be available for the purpose of research in accordance with section 6(d)(4); and

(2) such sums as may be necessary for each of the four fiscal years thereafter.

Any subsequent legislation to authorize appropriations to carry out the purposes of this Act shall be referred in the Senate to the Committee on Government Operations.

41 USC 410.

DELEGATION

SEC. 12. (a) The Administrator may delegate, and authorize successive redelegations of, any authority, function, or power under this Act, other than his basic authority to provide overall direction of Federal procurement policy and to prescribe policies and regulations to carry out that policy, to any other executive agency with the consent of such agency or at the direction of the President.

(b) The Administrator may make and authorize such delegations within the Office as he determines to be necessary to carry out the provisions of this Act.

41 USC 411.

ANNUAL PAY

SEC. 13. Section 5315 of title 5, United States Code, is amended by adding at the end thereof the following:

"(100) Administrator for Federal Procurement Policy.".

ACCESS TO INFORMATION

41 USC 412.

SEC. 14. (a) The Administrator and personnel in his Office shall furnish such information as the Comptroller General may require for the discharge of his responsibilities. For this purpose, the Comptroller General or his representatives shall have access to all books, documents, papers, and records of the Office.

Open public meetings, notice.

(b) The Administrator shall, by regulation, require that formal meetings of the Office, as designated by him, for the purpose of establishing procurement policies and regulations shall be open to the public, and that public notice of each such meeting shall be given not less than ten days prior thereto.

REPEALS AND AMENDMENTS

SEC. 15. The Federal Property and Administrative Services Act of 1949 (40 U.S.C. 471 et seq.) is amended as follows:

(1) Section 201(a)(1) of such Act (40 U.S.C. 481(a)(1)) is amended by inserting "subject to regulations prescribed by the Administrator for Federal Procurement Policy pursuant to the Office of Federal Procurement Policy Act," immediately after "(1)".

(2) Section 201(c) of such Act (40 U.S.C. 481(c)) is amended by inserting "subject to regulations prescribed by the Administrator for Federal Procurement Policy pursuant to the Office of Federal Procurement Policy Act," immediately after "Administrator,".

(3) Section 206(a)(4) of such Act (40 U.S.C. 487(a)(4)) is amended to read as follows: "(4) subject to regulations promulgated by the Administrator for Federal Procurement Policy pursuant to the Office of Federal Procurement Policy Act, to prescribe standardized forms and procedures, except such as the Comptroller General is authorized by law to prescribe, and standard purchase specifications.".

(4) Section 602(c) of such Act (40 U.S.C. 474) is amended in the first sentence thereof by inserting "except as provided by the Office of Federal Procurement Policy Act, and" immediately after "herewith,".

Approved August 30, 1974.

Public Law 93-401

August 30, 1974
[S. J. Res. 222]

JOINT RESOLUTION

To provide for the appointment of Doctor Murray Gell-Mann as citizen regent of the Board of Regents of the Smithsonian Institution

Smithsonian Institution.

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That the vacancy in the Board of Regents of the Smithsonian Institution, of the class other than Members of Congress, which will occur by the expiration of the term of Doctor Crawford H. Greenewalt of Wilmington, Delaware, on May 30, 1974, be filled by the appointment of Doctor Murray Gell-Mann of California for the statutory term of six years.

Approved August 30, 1974.

services and facilities for which fi-
available.

5, 1976, 90 Stat. 306.

rical Note

Legislative History. For legislative history and purpose of Pub.L. 94-258, see 1976 U.S.Code Cong. and Adm.News, p. 492.

CHAPTER 79—SCIENCE AND TECHNOLOGY POLICY, ORGANIZATION AND PRIORITIES

SUBCHAPTER I—NATIONAL SCIENCE, ENGINEERING, AND TECHNOLOGY POLICY AND PRIORITIES

Sec.

6601. Congressional findings; priority goals.
6602. Congressional declaration of policy.
(a) Principles.
(b) Implementation.
(c) Procedures.

SUBCHAPTER II—OFFICE OF SCIENCE AND TECHNOLOGY POLICY

6611. Establishment of Office.
6612. Director; Associate Directors.
6613. Functions of Director.
6614. Policy planning; analysis; advice; establishment of Advisory Panel.
6615. Five-year outlook.
(a) Identification and description of situations and conditions warranting special attention.
(b) Annual revision.
(c) Consultation with officials of departments and agencies having related programs and responsibilities.
(d) Consultation with officials of Office of Management and Budget and other appropriate elements of Executive Office of President.
6616. Additional functions of Director.
(a) Service as Chairman of Federal Coordinating Council for Science, Engineering, and Technology and as member of Domestic Council.
(b) Advice to National Security Council.
(c) Officers and employees; services; contracts; payments.
6617. Coordination with other organizations.
(a) Consultation and cooperation with Federal departments and agencies; utilization of consultants; establishment of advisory panels; consultation with State and local agencies, professional groups, and representatives of industry, etc.; hearings; utilization of services, personnel, equipment, etc., of public and private agencies and organizations, and individuals.

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6617. Coordination with other organizations—Continued
(b) Information from Executive departments, agencies, and instrumentalities.
(c) Assistance from Administrator of National Aeronautics and Space Administration.
6618. Science and technology report.
(a) Transmittal to Congress; preparation; issues discussed.
(b) Use of relevant data available from National Science Foundation and other Government departments and agencies.
(c) Availability as public document.

SUBCHAPTER III—PRESIDENT'S COMMITTEE ON SCIENCE AND TECHNOLOGY

6631. Establishment of Committee.
6632. Membership of Committee.
(a) Composition; appointment.
(b) Qualifications.
(c) Chairman; Vice Chairman.
(d) Compensation.
6633. Federal science, engineering, and technology survey; reports.
6634. Continuation of Committee.
6635. Staff and consultant report.

SUBCHAPTER IV—FEDERAL COORDINATING COUNCIL FOR SCIENCE, ENGINEERING, AND TECHNOLOGY

6651. Establishment, membership, and functions of Council.
(a) Establishment.
(b) Composition.
(c) Chairman.
(d) Participation of unnamed Federal agencies in meetings; invitations to attend meetings.
(e) Consideration of problems and developments affecting more than one Federal agency; recommendations.
(f) Other advisory duties.
(g) Assistance to Council by agency represented thereon.
(h) Establishment of subcommittees and panels.

SUBCHAPTER V—GENERAL PROVISIONS

6671. Authorization of appropriations.

LTH AND WELFARE Ch. 79

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SUBCHAPTER I—NATIONAL SCIENCE, ENGINEERING, AND TECHNOLOGY POLICY AND PRIORITIES

§ 6601. Congressional findings; priority goals

(a) The Congress, recognizing the profound impact of science and technology on society, and the interrelations of scientific, technological, economic, social, political, and institutional factors, hereby finds and declares that—

(1) the general welfare, the security, the economic health and stability of the Nation, the conservation and efficient utilization of its natural and human resources, and the effective functioning of government and society require vigorous, perceptive support and employment of science and technology in achieving national objectives;

(2) the many large and complex scientific and technological factors which increasingly influence the course of national and international events require appropriate provision, involving long-range, inclusive planning as well as more immediate program development, to incorporate scientific and technological knowledge in the national decisionmaking process;

(3) the scientific and technological capabilities of the United States, when properly fostered, applied, and directed, can effectively assist in improving the quality of life, in anticipating and resolving critical and emerging international, national, and local problems, in strengthening the Nation's international economic position, and in furthering its foreign policy objectives;

(4) Federal funding for science and technology represents an investment in the future which is indispensable to sustained national progress and human betterment, and there should be a continuing national investment in science, engineering, and technology which is commensurate with national needs and opportunities and the prevalent economic situation;

(5) the manpower pool of scientists, engineers, and technicians, constitutes an invaluable national resource which should be utilized to the fullest extent possible; and

(6) the Nation's capabilities for technology assessment and for technological planning and policy formulation must be strengthened at both Federal and State levels.

(b) As a consequence, the Congress finds and declares that science and technology should contribute to the following priority goals without being limited thereto:

(1) fostering leadership in the quest for international peace and progress toward human freedom, dignity, and well-being by enlarging the contributions of American scientists and engineers

to the knowledge of man and his universe, by making discoveries of basic science widely available at home and abroad, and by utilizing technology in support of United States national and foreign policy goals;

(2) increasing the efficient use of essential materials and products, and generally contributing to economic opportunity, stability, and appropriate growth;

(3) assuring an adequate supply of food, materials, and energy for the Nation's needs;

(4) contributing to the national security;

(5) improving the quality of health care available to all residents of the United States;

(6) preserving, fostering, and restoring a healthful and esthetic natural environment;

(7) providing for the protection of the oceans and coastal zones, and the polar regions, and the efficient utilization of their resources;

(8) strengthening the economy and promoting full employment through useful scientific and technological innovations;

(9) increasing the quality of educational opportunities available to all residents of the United States;

(10) promoting the conservation and efficient utilization of the Nation's natural and human resources;

(11) improving the Nation's housing, transportation, and communication systems, and assuring the provision of effective public services throughout urban, suburban, and rural areas;

(12) eliminating air and water pollution, and unnecessary, unhealthful, or ineffective drugs and food additives; and

(13) advancing the exploration and peaceful uses of outer space.

Pub.L. 94–282, Title I, § 101, May 11, 1976, 90 Stat. 459.

Historical Note

Short Title. Section 1 of Pub.L. 94–282 provided that: "This Act [enacting this chapter, amending section 1863 of this title, repealing sections 1, 2, 3, and 4 of Reorganization Plan Numbered 2 of 1962 (76 Stat. 1253), set out as a note under section 1861 of this title, and section 2 of Reorganization Plan Numbered 1 of 1973 (87 Stat. 1089), set out as a note under section 2271 of the Appendix to Title 50, War and National Defense, and enacting provisions set out as notes under this section, section 1862 and section 6611 of this title] may be cited as the 'National Science and Technology Policy, Organization, and Priorities Act of 1976'."

Legislative History. For legislative history and purpose of Pub.L. 94–282, see 1976 U.S.Code Cong. and Adm.News, p. 880.

Library References

Health and Environment ⇐25.5.

C.J.S. Health and Environment § 61 et seq.

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Legislative History. For legislative history and purpose of Pub.L. 94–282, see 1976 U.S.Code Cong. and Adm.News, p. 880.

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C.J.S. Health and Environment § 61 et seq.

§ 6602. Congressional declaration of policy

Principles

(a) In view of the foregoing, the Congress declares that the United States shall adhere to a national policy for science and technology which includes the following principles:

(1) The continuing development and implementation of strategies for determining and achieving the appropriate scope, level, direction, and extent of scientific and technological efforts based upon a continuous appraisal of the role of science and technology in achieving goals and formulating policies of the United States, and reflecting the views of State and local governments and representative public groups.

(2) The enlistment of science and technology to foster a healthy economy in which the directions of growth and innovation are compatible with the prudent and frugal use of resources and with the preservation of a benign environment.

(3) The conduct of science and technology operations so as to serve domestic needs while promoting foreign policy objectives.

(4) The recruitment, education, training, retraining, and beneficial use of adequate numbers of scientists, engineers, and technologists, and the promotion by the Federal Government of the effective and efficient utilization in the national interest of the Nation's human resources in science, engineering, and technology.

(5) The development and maintenance of a solid base for science and technology in the United States, including: (A) strong participation of and cooperative relationships with State and local governments and the private sector; (B) the maintenance and strengthening of diversified scientific and technological capabilities in government, industry, and the universities, and the encouragement of independent initiatives based on such capabilities, together with elimination of needless barriers to scientific and technological innovation; (C) effective management and dissemination of scientific and technological information; (D) establishment of essential scientific, technical and industrial standards and measurement and test methods; and (E) promotion of increased public understanding of science and technology.

(6) The recognition that, as changing circumstances require periodic revision and adaptation of this subchapter, the Federal Government is responsible for identifying and interpreting the changes in those circumstances as they occur, and for effecting subsequent changes in this subchapter as appropriate.

Implementation

(b) To implement the policy enunciated in subsection (a) of this section, the Congress declares that:

(1) The Federal Government should maintain central policy planning elements in the executive branch which assist Federal

agencies in (A) identifying public problems and objectives, (B) mobilizing scientific and technological resources for essential national programs, (C) securing appropriate funding for programs so identified, (D) anticipating future concerns to which science and technology can contribute and devising strategies for the conduct of science and technology for such purposes, (E) reviewing systematically Federal science policy and programs and recommending legislative amendment thereof when needed. Such elements should include an advisory mechanism within the Executive Office of the President so that the Chief Executive may have available independent, expert judgment and assistance on policy matters which require accurate assessments of the complex scientific and technological features involved.

(2) It is a responsibility of the Federal Government to promote prompt, effective, reliable, and systematic transfer of scientific and technological information by such appropriate methods as programs conducted by nongovernmental organizations, including industrial groups and technical societies. In particular, it is recognized as a responsibility of the Federal Government not only to coordinate and unify its own science and technology information systems, but to facilitate the close coupling of institutional scientific research with commercial application of the useful findings of science.

(3) It is further an appropriate Federal function to support scientific and technological efforts which are expected to provide results beneficial to the public but which the private sector may be unwilling or unable to support.

(4) Scientific and technological activities which may be properly supported exclusively by the Federal Government should be distinguished from those in which interests are shared with State and local governments and the private sector. Among these entities, cooperative relationships should be established which encourage the appropriate sharing of science and technology decision-making, funding support, and program planning and execution.

(5) The Federal Government should support and utilize engineering and its various disciplines and make maximum use of the engineering community, whenever appropriate, as an essential element in the Federal policymaking process.

(6) Comprehensive legislative support for the national science and technology effort requires that the Congress be regularly informed of the condition, health and vitality, and funding requirements of science and technology, the relation of science and technology to changing national goals, and the need for legislative modification of the Federal endeavor and structure at all levels as it relates to science and technology.

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Procedures

(c) The Congress declares that, in order to expedite and facilitate the implementation of the policy enunciated in subsection (a) of this section, the following coordinate procedures are of paramount importance:

(1) Federal procurement policy should encourage the use of science and technology to foster frugal use of materials, energy, and appropriated funds; to assure quality environment; and to enhance product performance.

(2) Explicit criteria, including cost-benefit principles where practicable, should be developed to identify the kinds of applied research and technology programs that are appropriate for Federal funding support and to determine the extent of such support. Particular attention should be given to scientific and technological problems and opportunities offering promise of social advantage that are so long range, geographically wide-spread, or economically diffused that the Federal Government constitutes the appropriate source for undertaking their support.

(3) Federal promotion of science and technology should emphasize quality of research, recognize the singular importance of stability in scientific and technological institutions, and for urgent tasks, seek to assure timeliness of results. With particular reference to Federal support for basic research, funds should be allocated to encourage education in needed disciplines, to provide a base of scientific knowledge from which future essential technological development can be launched, and to add to the cultural heritage of the Nation.

(4) Federal patent policies should be developed, based on uniform principles, which have as their objective the preservation of incentives for technological innovation and the application of procedures which will continue to assure the full use of beneficial technology to serve the public.

(5) Closer relationships should be encouraged among practitioners of different scientific and technological disciplines, including the physical, social, and biomedical fields.

(6) Federal departments, agencies, and instrumentalities should assure efficient management of laboratory facilities and equipment in their custody, including acquisition of effective equipment, disposal of inferior and obsolete properties, and cross-servicing to maximize the productivity of costly property of all kinds. Disposal policies should include attention to possibilities for further productive use.

(7) The full use of the contributions of science and technology to support State and local government goals should be encouraged.

(8) Formal recognition should be accorded those persons whose scientific and technological achievements have contributed significantly to the national welfare.

(9) The Federal Government should support applied scientific research, when appropriate, in proportion to the probability of its usefulness, insofar as this probability can be determined; but while maximizing the beneficial consequences of technology, the Government should act to minimize foreseeable injurious consequences.

(10) Federal departments, agencies, and instrumentalities should establish procedures to insure among them the systematic interchange of scientific data and technological findings developed under their programs.

Pub.L. 94–282, Title I, § 102, May 11, 1976, 90 Stat. 460.

Historical Note

Legislative History. For legislative history and purpose of Pub.L. 94–282, see 1976 U.S.Code Cong. and Adm.News, p. 880.

SUBCHAPTER II—OFFICE OF SCIENCE AND TECHNOLOGY POLICY

§ 6611. Establishment of Office

There is established in the Executive Office of the President an Office of Science and Technology Policy (hereinafter referred to in this subchapter as the "Office").

Pub.L. 94–282, Title II, § 202, May 11, 1976, 90 Stat. 463.

Historical Note

Short Title. Section 201 of Pub.L. 94–282 provided that: "This title [enacting this subchapter] may be cited as the 'Presidential Science and Technology Advisory Organization Act of 1976'."

Legislative History. For legislative history and purpose of Pub.L. 94–282, see 1976 U.S.Code Cong. and Adm.News, p. 880.

Library References

Health and Environment ⇐25.5.

C.J.S. Health and Environment § 61 et seq.

§ 6612. Director; Associate Directors

There shall be at the head of the Office a Director who shall be appointed by the President, by and with the advice and consent of the Senate, and who shall be compensated at the rate provided for level II of the Executive Schedule in section 5313 of Title 5. The President is authorized to appoint not more than four Associate Directors, by and with the advice and consent of the Senate, who shall be compensated at a rate not to exceed that provided for level III of the Executive

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Schedule in section 5314 of such title. Associate Directors shall perform such functions as the Director may prescribe.

Pub.L. 94-282, Title II, § 203, May 11, 1976, 90 Stat. 463.

Historical Note

Legislative History. For legislative history and purpose of Pub.L. 94-282, see 1976 U.S.Code Cong. and Adm.News, p. 880.

§ 6613. Functions of Director

(a) The primary function of the Director is to provide, within the Executive Office of the President, advice on the scientific, engineering, and technological aspects of issues that require attention at the highest levels of Government.

(b) In addition to such other functions and activities as the President may assign, the Director shall—

(1) advise the President of scientific and technological considerations involved in areas of national concern including, but not limited to, the economy, national security, health, foreign relations, the environment, and the technological recovery and use of resources;

(2) evaluate the scale, quality, and effectiveness of the Federal effort in science and technology and advise on appropriate actions;

(3) advise the President on scientific and technological considerations with regard to Federal budgets, assist the Office of Management and Budget with an annual review and analysis of funding proposed for research and development in budgets of all Federal agencies, and aid the Office of Management and Budget and the agencies throughout the budget development process; and

(4) assist the President in providing general leadership and coordination of the research and development programs of the Federal Government.

Pub.L. 94-282, Title II, § 204, May 11, 1976, 90 Stat. 463.

Historical Note

Legislative History. For legislative history and purpose of Pub.L. 94-282, see 1976 U.S.Code Cong. and Adm.News, p. 880.

§ 6614. Policy planning; analysis; advice; establishment of Advisory Panel

(a) The Office shall serve as a source of scientific and technological analysis and judgment for the President with respect to major policies, plans, and programs of the Federal Government. In carrying out the provisions of this section, the Director shall—

(1) seek to define coherent approaches for applying science and technology to critical and emerging national and international problems and for promoting coordination of the scientific and technological responsibilities and programs of the Federal departments and agencies in the resolution of such problems;

(2) assist and advise the President in the preparation of the Science and Technology Report, in accordance with section 6618 of this title;

(3) gather timely and authoritative information concerning significant developments and trends in science, technology, and in national priorities, both current and prospective, to analyze and interpret such information for the purpose of determining whether such developments and trends are likely to affect achievement of the priority goals of the Nation as set forth in section 6601(b) of this title;

(4) encourage the development and maintenance of an adequate data base for human resources in science, engineering, and technology, including the development of appropriate models to forecast future manpower requirements, and assess the impact of major governmental and public programs on human resources and their utilization;

(5) initiate studies and analyses, including systems analyses and technology assessments, of alternatives available for the resolution of critical and emerging national and international problems amenable to the contributions of science and technology and, insofar as possible, determine and compare probable costs, benefits, and impacts of such alternatives;

(6) advise the President on the extent to which the various scientific and technological programs, policies, and activities of the Federal Government are likely to affect the achievement of the priority goals of the Nation as set forth in section 6601(b) of this title;

(7) provide the President with periodic reviews of Federal statutes and administrative regulations of the various departments and agencies which affect research and development activities, both internally and in relation to the private sector, or which may interfere with desirable technological innovation, together with recommendations for their elimination, reform, or updating as appropriate;

(8) develop, review, revise, and recommend criteria for determining scientific and technological activities warranting Federal support, and recommend Federal policies designed to advance (A) the development and maintenance of broadly based scientific and technological capabilities, including human resources, at all levels of government, academia, and industry, and (B) the effective application of such capabilities to national needs;

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(9) assess and advise on policies for international cooperation in science and technology which will advance the national and international objectives of the United States;

(10) identify and assess emerging and future areas in which science and technology can be used effectively in addressing national and international problems;

(11) report at least once each year to the President on the overall activities and accomplishments of the Office, pursuant to section 6618 of this title;

(12) periodically survey the nature and needs of national science and technology policy and make recommendations to the President, for review and transmission to the Congress, for the timely and appropriate revision of such policy in accordance with section 6602(a)(6) of this title; and

(13) perform such other duties and functions and make and furnish such studies and reports thereon, and recommendations with respect to matters of policy and legislation as the President may request.

(b)(1) The Director shall establish an Intergovernmental Science, Engineering, and Technology Advisory Panel (hereinafter referred to as the "Panel"), whose purpose shall be to (A) identify and define civilian problems at State, regional, and local levels which science, engineering, and technology may assist in resolving or ameliorating; (B) recommend priorities for addressing such problems; and (C) advise and assist the Director in identifying and fostering policies to facilitate the transfer and utilization of research and development results so as to maximize their application to civilian needs.

(2) The Panel shall be composed of (A) the Director of the Office, or his representative; (B) at least ten members representing the interests of the States, appointed by the Director of the Office after consultation with State officials; and (C) the Director of the National Science Foundation, or his representative.

(3)(A) The Director of the Office, or his representative, shall serve as Chairman of the Panel.

(B) The Panel shall perform such functions as the Chairman may prescribe, and shall meet at the call of the Chairman.

