from the editors of Inside Energy...

A Review of Federal Activities in Superconductivity During 1987

15 April 2012
This is probably the most definitive source on the hysteria created by the discovery of high temperature superconductivity. It will an interesting historical exercise to compare with what has actually transpired over the past 25 years, particularly with respect to "Japanophobia."
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SUPERCONDUCTIVITY

June 1, 1987

DOE PLANS SUPERCONDUCTOR RESEARCH NETWORK

DOE will implement soon a computerized information exchange to help U.S. scientists keep abreast of rapidly developing results in superconductor research. In addition, the department is working with the White House on a July conference on superconductors, with President Reagan and Energy Secretary John Herrington slated to make presentations.

DOE will expand its database on superconductors and make it accessible through its Office of Scientific and Technical Information. OSTI will offer online access to data, bibliographic databases and research in progress.

The first step will be an electronic bulletin board accessible by computer, a spokesman said. The bulletin board will provide brief information on developments in superconductor research funded by DOE, including contact names and telephone numbers, he said. The department hopes to have the bulletin board operating within two months.

Subsequently, DOE will provide abstracts and other more detailed information on its superconductor activities.

DOE envisions two-way communications, with researchers not affiliated with the agency providing information on their own superconductor activities. "We hope that people will put into the system information on what they are working on and what developments they have achieved," the spokesman said.

"Scientists and industry normally rely on articles published in scientific journals to learn of new research developments," Energy Secretary John Herrington said in a statement announcing the department's plans. "Superconductor research is producing new results so fast that these communications channels are being overwhelmed. . . . The Department of Energy can use its existing computerized scientific and technical information systems, and expand upon them, to expedite the flow of this information. We intend to do so."

DOE is spending about $10 million on basic-science considerations of superconductivity, a agency spokesman said. The work is taking place at national laboratories and at universities. In addition, the agency is spending about $15 million on related equipment, such as magnets, for work in fusion and high-energy physics, he said.

Researchers interested in seeking more information on the database can contact Ana Larkin at 202-586-9220.

The department is working with the White House and other agencies to develop a conference bringing together scientists, industry specialists, and academic and industry leaders to discuss the implications of superconductor technology. As of press time, President Reagan and Energy Secretary John Herrington were scheduled to address the July 28-29 conference in Washington. Further details were not available.

June 15, 1987

LEAD DOE ROLE IN CONDUCTORS, GENOME POSED

Sen. Pete Domenici, R-N.M., last week announced plans for legislation that would assign DOE and its national laboratories more prominent roles in developing technology for superconductors, semiconductors and human genome mapping. Domenici said he had received encouragement — but no formal endorsements — from leading Reagan administration officials, including Energy Secretary John Herrington, White House science advisor William Graham and Chief of Staff Howard Baker Jr.

His plans expand on a proposal by President Reagan in his 1987 State of the Union address calling for formation of a number of Science and Technology Centers, where industry and academia would work jointly to strengthen the nation's r&d. Reagan's proposal did not include the national labs.

"America must unleash our greatest trade secret — our national laboratories," Domenici said. "The national labs have the know-how to act as a powerful catalyst in expanding our national research and development effort." The senator expressed disappointment that none of the bills pending in Congress to

increase the nation's competitiveness include the national labs.

A spokesman for Herrington said the secretary is reviewing Domenici's plans and thus had taken no position yet. "Philosophically and conceptually we agree we should move aggressively in this arena, but the labs have a specific and unique purpose and we don't want to do anything to deter from their missions and goals," the spokesman said.

The Domenici proposal apparently has struck a nerve in DOE's Defense Programs division, a department source said. Assistant Secretary S.R. Foley Jr. is concerned that enhancing the labs' civilian roles along the lines the senator has proposed would detract from their military commitments, the source said. Thus, Herrington is forced to walk a fine line on the issue until internal differences are resolved. Foley could not be reached for comment.

Domenici's proposal singles out new cooperative arrangements involving the labs and private industry in superconductors, semiconductors and the genome project (*IE/FL*, 12 Jan, 9). In each case, a consortium would be established, technology transfer would be encouraged and various antitrust and tax considerations would be addressed.

The senator said he decided to launch the initiative after conversations with scientists and officials at different national labs, including the Sandia and Los Alamos facilities in his home state of New Mexico, and with government and industry representatives. Domenici's press conference on Tuesday had been preceded by separate meetings with Herrington, Graham and Baker.

"The secretary indicated he would review the plan and get back to me quickly," Domenici said of Herrington. "I think it's fair to say he, too, perceives the national labs as something that should be used more in conjunction with the private sector."

The Domenici proposal would direct the energy secretary to establish — with cooperation from universities and industry — cooperative research centers at national labs to probe superconducting material technologies. The secretary would coordinate the effort through an interdisciplinary council representing government agencies, universities and industry. The council would provide guidance in setting goals and strategies for developing technology for room-temperature superconductors.

"Although the United States continues to lead the world in basic research in the field of superconductivity, the process of transforming these ideas into successful products needs to be improved if we are to assure our leadership in this field," Domenici said. "How we do is vital, because superconductivity could prove the generator of an entire new way of life in the 21st century."

His proposal on semiconductors builds on recommendations by the Defense Science Board Task Force Report and on the Sematech proposal made by the U.S. semiconductor industry. The latter involves a proposed center to strengthen the semiconductor industry that would be financed jointly by manufacturers, suppliers, users and the federal government. However, unlike those initiatives, Domenici's would use the national labs as a key to competition in electronics. The senator would make semiconductor r&d a major undertaking of the labs, in conjunction with the Defense Dept. and private industry consortia.

Domenici also would set up a government-industry consortium under the direction of the energy secretary to help map the human genome. If scientists are left on their own, the mapping of the human genome could take up to 100 years, said Domenici and Jack McConnell, corporate director of advanced technology for Johnston & Johnston, who has advised the senator on the issue. The Domenici proposal is designed to build a cooperative effort that will accomplish complete mapping within three to five years, they said.

In addition to addressing the three specific areas of research, Domenici's proposal would direct DOE to establish regional institutes of entrepreneurship at universities, where students would pursue specific projects as part of their studies. "Established companies can no longer keep pace with the rate of technology development," he said. "A new generation of entrepreneurs is needed to properly take advantage of today's dynamic environment of technology innovation."

The curriculum would include: developing and writing a business plan and establishing a corporate structure; venture capital; management of technology; and international markets and competition.

Domenici also released copies of a May 20 letter to Reagan in which he urged the president to include DOE and the national labs in the formation of the Science and Technology Centers instead of relying solely on the National Science Foundation as the coordinating agency.

In addition, he urged the president to stress technology applications, and not just fundamental research, as an objective of the centers. "I urge you to consider devoting one collaborative effort among universities, industry and the National Laboratories to the application of new technologies and the study of manufacturing processes," he wrote. "If there is an area where we are not in the forefront, this is it."

In a June 8 letter to Domenici, NSF Director Erich Bloch expressed his interest in the labs' par-

ticipation in the science centers as well as in NSF's new Engineering Research Centers program. "I believe it would be entirely appropriate for these university-based research centers to include the participation and support of a national laboratory in a proposal to the Foundation," he said.

A forthcoming report from the National Academy of Sciences and NSF's program announcement for the Science and Technology Centers will both include specific references to roles the labs can play, Bloch told Domenici. A similar reference will be included in future program announcements for the engineering centers, he said.

Bloch said he also intended to write to each of the national lab directors encouraging them to work with universities and DOE under the mandate of a recent presidential executive order devoted to increasing access to technology developments. The order encourages all federal agencies to examine the potential for including in their r&d programs the establishment of university-based research centers in engineering, science or technology, he said.

June 15, 1987

AFTER SUPERCONDUCTOR HEARING, HOUSE SCIENCE MAY INCREASE R&D FUNDS

The House Science, Space and Technology Committee took up the hot topic of high-temperature superconductivity in an all-day hearing last week. And the intense competition worldwide to capitalize commercially on the new superconductor materials was mirrored in the eagerness of several federal agencies to promote their own r&d efforts in this field.

Although none asked outright for additional funds and turf, witnesses from the different departments seemed to be laying claim to them by spelling out all their agencies have been doing on the superconductor front.

The committee is likely to add funds for superconductivity when it marks up an FY-88 authorization bill for DOE, an action that one committee aide said could take place "in a few weeks." Chairman Robert Roe, D-N.J., has said he intends to seek increased funding in the areas of basic research and applications, the aide said, but he declined to cite dollar amounts. The panel's ranking Republican, Rep. Manuel Lujan Jr. of New Mexico, has specified $20 million as the amount he wants to see added, another committee source said.

Two DOE officials — Assistant Secretary Donna Fitzpatrick and acting Energy Research Director James Decker, presenting jointly signed written testimony — underscored that DOE "has traditionally had the largest Federal program in superconductivity" because of its responsibilities in fusion, high energy physics and energy conservation.

The agency's experience has spanned basic research on theory and structure to the actual construction and use of large superconducting magnets and electrical transmission and storage devices for r&d, they said.

"The DOE with its laboratory resources, major interest, and experience in working with industry is well aware of the potential and is moving ahead aggressively to support scientific research and development efforts," Fitzpatrick and Decker testified. They cited as an example the recently dedicated Oak Ridge High Temperature Materials Laboratory, which provides "unique" facilities for basic research in ceramics and for accelerating engineering and manufacturing research, "if and when it becomes appropriate."

Fitzpatrick and Decker encouraged close cooperation between department researchers and those in private industry to help commercialize new high-temperature superconducting materials. "The first priority," they said, "must be directed at the known technical obstacles, such as microstructural/critical current characteristics, materials synthesis, and materials processing."

Some applications, such as magnets for fusion and accelerator physics, would be "more appropriate" for the federal government to support, while other applications, such as electronic devices, would be more the prerogative of industry, they said , adding that DOE work in recent years involving development of ceramic materials and fabrication of ceramic parts will aid those efforts.

Fitzpatrick and Decker were among nearly 20 witnesses from the government, industry and academia called to give the committee an overview of superconductivity developments and recommendations on what the government might do to foster that work.

In his opening remarks, Roe told the crowd crammed into the hearing room, "We must look to new and innovative ways in which we can harness the strengths of our undustry, our universities, and our government facilities. We must explore new institutional frameworks in which to best apply these

materials."

Rep. Doug Walgren, D-Pa., underscored the funding dilemma posed by such expensive endeavors. Said Walgren: "There are limited resources available for superconductivity, with many legitimate claims to them. We in Congress have a lot to learn if we are to make the correct decisions about allocating federal funds for research, development and deployment of superconductivity technology."

Rep. Marilyn Lloyd, D-Tenn., chairwoman of the subcommittee on energy research, said she also hopes to propose added funds for superconductivity when the full committee votes on an FY-88 authorization bill for DOE. Lloyd noted that her subcommittee's markup of the bill in March preceded the much-publicized breakthroughs in superconductivity research.

At DOE, the Office of Energy Research has established a newsletter and has held three meetings to keep researchers abreast of agency superconductivity activities, Fitzpatrick and Decker said. A fourth meeting is to be held in September. Industries represented at the last meeting included some giants — AT&T, IBM and Dupont — as well as such smaller outfits as Cerametec, Intermagnetics and Supercon, they said.

DOE's Energy Materials Coordinating Committee has established a subpanel on superconductivity to coordinate activities at the department, they said. Coordination with other agencies is accomplished through the Office of Science and Technology Policy's Committee on Materials (COMAT). COMAT also has established a subcommittee to coordinate government research in high-temperature superconductors, they said.

In addition, DOE is initiating an electronic database to encourage the free flow of information among researchers in government and the private sector, and is co-sponsor of a July 28-29 conference in Washington on superconductivity applications (*IE/FL*, 1 June, 1).

White House science adviser William Graham said superconductivity will receive priority attention within a new interagency task force on technology transfer he is forming. The task force is resulting from an executive order (12591) by President Reagan in April that called for improvements in federal technology transfer programs. The task force will be comprised of representatives of various agencies and the national laboratories.

"I believe that the recent breakthroughs in superconductivity offer a unique opportunity to assess the progress of technology transfer at the earliest stages of a new technology," Graham said. He added he will "strongly highlight" superconductivity in his report to the president on technology transfer.

At the hearing, Graham elaborated on the July superconductivity conference being organized by DOE, OSTP and other agencies. Invitations for the "Federal Conference on the Commercial Applications of Superconductivity" are being sent to representatives of industry, academia, trade groups, technical societies, Congress, and state and federal governments. "We intend to strongly stimulate the thoughts and ideas of those in attendance to pursue innovative and marketable applications for high temperature superconductors," he said.

"Superconductivity could potentially grow to become even more pervasive than other high-technology industries," Graham said. "But for the benefits of our basic research to be returned to us, our government, industry, and academia must recognize the potential impact of superconductivity and cooperate in ensuring that American breakthroughs in the laboratory become American breakthroughs in the marketplace."

In another effort to promote superconductivity research, Graham is calling on members of the Federal Coordinating Council for Science, Engineering and Technology to consider ways in which federal agencies can cooperate and coordinate "in the broader sense of superconductivity, beyond the high-temperature superconducting materials themselves." FCCSET is a high-level council representing OSTP and other federal agencies involved in research.

At a recent meeting of the FCCSET Committee for Materials, a Committee for Superconducting Materials was formed to help further coordinate work among the agencies, he said. In addition, COMAT and its superconductivity panel will cooperate with the National Critical Materials Council in monitoring critical materials used in the rare-earth copper oxides that form the new superconductors, he said.

The Defense Advanced Research Projects Agency is concentrating its efforts to develop as quickly as possible an industrial technology base for processing, fabricating and manufacturing new superconducting ceramics and then to select military applications for them, said its deputy director, Craig Fields. DARPA's ceramics manufacturing program forms the basis for its stepped-up response to superconductivity.

"We expect to develop small scale pilot production lines or 'boutique' factories, . . ." Fields said. "We hope to see some concept demonstrations aimed at Defense applications within three or four years. We are pursuing both bulk materials applications — like magnets and motors — and thin film ap-

plications — like high speed microelectronics components."

"We also will invest in new computer-based design tools, probably using some artificial intelligence technology, to aid the product developer in getting the most from the new materials," Fields said. "We feel a sense of urgency, both because Defense needs the capabilities promised by the new materials and because we know our adversaries are devoting considerable resources to achieve their own technology base in high temperature superconductors, both directly and indirectly."

Fields said DARPA has redirected "about a half-dozen" of its current ceramics contractors to explore ideas for production of ceramic superconductors and has begun contracting with an "additional half-dozen" organizations for similar work.

In addition, DARPA and the Office of Naval Research expect to submit in July "several hundred" r&d proposals involving ceramics concepts, he said. They would include "industry and industry-university-national-laboratory teaming, where appropriate," he said. "We hope to make our selection and begin work a few months later. Our funding level will be determined by both the quality of the proposals and congressional support for our FY 1988 request. I expect we will be spending several tens of millions of dollars a year."

Separately, the Defense Dept. intends to develop a fresh strategy on possible military applications for superconductivity, Dr. Ronald Kerber, its deputy under secretary for research and advanced technology, said. The Pentagon's funding for superconductivity this year has been expanded from $5 million to $12.5 million, he said. In addition, the department has assembled a team of specialists from the Army, Air Force, Navy and other military organizations to help draft the new strategy.

Kerber said Defense is interested in initiating "carefully chosen developmental and demonstration activities" to identify as early as possible the problem areas. "Special attention will be given to manufacturing and processing technologies for these new materials," he said.

Among other witnesses testifying were Paul Chu, leader of a University of Houston team that announced a new high-temperature superconductor exhibiting a critical temperature of about 93 Kelvin earlier this year, and Praveen Chadauri of IBM's Yorktown Heights Research Center, which in May announced it had increased by a factor of 100 the current-carrying capacity for thin-film single crystals of high-temperature superconducting materials.

Also testifying were Sen. David Durenberger, R-Minn., and Rep. Don Ritter, R-Pa., who have filed legislation (S. 880 and H.R. 2069) to establish a National Commission on Commercial and National Defense Applications for Superconductors. The commission would recommend strategies to develop improved superconductors and to expand the commercial and strategic application of them.

Durenberger's and Ritter's plans were criticized by National Science Foundation Director Erich Bloch. "The proposal to create a special commission to review the field and plan for the future is simply unnecessary, and would waste time and expertise that is needed in the laboratories."

Sen. Pete Domenici, R-N.M., sought support for legislation he plans to introduce to assign to DOE the responsibility of directing government involvement in consortia to develop technology in superconductors, semiconductors and mapping the human genome (related story elsewhere in this issue).

June 15, 1987

COMMERCE CITES SUPERCONDUCTIVITY AMONG 'EMERGING' TECHNOLOGIES

The new superconductors and their promise of energy savings in the next century came up for special attention last week when the Commerce Dept. released its study of major emerging technologies with huge market potential worldwide.

The department's Deputy Secretary Clarence Brown, who ordered the study and announced its release last Tuesday, noted that the recent dramatic breakthroughs in superconductivity had occurred after the list of emerging technologies was put together. Because the developments still pose "basic scientific questions and great technical problems" that impede applications, high-temperature superconductivity must remain in the category of "potential emerging" technologies, he said.

"But," Brown added, "all you have to do is to look at one possible application for these superconductors, the transmission of electrical energy, to realize the enormity of their promise. We now spend $160 billion a year on electric power in this country, and we waste a full 20 percent of that power due to losses in transmissions. If high-temperature superconductors can be developed to the point where they can be substituted for conventional electrical transmission wires, we could save more than $30 billion a year.

"When I talk about the potential of emerging technologies, that is what I am talking about, a revolu-

tion that could affect every industry in America and around the globe."

The point of the study was to identify not only the technologies most promising for commercial applications by the year 2000 but barriers to U.S. ability to capitalize on them and steps that could be taken to remove the barriers.

The seven major groups, covering 17 technologies, were selected by Commerce technical experts and agency heads after a review of scientific and industrial plans and the commercialization process here and abroad. The groups are: advanced materials, electronics, automation, biotechnology, computing, medical technology, and thin-layer technology.

Two energy-related applications were included — 1) under advanced microelectronics, enhanced VLSI and VHSIC chips that can boost energy generation by solar cells through more efficient photovoltaic conversion, and 2) under genetic engineering (biotechnology), design and production of highly selective agents for neutralizing environmental pollutants.

The barriers to U.S. commercialization cited by the study include: higher costs of capital funds and less favorable tax incentives, as compared with those of competing nations; management focus on short-term rather than longer-range goals for returns on investments; inadequate laws, regulations and enforcement practices to protect intellectual property rights; industry complacency and dependence on domestic markets; and product liability, antitrust and other regulatory restrictions.

The Commerce specialists recommended the following action: continued efforts to reduce the federal deficit and avoid high interest rates, which affect the cost of capital; creation of venture capital pools at the state and local levels; added tax incentives and other actions to increase aggregate savings; a commitment to tax law changes focusing on incentives for modernization investments; elimination of foreign tax-law provisions and regulations that discriminate against U.S. products; improved export controls; and reform of product liability, tort and antitrust laws that hobble U.S. businesses.

June 15, 1987

SECRETARY HERRINGTON STRESSED SUPERCONDUCTIVITY'S POTENTIAL for bringing "revolutionary" changes to the electric power industry, particularly through improvements in long distance electrical generation transmission lines and storage.

In an address delivered Tuesday at the Edison Electric Institute's annual convention in Cincinnati, Herrington said: "We need to closely monitor advances in superconductivity research and support research in this dynamic field. Advances in this new high temperature material bring a whole new perspective to the application of this technology."

Because of the potential of the technology, the U.S. must maintain its current leadership both in the laboratory and in the marketplace, Herrington told utility officials. "The Department of Energy has a deep interest in the development of this technology. Major advances in superconductivity have been accomplished at [DOE's] national laboratories, including significant contributions to processing techniques and structural composition," he said.

Herrington also discussed plans for a national conference on superconductivity on July 28-29 in Washington and an information network being set up by his agency (*IE/FL*, 1 June, 1).

June 22, 1987

NATIONAL LAB OFFICIALS URGE FEDERAL PROGRAM IN SUPERCONDUCTIVITY

Officials from three major national laboratories warned Congress recently that Japan may capitalize first on U.S. scientific breakthroughs in high-temperature superconductivity unless a federal initiative is launched to get the new superconducting materials through the r&d phase and into the marketplace.

All three officials — from the Argonne, Los Alamos and Oak Ridge labs, which do extensive research in superconductivity — proposed special funding for this effort and argued that the DOE national labs are the logical choice to lead it. They were testifying at a hearing on superconductivity held June 17 by the House Science, Space and Technology Committee.

Los Alamos Director Siegfried Hecker specifically called for six to eight "Exploratory R&D Centers" to be located at "appropriate" DOE labs and funded at approximately $5 million each per year for five years, with an additional $2 million/year for capital equipment and construction.

The centers would set up technology partnerships with industry, and industry would be encouraged to provide program guidance from the beginning, but the centers "should be initially funded solely by the federal government through the DOE," said Hecker. Eventually industry participants would be tap-

ped for funds and cooperative r&d.

Hecker described in great detail what he called "the innovation cycle," the process by which discoveries or inventions are brought to the marketplace. He divided the process into four components — research, development, manufacture, and marketing and distribution — but said, "It is important to note at the outset that there are no clear-cut boundaries, and that the process of innovation is not sequential. There has to be considerable overlap, feedback and dialogue for success."

Except for innovations in military technology, where the Defense Dept. is the customer, the U.S. falls down in the latter two categories, while the Japanese excel, said Hecker. "Much of the Japanese success in the world consumer markets stems from progress in these areas. Their emphasis on quality, product engineering, systems engineering, process control, automation, etc., has paid off. These activities have earned a significantly greater prestige in Japan than in the U.S., thereby attracting some of their best talent. . . ."

"In the U.S. there has been a strong tendency to describe the process of turning research ideas into products or services in terms of technology transfer. I believe this fosters an attitude that one can disconnect the research and development components from the other two in the innovation cycle. We must recognize that innovation is an interactive process . . . . We cannot expect to have one organization store their ideas (inventions) in a cupboard and have another come along and pick them off the shelf for commercialization," he said.