(4) Each member of the Panel shall, while serving on business of the Panel, be entitled to receive compensation at a rate not to exceed the daily rate prescribed for GS-18 of the General Schedule under section 5332 of Title 5, including traveltime, and, while so serving away from his home or regular place of business, he may be allowed travel expenses, including per diem in lieu of subsistence in the same manner as the expenses authorized by section 5703(b) of Title 5 for persons in government service employed intermittently.

Pub.L. 94-282, Title II, § 205, May 11, 1976, 90 Stat. 464.

Historical Note

Legislative History. For legislative history and purpose of Pub.L. 94-282, see 1976 U.S.Code Cong. and Adm.News, p. 880.

§ 6615. Five-year outlook

Identification and description of situations and conditions warranting special attention

(a) Within its first year of operation, the Office shall, to the extent practicable, within the limitations of available knowledge and resources, and with appropriate assistance from the departments and agencies and such consultants and contractors as the Director deems necessary, identify and describe situations and conditions which warrant special attention within the next five years, involving—

(1) current and emerging problems of national significance that are identified through scientific research, or in which scientific or technical considerations are of major significance; and

(2) opportunities for, and constraints on, the use of new and existing scientific and technological capabilities which can make a significant contribution to the resolution of problems identified under paragraph (1) of this subsection or to the achievement of Federal program objectives or national goals, including those set forth in section 6601(b) of this title.

Annual revision

(b) The Office shall annually revise the five-year outlook developed under subsection (a) of this section so that it takes account of new problems, constraints and opportunities and changing national goals and circumstances, and shall extend the outlook so that it always extends five years into the future.

Consultation with officials of departments and agencies having related programs and responsibilities

(c) The Director of the Office shall consult as necessary with officials of the departments and agencies having programs and responsibilities relating to the problems, constraints, and opportunities identified under subsections (a) and (b) of this section, in order to—

(1) identify and evaluate alternative actions that might be taken by the Federal Government, State and local governments, or the private sector to deal with such problems, constraints, or opportunities; and

(2) ensure that alternative actions identified under paragraph (1) of this subsection are fully considered by departments and agencies in formulating their budget, program, and legislative proposals.

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Consultation with officials of Office of Management and Budget and other appropriate elements of Executive Office of President

(d) The Director of the Office shall consult as necessary with officials of the Office of Management and Budget and other appropriate elements of the Executive Office of the President to ensure that the problems, constraints, opportunities, and alternative actions identified under subsections (a), (b), and (c) of this section are fully considered in the development of the President's budgets and legislative programs.

Pub.L. 94–282, Title II, § 206, May 11, 1976, 90 Stat. 466.

Historical Note

Legislative History. For legislative history and purpose of Pub.L. 94–282, see 1976 U.S.Code Cong. and Adm.News, p. 880.

§ 6616. Additional functions of Director

Service as Chairman of Federal Coordinating Council for Science, Engineering, and Technology and as member of Domestic Council

(a) The director shall, in addition to the other duties and functions set forth in this subchapter—

(1) serve as Chairman of the Federal Coordinating Council for Science, Engineering, and Technology established under subchapter IV of this chapter; and

(2) serve as a member of the Domestic Council.

Advice to National Security Council

(b) For the purpose of assuring the optimum contribution of science and technology to the national security, the Director, at the request of the National Security Council, shall advise the National Security Council in such matters concerning science and technology as relate to national security.

Officers and employees; services; contracts; payments

(c) In carrying out his functions under this chapter, the Director is authorized to—

(1) appoint such officers and employees as he may deem necessary to perform the functions now or hereafter vested in him and to prescribe their duties;

(2) obtain services as authorized by section 3109 of Title 5, at rates not to exceed the rate prescribed for grade GS–18 of the General Schedule by section 5332 of Title 5; and

(3) enter into contracts and other arrangements for studies, analyses, and other services with public agencies and with private persons, organizations, or institutions, and make such payments

as he deems necessary to carry out the provisions of this chapter without legal consideration, without performance bonds, and without regard to section 5 of Title 41.

Pub.L. 94–282, Title II, § 207, May 11, 1976, 90 Stat. 466.

Historical Note

Legislative History. For legislative history and purpose of Pub.L. 94–282, see 1976 U.S.Code Cong. and Adm.News, p. 880.

§ 6617. Coordination with other organizations

Consultation and cooperation with Federal departments and agencies; utilization of consultants; establishment of advisory panels; consultation with State and local agencies, professional groups, and representatives of industry, etc.; hearings; utilization of services, personnel, equipment, etc., of public and private agencies and organizations, and individuals

(a) In exercising his functions under this chapter, the Director shall—

(1) work in close consultation and cooperation with the Domestic Council, the National Security Council, the Council on Environmental Quality, the Council of Economic Advisers, the Office of Management and Budget, the National Science Board, and the Federal departments and agencies;

(2) utilize the services of consultants, establish such advisory panels, and, to the extent practicable, consult with State and local governmental agencies, with appropriate professional groups, and with such representatives of industry, the universities, agriculture, labor, consumers, conservation organizations, and such other public interest groups, organizations, and individuals as he deems advisable;

(3) hold such hearings in various parts of the Nation as he deems necessary, to determine the views of the agencies, groups, and organizations referred to in paragraph (2) of this subsection and of the general public, concerning national needs and trends in science and technology; and

(4) utilize with their consent to the fullest extent possible the services, personnel, equipment, facilities, and information (including statistical information) of public and private agencies and organizations, and individuals, in order to avoid duplication of effort and expense, and may transfer funds made available pursuant to this chapter to other Federal agencies as reimbursement for the utilization of such personnel, services, facilities, equipment, and information.

Information from Executive departments, agencies, and instrumentalities

(b) Each department, agency, and instrumentality of the Executive Branch of the Government, including any independent agency, is au-

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thorized to furnish the Director such information as the Director deems necessary to carry out his functions under this chapter.

Assistance from Administrator of National Aeronautics and Space Administration

(c) Upon request, the Administrator of the National Aeronautics and Space Administration is authorized to assist the Director with respect to carrying out his activities conducted under paragraph (5) of section 6614(a) of this title.

Pub.L. 94–282, Title II, § 208, May 11, 1978, 90 Stat. 467.

Historical Note

Legislative History. For legislative history and purpose of Pub.L. 94–282, see 1976 U.S.Code Cong. and Adm.News, p. 880.

§ 6618. Science and technology report

Transmittal to Congress; preparation; issues discussed

(a) The President shall transmit annually to the Congress, beginning February 15, 1978, a Science and Technology Report (hereinafter referred to as the "Report") which shall be prepared by the Office, with appropriate assistance from Federal departments and agencies and such consultants and contractors as the Director deems necessary. The report shall draw upon the information prepared by the Director pursuant to section 6615 of this title, and to the extent practicable, within the limitations of available knowledge and resources, discuss such issues as—

(1) a review of developments of national significance in science and technology;

(2) the significant effects of current and projected trends in science and technology on the social, economic, and other requirements of the Nation;

(3) a review and appraisal of selected science- and technology-related programs, policies, and activities of the Federal Government;

(4) an inventory and forecast of critical and emerging national problems the resolution of which might be substantially assisted by the application of science and technology;

(5) the identification and assessment of scientific and technological measures that can contribute to the resolution of such problems, in light of the related social, economic, political, and institutional considerations;

(6) the existing and projected scientific and technological resources, including specialized manpower, that could contribute to the resolution of such problems; and

(7) recommendations for legislation on science- and technology-related programs and policies that will contribute to the resolution of such problems.

Use of relevant data available from National Science Foundation and other Government departments and agencies

(b) In preparing the Report under subsection (a) of this section, the Office shall make maximum use of relevant data available from the National Science Foundation and other Government departments and agencies.

Availability as public document

(c) The Director shall insure that the Report, in the form approved by the President, is printed and made available as a public document.

Pub.L. 94–282, Title II, § 209, May 11, 1976, 90 Stat. 468.

Historical Note

Legislative History. For legislative history and purpose of Pub.L. 94–282, see 1976 U.S.Code Cong. and Adm.News, p. 880.

SUBCHAPTER III—PRESIDENT'S COMMITTEE ON SCIENCE AND TECHNOLOGY

§ 6631. Establishment of Committee

The President shall establish within the Executive Office of the President a President's Committee on Science and Technology (hereinafter referred to as the "Committee").

Pub.L. 94–282, Title III, § 301, May 11, 1976, 90 Stat. 468.

Historical Note

Legislative History. For legislative history and purpose of Pub.L. 94–282, see 1976 U.S.Code Cong. and Adm.News, p. 880.

Library References

Health and Environment ⇐25.5. C.J.S. Health and Environment § 61 et seq.

§ 6632. Membership of Committee

Composition; appointment

(a) The Committee shall consist of—

(1) the Director of the Office of Science and Technology Policy established under subchapter II of this chapter; and

(2) not less than eight nor more than fourteen other members appointed by the President not more than sixty days after the Director has assumed office (as provided in section 6612 of this title).

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Qualifications

(b) Members of the Committee appointed by the President pursuant to subsection (a)(2) of this section shall—

(1) be qualified and distinguished in one or more of the following areas; science, engineering, technology, information dissemination, education, management, labor, or public affairs;

(2) be capable of critically assessing the policies, priorities, programs, and activities of the Nation, with respect to the findings, policies, and purposes set forth in subchapter I of this chapter; and

(3) shall collectively constitute a balanced composition with respect to (A) fields of science and engineering, (B) academic, industrial, and government experience, and (C) business, labor, consumer, and public interest points of view.

Chairman; Vice Chairman

(c) The President shall appoint one member of the Committee to serve as Chairman and another member to serve as Vice Chairman for such periods as the President may determine.

Compensation

(d) Each member of the Committee who is not an officer of the Federal Government shall, while serving on business of the Committee, be entitled to receive compensation at a rate not to exceed the daily rate prescribed for GS-18 of the General Schedule under section 5332 of Title 5, including traveltime, and while so serving away from his home or regular place of business he may be allowed travel expenses, including per diem in lieu of subsistence, in the same manner as the expenses authorized by section 5703(b) of Title 5 for persons in Government service employed intermittently.

Pub.L. 94-282, Title III, § 302, May 11, 1976, 90 Stat. 468.

Historical Note

Legislative History. For legislative history and purpose of Pub.L. 94-282, see 1976 U.S.Code Cong. and Adm.News, p. 880.

§ 6633. Federal science, engineering, and technology survey; reports

(a) The Committee shall survey, examine, and analyze the overall context of the Federal science, engineering, and technology effort including missions, goals, personnel, funding, organization, facilities, and activities in general, taking adequate account of the interests of individuals and groups that may be affected by Federal scientific, engineering, and technical programs, including, as appropriate, consultation with such individuals and groups. In carrying out its functions

under this section, the Committee shall, among other things, consider needs for—

(1) organizational reform, including institutional realinement designed to place Federal agencies whose missions are primarily or solely devoted to scientific and technological research and development, and those agencies primarily or solely concerned with fuels, energy, and materials, within a single cabinet-level department;

(2) improvements in existing systems for handling scientific and technical information of a Government-wide basis, including consideration of the appropriate role to be played by the private sector in the dissemination of such information;

(3) improved technology assessment in the executive branch of the Federal Government;

(4) improved methods for effecting technology innovation, transfer, and use;

(5) stimulating more effective Federal-State and Federal-industry liaison and cooperation in science and technology, including the formation of Federal-State mechanisms for the mutual pursuit of this goal;

(6) reduction and simplification of Federal regulations and administrative practices and procedures which may have the effect of retarding technological innovation or opportunities for its utilization;

(7) a broader base for support of basic research;

(8) ways of strengthening the Nation's academic institutions' capabilities for research and education in science and technology;

(9) ways and means of effectively integrating scientific and technological factors into our national and international policies;

(10) technology designed to meet community and individual needs;

(11) maintenance of adequate scientific and technological manpower with regard to both quality and quantity;

(12) improved systems for planning and analysis of the Federal science and technology programs; and

(13) long-range study, analysis, and planning in regard to the application of science and technology to major national problems or concerns.

(b)(1) Within twelve months from the time the Committee is activated in accordance with section 6632(a) of this title, the Committee shall issue an interim report of its activities and operations to date. Not more than twenty-four months from the time the Committee is activated, the Committee shall submit a final report of its activities, findings, conclusions, and recommendations, including such supporting data and material as may be necessary, to the President.

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(2) The President, within sixty days of receipt thereof, shall transmit each such report to each House of Congress together with such comments, observations, and recommendations thereon as he deems appropriate.

Pub.L. 94–282, Title III, § 303, May 11, 1976, 90 Stat. 469.

Historical Note

Legislative History. For legislative history and purpose of Pub.L. 94–282, see 1976 U.S.Code Cong. and Adm.News, p. 880.

§ 6634. Continuation of Committee

(a) Ninety days after submission of the final report prepared under section 6633 of this title, the Committee shall cease to exist, unless the President, before the expiration of the ninety-day period, makes a determination that it is advantageous for the Committee to continue in being.

(b) If the President determines that it is advantageous for the Committee to continue in being, (1) the Committee shall exercise such functions as are prescribed by the President; and (2) the members of the Committee shall serve at the pleasure of the President.

Pub.L. 94–282, Title III, § 304, May 11, 1976, 90 Stat. 470.

Historical Note

Legislative History. For legislative history and purpose of Pub.L. 94–282, see 1976 U.S.Code Cong. and Adm.News, p. 880.

§ 6635. Staff and consultant support

(a) In the performance of its functions under sections 6633 and 6634 of this title, the Committee is authorized—

(1) to select, appoint, employ, and fix the compensation of such specialists and other experts as may be necessary for the carrying out of its duties and functions, and to select, appoint, and employ, subject to the civil service laws, such other officers and employees as may be necessary for carrying out its duties and functions; and

(2) to provide for participation of such civilian and military personnel as may be detailed to the Committee pursuant to subsection (b) of this section for carrying out the functions of the Committee.

(b) Upon request of the Committee, the head of any Federal department, agency, or instrumentality is authorized (1) to furnish to the Committee such information as may be necessary for carrying out its functions and as may be available to or procurable by such department, agency, or instrumentality, and (2) to detail to temporary duty with the Committee on a reimbursable basis such personnel within his

administrative jurisdiction as it may need or believe to be useful for carrying out its functions. Each such detail shall be without loss of seniority, pay, or other employee status, to civilian employees so detailed, and without loss of status, rank, office, or grade, or of any emolument, perquisite, right, privilege, or benefit incident thereto to military personnel so detailed. Each such detail shall be made pursuant to an agreement between the Chairman and the head of the relevant department, agency, or instrumentality, and shall be in accordance with the provisions of subchapter III of chapter 33 of Title 5.

Pub.L. 94–282, Title III, § 305, May 11, 1976, 90 Stat. 470.

Historical Note

Legislative History. For legislative history and purpose of Pub.L. 94–282, see 1976 U.S.Code Cong. and Adm.News, p. 880.

SUBCHAPTER IV—FEDERAL COORDINATING COUNCIL FOR SCIENCE, ENGINEERING, AND TECHNOLOGY

§ 6651. Establishment, membership, and functions of Council

Establishment

(a) There is established the Federal Coordinating Council for Science, Engineering, and Technology (hereinafter referred to as the "Council").

Composition

(b) The Council shall be composed of the Director of the Office of Science and Technology Policy and one representative of each of the following Federal agencies: Department of Agriculture, Department of Commerce, Department of Defense, Department of Health, Education, and Welfare, Department of Housing and Urban Development, Department of the Interior, Department of State, Department of Transportation, Veterans' Administration, National Aeronautics and Space Administration, National Science Foundation, Environmental Protection Agency, and Energy Research and Development Administration. Each such representative shall be an official of policy rank designated by the head of the Federal agency concerned.

Chairman

(c) The Director of the Office of Science and Technology Policy shall serve as Chairman of the Council. The Chairman may designate another member of the Council to act temporarily in the Chairman's absence as Chairman.

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Participation of unnamed Federal agencies in meetings; invitations to attend meetings

(d) The Chairman may (1) request the head of any Federal agency not named in subsection (b) of this section to designate a representative to participate in meetings or parts of meetings of the Council concerned with matters of substantial interest to such agency, and (2) invite other persons to attend meetings of the Council.

Consideration of problems and developments affecting more than one Federal agency; recommendations

(e) The Council shall consider problems and developments in the fields of science, engineering, and technology and related activities affecting more than one Federal agency, and shall recommend policies and other measures designed to—

(1) provide more effective planning and administration of Federal scientific, engineering, and technological programs,

(2) identify research needs including areas requiring additional emphasis,

(3) achieve more effective utilization of the scientific, engineering, and technological resources and facilities of Federal agencies, including the elimination of unwarranted duplication, and

(4) further international cooperation in science, engineering, and technology.

Other advisory duties

(f) The Council shall perform such other related advisory duties as shall be assigned by the President or by the Chairman.

Assistance to Council by agency represented thereon

(g) For the purpose of carrying out the provisions of this section, each Federal agency represented on the Council shall furnish necessary assistance to the Council. Such assistance may include—

(1) detailing employees to the Council to perform such functions, consistent with the purposes of this section, as the Chairman may assign to them, and

(2) undertaking, upon request of the Chairman, such special studies for the Council as come within the functions herein assigned.

Establishment of subcommittees and panels

(h) For the purpose of conducting studies and making reports as directed by the Chairman, standing subcommittees and panels of the Council may be established.

Pub.L. 94-282, Title IV, § 401, May 11, 1976, 90 Stat. 471.

Historical Note

Legislative History. For legislative history and purpose of Pub.L. 94–282, see 1976 U.S.Code Cong. and Adm.News, p. 880.

Library References

Health and Environment ⇐25.5. C.J.S. Health and Environment § 61 et seq.

SUBCHAPTER V—GENERAL PROVISIONS

§ 6671. Authorization of appropriations

(a) For the purpose of carrying out subchapter II of this chapter, there are authorized to be appropriated—

(1) $750,000 for the fiscal year ending June 30, 1976;

(2) $500,000 for the period beginning July 1, 1976, and ending September 30, 1976;

(3) $3,000,000 for the fiscal year ending September 30, 1977; and

(4) such sums as may be necessary for each of the succeeding fiscal years.

(b) For the purpose of carrying out subchapter III of this chapter, there are authorized to be appropriated—

(1) $750,000 for the fiscal year ending June 30, 1976;

(2) $500,000 for the period beginning July 1, 1976, and ending September 30, 1976;

(3) $1,000,000 for the fiscal year ending September 30, 1977; and

(4) such sums as may be necessary for each of the succeeding fiscal years.

Pub.L. 94–282, Title V, § 501, May 11, 1976, 90 Stat. 472.

Historical Note

Legislative History. For legislative history and purpose of Pub.L. 94–282, see 1976 U.S.Code Cong. and Adm.News, p. 880.

Library References

Health and Environment ⇐25.5. C.J.S. Health and Environment § 61 et seq

States military personnel stationed in Panama and should notify the Government of Panama of the intention of the United States to suspend, should it prove to be required by the supreme national security interests of the United States, the operation of any provision of the Panama Canal Treaties of 1978 mandating the withdrawal of United States military personnel or the closure of any United States military base protecting the Panama Canal.".

CHAFEE AMENDMENT NO. 1626

Mr. CHAFEE proposed an amendment to the bill S. 1721, supra; as follows:

On page 16, after the period on line 19 (in section 2 of the bill, subsection 503(c)(4)) add the following new sentence at the end of the subsection:

"Any information provided by the President pursuant to this subsection shall be subject to the provisions of S. Res. 400, 94th Congress, and to Rule XLVII of the Rules of the House of Representatives, and may be subsequently disclosed by the recipients only in accordance with the applicable provisions of such Resolution or Rule."

DEPARTMENT OF ENERGY NATIONAL LABORATORY COOPERATIVE RESEARCH INITIATIVES ACT

DOMENICI (AND OTHERS) AMENDMENT NO. 1627

(Ordered referred to the Committee on Energy and Natural Resources.)

Mr. DOMENICI (for himself, Mr. MCCLURE, and Mr. BINGAMAN) submitted an amendment intended to be proposed by him to the bill (S. 1480) to improve the integration of universities and private industry into the National Laboratory system of the Department of Energy in order to speed the development of technology in areas of significant economic potential; as follows:

Strike out all after the enacting clause and insert in lieu thereof the following:

SECTION 1. SHORT TITLE.

This Act may be cited as the "Department of Energy National Laboratory Cooperative Research Initiatives Act".

SEC. 2. DEFINITIONS.

For purposes of this Act—

(1) The term "National Laboratory" means—

(A) Lawrence-Livermore National Laboratory;

(B) Lawrence-Berkeley Laboratory;

(C) Los Alamos National Laboratory;

(D) Sandia National Laboratory;

(E) FERMI National Accelerator Laboratory;

(F) Princeton Plasma Physics Laboratory;

(G) Idaho National Engineering Laboratory;

(H) Argonne National Laboratory;

(I) Brookhaven National Laboratory;

(J) Oak Ridge National Laboratory;

(K) Pacific Northwest Laboratory;

(L) Ames Laboratory; and

(M) Stanford Linear Accelerator Center.

Such term does not include Naval Nuclear Propulsion Reactor Laboratories, their contractors or subcontractors performing work covered under Executive Order 12344, as codified in section 7158 of title 4, United States Code.

(2) The term "Federal agency" means any executive agency as defined in section 105 of title 5, United States Code, and the military departments defined by section 102 of title 5, United States Code.

(3) The term "contract" means any contract, grant, or cooperative agreement as those terms are used in sections 6303, 6304, and 6305 of title 31, United States Code, entered into between any Federal agency and any contractor for the performance of experimental, developmental, or research work funded in whole or in part by the Federal Government. Such term includes any assignment, substitution of parties, or subcontract of any type entered into for the performance of experimental, developmental, or research work under a contract.

(4) The term "cooperative research and development agreement" means any agreement as defined in section 11 of the Stevenson-Wydler Technology Innovation Act of 1980 (15 U.S.C. 3710a (d)(1)).

(5) The term "funding agreement" means any contract, grant, or cooperative agreement entered into between the Secretary of Energy and a contractor operating a National Laboratory of the Department of Energy that provides for such contractor to perform research and development at such National Laboratory.

TITLE I—THE DEPARTMENT OF ENERGY NATIONAL LABORATORIES CENTERS FOR RESEARCH ON ENABLING TECHNOLOGIES FOR HIGH TEMPERATURE SUPERCONDUCTING APPLICATIONS

SEC. 101. FINDINGS.

The Congress finds that—

(1) the Department of Energy has conducted extensive research in superconducting materials to support its programmatic activities in High Energy Physics, Magnetic Fusion Energy, Energy Storage Systems, Electric Energy Systems, and Energy Conservation pursuant to the Federal Nonnuclear Energy Research and Development Act of 1974 (Public Law 93-577), the Energy Reorganization Act of 1974 (Public Law 93-483), and the Department of Energy Organization Act (Public Law 95-91);

(2) recent developments in high-temperature superconducting materials hold great promise for highly efficient energy storage and transmission, medical diagnostics, magnets for physics research and fusion reactors, and smaller supercomputers;

(3) the United States is a world leader in basic research on high-temperature superconducting materials, and programs supporting this research at the National Science Foundation and the Department of Energy should be maintained and strengthened;

(4) international interest in the commercialization of high-temperature superconducting materials is high and the key to success lies in the rapid development of these materials and the identification of applications; and

(5) the National Laboratories of the Department of Energy have demonstrated expertise in superconductivity research and a proven record in research in enabling technologies which can benefit industrial efforts in product development.

SEC. 102. PURPOSES.

The purposes of this title are—

(1) to research critical enabling technologies to assist United States industry in the commercialization of high-temperature superconductors;

(2) to provide national organization and coordination in research, development, and commercialization of high-temperature superconductors; and

(3) to encourage private industry, university, and Department of Energy National Laboratory interaction through Centers for Research on Enabling Technologies at the National Laboratories.

SEC. 103. ESTABLISHMENT OF THE SUPERCONDUCTOR RESEARCH INITIATIVE.

The Secretary of Energy shall initiate and carry out a cooperative program of research on enabling superconductor technology and on the practical applications of superconductor technology (hereafter in this title referred to as the "Superconductor Research Initiative").

SEC. 104. PARTICIPATION OF NATIONAL LABORATORIES OF THE DEPARTMENT OF ENERGY.

(a) MISSIONS OF NATIONAL LABORATORIES.—The Secretary of Energy shall ensure that the National Laboratories of the Department of Energy participate in the Superconductor Research Initiative, to the extent that such participation does not detract from the primary mission of the National Laboratory.

(b) AGREEMENTS.—The Secretary of Energy may enter into agreements with other Federal agencies, with United States private industrial or research organizations, consortias, or with any college or university as necessary to provide for the active participation of the National Laboratories of the Department of Energy in the Superconductor Research Initiative.

(c) REQUIRED PROVISIONS.—The Superconductor Research Initiative shall include provisions for one or more National Laboratories of the Department of Energy to conduct research and development activities relating to research on high-temperature superconductivity. Such activities may include research and development in associated technologies including thin film and bulk ceramic synthesis and processing and the characterization of physical, chemical, and structural properties in materials.

SEC. 105. FORMATION OF COUNCIL AND CENTERS FOR RESEARCH ON ENABLING TECHNOLOGIES.

(a) COUNCIL.—The Secretary of Energy shall form a council to be known as the "Council for Research on Enabling Technologies" (hereafter in this title referred to as the "Council") which shall be composed of representatives of appropriate government agencies, universities, and industries, to provide guidance in setting goals and strategies for the timely research on critical enabling technologies in high-temperature superconductors. The Council shall set guidelines for the release of technical findings and developments made by the cooperative research centers established pursuant to subsection (b).

(b) COOPERATIVE RESEARCH CENTERS.—(1) The Secretary of Energy shall establish cooperative research centers in enabling technology for superconducting materials and applications (hereafter in this title referred to as "centers") at National Laboratories with appropriate university and private industry participants.

(2) The centers shall be located at National Laboratories which demonstrate expertise in—

(A) superconductive research; and

(B) research in associated technologies including—

(i) thin film and bulk ceramic synthesis and processing; and

(ii) characterization of physical, chemical, and structural properties in materials.

SEC. 106. PERSONNEL EXCHANGES.

The Superconductor Research Initiative shall include provisions for temporary exchanges of personnel between any domestic firm or university referred to in this title and the National Laboratories of the Department of Energy that are participating in the Superconductor Research Initiative. The exchange of personnel shall be subject to such restrictions, limitations, terms and conditions as the Secretary of Energy considers necessary in the interest of national security.

SEC. 107. OTHER DEPARTMENT OF ENERGY RESOURCES.

(a) AVAILABILITY OF RESOURCES.—The Secretary of Energy shall make available to other departments or agencies of the Federal Government, and to any participant in research and development projects under the Superconductor Research Initiative, any facilities, personnel, equipment, services, and other resources of the Department of Energy for the purpose of conducting research and development projects under the Superconductor Research Initiative consistent with section 104.

(b) REIMBURSEMENT.—The Secretary may make facilities available under this section only to the extent that the cost of the use of such facilities is reimbursed by the user.

SEC. 108. BUDGETING FOR SUPERCONDUCTIVITY RESEARCH.

The Secretary of Energy, in preparing the research and development budget of the Department of Energy to be included in the annual budget submitted to the Congress by the President under section 1105(a) of title 31, United States Code, shall provide for programs, projects, and activities that encourage the development of new technology in the field of superconductivity.

SEC. 109. COST-SHARING AGREEMENTS.

(a) PERMITTED PROVISIONS.—The director of each National Laboratory of the Department of Energy that is participating in the Superconductor Research Initiative or the contractor operating any such National Laboratory may include in any cooperative research and development agreement entered into with a domestic firm, or university in conjunction with the Superconductor Research Initiative, a cooperative provision for the domestic firm or university to pay a portion of the cost of the research and development activities.

(b) LIMITATIONS.—(1) An amount equal to not more than 10 percent of any National Laboratory's annual budget shall be received from nonappropriated funds derived from contracts entered into under the Superconductor Research Initiative in any fiscal year except to the extent approved in advance by the Secretary of Energy.

(2) No Department of Energy National Laboratory may receive more than $10,000,000 of nonappropriated funds under any cooperative research and development agreement entered into under this subsection in connection with the Superconductor Research Initiative except to the extent approved in advance by the Secretary of Energy.

SEC. 110. DEPARTMENT OF ENERGY OVERSIGHT OF COOPERATIVE AGREEMENTS RELATING TO THE SUPERCONDUCTOR RESEARCH INITIATIVE.

(a) PROVISIONS RELATING TO DISAPPROVAL AND MODIFICATION OF AGREEMENTS.—(1) The Secretary of Energy or his designee may review a cooperative research and development agreement for the purpose of disapproving or requiring the modification of the cooperative research and development agreement if the agreement exceeds $1,000,000. If the Secretary notifies the parties to the agreement of his intent to review the agreement, the agreement shall provide a 30-day period within which the agreement may be disapproved or modified beginning on the date the agreement is submitted to the Secretary.

(2) In any case in which the Secretary of Energy or his designee disapproves or requires the modification of any agreement presented under this section, the Secretary of Energy or such designee shall transmit a written explanation of such disapproval or modification to the head of the laboratory concerned.

(b) RECORD OF AGREEMENT.—Each National Laboratory shall maintain a record of all agreements entered into under this section.

SEC. 111. AVOIDANCE OF DUPLICATION.

In carrying out the Superconductor Research Initiative, the Secretary of Energy shall ensure that unnecessarily duplicative research is not performed at the research facilities (including the National Laboratories of the Department of Energy) that are participating in the Superconductor Research Initiative.

SEC. 112. INTERNAL REVENUE CODE TREATMENT.

(a) TAX EXEMPTIONS.—Any cooperative agreement, association, or consortium established by the Department of Energy or the National Laboratories of the Department of Energy, which is consistent with the purposes of this title, shall be treated as an organization described in section 501(c)(3) of the Internal Revenue Code of 1986 and exempt from tax under section 501(a) of such Code with respect to activities authorized by this title.

(b) BASIC RESEARCH PAYMENTS.—Any amounts transferred to an organization described in subsection (a) by a participating member of such an organization shall be taken into account as basic research payments for purposes of section 41(a)(2) of such Code.

(c) CAPITAL GAINS TREATMENT.—

(1) No gain or loss shall be recognized in connection with the transfer pursuant to this title of any patent, copyright, trademark, trade secret, mask work, or other intellectual property by or between an organization described in subsection (a) and any participating member of such an organization.

(2) If property is received in a transfer described in paragraph (1), the basis of the property in the hands of the transferee shall be the same as it would be in the hands of the transferor.

SEC. 113. ANTITRUST TREATMENT.

Any cooperative agreement, association, or consortia created by the Department of Energy or the National Laboratories of the Department of Energy pursuant to the provisions of this title, shall be considered a joint research and development venture within the meaning of section 2(a)(6) of the National Cooperative Research Act of 1984 (15 U.S.C. 4301 et seq.), for purposes of such Act.

TITLE II—HUMAN GENOME INITIATIVE

SEC. 201. FINDINGS.

The Congress finds that—

(1) knowledge relating to the location and sequences of genes on human chromosomes and those of other organisms will enable more rapid elucidation of the basis for development processes and for human disease;

(2) the comprehensive understanding of human genetic makeup, and the genetics of other organisms, will enhance our ability to develop methods for the prevention and treatment of disease states;

(3) the health and well-being of our Nation depends on the medical breakthroughs in hereditary diseases, cancer, cardiovascular disease, acquired immunodeficiency syndrome, and the aging process that could follow from the mapping and eventually sequencing our human genetic structure, known as the human genome;

(4) the knowledge gained, as well as the countless applications derived from this knowledge, will be very economically important to the Nation that assembles these important biomedical tools;

(5) advances in biomedical research and technology development already have accelerated efforts to localize genes to specific chromosomes;

(6) the Department of Energy has conducted extensive research on the human health consequences of nuclear and nonnuclear energy technologies including the consequences for human genetic material, pursuant to the Federal Nonnuclear Energy Research and Development Act of 1974 (Public Law 93-438), and the Department of Energy Organization Act (Public Law 95-91);

(7) it is a compatible and essential part of the mission of the Department of Energy's National Laboratories to participate in research and technology development projects related to mapping and sequencing of the human genome;

(8) the Secretary of Energy should augment and accelerate the ongoing genetic science research of the Department of Energy;

(9) several other Federal agencies—including National Institutes of Health and the National Science Foundation—are presently funding research related to the mapping and sequencing of genes, or the development of new technologies and instruments for this research;

(10) in order to most efficiently expend research funds, and to most expeditiously advance our understanding of human genetics, it is essential that the agencies involved coordinate their research efforts; and

(11) in order to enhance the competitiveness of the United States biotechnology industry, the transfer of knowledge and technological capability derived from this research must flow more quickly and smoothly from government supported laboratories to private, commercial applications.

SEC. 202. NATIONAL ADVISORY PANEL ON THE HUMAN GENOME.

(a) PURPOSE.—The purpose of this section is to establish a National Advisory Panel on the Human Genome that shall coordinate—

(1) national activities to ensure the construction of maps of human chromosomes and DNA of other organisms to be used as powerful research tools for biomedical research;

(2) the development of new tools to analyze DNA, in cooperation with philanthropic organizations, companies, and other private sector interests; and

(3) the development of plans to enhance the transfer of knowledge and technology developed and derived from national genome research efforts to commercial applications by United States companies.

(b) ESTABLISHMENT.—There is established a National Advisory Panel on the Human Genome (hereafter referred to in this title as the "Panel") to advise Congress and the President on matters concerning the mapping and sequencing of the human genome.

(c) MEMBERSHIP.—The Panel shall consist of the following individuals or the designees of such individuals—

(1) the Secretary of Energy;

(2) the Director of the National Institutes of Health;

(3) the Director of the National Science Foundation;

(4) the Director of the National Library of Medicine;

(5) four individuals representing private industry, to be appointed by the President, after consultation with relevant industrial groups, with members appointed within 90 days after the date of enactment of this Act;

(6) four individuals representing the university research community, to be appointed by the President from a pool of applicants to be recommended by the National Academy of Sciences, with members appointed within 90 days after the date of enactment of this Act;

(7) one individual with expertise in biomedical ethics, to be appointed by the President from a pool of applicants to be recommended by the National Academy of Sciences, with such member being appointed within 90 days after the date of enactment of this Act; and

(8) one individual representing national foundations, medical institutes, and other philanthropic organizations involved in biomedical research, to be appointed by the President from a pool of applicants to be recommended by the National Academy of Sciences, with such a member being appointed within 90 days after the date of enactment of this Act.

(d) CHAIRMEN.—The Panel shall be cochaired by the Secretary of Energy and the Director of the National Institutes of Health or the designees of the Secretary and Director.

(e) FUNCTIONS.—The Panel shall—

(1) identify the optimal national strategy for mapping and sequencing the human genome utilizing for guidance information and recommendations from previous reports, including those of the Office of Technology Assessment and the National Academy of Sciences;

(2) determine research and development goals that will ensure United States leadership in human genome research;

(3) establish standards for the collection and storage of data and materials;

(4) assess the capability of existing common research resources, such as materials repositories and databases, and the need to enhance or expand such resources;

(5) monitor relevant research programs supported by Federal agencies and private funding sources;

(6) identify commercial opportunities arising from national research programs, and methods for improving the flow of knowledge and technological capability derived from this research to private companies for commercial use, primarily by United States companies;

(7) examine the usefulness of establishing cooperative agreements, associations, or consortia between government, university and private sector researchers to enhance human genome research efforts and technology transfer;

(8) evaluate methods of assuring that small businesses are able to contribute to genome development efforts and participate in commercial development of genome research;

(9) oversee interagency cooperation through datasharing, joint sponsorship of meetings, joint funding of research resources, and communication of annual budget plans;

(10) assess the needs, benefits, and risks of international cooperation in mapping and sequencing the human genome;

(11) evaluate the ethical considerations of research and development of products from mapping and sequencing the human genome; and

(12) evaluate appropriate forms of commercial protection for new biological materials, such as cell lines and their biotechnology derivatives, patent rights and ownership of data on the human genome, and provide advice to interested Federal agencies, the scientific community, and private industry.

(f) REPORTS.—Not later than 18 months after the date of enactment of this section, the Panel shall issue a report to the Congress and the President that contains recommendations based on the activities of the Panel under subsection (e). Additional reports shall be issued as the Panel considers necessary, or on demand of the Congress or the President.

SEC. 203. RESEARCH INITIATIVES.

The Secretary of Energy shall initiate and carry out a cooperative research program (hereafter referred to in this title as the "Human Genome Initiative") on—

(1) developing new techniques and improving existing methods for large-scale DNA mapping and sequencing, including the applications of automation and robotics;

(2) developing new methods of characterizing and locating genes using both computational and cloning techniques; and

(3) establishing computer facilities and developing computer data bases for the storage, retrieval, and dissemination of cloning, mapping and sequence information (including cross-references to other relevant data bases).

The Human Genome Initiative shall focus on improving and inventing algorithyms for analyzing DNA sequences, including methods for identifying coding regions, predicting protein structures and functions, and identifying genetic regulatory sites.

SEC. 204. PARTICIPATION OF NATIONAL LABORATORIES OF THE DEPARTMENT OF ENERGY.

(a) MISSION OF THE NATIONAL LABORATORIES.—The Secretary of Energy shall ensure that the National Laboratories of the Department of Energy participate in the Initiative, to the extent that such participation does not detract from the primary mission of the National Laboratory.

(b) AGREEMENTS.—The Secretary of Energy shall enter into agreements with other Federal agencies, with United States private industrial or research organizations, cooperative agreements, associations, consortia, or with any college or university as may be necessary to provide for the active participation of the National Laboratories of the Department of Energy in the Human Genome Initiative.

SEC. 205. PERSONNEL EXCHANGES.

The Secretary of Energy shall provide for temporary exchanges of personnel between any domestic firm or university referred to in this title and the National Laboratories of the Department of Energy that are participating in the Human Genome Initiative. The exchange of personnel shall be subject to such restrictions, limitations, terms and conditions as the Secretary of Energy considers necessary in the interests of national security.

SEC. 206. OTHER DEPARTMENT OF ENERGY RESOURCES, IN GENERAL.

(a) AVAILABILITY OF RESOURCES.—The Secretary of Energy shall make available to other departments or agencies of the Federal Government, and to any participant in research and development projects, any facilities, personnel, equipment, services, and other resources of the Department of Energy for the purpose of conducting research and development projects consistent with sections 203 and 204.

(b) REIMBURSEMENT.—The Secretary may make facilities available under this section only to the extent that the cost of the use of such facilities is reimbursed by the user.

SEC. 207. BUDGETING FOR HUMAN GENOME RESEARCH.

The Secretary of Energy, in preparing the research and development budget of the Department of Energy to be included in the annual budget submitted to the Congress by the President under section 1105(a) of title 31, United States Code, shall provide for programs, projects, and activities that ad-

vance research and technology development consistent with sections 203 and 204.

SEC. 208. INTERNAL REVENUE CODE TREATMENT.

(a) TAX EXEMPTIONS.—Any cooperative agreement, association, or consortium established by the Department of Energy or the National Laboratories of the Department of Energy, and which is consistent with the national strategy to be developed by the Panel, shall be treated as an organization described in section 501(c)(3) of the Internal Revenue Code of 1986 and exempt from tax under section 501(a) of such Code with respect to activities authorized by this title.

(b) BASIC RESEARCH PAYMENTS.—Any amounts transferred to an organization described in paragraph (a) by a participating member of such an organization shall be taken into account as basic research payments for purposes of section 41(a)(2) of such Code.

(c) CAPITAL GAINS TREATMENT.—

(1) No gain or loss shall be recognized in connection with the transfer pursuant to this title of any patent, copyright, trademark, trade secret, mask work, or other intellectual property by or between an organization described in paragraph (a) and any participating member of such an organization.

(2) If property is received in a transfer described in paragraph (1), the basis of the property in the hands of the transferee shall be the same as it would be in the hands of the transferor.

SEC. 209. ANTITRUST TREATMENT.

Any cooperative agreement, association, or consortia created by the Department of Energy or the National Laboratories of the Department of Energy pursuant to the provisions of this title, shall be considered a joint research and development venture within the meaning of section 2(a)(6) of the National Cooperative Research Act of 1984 (15 U.S.C. 4301 et seq.), for purposes of such Act.

TITLE III—SEMICONDUCTOR TECHNOLOGY MANUFACTURING EXCELLENCE INITIATIVE

SEC. 301. FINDINGS.

The Congress finds that—

(1) semiconductors and related microelectronic devices are key components in computers, telecommunications equipment, advanced defense systems, and other equipment;

(2) aggregate sales of such equipment, which are in excess of $230,000,000,000 annually, comprise a significant portion of the gross national product of the United States;

(3) the leadership position of the United States in advanced technology is threatened by—

(A) competition from foreign businesses which is promoted and facilitated by the increasingly active involvement of foreign governments; and

(B) other changes in the nature of foreign competition;

(4) the principal cause of the relative shift in strength of the United States and its semiconductor competitors is the establishment of a long-term goal by a major foreign competitor to achieve world superiority in semiconductor research and manufacturing technology and the pursuit of such goal by that competitor by effectively marshaling all of the government, industry, and academic resources needed to achieve that goal;

(5) although the United States semiconductor industry leads all other principal United States industries in terms of its reinvestment in research and development, this has been insufficient by worldwide standards;

(6) electronic equipment is essential to protect the national security of the United States, as is evidenced by the allocation of approximately 35 percent of the total research, development, and procurement budgets of the Department of Defense to electronics research;

(7) the Armed Forces of the United States will eventually depend extensively on foreign semiconductor technology unless significant steps are taken, and taken at an early date, to retain United States leadership in semiconductor technology research;

(8) it is in the interests of the national security and national economy of the United States for the United States to regain its traditional world leadership in the field of semiconductors;

(9) the most effective means of regaining that leadership is through a joint research effort of the Federal Government and private industry of the United States to improve semiconductor manufacturing technology and to develop practical uses for such technology;

(10) in order to meet the national defense needs of the United States and to ensure the continued vitality of a commercial manufacturing base in the United States, it is essential that priority be given to the development, demonstration, and advancement of the semiconductor technology base in the United States; and

(11) the National Laboratories of the Department of Energy are a major national research resource, and the extensive involvement of such laboratories in the semiconductor research initiatives of the Federal Government and private industry would be an effective use of such laboratories and would help ensure the success of such initiatives.

SEC. 302. ESTABLISHMENT OF THE SEMICONDUCTOR MANUFACTURING TECHNOLOGY RESEARCH INITIATIVE.

The Secretary of Energy shall initiate and carry out a program of research on semiconductor manufacturing research technology and on the practical applications of such technology (such program shall hereafter in this title referred to as the "Semiconductor Research Initiative"). The Secretary shall carry out the Semiconductor Research Initiative in a way as to complement the activities of Sematech or any other consortium of United States semiconductor manufacturers, materials manufacturers, and equipment manufacturers, established for the purpose of conducting research concerning advanced semiconductor manufacturing techniques and developing techniques to adopt manufacturing expertise to a variety of semiconductor products.

SEC. 303. PARTICIPATION OF NATIONAL LABORATORIES OF THE DEPARTMENT OF ENERGY.

(a) MISSION OF NATIONAL LABORATORIES.—Each National Laboratory of the Department of Energy shall participate in research and development projects under the Semiconductor Research Initiative in conjunction with the Department of Defense, any consortium, college or university carrying out any such project for or in cooperation with the consortium referred to in section 302, to the extent that such participation does not detract from the primary mission of the National Laboratory.

(b) AGREEMENTS.—The Secretary of Energy shall enter into such agreements with the Secretary of Defense, with any consortium referred to in section 302 and with any college or university as may be necessary to provide for the active participation of the National Laboratories of the Department of Energy in the Semiconductor Research Initiative.

(c) WORK PROGRAM.—The Semiconductor Research Initiative shall include provisions for one or more National Laboratories of the Department of Energy to conduct research and development activities relating to research on the development of semiconductor manufacturing technologies. Such activities may include research and development relating to materials fabrication, materials characterization, design and modeling of devices, and new manufacturing equipment.

SEC. 304. PERSONNEL EXCHANGES.