Hecker cited the AT&T Bell Laboratories as one of "the very few organizations in the U.S." that conduct all phases of the cycle under one management. "Their record of innovation speaks for itself," he said.

In arguing that the national labs are best suited to manage superconductivity development, he noted the labs' "significant technological experience with conventional superconducting applications," their extensive facilities and their capabilities in materials sciences and low-temperature physics — all needed to develop "the enabling technologies" for applying high-temperature superconductors.

Hecker proposed "central oversight' by DOE and perhaps the appointment of "a single governing board comprised of government, industry, and university leaders . . . to oversee and guide the program. Private industry has shown considerable sentiment for some overall coordination of high-temperature superconductor R&D because of the intense competition that we face internationally."

The director of Argonne's Materials Science Division, Frank Fradin, recommended "a national plan" for superconductor r&d to confront "a major danger that superconductors could go the way of the VCRs, semiconductors and other high-tech products for which the U.S. provided the scientific breakthroughs, but which then were lost to foreign commercialization."

Fradin's plan, calling for additional funding of roughly $500 million over five years, would boost spending on the superconductor program in DOE's basic energy sciences from $10 million to $40 million a year "as quickly as possible," and would "rapidly" restore funds to DOE's conservation and renewable energy division to explore various possible superconductor applications — AC and DC superconducting transmission lines, motors and generators, energy storage, new transportation systems, magnets to separate ores, and containerless casting of steels.

His plan also calls for expansion of DOE's nuclear fusion, high-energy physics and nuclear physics programs, all of which could benefit from superconductor applications.

Acknowledging his plan "has ambitious goals," Fradin defended it by saying that "when you consider the billions of dollars of potential annual savings and the entirely new industries that will be built, it is a modest investment for this country." He proposed that one multipurpose national lab lead the program and he suggested Argonne.

Oak Ridge was represented by the director of its Solid State Division, Bill Appleton, who called superconductor development a materials problem "ideally suited for the national laboratories."

Appleton noted the scientific and technical barriers to commercial application of the high-temperature superconductors and said, "These constraints forecast a need for a broad multi-disciplinary, project-oriented program capable of coordinating results from basic research through to product design and application. National laboratories were structured from the beginning to handle just these kinds of projects."

July 13, 1987

LEADERS IN U.S. SUPERCONDUCTIVITY RESEARCH ARE SET TO SPEAK at this month's Federal Conference on the Commercial Applications of Superconductivity, a two-day event being hosted by DOE and the White House Office of Science and Technology Policy. It will be held July 28-29 at the Washington Hilton Hotel.

Among the speakers will be Dr. Paul Chu of the University of Houston, who achieved the earliest of the recent major breakthroughs in superconductivity research; Nobel Laureate Robert Schrieffer of the University of California at Santa Barbara; Dr. Angelica Stacy and Dr. Theodore Van Duzer of the University of California, Berkeley, a major center of superconductivity research; and Dr. Praveen Chaudhari of IBM.

The lineup of panelists includes other specialists from the expanding U.S. superconductivity industry, who will talk about current and future commercial applications in electronics, computers, communications, transportation, power distribution, instrumentation, sensing and diagnosing.

The conference topics will further include critical technology issues to be resolved before the new high-temperature materials can be applied, foreign technological advances, and the role of technology transfer in aiding applications.

Two congressmen highly interested in superconductivity — Sen. Pete Domenici, R-N.M., and Rep. Don Ritter, R-Pa. — will co-chair a workshop on "Industry/University/Goverment Cooperation," one of several workshops to run concurrently during the conference. Domenici has proposed legislation to promote rapid advances in superconductivity r&d in the U.S. (*IE/FL*, 15 June, 1), and Ritter, a member of the House Science, Space and Technology Committee, has been one of the most insistent voices in the House calling for steps to protect U.S. competitiveness in this field.

Co-sponsors of the conference include the departments of Commerce and Defense, the National Science Foundation and the National Research Council of the National Academy of Sciences. White House Science Adviser William Graham and Energy Secretary John Herrington will be among the federal officials addressing the conferees.

July 20, 1987

DOE DISTANT AS DOMENICI OFFERS BILL TO GIVE LABS CONDUCTIVITY LEAD

A bill aimed at expanding the role of DOE and its national laboratories in the development and commercialization of three major new technologies was introduced July 10 by Sen. Pete Domenici, R-N.M. The measure, promised by the lawmaker last month, proposes that the national labs, two of which are located in Domenici's state, be used as centers for joint government-industry-university research on superconductors, advanced semiconductors and human genome mapping.

DOE reaction to the Domenici bill was guarded. Stressing he had not had time to look at the bill, James Decker, acting director of the Office of Energy Research, nevertheless described the Domenici effort as unnecessary. "Most of what he wants to do to allow consortia to work with the labs can be done without legislation," he said. "We're already doing that at Oak Ridge" National Laboratory, he added.

A spokesman for Energy Secretary John Herrington said the agency still had not decided whether to endorse the measure. He repeated an earlier statement (*IE/FL*, 15 June, 2) that DOE "philosophically and conceptually" agrees it "should move more aggressively in this arena," but at the same time cautioned the agency does not wish to deter from the labs' "specific and unique purpose."

An industry source in Washington said DOE will probably oppose the bill, using the rationale that it is unnecessary and "doesn't do anything that can't be done without legislation." Apart from the general philosophical argument of the Office of Management and Budget against congressional interference in executive branch decisionmaking, DOE officials complain they were not consulted on the legislation, he said.

The industry source noted that concerns over the commercialization of sensitive weapons-related research conducted at both the Sandia and Los Alamos labs might also contribute to DOE opposition to the Domenici bill.

However, Domenici did meet with Herrington, as well as with White House Science Advisor William Graham and Chief of Staff Howard Baker Jr., prior to introducing his bill. The lawmaker said at the time he had received encouragement for his efforts from those officials.

Domenici's measure was interpreted by the source as an attempt to get "a piece of the pie" for the national laboratories, particularly the Los Alamos and Sandia facilities, both of which are located in New Mexico. President Reagan's competitiveness initiative announced early this year greatly expanded

the r&d role of the National Science Foundation, but left out the national labs.

The bill stipulates that the center for each new technology is to be located at laboratories "which demonstrate expertise in the particular research and research in associated technologies."

The lead role for superconductor research has already been given to Argonne National Laboratory, which together with the Brookhaven and Ames facilities are involved in a five-year project to develop a superconducting wire, a DOE spokesman noted.

Dr. Alan Schriesheim, Argonne director, told *Inside Energy/with Federal Lands* he thought the Domenici legislation "would facilitate" consortia between the labs and industry. While he is "generally supportive" of enabling legislation along the lines of the bill, it is "with the proviso that the mission of the labs isn't distorted."

"We are very much concerned with developing better relationships with industry," Schriesheim said. "Clearly, having an increased ability to work with a consortium of industries would be a good thing."

On the other hand, the lab director said he would not want to see consortia formed "in a laundry list fashion." The areas of joint r&d activity should only be "where there is a real national interest," as in the three areas focused on by Domenici.

On Capitol Hill, a Domenici aide said the senator had just begun the process of lining up support for the measure from fellow lawmakers. Domenici has requested hearings on the bill, and has "talked briefly to a few of his colleagues" about the measure, but has not had the time to lobby other senators to any extent, the aide said.

A source with the Senate Energy Committee said hearings on the bill probably will not be held before the August congressional recess. "I don't know when we'll get the time for it," he said. "If it's something Domenici is committed to, it's probably got a pretty good chance," he noted, but added it "isn't on anybody's radar screen yet."

In the House, separate Republican and Democratic efforts are under way to quickly draft legislation along the lines of the Domenici bill, but dealing exclusively with the superconductivity issue. Spearheading the minority effort is Rep. Don Ritter, R-Pa., while on the majority side a joint effort by Reps. Robert A. Roe, D-N.J., and Dave McCurdy, D-Okla., is being coordinated by the House Science, Space and Technology Committee, according to an aide there. Roe chairs the committee.

Members from both sides of the House aisle expect their legislation to be introduced within the next two weeks, but neither group wants its proposal characterized as a companion measure to Domenici's. The committee aide said Roe and McCurdy "want to see the focus of federal efforts in some fashion. Obviously DOE is important, Commerce [Dept.] is important, and the [Defense Dept.] is important. How you bring that all together is what we're looking at."

The emphasis of the Roe-McCurdy legislation, he said, will be to speed commercialization of new superconductor technology. "Certainly the application [of superconductivity] is what we're all interested in."

Neither the committee source nor an aide in Ritter's office would be specific about the content of their proposals. Ritter's bill also would promote the rapid commercialization of superconductors, and will involve both the national labs and the Defense Advanced Research Projects Agency "in lead roles," according to an aide.

Concerned that the traditional route to commercialization of new technologies "isn't going to happen fast enough for superconductors," Ritter wants to "provide some funds through a special program to do something right now," the aide said. — *David Kramer*

July 27, 1987

BILL SEEN AS THREAT TO SUPERCONDUCTOR BID

Warnings were sounded last week that California environmentalists could cripple the U.S. in its race to commercialize the new superconductors, by persuading Congress to declare off-limits most of the nation's known resources of rare earth elements, considered essential ingredients in superconducting ceramic materials.

The Senate bill (S. 7), known as the "California Desert Protection Act," would place off-limits to mineral exploration and development activities some 10.4-million acres, more than doubling the amount of desert land currently committed to park and wilderness preservation. Although the bill would permit continued operation of the one existing rare earth mine — the Mountain Pass mine operated by Molycorp Inc., a unit of Unocal Inc. — expansion beyond its current operations would be barred. Moreover, all further mining activity in the area would be prohibited under the legislation.

Besides having the largest capacity of any rare earth mine in the world, the Mountain Pass mine is

the only major mine producing rare earths as a primary product, according to the Bureau of Mines. Located within the bill's proposed "Mojave National Park," the seven-and-a-half-mile-long deposit on which the mine is situated is estimated to contain 3.6-million tons of rare earth oxides. All but a few hundred acres of that deposit that are already under development by the mine would be closed to further exploration and development activity, according to H. Marie Brashear, chief executive officer of the California Desert Coalition, a group opposing the plan.

Other opponents of S. 7, which was sponsored by Sen. Alan Cranston, D-Calif., point out that Mountain Pass currently produces 97% of U.S. output of rare earth elements, also called lanthanides. J. Steven Griles, Interior Dept. assistant secretary for land and minerals management, told a Senate hearing on the bill last week that two of the rare earths, lanthanum and yttrium, "make high-temperature superconductors feasible." Areas with similar environments favorable to finding additional rare earth deposits exist throughout the California desert, he said. "We cannot afford to limit or prevent the future development of these materials by putting them in a national park."

According to Donald Fife, a geologist and non-renewable resource consultant to the National Inholders Association, a group representing property owners within federally managed areas, S. 7 will "leave the existing rare earth mine open to deplete the ore reserves, but will lock up the known geologic environments favorable for new discoveries needed to convert society to this new [superconductivity] technology."

Fife, who also testified at last week's hearing of the Senate Energy subcommittee on public lands, national parks and forests, noted the existing mine operates on an area of less than 50 acres. "Rational exploration would suggest that as much area as possible be left open, since many mineral deposits have been found by accident."

So far, say Bureau of Mines specialists, the only other significant source of rare earths is China, which holds an estimated 76% of the world's reserves. The U.S., by comparison, contains only a 14% share of the world's reserves, but half of the non-communist world's resources. While alternative sources, such as phosphate mining by-products, are possible, they would be much more costly.

No one knows for sure at this point which of the 15 or so rare earth elements will be required to make the high-temperature superconductors, or how much will be required. It is unlikely that a shortage of the material will occur so long as high-temperature superconductors remain in the development stage, according to the Bureau of Mines source. But the crunch will come if superconductors are to be commercialized on a widespread basis.

One recently developed high-temperature superconducting ceramic material contains one part yttrium to two parts barium oxide and three parts copper oxide, a ceramic expert explained.

— David Kramer

July 27, 1987

DOE STILL PONDERS WHETHER TO OPEN UP ITS SUPERCONDUCTOR DATA BASE

Although DOE is continuing to upgrade its in-house computerized superconductivity information exchange system, the agency has yet to decide whether and when to make the data exchange system available to the general public.

Phase two of the information system, comprising a listing of superconductivity research in progress within the DOE research system, together with the major findings of those projects, will be on-line by Aug. 4 within the DOE pilot system. William Buchanan, the deputy assistant manager for information acquisition and appraisal at the Oak Ridge National Laboratory and the superconductivity data system project manager, asserted last week DOE's goal continues to be to make the system public. But questions remain whether the public system is better handled by the government or the private sector.

"The whole idea of the system is to provide industry access," he said. "The ultimate goal is to make it available to industry and academia."

Buchanan described the first phase of the program, initiated July 6, as an "electronic mail and bulletin board." The current system is limited to providing a list of current projects under way on superconductivity within the DOE network, along with contacts for further information.

The second and third phases of the exchange system will be true databases, Buchanan explained, allowing scientists to retrieve indexed information on a real-time basis. Phase two will contain a listing of research in progress and the results achieved. "That's the essence of our program — researchers sharing information among themselves," he said.

The final phase of the trial project, set to debut Sept. 14, will add to the database pre-prints of

research work to be published in technical journals. No timetable has yet been established for taking the system beyond the trial phase.

During the trial period, access is limited to 200 DOE and DOE contractor password holders. If approved by officials in the agency's conservation and renewable energy division, a limited number of outside users could be provided access during the trial period, but total password holders still could not exceed 200, Buchanan explained.

After a decision is made to expand the trial program to the public, it would be "several months" before the agency could gear up for expanded access, he said. But, since the service will be provided on a fee basis, DOE may determine that the public system is a project better suited for the private sector.

Buchanan said DOE headquarters personnel have been provided with some "very preliminary" numbers on the proposed fee. But he declined to identify the figures. The potential audience for the database is wide-ranging, including the scientific community, thousands of companies interested in commercializing the research, and the media. — *David Kramer*

July 27, 1987

A CERAMICS TRADE GROUP HAS TAKEN THE GOVERNMENT TO TASK for what it considers poorly coordinated research in emerging technologies. Steven Hellem, executive director of the 19-month-old U.S. Advanced Ceramics Assn., charged July 15 that competition among federal agencies for support in advanced ceramics, superconductors and other technologies is "notorious." Hellem added: "We in industry see little evidence of coordination and communication."

According to Hellem, industry is much better prepared to undertake programs aimed at commercialization of advanced ceramics than is the government, despite some $50 million a year he said various agencies spend on ceramics r&d. The formation of the Washington-based trade group, whose membership is comprised of more than 30 producers and users of advanced ceramics, bears out industry's interest, he added.

"Clearly, the federal government has a role to play in research and development of new emerging technologies, particularly advanced ceramics," Hellem told a House Budget Committee Task Force on Community and Natural Resources. "The role is to search out and identify emerging technologies, prime the pump on risky, long-term activities and initiate research and development programs with a clear focus on the ultimate commercialization of those products by private industry."

DOE's Advanced Technology Applications Program is a good example of how such a focused program can work, Hellem said. The goal of ATAP is to develop an automotive gas turbine engine for the marketplace and, according to Hellem, the program has proved successful so far in advancing toward that objective and in promoting increased involvement and investment by industry.

July 27, 1987

NEW SUPERCONDUCTIVITY TRADE GROUP TO BE ANNOUNCED AT CONFERENCE

A new Washington-based superconductivity trade group with the goal of speeding commercialization of high-temperature superconductors will be announced this week, according to sources close to the new association. To be called the Council on Superconductors and Applied Technologies, the group will be chaired by George Keyworth, the former White House science adviser.

William Graham, current science adviser to President Reagan, is expected to formally unveil the association and its chairman when he addresses a federal conference on the commercial applications of superconductivity Tuesday (July 28) in Washington, according to the source. The two-day conference also features addresses by President Reagan, Energy Secretary John Herrington, Commerce Secretary Malcolm Baldrige, U.S. Trade Representative Clayton Yeutter, members of Congress and a host of private sector researchers.

The trade group's mission statement, a copy of which was obtained last week by *Inside Energy/with Federal Lands*, describes its function as a "technology clearing house to educate and inform its members of emerging and/or existing superconductor developments that could affect both 'high-tech' and traditional industries in which applications are plausible and potentially profitable." Sponsored by U.S. corporations, it will also have associate members from the scientific, academic and government communities.

"The council's aim is to affect the efficient transfer of research information and superconductor technology to those industries ultimately responsible for the applications of these technologies to

economically competitive products and processes," according to the statement. "Through conferences, newsletters, technical seminars, briefings and regular reports, the council will further domestic economic competitiveness goals while applying superconductor developments, as well as serving as a Washington-based policy forum to insure sound policies and practices are developed in the federal sector to further these economic objectives."

Industry sources were generally skeptical of the group's prospects. One industry source in Washington said major companies like IBM, Westinghouse and General Electric, which are doing their own work on advanced superconducter technology, "wouldn't be interested in sitting down with each other" to share their developments. And a congressional source termed the formation of such a group premature, noting that the first commercialization of advanced superconductivity is probably still two to five years away.

But judging from its position paper, the group already recognizes that the commercialization period will be "years, not months." It also emphasizes that superconductivity will play a role in all industries, not just high-technology applications.

"This truly comprehensive application of technology across the spectrum of American businesses, old, new and as yet unheard of, can be achieved by basic tried and true methods of information exchange, and people-to-people contact," the group's paper states. — *David Kramer*

August 3, 1987

DOE Labs To Serve As Focal Points

REAGAN'S PLAN AIMS AT SPEEDING SUPERCONDUCTOR COMMERCIALIZATION

President Reagan last week announced an 11-point program to speed the commercialization of new superconducting technologies. But the proposal, which directs DOE, the Defense Dept. and other federal agencies to beef up their r&d activities in superconductivity, did not include any specific new funding for those government efforts, instead envisioning the redirection of existing resources from other r&d activities.

The president's "Superconductivity Initiative" is aimed at promoting greater cooperation between the federal government, academia and industry in basic superconductivity research, while speeding the private sector's commercialization into new products and processes and protecting industry's patent and other rights to those developments. The program, much of which represents repackaged legislative proposals made by Reagan earlier this year, was unveiled at last week's federal conference on commercial applications of superconductivity.

"The laboratory breakthroughs into high-temperature superconductivity are an historic achievement," Reagan said. "But for the promise of superconductivity to become real, it must bridge the gap from the laboratory to the marketplace; it must make the transition from a scientific phenomenon to an everyday reality, from a specialty item to a commodity."

Topping the list of the president's proposals is the creation of a panel of "wise men" within the White House Science Council to advise the administration on research and commercialization. The group, composed of three to five people from industry and academia, is to be appointed by the president and will report to him through the president's science adviser.

Reagan also proposed establishment of three "Superconductivity Research Centers" at DOE national laboratories to conduct important basic r&d and to serve as repositories of information to be disseminated throughout the scientific community.

The three centers are to be established at Argonne National Laboratory, Lawrence Berkeley Laboratory and the Ames Laboratory. Argonne, which has already been given the lead DOE role in developing a superconducting wire, will focus on applications for superconductivity, while Lawrence Berkeley is to be given the task of developing thin film material for electronic applications. Ames is to serve as the "Center for Basic Scientific Information," a role it has already initiated with the publication of a weekly newsletter on superconductivity developments.

The agency's efforts to develop a database on superconductivity at its Office of Scientific & Technology Information at the Oak Ridge National Laboratory also was mentioned as part of the initiative. That system is presently operating in-house only, but DOE officials assert it will ultimately be available for public use (*IE/FL*, 27 July, 3).

DOE officials described the research centers as being a formalization of the agency's own efforts to coordinate its superconductivity effort. James Decker, acting director of DOE's Office of Energy

Research, said the centers would serve as a "focal point" for companies interested in working with the national labs on various aspects of superconductivity. "Clearly our thought is that [the labs] need to have some expertise," he said. "If [industry] is really interested in thin films, then Lawrence Berkeley will at least be able to point a company in the right direction." But Decker added that it was not intended for a single laboratory to become the sole site for the specific research area.

Alan Schriesheim, Argonne director, welcomed the center concept, saying it would "highlight and help our ability to aid technology transfer to industry." He added he "hoped" the centers would entail additional funding for the labs.

But William Graham, the president's science adviser, said the initiative would consist of "reprogramming" FY-87 and FY-88 funds within the various agencies to "increase the emphasis and priority in this area." Graham said a "careful review" of the agencies' FY-89 budgets also will be undertaken to ensure that adequate resources are allocated for federal superconductivity efforts.

In his speech, Reagan also reported that Defense will spend $150 million over the next three years on superconductivity applications in military systems. By comparison, current total federal efforts amount to $55 million, with half of that amount representing a redirection of funds from other r&d activities over the last six months.

DOE's office of basic research is spending about $25 million currently on superconductivity, according to Decker. "Bits and pieces" of r&d activity are being conducted by other DOE operations, including the conservation and renewable energy division, he said.

But Decker refused to characterize the large Defense role as representing a relative decline of DOE's own efforts. Pointing out that much of the Defense activity is in the area of applications, while DOE's role is focused on basic research, Decker noted "once you get into applications you can spend a lot of money very quickly."

And another DOE source said the Defense program has been ongoing for years, although its funding level has never been specifically broken out until now, when the surge of interest in superconductivity led to its quantification.

Reagan told the conference he would soon send a "legislative initiative" to Congress to revamp antitrust laws, patents and the Freedom of Information Act, as they relate to the commercial application of superconductor technology. Although similar administration proposals made on a non-industry specific basis have gone nowhere on Capitol Hill, the White House is hopeful the excitement over recent developments in superconductivity will help push the package through this time.

The president wants to amend the current antitrust laws to permit companies to operate some joint production ventures. Current antitrust law exemptions allow joint efforts only up to the point of commercialization. The administration would also like to amend the Freedom of Information Act to authorize federal agencies to withhold from release to the public commercially valuable scientific and technical information generated in government-owned and operated labs.