The Semiconductor Research Initiative shall include provisions for temporary exchanges of personnel between any domestic firm, the consortium referred to in section 302 and the National Laboratories of the Department of Energy that are participating in the Semiconductor Research Initiative. The exchange of personnel shall be subject to such restrictions, limitations, terms, and conditions as the Secretary of Energy consider neeessary in the interest of national security.

SEC. 305. OTHER DEPARTMENT OF ENERGY RESOURCES, IN GENERAL.

(a) AVAILABILITY OF RESOURCES.—The Secretary of Energy may make available to the Department of Defense, to any other department or agency of the Federal Government, and to any consortium that has entered into an agreement in furtherance of this Semiconductor Research Initiative any facilities, personnel, equipment, services and other resources of the Department of Energy for the purpose of conducting research and development projects under the Semiconductor Research Initiative consistent with section 303(a).

(b) REIMBURSEMENT.—The Secretary may make facilities available under this section only to the extent that the cost of the use of such facilities is reimbursed by the user.

SEC. 306. BUDGETING FOR SEMICONDUCTOR MANUFACTURING TECHNOLOGY RESEARCH.

The Secretary of Energy, in preparing the research and development budget of the Department of Energy to be included in the annual budget submitted to the Congress by the President under section 1105(a) of title 31, United States Code, shall provide for programs, projects, and activities that encourage the development of new technology in the field of semiconductors.

SEC. 307. COST-SHARING AGREEMENTS.

(a) PERMITTED PROVISIONS.—The Director of each National Laboratory of the Department of Energy that is participating in the Semiconductor Research Initiative or the contractor operating any such National Laboratory may include in any research and development agreement, entered into with a domestic firm in connection with the Semiconductor Research Initiative a cooperative provision for the domestic firm to pay a portion of the cost of the research and development activities.

(b) LIMITATIONS.—(1) Not more than an amount equal to 10 percent of any National Laboratory's annual budget shall be received from nonappropriated funds derived from contracts entered into under the Initiative in any fiscal year except to the extent approved in advance by the Secretary of Energy.

(2) No Department of Energy National Laboratory may receive more than $10,000,000 of the nonappropriated funds under any cooperative research and development agreement entered into under this subsection in connection with the Semiconductor Research Initiative except to the extent approved in advance by the Secretary of Energy.

SEC. 308. DEPARTMENT OF ENERGY OVERSIGHT OF COOPERATIVE AGREEMENTS RELATING TO THE INITIATIVE.

(a) PROVISIONS RELATING TO DISAPPROVAL AND MODIFICATION OF AGREEMENTS.—(1) The

Secretary of Energy or his designee may review a cooperative research and development agreement for the purpose of disapproving or requiring the modification of the cooperative research and development agreement if the agreement exceeds $1,000,000. If the Secretary notifies the parties to the agreement of his intent to review the agreement, the agreement shall provide a 30-day period within which the agreement may be disapproved or modified beginning on the date of the agreement is submitted to the Secretary.

(2) In any case in which the Secretary of Energy or his designee disapproves or requires the modification of any agreement presented under this section, the Secretary of Energy or such designee shall transmit a written explanation of such disapproval or modification to the head of the laboratory concerned.

(b) RECORD OF AGREEMENTS.—Each National Laboratory shall maintain a record of all agreements entered into under this section.

SEC. 309. AVOIDANCE OF DUPLICATION.

In carrying out the Semiconductor Research Initiative, the Secretary of Energy shall ensure that unnecessarily duplicative research is not performed at the research facilities (including the National Laboratories of the Department of Energy) that are participating in the Semiconductor Research Initiative.

SEC. 310. AUTHORIZATION OF APPROPRIATIONS.

(a) IN GENERAL.—There is authorized to be appropriated to the Department of Energy for each fiscal year 1989 through 1993, the additional sum of $25,000,000 per year, for the activities of the Department of Energy under the Semiconductor Research Initiative.

(b) RELATIONSHIP TO OTHER FUNDS AVAILABLE TO THE DEPARTMENT OF DEFENSE.—Funds available to the Secretary of Energy in connection with activities of the Department of Energy under the Semiconductor Research Initiative shall be in addition to amounts available to the Department of Defense for semiconductor manufacturing technology research and development.

SEC. 311. INTERNAL REVENUE CODE TREATMENT.

(a) TAX EXEMPTIONS.—Any cooperative agreement, association, or consortium established by the Department of Energy or the National Laboratories of the Department of Energy, and which is consistent with the purposes of this title, shall be treated as an organization described in section 501(c)(3) of the Internal Revenue Code of 1986 and exempt from tax under section 501(a) of such Code with respect to activities authorized by this title.

(b) BASIC RESEARCH PAYMENTS.—Any amounts transferred to an organization described in paragraph (a) by a participating member of such an organization shall be taken into account as basic research payments for purposes of section 41(a)(2) of such Code.

(c) CAPITAL GAINS TREATMENT.—

(1) No gain or loss shall be recognized in connection with the transfer pursuant to this title of any patent, copyright, trademark, trade secret, mask work, or other intellectual property by or between an organization described in paragraph (a) and any participating member of such an organization.

(2) If property is received in a transfer described in paragraph (1), the basis of the property in the hands of the transferee shall be the same as it would be in the hands of the transferor.

SEC. 312. ANTITRUST TREATMENT.

Any cooperative agreement, association, or consortia created by the Department of Energy or the National Laboratories of the Department of Energy pursuant to provisions of this title, shall be considered a joint research and development venture within the meaning of section 2(a)(6) of the National Cooperative Research Act of 1984 (15 U.S.C. 4301 et seq.), for purposes of such Act.

TITLE IV—TECHNOLOGY MANAGEMENT AT THE DEPARTMENT OF ENERGY NATIONAL LABORATORIES

SEC. 401. FINDINGS.

The Congress finds that—

(1) private industry has great interest in scientific collaboration with the Department of Energy National Laboratories but only if the present Department of Energy laboratory contracting process can be streamlined and intellectual property associated with joint ventures, adequately protected;

(2) management authority for intellectual property must be granted to the Directors of the Department of Energy National Laboratories to ensure that they can negotiate with industry to set up cooperative research and development agreements;

(3) the present Department of Energy policy of disseminating computer software publically, via the National Energy Software Center, has at times, benefited foreign companies and there should be a timely, consistent review procedure to ensure that the potential for practical applications is considered, when software is developed under a Department of Energy contract or may have involved some Department of Energy funding;

(4) the Department of Energy National Laboratories must be perceived as "user-friendly" in order for industry to seriously consider the laboratories partners for collaborative research and development ventures;

(5) the National Laboratories must aggressively seek contact with private industries to ensure that they recognize the technical and scientific expertise resident in these laboratories, in addition to publicizing the availability of user facilities and technological projects in process; and

(6) the National Laboratories have demonstrated successes in technology transfer into the private sector but the effort can be significantly enhanced if—

(A) industry becomes more aware of the laboratories research and development projects and capabilities;

(B) technology transfer is considered a significant part of each laboratory's mission;

(C) the laboratories become better educated in industry market requirements; and

(D) industry gets involved with the laboratories early enough in the research and development process to direct development of commercially viable products.

SEC. 402. PURPOSE.

The purpose of this title is to better meet the continuing responsibility of the Federal Government to ensure the full use of the results of the Nation's Federal investment in research and development in meeting international competition.

SEC. 403. POLICY.

It is the policy of Congress that intellectual property rights in technology or devices developed at the National Laboratories should be controlled in a manner that promotes the use of such technology and devices to improve the competitive advantage of the United States industries.

SEC. 404. DEFINITIONS.

For purposes of this title—

(1) The term "invention" means any invention which is or may be patentable or otherwise protected under title 35, United States Code, or any novel variety of plant which is or may be protectable under the Plant Variety Protection Act (7 U.S.C. 2321 et seq.).

(2) The term "subject invention" means any invention of a National Laboratory first conceived or reduced to practice in the performance of work under a contract or funding agreement for the operation of a National Laboratory.

(3) The term "made" when used in conjunction with any invention means the conception or first actual reduction to practice of such invention.

(4) The term "technical data" means recorded information of a scientific or technical nature regardless of form or the media on which it may be recorded.

(5) The term "computer software" means recorded information regardless of form or the media on which it may be recorded comprising computer programs or documentation thereof.

(6) The term "intellectual property" means patents, trademarks, copyrights, trade secrets, mask works, and other forms of intellectual property enacted by Congress or the States.

(7) The term "collaborative party" means a party to a cooperative research and development agreement as defined in paragraph (5).

(8) The term "laboratory owned" means any rights in intellectual property conveyed under this title to a contractor operating a National Laboratory or any rights in intellectual property arising under the operating contract for a National Laboratory where rights are not expressly taken by the United States Government or by a subcontractor.

SEC. 405. COOPERATIVE RESEARCH AND DEVELOPMENT AGREEMENTS.

(a) GENERAL AUTHORITY.—The Secretary of Energy shall permit the director of any of its National Laboratories—

(1) to enter into cooperative research and development agreements on behalf of the Department of Energy with—

(A) other Federal agencies;

(B) units of State or local government;

(C) industrial organizations including corporations, partnerships, and limited partnerships, consortia, and industrial development organizations;

(D) public and private foundations;

(E) nonprofit organizations including universities; or

(F) other persons including licensees of inventions, technical data or computer software owned by the National Laboratory; and

(2) to negotiate intellectual property licensing agreements for National Laboratory owned inventions, technical data or computer software, assigned or licensed to the National Laboratory by third parties including voluntary assignment by employees.

(b) SPECIFIC AUTHORITY.—Under cooperative research and development agreements entered into pursuant to subsection (a)(1), the Director of a National Laboratory may—

(1) accept, retain, and use funds, personnel, services, and property from collaborating parties and provide personnel, services, and property to collaborating parties;

(2) grant or agree to grant in advance to a collaborating party, intellectual property licenses or assignments, or options thereto, in any invention, technical data or computer software, made in whole or in part by a National Laboratory employee under the cooperative research and development agreement; and

(3) to the extent consistent with Department of Energy requirements and standards of conduct, permit employees or former employees of the National Laboratory to par-

ticipate in efforts to commercialize inventions, technical data or computer software such employees or former employees made while in the service of the National Laboratory.

(c) APPROVAL OF AGREEMENTS BY SECRETARY.—(1) If the value of an agreement entered into under this section does not exceed $1,000,000, the agreement shall not be subject to the approval of the Secretary of Energy.

(2) If the value of an agreement entered into under this section exceeds $1,000,000, but does not exceed $10,000,000 (the maximum amount for a cooperative research and development agreement), the Secretary of Energy or his designee shall approve, disapprove, or require the modification of the agreement. The agreement shall provide a 30-day period beginning on the date the agreement is presented to the Secretary of Energy or his designee by the head of the National Laboratory concerned, within which such action shall be taken. In any case in which the Secretary of Energy or his designee disapproves or requires the modification of any cooperative agreement presented under this section, the Secretary or his designee shall transmit a written explanation of such disapproval or modification to the head of the National Laboratory concerned. If such action is not taken within this 30-day period, the cooperative research and development agreement shall be deemed approved.

(d) LIMIT ON NUMBER OF AGREEMENTS.—The cumulative total of all agreements entered into by each National Laboratory Director under this section shall not exceed 10 percent of that laboratory's annual budget.

(e) RECORDS OF AGREEMENTS.—Each National Laboratory shall maintain a record of all agreements entered into under this section.

SEC. 406. CONTRACT CONSIDERATIONS.

(a) REGULATIONS AND PROCEDURES.—(1) The Office of Federal Procurement Policy may issue regulations or set forth suitable procedures for implementing the provisions of section 405(a)(1) after public comment. Implementation of section 405(a)(1) shall not be delayed until issuance of such regulations.

(2) Any regulations covering National Laboratory cooperative research and development agreements under section 405(a)(1) shall be guided by the purpose of this title.

(b) AGREEMENT CONSIDERATIONS.—The Director of the National Laboratory in deciding what cooperative research and development agreements to enter into shall—

(1) give special consideration to small business firms and consortia involving small business firms;

(2) give preference to business units located in the United States, which agree that products embodying inventions, technical data or computer software, made under the cooperative research and development agreement or produced through the use of such inventions, technical data or computer software, will be developed and manufactured substantially in the United States;

(3) in the case of any industrial organizations or other person subject to the control of a foreign company or government take into consideration whether or not such foreign government permits the United States agencies, organizations, or other persons to enter into cooperative research and development agreements and licensing agreements; and

(4) provide universities the opportunity to participate in such cooperative agreements when such participation will contribute to the purpose of this legislation.

(c) RECORD OF AGREEMENTS.—The Department of Energy shall maintain a record of all agreements entered into under this section.

SEC. 407. PATENT OWNERSHIP AND THE CONDITIONS OF OWNERSHIP.

(a) DISPOSAL OF TITLE TO INVENTIONS.—Notwithstanding section 152 of the Atomic Energy Act of 1954 (42 U.S.C. 2182), section 9 of the Federal Nonnuclear Energy Research and Development Act of 1974 (42 U.S.C. 5908), or any other provision of law, the Secretary of Energy shall dispose of the title to any subject invention made in the performance of a Department of Energy contract to operate any National Laboratory in the same manner as applied to small business and nonprofit organizations under chapter 18 of title 35, United States Code.

(b) RETENTION OF TITLE BY UNITED STATES.—(1) Whenever a National Laboratory makes an invention to which the Department of Energy has determined to retain title at the time of contracting—

(A) for exceptional circumstances under section 202(a)(ii) of title 35, United States Code; or

(B) because the invention is made in the course of or under a funding agreement described in section 202(a)(iv) of title 35, United States Code,

the title to such invention shall be retained by the Government unless the National Laboratory at which the invention is made requests title to such invention and the Secretary of Energy does not notify the National Laboratory within 90 days of such request that the invention is covered by an exceptional circumstances determination or has been designated sensitive technical information as authorized by Federal statutes other than those involving export control.

(2) The Secretary may not use export control statutes or regulations as a basis for refusing a request for title under this subsection.

(3) The Secretary may not retain title to a subject invention under the exception set forth at section 202(a)(iv) of title 35, United States Code, without first determining that the invention has been classified or has been designated sensitive technical information as authorized by applicable statutes other than those involving export control. If the Secretary does not notify the requesting National Laboratory, the Laboratory shall be deemed to have elected title to the invention under the Government-wide contractor patentable ownership provisions of chapter 18 of title 35, United States Code.

SEC. 408. TECHNICAL DATA OR COMPUTER SOFTWARE AND THE CONDITIONS OF OWNERSHIP.

(a) RIGHTS RETAINED BY A NATIONAL LABORATORY.—Notwithstanding any other provision of law, the Secretary of Energy shall permit a National Laboratory to elect ownership to any intellectual property rights that can be established to protect technical data or computer software obtained or generated under a Department contract for the operation of such National Laboratory subject to a royalty free license to use and reproduce such technical data or computer software for United States Governmental purposes.

(b) PROTECTION OF TECHNICAL DATA AND COMPUTER SOFTWARE.—(1) Technical data or computer software obtained or generated by National Laboratory shall not be disclosed to the public if the Director of the National Laboratory or his designee determines that—

(A) the technical data or computer software is commercially valuable; and

(B) there is a reasonable expectation that disclosure of the technical data or computer software could cause substantial harm to the commercial application of such information.

(2) A cooperative research and development agreement which provides that technical data or computer software which meets the conditions of paragraph (1) obtained or generated—

(A) by the Department of Energy or the National Laboratory pursuant to such cooperative research and development agreement; or

(B) under a National Laboratory cooperative research and development agreement,

shall not be disclosed to the public.

(3) Documentation disclosing technical data or computer software subject to nondisclosure under paragraphs (1) and (2) shall not be considered as agency records under the Freedom of Information Act during the term of nondisclosure to the public.

(c) REGULATIONS.—The Office of Federal Procurement Policy, in cooperation with other interested Federal agencies, shall issue within 180 days after the date of enactment of this title including 30 days for public comment, regulations establishing a standard contract clause to implement this section in the Department of Energy contract for the operation of any National Laboratory.

SEC. 409. SPECIAL RULE FOR WAIVER OF GOVERNMENT LICENSE RIGHTS.

Any of the rights of the Government or obligations of a National Laboratory described in chapter 18 of title 35, United States Code, including the license reserved in section 202(c)(4) of title 35, United States Code, may be waived or omitted if the Secretary of Energy determines that the interests of the United States and the general public will be better served or the objectives and policies of this title will be better promoted by such waiver or omission. A waiver or omission shall be considered—

(1) if it is necessary to obtain a uniquely or highly qualified contractor;

(2) if the invention involves cosponsored, cost-sharing or joint venture research and development, and the contractor, cosponsor or joint venturer is making substantial contribution of funds, facilities or equipment to the work performed on the invention; or

(3) if the invention will require substantial additional investment in development before a product is created and it is expected that the primary market for such product is the United States Government.

SEC. 410. INTELLECTUAL PROPERTY CONTRACT PROVISIONS.

(a) CONTRACT PROVISIONS.—Any Department of Energy contract to operate a National Laboratory shall provide—

(1) that any royalties or income that is earned by the National Laboratory from the licensing of laboratory-owned intellectual property rights in any fiscal year shall be used as authorized under subsection 202(c)(7)(E) of title 35, United States Code and section 13(a)(1)(B)(i)-(iv) and section 13(a)(2)-(4) of the Stevenson-Wydler Technology Innovation Act of 1980 (15 U.S.C. 3710c(a)(1)(B)(i)-(iv) and 3710c(a)(2)-(4));

(2) that the costs of obtaining and protecting intellectual property rights in any invention, technical data or computer software, owned by the National Laboratory shall be paid for by the Department of Energy to the extent not offset by royalty income earned from the licensing of National Laboratory-owned intellectual property rights; and

(3) that the management of intellectual property rights, including procurement and retention of such rights as well as licensing of such rights, in connection with laboratory-owned inventions, technical data and computer software shall be the responsibil-

ity of the Director of the National Laboratory at which the invention, technical data, or computer software are made, developed, or assigned.

(b) COMPENSATION.—(1) Subject to paragraph (2), in return for retaining title to any intellectual property rights in any invention or discovery made in performance of a Department of Energy cooperative research agreement, the National Laboratory contractor shall pay to the United States reasonable compensation based on the value of the technology transferred. The amount of the payment arising as a result of the transfer shall be set by an arbitration board consisting of one member selected by the contractor, one member selected by the Secretary of Energy, and one member jointly selected by the contractor and the Secretary. In determining the payment, the arbitration board shall set an amount that is proportionate with the research and development costs funded by the United States. The arbitration board shall have discretion to permit the payment to be made in installments according to the extent the contractor uses or employs the intellectual property.

(2) This subsection shall not apply if—

(A) the contractor is operating the National Laboratory for no profit or fee beyond expenses; and

(B) the contractor is offering the intellectual property for fair market value and any value or royalties the contractor derives from the intellectual property will be returned to the National Laboratory or the Federal Treasury in accordance with section 202(c)(7)(E) of title 35, United States Code.

SEC. 411. MARCH-IN RIGHTS.

(a) RIGHTS.—Each funding agreement for the operation of a National Laboratory shall contain a provision allowing the Department of Energy to require the licensing to third parties of inventions, technical data, or software owned by the contractor that are subject to the provisions of this title. Such provision will ensure that the technology is licensed and commercialized by affording similar Federal march-in rights provided for inventions under section 203 of title 35, United States Code, but will be applicable to all intellectual property for which title was acquired by the National Laboratory Directors under this title.

(b) DEFINITION.—For purposes of this section, "third parties" and "third party applicants" are domestic entities located in the United States whose research, development, and manufacturing activities occur substantially in the United States. Domestic entities include industrial organizations, corporations, partnerships and limited partnerships and industrial development organizations; public and private foundations; nonprofit organizations such as universities and consortia.

(c) REGULATIONS.—The Office of Federal Procurement Policy, in cooperation with other interested Federal agencies, shall issue within 180 days from enactment including 30 days for public comment, regulations to implement the march-in rights under this section.

SEC. 412. EFFECTIVE DATE.

This title shall take effect on the date of enactment. The Secretary of Energy shall immediately enter into negotiations with the contractors of the National Laboratories to amend all existing contracts for the operation of the National Laboratories, to reflect this title. Pending such amendment, the provisions of this title shall govern the disposition of all intellectual property rights covering laboratory-owned inventions, technical data, and computer software, generated in performance of Department of Energy contracts for the operation of the Department of Energy National Laboratories.

Mr. DOMENICI. Mr. President, I am pleased today to submit an amendment in the nature of a substitute for S. 1480, legislation that the Energy and Natural Resources Committee has spent much time reviewing since I introduced it 7 months ago.

This bill, known as the National Laboratory Cooperative Research Initiatives Act, has gone through a lot of changes since July, major changes. I would like to describe them for the benefit of my colleagues, as I consider this one of the major legislative opportunities the Senate will have this year.

The purpose of my substitute is the same as the purpose of the original bill: To integrate more effectively the expertise of our universities and private industry with the Department of Energy system of national laboratories in order to speed the development of technology in areas with significant economic potential.

What differs in this new version is how to get there.

How do we break down the barriers that are preventing or discouraging private industry and universities from working cooperatively with the national laboratories?

Specifically, this new version of S. 1480:

Gives the national laboratory directors the authority they need to enter into cooperative research and development agreements, without prior approval from DOE, thus streamlining the time and process in contracting with the national laboratories;

Ensures that technical data, computer software, and inventions developed under cooperative agreements are protected for commercial purposes;

Allows the national laboratory directors automatically to acquire rights to technologies developed within the laboratories, assuming that the technology is not classified, sensitive, or meets an exceptional circumstances criteria; this provision is significant since it provides the directors with a bargaining chip in negotiating cooperative agreements with private industry;

Gives the laboratory directors the authority to withhold for public disclosure technical data or computer software that may have commercial potential, in essence creating a trade secret;

Ensures that U.S. industry benefits from these new commercialization opportunities and jobs that grow from technologies developed under this legislation; and

Ensures that technology does not "sit on the shelf" by granting DOE rights to step in and require licensing of technology, after giving the laboratories a reasonable period to offer the technology for commercial development.

The Department of Energy national laboratories represent the largest single concentration of scientific and technical expertise and facilities in the world. This is a national asset that can be used to improve the Nation's ability to develop competitive products.