A third proposal in the legislative package would amend patent laws to increase protection for manufacturing process patents. The White House hopes this would enable U.S. owners of process patents to obtain damages for infringement where imported products are made using those processes. Administratively, the president is directing the patent and trademark office to accelerate the processing of patent applications and adjudication of disputes relating to superconductivity.

Other elements of the White House superconductivity program include: the establishment of a superconductivity center at the National Bureau of Standards laboratory in Boulder, Colo., to focus on electronic applications of high temperature superconductors; establishment of a coordinating group on superconductivity activities at the National Aeronautics and Space Administration; and the augmentation of r&d programs at three of the National Science Foundation's materials research laboratories. NSF will also initiate a series of "quick start" grants for research into processing superconducting materials into useful forms, including wire, rods, tubes, films and ribbons.

Federal agencies have been urged to implement the steps outlined in Reagan's April executive order, which was designed to transfer technology from the federal laboratories into the private sector and encourage joint industry-government-university research. Graham is instructed to report to the president by Dec. 1 on the progress in implementing the order, especially as it relates to superconductivity.

Reagan asked Defense to accelerate prototype work in sensor, electronic and superconducting magnet-based military applications, while the Commerce Dept. has been urged to accelerate its development of prototypes in detection and measurement of weak magnetic fields.

The Pentagon effort will specifically address the definition of engineering parameters for high temperature superconducting materials; development of processing and manufacturing capabilities; and

necessary development, engineering and operational prototype testing of superconductors. Small-scale applications of Defense-related work having commercial spinoff potential include sensors and electronics, while potential large-scale applications include compact, high-efficiency electric ship drive, electrical energy storage, pulsed power systems and free electron lasers, according to the White House.

— David Kramer

August 3, 1987

HOUSE BILLS SEEK TO ADVANCE OPPORTUNITIES FOR U.S. SUPERCONDUCTORS

Legislation to establish a "National Superconductor Manufacturing and Processing Technology Initiative" was introduced last week by Rep. Don Ritter, R-Pa. Ritter, an ex-professor of metallurgy, serves on the House Science, Space and Technology Committee. The bill (H.R. 3024) seeks to provide what the congressman described as "a major national thrust" in the processing and manufacturing of superconducting materials.

The bill is one of several measures now pending in the House dealing with superconductivity, according to congressional aides. Rep. Dave McCurdy, D-Okla., another member of the House science committee, recently introduced legislation (H.R. 3048) for a five-year, $500-million program in superconductivity. Also, Ritter won approval from the science committee to include an earlier superconductivity bill in broader technology legislation (H.R. 2916) passed 20-0 by the panel on July 23.

No further plans for Ritter's or McCurdy's bills had been made as of late last week, aides said. Ritter, however, speaking at a Washington conference on the technology, said, "I think we're going to have a major legislative effort in Congress on superconductivity."

Ritter's bill is the result of more than five months of work by the House Republican Research Committee's Task Force on High Technology and Competitiveness, which Ritter chairs. It is similar in many respects to legislative initiatives announced by President Reagan last week.

The initiative outlined in Ritter's bill would be carried out by a coordinating council, whose members would include representatives of the Defense Advanced Research Projects Agency, DOE, the National Science Foundation, the National Bureau of Standards, and the Commerce Dept. The initiative would provide $50 million for DARPA, $12.5 million each for DOE and NSF, and $5 million for NBS.

The coordinating council would be advised by a private sector contingent selected from a newly created National Commission on Superconductivity, with participants from academia, industry and government. The commission idea is similar to one included in Ritter's earlier superconductor bill, which was included in the broader measure approved by the committee.

DARPA was selected as the lead agency because of its focus on manufacturing and its lengthy experience in managing large teams of industry participants, with university and national laboratory involvement, Ritter said in a statement accompanying introduction of the bill. A "civilian DARPA" would take too long to create, he added.

"We're in the technological race of our lives on this superconductor issue," Ritter told the conference. Original co-sponsors of the bill, all Republicans, are: Reps. Manuel Lujan of New Mexico, George Brown of California, Claudine Schneider of Rhode Island, Tom Lewis of Florida, Harris Fawell of Illinois, Paul Henry of Michigan, and Sherwood Boehlert, Hamilton Fish and Amo Houghton, all of New York.

McCurdy's bill would provide $100 million annually — beginning in FY-89 — to speed commercial applications of superconductivity in civilian projects. A subsequent bill will address defense applications, an aide said. DOE would receive $48 million of that annual allocation, with $40 million going to the National Science Foundation and most of the rest of the funds going to the Commerce Dept., the aide said.

August 3, 1987

OFFICIALS VOW TO PROTECT U.S. SUPERCONDUCTORS FROM UNFAIR TRADE

Top Reagan administration officials asserted last week they will move aggressively to protect the U.S. against dumping or other unfair trade practices that foreign developers of superconductors may use to capture the U.S. market for their products.

In an unusually blunt statement delivered to a federal conference on superconductivity applications last week, U.S. Trade Representative Clayton Yeutter warned Japan and other nations now developing the same technology that they will not be allowed to take unfair advantage of the U.S. market as some say they have with other industries, such as semiconductors. Many in the fledgling domestic superconductor industry fear that the Japanese, with assistance from their government, will commercialize the

technology first, then move aggressively to penetrate the U.S. before domestic producers have had a chance to bring their products to the market.

"We in government are going to do our best to ensure that you're going to be operating on a level playing field," Yeutter assured. "We'll be a lot less passive in these areas than we have been in the past. We've provided a lot of opportunities in the past for other countries by being passive."

Yeutter's words were echoed by Ernest Ambler, director of the Commerce Dept.'s National Bureau of Standards. Reading from a speech prepared for delivery by Commerce Secretary Malcolm Baldrige, who was killed July 25, Ambler asserted "we must insist that our competitors play by the rules and not resort to unfair trade practices." Using the example of sanctions imposed on Japan by the White House earlier this year for violations of a semiconductor agreement, he promised, "We'll do it again whenever and wherever necessary."

Japan and other nations have often used a practice known as targeting to rapidly commercialize new products and to enter the international marketplace. Government assistance is provided to the targeted industry, and often the foothold in foreign markets is gained through dumping the product (selling at below the cost of production).

"The U.S. could follow that practice," Yeutter acknowledged. "But I hope we don't go that route. I hope we can convince other nations to abandon those practices which are really not advantegeous in the long run."

The trade representative said the president has adequate authority to respond to unfair trade practices of other nations under U.S. trade laws. He encouraged companies involved in the superconductor field to bring to his office any unfair trade complaints they might have.

But both officials stressed the need for the private sector to take the lead in the international race to commercialize the new technology. Saying he was "tired of American businessmen telling me we just can't compete anymore," Yeutter said superconductivity was an area where "we should not underestimate ourselves." And Ambler said he was "concerned that months after the initial laboratory experiments indicated high-temperature superconductivity was a reality, this country still doesn't have a single consortium of companies, universities or federal agencies working on this technology."

"We must do everything possible to shorten the cycle from laboratory r&d to the introduction of a final product," Ambler said. "In the case of superconductivity, that means companies must start planning now for the products that we think laboratory research will make possible in the months and years ahead."

August 3, 1987

AFTER FOUR MONTHS, REAGAN TECH-TRANSFER ORDER REMAINS UNFULFILLED

More than four months after President Reagan directed the agencies to take broad steps to facilitate technology transfer from the federal sector to industry and universities, some agencies are still not totally familiar with the presidential order, according to White House and federal laboratory officials.

But several federal laboratory officials now involved in superconductivity research said they have moved within the last year to open up their facilities to the public. Alan Schriesheim, director of DOE's Argonne National Laboratory, said at last week's superconductivity conference that "if you can think of a way to interact with a national laboratory, it is probably possible to do so." And Herman Postma, director of the Oak Ridge National Laboratory, pointed out that each lab is now required to have a full-time person to act as a contact for outsiders interested in using the lab facilities.

Nonetheless, Eugene McAllister, special assistant to the president and executive secretary of the Economic Policy Council, admitted that administration officials have not been doing enough to spread the word about Executive Order 12591, issued last April 10.

The order directs agency heads to encourage collaboration between the federal laboratories, state and local governments, universities and the private sector, with an emphasis on small business. The aim is to assist in the transfer of technology to the marketplace.

Under the order, the agencies were instructed to enter into cooperative r&d agreements and to license, assign or waive rights to intellectual property developed by the laboratory under those agreements. The order also directs them to identify "ferrets," or persons to act as conduits for technology transfer between and among federal laboratories, universities and the private sector.

The government is also supposed to ensure the private sector is provided with information on the technology, expertise and facilities available in federal labs, and to take other steps to deal expeditiously with the patent and royalty questions involved in joint r&d efforts. Agencies operating

federal labs were told to select one or more of their facilities to participate in a "Technology Share Program," under which r&d areas of potential importance to long-term national economic competitiveness are identified and addressed through a joint industry-governmenment-university consortium.

According to Postma, 25% of Oak Ridge personnel are visitors at any given time. Some $20-million worth of r&d work has been subcontracted by Oak Ridge to universities this year, while an additional $15 million has been subcontracted to industries. He acknowledged, however, that improvements still need to be made in expediting approval for patents and waivers, in the formation of consortia, in reaching small firms and in getting lawyers to accept the changes that have been made in the law.

Argonne has formed a separate subsidiary to conduct patent transfers, licensing, joint ventures and other business transactions related to technology transfer from the lab, Schriesheim said. The subsidiary is wholly-owned by the University of Chicago, which is the Argonne contractor.

Schriesheim agreed that the "cultural relationship" necessary for private industry to turn to the labs on research questions has been lacking, but added "that's in the past." New innovative approaches still need to be developed to tie industry and government together while maintaining "some independent infrastructure on both sides," he said.

Each of the national and federal laboratories have user facilities available for industry use, and proprietary technology can be protected fully if necessary through payment to the lab for use of the facility. Lyle Schwartz, director of the center for materials science at the National Bureau of Standards, noted that the charge for use of the equipment does not factor in depreciation, and so it is in fact a bargain. The daily user cost for one complex piece of NBS equipment, a neutron scatterer, is only $150.

All the lab officials agreed that direct contact between the individual lab researchers involved in a particular aspect of r&d was the preferable route for the private sector to take. Postma noted that a private sector potential user of the labs is never more than a few phone calls away from reaching the lab researcher he wants. — *David Kramer*

August 3, 1987

HERRINGTON TELLS INDUSTRY TO MOVE ON SUPERCONDUCTOR APPLICATIONS

Energy Secretary John Herrington last week warned private industry not to neglect r&d into the commercialization of new superconducting technologies, even as it continues to work on perfecting the superconductivity technology itself.

In his address to the federal conference on commercial applications of superconductivity, Herrington stressed the need for industry to strike a balance between short-term profits and future development. While the Reagan administration is doing a number of things to promote the use of superconductivity, "ultimately the challenge is up to you," he told attendees.

"We must not wait until the technology has been perfected to assess the possibilities of commercialization. Even before the new breakthroughs, the superconductor industry was more than a $100 million business," Herrington said. "Now the ability to use liquid nitrogen for cooling — a substance which at 22 cents a quart is cheaper than milk — offers many opportunities for cost-effective development. Recent advances in current-carrying capacity are already paving the way for using superconductors in microelectronic devices."

Success in commercializing the new technology will depend on the ability to eliminate the barriers between basic and applied research. "We cannot wait for all the scientific questions to be answered before anticipating the needs of design and manufacturing. For a technology like superconductivity — with so much potential to affect the American and world economy — the process must be one," he said.

Improving the manufacturing and marketing end of the long process from lab to the market is one goal, while greater emphasis on quality and product and systems engineering is also needed to meet the international competition. "What we need is a more integrated process where the end is in view from the beginning — where those doing the research have an appreciation and anticipation for how their discoveries may be applied in manufacturing and marketing," Herrington said.

Handling the new ceramic superconductors and using them in commercial products will require advanced expertise in processing and fabrication, sophisticated plant design and new engineering for manufacturing. "It will do no good at all to perfect the new superconductors if we have not developed the capability to produce them," he noted.

The government has moved to minimize overlapping research activities in superconductivity and to ensure that information is shared quickly with the private sector. But new ways need to be found to facilitate cooperative research and encourage collaboration, especially with small business, Herrington

stated. Issues raised through those collaborative efforts concerning the ownership of intellectual property also need to be settled.

And while a coordinated superconductivity research effort is needed, Herrington stressed "it should not be made by a government that decides what research and development should be done and by whom. Instead our government should serve as a powerful catalyst for technological and economic progress, providing an environment of communication which can nurture the spirit of enterprise.

"Although we have the jump on our competitors in basic research, we must marshall all our resources and tap our ingenuity to the fullest to compete effectively in the marketplace," Herrington concluded.

August 10, 1987

HERRINGTON ADDS LOS ALAMOS TO LABS LEADING SUPERCONDUCTOR EFFORTS

In the wake of the recent federal conference on superconductivity, Energy Secretary John Herrington moved quickly to add Los Alamos National Laboratory to the list of DOE facilities with a leading role in this field. Los Alamos, which was not included in President Reagan's July 28 "Superconductivity Initiative," has been asked by Herrington to explore private-sector interest in establishing cooperative research programs to develop enabling technologies for commercializing the new high-temperature superconducting materials.

"Along with our traditional support for basic research, we must lay the foundation for commercial applications," Herrington said. "I believe we can and should play a leading role in promoting a partnership between the private sector and the laboratory and encouraging collaboration at all levels."

DOE officials said Los Alamos is being asked to head the effort to explore partnerships with U.S. industry. The effort could lead to establishment of a pilot program that, if successful, will be expanded to other DOE labs.

The president's 11-point initiative included designation of three DOE labs as superconductivity research centers, but Los Alamos was not among them.

DOE sources said last week the Los Alamos facility was chosen for its new role at least partly because it has had some success in spin-offs and joint ventures with private companies involving new technologies. One project cited involved a "magnetic refrigerator," but a Los Alamos official said none of the spin-offs so far has been specifically related to superconductivity.

Noting that the idea behind naming specific research centers was to establish a "point of contact" for interested parties outside the national lab system, the DOE source explained, "What was thought to be lacking was a method to accelerate the close cooperation we want to achieve with industry." He stressed that the selection of certain labs for these centers was not meant to suggest other facilities are to be excluded from such activity.

James Williams, deputy director of the office of industrial applications at Los Alamos, attributed the lab's inclusion in the program to Los Alamos Director Sig Hecker's "very strong interest in developing research partnerships with industry" in superconductivity. He also praised Herrington for "recognizing how important this could be to the nation's competitiveness if we are successful." While Los Alamos does not claim any greater success with spin-offs than the other labs, Williams said it has had particular success with what he called "entrepreneurial spin-offs."

But others interpreted the inclusion of Los Alamos in the agency's superconductivity program as a move to satisfy Sen. Pete Domenici, R-N.M., who has been seeking a greater role for Los Alamos in the race to commercialize new technologies, including superconductivity. One Capitol Hill source pointed out that other national labs, such as Argonne and Oak Ridge, have had at least as much success in forming joint industry-government spin-offs for technology transfer, and he suggested that Domenici's interest was in fact the principal reason for assigning Los Alamos its new role. A Domenici staffer acknowledged "the reason DOE did it was because Sen. Domenici asked him to."

Another Washington industry source termed the Herrington announcement "clearly an afterthought and a concession to Domenici." He pointed out, however, that Los Alamos does have considerable experience with technology transfer.

Domenici last month introduced legislation to give the national labs a larger part in r&d on superconductors and other advanced technologies (*IE/FL*, 20 July, 5). He then unsuccessfully sought to attach the measure to the omnibus trade bill. Domenici's bill would instruct DOE to form three industry-government-university consortia dealing with superconductors, semiconductors and human genome mapping, although it would not have assigned a specific superconductivity role to Los Alamos.

The three research centers named in Reagan's plan are to be established at the Argonne,

Lawrence Berkeley and Ames labs. The centers are supposed to facilitate the dissemination to industry of research and information pertinent to superconductivity.

DOE spokesmen said last week those centers are expected to be operational in a few months. Telephone numbers and procedures regarding access to them will be announced in the next several weeks. Argonne is to serve as the center for superconductivity applications, while Lawrence Berkeley will act as the center for thin film applications. Ames Laboratory is to serve as the center for basic scientific information.

Work on high-temperature superconductivity is currently under way at the Argonne, Brookhaven, Los Alamos, Sandia and Oak Ridge labs, as well as at Ames and Lawrence Berkeley. Argonne has already been given the lead role in a five-year project for development of a superconducting transmission material.

Working with Argonne on conductor development are Brookhaven and Ames. Oak Ridge and Los Alamos are working with Lawrence Berkeley on thin film applications. Oak Ridge is also responsible for the continuing development of a computer database on superconductivity, a system now in its trial phase. DOE eventually hopes to open up that system to public usage on a fee basis. — *David Kramer*

August 10, 1987

TELLER SEEN LIKELY SELECTION AS 'WISE MAN' OF SUPERCONDUCTIVITY

President Reagan's "wise men" of superconductivity are likely to be culled from within the White House Science Council, an existing 11-member group of scientists who advise William Graham, the president's science adviser, according to administration sources.

Although formation of the superconductivity panel has not proceeded much beyond its announcement two weeks ago, sources said one probable panelist is Edward Teller, best known for his work on the development of the atomic and hydrogen bombs and, more recently, the most prominent scientific proponent of the Strategic Defense Initiative. Reagan named Teller in his speech on superconductivity July 28 as one who had advised him of superconductivity's potential.

The wise men panel, part of Reagan's 11-point superconductivity initiative, is to consist of three to five members from industry and academia, according to the White House. A White House source said the superconductor group will probably operate much as the science council does, advising the president — through Graham — on research and commercialization policies of the new technology.

Besides Teller, members of the council include two former directors of DOE's office of energy research: John Deutch, who also served as DOE under secretary, and Edward Frieman, now executive vice president of Science Applications International Inc. of La Jolla, Calif. Other council members include former Science Adviser to the President Edward David Jr.; Solomon Buchsbaum, executive vice president of Bell Labs; former American Assn. for the Advancement of Science President and Chairman D. Allan Bromley, now with Yale University; David Packard, chairman of Hewlett-Packard Co.; IBM Senior Vice President Ralph Gomory; former GA Technologies Inc. President Harold Agnew; and Isadore Singer of the mathematics department at the University of California, Berkeley.

The council is primarily an informal group, but occasionally compiles a formal report. The most recent was a report on the health of the country's university system, prepared under the direction of Packard and Bromley.

August 10, 1987

INDUSTRY, ACADEMIA SEND 224 SUPERCONDUCTOR R&D PROPOSALS TO DARPA

The Defense Advanced Research Projects Agency last week was assessing more than 200 proposals it had received from industry and universities for r&d projects in the processing and fabrication of superconducting materials. DARPA hopes to have as much as $50 million available in each of the next three fiscal years for superconductivity research, a figure consistent with President Reagan's July 28 announcement of an 11-point "Superconductivity Initiative."

A DARPA official said last week the agency had received 224 project proposals by its July 24 deadline, with slightly more than half of those from industry and the rest from universities. DARPA and its partner in the program, the Office of Naval Research, hope to have completed evaluation of the proposals by mid-September, according to the official.

Although DARPA has a total of just $10 million firmly committed at present, it is confident it can line up much more than that, the official said, noting that additional funds are expected to come both from Congress and from "teaming" with other sections of the Defense Dept. also interested in super-

conductivity. For example, he explained, ONR, which has already committed $500,000 to the project, could contribute additional funds. Other Defense units involved in superconductivity technology include the Air Force Office of Scientific Research, the Strategic Defense Initiative Organization, the National Security Agency and the Army, primarily at its Ft. Monmouth facility.

In recent testimony to the House Science, Space and Technology Committee, Craig Fields, DARPA deputy director for research, said the agency was pursuing both bulk materials applications, such as magnets and motors, and thin film applications like high speed microelectronics components. He acknowledged that DARPA's efforts, biased toward developing an industrial technology base for processing and manufacturing of the materials, did not represent a balanced r&d program on superconductivity. The agency plans to rely on other organizations, such as DOE (*IE/FL*, 3 Aug, 5), to do the theoretical work for understanding the properties of the new materials.

The length of the projects proposed varies from eight months to three years. Although contracts are to be awarded principally for materials processing and manufacturing, the DARPA source said the contracts could cover fundamental work on the materials themselves to the extent their properties must meet manufacturing requirements for specific applications.

Although the exact funding level for the program has yet to be determined, DARPA is downplaying the degree of uncertainty the dollar factor may inject into the award process. "I don't see that as limiting our ability to make a choice," the official said. "If it turns out there isn't enough money, re-evaluations can be made." — *David Kramer*

August 17, 1987

FOUR SUPERCONDUCTIVITY BILLS ARE SCHEDULED FOR HEARINGS shortly after the summer congressional recess, but legislative observers think it's probably too late in the session for any legislation to move far this year.

The House Science, Space and Technology's subcommittee on transportation, aviation and materials is scheduled to consider Oct. 7 two bills on superconductivity sponsored by Rep. Dave McCurdy, D-Okla. The most recent was introduced Aug. 7 and would authorize $50 million annually for Defense Dept. r&d in the field, the same yearly sum mentioned by President Reagan in his July 28 superconductivity initiative. A McCurdy bill introduced in late July calls for a $100 million, five-year federal r&d program involving DOE, the Commerce Dept. and the National Science Foundation.

A Republican bill on superconductors introduced by Rep. Don Ritter of Pennsylvania is also likely to be considered at that hearing, according to committee staff. His bill, backed by nine other lawmakers, including New Mexico Rep. Manuel Lujan, ranking Republican on the Science, Space and Technology Committee, would establish a "national superconductor manufacturing and processing technology initiative" to be implemented by a newly created coordinating council composed of representatives of the federal agencies conducting the r&d. The initiative would include $50 million for the Defense Advanced Research Projects Agency, $12.5 million for both DOE and NSF and $5 million for Commerce's National Bureau of Standards.

Hearings have also been scheduled by the Senate Energy Committee for the week of Sept. 15 on a bill to establish joint government-industry cooperative r&d efforts in superconductivity, human genome mapping and semiconductors. The measure, sponsored by Sen. Pete Domenici, R-N.M., would give DOE's national laboratories the lead role in the formation of industry-government-university r&d consortia for each of those three areas. Although Domenici failed in a July bid to expedite the bill's passage by attaching it to the Senate's omnibus trade bill, observers believe he may well try to attach the measure to another legislative vehicle before the end of this year's legislative session.

August 24, 1987

DARPA SELECTION OF SUPERCONDUCTOR PROJECTS NOW SET FOR NOVEMBER

The Defense Advanced Research Projects Agency (DARPA) has set early November as its new target date for selecting from more than 200 superconductivity research proposals the projects it will fund, according to Kay Rhyne, program manager of superconductivity and ceramics at the Defense Dept. agency.

Rhyne and other DARPA officials continue to sift through 203 r&d proposals on superconductivity submitted by industry, universities and government and non-profit groups. DARPA originally had hoped to have the proposals evaluated by mid-September, but extension of the original deadline to July 24

stretched out the timetable.

The agency's r&d program is focused on the processing and fabricating of superconducting materials.

Rhyne said one or more proposals have been submitted by 120 private companies, 60 universities and 12 government and non-profit groups. Bulk applications — such as monoliths, composites and ribbons used in magnets and motors — predominate in the submissions, with 78 proposed, while thin film applications, primarily for electronic applications, account for 67 proposals.

Another 21 proposals concern thick film, or coating applications, which Rhyne described as falling in between thin film and bulk uses; 32 deal with combinations of thin and bulk film applications; and another five would establish databases for superconductivity developments.

Rhyne declined to provide the names of specific applicants, saying release of that information would provide valuable information to competitors while evaluations are ongoing.

Earlier, DARPA said it had received 224 proposals (*IE/FL*, 10 Aug, 5). But Rhyne explained that some of those proved to be duplicates resulting from the extension of an earlier deadline.

Although DARPA has only $10 million earmarked for superconductivity r&d at this point, Rhyne is confident that additional funds will be allocated to the effort. Because of the funding uncertainty, the agency does not know exactly how many of the projects it will be able to fund.

"Until our budgets are declared, it's hard to tell where [funding] will come from," she said. The agency expects to obtain additional money from three sources: DARPA itself, redirected Defense Dept. funds and further appropriations from Congress. Once Congress passes appropriations for FY-88, the agency should have a much clearer idea how much will be available.

According to Rhyne, DARPA could "easily" expand its superconductivity program to $80 million annually. She said that at a funding level of less than $50 million a year, DARPA would be "leaving things out."

August 24, 1987

GOVERNMENT EXPLORES FEDERAL STOCKPILE OF SUPERCONDUCTOR ELEMENTS

The federal government is examining whether some of the elements used in the new generation of superconducting materials should be stockpiled in order to ensure an adequate supply of the material during national emergencies. The Federal Emergency Management Agency is considering adding at least one of the rare earth elements, yttrium, to the list of strategic materials that are now held in the National Defense Stockpile, according to an agency official.

FEMA has contracted with ASM International of Metals Park, Ohio, to investigate whether yttrium and more than a dozen other materials ought to be stockpiled. The FEMA official said the ASM study is due to be completed this fall, but added there is no firm timetable for the agency to decide on its addition to the stockpile.

Currently, 32 mineral commodities are held in the defense stockpile. But much of that material is considered excess to current needs and is to be sold, while other materials have been targeted for acquisition. Strategic and critical materials are defined as those needed to supply the military, industrial and essential civilian needs of the U.S. in a national emergency, and which are not found or produced domestically in sufficient quantities to meet that need.

Ironically, rare earths were stockpiled at one time, but were declared excess to needs in 1970, and all but 457 tons were sold off by 1984. The FEMA official acknowledged the ASM study contract was actually issued prior to the revelations of early this year connecting yttrium with superconductivity, saying the element was included in the study because it is becoming increasingly used for other commercial applications. These include metallurgy, glass, high temperature ceramics, electronics, chemicals and nuclear applications.

Meanwhile, two units of the Interior Dept. jointly submitted a report to a Senate committee identifying several areas of the California desert as containing significant existing and potential deposits of rare earth elements. The U.S. Geological Survey and the Bureau of Mines confirmed Interior officials' earlier assertions that the desert is an important source of rare earths and should not be closed off to exploration and development as proposed under S. 7, the California Desert Protection Act of 1987.

The report to Congress listed seven areas out of a total of 110 targeted for closure to development under S. 7 as having significant potential for containing rare earth deposits. Those areas are in addition to the Mountain Pass region, which is also in the region proposed for closure, and now accounts for 97% of U.S. rare earth production (*IE/FL*, 27 July, 1).

In a July 31 letter to Sen. Dale Bumpers, chairman of Energy subcommittee on public lands, national

parks and forests, David Brown, deputy director of the Bureau of Mines, said U.S. success in commercializing new superconducting technology "will depend upon assured availability of the mineral raw materials for such rapidly changing and advancing technologies." — *David Kramer*

September 14, 1987

A NEW SUPERCONDUCTIVITY TRADE GROUP HAS NAMED BOARD MEMBERS, including three current or former DOE officials. The Council on Superconductivity for American Competitiveness will hold its first board meeting in mid-October, and has invited more than a dozen other key people in the field to join the initial seven members on the board.

So far, the directors of two DOE national laboratories have agreed to serve on the board. They are Sig Hecker of the Los Alamos facility and Alan Schriesheim, of the Argonne lab. In addition, John Deutch, a former director of energy research at DOE, and currently provost at Massachusetts Institute of Technology and a member of the White House Science Council, is on the board.

Other members of the board will include Roland Schmitt, senior vice president and chief scientist at the General Electric Co., who has been designated vice chairman; Sadeg Faris, president of Hypres Inc., Elmsford, N.Y.; Carl Rosner, president of Intermagnetics General Corp., Guilderland, N.Y. and former California Republican congressman Ed Zschau, now a general partner in Brentwood Associates, Menlo Park, Calif.

The group's chairman is George Keyworth, former White House science adviser and currently president of his own consulting firm, has agreed to serve as chairman of the group, (*IE/FL*, 27 July, 3).

According to the group's literature, its purpose is to provide a focal point for private sector efforts in the development and commercialization of superconductivity. It will serve as an information clearinghouse, provide a forum for industry, government and academia to share that information and also act as a lobbying group on policy related to the technology.

Membership is open to domestic companies, individuals, academic and scientific institutions interested in the development and commercialization of superconductivity. Current membership has not yet been released.

September 21, 1987

Tech Transfer Concerns Also Raised

NAS SUPERCONDUCTIVITY STUDY URGES $100M AS START FOR FEDERAL R&D

A National Academy of Sciences report due out today (Sept. 21) says a $100-million federal research program in high-temperature superconductivity next fiscal year would represent a good start toward solving some of the complexities of the sensational new field. The report stresses, however, that the funding should not come at the expense of other science programs.

The 36-page report also views as essential a commitment by federal agencies to help U.S. industries secure a competitive edge in superconductivity through technology transfer and other programs. In particular, it expressed concern over the effectiveness of the technology transfer programs at national laboratories and urged the government and industry to "pursue linkages more aggressively."

The report was requested by National Science Foundation Director Eric Bloch and was to be presented to the White House Office of Science and Technology Policy and to NSF on Friday.

"The United States has a good competitive position in the science of this field," the report says. "It has also shown flexibility, as scientists in universities and industrial and government laboratories spontaneously switched into this field from their previous endeavors and have contributed significantly to the world wide expansion of scientific knowledge on the new superconductors.

"Nevertheless, there is concern about the effectiveness of the nation's capabilities for translating this research strength into commercial products," the report adds.

According to the report, the federal government in FY-87 has reprogrammed nearly $30 million of research funds for high-temperature superconductivity work at university and industrial labs. It estimates that at least an equivalent amount of funds is being spent by private industry. It further estimates that total government and private funding will range from $100 million to $200 million by 1988, although it cautions that "firm figures" from industry have been unavailable.

The expenditure of $100 millon in federal funds in FY-88, which begins Oct. 1, would represent "a good beginning in addressing the challenges and opportunities offered by the new materials," the report says. But it adds, "Sufficient new money must be provided both to the science and the technology of

high-temperature superconductivity so that other important and promising areas of research and development are not held back." A concern of many science officials is that future funding of superconductivity work would come in the form of funds reprogrammed from other research initiatives.

The report also contains these recommendations:

— A mechanism should be established to monitor the potential demand for increased scientific and technical manpower if the promise of high-temperature superconductivity is fully realized, and to formulate appropriate recommendations on the funding of U.S. graduate and postgraduate research programs.

— An interagency mechanism should be established to help coordinate planning for superconductivity programs among various federal agencies.

— Given the anticipated rate of advance in high-temperature superconducting science and technology, the federal government should review progress in the field after 12 months as a guide to future resource allocation.

— Through its agencies, the U.S. government must enhance the probability that the U.S. industry gains a competitive advantage in this new field. This could be accomplished by the close association of industry with the Engineering Research Center or Science and Technology Center programs of the National Science Foundation, by cost-sharing between government and industry on proof-of-concept projects, and by other joint efforts.

— An important mechanism for enhancing U.S. industry's position is improved technology transfer from the national laboratories to the private sector. Although a variety of means are already in place to encourage such transfer, the panel is concerned about the effectiveness of past efforts and urges both government and industry to pursue linkages more aggressively.

"While the base of experimental knowledge on the new superconductors is growing rapidly, there is as yet no generally accepted theoretical explanation of their behavior," the report says. "Applications presently being considered are largely extrapolations of technology already under investigation for lower-temperature superconductors. To create a large scope of applications, inventions that use the new materials will be required. The fabrication and processing challenges presented by the new materials suggest that the period of precommercial exploration for other applications will probably extend for a decade or more."

The report lists the following as near-term prospects for applications: magnetic shielding, the voltage standard, SQUIDs, infrared sensors, microwave devices and analog signal processing. Longer-term prospects include such large-scale applications as: microwave cavities, power transmission lines and superconducting magnets in generators, energy storage, particle accelerators, rotating machinery, medical imaging, levitated vehicles and magnetic separators.

In electronics, long-term prospects include computer applications with semiconducting-superconducting hybrids, and Josephson devices or novel transistor-like superconducting devices, it says.

John Hulm, director of corporate research and r&d planning for the Westinghouse R&D Center, Pittsburgh, chaired a 26-member Committee on Science, Engineering, and Public Policy that prepared the report.

Basic research in high-temperature superconductivity is being pursued actively in Europe, Japan, the Soviet Union and in several developing countries, in addition to the U.S., the report says. Generally, no new major government resources have been committed. "The prevailing attitude appears to be that of waiting to see how the science progresses," it says.

"In Japan," the report says, "the scientific and technical community has responded vigorously, but aside from reprogramming, there has been modest immediate additional action by government agencies. The latter have, however, been very active in formulating plans for the next fiscal year (which begins in April 1988). Private industrial corporations are said to be investing their own funds heavily in research on high-temperature superconductors, with the government intervening to establish industry consortia to pursue the prototyping and other early development activities. Japan offers perhaps the strongest long-range competitive threat to the U.S. position."

September 28, 1987

NEW SUPERCONDUCTORS SEEN SPARKING DEVELOPMENTS IN FUSION RESEARCH

High temperature superconductors could help physicists achieve the ignition point in the fusion reaction process with reduced power needs, while also cutting by 6-8% the costs for new test reactors, according to a summary of a recent workshop on the application of the new superconductors to magnetic fusion held at Argonne National Laboratory.

Charles Baker, director of fusion power at Argonne, who summarized the workshop at a fusion sym-

posium at Princeton Aug. 28, said the new superconductors could substantially reduce shielding requirements for the magnets, since the materials would operate at considerably higher temperatures than current superconducting magnets.

There is also what Baker described as a "broad consensus" that use of the liquid nitrogen technology for cooling the new materials in place of liquid helium will result in substantial design simplifications and improved reliability of the magnets and reactors. And use of liquid nitrogen is also expected to lead to enhanced safety performance in the magnet.

Other possible advantages to the magnetic fusion program are features of the new superconductors that might result in different mechanical supports for the cryostat, which could facilitate the maintenance and removal of magnets. The cost of the new superconductors should not exceed $200 per kilogram, which is approximately that of the current superconducting niobium/tin compounds, the scientists suggested.

October 5, 1987

LABS DEVELOP NEW SUPERCONDUCTIVITY ROLES

Two months after President Reagan's July Superconductivity Initiative, several of DOE's national laboratories are well into implementing their portions of the program. But an advisory panel of three to five "wise men" of superconductivity promised by the White House to advise it on policy matters has yet to materialize.

DOE's computerized databank of superconductivity-related research began operating in its third and final trial phase mode — the compilation of research preprints — as scheduled on Sept. 14. The agency is currently in the process of inviting a limited number of non-DOE participants to access its database, according to William Buchanan, deputy assistant manager for information acquisition and appraisal at DOE's Office of Scientific and Technical Information. Outside participants, which will include companies, universities and other government agencies, are expected to number about 35, he added.

Included on the list of private sector invitees are IBM, AT&T, Battelle Columbus Laboratories, and General Electric. Other government agencies involved in superconductivity research include the National Bureau of Standards, NASA, the Naval Research Laboratories, and the Defense Dept. Universities invited to join the information exchange will include the Massachusetts Institute of Technology, the University of Wisconsin, Texas A&M and Stanford University.

Buchanan said criteria for selecting the outside participants include a requirement that they all be actively engaged in superconductivity research. Excluded for the time being are media and others seeking only to obtain information without providing any input of their own. Ultimately, DOE still plans to make the information in the system available to anyone who wants to access it, on a fee basis.

Just when the system will go public is still not clear. The trial phase is expected to continue at least through next March, and DOE officials still have to decide whether the agency should operate the public version or contract it out.

At Los Alamos National Laboratory, officials hope to have ready by Dec. 1 a proposal on how to transfer superconducting technology to the private sector. The facility was assigned that specific role by Energy Secretary John Herrington shortly after the July presidential initiative.

According to James Williams, deputy director of the lab's office of industrial applications, a few firms are being targeted in each of several fields: electric utilities, computers, communications, defense technology and medical equipment. The companies are being surveyed on what types of arrangements, such as joint ventures and partnerships, they would be interested in entering into with the lab in the area of superconductivity r&d.

Williams stressed that the small sampling of firms now being undertaken was not meant to exclude other companies from participation in the technology transfer project once it it initiated. Given the short time scale and the "logistics" involved, the sampling process is the only reasonable method to accomplish the task, he explained.

As for the superconductivity wise men group, the White House Science Council, an advisory group to presidential science adviser William Graham, considered the matter at a recent meeting, but reportedly came to no conclusions as to the composition of its membership. Observers continue to feel that at least some of the members will be culled from the science council itself, since that group contains a number of scientists familiar with superconductivity issues, including Edward Teller, Solomon Buchsbaum of Bell Laboratories, and David Packard of Hewlett-Packard.

Of the labs given roles in the effort, Argonne National Laboratory appears to have progressed the furthest in organizational terms, perhaps by virtue of previously having been given the lead role in a

project to develop a superconducting wire. The Illinois facility has established a Superconductivity Applications Information Office to function as the center designated by Reagan. Gregory Besio, the contact person, will direct inquiries from industry and universities on transmission cables, generators, motors, and storage devices to the appropriate technical contacts at the lab.

Argonne has also set up an Industrial Affiliates Program for Superconductivity, a package which includes an annual meeting, mailings of the lab's journal and report preprints and reprints, a quarterly newsletter, hotline, and market surveys of important applications and industries done in conjunction with the University of Chicago. Package buyers also obtain one consulting day annually, which entitles them to meet with lab scientists active in their field of interest. They also will receive the services of a University of Chicago MBA student, who will act as a consultant for the firm, watching superconductivity developments as they relate to that particular company.

The annual subscription fee charged by Argonne is based on company size: firms with less than 500 employees are charged $15,000, while those with more than that number pay $25,000. Besio said the lab will consider itself "extremely successful" if it signs up 15 companies. Firm commitments have already been received from utilities, major chemical and industrial gas companies. The program is expected to get underway around the first of next year.

"This is client development," Besio said. "This will help us identify who the serious players are in the business." The lab has been "swamped" with requests for superconductivity related tours, and it cannot afford to continue that service for free, he said.

Lawrence Berkeley National Laboratory, which was designated in the president's program as the contact lab for thin film applications of superconductors, is reported to be in the final stages of organizing its program. Located within its center for advanced materials, it will include an information center to answer inquiries on thin film and device applications. The program will also coordinate research efforts in basic superconductor science, thin films and devices and materials processing.

A Lawrence Berkeley official said the lab is working with DOE to determine exactly what the thin film applications information center will comprise. It's expected to include a computerized database containing abstracts and unpublished data, workshops, newsletters and a variety of meetings.

The third DOE-designated national laboratory, Ames, which was assigned the role as "center for basic scientific information," began publishing a weekly newsletter on superconductivity developments even before the Reagan initiative was announced in July. According to Ellen Feinberg, the project manager, the letter's circulation has jumped from around 600 in June to more than 1,500 today, and continues to grow at the rate of about 50 a week. The newsletter is also sent electronically to 160 others. Funding for the project is obtained from DOE, the Defense Advanced Research Projects Agency, and the Air Force Office of Scientific Research.

Feinberg said she has been receiving calls from individuals who want to become involved in the superconductivity field, but don't know exactly how. Ames' center hopes to develop a database to facilitate communications between these people.

The Ames center has also been "tracking down a lot of rumors that are rampant in the field," Feinberg said. Most of these prove to be just rumors, she added. — *David Kramer*

October 5, 1987

Region Produces Rare Earth Metals

STRATEGIC MATERIALS PANEL ATTACKS CALIFORNIA-DESERT-PROTECTION BILL

An Interior Dept. advisory panel last week recommended that Secretary Donald Hodel "actively oppose" a Senate bill that would declare 10-million acres of the California desert off-limits to mineral exploration. The affected region now contains the non-communist world's only primary producing deposit of rare earth metals, which are used in formulation of the new generation of high temperature superconductors, and geologists rate the potential for further rare earth finds in the area as high.

"In view of the emerging advanced material applications of these minerals in superconductivity and ceramics, the exploration and further development of this area is critical to national security and international competitiveness," stated the unanimous recommendation of the 25-member panel, known as the National Strategic Materials and Minerals Program Advisory Committee. The group charged that the California Desert Protection Act (S. 7), sponsored by Sen. Alan Cranston, D-Calif., is "ill-conceived and contains excessive land withdrawals." It asserted that domestic mineral and material needs would best be served by allowing the Bureau of Land Management to continue the area's land management under provisions of the Federal Land Management and Planning Act.

Interior officials, including Assistant Secretary J. Steven Griles, have already testified in opposition

to the bill at Senate hearings (*IE/FL*, 27 July, 1.) Interior maintains that its existing land use plan is adequate for the 15-million acres it has designated as the California Desert Conservation Area. The area presently produces about half of the state's $2.2 billion worth of non-energy mineral production.

Rare earth elements, particularly yttrium, are used in the formulation of the newly-developed high-temperature superconducting ceramics. The only current primary production of these elements in the U.S. occurs at the Mountain Pass mine operated by Molycorp Inc., a unit of Unocal Inc., in the area proposed to be excluded from exploration and development activities.

According to W. Glenn Zinn, an executive with Hecla Mining Co., Coeur D'Alene, Idaho, and a panel member, potential developers of rare earth mines may be deterred by the $250-million cost of an ore processing facility. While there is plenty of potential for rare earth finds elsewhere in the U.S., Zinn acknowledged it would be difficult for a newcomer to break into an area where production is already dominated by a few companies, especially when demand for the materials is still very limited.

Hecla itself is planning to extract rare earths from a mine it will open shortly in Canada's Northwest Territories, Zinn said.

October 5, 1987

THE BOARD OF A NEW SUPERCONDUCTIVITY TRADE GROUP HAS GROWN. Three more executives agreed to serve as members of the Council on Superconductivity for American Competitiveness board of directors. They are: Frank Carruba, director of Hewlett-Packard Laboratories; Robert Stratton, vice president of the corporate staff and director, Texas Instruments Inc.; and George McGowan, president and chief operating officer, Baltimore Gas & Electric Co.

The additions bring to 11 the total number of industry and government officials who have accepted positions on the board, including its chairman, former White House science adviser George Keyworth (*IE/FL*, 14 Sept, 10). Other invitations to serve on the board are still outstanding. The group will hold its first board meeting in Washington the week of Oct. 12.

October 12, 1987

STUDY TO ASSESS SUPERCONDUCTOR MATERIALS

DOE and the Electric Power Research Institute have agreed to a $1-million joint effort to identify the material characteristics needed for a variety of high-temperature superconductor applications. The assessment, to be administered through Oak Ridge National Laboratory, will identify properties such as current densities, tensile and mechanical strength, malleability, and temperatures needed if the new-generation superconductors are to find homes in applications ranging from small electric motors to magnetic waste separation.

According to Donna Fitzpatrick, DOE assistant secretary for conservation and renewable energy, the preliminary results of the assessment are expected in about six months, and a final report will be published in about one year. The work is to be performed by DOE's national laboratories and by non-profit organizations and universities, but the specific contracts have not yet been signed, she said.

The project funding will be obtained about equally from the department and EPRI, James Eberhardt, director of DOE's Energy Conversion and Utilization Technologies Office, said. Applications to be assessed under the program include:

— Small electric motors.

— Power electronics, such as control systems, but excluding power transmission.

— Transportation, including applications like magnetically levitating trains and linear induction pickup vehicles.

— Electromagnetic pumping, primarily for industrial processing applications.

— Magnetic materials processing, including ore separation.

— Magnetic materials fabrication, such as casting, forging and consolidation of powders.

— Magnetic waste separation.

DOE's Division of Fossil Energy is also involved in the program. One DOE source said it may become possible, using the new superconductors, to separate sulfur and other contaminants from coal, perhaps adding a new wrinkle to clean coal technology.