While the original purpose of these laboratories was to develop nuclear weapons and perform energy research, their mission has evolved into a diverse set of technologies, including: Biotechnology, nuclear medicine, electrochemistry, geophysics, microengineering, radiation hardened electronics, alternate energy sources, superconductivity, and various other basic science initiatives.

Thirteen laboratories are included within the national laboratory system under this new version of the bill. Under the previous version of S. 1480, nine multiprogram DOE laboratories had been included.

I have been persuaded by scientific representatives, that these four additional laboratories have major research efforts in technologies with economic potential.

The need for this bill has become increasingly apparent as we examine the U.S. trade deficit, month by month, looking for continued signs of improvement. We realize more vividly than ever, the impact that the trade balance and the budget deficit have on the economic wellbeing of our country, particularly after the stock market turmoil we experienced in the autumn.

All of us have asked ourselves what can be done to strengthen America's ability to compete internationally. We have the research and development expertise, we have the sense of innovation, the new inventions, and the marketing network to be successful. What we lack is the cooperative ability to quickly translate technological ideas and inventions into marketable products.

The problem is twofold: First, attracting industries and universities to take advantage of the scientific expertise of the national labs, and second, eliminating the redtape and delays in doing business with the national laboratories.

Without some assurance that contracting by the national laboratories can be significantly streamlined and that intellectual property—inventions, technical data, and computer software—can be adequately protected, private industry might never enter into cooperative research and development agreements with our national laboratories.

The more I became involved in S. 1480's content, the more I realized that it was wrong to limit the technology management provisions to only superconductivity, semiconductors, and the human genome.

Technology management was the key to success in commercial technology developed in the national laboratories, and should be applied to all technologies that have economic potential.

Consequently, I created a new title IV, a technology management title, ex-

tending the technology management provisions to all technologies.

I believe that this new technology management title will go far toward allowing all the key players—universities, private industry, and the DOE national laboratories—to work together as a team. Each of these players has a contribution to make in creating a new U.S. capability to produce innovative products, to make the United States stronger in an increasingly competitive world.

Our national laboratories provide an unequalled source of experience in high-risk, multidisciplinary research and development projects, as well as exceptional scientific and engineering expertise and facilities.

The universities provide the foundation for basic research and development, as well as a continuing source of new scientific and engineering personnel with up-to-date knowledge.

The private sector has specialized expertise in converting this research and development and turning it into products, then marketing the products.

It's time that we take the action called for in S. 1480.

I doubt that any of us question that America's strength is derived from our industrial base. Let's work together to strengthen that base. In this one instance, let us prove that the Federal Government can work to benefit industry, not to thwart it.

With that general discussion, I would now like to describe in some detail this revised version of S. 1480:

Title I sets up centers for research on critical technologies in high-temperature superconductivity, and provides a national organization to coordinate R & D and expedite the transfer of superconductivity research to industry.

This title has undergone only minor modifications from the version I introduced in July. But the significance of superconductivity and its potential for product development deserves review.

Annual sales of electronic and medical systems that depend on superconductors total about $400 million. With recent discoveries sales are expected to grow.

Recently new materials have been discovered that are superconducting at much higher temperatures. More progress has been made in superconducting materials over the past 2 years than was made in the previous 75 years. These recent discoveries will permit improvements, especially cost reductions, to be made in many of the existing superconducting technology applications.

For example, the cost of nuclear magnetic resonance imaging machines for medical applications should be reduced significantly so that this technology will be available to a larger portion of our population.

However, such applications seem minor in comparison to what will become possible if materials can be developed that are superconductive at room temperature. Many scientists are cautiously optimistic that this can be achieved.

In the future we may see extremely powerful electromagnets for magnetic fusion. Success in fusion would assure the world of an endless supply of energy. Powerful, yet compact and highly efficient, electric motors and generators are expected.

Magnetic propulsion and magnetic levitation may become commercial realities. Long term, efficient storage of electrical energy may be possible. Energy losses in utility electric power transmission networks may be eliminated.

The future seems unlimited to those who convert these concepts into products. That is why we must act, and this year.

This title, as well as title II of this amendment, contains no specific authorization in dollars. Each requires the appropriate Federal agencies to provide programs, projects, and activities that will encourage new technologies in the appropriate fields.

The national laboratories are already doing research and development work in superconductivity and human genome mapping, but it is managed and coordinated differently from the methods required in this bill.

The next title, title II, deals with another vital challenge, a national research effort to map and sequence the human genetic code.

This title will coordinate national research efforts and advance genome research and technology development at the national laboratories.

Just in recent days, the National Research Council of the National Academy of Sciences released its evaluation of the desirability and feasibility of a genome mapping and sequencing project. This impressive group of scientists stated clearly that such a project would be very worthwhile. They also argued, as I do today, that such a project requires special considerations that make it different than the ordinary types of biological research we finance. This effort needs considerable coordination and focus.

Title II establishes a national advisory panel on the human genome that will give the genome initiative a national focus. It will provide a forum for Government, universities, and private industry to set a national strategy, one that will assure U.S. leadership in this very important endeavor.

The panel's chairmanship and membership have been discussed over the past several months. I am convinced that our current version gives representation to the key sectors concerned with this significant research.

Representatives of the Department of Energy and the National Institutes of Health will chair the panel. In addition to balancing the representation from Government, universities, and industry, I have also included a representative from nonprofit organizations and an expert in biomedical ethics.

Mr. President, within our genetic structure lie the secrets of our life processes and many of the diseases that plague mankind. Located on the chromosomes within the nucleus of every cell are a series of genes that govern the growth and development of cells and organs in our body.

While researchers have come to understand the general structure of our genetic system, the locations and structures of individual genes remain, for the most part, a mystery. Researchers are just beginning to discover the locations of particular genes and analyze the sequences of those genes.

Creating a map of our genetic code, and the sequences of the genes contained therein, will provide extremely useful tools for biomedical research. It could very well spark a revolution in our understanding of biological science. Such a revolution could eventually lead to treatments and cures for an estimated 3,000 diseases that are believed to be linked to genetics.

In addition, these tools—and the technologies being developed to create the tools—will provide a strong basis for the emerging biotechnology industries that will find an enormous array of useful applications for this research.

The United States is certainly not alone in this field. We know that Japan has recognized the importance of genetic research and has targeted the biotechnology industry through a coordinated, focused, national effort. The nation that first develops this new scientific capability will certainly have an extremely potent economic resource.

While there is some coordination of Federal activities—and I applaud the efforts of these agencies—I do not believe there is enough. Nor do I believe we have the structures in place that will provide long-range, strategic guidance to a truly national effort, one that includes private industry.

Mr. President, if the United States is to lead the world in genome research and enable U.S. companies to benefit from that research, we need to coordinate the many and varied national resources we have, and commit ourselves to completing this project as expeditiously as possible.

Title III of my substitute establishes a cooperative Government/industry program of research on semiconductor manufacturing technology and the practical applications of that technology.

This title has not been revised in any major way from the original version of S. 1480. In fact, this title was enacted as part of the fiscal year 1988 Department of Defense authorization bill, Public Law 100-180. This title is necessary so that the national laboratories can participate as a partner with SEMATECH. In the next year we should

have concrete evidence of the benefits of this partnership.

This title is included in the bill because the program requires reauthorization. Under this title the Secretary of Energy would initiate and carry out a program of research on semiconductor manufacturing technology and on the practical applications of that technology.

R&D projects would be entered into through cost-sharing agreements with private firms and universities. These agreements would allow access to the facilities and equipment of the National labs, and would provide for exchanges of personnel.

This title of the bill will strengthen the SEMATECH initiative by including DOE's national laboratories in this national effort. The national laboratories work would complement the overall SEMATECH work program.

Both the Semiconductor Research Corp., and the Semiconductor Industry Association believe that close collaboration with our national laboratories is essential for an effective national strategy for semiconductors. This was also the conclusion of the joint planning workshops sponsored by the National Academy of Sciences in February and May of last year.

According to the report released by the Academy:

> The workshop participants concluded that the facilities and expertise at the national laboratories represent a valuable set of resources that should be utilized effectively to augment the research capabilities of industry and universities.

A number of national laboratories have already submitted proposals for semiconductor manufacturing development.

Brookhaven has proposed the development of synchrotron x-ray lithography. Lawrence Berkeley has proposed the estabilishment of a process analysis and diagnostics program.

In my State, Sandia National Laboratories has proposed a center for compound semiconductor technology and a center for ultra clean silicon processing. Because these centers would expand on Sandia's expertise in radiation-hardened microelectronics, the work will be especially useful for space and strategic programs. However, because of the importance of semiconductors to our economic health, I want to review their applications and economic impact.

The basic building blocks of today's electronic systems are integrated circuits made from semiconducting materials. Annual sales of electronics products are presently close to $300 billion. By the year 2000, sales are expected to triple, and electronics will be second to agriculture in annual sales.

The dramatic growth in the electronics business can be traced to the fact that the number of transistors that can be packed onto a single chip of semiconducting material has increased, integrated circuit speed has increased, and integrated circuit reliability has increased, while integrated circuit costs have dropped dramatically. These advances are due to improvements in manufacturing technology.

Future success of the United States in electronics sales depends on strengthening our semiconductor manufacturing base. It is also important that we lead in developing applications for new compound semiconductor materials.

The primary payoff will sustain the health of our economy. Highly compact computer systems with huge memories that provide more rapid data retrieval, or perform complex scientific analyses, are assured. Computer controls for more and more mechanical systems will follow.

Applications of artificial intelligence could become commonplace, with computer-controlled robots performing routine manufacturing tasks.

To assist in the work of this title, $25 million in Federal spending is authorized for each of the 5 fiscal years beginning in fiscal year 1989.

The new title IV is the key to this revised bill. And as I have indicated previously, this title represents the biggest change from the original version of S. 1480. This title is entirely new, but it builds on and expands, current law which all witnesses agreed is working well and should be expanded to cover all national laboratories—regardless of mission, regardless of contractor, or regardless of operator.

It also expands the current law to include all types of protectable intellectual property.

This title provides the intellectual property and contracting tools necessary to ensure that technology is transferred from the national laboratories to the private sector in a way that leads to more rapid development of marketable products.

It applies to any technology developed by a national laboratory that may have potential for application by private industry.

This title moves the technology management function away from Washington into the national laboratories. I am convinced that this move is essential if we are to accelerate the development of marketable products.

As a result of hearing testimony, I have gained a whole new appreciation for the realities associated with private industry's requirements. The ability to move rapidly is critical to a firm's market opportunities. Preserving proprietary information and protecting intellectual property is the only way to gain an advantage over competitors and protect capital investments in R&D programs.

Cutting redtape, bureaucracy, time, paperwork, and uncertainties in dealing with the Government are objectives of this title. This will translate into savings in time and money for industry.

Under the title, laboratory directors are granted the authority to enter directly into cooperative R&D agreements with private industry and to negotiate for the rights to the technologies involved, including future royalties.

In negotiating cooperative agreements, the national laboratory directors must give preference to small businesses and businesses located in the United States. Universities will also be given special consideration.

The national laboratory directors will be able to withhold technical data or computer software from public dissemination when it is determined that this would damage the commercial potential of the data.

If the value of the cooperative agreement is less than $1 million, no DOE approval is required. If however, the value of the agreement is between $1 million and $10 million, the Secretary of Energy is given 30 days to disapprove or modify the agreement. No single agreement can exceed $10 million.

The total dollar value of cooperative agreements is limited to 10 percent of each laboratory's annual budget, so that these agreements do not siphon of the laboratory's ability to perform its primary mission.

Present Federal rights to go into the labs and release inventions for development—so-called "march-in rights"—are extended under the bill to technical data and computer software controlled by the national laboratories, if they are not being effectively used for product development.

The U.S. Government is automatically granted a nonexclusive, paid-up license to any technology for which the national laboratories are granted rights under this legislation. However, at the Secretary of Energy's discretion, this license can be waived if it is in the best interests of the Government. This may be necessary when the U.S. Government would be the only customer for a product, but substantial additional investment would be required before a product is created.

The royalties flowing from industrial application of technologies developed at the national laboratories are returned to the labs to further the research and development programs at each respective laboratory.

Technology developed as a result of these cooperative R&D agreements must be licensed to companies located in the United States that agree the resulting products will be researched, developed and manufactured substantially in the United States, thus ensuring that the United States benefits from these ventures in every possible way.

Each title in this new version of the bill has a specific set of objectives. But the purpose of the entire bill is to better integrate universities and private industry into the DOE national laboratory system, to speed the development of technology in areas of significant economic potential.

This is not something that we expect to achieve overnight. But passage of

this bill will start us off in the right direction. It's a long road, but one we must travel if we hope to get to a more competitive position, internationally.

Mr. President, this is sound legislation. I am convinced that it is needed legislation. I urge my colleagues to study this new version of the bill. When they do, I am convinced they will see it as a golden opportunity to return America to the forefront of product development.

Mr. President, I ask unanimous consent that the amendment in the nature of a substitute be printed at this point in the RECORD, and I ask unanimous consent that the legislation be printed by the Senate on a bill form, as if it were new legislation. I also ask that a summary of the bill and a section-by-section analysis also appear in the RECORD following the text of the legislation.

Additionally, I ask unaminous consent that the following articles be printed in the RECORD.

"Technology Transfer Isn't Working," from Business Month, formerly Dun's Business Month.

The semiconductor industry and the national laboratories—executive summary, report of a workshop conducted by the Manufacturing Studies Board and National Materials Advisory Board Commission on Engineering and Technical Systems—National Research Council, February 27, 1987.

Letter to Senator PETER V. DOMENICI, dated September 21, 1987, from Larry W. Sumney, president, Semiconductor Research Corp., supporting S. 1480.

"New Superconductors May Have Significant Economic Impact," article by A.M. Wolsky, E.J. Daniels, and R.F. Giese, published in Logos, Argonne National Laboratory Publication, autumn 1987.

"Los Alamos Unveils Superconductivity Breakthrough," news release, dated February 24, 1988.

"New Process Improves Semiconductor Fabrication Technology," news release from Sandia National Laboratories, dated February 24, 1988.

"Expert Committee Finds Mapping and Sequencing Human Genome Feasible; Recommends $200 Million Annual Budget," news release from the National Research Council, dated February 11, 1988.

There being no objection, the material was ordered to be printed in the RECORD, as follows:

SECTION-BY-SECTION ANALYSIS OF NATIONAL LABORATORY COOPERATIVE RESEARCH INITIATIVES ACT, SENATE BILL 1480

General Findings

The Department of Energy has nine multiprogram National Laboratories which represent an annual government investment in Research and Development of about $5 billion.

The mission of these National laboratories has evolved over the years beyond their primary missions of basic science, energy research, and nuclear and weapons-related research to include such diverse technologies as: biotechnology; nuclear medicine; material science; microelectronics; space technology; electrochemistry; geophysics; environmental R & D; microengineering; and arms control verification.

These Laboratories have large and complex "user facilities", uncomparable research equipment, unparalleled computer facilities, and excellent research and support staffs.

These National laboratories have substantial experience in applied as well as exploratory Research and Development. The labs have extensive and unique expertise in conducting large-scale, long-term, goal-oriented, high-risk Research and Development projects using multi-disciplinary teams.

While each National laboratory has a technology transfer program, the commercialization potential of the laboratories Research and Development activities has been largely untapped, because private industry has not been sufficiently involved with the laboratories.

In order to increase the flow of technology from these laboratories to private industry, the laboratories must seek new partnerships with industry to aggressively merge the scientific and technological capabilities of the labs with the market pull of industry.

A new national initiative is needed whose goal would be to link the nation's capabilities for generating scientific and technological innovations to its capabilities for commercial activities.

General Purposes

To better integrate university and private industry into the National Laboratory system of the Department of Energy so as to speed the development of technology in areas of significant economic potential.

TITLE I—THE DEPARTMENT OF ENERGY NATIONAL LABORATORIES CENTERS FOR RESEARCH ON ENABLING TECHNOLOGIES FOR HIGH TEMPERATURE SUPERCONDUCTING APPLICATIONS

Findings

Recent developments in high-temperature superconducting materials hold great promise for highly efficient energy storage and transmission, medical, diagnostics, magnets for physics research and fusion reactors, and smaller supercomputers.

The United States is a world leader in basic research on high-temperature superconducting materials and programs supporting this research at the National Science Foundation and the Department of Energy should be maintained and strengthened.

In FY-86, the Department of Energy National laboratories devoted over $.5 billion to materials activities and employed approximately 2,000 scientists and engineers in the field of materials.

International interest in the commercialization of high-temperature superconducting materials is high and the key to success lies in the rapid development of these materials and the identification of applications.

The Department of Energy's Laboratories have demonstrated expertise in superconductivity research and a proven record in research in enabling technologies which can benefit industrial efforts in product development.

There have been significant milestone in superconductivity research and applications accomplished by the Department of Energy National laboratories. These include: the world's first superconducting accelerator for heavy ions; the desing, building and testing of a superconducting magnetic energy storage system for a electric power demonstration project; the first particle detector to use a large (107 tons) superconducting magnet; the first laboratory in the world to grow single crystals of a ceramic superconductor; the first American research organization to make a wire from the new superconducting materials and the first to put current through such a wire.

Much challenging work remains to be accomplished in superconductivity: understanding the basic physics of new superconductors; improving the flexibility of wires and tapes; streamlining the fabrication process; improving the physical properties and current carrying capacity of superconductors; and devising commercial processing techniques.

Purpose

To research critical enabling technologies to assist U.S. industry in the commercialization of high-temperature superconductors.

To provide national organization and coordination in the research, development, and commercialization of high-temperature superconductors.

To encourage private industry, university, and Department of Energy Laboratory interact through Centers for Research on Enabling Technologies at the Laboratories.

Establishment of the Superconductor Research Initiative

The Secretary of Energy is directed to carry out a cooperative program of research on enabling superconductor technology and practical applications of superconductor technology. (Hereafter referred to as the "Initiative".)

Participation of National Laboratories of the Department of Energy

The Secretary of Energy shall ensure that the National laboratories participation in the initiative does not detract from their primary mission.

The Secretary of Energy shall enter into such agreements with other Federal agencies, with U.S. private industrial or research organizations, consortias, or with any college or university as may be necessary to provide for the active participation of the National labs in the Initiative.

The Initiative shall include provisions for one or more national laboratories to conduct R & D on high-temperature superconductivity and associated technologies.

Formation of Council and Centers for Research on Enabling Technologies

The Secretary of Energy is authorized and directed to form a Council comprised of representatives of appropriate government agencies, universities and industry to provide guidance in setting goals and strategies for the timely research on critical enabling technologies in high-temperature superconductors. The Council should also set guidelines for the release of technical findings and developments.

The Secretary of Energy is authorized and directed to establish cooperative research centers in enabling technology for superconducting materials and applications at National Laboratories with appropriate university and private industry participants.

Centers should be located at Laboratories which demonstrate expertise in superconductivity research and research in associated technologies (e.g. thin film and bulk ceramic synthesis and processing; characterization of physical, chemical, and structural properties in materials).

Industry/National Laboratory Personnel Interchange

Visitations must be an important part of this program if it is to succeed, therefore, personnel from both the Laboratories and industry may participate in temporary assignments. U.S. industry personnel may have temporary assignments at the National Laboratories; and likewise, Laboratory personnel may have assignments with private

industry on a rotating basis in order to maximize the exchange of knowledge. However, this activity should be carried out so as not to jeopardize security at the National Laboratories.

Other Department of Energy Resources

The Secretary of Energy shall make available to participants in research and development projects under the Initiative, resources of the DOE. This provides that participants in the Initiative may make use of DOE facilities, personnel, equipment, services, and other resources to the extent that the cost of the use of such facilities is reimbursed by the user.

Budgeting for Superconductivity Research

The Secretary of Energy shall provide in his annual budget submission to Congress by the President, for programs, projects, and activities that encourage the development of new technology in the field of superconductivity.

Cost Sharing Agreements

The National laboratory directors are directed to seek cost sharing from private industry and university participants through such cost sharing provisions in cooperative research and development agreements.

Any national laboratory cannot receive more than 10 percent of its annual budget from non-appropriated funds, during any one fiscal year, derived from contracts entered into under the Initiative, unless approved in advance by the Secretary of Energy. This ensures that the aggregate of cooperative agreement commitments for the national laboratories does not grow to be too large a share of their responsibilities and detract from the primary mission of the laboratory.

The value of a cooperative research and development agreement entered into by a National laboratory under this Initiative can not exceed $10,000,000, unless approved in advance by the Secretary of Energy. This creates another limitation on the Laboratory Directors to ensure that these cooperative R&D agreements do not get out of hand and compete with resources that are needed for the primary mission. It also provides DOE with the opportunity to review a cooperative R&D agreement if it exceeds the limits set, thereby providing oversight of large dollar projects.

Avoidance of Duplication

The Secretary of Energy shall ensure that unnecessarily duplicative research is not performed at the research facilities, including the National laboratories, that are participating in this Initiative.

Internal Revenue Code Considerations

Provide that cost sharing funds of private industry qualify for research and development tax credit.

TITLE II—THE HUMAN GENOME INITIATIVE

Findings

Knowledge relating to the location and sequences of genes on human chromosomes will greatly enhance our ability to understand biological development processes and to develop prevention and treatment methods for many diseases.

The health and well being of our Nation depends on the medical breakthroughs that will follow from mapping and eventually sequencing our human genetic code—known as the human genome.

The knowledge gained—and the countless applications that will be derived from the knowledge—will be very economically important to the nation that assembles these important biomedical research tools.

The Department of Energy has conducted extensive research on human genetics, and it is a compatible and essential part of the Department of Energy's National Laboratories' mission to participate in research and development projects to map and sequence the human genome.

The Secretary of Energy should augment and accelerate the Department's ongoing genetic science research.

In addition to the Department of Energy, several Federal agencies—most notably the National Institutes of Health and the National Science Foundation—are presently funding research related to mapping and sequencing of the human genome.

In order to most efficiently expend research funds and most expeditiously advance our understanding of human genetics, it is essential that the agencies involved coordinate research efforts.

In order to enhance the competitiveness of the U.S. biotechnology industry, the transfer of knowledge and technological capability derived from this research must flow more quickly and smoothly from government supported laboratories to private, commercial applications.

Creation of a National Advisory Panel

Several Federal agencies are currently conducting genome research, as are many universities, private institutes and companies. And while some cooperation has occurred between key government agencies, no formal process is established for cordinating Federal efforts to research the genome. Neither is there established any real working relationship between government and non-government researchers.

Because of the size of the project, and the need for project-oriented technology development, the overall effort to map and eventually sequence the human genome could be greatly enhanced by establishing a body to coordinate and direct national research efforts. Toward this end a National Advisory Panel on the Human Genome is created to coordinate the following:

National genome mapping research activities to ensure the expeditious construction of genome maps.

The development of new tools and technologies to analyze genetic material and information—in cooperation with non-public researchers.

The development of systems to enhance technology transfer from national genome research efforts to commercial applications primarily by U.S. companies.

Membership of the National Advisory Panel:

Four government members representing the Department of Energy, National Institutes of Health, National Science Foundation, and the National Library of Medicine.

Four members representing private industry,

Four members representing the university research community,

One member with expertise in biomedical ethics,

One representative of national foundations or philanthropic organizations involved in biomedical research.

National Advisory Panel to be co-chaired by the Department of Energy and National Institutes of Health.

National Advisory Panel would have the following types of functions:

To coordinate a national strategy for conducting human genome research that will assure U.S. leadership in the field.

To promote cooperation between public and private research efforts that will improve the quality and usefulness of genome research and provide for the timely transfer of knowledge and technology to commercial applications, primarily by U.S. companies.

To evaluate, and make recommendations concerning, the ethical and moral concerns raised by research on the human genome.

To evaluate the needs, benefits, and risks of international cooperation in human genome research.

To determine appropriate protections (patents, copyrights, etc.) for data on human genome, and new biological materials such as cell lines and their derivatives which result from the applications of biotechnology.

Research Initiatives

This section directs the Secretary to improve on current genome research activities within the Department of Energy.

Participation of National Laboratories

The strategies to be laid out by the National Advisory Panel may recommend the formation of certain cooperative arrangements between government, university, and private-sector labs. This section is intended to assure that the DOE National Laboratories are allowed to fully participate in any such cooperative agreements, as long as their participation does not detract from the National Laboratories' primary mission.

Personnel Exchanges and Other DOE Resources

In order for the project to be successful, there must be considerable collaboration between many different types of scientists and between scientists from different labs. For this reason, the National Laboratories are permitted to exchange personnel and make available necessary resources of the Department of Energy for the purpose of conducting research consistent with the National Advisory Panel strategy.

Budgeting for Genome Research

This section is intended to assure that genome research at the DOE would be identified in their annual budget.

Internal Revenue Code Considerations

Provide tax-exempt status for the Human Genome Consortium, association, or cooperative agreement consistent with the national strategy to be developed by the National Advisory Panel.

Provide that basic research payments transferred to the Human Genome organizations qualify for R&D tax credits.

Provide that there is no taxable event upon the transfer of technology from the Human Genome organizations to the member companies.

Antitrust

Provide for an expedited review for Human Genome organizations described in this title, under the National Cooperative Research Act.

TITLE III—SEMICONDUCTOR MANUFACTURING EXCELLENCE INITIATIVE

Findings

Semiconductors and related microelectronic devices are key components in computers, telecommunications, advanced defense systems and other equipment which together represent $230 billion in annual sales;

The leadership position of this country in high technology areas is threatened by the changing nature of foreign competition, which is often strongly supported by the national governments involved;

The United States Semiconductor industry leads all other principal U.S. industries in terms of its investment in research and development. The U.S. reinvested eighty-three percent of pretax profits however, this has been insufficiently by worldwide standards;

Technological superiority is a vital battlefield advantage for United States military forces;

The critical role of electronics to our national defense is evidenced by the fact that the Department of Defense expends thirty-five percent of its research, development and procurement funds on electronics research;

A principal factor responsible for the relative shift in strength of the U.S. and its semiconductor competitors is the fact that the major competitor established a strategic, long term goal of world superiority in semiconductor research and manufacturing technology.

It is in the interests of the national security and national economy of the United States to create a partnership between private industry and the federal government to improve semiconductor manufacturing technology and to facilitate practical deployment of such technology in order to regain the United States' traditional world leadership in the field of semiconductors;

Priority should be given to the development, demonstration and advancement of the semiconductor technology base in order to meet the needs of our Defense Department and to ensure the continued vitality of a commercial manufacturing base;

The Department of Defense is supporting the formation of Sematech to provide a national focus in assuring the vitality of the U.S. semiconductor industry in view of that industry's importance to national security. The Department of Energy's National Laboratories can provide essential support for this effort.

The Department of Energy's National Laboratories have large and complex "user facilities," uncomparable research equipment, unparalleled computer facilities, and excellent research and support staffs in the area of semiconductor technology.

It is in the national interest to ensure that the rights in intellectual property be used to commercialize this new technology rapidly and effectively by the U.S. semiconductor industry;

Interaction between industry and government in order to achieve program consensus is extremely important for the success of this initiative.

To facilitate an exchange of knowledge, certain National Laboratory personnel may be temporarily assigned to Sematech and U.S. industry personnel may be temporarily assigned to the National Laboratories.

Purpose

To establish and conduct a cooperative government/industry program of research on semiconductor manufacturing technology and on the practical applications of such technology. And to apply effectively the unique capabilities of the Department of Energy's National Laboratories in this effort.

Role of Department of Defense

Instruct the Secretary of Defense to establish and conduct a cooperative government/industry program of research on semiconductor manufacturing technology and on the practical applications of such technology.

Instruct the Secretary of Defense to consult, advise and coordinate with the Secretary of Energy and other departments as the Secretary of Defense deems appropriate.

Role of the Department of Energy's National Laboratories

Provide that it is a compatible and essential part of the Department of Energy, and hence the National Laboratories' mission to participate in research and development projects in advanced semiconductor manufacturing techniques in conjunction with the Department of Defense, Department of Commerce, private consortia such as Sematech, universities and others.

Instruct the Secretary of Energy to enter into agreements with Department of Defense, industry consortia such as Sematech and universities working with Sematech to use the National Laboratories' expertise to assist in the research and development of advanced semiconductor technology.

Instruct the Secretary of Energy to include in his annual planning for the Research and Development budget such work as to encourage development of new technology in semiconductors.

Authorize an additional $25 million for additional research and development in this area; to accelerate and compliment ongoing research and to work in conjunction with U.S. industry in areas which are essential to manufacturing success.

Instruct the Secretary of Defense to consult, advise, and coordinate with the Secretary of Energy and other heads of appropriate government agencies to insure that the resources existing at the National Laboratories are used to enhance the semiconductor manufacturing technology program and to avoid duplication.

Work Program for Sematech

Should follow the Sematech business plan. Areas to be developed in cooperation with U.S. industry should include research and development in such areas as advanced semiconductor manufacturing techniques, including sub-micron lithography, deposition, advanced materials, etching, cleaning and epitaxy, silicon process integration; new compound semiconductors and devices that are the basis for optoelectronics and optical communications; Test and demonstrate these techniques on an actual production line; develop techniques for adapting the processes which are proven on the demonstration line to provide flexible manufacturing so that the techniques can be applied to the manufacture of a wide variety of other products; create an automated and computer integrated manufacturing pilot emphasizing flexibility and high-volume.

Work Program for DOE National Laboratories Participating in the Semicondcutor Initiative

Program should complement the Sematech work program.

Research and development in silicon and compound semiconductors should be performed in cooperation with U.S. industry. Progam should emphasize advanced semiconductor manufacturing technologies including: ultra clean processing, processing technology for ultra high density silicon circuits, and improved compound semiconductors and devices. The program may further include materials fabrication, materials characterization, device design and modeling, working with industry to develop new processing equipment and related activities.

Establishment of the Semiconductor Manufacturing Technology Research Initiative

The Secretary of Energy is directed to carry out a cooperative program of research on semiconductor manufacturing research technology and on the practical applications of such technology. (Hereafter referred to so as to complement the activities of Sematech (a consortium of semiconductor manufacturers, materials manufacturers, and equipment manufacturers).

Participation of National Laboratories of the Department of Energy

The Secretary of Energy shall ensure that the National laboratories participation in the initiative does not detract from their primary mission and that the laboratories participate with the Department of Defense, any consortium, college or university working with the consortium.

The Secretary of Energy shall enter into such agreements with other Federal agencies, with U.S. private industrial or research organizations, consortias, or with any college or university as may be necessary to provide for the active participation of the National labs in the Initiative.

The Iniatitive shall include provisions for one or more national laboratories to conduct R&D activities relating to semiconductor manufacturing technologies. These activities may include R&D on materials fabication, materials characterization, design and modeling of devices, and new processing equipment.

Personnel Exchanges

Visitations must be an important part of this program if it is to succeed, therefore, personnel from the National laboratories, Sematech, and industry may participate in temporary assignments. U.S. industry or Sematech personnel may have temporary assignments at the National laboratories; and likewise, laboratory personnel may have assignments with private industry or Sematech on a rotating basis in order to maximize the exchange of knowledge. However, this activity should be carried out so as not to jeoparidize security at the National laboratories.

Other Department of Energy Resources

The Secretary of Energy shall make available to participants in research and development projects under the Initiative, resources of the DOE. This provides that participants in the Initiative may make use of DOE facilities, personnel, equipment, services, and other resources to the extent that the cost of the use of such facilities is reimbursed by the user.

Budgeting for Semiconductor Manufacturing Technology Research

The Secretary of Energy shall provide in his annual budget submission to Congress by the President, for programs, projects, and activities that encourage the development of new technology in the field of semiconductors.

Cost Sharing Agreements

The National laboratory directors are directed to seek cost sharing from private industry and university participants through such cost sharing provisions in cooperative research and development agreements.

Any national laboratory cannot receive more than 10 percent of its annual budget from non-appropriated funds, during any one fiscal year, derived from contracts entered into under the Initiative, unless approved in advance by the Secretary of Energy. This ensures that the aggregate of cooperative agreement commitments for the national laboratories does not grow to be too large a share of their responsibilities and detract from the primary mission of the laboratory.

The value of a cooperative research and development agreement entered into by a National laboratory under this Initiative can not exceed $10,000,000, unless approved in advance by the The Secretary of Energy. This creates another limitation on the Laboratory Directors to ensure that these cooperative R&D agreements do not get out of hand and compete with resources that are needed for the primary mission. It also provides DOE with the opportunity to review a cooperative R&D agreement if it exceeds the limits set, thereby providing oversight of large dollar projects.

Avoidance of Duplication

The Secretary of Energy shall ensure that unnecessarily duplicative research is not performed at the research facilities, including the National laboratories, that are participating in this Initiative.

Additional Considerations

This Act shall take precedence over any other Act which would require a disposition of rights in intellectual property or treatment of collaborative agreements in a manner inconsistent with this Act, including but not necessarily limited to section 152 of the Atomic Energy Act of 1954 (42 USC 2182) and Section 9 of the Federal nonnuclear Energy Research and Development Acat of 1974 (42 USC 5901)

Nothing in this section shall be construed to limit the DOE National Laboratories from performing other semiconductor technology related research and development arranged for, or approved by the The Secretary of Energy or his delegate. In such activities under this subsection, the The Secretary of Energy is authorized to seek reimbursement from non-governmental funds such portion of the laboratories' cost as the Secretary determines to be appropriate.

Provide that although DOE may promulgate regulations, the law shall apply immediately.

Internal Revenue Code Considerations

Provide that cost sharing funds of private industry qualify for research and development tax credit.

Provide tax-exempt status for Sematech.

Provide that contributions of Sematech shall qualify for the R&D tax credit.

Provide that there is no taxable event upon the transfer of technology from Sematech to the member companies.

Antitrust

Provide that all activities set forth in this Act undertaken by private industry shall be covered by the National Cooperative Research Act.

Provide an expedited review for Sematech under the National Cooperative Research Act.

TITLE IV—TECHNOLOGY MANAGEMENT AT THE DEPARTMENT OF ENERGY NATIONAL LABORATORIES

Findings

Private industry has great interest in scientific collaboration with the Department of Energy National laboratories but only, if the present DOE laboratory contracting process can be streamlined and intellectual property associated with joint ventures, adequately protected.

Management of intellectual property must be provided to the Directors of the Department of Energy National laboratories to ensure that they can negotiate with industry to set up cooperative research and development agreements.

The present DOE policy of disseminating computer software publically, via the National Energy Software Center, despite its commercialization potential, has at times, benefited foreign companies. There does not appear to be a timely, consistent review procedure to ensure that commercialization potential is considered, when software is developed under a DOE contract or may have involved some DOE funding.

The Department of Energy National laboratories must be perceived as "user-friendly" in order for industry to seriously consider the laboratories partners for collaborative Research and Development ventures.

The National laboratories must agressively seek contact with private industries to ensure that they recognize the technical and scientific expertise resident in these laboratories, in addition to publicizing the availability of user facilities and technological projects in process.

The National laboratories have demonstrated successes in technology transfer into the private sector but the effort has been modest for many reasons: industry has not been sufficiently involved with the laboratories; technology transfer was not considered a significant laboratory mission; the laboratories were not well versed in industry market requirements; and industry was not involved with the laboratories early enough in the R&D process to direct development of conmercialy viable products.

Purpose

In general, to better meet the continuing responsibility of the Federal government to ensure the full use of the results of the Nation's Federal investment in research and development in meeting international competition.

Provide the intellectual property and contracting tools necessary to ensure that technology transfer from the National laboratories to the private sector is enhanced to better take advantage of our Research and Development accomplishments through the rapid commercialization of marketable products.

Policy

It is the policy of Congress that intellectual property rights in technology or devices developed at the National laboratories be controlled in a manner that promotes the use of such technology and devices to improve the competitive advantage of United States industries.

Technology Management at the Department of Energy National Laboratories

Lists 13 laboratories which, for purposes of this title, are defined as National laboratories. The Naval Nuclear Propulsion Reactor laboratories are specifically excluded from the provisions of this title.

"Subject invention" definition is included to ensure that it is clear that this is an invention which is first conceived or reduced to practice under a contract/funding agreement to operate a National laboratory.

New definitions of 'technical data" and "computer software" were developed to cover technological advances in recording media and to ensure that all such data is protectable as intellectual property, independent of its form (e.g. engineering drawings, computer printouts, magnetic tape recordings, laser discs, etc.).

The definition of "intellectual property" was expanded beyond P.L. 99-502 (Federal Technology Transfer Act of 1986) which just addressed patents. Trademarks, copyrights, trade secrets, and mask works are also considered significant forms of intellectual property, with commercialization relevance. The ownership of all of these forms of intellectual property are valuable negotiating factors for the National laboratory directors in their negotiation of cooperative research and development or licensing agreements. Since, Congress and the States are empowered to enact other forms of intellectual property, these would also be included under the definition once officially enacted.

"Laboratory owned" was included in the definitions because a number of Department of Energy National laboratories are not considered legal entities.

Cooperative Research and Development Agreements

The Secretary of Energy shall permit the National laboratory directors to enter into cooperative research and development agreements with other legal entities, on behalf of the DOE.

Current law, Section 2 of the Federal Technology Transfer Act of 1986 (P.L. 99-502) only gives the Government Operated, Federal laboratories the authority to enter into cooperative R & D agreements. This provision would allow the Government Owned, Contractor Operated Federal laboratories (GOCO's) the same authority to enter into such cooperative agreements. This would streamline the current procedures to get DOE approval of a collaborative agreement, which are long and cumbersome. These current procedures have frequently been cited by private industry as a disincentive for entering into collaborative agreements with the National laboratories.

When the value of the cooperative agreement is under $1 million. It is not subject to the approval of the Secretary of Energy. For these small dollar cooperative efforts, timeliness and lack of red tape are key factors in industry's willingness to collaborate with the national laboratories.

When the value of the cooperative agreement is over $1 million but not greater than $10 million, the Secretary of Energy has the opportunity to disapprove or modify the cooperative agreement, within a 30-day period of its presentation to him or her. If the Secretary does not notify the Director of the laboratory concerned within this 30-day period, in writing explaining the reason for such modification or disapproval, the agreement is deemed approved. Department of Energy approval of major cooperative agreements was considered a necessary function related to DOE's oversight responsibility. The 30-day timeframe was established so as to be responsive to industry requirements and is consistent with Section 2 of the Federal Technology Transfer Act of 1986 (P.L. 99-502).

The cumulative total of cooperative R & D agreements for each National laboratory cannot exceed 10 percent of that laboratory's annual budget. This ensures that these cooperative agreements do not require too large a share of the labs resources.

The Secretary of Energy shall permit the Director of any National laboratory to negotiate intellectual property licensing agreements for laboratory-owned or assigned inventions, technical data or computer software. Current law (P.L. 99-502 Section 2) provides this authority to Government Operated Federal laboratories, this provision would expand that authority to Government Owned, Contractor Operated laboratories as well. Moreover, this provision expands intellectual property licensing to cover technical data and computer software, whereas P.L. 99-502 section 2 only applies to inventions.

Reason for change: The authority to enter into cooperative research and development agreements and to be able to negotiate intellectual property licensing should be expanded to cover all national laboratories participating in this research initiative, therefore, Government Owned, Contractor Operated laboratories should be included in these Technology Transfer Act of 1986 provisions. With respect to expanding intellectual property licensing to include technical data and computer software as well as inventions, protection of this type of data is just as significant for potential commercialization and ensures a participant in a cooperative agreement that their investment is protected from other competitors. The results of a cooperative research and development agreement could include various software packages, engineering drawings, specifications, other technical data in addition to inventions.

The Director of the National laboratory may, under a cooperative research and de-

velopment agreement, accept, retain, and use funds, personnel, services, and property from collaborating parties and provide them the same. He may also grant in advance to a collaborating party, intellectual property licenses to inventions, technical data or software developed under a cooperative agreement. To the extent possible, emloyees or former employees of the National laboratory should be allowed to participate in commericalization of inventions, technical date or software that they made while employed at the National laboratory.

Contract Considerations

The Office of Federal Procurement Policy (OFPP) is authorized to issue regulations implementing the National laboratory directors ability to enter into cooperative research and development agreements and to negotiate intellectual property licensing for laboratory-owned inventions, technical data and computer software. However, implementation of these provisions shall take effect on the date of enactment of this legislation.

The Director of the National laboratory, when deciding what cooperative agreements to enter into shall, give special consideration to: small business firms; to firms located in the United States which agree that inventions, technical data or comuter software resulting from the cooperative agreement will be substantially developed and manufactured in the United States; and universities when their participation will contribute to the purposes of this Title.

Current law: P.L. 99-502 Section 2 and Title 35 U.S.C. Section 200 only requires that inventions developed as a result of a cooperative R & D agreement need be included in consideration, whereas this provision includes technical data and software as well. Moreover, the National laboratory director besides giving preference to small businesses and business units located in the U.S. which agree to manufacture resulting products in the U.S., this provision suggests that the developmental works also be performed in the U.S. This was added to ensure that the U.S. benefits from the results of these cooperative agreements with respect to international competitiveness, jobs in manufacturing, technological innovation, and research and development opportunities. The definition of a U.S. company has become complicated by various types of ownerships, subsidiary arrangements, and the fact that frequently U.S. companies use foreign locations for manufacturing facilities.

Each National laboratory will maintain a record of all agreements entered into under this section.

Patent Ownership and the Considerations of Ownership

All National laboratory contractors would be provided the same rights to elect title to inventions developed under federally funded R & D work, as that provided to universities, non-profits and small, for profit business contractors under current law (Section 200 et seq. of Title 35 U.S.C.).

The Secretary of Energy can retain the title to inventions for exceptional circumstances under Section 202 (a) ii, Title 35 U.S.C. or because the invention is made under a funding agreement which includes a GOCO DOE facility primarily involved in naval nuclear propulsion or weapons programs (Section 202 (a) (iv). The title to such inventions will be retained by the government unless the National laboratory involved, requests title. The Secretary of Energy has 90 days after the request, to notify the lab of the exceptional circumstances determination or that the invention is classified or has been designated sensitive technical information, otherwise the requesting National laboratory shall be deemed to have elected title.

Technical Data or Computer Software and the Conditions of Ownership

The Secretary of Energy shall permit its National laboratories to elect ownership of any intellectual property rights to protect technical data or computer software, generated under a DOE contract for operation of the laboratory, subject to a royalty free license for the U.S. government.

This section provides the Directors of the National laboratories, once they acquire ownership of the intellectual property, the ability to establish a trade secret based on the commerical potential of the technical data or software. If public disclosure of this data is expected to cause substanital harm to the commerical application, the laboratory director can withhold it from the public. This provision would apply to technical data or software obtained or generated under a cooperative research and development agreement, by the National laboratory, or by the agency pursuant to such a cooperative agreement.

Current policy: Software generated under a DOE contract or involving any DOE funding, is automatically owned by the Department of Energy and routinely turned over to the National Energy Software Center (NESC) public code repository. This public disclosure software process is accomplished without due consideration of commercial potential for U.S. companies.

Reason for change: There have been a number of instances when foreign companies have acquired software packages from NESC, at nominal cost, commercialized this software and resold it internationally, to include U.S. companies. This section would ensure that commercialization potential can be taken into consideration before software is publically disclosed. Furthermore, the laboratory directors, in negotiating cooperative agreements, could provide assurances to private industry that software or technical data that they already own, or that is generated under a cooperative agreement, would be adequately protected. Otherwise, these companies would be hesitant to enter into such agreements much less risk investment capital to such a venture.

In addition, this section is consistent with paragraph B6 of Executive Order 12591 which states that there should be a uniform policy permitting Federal contractors to retain rights to software, engineering drawings, and other technical data generated by Federal grants or contracts.

The Office of Federal Procurement Policy (OFPP) would be responsible for developing a standard contract clause for DOE contracts for operation of the National laboratories, providing the laboratory directors with the authority to own intellectual property and therefore to be able to properly protect it under cooperative agreements. This further ensures consistency with respect to the rights of all National laboratories.

Special Rule for Waiver of Government License Rights

When the contractor-operator of any of the National laboratories elects title to inventions, technical data or software under the provisions of ths title, the government is automatically provided with a nonexclusive, paid-up license to that technology or device. The Secretary of Energy may waive this license or other rights reserved in sections 200-204, Title 35, U.S.C., when he determines that the interests of the United States and general public will be better served or the objectives of this Title better promoted.