Eberhardt said he expected the materials processing and fabrication studies to take the longest, since there are so many possible applications in these areas. While ECUT is interested in the performance characteristics of materials, any applications that might result from the work would be developed through Conservation and Renewable Energy's Office of Industrial Programs in cooperation with the

private sector.

Right now, researchers can only theorize about the magnitude of magnetic fields achievable with the new high-temperature superconductors and the applications they might open up, he said. Where conventional magnets can only achieve fields of about 1 Tessler, and current superconducting magnets can reach the 15-20T range, the new materials could theoretically accommodate up to 200T.

"We want to determine what the performance characteristics of these materials are," Eberhardt said. So far, the superconducting ceramics have proven to be very unstable chemically, vulnerable to oxidation and rapid loss of their superconducting properties. Moreover, their brittleness has made fabrication into any useful form extremely difficult. — *David Kramer*

October 12, 1987

Administration Phalanx Testifies Against

BILLS TO COORDINATE SUPERCONDUCTOR R&D UNDEFLECTED BY AGENCY PANS

DOE and other Reagan administration officials last week attacked as unnecessary legislation aimed at coordinating federal superconductivity r&d efforts. But key members of two House panels appeared unconvinced that current federal activities were sufficient in the drive to commercialize the emerging technology, and staffers said they will press ahead with their bills.

At issue were three House bills, two authored by Rep. Dave McCurdy, D-Okla., and the other by Rep. Don Ritter, R-Pa., each of which would establish a new council or commission aimed at coordinating federal r&d efforts. Administration officials were particularly adamant in their opposition to these provisions, arguing that coordinating mechanisms already exist and a further layer of bureaucracy would be counterproductive.

Thomas Moore, a member of the Council of Economic Advisers and also the National Critical Materials Council, objected to McCurdy's proposal to place NCMC in charge of drafting a five-year federal r&d plan, saying it "does not make economic or practical sense for the council to be greatly expanded to perform a function better left to the agencies." Moore told members of the Science, Space and Technology's subcommittees on transportation, aviation and materials, and science, research and technology that "adding another layer of bureaucracy will only lead to inefficiency and would pull valuable resources away from the research effort."

That statement brought a sharp response from McCurdy, who said government r&d efforts to date have not been adequately coordinated. Asserting that superconductivity commercialization efforts should be given a high priority, McCurdy told Moore that "we're tired of Rose Garden ceremonies without the money following them."

James Decker, acting director of DOE's Office of Energy Research, commented the bills' proposals to establish a central DOE office of superconductivity were not necessary or desirable. It would be "very awkward" to combine the activities being conducted by the numerous DOE offices now involved in the effort, he said, adding there is already a coordinating committee within the agency that serves as a conduit for information exchange. Decker said the five-year national superconductivity program called for in McCurdy's bills could be "counterproductive," since it would initiate efforts "very similar to those already in progress."

Moore, Decker and White House Science Adviser William Graham all pointed to COMAT (the Committee on Materials), under the White House Office of Science and Technology Policy, as one of the foremost existing federal r&d coordinating mechanisms. Composed of officials from the various agencies, COMAT "has been able to respond on short notice to the developments in the superconductivity field and establish a subcommittee at an early stage focused on that technology," Graham stated. Additional mechanisms are available through the National Research Council, the Cabinet-level Economic Policy Council, which has established a "working group" on superconductivity, and the so-called "wise men" advisory group called for under the president's initiative but yet to be formed under auspices of the White House Science Council.

Administration officials also objected to the level of funding contemplated by the legislation. The two bills sponsored by McCurdy would channel $150 million annually into federal r&d efforts, while Ritter's legislation would earmark $80 million annually. The Reagan superconductivity initiative proposes a $76-million federal effort through funds redirected from other r&d activities. This follows $27 million that has been redirected into federal efforts over the past six months.

"We cannot support actions that would lead to a wasteful increase in the deficit or reprogram funds without due cause," said Graham. "To the extent that these bills would reprogram funds, they take away management options within the agencies that have proven effective in allowing them to respond to

developments in superconductivity in the recent past, and lead to government inefficiency."

Moore agreed, saying the White House opposed the bill "because it would add hundreds of millions of dollars to a budget already overburdened with excessive spending and massive deficits."

But John Hulm, director of corporate research and r&d planning for Westinghouse, pointed to a National Academy of Sciences/National Academy of Engineering recommending that the government spend $100 million annually on superconductivity (*IE/FL*, 21 Sept, 3). He said the Japanese Diet plans to channel $56 million annually into government efforts in that country.

Several committee members expressed concern that the largest chunk of the Reagan Initiative funds — $50 million annually — has been earmarked for the Defense Dept. Ritter said he had "trepidation" in looking at applications that are purely military in nature, noting that his bill was designed to ensure that private-sector commercialization opportunities not be shortchanged. — *David Kramer*

October 12, 1987

DEFENSE ENDS FIRST PHASE OF PLANNING FOR SUPERCONDUCTOR PROGRAM

The Defense Department has completed the first phase of planning for a five-year superconductivity r&d program, the goal of which is to utilize recent developments in the field as rapidly as possible for military applications, while also transfering appropriate aspects to the civilian sector. The program, as outlined to a congressional panel by Ronald Kerber, deputy under secretary of defense for research and advanced technology, will involve the the armed services, the Defense Advanced Research Projects Agency, the Strategic Defense Initiative Organization and other Defense components.

Defense activities in superconductivity will be funded at $50 million annually for at least three years, in line with President Reagan's superconductivity initiative, Kerber said. This compares to $27 million spent on the technology by the agency in FY-87.

Responding to concerns expressed by several members of the House Science, Space and Technology Committee about the heavy Defense emphasis in the Reagan plan, Kerber said the agency "recognizes that the utilization of federal r&d by the private sector is imperative in this era of growing competition in world markets." The department's "historically close working relationships with industry and university researchers" will facilitate technology transfer to the commercial sector, he said.

Included within the scope of the Defense program are basic characterizations of known superconducting materials, searches for still higher temperature superconductors and approaches to the processing of thin film and bulk materials. It also includes exploitation of small-scale applications, such as sensors, superconducting electronics, hybrid superconducting-semiconducting electronics, and the sceince and technology base of large-scale applications, such as magnets, motors, generators, electromagnetic launchers and directed energy systems.

Materials research is oriented toward Defense-specific applications like sensors, ultra-high-speed signal processors and memories, and high-current-density conductors for electric motors and generators, for energy storage, for electromagnetic launchers and for high power radar transmitter tubes, he said. Processing work involves studies of precursor materials, densification, deposition and crystal growth, while underlying science investigations address crystal chemistry, compositional phase equilibria, optimum routes to materials synthesis and materials compatibility.

Large scale applications work, such as generators and magnets, is being closely coordinated with DOE's activities in the same area, Kerber said. Defense's program calls for efforts in the science and technology of high-current-density, high-magnetic-field superconducting wires, cables and bars.

October 12, 1987

DARPA PRAISES HALF OF SUPERCONDUCTOR BIDS, SAYS $65M/YEAR NEEDED

The Defense Advanced Research Projects Agency has identified half the 203 proposals on superconductivity research it received from the private sector as "top notch." Craig Fields, DARPA deputy director for research, told a House panel last week the agency would need to spend $65 million annually in order to fund that half of the proposals, but is likely to have funds available for only about half of them.

Kay Rhyne, DARPA's program manager of superconductivity and ceramics, said current expectations are for annual funding in the range of $20 million to $35 million, with the lower end of that range viewed more likely. The agency is still awaiting word from Congress, which has yet to act on Defense appropriations for FY-88.

Fields said the contractor selection process will begin around Nov. 1, with the bulk of the contracting to be completed by Jan. 1. He told the House Science, Space and Technology's subcommittees on

transportation, aviation and materials and science, research and technology that a total of $330 million in federal funds were sought in the 203 proposals received from universities and private industries. The projects range in duration from less than one year to three years, but 60% are three-year proposals.

"The creative researchers that submitted these proposals have presented the government with an unprecedented opportunity for laying a firm foundation for the manufacturing of ceramic high temperature superconductors," Fields said.

Thin film application proposals included deposition techniques such as laser flash evaporation, sputtering, molecular beam epitaxy, metal-organic chemical vapor deposition and chemical approaches involving spun-on films and sol gel techniques. Component applications for thin films included ultra-sensitive magnetic detectors, field effect transistors, infrared detectros, lossless high speed microelectronics transmission lines and interconnects, A/D converters, Josephson Junction devices, microwave or millimeter wave phase shifters, electronic frequency filters and other circuits, and RF cavities.

In the bulk materials area, processing ideas involved chemical approaches to manufacturing powders, fiber reinforced composites, and various kinds of monoliths and tapes, he said. Component applications included large scale transmission cables, magnets, magnetic shielding, actuators, solenoids, motors, energy storage devices and magnetic bearings.

DARPA, which has no laboratory of its own, is operating the project in conjunction with the Office of Naval Research. Fields said 68% of the proposals received were from small businesses, and 63% were from organizations that traditionally have not participated in Defense Dept. r&d activity.

"While our motivation is to assure a domestic source of supply of the high temperature superconductors for Defense, we expect there will be significant commercial spin-offs from our investment," he said. "In fact, for the next few years the technology base largely will be dual use, supporting both national security and economic strength. We are particularly concerned that the manufacturing technology we develop support both large scale and small scale production, and that it provide a cost effective base for defense manufacturing."

October 12, 1987

Argonne Study Sets R&D Priorities

KEY SUPERCONDUCTOR ISSUE: HOW MUCH CURRENT CAN A MATERIAL CARRY?

Getting the new high-temperature superconductors to carry more electrical current should be the single most important objective of researchers, a just-released DOE study asserts. Prepared for the Office of Energy Storage and Distribution by Argonne National Laboratory, the study says the achievement of higher current densities is more critical to the commercialization ofNhe new materials than is any further elevation in the materials' transition temperatures.

OESD will itself make higher current densities in wires and tapes the top r&d priority for its superconductivity program. The 181-page study on bulk applications for the new high-temperature materials maintains that current densities so far observed in samples are too small to permit commercial applications on earth.

The study, entitled "Advances in Applied Superconductivity: Goals and Impacts, a Preliminary Evaluation," was begun in April. DOE said its results, which are consistent with the results of similar assessments prepared by other nations, should give the research community direction in its efforts.

Another property of the new materials requiring further investigation is their chemical stability in the presence of oxygen and water, the study says. The materials have shown a propensity to lose oxygen, and along with it their superconducting properties.

Moreover, the new superconductors have so far achieved only the circulation of direct current without power loss, while their alternating current properties remain unknown. AC properties are a must for applications involving generators, transformers, power transmission and motors.

In spite of these unknowns, the study points to promising applications for the new superconductors if necessary current densities can be attained. Its analysis foresees economic applications in generators, transformers, magnetic energy storage, power transmission, motors and the high-gradient magnetic separation of kaolin — a material used in the production of ceramics.

However, the new superconductors alone are not expected to substantially change the economic feasibility of magnetically levitated trains.

Other near-term objectives oESD's superconductivity r&d program will be to conduct a technical assessment and market analysis of promising applications for the materials, including evaluation of the appropriate size for such devices; assessing various approaches to cooling the materials, particularly at

the conductor surface, and developing new electrical stability criteria; devising processing and fabrication techniques, including working samples of wires and tapes; characterizing the mechanical behavior necessary for each application; and developing techniques to ensure the adhesion of the superconducting materials to various mechanical and electrical stabilizers.

The new superconductors also may compete with units fueled by natural gas for the supply of peaking power, by providing a method for the storage of solar power. Superconducting magnetic energy storage (SMES) could play a role in absorbing transient power and discharging level power, while superconducting transmission lines could favorably impact the economics of offshore ocean thermal energy conversion (OTEC), according to the study.

Assuming the necessary critical current densities can be achieved, generators using the new superconductors will be more economic than either conventional units or those using low-temperature superconductors. A high-temperature superconducting 300-Mw generator might have an efficiency of 99.7%, compared with 99.5% for a low-temperature generator and 98.6% for a conventional machine. An additional benefit from the increased efficiency is reduced air pollution from conbustion. The study recommends that engineering research and economic evaluation be devoted to generators in the 60 Mw-range, for which there is now a greater demand than for those of the 300-Mw size.

The cost of service for a 1,000-Mw transformer utilizing the new materials would be 64% that of a low-temperature superconducting unit, the study estimates, and only 40% of the cost of a conventional transformer. The comparisons reflect the 99.92% efficiency of the high-temperature unit.

For SMES, it's estimated that the new materials could result in capital cost savings ranging from 3% to 8%, both in lower refrigeration costs and the expected lower cost of the materials themselves. "Under reasonable assumptions," the savings might be enough to make SMES competitive with gas-fired peaking plants for energy storage, according to the study.

In power transmission, the cost of service for an underground 66-mile 10,000-Mw, AC superconducting line is about 60% that of conventional underground oil-filled-pipe transmission. While both lines are more expensive than a conventional aerial transmission line, it is assumed that concern over health and environmental effects of overhead lines will result in future requirements that underground lines be constructed. The agency recommended research and economic evaluation be concentrated on 300-1,000-Mw lines, for which there is greater demand than for 10,000-Mw lines.

Large motors (1,500 horsepower) utilizing the high-temperature materials could provide shaft power for 75% of the cost of service of a conventional motor, the study estimates. The savings reflect an assumed 97% efficiency for the superconducting AC motor, which compares to 95% efficiency for a conventional motor. If the capital cost of the system could be lowered by 40% through elimination of the refrigeration system, the superconducting motor's cost of service would be about 65% that of a conventional motor.

Low-temperature superconductors have recently been commercially applied to high-gradient magnetic separation (HGMS) of magnetic contaminants in kaolin processing. The primary advantage of high-temperature superconductors in the application would be a reduction?of 10% to 15% in Capital costs attributable to the elimination of the helium refrigeration/reliquefaction system. The study also notes that the high-tempearture materials amy be applicable to other industrial processes, including gas/gas phase separation, materials handling, and materials fabrication.

Magnetically leviated trains represent the one application seen as not greatly impacted by the advent of the new materials. The study says that present designs call for only about 1% of the capital costs of such systems being spent on the levitating magnets. However, the high-temperature superconductors may offer ease of operation and an increase in system reliability that could make magnetically levitated trains the preferred choice among high-speed rail technologies.

October 12, 1987

JAPAN'S STRATEGY FOR SUPERCONDUCTIVITY R&D LEADS THE WORLD, according to a report by Battelle Memorial Institute. Despite significant U.S. breakthroughs in superconductivity research, Japan is well ahead in the race to develop and implement a national strategy for r&d. According to Battelle researcher Donald Slivka, planners in Japanese federal agencies have "worked 16-hour days" since last December, when Paul Chu of the University of Houston presented the results of his work. The study says Japan's Ministry of International Trade and Industry, its Science and Technology Agency and its Ministry of Education, have led the Japanese effort.

According to Battelle, MITI is establishing an international center for superconductivity, comprised of about 80 electric power, electric equipment, cable and ceramic companies. The center will include a

research lab that will exchange researchers with the U.S. and Europe. Working through the center's participants, MITI will direct r&d efforts in new superconducting theory and materials, thin film techniques for producing the Josephson junction device and applying it to computers and other electronic equipment, and superconductor coiling techniques and producing power generation and power storage system test models.

STA, the second organization, held symposia attracting about 130 firms when it opened its superconducting materials research multicore project in February. The project is divided into theory, synthesis and evaluation phases, with special emphasis on materials evaluation. STA also proposes to establish a foundation to attract private firms to participate in research projects, and is considering a system to facilitate joint research with foreign organizations.

ME, the third government body, controls research budgets for universities in Japan and intends to greatly expand the budget for special research on high-temperature superconductivity beginning next year, according to Battelle. Major Japanese corporations are investing significant resources in developing the materials, forms and devices. Sumitomo Electric Industries, for one, has about 65 researchers working with wire and thin film, and 700 patent applications have been filed by another 200 staff members dedicated to superconductor work.

October 19, 1987

SUPERCONDUCTIVITY COUNCIL HOLDS FIRST MEETING, SETS FEE SCHEDULE

The Council on Superconductivity for American Competitiveness, the new trade group whose aim is to commercialize applications for high-temperature superconductors, was formally launched last week with the first meeting of its 14-member board.

The group, chaired by former White House Science Adviser George Keyworth, hopes to recruit 120 corporate members by next June, according to its organizers. A full-time staff, initially three persons, will be in place by the end of October.

Membership so far has been limited to the 14 board members, who represent industry and government agencies. The newest members are Kay Rhyne, program manager of superconductivity and ceramics at the Defense Advanced Research Projects Agency; Peter Bridenbaugh, vice president for research and development at Alcoa; and David Duke, senior vice president for research and engineering at Corning Glass Works. Robert Stratton, vice president of Texas Instruments Inc., is expected to become the 15th member shortly.

Board members set a membership-fee schedule ranging from $1,000 to $25,000 annually, based on an average of the previous two years' annual revenues. Universities and government laboratories will pay annual dues of $1,000, while individuals working for universities or federal, state or local governments will be charged $95 annually.

October 19, 1987

PANEL: DON'T DELAY SSC FOR SUPER MAGNETS

Commercialization of new high-temperature superconducting magnets that could be used in the Superconducting Super Collider will not occur for another 10 to 15 years, according to a DOE advisory group. Moreover, a recent study by the SSC Central Design Group at Lawrence Berkeley National Laboratory concludes there is likely to be no economic advantage in using the new superconductors for SSC-type applications.

Albert Narath, vice chairman of government systems for Bell Laboratories, told a meeting of DOE's Basic Energy Sciences Advisory Committee last week that a BESAC subcommittee he chairs found the new high-temperature superconductors "are not relevant to the SSC design." BESAC was asked by former Energy Research Director Alvin Trivelpiece to examine the impact the liquid-nitrogen-temperature materials could have on magnets of the same scale as those to be used in SSC (about 6.6 Tessler.)

Some critics of SSC, including Rep. Don Ritter, R-Pa., have argued that the latest breakthroughs in superconducting materials warrant a delay in the $4.4-billion project until they can be adapted to the collider's magnet system. Ritter continues to believe scarce federal r&d resources would be better spent on development of superconductor technology and applications.

The BESAC subcommittee's final report, which will suggest a program for applying the new materials to superconducting magnets, is due to be completed by December. Narath told BESAC his

panel "can't get anyone to provide us a coherent argument that this technology could be greatly accelerated."

But even if it were possible to speed application of the new materials to large magnets, the LBL study concluded, no economic benefit would derive from using them in place of existing niobium-titanium superconducting magnets. According to Stan Wojcicki, deputy director of the SSC central design committee, the reason is the trade-off between the lower cost of liquid nitrogen and the higher cost of a vacuum system to accommodate the nitrogen coolant.

Hydrogen, a prime contaminant of vacuums, is "frozen out" at liquid helium temperatures but remains a gas at liquid nitrogen temperatures. In order to remove the hydrogen from the coolant at nitrogen temperatures, materials must be added to the magnet to absorb the gas. That in turn would mandate magnets with larger apertures, greatly increasing their cost, he explained.

Wojcicki said the study's calculations assumed that the cost of a magnetic cable made of the high-temperature superconductors would be the same as that for existing superconducting cable, and that the current densities of the two materials are also the same.

Moreover, he told *Inside Energy/with Federal Lands*, claims that the new superconductors will permit huge increases in magnetic fields of the order of 60T fail to take into account the greatly expanded supporting structures that would be required for the magnets, due to the enormous forces such fields would exert. As an example of magnetic forces in the 60T range, he noted that copper would flow.

—David Kramer

October 26, 1987

ONE SUPERCONDUCTOR APPLICATION, MAGNETICALLY LEVITATED TRAINS, would be singled out for its own federal r&d program under a bill introduced recently by Sen. Daniel Patrick Moynihan, D-N.Y. Dubbed the FAST act, for Federal Advanced Superconducting Transportation, Moynihan's measure would provide $100 million in federal funding for the first three years of the r&d program, followed by $200 million for the next two years, and an unspecified level of funding to be determined by Congress after that.

NASA is charged with the responsibility for perfecting the technology, while a new office would be set up within the Transportation Dept. to oversee design and regulations for a national system of magnetically levitated trains. The bill would also require states to provide entities with an exclusive franchise to construct and operate the systems, and calls for unspecified federal tax incentives to be provided to spur development of the rail system.

Acknowledging that "one appropriate location" for the trains he has in mind is the Northeast corridor, Moynihan also pointed to efforts by Florida to examine a high-speed rail corridor in that state. Other viable corridors for initial system development include San Diego-Los Angeles, Los Angeles-Las Vegas, Detroit-Chicago, Chicago-Milwaukee, and Ohio-Pennsylvania.

The trains, which would use superconducting magnets, "could alleviate many of the problems faced by our nation's transportation industry: congestion, pollution and safety," he said. "If we fail to act now, the inevitable result will be that one of the largest capital projects in the United States during the 21st Century will be based upon imported foreign technology, either Japanese or German."

October 26, 1987

IBM'S GOMORY TO CHAIR REAGAN 'WISE MEN' PANEL ON SUPERCONDUCTORS

Ralph Gomory, senior vice president for science and technology at IBM, has agreed to serve as chairman of the so-called "wise men" panel set up to advise the White House on superconductivity issues. Gomory is currently a member of the White House Science Council, which advises President Reagan on scientific issues through Science Adviser William Graham.

Graham told a congressional panel last week most of the panel members have been selected, but that he would wait until all the members had accepted before releasing the names of the others. He told *Inside Energy/with Federal Lands* that the group will consist of five members, not all of whom are members of the science council. Additionally, Solomon Buchsbaum, who chairs the science panel, will serve as an ex officio member of the superconductivity panel, which Reagan announced in July as part of his superconductivity initiative.

Graham said the names of the panel members will probably be announced this week. Although not set up as a subcommittee of the science council, the superconductivity group will keep the council apprised of its activities, Graham said. The group plans to "work closely" with the Council on Supercon-

ductivity for American Competitiveness, the newly formed private sector trade group, he said.