Reason for change: This is a new concept intended to encourge private industry to develop products that only the government is expected to purchase. Technical advances made at DOE laboratories may require further development to bring the advances to the point of commercialization. It is often advantageous from the government viewpoint, to call upon private risk capital to perform the requisite development and marketing. Without intellectual property protections, however, a competitor may reap rewards attributable a market pioneer without commensurate investment. In some cases, the government's reserve license may be a disincentive to private industry to develop products and services which primarily address a government market. The reserve license, rather than saving the government the cost of royalities, may end up depriving the government of new products and services. (Note that under Section 1498, Title 28 U.S.C., the government may authorize a competitor to use a patented invention, leaving the patent holder an action for reasonable compensation.)

Intellectual Property Contract Provisions

A Department of Energy contract to operate a National laboratory shall provide that royalties or income earned by the National laboratory as a result of licensing of laboratory owned intellectual property rights, under this Title, shall be used to further the objectives of this Act. The use of this royalty income would be guided by Section 202(c)(7)(e), Title 35, U.S.C. for Government Owned, Contractor Operated facilities and by Section 3710c (a)(1) (B) (i)-(iv), Title 15, U.S.C. for Government Owned, Government Operated laboratories. Appropriate use of royalty income would include:

Laboratory costs to obtain intellectual property rights in furtherance of the Act;

Costs of procuring patents/licenses/copyrights/etc. for subject intellectual property, payments to authors and inventors, support of scientific research, development and education at the laboratory, furthering scientific exchange among GOGO's of the agency, and rewarding of scientific, engineering, and technical employees of the laboratory.

The management of the intellectual property, including procurement and licensing, shall be administerd by the contractor employees at the National laboratory, instead of in Washington.

Current Law: Section 202 (c) (7) (C) and (E) are similar to the proposed section, however, current law only applies to the nonprofit and small business contractors and excludes facilities primarily dedicated to weapons related and naval nuclear propulsion programs of DOE.

Reason for Change: These provisions need to be expanded to cover all National laboratories participating in this Initiative, therefore Government Owned, Contractor Operated labs should be included in these "Bayh-Dole" provisions. There is no reason to exclude them.

Section b is a new concept which will ensure that the government does not pay for the Research and Development costs for technology transfered, along with the intellectual property rights, to a National laboratory contractor operator who will use the resulting royalty income for its own benefit rather than using it to benefit the National laboratory system.

March-in Rights

This provision ensures that the invention, technical data, or software acquired as a result of this Title by the laboratory contractor, is offered to a third party for commercialization purposes. If the contractor has not or is not expected to take effective

steps, within a reasonable time, to achieve practical application of the subject invention, technical data, or computer software, the Federal agency can require the contractor to grant a nonexclusive, partially exclusive, or exclusice license to a responsible third party.

A third party, for purpose of this section, is limited to domestic entities located in the U.S. and whose research, development and manufacturing activities occur substantially in the United States.

Current law: Section 203, Title 35, U.S.C. addresses similar march-in rights for the Federal government with respect to small business firms or nonprofit organizations. It specifies that these rights apply to inventions, but does not mention technical data or computer software.

Reason for change: Since, the National laboratory contractors are provided title rights to inventions, technical data, and computer software under the provisions of this title, the Federal government must be provided comparable rights to over ride these if the contractor does not effectively carry out the associated obligations. This will ensure that technology/devices/software do not sit on the shelf, but are offered to private industry for commercialization.

The Office of Federal Procurement Policy would issue implementing regulations for these march-in rights, patterned after Section 203, Title 35 U.S.C.

Effective Date

The Title would take effect on the date of enactment, and would require the Secretary of Energy to immediately enter into negotiation with the National laboratory contractors to modify the existing contracts, for the operation of the National laboratories, to relect the provisions of this title. This will ensure that inventions, technical data, or computer software already in the pipeline will be handled expediously according to this Title.

[From September 1987, Business Month (formerly Dun's Business Month)]

TECHNOLOGY TRANSFER ISN'T WORKING

(By Fred V. Guteri)

In just a few years, a major new chip-manufacturing technology called X-ray lithography could well become the key to survival in the semiconductor industry. The question is, who will be the first to develop it?

Japan's Ministry of International Trade and Industry plans to spend $700 million on the problem this year. Among other things, it is funding the construction of four specialized synchrotrons for chipmakers to produce the X rays essential for research into the new technology.

In the U.S., the Department of Energy recently finished building the nation's first large-scale synchrotron at its Brookhaven National Laboratory in Upton, New York. But it is a general purpose synchrotron used by about ninety academic and corporate research groups for a variety of projects. IBM Corp. is the only company using the synchrotron for X-ray lithography, and its researchers often have to wait in line to use it. "The IBM people are pretty unhappy with the schedule," says William Marcuse, director of technology transfer at the lab. "They spend a lot of time twiddling their thumbs."

The DOE plans to build two more synchrotrons for its labs, but neither one will be tailored to X-ray lithography. And to a growing number of industry leaders, government officials and scientists worried about the United State's flagging competitiveness in technology, this state of affairs is a vivid symbol of the inadequacy of the government's program for transferring R&D to industry.

The federal research labs constitute a formidable chunk of the nation's pool of talent and equipment. The 700-plus labs across the country spend more than $18 billion a year and employ one sixth of the nation's research scientists and engineers.

By tradition, the labs disseminate technology to the public and issue licenses for their published patents to anyone who wants them. But American companies have used few of the thousands of new patents filed every year because they are loath to invest in a technology their competitors can obtain easily. It was a Japanese firm, for example, that developed solar cells for calculators from a National Aeronautics and Space Administration patent.

Since 1980 the Reagan Administration has been spearheading an ambitious campaign to make the fruits of the federal research labs available to private industry. One results is new legislation that now allows companies to license exclusive patents owned by the labs and encourages cooperative R&D programs for industry, government and universities.

These moves have been welcomed. But no significant technological benefits have yet accrued to industry, and the obstacles to implementing the transfer of technology now look so numerous and deeply rooted that it seems doubtful the government labs will ever be able to help industry fulfill its research needs. "The new laws are no panacea for getting technology into private industry," says William Burkman, director of physics at AT&T Bell Laboratories. "There are a lot of stumbling blocks involving the kind of priorities the labs have set up."

The basic problem is that the whole notion of working with private industry runs counter to the long-standing mission of the federal labs to serve the general public. For the better part of four decades, they have pursued their own agendas sheltered from the needs of the marketplace. Federal researchers have deepened the pool of scientific knowledge and enhanced the nation's weapons arsenal. Any benefit derived by industry has been a mere afterthought.

The need to keep classified weapons research under wraps has impeded technology transfer in the DOE and the Defense Department. That becomes a formidable barrier considering that defense will account for 72% of government R&D spending next year, up from 51% in 1980, and that the lion's share of the labs belongs to those two departments.

The DOE is particularly hostile to industry-directed research. It has refused to give its labs authority to license patents to companies—a step that industry considers crucial for making the technology accessible. The department's policy of reviewing every application for a patent license case-by-case, industry complains, is too much trouble and takes too long—anywhere from six months to several years—to pass through the labyrinth of DOE bureaucracy.

This procedure discourages companies from using the labs as a resource. Lee M. Rivers, who recently left the White House Office of Science and Technology Policy to represent the Federal Laboratory Consortium in Washington, says he is "up to my eyeballs" trying to get industry to take the labs seriously. "If a businessman has to take four months to figure out what he needs to do and then has to go through six layers of bureaucracy in Washington, that's going to be tough," he notes.

DOE officials insist they are proceeding with caution only until they learn more about technology transfer and promise to streamline the waiver process down to six months or so. Critics say they are stalling. And Bryan Siebert, DOE director of international security, admits, "I would err on the side of reviewing practically everything, even if it involves delays."

In fact, when Congress passed legislation in 1984 allowing universities and nonprofit organizations that operate DOE labs to license patents, the department tried to nullify the law by claiming that national security and nuclear nonproliferation took precedence. Its position led to an executive order by President Reagan last spring restricting the DOE's discretion to withhold patent licenses.

Regulations also limit the amount of money the DOE labs can spend on research for outside organizations to 20% of their budgets, with most of that going to other government labs. And no company can do research at a DOE lab if comparable facilities can be obtained elsewhere. Emphasizing the DOE's stand, Antoinette G. Joseph, director of field operations management, says, "People argue that there is this technology sitting on the shelf and that if you have a uniform technology transfer policy, the government can make it all available in one fell swoop. Well, it can't. The national defense mission is more important than the technology transfer mission."

The Defense Department has its own bureaucratic problems, but it has been more flexible in issuing licenses. For years, the DOD has allowed the companies it does business with to commercialize at no cost the patented technology they develop. These relationships, however, have existed primarily within the close-knit community of government contractors working on classified projects. "Everything done in the labs is documented and made available to people with the appropriate clearances," says Frank Sobieszczyk, chief of the DOD research program office. "The labs will call in defense contractors and give them a dog-and-pony show." Because of its fear of leaks, the DOD is reluctant to enter into cooperative R&D agreements with other companies.

In addition to the problem of classified R&D, identifying promising new technologies for industry to exploit is a monumental task. Corporate R&D executives have largely ignored what goes on in the labs, viewing them as irrelevant and inaccessible. Reluctant to deal with the bureaucracy, they are unaware of helpful research buried within multimillion-dollar programs.

At the same time, most federal labs lack the staff necessary to sift through the enormous number of projects, ferret out the good ideas and target them for specific industries or companies. "There's a lot of research going on at the labs," says President A. Sidney Alpert of University Patents Inc., which sells university-owned patents to industry. "If they put enough manpower on it, there could be some good inventions. But you won't find them the way the labs are going about it."

It does not help that lab researchers must depend on their technology transfer specialists to explain their innovations to corporate R&D people. These specialists are in short supply—only one DOD lab has one, for instance—and they are a harried lot with responsibility for hundreds of different projects.

As intermediaries, they also are one more roadblock for industry. Hillard Williams, vice president for technology at Monsanto Corp., says that government tech transfer people lack experience in getting technology out to industry. John D. Hale, vice president for research at Kerr-McGee Corp., comments: "We have enough trouble transferring technology out of our own lab. How are

we going to keep up with the technology coming from the federal labs?"

Even if industry had free access to the technology at the labs, raw research requires considerable development before it is applicable to new products, and much more input from the labs—information about manufacturing processes, the expertise and judgment of the original researchers, and so forth—is needed by a company planning to adopt a technology. "The basic research at DOE labs is one level less practical than the stuff that is done at universities, which isn't very practical" says University Patents' Alpert.

The labs have limited resources to devote to the kinds of cooperative R&D programs that would help industry absorb basic research. And they have had trouble attracting financial support from industry because they lack the authority to isssue patents in return for funds.

Companies are also put off by the government's inflexibility in negotiating cooperative research agreements. The agreements are often written like procurement contracts, with specific deadlines scheduled years in advance. Such tight schedules lead to misunderstandings when the research doesn't pan out the way it was originally planned. "Federal people don't speak the same language," says Monsanto's Williams. "Things get complicated, and industry tends to just give up."

Amid this bleak picture, there are a few hopeful signs. Payoff from exclusive patenting, for instance, is evident in Oak Ridge, Tennessee, where a dozen or so companies have sprung up to develop products—heat-resistant diesel engines, high-strength cutting tools and more—based on patent licenses granted by the DOE lab there.

"A kind of magic has set in," says William W. Carpenter, vice president for technology applications at Martin Marietta Energy Systems, which runs the lab for the DOE and aggressively pushed the patents through its licensing process. "In Oak Ridge, houses are selling, school enrollment is up for the first time in twenty years, a new missile plant has gone up. A great deal of that is due to our technology transfer program."

Inside the labs as well, there is some movement afoot to open the door. Eugene E. Stark, an engineer at DOE's Los Alamos National Laboratory, is one of a new generation of government researchers who now sees a unique opportunity to get the labs into the mainstream of technology.

In his spare time, Stark is chairman of the Federal Laboratory Consortium for Technology Transfer, an ad hoc government and industry group that is promoting technology sharing. "We can't wait ten more years to break down the institutional barriers to technology transfer," Stark says. "We're entering a period of restructuring in science and technology institutions. Whatever new relationships develop as a result of international competition will take place in the next three-to-five years. If the labs move slowly, they will become irrelevant."

Groundwork also has been laid for several cooperative agreements between industry and the labs. The Army's Electronics Technology and Devices Laboratory in New Jersey is setting up a consortium with several electronics firms to develop flat-panel display screens. And the DOE's Argonne National Laboratory and the University of Chicago are currently negotiating with companies to do superconductor research.

Meanwhile, the Defense Department is funding a study on building a synchrotron devoted exclusively to semiconductor research. And at the DOE's conference on superconductivity last July, President Reagan proposed a government-sponsored "Superconductivity Initiative," which would include, among other things, increased spending by the labs. In addition, DOD proposes spending $150 million over three years to apply superconductivity research to military ships and weapons.

How all the money is spent—whether industry gets to set at least part of the research agenda—may be the first real test of the technology transfer laws and the nation's resolve.

THE SEMICONDUCTOR INDUSTRY AND THE NATIONAL LABORATORIES
(Part of a National Strategy)

EXECUTIVE SUMMARY

According to a recent report by the Defense Science Board, leadership in 19 of 25 key products and processes in the semiconductor industry has been lost to Japan and the relative position of U.S. producers is continuing to decline.[1] One response to this competitive challenge is to increase the U.S. semiconductor industry's efficiency through shared and collaborative research efforts. Existing industry cooperatives, such as the Semiconductor Research Corporation (SRC) and the Microelectronics and Computer Corporation (MCC), are proving the feasibility and effectiveness of collaborative research efforts. As an adjunct to industry collaboration, should other national resources, such as the national laboratories of the U.S. Department of Energy (DOE), be mobilized to leverage facilities, capabilities, and results on a national level?

To begin to answer this question and to determine the potential value, role, and contributions of the national laboratories in addressing the problems of the semiconductor industry, the National Research Council held a workshop on February 24, 1987. The workshop assembled representatives from the semiconductor industry, the national laboratories, federal agencies, and Congress to determine how cooperation between the laboratories and industry might take place within the context of a broader national action program.

A variety of issues related to the competitiveness of the semi-conductor industry was discussed at the workshop. The participants agreed that the current problems of the semiconductor industry represent a national crisis that requires a coherent national action program in response. To summarize the discussion, workshop participants recognized that little progress is likely without a consensus on the short- and long-term competitive goals of the U.S. semiconductor industry.

Once these goals are identified, a national strategy to achieve them must be developed that would address issues such as the role of government, the extent of cooperation versus competition appropriate for a healthy industry in the future, appropriate research foci, effective use of resources outside of the industry, and mechanisms for achieving cooperation and synergism among participants in this national strategy. The workshop participants raised the idea that an organization or advisory committee with representatives from the semiconductor manufacturers, their suppliers and customers, government, and universities might be formed to provide the necessary leadership to build consensus and devise an effective national strategy.

In discussing the elements of an effective national strategy, the workshop participants agreed that it should combine and coordinate the resources of the semiconductor industry and the federal government in a cooperative effort to restore competitiveness. There was a consensus that the facilities and expertise available at the DOE's national laboratories are valuable resources that should be used to augment the research capabilities of industry and the universities.

To facilitate greater cooperation between the national laboratories and the semiconductor industry, several suggestions were made.

A dialogue between the semiconductor industry and the national laboratories should be initiated and formalized to identify appropriate research projects and to negotiate pragmatic solutions to issues like data access, ownership and publication rights, cost sharing, scheduling, and technology transfer mechanisms. Existing collaborative research efforts could serve as models.

A standing advisory council with representatives from industry and the various national laboratories could be formed to facilitate this dialogue and to serve as a forum for the discussion of issues. Such a council could develop a broad agreement on the generic issues involved in cooperation and coordinate the overall cooperative effort, thereby facilitating agreements on specific research projects that are likely to be negotiated between individual laboratories and interested companies.

There are opportunities for the national laboratories to continue existing projects and to initiate new research that would be beneficial to the industry. However, to maximize the effectiveness of this research, the mission of the laboratories needs to be expanded to include research in semiconductor-related science and technology. Additional funding will also be needed to provide the laboratories with sufficient resources to make an effective contribution to the long-term competitiveness of the semiconductor industry. The workshop attendees believed that these two issues—a broadened mission and increased funding—need to be addressed in DOE's budget process as quickly as possible.

There was broad agreement at the workshop that the federal government in general, and the national laboratories in particular, have a role to play in restoring U.S. competitiveness in semiconductors. If the industry can articulate specific areas of generic research that conform to the capabilities of the national laboratories, and the laboratories can adjust their operations and mobilize their resources to address those research areas, the potential contribution of the national laboratories for future industry competitiveness can be realized.

SEMICONDUCTOR RESEARCH CORP.
September 21, 1987.

HON. PETE V. DOMENICI,
U.S. Senate,
Washington, DC.

DEAR SENATOR DOMENICI: The Semiconductor Research Corporation strongly supports "The Department of Energy National Laboratory Cooperative Research Initiatives Act" (S. 1480). The National Laboratories of the Department of Energy are a major national resource. They should be given a mission to participate in research on advanced semiconductor manufacturing technology, so vital to the national security and economic interests of the United States. We believe that your bill, S. 1480, would accomplish this purpose.

The semiconductor industry has recognized the desirability of a role for the national labs in SEMATECH, a private sector-driven consortium composed of major U.S. semiconductor manufacturers in partnership with government. The industry has proposed a mechanism for a laboratory/industry partnership in its business plan for SEMATECH. We envisage that the research

of the national labs in this area should be designed to complement the overall SEMATECH work program.

The joint planning workshops sponsored by the National Academy of Sciences in February and May put into motion the first steps toward matching the semiconductor industry's and the national labs' R&D efforts. Collaboration on the specific technological objectives of each national laboratory with industry will continue to be explored and identified as a result of future workshops to be sponsored by the SEMATECH consortium.

We envisage that the Secretary of Energy would be part of a "National Advisory Committee on Semiconductor Research and Development" composed of government and private sector members. The committee would provide a focal point for coordinating, devising and implementing an effective national strategy for semiconductors. Indeed, if the the national labs are to provide beneficial support to SEMATECH, more coordinated programs between the labs and SEMATECH will be necessary.

We believe that in developing technology roadmaps for SEMATECH, those programs involving the labs would eliminate duplication of efforts. However, the urgency of the problem demands a change in the nature and pace of the research pursued. Needless to say, mobilizing the national labs in coordination and collaboration with industry efforts requires the immediate attention of federal policymakers in order that such efforts can provide timely answers.

In establishing a National Laboratory Cooperative Research Initiative, the bill would make a number of recommendations in anticipation of the formation of research consortium such as SEMATECH. Since SEMATECH was established in May, 1987, we have a few recommendations that could improve the proposal. We believe: (1) The legislation should specify coordinating the research of the national labs under this initiative with the semiconductor industry's new R&D consortium, SEMATECH. (2) The legislation should clarify that any funds expended by the Department of Energy on such projects would be in addition to the funds expended on SEMATECH by the Department of Defense. We do not view a national labs' semiconductor research initiative as an alternative to DoD efforts, and do not anticipate that such an effort should result in a substitution or dilution of the Defense Department's funding level for SEMATECH of $100 million per year for the next five fiscal years. (3) Finally, we believe that DOE should fully fund the research of the national labs, and that the proposed cost sharing arrangements with industry in this case would not be necessary.

We strongly support S. 1480 and federal funding in the Energy Department's Budget for the National Laboratories to conduct semiconductor manufacturing research in coordination with SEMATECH. We firmly believe that a coalition of SEMATECH and the national labs would strengthen the future competitiveness of the semiconductor industry.

Sincerely yours,

LARRY W. SUMNEY,
President.

NEW SUPERCONDUCTORS MAY HAVE SIGNIFICANT ECONOMIC IMPACT

(By Alan M. Wolsky, Edward J. Daniels and Robert F. Giese)

Economics essentially concerns the competition between different ways of doing things. In the field of superconductivity, the competitors are normal conductors (copper, for example), low-temperature superconductors (niobium-tin), and the new high-temperature superconductors (copper-oxide ceramics).

Superconductors carry electrical current with almost no loss. Thus, they offer many benefits compared to conventional conductors, which waste energy by resisting current flow. Recently discovered high-temperature superconductors use cheaper, more efficient cooling systems than their low-temperature counterparts.

The new materials might have significant economic impact on medical imaging, industries using magnetic separations, and the development of advanced energy sources. They would increase the efficiency of generators and motors, and enhance development of desktop supercomputers, levitated trains and underground electrical transmission lines.

The technology evaluations group at Argonne National Laboratory is spearheading a muitilaboratory study for the Department of Energy to evaluate the economic promise of high-temperature superconductors and examine potential limitations. If present problems can be solved, we believe the new materials will cut capital and operating costs in numerous industries and even spawn new technologies.

Superconductivity is influenced by three interrelated properties: temperature, magnetic field and current density. Transitional superconductors, such as niobium-tin, lose all resistance to electricity when cooled to about 18 Kelvin (minus 427 degrees Fahrenheit). The total cost of refrigerating these materials is formidable. Capital is required to buy refrigeration equipment and thermal insulation, which slows the rate at which outside heat reaches the superconductors. Operating costs pay for liquid helium ($11 per gallon) and for the energy needed to remove heat that penetrates the insulation.

In comparison, copper-oxide ceramics become superconducting at about 90 K (−297 F). This critical temperature (T_c) reduces refrigeration costs in two ways. First, less insulation is needed because heat transfer is much slower at warmer temperatures. Second, liquid nitrogen (22 cents per gallon) can be used as the coolant.

For example, magnetic resonance imaging uses a large superconducting magnet cooled to about 4 K (−452 F). The capital costs for insulation is around $100,000, and liquid helium costs about $30,000 per year. If the magnet could be maintained at 77 K (−321 F) instead, insulation costs would be cut to only $50,000—a 50-percent savings. Cooling with liquid nitrogen would reduce refrigerant costs to $3,000 annually—an even more dramatic savings of 90 percent.

Magnetic field strength also affects superconductivity. If the magnetic field is too strong, superconductivity is lost. The new materials appear to maintain superconductivity field strengths than current superconductors. This might lead to practical, lightweight electromagnets with stronger magnetic fields. If the magnetic field is too strong, however, it can cause enough mechanical stress to pull apart the magnet. This may restrict potential uses of large superconducting electromagnets.

The major limiting factor, however, for commercial applications of high-T_c superconductors is current density—the new materials simply do not carry enough electricity to be useful on a large scale. Critical current density measures how much current the material can carry before losing superconductivity.

Most applications have an operating current density—which is lower than critical current density—greater than 10,000 amperes per square centimeter (A/cm²). This is 10 to 100 times higher than critical current densities measured thus far in wires and tapes made from ceramic superconductors. However, single crystals and thin films have demonstrated current densities greater than 1 million A/cm².

The popular press has focused on critical temperature, but current density is more important to the engineer and economist for several reasons:

Size and weight. As current density rises, the required size and weight of the superconducting magnet falls. Smaller, lighter magnets would reduce costs for supporting structures and increase payloads for levitated vehicles.

Flexibility. Higher current density allows the superconductor to be thinner, which increases flexibility. This means the material is more easily wound in the form or wire or tape. Improved flexibility also makes the material more reliable and durable.

Cost of raw materials. Smaller superconductors are less expensive to manurfacture.

High current density would make high-T superconductors invaluable in energy production, magnetic separations and other industries that use powerful electromagnets. Conventional electromagnets are large, heavy, and require large amounts of electricity. They have an iron core, which strengthens the magnetic field generated by copper coils. But iron makes the magnet heavier and limits its uses. If high-T superconducting coil could carry more current, the iron core could be eliminated, making the magnet smaller and lighter. Such a magnet would cut electric bills by 75 to 90 percent.

Several other properties of the new materials also affect their economic potential. One consideration is their ability to bond with other materials, which would improve strength and reliability. A brittle superconducitng wire could be sheathed in metal for protection and strength. The metal would also act as a shunt for current flow in case superconductivity is lost.

Chemical stability is another important factor. The new materials are prone to lose oxygen and thus their superconductivity.

Finally, contrary to popular belief, superconductors do not necessarily transmit electricity entirely without loss. Actual energy savings depend on whether direct current (DC) or alternating current (AC) is used. Direct current, which moves in a constant direction, circulates without loss in superconductors and creates steady magnetic fields. Alternating current reverses direction at regular intervals, which causes small amounts of electricity to be lost even in superconductors. Unfortunately, our electrical infrastructure uses AC, because in normal conductors is loses less energy than DC.

Still superconductors with favorable properties would have profitable applications in many industries, including electronics, communications, transportation and medical diagnostics.

In energy production and storage, both utilities and consumers will save money. Utilities suffer losses during the generation, transmission and distribution of electricity. A typical AC generator is 98.5 percent efficient in producing electricity, and 95 percent of this power reaches consumers.

High-T, superconductivity might improve those figures. Superconducting AC generators and power transformers would both have operating efficiencies greater than 99.7 percent. This improvement may sound small, since generators are already 98.5 percent efficient, but it would cut energy losses by about 80 percent. On a large scale, this could produce substantial savings—up to 60 percent over conventional units.

Efficiency is not the answer, however, for underground superconducing transmission lines. Such lines might lose less than the 1 percent of electricity per 100 miles lost by conventional aerial lines, but they will not make them obsolete. Air provides "free" cooling and electrical insulation, and stringing lines overhead is far less expensive than digging trenches to hide them underground.

But aerial lines have problems with aesthetics and potential health risks that may cause underground transmission lines to become a viable alternative. If this occurs, high-T superconducting lines might save 40 percent over conventional underground lines, which experience energy loses of nearly 4 percent.

Superconducting magnetic energy storage (SMES)—huge magnets that can store electricity indefinitely without loss—could increase effective generating capacity by 15 percent or more. High-T superconductors would reduce the capital cost by 5 to 8 percent, compared to low-T systems. These savings might make SMES competitive with gas-fired plants in providing electricity for peak consumption. SMES also might enable solar energy to displace natural gas in the production of electricity, although coal and nuclear power will continue to dominate.

On the consumer's side of the meter, high-T superconductors would increase the efficiency of motors, while cutting their costs about 25 percent. Approximately 64 percent of all electrical power is used in motors, which have efficiencies ranging from 78 to 95 percent. Large motors would benefit most from superconductivity—despite their 95-percent efficiency—for two reasons. First, large motors use substantial amounts of electricity, so small increases in efficiency can still yield substantial cost savings. Second, compared to small motors, large super-conducting motors would need less refrigeration per horsepower of output.

As we have mentioned, the health industry and its clients—us—would benefit by applying high-T superconductors to magnetic resonance imaging (MRI). Doctors diagnose disease with the powerful magnetic field generated by the cylindrical superconducting magnet, which is about 3 feet in inside diameter and 7 feet long.

Installed cost of an MRI machine is about $2.25 million, of which $400,000 is for the magnet itself. The additional money is spent on electronics and construction required to house the 35-ton machine. Lighter magnets and liquid-nitrogen cooling systems would reduce capital and operating expenses, savings patients up to 10 percent over current MRI costs. The machines would also be more portable, allowing truck-mounted MRI units to visits hospitals and clinics that cannot afford machines of their own.

But the most valuable economic effect to MRI may come from another direction entirely. High-T superconductors may increase the usuable diameter of the magnet—the hollow area where the patient fits—by 6 inches. This space is presently taken up by cooling equipment and insulation. Enlarging the diameter from 18 to 24 inches would allow the machine's use on the 5 percent of the population who currently cannot fit inside. The economic gain becomes even greater when the lengthened productive life of treated patients is considered.

High-speed trains are a frequently discussed application of high-T superconductors. Such trains are being considered for a dozen routes within the United States. The new superconductors will not significantly cut total capital costs of magnetic levitation systems, because present designs allocate only about 1 percent of capital cost to levitating magnets. But if the new materials operate efficiently at 77 K, they may provide the ease of operation and improved system reliability that will make superconducting magnetic levitation systems the preferred choice among high-speed rail technologies.

MRI and levitated trains highlight the economic subtleties of new technology, which are not always revealed by looking at energy usage or dollar signs. Again and again, when we look at applications, there will be benefits difficult to foresee on a straight energy basis.

Magnetic separations are another area where high-T superconductors could reduce operating and maintenance costs. The paper industry uses electromagnets to separate the impurity titanium from kaolin, which brightens paper. In the steel industry, magnets remove recyclable iron scrap from sludge and wastewater. Iron impurities picked up from pipes are removed from food and drugs.

High-T superconducting magnets may offer several advantages—reduced weight, higher throughput, smaller floor space—over conventional electromagnets, in addition to an 80-percent reduction in power consumption. High-T superconductors would save 15 or 20 percent, respectively, in capital cost over conventional or low-T systems.

Magnets made from the new materials might also be applied to other industrial processes, such as materials handling and fabrication, gas-phase separations and water treatment.

High-T superconductors have the potential for enormous economic impact. Before their true economic potential can be realized, however, we must discover their thermal, electrical and mechanical properties and develop methods of manufacturing the ceramics reliably.

An immediate concern is that the new superconductors do not carry enough current. This is the major limiting factor from an economic point of view, because higher current density translates into less weight and smaller size. Current density must be increased 1,000 to 10,000 times before the materials will carry enough electricity to reduce magnet size and weight and compete effectively with conventional conductors on a large-scale basis.

If these problems can be overcome, high-T superconductors may live up to the expectations aroused by recalling the transistor and the laser. In short, they could change the way we live.

Los Alamos Unveils Superconductivity Breakthrough

Los Alamos, NM, Feb. 24, 1988—A startling discovery at Los Alamos National Laboratory may revolutionize how scientists research why certain materials conduct electricity.

A team led by chemist Kevin Ott has discovered that a change in the type of oxygen isotopes used in a superconducting material can dramatically affect at what temperature the material will conduct electricity.

"The results were so surprising that at first it was almost scary," said Ott, of the Lab's Chemical and Laser Sciences Division. "You ask yourself, is there something wrong with the experiment samples?"

Ott's research revealed that synthesizing certain oxygen isotopes with "heavier" oxygen caused the material to conduct electricity at a much lower temperature.

Ott's experiments substituted oxygen-16—the type of oxygen that comprises most of Earth's atmosphere—with oxygen-18, an oxygen isotope with two more neutrons, making it heavier.

Neutrons are electrically neutral subatomic particles.

Ott's oxygen substitution caused a drop in the "critical temperature"—or temperature at which a material becomes superconducting—of 33 degrees Kelvin, or about 60 degrees Fahrenheit.

The experiments caused the material to begin conducting electricity at 59 degrees Kelvin, or 355 degrees below zero Fahrenheit.

The superconducting race has scientists from around the world scrambling to unlock the mysteries of why certain materials, when cooled to extremely low temperatures, allow electricity to freely flow through them.

The material synthesized by Ott for the Los Alamos experiments was comprised of metals used in previous superconducting experiments: yttrium, barium and copper.

The compound was interconnected with oxygen atoms to hold it together.

"I believe the key to our success was that when we built the lattices, we did not use a gas-phase exchange process," said Ott.

That process, previously used in other superconducting experiments, involves placing the compound in an enriched oxygen atmosphere, which allows the isotopic oxygen atoms to diffuse around and replace the natural oxygen in the compound.

"In our experiments, we started from scratch," he said. "We dissolved the metals in oxygen-18 nitric acid and then processed them into a material containing heavier oxygen isotopes."

Placing the oxygen with the metals in the material from the beginning assured the oxygen was thoroughly integrated throughout the compound. Gas-phase exchange allows less of the oxygen atoms to permeate the material.

"It's the difference between having the oxygen isotopes in 94 to 96 percent of the material and having it in less than 90 percent," said Ott. "I think that high level of oxygen distributed throughout the lattice was the key difference in the success of our experiments."

The Los Alamos team anticipated that the oxygen-isotope exchange would cause a slight shift in the compound's critical temperature.

"We thought it would be subtle, in the range of half a degree," said Ott. "When it resulted in a 33 degree (Kelvin) shift, we were worried at first that we had done something wrong when we produced the samples."

Ott affirmed the discovery by preparing six more samples with oxygen-18 and experimenting with them. He also experimented with oxygen-17 samples to verify his results.

"After the oxygen-17 experiments, we were convinced that we were on to something very interesting," he said.

One goal of the worldwide superconductivity race is to find materials that will reach the point of superconductivity as near room-temperature as possible.

While the Los Alamos experiments illustrate a drop in superconductivity temperature, not an increase, the isotope-exchange results will advance the understanding of superconductivity materials.

"Our results are likely to change the physics theory on what causes superconductivity," said Ott.

"This was a perfect example of what close collaboration can do," he said. "Chemists, solid state physicists and material scientists all worked together closely on this effort."

Said Ott: "The project's success also was made possible by the fact that Los Alamos is one of only a handful of facilities in the world that can separate oxygen isotopes.

This capability made our isotopic synthesis possible."

Collaborating with Ott on the experiments were James L. Smith and James F. Smith, both of the Lab's Center for Materials Science; Jeffrey Willis, Robert Aiken, Ballard Pierce and Joe Thompson, all of the Condensed Matter and Thermal Physics Group; and Bill Hutchinson of the Analytical Chemistry Group.

Also collaborating: George Kwei of the Physical Chemistry Group; and Eduardo Garcia, Maxwell Goldblatt and Thomas Walker, all of the Isotope and Structural Chemistry Group.

Los Alamos National Laboratory is operated by the University of California for the Department of Energy.

NEW PROCESS IMPROVES SEMICONDUCTOR FABRICATION TECHNOLOGY

ALBUQUERQUE, NM.—Researchers at Sandia National Laboratories have developed a new technique that promises to improve control of compound semiconductor fabrication technology. Called ion-damage-controlled photochemical dry etching, it uses accelerated ions to change the electronic behavior of selected areas on a semiconductor so the areas act as a "mask" for subsequent photochemical etching.

Because this mask becomes part of the semiconductor wafer, it cannot slip or change position during fabrication, as can happen with conventional photolithographic technologies. Since ion implantation is an essential processing step for many devices, using the new technique as an integral part of that processing should reduce the number of steps needed to prepare complicated circuits. This could save processing time and money.

The new process is the result of a group effort involving Sandians Carol I. H. Ashby, David R. Myers, and Frederick L. Vook. "The exciting thing about it is the control it gives you for device fabrication," says Myers. The process is an advancement of the basic dry photochemical etching technique developed at Sandia several years ago by Ashby and James Dishman.

In conventional semiconductor fabrication techniques, a thin wafer is covered with a mask patterned with a protective material (photoresist), then exposed to a reactive chemical for etching. Where there is a opening in the mask, the chemicals etch out a corresponding shape, such as a pit or groove.

Complex integrated circuits require multiple masks and multiple etchings. Because it is difficult to get perfect alignment between masks and the structures already etched in the wafer, each subsequent masking and etching step increases the risks that a mask will not precisely match the existing pattern. This could result in degraded performance for the integrated circuit.

The new Sandia etching technique reduces the need for multiple masks by exploiting the chemical effects of an initial ion implantation, as is typically performed to provide localized doping of a wafer. An ion encountering a semiconductor surface will damage the material, thereby producing traps for "free carriers"—free electrons or holes—in the material. Since free carriers are particularly important in selected photochemical reactions, the ion-damaged surface areas are relatively chemically inert compared with undamaged sections.

In conventional techniques, the semiconductor is heated after ion bombardment to restore the electronic properties of the semiconductor by annealing out the damage caused by the ions. In photochemical dry etching, however, this annealing step is delayed so the unique chemical properties of the ion-damaged areas can be exploited. The mask that determines where the ions strike the wafer is stripped away and the semiconductor is then placed in a chamber containing a low concentration of a highly reactive chemical. Sandia's researchers have been using atomic chlorine to etch gallium arsenide.

The semiconductor is bathed in a strong light to generate free carriers. Sandia uses a laser for this purpose, but the researchers say other forms of illumination work as well. These optically generated free carriers drive the chemical reaction between the semiconductor and the surrounding chlorine gas. The reaction products leave the surface and are transported away, leaving behind an etched pattern in the surface.

The material will be etched readily where there are a great number of surface free carriers. The reaction is greatly slowed or even prevented where there are relatively few free carriers—where the surface has been ion bombarded. The damage produced by the ion implantation acts as the mask for all subsequent etching processes.

Because this mask is formed directly in the semiconductor itself, there is no chance that it could slip and ruin the whole wafer. "Once you've put the damage in, it acts as an integral mask for subsequent process steps," says Myers.

Similar, "self-aligning" techniques are common in silicon wafer fabrication technologies, but self-aligning technologies for compound semiconductor processing have been only modestly successful and require complex metallurgy.

Photochemical dry etching gives much finer control during fabrication. As Ashby has demonstrated previously, it is possible to decrease or increase the number of free carriers available by changing the amount or wavelength of light shining on the semiconductor. Also, the depth of the ion-damaged material can be tailored by controlling the energy of the ions used.

The new techinque can be adapted to a wide variety of materials and device structures. The technique's only major limitation is that it will not work on semiconductor wafers that were already doped extremely heavily before the masking and etching process.

The Sandia researchers say that the first practical application of the process will be the fabrication of a striped-array laser, a type of solid-state laser that requires multiple grooves be cut on a very small scale across a wafer of semiconducting material. But they add that it could be used with virtually any type of semiconducting material and has already been demonstrated on gallium arsenide and gallium phosphide.

Sandia National laboratories, with facilities in Albuquerque, N.M., and Livermore, Calif., is operated for the U.S. Department of Energy by AT&T Technologies, Inc.

EXPERT COMMITTEE FINDS MAPPING AND SEQUENCING HUMAN GENOME FEASIBLE; RECOMMENDS $200 MILLION ANNUAL BUDGET

WASHINGTON.—A $200-million-a-year effort to discover the location of every gene within human chromsomes should begin immediately, a National Research Council committee urged today. The program should give development of new mapping techniques highest priroity, but should also include research on new methods for determining the precise chemical makeup of individual genes on the map.

"The committee strongly believes that a project to map and sequence the human genome should be undertaken." the report says. "Such a special effort in the next two decades will greatly enhance progress in human biology and medicine." The committee also emphasized a need to study the genetic make-up of other animal species to provide comparative data.

Some 3,000 human diseases are known to be inherited, including cystic fibrosis, Huntington's disease, and certain kinds of Alzheimer's disease. Gene mapping "offers the best hope of identifying the responsible genes" for these disorders and may ultimately lead to treatments for them, the committee said. The project could also help unlock such fundamental biological secrets as the mechanisms that govern human development from an embryo to an adult.

The Research Council study was funded by the James S. McDonnell Foundation of St. Louis, MO. The committee was asked to study the feasibility, cost, and management of a national project to map the human "genome," a term scientists use to refer to the entirety of human genetic material.

The National Research Council is the principal operating agency of the National Academies of Sciences and Engineering.

THE DNA BLUEPRINT

Each of the body's cells carries a complete set of genetic blueprints for the human body. These blueprints take the form of genes, which collectively serve as a kind of biological construction manual that dictates the body's form (hair and eye color, for example) and function (digestion, respiration, and other essential physiological functions).

These genes are located on chromosomes, long strands of deoxyribonucleic acid (DNA) strung together from pairs of molecules called nucleotides. These nucleotide pairs give DNA its characteristic "double helix" shape, rather like a twisted rope ladder. Human chromosomes hold approximately 100,000 genes. These genes, in turn, consist of nucleotides—some 3 billion in all. The location of fewer than 1,500 of the 100,000 genes have been charted on chromosomes; an even smaller proportion of the nucleotide sequences (less than 0.1 percent) have been determined.

Most genes are responsible for building protein molecules. These proteins are responsible for both the form and functions of the human body. In inherited diseases, faulty genes produce too much, too little, or the wrong kind of protein.

A GENETIC ATLAS

Mapping the location of genes on the chromosomes is the first step toward understanding what causes these disorders. After the mapping is complete, the exact order of the nucleotides remains to be determined, a process called sequencing.

One way to understand the difference between mapping and sequencing is by likening the process to a road map. Mapping puts in the highways and major interactions; sequencing fills in the details. The ultimate genetic atlas is the nucleotide sequence, in which the identity and location of each of the 3 billion nucleotide pairs is known. "Only such a sequence reveals all or nearly all the information in the human genome," the committee stressed.

"It is no exaggeration to say that current maps of human chromosomes compare in quality to the navigational charts that guided explorers to the New World," the committee said. "Another decade of special effort directed toward mapping the human genome could yield maps comparable to the best modern maps of the earth's surface."

"Much of the effort in the next few years should be devoted to refining existing mapping techniques and developing even more powerful ones," the committee said. It recommended that support go to groups that

are attempting to map large genomes—both for humans and other organisms—with support for different kinds of mapping methods proceeding in parallel until the best methods are found.

Sequencing of the entire genome, however, "should not be initiated at present," the committee wrote. Instead, research efforts should be encouraged to increase the efficiencies of technologies used in DNA sequencing.

FUNDING AND MANAGEMENT

The committee recommended funding the project at $200 million annually for 15 years. The amount of funding is roughly 3 percent of current federal expenditures on basic biology, the committee explained.

Funds should be earmarked for individual researchers and medium-sized research teams, the report stresses. "Individual investigators working in small groups have been the source of nearly all the major methodological breakthroughs that have driven the modern revolution in biology," the committee said. No large national centers should be created to do mapping and sequencing work at this time, it added.

However, because such a large amount of data and materials will be generated by a mapping and sequencing project, "[it] will require an unprecedented degree of sharing of materials among the laboratories involved," the committee said. It urged creating a facility to store and inventory pieces of DNA used in previous experiments and a central bank for storing DNA sequence data. When fully mapped and sequenced, the data printout for the human genome alone—in terse chemical shorthand—would fill more than a million textbook pages.

The committee recommended designating one federal agency as the lead agency in human genome work, but did not specify which of the three agencies currently doing genome work—the Department of Energy, National Institutes of Health, or National Science Foundation—should fill that role. It did recommend creating a Scientific Advisory Board to monitor the peer review of competing projects and coordinate the work of the laboratories involved.

ETHICAL QUESTIONS

Whatever its scientific merits, "a concerted effort to map and sequence the human genome would have profound social significance," the committee said. For example, the committee warned that "diagnoses that trace diseases to our genes can also convey stigma and set the scene for social prejudice."

"It will be the burden of researchers to interpret the correlations they draw as clearly as possible, to avoid simplistic associations between genetic markers and clinical conditions, and to educate clinicians and the public about the actual implications of their findings for individuals," the committee stressed.

The 15-member committee was chaired by Bruce M. Alberts, professor of biochemistry at the University of California, San Francisco.

Serving with Alberts on the committee were David Botstein, professor of genetics, Massachusetts Institute of Technology, Cambridge; Sydney Brenner, member and director, unit of molecular genetics, Medical Research Council, Cambridge, U.K.; Charles R. Cantor, chairman, department of genetics and development, Columbia University Medical School, New York City; Russell F. Doolittle, professor of chemistry, University of California, San Diego; Leroy Hood, professor of biology, California Institute of Technology, Pasadena; Victor A. McKusick, University Professor of Medical Genetics, Johns Hopkins Hospital, Baltimore, Md.; Daniel Nathans, University Professor of Molecular Biology and Genetics, Johns Hopkins University School of Medicine, Baltimore, Md.; Maynard V. Olson, professor of genetics, Washington University School of Medicine, St. Louis, Mo.; Stuart Orkin, Leland Fikes Professor of Pediatric Medicine, Harvard School of Medicine, Cambridge, Mass., and investigator, Howard Hughes Medical Institute; Leon E. Rosenberg, dean and C. N. H. Long Professor of Human Genetics, Medicine, and Pediatrics, Yale University School of Medicine, New Haven, Conn.; Francis H. Ruddle, professor of biology and human genetics, Yale University; Shirley Tilghman, professor of life sciences, department of molecular biology, Princeton University, Princeton, N.J.; Jonathan Tooze, executive secretary, European Molecular Biology Organization, Heidleberg, F.R.G.; and James D. Watson, director, Cold Spring Harbor Laboratory, Long Island, N.Y.

John E. Burris, director of the Research Council's Board on Basic Biology, served as study director. Robert A. Mathews, formerly of the Research Council's Commission on Life Sciences, served as staff officer during his tenure here.