In his testimony before House Science, Space and Technology's subcommittee on energy research and development, Graham also revealed the administration has acted to speed up the patenting process for superconductivity-related applications. As of Sept. 1, such patent applications were moved to the "top of the pile" instead of being processed in the normal chronological order of receipt. As a result, the normal two-to-three-month period required for reaching the examining area has been cut to one month, and the overall process, from application to award, will be reduced by about six months, from two years to 18 months.

Graham said DOE has been allocated $12 million in FY-88 funds for r&d related to high-temperature superconductivity. In FY-87, total DOE superconductivity efforts, for both conventional, or low-temperature superconductors, and for the new high-temperature materials, was $42 million. Graham did not supply a figure for proposed FY-88 conventional material funding, and he cautioned that the FY-88 figures were "not set in stone."

While sensor applications are likely to be the first commercial applications for the new superconductors, usage in electronics is expected to occur shortly thereafter, according to Graham. Since both silicon and gallium arsenide — the two major semiconductor materials — can operate at liquid nitrogen temperatures, there are opportunities for "synergism" between the new superconductors and semiconductors. Such applications are not possible with conventional superconductors because semiconductors do not function at the extremely low temperatures of liquid helium.

Graham said the administration feels it "essential" to fund both superconductivity research and the Superconducting Super Collider. But Rep. Sid Morrison, R-Wash., voiced concerns that the two initiatives will be competing for already scarce federal r&d money. "The place [the two projects] collide is when you get to the Treasury," Morrison said. "How do we prioritize them financially?"

— David Kramer

November 2, 1987

INVITATIONS TO JOIN DOE'S SUPERCONDUCTIVITY DATA BASE HAVE GONE to 40 companies, universities and government agencies. Program chief William Buchanan, who is deputy assistant manager for information acquisition and appraisal at DOE's Office of Scientific and Technical Information, said responses are expected back from invitees within a month. The office, which is located at Oak Ridge National Laboratory, will make its computerized databank available on a free trial basis to those invited, and also is continuing to select additional organizations for its trial.

November 2, 1987

CONVENTIONAL LOW-TEMP SUPERCONDUCTORS SHOULDN'T BE ABANDONED in the rush to commercialize the new high-temperature ceramic materials, an industry expert warned recently. In testimony to House Science, Space and Technology's subcommittee on energy research, John Stekly, vice president of Intermagnetics Corp., called the competitive spirit driving the race for yet higher temperature materials "admirable," but added that comparable attention should be focused on the traditional niobium-nitride, niobium-tin and niobium-titanium materials that operate at liquid helium temperatures.

Representing the Council on Superconductivity for American Competitiveness, Stekly reasoned that it will be at least several years before the prospects are good for "that ultimate superconductor, the one that can operate at room temperature." Until the new materials are understood, research activity should also be focused on ways to use superconductors in general. "After all, we have tremendous incentive in 1987 that we didn't have in 1986 to become expert in the ways to use superconducting technology," he said.

November 2, 1987

BONNEVILLE POWER REQUIREMENTS FOR SUPERCONDUCTING TECHNOLOGY are being examined in a joint study by the agency and the Pacific Northwest Laboratory. Unlike current research in superconductivity, which consists of separate efforts directed at specific components of a power system, such as generators, magnetic storage and underground cables, the PNL effort is aimed at providing a picture of how these elements will come together within an electric power generation and transmission system using superconducting equipment components, or whatever additional apparatus may be required to make the system operate effectively.

According to Thomas Claudson, PNL associate director, the Bonneville Power Administration and

utilities in the Northwest will have to make long-range decisions about building new facilities within the next five to 10 years. "From a long-term planning aspect, BPA already perceives that the addition of new generating facilities may be delayed when the new [high-temperature superconducting] technology is applied to increase efficiency and to conserve energy resources," he told House Science, Space and Technology's subcommittee on energy research and development at a recent hearing.

November 9, 1987

DARPA FEARS FISCAL AUSTERITY WILL CURTAIL SUPERCONDUCTIVITY EFFORT

Fiscal austerity could drastically curtail the Defense Advanced Research Projects Agency's ambitious plans for funding superconductivity r&d. DARPA, which was hoping for as much as $50 million in FY-88 funding for its superconductivity program, now fears it could get no money at all for the effort. Kay Rhyne, program manager of superconductivity and ceramics at the agency, said DARPA's plans could fall victim to the new fervor being devoted to budget balancing in the wake of the stock market collapse last month.

DARPA has nearly completed its evaluation of 203 r&d proposals from industry, universities and non-profit groups, but cannot award contracts until Congress appropriates FY-88 funds. Rhyne and other DARPA officials have described about half the proposals as "top notch," saying they need about $65 million annually to support those efforts. As recently as last month, DARPA said it was expecting to get at least $20 million for the projects (*IE/FL*, 12 Oct, 8).

But other sources feel the superconductivity program will be spared from the budget axe because of its presidential imprimatur. President Reagan himself proposed a three-year $150 million Defense Dept. r&d program as part of his "superconductivity initiative" unveiled in July.

Said one congressional aide: "If the axe falls, it will fall on other programs that are from a technical point of view just as important." With total federal r&d efforts amounting to around $70 billion a year, there ought to be room enough to carve out $150 million or so for a superconductivity program, he added.

Rhyne acknowledged last week that "we're in pretty good shape" should DARPA be funded at or above FY-87 levels. The worst situation for the superconductivity program would see DARPA included in an across-the-board cut applied to all federal agencies.

November 23, 1987

McCURDY, RITTER BOW TO COMPROMISE EFFORT ON SUPERCONDUCTOR BILL

A compromise is in the works on House legislation designed to spur federal r&d activities in superconductivity, since Reps. Dave McCurdy, D-Okla., and Don Ritter, R-Pa., have agreed to modify their respective bills. DOE would be the prime beneficiary of the package; its superconductivity research funds would jump to $40 million in FY-89, from an expected $15 million this fiscal year.

Moreover, the new bill would allocate $15 million annually to DOE's Office of Conservation and Renewable Resources for work on applications of superconductivity. That office currently has virtually no money allocated for such r&d activity.

Staff for the two lawmakers say there's still a chance the compromise package could be marked up this year, but it's more likely to be early next year before the Science, Space and Technology Committee gets to it. Three subcommittees have jurisdiction in the area, and approval from all will be needed. But timing is not viewed as critical at this point, since the funding authorizations in the bill would not take effect until FY-89.

The package, which will probably be offered as a substitute to McCurdy's bill, would drop McCurdy's proposal to form a new "office of superconductivity" within each of the federal agencies working on the technology to coordinate their r&d activities. Reagan Administration officials had particularly objected to this proposal, saying it would create a new bureaucracy and waste scarce resources.

The compromise bill would fund total federal r&d activity at $100 million to $120 million annually for a five-year period. McCurdy had proposed $150 million annually, while Ritter asked for $80 million. The new bill would give Defense $50 million, the same amount the White House proposed in its July Superconductivity Initiative but with the additional stipulation that the bulk of it go to the Defense Advanced Research Projects Agency. The National Science Foundation would receive about $20 million under the compromise bill. Although McCurdy had first proposed funding NSF at $40 million annually, the scaleback came after the agency said it would be unable to spend that much.

The Reagan administration has opposed both lawmakers' plans, claiming that its own initiative

focuses sufficient federal efforts in the area. The White House in FY-88 would channel $76 million in federal money redirected from other science r&d activities (*IE/FL*, 12 Oct, 7), with the bulk of that, $50 million, going to the Defense Dept.

But both McCurdy, who chairs Science, Space and Technology's subcommittee on aviation, transportation and materials, and Ritter fear that once Reagan is gone, the superconductivity effort could be cut or dropped at the whim of the next president. They feel that five-year legislation will commit the nation to a superconductivity program. — *David Kramer*

November 23, 1987

SUPERCONDUCTING MAGNETS FOR FUSION ACHIEVE RECORD FIELD STRENGTH

Researchers at Oak Ridge National Laboratory recently completed an 18-month test of experimental superconducting magnets for fusion power. In the $180-million, four-nation program, all six magnet coils achieved magnetic fields of 9 tesla, well beyond their original design goals of 8T.

According to Paul Haubenreich, manager of ORNL's large-coil program, no other magnets this big have achieved such a high field strength. The D-shaped coils are each 20 feet tall and weigh about 40 tons. "By testing six different, highly instrumented coils that gave revealing information, we can identify the magnet designs and manufacturing techniques that could provide reliable, cost-effective magnet systems for fusion power," he said.

Additionally, the program helped laboratories and industries develop capabilities for designing and building superconducting magnets. It further demonstrated that development of high technology hardware could be achieved efficiently through international collaboration.

Besides the U.S., West Germany (acting for EURATOM, a European Community consortium), Japan and Switzerland participated in the program, which was organized under the International Energy Agency. ORNL was the lead laboratory, building three of the six magnets under contracts with General Dynamics, General Electric and Westinghouse. EURATOM's coil was built by Siemens, and Brown Boveri Co. built the Swiss coil.

Five of the magnets tested at ORNL have superconducting filaments made of niobium-titanium, while the Westinghouse magnet employs niobium-tin. Liquid helium is used to cool the conducting materials by two different methods. In three of the coils, helium at 15 times atmospheric pressure is forced to flow through channels in the conductors. In the other three, conductors were immersed in a bath of helium that filled the structural shell.

Preliminary analysis of the test results showed that both methods of cooling are practical for large coils. It also showed that manufacturing flaws had limited the performance of the niobium-tin material.

Analysis of the test data and comparative evaluation of the features of the six coils will require several more months. A joint technical report by project participants, comparing performance and reliability of different designs and manufacturing procedures, is expected in the spring of 1988.

November 30, 1987

BECHTEL, EBASCO PICKED TO DEVELOP SMES TEST MODEL CHIEFLY FOR SDI

Two companies have been named prime contractors in a Defense Dept. project to develop a superconducting magnetic energy storage (SMES) test model. Bechtel National Inc. of San Francisco and Ebasco Services Inc. of New York were each awarded two-year contracts valued at $13.8 million and $13.9 million respectively to demonstrate the feasibility of using SMES to power ground-based lasers and other devices being developed as part of the Strategic Defense Initiative.

The initial phase of the project also will evaluate the feasibility of using a full-scale SMES facility for meeting the peaking power demands of electric utilities. The Strategic Defense Initiative Organization, one of the two awarding government agencies, envisions SMES facilities being used for utility load leveling purposes in peacetime, and switched over to fulfill the power needs of a ground-based laser for SDI during national emergency.

Bechtel and Ebasco Services were selected for the initial two-year phase of the SMES project by SDIO and the Defense Nuclear Agency. Contracts call for the two firms to continue their research on SMES technology, develop and test full-size critical components, and prepare conceptual designs and cost estimates. As with other SDI-related contracts, the SMES project uses a "racehorse" approach, whereby one of the two first-phase contractors will be selected to build the actual system under a three-year second phase valued at $50 million to $60 million.

DOE, which operated the only full-scale SMES to date, will provide technical expertise to the

project through its office of energy storage and distribution. Kenneth Klein, director of the office, said the 30-megajoule SMES, which has since been dismantled, operated successfully for about one year in the Bonneville Power Administration grid, smoothing out "transients" — very brief current fluctuations in power transmission lines. Klein also pointed to DOE's expertise in superconducting transmission cable and generator applications as useful to the SDIO effort.

The SMES Engineering Test Model will be a large, cylindrical coil about 100 meters in diameter, placed in a nine-meter-deep trench. Energy is stored in a magnetic field supported by current flowing through the superconducting coil. The stored energy can be retrieved almost instantaneously for SDI, or slowly for utility usage. To demonstrate the ability to power the ground-based lasers envisioned for SDI, the SMES test model will release a burst of 400 megawatts to 1,000 Mw for 100 seconds.

C. Paul Robinson, senior vice president and principal scientist of Ebasco Services, said contractors will work during the initial phase to find solutions to problems he termed "show stoppers." These include fabrication of the facility, its cooling system, finding a bridging mechanism to transfer power into and out of the SMES, and what will happen to the stored energy if the system should warm up and lose its superconducting properties. Ebasco claims to have solved the warm-up question, and will prove it during the contract period.

Robinson said the SMES is envisioned to utilize conventional low-temperature niobium-titanium superconductors. But part of the first phase also will be to evaluate when the new high temperature ceramics could be substituted. Ebasco has estimated use of the new materials could save 5% to 10% of the cost of using the conventional materials, assuming the materials themselves are the same cost. Savings are attributed to the lower cost of the liquid nitrogen refrigeration system, which is suitable for the new ceramic superconductors, but not for conventional materials.

Harold Forsen, senior vice president and manager of r&d at Bechtel, said his firm's six-year corporate support for SMES research represented a commitment "far longer than anyone else in our industry." Robert Loyd, Bechtel's project engineering manager, said the SDIO project will be the first application of superconducting technology for bulk energy storage. "SMES can meet both military and commercial needs for cost effective storage of large quantities of electrical energy," he noted.

Since the coil can be charged and discharged at a fully controlled rate, SMES is a promising method for storing energy for peak load demands on utility systems. The commercial requirement for the SDIO system calls for the facility to feed 10 to 25 MW into a utility grid for two hours.

Because of this promise, utilities are lining up to have the demonstration SMES facility located in their service areas. Nine have proposed more than a dozen sites in five states as locations for the Bechtel-constructed facility, while Ebasco Services has proposed three sites, two of them owned by El Paso Electric, for the location of its system. El Paso services the area around the White Sands (N.M.) Missile Test Range, where the SDI ground-based laser test facilities are located.

Robinson said it's believed the federal government will transfer title to the SMES once the plant is completed. He pointed out that for load leveling purposes, SMES is a much less expensive alternative to the construction of a dedicated power station. Because of the enormous interest expressed by utilities, its likely the government will open the site up to a separate competitive selection process, he noted.

Both prime contractors have lined up impressive lists of subcontractors. Bechtel's majors are General Dynamics, which claims to have built about 70% of DOE's large superconducting magnets; GA Technologies, which built the coil for the DOE-BPA facility and General Electric. Other Bechtel subcontractors include Pitt-Des Moines, CVI, Cryogenic Consultants and Ansaldo. Subcontractors to General Dynamics include the Texas Accelerator Center and Intermagnetics General.

Subcontractors to Ebasco Services are the University of Wisconsin, a major center for superconductivity r&d; Central Wisconsin Development Corp., a wholly owned subsidiary of Madison Gas & Electric, which also proposed one of the sites; Westinghouse; Chicago Bridge & Iron, a high-technology hardware firm; and Teledyne Wah Chang, the world's largest supplier of superconducting materials.

— Dave Kramer

December 7, 1987

ABOUT 60 FIRMS QUIZZED FOR LANL REPORT ON JOINT SUPERCONDUCTOR R&D

Los Alamos National Laboratory has nearly wrapped up its report examining how government and industry can cooperate on high-temperature superconductivity r&d efforts. Expected to be made public after its presentation to DOE officials, the report will distill information gleaned from about 60 companies surveyed by questionnaire and at a series of workshops on the topic recently hosted by the lab.

LANL was assigned by Energy Secretary John Herrington in August to explore private-sector interest in establishing cooperative r&d programs to develop enabling technologies for commercializing the

new superconductors. According to James Williams, deputy director of LANL's office of industrial applications, the companies surveyed by the lab were "very interested in following the sciences that emerge from the laboratories and universities and feel strongly that having early access to the research is going to be a key to their success in exploiting this technology."

Major concerns raised by the firms, he said, include the timeliness of gaining access to the research results, the assignment of intellectual property rights, and the lack of federal funding to stimulate start-up ventures for small businesses.

Williams said that many inventors, lacking the capital to commercialize their inventions, will require federal grants to accomplish the task. Without such grants, the inventor must turn to venture capitalists, who wind up owning most of the company that is established and thereby rob the inventor of his incentive.

Moreover, he said, with the value of the dollar so low, foreigners now view many venture capital companies as attractive investments. This often results in newly commercialized technologies quickly falling into the hands of overseas competitors.

About 25 companies attended the three LANL workshops. They included officials of National Semiconductor Corp., Corning Glass Works and Cryo Power Inc., of Los Alamos, N.M. DOE research facilities represented at the workshops were LANL, Sandia National Laboratories, Argonne National Laboratory and Idaho National Engineering Laboratory.

"This is a window of opportunity for both industry and the DOE laboratories," said John Whetten, LANL associate director for energy and research applications. "We hope to establish strong partnerships between industry and the labs so that both will benefit, and the country will be more economically competitive." — *David Kramer*

December 7, 1987

U.S. TRADE OFFICIALS WILL DISCUSS SUPERCONDUCTIVITY DEC. 9 with their European Community counterparts at a meeting in Brussels. Louis Ianniello, DOE deputy associate director for basic energy sciences, and Frank Fradin, associate director of Argonne National Laboratory, will join a delegation headed by James Murphy, assistant U.S. trade representative for Europe and the Mediterranean, for what are described as informal consultations on the technology with the European Community. The U.S. delegation also will include an official of the National Bureau of Standards.

Technology consultations are held with the EC on a semiannual basis, a USTR official explained, and focus on a different area of science each time. The exchange of information is designed to identify and defuse any potential areas where trade conflicts might arise in the future. The session is not expected to lead to a proposal for cooperative r&d activity, both sides acknowledge, since the EC does not yet have its own organized program for superconductivity. However, the consultations do provide the forum for such international cooperative proposals to be raised and considered.

December 7, 1987

FUNDING UNCERTAINTY THREATENS SUPERCONDUCTOR R&D PLANS AT DARPA

The Defense Advanced Projects Agency is still hopeful that a resolution of the federal budget situation will come in time for the agency to award some r&d contracts for high-temperature superconductivity. As it stood last week, separate congressional bills have earmarked $10.5 million and $20 million for DARPA's program, amounts far below the $50 million the agency had once hoped to get.

Kay Rhyne, DARPA's superconductivity program director, warned that if funds are not appropriated by the end of the year, major revisions might have to be made to the proposals it received from industry and universities, further delaying an award process that was supposed to be completed in early November. Many proposals, she explained, have "finite limits on their validity," meaning they may require new cost figures and other changes.

The Defense Authorization Act for FY-88 and FY-89 allocated $10.5 million in each year for DARPA's superconductivity program and for r&d supporting the electric drive program of the Defense Dept. Those funds are included in the $60.5 million authorized in each year for all Pentagon high-temperature superconductivity efforts. Both Houses have now passed the authorization bill.

However, the House Appropriations Committee provided $20 million for DARPA's high-temperature superconductivity program, calling it "imperative that the U.S. sustain its scientific and engineering advances in the field." The Senate Defense Appropriations subcommittee last week approved its version of the bill, and the full committee was scheduled to act on the measure Thursday. Word on the funding

level contained for DARPA's program was not available by press time.

Over the next few weeks, the two appropriation bills are expected to be reconciled as part of a long-term continuing resolution. House and Senate leaders hope to have that measure completed by the time the current short-term continuing resolution expires Dec. 16.

Rhyne said that the degree of uncertainty over the funding levels makes it impossible for DARPA to make any awards at this point. There are a number of different scenarios for cutting the scope of the original program, she noted, including the possibility the agency will restrict its support for r&d projects either to thin-film or to bulk applications for superconductivity. DARPA's original intent was to pursue both types of applications.

As recently as October, DARPA was expecting to get $20 million to $35 million for the superconductivity program. In Congressional testimony at that time, DARPA deputy director Craig Fields said the agency would require $65 million annually to fund the industry proposals it considered to be "top notch (*IE/FL*, 12 Oct, 8). — *David Kramer*

December 7, 1987

LOS ALAMOS: NEW CONDUCTORS MIGHT LEAD TO IMPROVED ACCELERATORS

Researchers at Los Alamos National Laboratory believe new high-temperature superconductors might lead to a new generation of more efficient and compact accelerators. Experiments are being conducted at the lab to determine how the materials might behave if used to build or coat the radio frequency cavities now found in most every particle accelerator.

Radio frequency cavities are basketball-sized particle boosting devices in which electrical forces kick subatomic particles up to useful energy levels. Most existing accelerators use radio frequency cavities made of copper. But cavities made of superconducting materials could sharply cut the accelerator's operating cost, because none of the input energy would be wasted.

"Our measurements will help pinpoint the defense, research and commercial potential of these highly publicized superconductors," said George Lawrence, of the lab's accelerator technology division. In addition to impacting high energy physics research, the work has important implications for two Strategic Defense Initiative programs: the neutral particle beam and the free electron laser.

In a parallel effort, Los Alamos scientists are developing two techniques, both utilizing radio frequency waves, to measure the efficiency of new high-temperature superconducting materials. Previous measurement techniques rely on electrical contacts for data gathering.

Eddy-current measurement is first used to perform a quick analysis of a superconductor's general performance. Using this process, researchers screen materials to decide which are candidates for more detailed analysis. That task is performed using a niobium superconducting cavity. Niobium, a so-called conventional superconductor, achieves superconductivity near absolute zero.

According to James Doss, an electrical engineer in the lab's medium energy physics division, the eddy current technique measures superconductor properties continuously from room temperature to near absolute zero (about 452 below zero F) and back to room temperature. The niobium cavity currently measures only at room temperature and at absolute zero, but will be modified to take continuous measurements.

"Radio frequency electromagnetic fields are useful in measuring superconductors because they provide information on electrical resistance without touching or affecting superconductors," Doss said.

December 7, 1987

SUPERCONDUCTIVITY RESEARCH AT DOE LABORATORIES IS FOCUSING now on two areas: the properties of the microstructure around the grain structure of the new high-temperature ceramic superconductors and possible methods for aligning the crystals within those ceramics. Louis Ianniello, associate director of DOE's basic energy sciences, said the new ceramic crystals are "anisotropic," meaning they are much better superconductors in one direction than in the other. Multiple crystals therefore need to be lined up the same way in order for their properties to be maximized.

Ianniello told *Inside Energy/with Federal Lands* that DOE's national laboratories and some of the major private-sector firms, such as Bell Laboratories, are now concentrating their superconductivity r&d efforts in these areas. The researchers are hoping to dramatically increase the current carrying capability of the new ceramics for bulk applications, such as magnets, wires and motors.

Current density is not as great a problem with thin-film superconductors used for electronics applications, since many of these applications can be accomplished with single crystals. The crystals still

must be oriented the right way, however, and there are certain thin-film applications for which single crystals cannot be used, he added.

Meanwhile, universities active in superconductivity research generally are focusing their efforts on developing a theory for why the materials work. Despite the discovery that the materials are superconducting, there is still no general agreement on the mechanism, he noted.

While there are continuing announcements of new high-temperature materials, researchers are working primarily with the yttrium-barium-copper oxide material, which superconducts at up to 95 degrees K. While other rare earth elements can be substituted for the yttrium, researchers feel that if they can work out the problems encountered with the yttrium material, the other compounds will follow closely behind, Ianniello explained.

Uncertainty continues to surround federal r&d activities in the area, since the agencies still do not know how much money they will have to work with this fiscal year. Coordinated under COMAT, the interagency Committee on Materials, the agencies will meet again in January to discuss progress. Ianniello, who chairs the COMAT subcommittee on superconductivity, said an updated report on what each government office is doing will be available at that time.

DOE itself will hold its fifth coordinating meeting on superconductivity on January 25 and 26 at Sandia National Laboratories. The session is designed to bring together the national laboratories, DOE personnel, private-sector and university researchers who are active in the field. About 180 persons attended the last such session at Argonne National Laboratory in September.

December 7, 1987

NAMED EXECUTIVE DIRECTOR OF THE COUNCIL ON SUPERCONDUCTIVITY for American Competitiveness was Kevin Ott, formerly assistant vice president of the resources and technology department at the National Assn. of Manufacturers.

CSAC is a Washington-based trade group established to promote superconductivity. It is chaired by George Keyworth, a former White House science adviser.

Ott joined NAM in 1981 as a program analyst in the resources and technology department, and also served as NAM's director of natural resources. He previously held positions at Honeywell Inc. and Brown & Root Inc.

December 14, 1987

MARKET FOR NEW SUPERCONDUCTORS IN CONSERVATION EYED BY DOE, EPRI

DOE and the Electric Power Research Institute have launched a joint $1-million effort to assess the market potential for energy conservation applications of high-temperature superconductors. The study, due to be completed by the end of next June, will involve the efforts of several of DOE's national laboratories as well as the Battelle Memorial Institute. Oak Ridge National Laboratory will act as the lead laboratory on the project.

According to Anthony Schaffhauser, manager of conservation technology programs in the metals and ceramics division at ORNL, the project officially got under way Dec. 1. The first meeting of a university-industry advisory committee is slated for Dec. 17-18 in Washington, and a summary of the report is expected by the end of March.

Funding for the study is being shared about equally by DOE and EPRI, with all but $75,000 of DOE's share coming from its Energy Conservation and Utilization Technologies Office. The Office of Fossil Energy is contributing the remainder because of the potential for high-temperature superconductors in magnetic separation of impurities, such as sulfur, from coal.

It will examine the properties needed to enable the new superconducting materials to be used in a variety of applications, ranging from magnetically levitated trains to magnetic materials separation. Other applications to be examined include small electric motors, power electronics, transportation, electromagnetic pumping, and magnetic materials processing and fabrication (*IE/FL*, 12 Oct, 1).

ORNL will be responsible for work on materials fabrication and separation, electric motors and power electronics. Argonne National Laboratory is to work on transportation, electromagnetic pumping and electromagnetic heat pumps. Idaho National Engineering Laboratory is responsible for materials production, while Lawrence Berkeley Laboratory is in charge of lighting applications and innovative concepts.

ORNL and Argonne are jointly responsible for development of technical and economic ground rules. Schaffhauser explained that common standards need to be adopted to enable the researchers to speak to

each other in the same language. Battelle Columbus is to work with INEL on materials production and with ORNL on materials fabrication. Sandia National Laboratories will work with ORNL on power electronics.

December 21, 1987

THE U.S. ISN'T WITHHOLDING INFORMATION ON NEW SUPERCONDUCTORS, trade and science officials recently reassured their European Community counterparts. At a Dec. 9 meeting in Brussels, a U.S. delegation headed by Assistant Trade Representative James Murphy and comprised of DOE and national laboratory officials addressed EC fears that the community is somehow being excluded from the free flow of scientific information relating to the new high-temperature superconductor technology.

According to Louis Ianiello, DOE's deputy associate director for basic energy sciences, who was a member of the delegation, the two sides agreed that a more formal exchange of technical information would be "useful." Specifically, the information exchange should include government activities in superconductivity and the development of standardized data. But Ianiello said a formal mechanism for that exchange was not established at the one-day session.

The superconductivity discussion was held during the semi-annual meeting of the High Technology Committee of the U.S.-EC Group. The next session of the group is expected to be held in Washington next June.

Ianiello said the Europeans, who requested that superconductivity be included on the agenda of the Dec. 9 meeting, may have misinterpreted foreigners' exclusion from last July's federal conference on superconductivity as being an indication that U.S. research results on the subject would be kept from European scientists. But the U.S. officials pointed out that the federal conference was not meant to be a technical session but rather a sort of "pep rally" for U.S. industry.

Joining Ianiello and Murphy in the U.S. delegation were Frank Fradin, associate director of Argonne National Laboratory, and an official from the National Bureau of Standards.

SUPERCONDUCTING SUPER COLLIDER

January 12, 1987

DOE BOOSTS GENERAL SCIENCE 13% IN FY-88 REQUEST; SSC'S FATE PENDING

The fate of the Superconducting Super Collider still hangs in limbo, pending a decision by the White House later this month on whether to add $60 million to DOE's FY-88 budget request for start of SSC construction. Otherwise, civilian basic-science programs funded by DOE came off far better than most in the administration's summary budget document sent to the Hill last week.

DOE Under Secretary Joseph Salgado announced at a Monday press conference that the department is requesting a 13% increase for basic research in high energy and nuclear physics, and substantial increases for two biological and environmental research projects — an additional $11.6 million for genome mapping and another $10 million for radon research.

SSC, a $4-billion particle accelerator, comes under high energy physics, but the 13%-plus increase in that category includes no funds for the huge collider. The department is asking for about $66.9 million more than the FY-87 appropriation of $499.7 million chiefly to make use of newly upgraded facilities at Stanford Linear Accelerator Center (home of the linear collider) and the Fermi National Accelerator Laboratory (home of Tevatron I and II). The money would go to facility operations, expanded physics research and additional capital equipment, says a DOE budget officer.

In fact, Salgado made no mention of SSC in his formal presentation. When questioned about it, he said the matter of construction funding "is currently under active discussion within the administration" and that "funds are available or will be made available" if DOE gets approval for an FY-88 construction start. Pressed for details, he said only that he was talking about "a modest amount of dollars necessary to go forward with SSC . . . $60 million, more or less."

A budget officer at the press conference told *Inside Energy/with Federal Lands* that the $60 million does not exist in the DOE request package now. "We would have to amend the budget to include it," he said.

The Domestic Policy Council took up the SSC question in late December (*IE/FL*, 22 Dec, 3) but word from outside the department is that the council has suspended judgment and suggested that DOE takes its appeal to the top, presumably to the president or one of his top advisers.

One congressional committee source who follows SSC noted Reagan might be hard to reach, given his surgery last week and the need to recuperate, but the source said, "If they [DOE management] could get to the old man, he might buy it." He suggested Vice President Bush is another possible avenue, since members of the Texas congressional delegation "have an in" with him and have shown considerable interest in the project. But he added he wasn't aware of any current stirrings by the Texans on this front.

A spokesman for DOE's energy research office said he couldn't say when or if the White House decision on SSC would be publicly announced, and implied a no-go outcome might emerge simply by default.

Most of the $28.1-million increase in the nuclear physics budget would go toward continued construction of the Continuous Electron Beam Accelerator Facility — that line items jumps from $16.2 million (FY-87 appropriation) to $33.5 million (FY-88 request) and the construction line item moves up from $24.1 million to $41.5 million. Other items show only slight increases, chiefly reflecting inflation.

The magnetic fusion budget is essentially flat, but Salgado announced that the total ($345.6 million) includes funds for the two top priorities of program management — construction of the Compact Ignition Tokamak and international collaboration on design of a world engineering test reactor (ETR). He said the budget request specifies $8 million to get started on CIT construction, which will cost about $300 million in all. The amount earmarked for international collaboration is up from $4.3 million to about $16 million.

A senior aide on the House Science and Technology Committee staff found the fusion-budget news "mixed," calling the CIT funding "gratifying" and the international funding an item "we have to look at . . . carefully." Rep. Marilyn Lloyd, D-Tenn, who chairs the subcommittee on energy research and production, has expressed concern, he said, about "the illusion" that an international effort means shared r&d costs and thus lowered costs for the U.S., when it's not yet clear that's the case nor that the institutional difficulties of collaboration can be worked out. "She would worry about people being deluded," he said.

The same source thinks it unlikely Congress will endorse the "hefty" increases for high energy and

nuclear physics. "They really stand out" amongst the reductions, he said, and will probably get "whittled by both the authorizing and appropriations committees." — *Amelia Manning*

January 26, 1987

PRESIDENT REAGAN'S POSITION ON SSC, WIDELY EXPECTED TO BE at least mentioned in his State of the Union address to Congress tommorrow night (Jan. 27), appeared likely to come too late for inclusion in the speech, administration sources said last week. A presidential decision on the $4-billion Superconducting Super Collider had not been made as of Wednesday, which left precious little time for his aides to process it even if he got to the issue later in the week, one informed source said.

The same source pointed out that the president's recent surgery, coupled with the Iran arms sales investigations, had put the administration about five weeks behind schedule, and that other more urgent matters could easily pre-empt Reagan's attention in the few days remaining before public presentation of his agenda.

The question of whether to propose construction funding for SSC has been before the Domestic Policy Council since mid-December (*IE/FL*, 22 Dec, 3), and the council reportedly has sent to the president a confidential memorandum listing arguments for and against the project and presenting options, among them deferring the decision.

One of the sources expressed certainty a decision will come soon, but "not necessarily by Tuesday [tomorrow]," and gave the project about a 50-50 chance of winning Reagan's endorsement when he reviewed the pros and cons. Although budget pressures argue strongly against it, Reagan is such a booster of basic research he may — if he's won by the pro-SSC arguments — "feel compelled" to seek a start on its construction before he leaves office, the source said, noting, "the next president might not be so turned on by science."

This source characterized the president as inclined to evaluate each major scientific initiative on its own merits, rather than to weigh one against another, and not likely to reject SSC because of other expensive science projects he's promoting — for example, a space station for NASA.

Observers at DOE and in Congress believe the president may attempt to sell SSC in the context of U.S. competitiveness, a key slogan for various programs this year. But one savant at the Office of Management and Budget sees the connection as too tenuous to make for a strong argument. While acknowledging that investments in science deliver high yields to business and technology eventually, the budget specialist commented "that's accidental and not what you're doing it for."

The OMB source said that if Reagan decides to propose SSC construction funding for FY-88, OMB would generate "a technical adjustment," or amendment, to the DOE budget to include the requested funds. Such a document customarily goes to Congress within 24 to 26 days after the detailed budget is delivered.

Officials said there would be no "pre-announcement" of a Reagan decision on SSC before he addresses Congress tomorrow.

February 2, 1987

HERRINGTON SELLS REAGAN ON $4.4-BILLION SSC

DOE announced late Friday that President Reagan has approved plans to begin construction of a $4.4-billion Superconducting Super Collider, a huge particle accelerator that high-energy physicists say is essential if the U.S. is to maintain its edge in scientific research.

The agency's announcement came a day after Energy Secretary John Herrington presented the agency's case for the SSC project to President Reagan. Department officials touted the president's approval as a victory for Herrington, who has lobbied hard on behalf of the project.

White House approval of the project must be followed by a determination of where the facility — an underground tunnel 52 miles in circumference — will be located. The issue will almost certainly attract strong debate in Congress among a number of state delegations vying for the project.

At an afternoon press conference Friday, Herrington said that there is no "front runner" as a base for the SSC and added that he has asked Under Secretary Joseph Salgado to develop a site selection process. Details on the process will be announced by Salgado Feb. 10.

The project is expected to prove attractive to a number of states because it promises to provide 8,000 construction jobs and openings for as many as 2,500 scientists, who would operated the 40-TeV collider once it is completed.

While DOE sources stressed that no one state is under consideration now, among those lobbying

hard for it are California, Illinois and Texas. All told, more than 20 states are likely to compete for the project.

Herrington said Friday that the department estimates it will need $60 million for initial project funding in FY-88. An SSC Conceptual Design Report completed last year set the "optimized" figures for a construction start in the next fiscal year at a level of $130 million in obligations and $75 million in cost. DOE's specific budget request may come as early as Feb. 10.

Herrington said the department will attempt to obtain "maximum cost sharing" for the project from other countries, private industry and state and local governments.

The project is expected to cost $4.4 billion in 1988 dollars and may require as much as $6 billion over the life of the construction period when future inflation is taken into account. A DOE spokesman said Friday that the collider could be ready for research in 1996 if Congress approves funding levels recommended by the administration.

Construction of an SSC has been recommended to the administration by several scientific advisory groups, among them the Energy Research Advisory Board, the High Energy Physics Advisory Panel and the National Academy of Sciences.

February 9, 1987

DOE MUST FUND SSC OUT OF PRESENT BUDGET

FY-88 funds for the proposed Superconducting Super Collider will come out of DOE's present budget request of $566.5 million for high energy physics (HEP), DOE Energy Research Director Alvin Trivelpiece told the Senate Budget Committee at a hearing last Wednesday. He declined to explain how that will work, noting that DOE planned to "make known all the details" at a press conference to be held by Energy Secretary John Herrington tomorrow (Feb. 10).

Office of Management and Budget spokesman Edwin Dale also said last week that OMB would be requesting no additional funds for SSC, only a budget amendment to make it a line item and to show the HEP fund transfers that must be made to accommodate the project now that President Reagan has approved it (*IE/FL*, 2 Feb, 1).

There was a suggestion from some sources that the allotment for SSC in FY-88 will fall below the $60 million mentioned by DOE Under Secretary Joseph Salgado last month. Salagado gave that figure as the amount, "more or less," that "will be made available" for a construction start, and DOE budget officers explained then that he meant it would be added on. The $60 million was already $15 million under the planner's estimate of FY-88 construction costs. But even if the figure goes lower, the department is still talking about a start-up — construction "preliminaries," as one source put it — not simply continued r&d.

Trivelpiece said Herrington's announcements on SSC would include budget estimates for FY-89 and beyond, and an outline of the site selection process. "We are not quite ready to go public with that," Trivelpiece said at the hearing, but he assured the panel that DOE's goal was "a level playing field" for all the competing states.

Asked by Sen. Pete Domenici, R-N.M., ranking minority member, whether the amount of money a state could contribute to the project would be influential in DOE's decision, Trivelpiece replied, "It would be impossible for it not to be," since "DOE plans to use the maximum possible cost-sharing" by state and local governments, as well as other countries, to help cover the estimated $4.5 billion (in 1988 dollars) needed for SSC construction. But Trivelpiece nodded when Domenici observed, "I don't think it would be a good idea to get into a few-million-dollars bidding war" by the states over a project that will cost in the billions.

In describing the selection process, what Herrington may not say tomorrow is that the administration hopes to nail down the SSC site by August 1988, not only because the state chosen could be a big help in the presidential election that year but because a failure to pick the site by then might put the project in jeopardy.

An August '88 deadline for site selection doesn't leave room for many hitches and delays in the probable timetable. Unless DOE has revised its initial plan, the process would go as follows:

— A call for site proposals, with simultaneous establishment of a Blue Ribbon panel to evaluate them, within three or four months (say by June '87).

— At least a six-month period for submission of proposals by all the interested states (say January '88).

— Three to four months of site consideration before the panel issues a short list of acceptable sites

(June '88), at which point maybe three to six states would remain in the running.

— A review of the candidate sites by DOE officials, which would take another month or more (July '88).

— And finally, selection of the host state, at a point when the presidential campaign will be moving into the home stretch.

Those who note the timing do not suggest politics is the primary motivation for Reagan's decision on SSC or DOE's likely schedule — they just cite it as a factor that can't be ignored.

Whether Congress will approve the president's SSC proposal is very uncertain given widespread reservations on the Hill about the project's price tag. Staff members of some key committees don't see how it could possibly fly. But if last week's Senate budget hearing was any kind of bellwether, SSC proponents can take heart. The subject was the relationship of science and technology to U.S. economic competitiveness, and not a Democrat nor a Republican on the panel challenged the administration's request for increased science funding in general — or SSC, specifically — as unrealistic in the present budget climate.

Dr. Edward Knapp, president of Universities Research Assn. (the DOE contractor that administers SSC design work), attended the hearing and said afterward he was struck by the lack of "budget-busting talk." Other observers also commented on the panel's positive treatment of the witnesses — National Science Foundation Director Erich Bloch and AT&T Bell Laboratories President Ian Ross, as well as Trivelpiece, all of whom asserted that the link between research funding and industrial performance is critical. Trivelpiece illustrated the connection with this off-the-cuff statistic: a full third of the present U.S. gross national product derives from the discovery of the electron 90 years ago.

On the House side, a Science and Technology committee aide said last week it was too early to assess the impact of Reagan's decision on committee thinking. But he noted that the number of "very big states" interested in winning the site selection contest constitutes a substantial bloc in SSC's favor.

Although this kind of budget issue is usually decided by committee forces, not a floor vote, state delegations can exert considerable influence on the authorizing and appropriations process when their members are united. A spokesman for Rep. Harris Fawell, R-Ill., a strong supporter of SSC who sits on the House Science and Technology Committee, said the congressman has been talking up the project in the Illinois delegation. "I don't know of anyone [in that delegation] who's against it," the aide said, adding that the members consider Illinois "one of the front runners" for the project.

Another front-runner is Texas, and Rep. Joe Barton, a Democrat from that state who used to sit on Science and Tech but has moved to the Energy and Commerce Committee, said last week that not merely the state delegation but every sector of the state — public, private and academic — is united in an effort to win the project. Barton said he believes the state can come up with the "most competitive" proposal in terms of "land and resources offered." That offer, he elaborated, will be "I won't say irresistible, but we'll be able to make it, in the words of 'the Godfather,' very difficult to refuse." The Science and Tech committee now has two members from Texas — Lamar Smith, a Democrat, and Jim Chapman, a Republican.

Also mentioned as leading contenders are California, New York and Ohio, although the latter two haven't yet martialed resources to the extent the other three have.

Word of Reagan's Jan. 30 decision to propose SSC construction traveled fast not only across the country but across the world. Press accounts appeared in Japan, one of the countries the administration hopes may contribute to the U.S. project.

A Japanese Embassy spokesman said last week that the discussions of Japanese participation in SSC so far have occurred among researchers, not at the government level. He added that a national committee of scientists formed to study the future of Japan's accelerator program is now contemplating what the country's next step should be as Japan completes its latest big HEP project, TRISTAN (transposable ring intersecting storage accelerator in Nippon).

The SSC Central Design Group in California got the news from DOE's HEP management by telephone, shortly before Herrington's press conference Jan. 30. According to one member of the group, "We finished out the work day, then had a little celebration," but he said CDG's jubilation was tempered by the knowledge that Reagan's backing "is a necessary but not sufficient condition. . . . a step along the way."

There is much r&d work still to be done over the next two years, especially on the superconducting magnets that will go within the 52-mile accelerator ring to guide the speeding particles. Since SSC calls for 10,000 magnets, "we have to be absolutely sure they will work the way they're supposed to," the CDG source said. Even without a site, project participants can proceed with refinement of various component designs and with procurement of such items as a prototype refrigerator to test the big cryogenics

system, he said.

A URA spokesman in Washington confessed surprise at the amount of media attention given the SSC decision. The prominent play in major dailies, on radio and elsewhere had been "mostly upbeat," he observed, which could have a positive effect on Congress.

Energy research officials at DOE acknowledged last week that the need to draw SSC's FY-88 funding from the present budget presents, as one said, "a serious problem." This source recalled that "Congress really balled us out [in the past] for inadequate use of DOE facilities," which is just what the shortage of funds will dictate "for another year."

Another source within HEP predicted a "sharing of pain" by all the HEP programs and said each will be "less vigorous" as a result. But program management accepts the pain as a small price to pay for the SSC go-ahead, he added, because "that's where the future is." —*Amelia Manning*

February 16, 1987

1988 TARGET SET FOR SSC SITE SELECTION; INVITATIONS DUE OUT IN APRIL

DOE will select by July 1988 a site for a $4.4-billion Superconducting Super Collider, the huge particle accelerator proposed by the Reagan administration on Jan. 30, Energy Secretary John Herrington said last week. The agency's announcement of its site selection process marks the official start of what is certain to be an intense competition among more than 30 states hoping to land the project.

Under the site selection process, an invitation for proposals will be issued by this coming April. This invitation will contain a description of criteria considered essential to operating SSC.

Among the requirements to which DOE will assign high value are proximity to universities and research centers, up to 250 Mw of electricity necessary to power the accelerator's magnets, a water supply capable of providing up between 2,000 and 3,000 gallons per minute and as many as 13,000 acres of land needed to contain the project, an oval-shaped tunnel 52 miles in circumference.

In a meeting with reporters Tuesday, Herrington also said DOE would seek $35 million for SSC work in FY-88, while increasing the amount it will spend this fiscal year from $16 million to $20 million. The agency's decision to request only $35 million for project funding in the next fiscal year — $25 million for r&d work and $10 million for construction — is considerably less than the $60 million estimate provided by DOE officials late last month, but it appears to address concerns raised by some scientists who have argued that the project could result in reduced funding for other research programs.

In a hearing Wednesday before the House Budget Committee, Rep. Robert Roe, D-N.J., chairman of the House Science, Space and Technology Committee, said his committee will recommend adding $15 million to FY-88 spending for high energy physics "to complement the r&d funding already contained in the budget request."

DOE will ask Congress to establish a separate line item in the budget for SSC, ensuring that funding for the project would not be considered part of the agency's budget for high energy physics after FY-88, Herrington said. The additional funds needed for the project in FY-87 and FY-88 will come from "reprogramming" the high-energy physics budget.

According to DOE estimates, project funding will jump to $348 million in FY-89, reach $675 million in FY-91, and continue to increase through the 1994 fiscal year when the agency projects it will need $709 million for construction and r&d costs. DOE hopes to have the accelerator completed by 1996.

Herrington said last week the department is hoping to attract financial support from a number of countries and that as much as 25% to 50% of the required funds could come from abroad. He quickly added, however, such estimates are speculative and said the administration's decision to proceed with the project does not depend on foreign participation.

The secretary said that the department expects interested states to provide free land for the project. He did not, however, rule out any plan that would base SSC on land already owned by the federal government.

DOE is asking that interested states submit their proposals by August 1987. The proposals would be received by a special "DOE SSC Site Task Force", and would enter what the agency describes as a "confidential site qualification process."

All qualifying proposals would be turned over in September to a Select Panel of the National Academy of Sciences and the National Academy of Engineering. This panel, which DOE says will be made up of 15 individuals appointed by the presidents of NAS and NAE will review the proposals based on the department's site evaluation criteria. Herrington said that the panel will not be asked to rank the

proposals.

By December of this year, the panel will recommend to DOE what it considers to be the best proposals. A detailed DOE staff analysis will follow the panel's recommendations and the secretary will announce the preferred site in July 1988.

After naming the preferred site, the department will conduct an environmental impact statement that will assess the probable effects of constructing and operating SSC at the chosen location. Following the completion of the EIS, the department will announce the final site in January 1989.

DOE Energy Research Director Alvin Trivelpiece said Tuesday that the department believes the preferred site named in July 1988 will be the final site, if no difficulties develop in the EIS process.

No one state has an advantage in the process, Herrington said, promising that the selection will be "fair and above-board."

In testimony last week before two House subcommittees and in remarks Tuesday, Herrington rejected any attempts to link the siting of SSC to the nuclear waste repository. Several House and Senate members have recently suggested that any state willing to play host to a waste repository should be rewarded with SSC.

"I just don't think it's good policy to link the two projects and it could hurt the integrity of both," Herrington said. He added that such a proposal would be difficult since the president is not expected to decide upon a final site for a waste repository until well after SSC construction is underway.

In a hearing Wednesday before the House Energy subcommittee on energy and power, Chairman Philip Sharp, D-Ind., told Herrington a number of states have expressed concern that the August deadline for submitting proposals may provide an unfair advantage to those states that are already far along in their efforts to woo the project.

"My basic feeling is that we will keep the process open, but most of those [states] interested in it [SSC] have known about it for three years and have already done work," Herrington said.

March 30, 1987

HOUSE AND SENATE PANELS WILL HEAR THE PROS AND CONS OF SSC next week. The House Science, Space and Technology Committee has scheduled three days of hearings, April 7-9, on DOE's proposed Superconducting Super Collider, to replace a hearing the panel's subcommittee on energy research and production had planned to hold last Tuesday.

The subcommittee decided on postponement when it was unable to schedule additional hearings in the same week to explore fully all the issues surrounding construction of the $4.5-billion particle accelerator. The subject was passed up to the full committee, which is chaired by Robert Roe, D-N.J., and the witness list expanded to embrace as many viewpoints as possible, including those of accelerator experts from abroad and representatives of pertinent U.S. technologies. A committee source said officials from a number of states competing for the project have asked to present testimony, too.

A separate SSC hearing is planned the Senate Appropriations subcommittee on energy and water development, chaired by J. Bennett Johnston, D-La., on April 7.

Energy Research Director Alvin Trivelpiece will be DOE's primary witness at the hearings and will be making his final case for the project, since he is scheduled to leave the department shortly thereafter for the American Assn. for the Advancement of Science.

April 6, 1987

DOE INVITES SSC SITE PROPOSALS, SCHEDULES Q&A SESSION FOR APRIL 29

DOE, in opening the siting process for the $4.5-billion Superconducting Super Collider last Wednesday, signaled its intent to keep the contest fair by scheduling a "preproposal conference" for April 29. This will allow all potential competitors to submit questions about the Invitation for Site Proposals, and guarantees that all answers will arrive at the same time.

Those questions have to be submitted to DOE in writing by April 24.

The "bidders' conference," as one DOE spokesman called it, will be an open meeting in the Departmental Auditorium of the General Services Administration building at 14th Street and Constitution Avenue, N.W., beginning at 8:30 a.m. that Wednesday. The auditorium has 1,325 seats — which may be barely enough given the number of localities seeking selection. Texas alone had nine at last count, and DOE won't even guess how many states plan to make proposals. All 50 have expressed some interest, though probably no more than half of them will actually compete.

The invitation specifies that proposals may come from a state, group of states, a county, a group of

counties, and a corporation or other private landowner. The same entity may submit proposals for more than one site, but each site must be proposed separately. All sites must be within the U.S.

Included with the invitation are procedures for selection, qualification criteria, technical evaluation criteria, and cost considerations. This is the first official DOE document on site criteria, although the SSC Central Design Group in California published a tome on "site perameters" some time ago. DOE makes it plain the land for the project must be provided at no cost to the federal government. And the invitation restates the selection schedule (*IE/FL*, 16 Feb, 6a). The deadline for proposals is Aug. 3.

Senators, representatives, governors and/or lietenant governors from at least 16 states are scheduled to appear before the House Science, Space and Technology Committee Wednesday and Thursday to promote the project, which would bring with it an annual federal budget of $270 million and employ about 2,500 people after construction.

April 13, 1987

TROUBLE OVER SSC'S BID DEADLINE SURFACES

Trouble appears to be brewing over DOE's site-selection schedule for the Superconducting Super Collider.

The schedule sets a deadline of Aug. 3 for submission of site proposals, allowing four months from the day (April 1) the department issued its invitation for bids. Some states began appropriating funds and preparing their plans nearly two years ago, after publication of the SSC Central Design Group's site parameters, but others waited till SSC construction was actually proposed by the administration earlier this year. States in the latter group are complaining that four months is unrealistic and gives an unfair advantage to the early starters.

According to testimony by Energy Research Director Alvin Trivelpiece before the House Science, Space and Technology Committee last week, there's pressure on DOE from both sides, with states that oppose a later deadline also writing or calling in. "To whom should we listen?" Trivelpiece asked during a barrage of questions from Rep. Tim Valentine, D-N.C.

North Carolina had expected DOE "to allow a year or two for site proposals," said Valentine, and state leaders had considered it "not fit that we should commit resources" to the project before it was approved by President Reagan. Now, with some states "well along in their plans," DOE must address "the perception abroad in the land of unfairness," the congressman said.

Valentine asked "what possible objection" DOE or competing states could have to an extension, and was joined in his interrogation by several other committee members, including Democrat Jim Chapman of Texas, whose state is among the best prepared. Chapman said "90 to 120 days [for preparing a site proposal] is ridiculous if you're starting from scratch." Rep. Tom McMillen, D-Md., suggested resistance to changing the schedule might arise from political considerations. "Are we moving it [site selection] into a new administration" by proposing an extension? he asked.

Trivelpiece replied that under the present schedule, selection of the preferred site "for all practical purposes" would occur in July 1988, well before the change of administration, and he defended the schedule by saying a longer time for bid preparation would have imposed additional and "unwarranted costs" on the states.

Told that the Illinois governor had recently asked that state's legislature for an additional $15 million to go toward its SSC bid, Trivelpiece observed the amount was "more than is needed . . . quite a bit per page" and said "fancy proposals are not expected." (An Illinois source said the state had already committed $4.5 million to its SSC effort, that the new appropriation would be for the next fiscal year, beginning in July, and that not all the $15.1 million requested was intended for bid preparation.)

Trivelpiece noted that the "procurement" process being used for site selection leaves room for "amendments" and that states unhappy with the schedule could direct their concerns to DOE's Site Selection Task Force in time for the April 29 bidders' conference, when all proponents will have an equal opportunity to raise objections (*IE/FL*, 6 April, 3).

Earlier in his testimony, Trivelpiece told the committee SSC "may be the best analyzed physics project ever brought forth by an administration to the Congress." Reagan's decision to present it, he said, "contained an understanding" that SSC would have the maximum amount of cost-sharing by the host state and other countries. He said the private sector is "not likely to make a cost contribution until the site is selected."

Trivelpiece's comment that DOE would "be amenable" to foreign offers of SSC components, such as magnets, in lieu of funds, worried some U.S. leaders in accelerator technology who testified

before the committee Wednesday. One of them — Carl Rosner, chairman and president of Intermagnetics General Corp. — warned that equipment contributions could be motivated by a desire to invade the U.S. economy and could be devastating to American companies. He noted that U.S. firms have not been allowed to provide magnets for the European accelerator projects and said foreign "freebies" should be allowed only if "accompanied by large cash contributions and a reciprocal arrangement" for U.S. firms in projects abroad.

The committee's three days of SSC hearings, Tuesday through Thursday, played to a background of science-funding slashes in the House Budget Committee. The budget activity, which moved to the floor Wednesday, intermittently called members away for votes and left committee Chairman Robert Roe agonizing out loud about the difficulties of promoting such a costly new initiative.

"I don't want people saying we're going to set up false hope [if we authorize SSC]," Roe told Trivelpiece. But he and ranking minority member Manuel Lujan, R-N.M., expressed support for the project, and all but two other members — Democrat Buddy MacKay of Florida and Republican Don Ritter of Pennsyvania — seemed disposed to back it.

Ritter's theme was that the latest breakthroughs in superconducting materials argue for a delay in SSC. He said the U.S. should wait until the new materials can be adapted to the collider's magnet system, and that the $4.5 billion would be much better spent on development of superconductivity technology and applications, to boost U.S. competitiveness now. "You can bet the Japanese are going to do it," he said.

Ritter was undeterred by assertions from a number of expert witnesses that the new high-temperature superconducting materials hold little promise of accelerator applications in the next decade. J.M. Rowell of Bell Communications Research spoke of limitations in the new materials that have not been fully explored by the scientists nor duly noted by the press.

MacKay said he thought every state competing for SSC should be asked, "Would you [still want] it if [getting it meant] the federal support for universities in your state were cut by a third?" MacKay, skeptical of promises that SSC won't cramp existing science projects, said he thought it would be appropriate for the committee to ask DOE for a 10-year plan for all its science programs. Dr. Sheila Widnall, president of the American Assn. for the Advancement of Science, who was testifying at the time, agreed, and added "including budget estimates."

Widnall was one of several members of the science community who expressed reservations about launching the project now, while the budget's so tight, although she said under questioning that SSC must be built and fairly soon to avoid "blocking" high energy physics in the U.S.

Another witness, Prof. James Krumhansl of Cornell University, vice president of the American Physical Society, retreated from some statements he made in a letter to Energy Secretary John Herrington Feb. 19, disparaging high energy physics and SSC. Ritter introduced Krumhansl's letter to the record and quoted this passage from it: "First, regarding Supercollider, in the last thirty years I have not seen that particle physics has made any substantive contribution to technology generally, nor energy science and technology specifically. The proposed project will not be different."

Explaining his remarks, Krumhansl told the committee that the "Irish" from his mother's side had surfaced in that letter, although he said "I stand by the main points." He wrote Herrington, he said, in reaction to what he saw as the secretary's exaggerated claims for SSC and in the context of "what has happened to the material sciences. It's very apparent what the missed opportunities are." After Krumhansl suggested he had perhaps gone too far, Ritter observed, "Sometimes in the heat of battle the truth will emerge."

Trivelpiece, asked by Ritter about Krumhansl's remarks (including higher cost estimates for SSC construction and operation than DOE's), said he was "exceedingly disappointed [Krumhansl] would take the position he did in the letter" and could not imagine how the Cornell professor had arrived at his estimates, since DOE had arrived at its own through the most detailed analysis. Krumhansl's assertions about particle physics were "simply not correct," said Trivelpiece, noting that "the accelerator-based business in this country is now a $4-billion a year business."

For the second half of the hearings, the panel heard from states competing for SSC, through their representatives in Congress or top state officials. First up was Lt. Gov. Stan Lundine of New York, who used to sit on that committee. He told his former colleagues that New York's bid for SSC will be supported by the entire Northeast section of the country, and that the state is engaged in a dialogue with the Canadian province of Quebec, not the Canadian government — "so as not to offend" DOE. (The department's bid invitation "strongly discourages proposers from duplicating U.S. Government efforts to obtain collaboration from foreign governments. This policy, however, is not intended to affect existing or planned international collaboration between potential proposers and foreign industrial, academic,

regional or local entities.")

The New York/Quebec discussions center on possible contributions the province and the Canadian private sector might make should SSC be sited in New York near the Canadian border. Quebec officials "are lobbying their federal government as we're lobbying ours," Lundine reported. Though he said in response to questions that he knows of "no policy reason why [a transborder siting] should be ruled out," New York is "going to propose what DOE wants [i.e., a site entirely within the U.S.]. . . . I am trying to be an advocate for my state." Trivelpiece had explained this DOE decision as an attempt to be fair to non-border states, which lack access to a potential foreign partner in the bidding, and also to avoid the "security" costs that would be involved in a bilateral siting.

Lundine later told reporters he views SSC as "not wired" yet for passage by Congress but he said he's "optimistic" it will be in the near future —"otherwise I wouldn't have proposed" that New York spend $3 million on its site proposal.

He said New York was not one of the states insisting that DOE keeps to its four-month proposal schedule. California Rep. Ron Packard, a Republican, told the committee he thought the present schedule was "attainable" and fair, since every state was notified of DOE's intent two years ago, but Illinois Rep. Terry Bruce, a Democrat, said his state would support "some reasonable compromise of time" to accommodate "all brother states" that want an extension. — *Amelia Manning*

May 18, 1987

DOE EFFORTS TO SECURE INTERNATIONAL COLLABORATION ON SSC have begun informally, but the department will need a congressional commitment to the $4.5-billion Superconducting Super Collider before it can officially explore the subject with foreign governments, a high-level DOE official told House members recently.

George Bradley Jr., principal deputy assistant secretary for international affairs and energy emergencies, was called to testify before the House Science, Space and Technology subcommittee on international scientific cooperation, specifically to describe the role of international collaboration in the SSC project.

Bradley heads an interagency working group, embracing the State Dept. and the Office of Science and Technology Policy as well as DOE, that is gathering information on the best approaches to international collaboration. The strategies and recommendations it arrives at will be delivered to a senior management group led by DOE Under Secretary Joseph Salgado. "Through both the working group and the senior group, we are developing an action plan to obtain maximum participation from other countries," Bradley told the House panel, chaired by Rep. Ralph Hall, D-Tex.

The working group is already receiving information from U.S. embassies on the prospects for international collaboration among the Western allies — assessments not only of countries' interest but also of their capabilities to contribute. Thos reports also identify key organizations and key individuals to approach.

"Based on the outcome of an interagency review [of this information] and after an expression of Congressional intent for the project, we intend to initiate visits to key capitals by high-level teams," said Bradley. "We would use these occasions to have an exchange of ideas with our counterparts and explore their interest in and requirements for participation." Bradley said the plans do not include discussions with Eastern Bloc countries at this time.

"It is vital," Bradley stressed, ". . . that we be able to project a domestic commitment to the SSC. Other countries would have to make long range commitments to such a project and therefore our commitment would also have to be long range."

A DOE spokesman said after the hearing that the working group will be consulting with the Defense Dept., Commerce Dept. and any other agency with an interest in foreign participation in SSC, to clarify and resolve "up front" any possible concerns about collaboration.

May 25, 1987

MEMBERS SEEK EXTENDED SSC DEADLINE; SENATE DISCOUNTS LOCAL OFFERS

Three members of the House Science, Space and Technology Committee say they will support an amendment to an FY-88 DOE authorization bill that would require the department to extend by five months its deadline for receiving site proposals from states bidding for the $4.5-billion Superconducting Super Collider.

In a May 19 letter to committee members, Reps. Tim Valentine, D-N.C., Marilyn Lloyd, D-Tenn.

and Sid Morrision, R-Wash., said DOE's April decision to require states to submit detailed SSC site proposals by Aug. 3 fails to consider the fact that many states were not able to commence activities until they were assured that the president would actually submit the proposal to Congress.

"As such, a number of states find that the three-month [sic] allowance for proposal submission, including detailed response to the multitude of technical criteria is *a priori* precluding them from preparing a truly competitive response," the legislators wrote.

The amendment, which will be offered by Valentine and attached to the committee's authorization bill (H.R. 2369), would move back the deadline until Dec. 31. The five-month extension, the members believe, would not significantly increase the project's cost or timing, but would ensure "a reasonable measure of fairness for all interested parties."

An aide to Valentine said Friday the congressman believes there is a substantial amount of support for the amendment in committee. The decision to seek a five-month extension came after a number of competing states said the additional time would be sufficient to prepare adequate proposals. In committee hearings on the SSC last month, Valentine expressed concern that the August deadline would give such states as Texas and Illinois, which have already invested large amounts of time and money in preparing for the project, an unfair advantage over other states (*IE/FL*, 13 April, 1).

In a related matter, the Senate adopted an amendment designed to block DOE from taking into account any financial contribution a city or state may offer in selecting an SSC site. Specifically, the measure, offered by Sen. Pete Domenici, R-N.M., prohibits the agency from spending funds implementing a section of its site-selection plan that encourages local contributions. The provision was attached to the FY-87 supplemental appropriations bill.

"I think the wish of the Senate is that on the Superconducting Super Collider, we pick the best site and not take into account financial remuneration from cities or states or compensation they may offer to the U.S. Government," Domenici said in a floor statement Wednesday.

His introduction of the amendment sparked a sharp debate among several senators, including ones from Texas and Illinois who argued that discouraging local contributions to the project and forcing the federal government to pay a larger share might jeopardize Senate support for it. Energy Secretary John Herrington echoed that sentiment in a May 20 letter to Senate Energy Committee Chairman J. Bennett Johnston, D-La.

"To prohibit the Department from considering financial or in-kind contributions in its site selection would unnecessarily overlook potential savings to the taxpayers as a result of cost-sharing," Herrington said. Since the state chosen for the SSC would receive substantial economic benefits, Herrington argued that it is reasonable for those competing for the project to offer contributions to the cost of construction and operation of the facility.

June 8, 1987

HERRINGTON MAKING DIRECT APPEALS ON SSC

Energy Secretary John Herrington is personally riding shotgun on DOE's proposed Superconducting Super Collider, determined to resolve congressional concerns over the $4.5-billion project before they become a serious threat to SSC funding or scheduling. In letters to Capitol Hill and in meetings with legislators, Herrington is stressing what DOE sees as the urgency of avoiding delays that could give foreign competitors an edge in the technology.

SSC's first test votes in the House could come as soon as the Science, Space and Technology Committee and the Appropriations subcommittee on interior conduct markups of legislation addressing the project. Aides to both panels say they hope to act soon, although no dates had been set as of press time.

But Herrington isn't waiting around. Recently, the secretary sent letters to Rep. Robert Roe, D-N.J., chairman of the science committee, and Rep. Tom Bevill, D-Ala., chairman of the Appropriations subcommittee, seeking their support for the $35 million DOE has requested for SSC in FY-88. In addition, Herrington met personally with several members of Bevill's subcommittee and planned another session this week with science panel members, an agency source said.

Meanwhile, three House science committee members seeking a delay in DOE's deadline for accepting site proposals from states plan to offer the amendment when their panel takes up the authorization bill. Reps. Tim Valentine, D-N.C., Marilyn Lloyd, D-Tenn., and Sid Morrison, R-Wash., want the deadline extended by nearly five months, from Aug. 3 to Dec. 31, 1987, to give some states more time to prepare their offers (*IE/FL*, 25 May, 3).

An aide to Valentine said his boss would seek support from the Appropriations Committee, if neces-

sary. The science committee's authorization bills often go unacted upon by the full House.

An aide to Roe said the committee chairman had "concerns about scheduling and fairness" but had "not decided yet what to propose." The aide said a committee markup could take place next week.

Bevill has not publicly indicated his position on SSC, an aide to the Appropriations subcommittee chairman said.

"I strongly urge the Committee to approve this request in full and to support the construction timetable which has been proposed for this project," Herrington wrote in identical May 28 letters to Roe and Bevill. The agency has proposed a completion date of 1996 for SSC, with selection of a preferred site by 1998. "These target dates reflect both a realistic project timetable and the importance attached to the Super Collider's completion by the mid-1990s.

"While two projects, the Tevatron Collider and the Stanford Linear Collider, will be the world forefront facilities for the next few years, Western Europe and the Soviet Union are presently constructing new accelerators which could give them world leadership in high energy physics during the 1990s. . . . Any delay in either the funding or the proposed site selection timetables could very well jeopardize our Nation's leadership in high energy physics."

Another concern among DOE officials is the damage a lukewarm congressional reception for SSC would do to the agency's efforts to win some foreign backing for the project.

The funding authorization sought by DOE includes $25 million for r&d involving superconducting magnets and other systems and $10 million in construction funds for purchases involving long lead times, such as cabling machines.

DOE officials are attempting to end speculation that inclusion of construction funds in the agency's request hints at some inclination to a specific site. Herrington acknowledged those concerns in his letters when he said: "I must emphasize that the funds requested in FY-88 for construction do not pertain in any way to site-specific work."

Appropriations Committee members meeting with Herrington over breakfast last week included: Reps. Vic Fazio, D-Calif.; Bill Chappell Jr., D-Fla.; Wes Watkins, D-Okla.; Lindy Boggs, D-La.; John Myers, R-Ind.; and Carl Pursell, R-Mich. "They had a good meeting," an agency official said. "There were some concerns about where the money is coming from and what kind of commitment the administration has to the project."

The DOE official characterized administration support as "very strong" and said the agency anticipated receiving from the Office of Management and Budget within several weeks a mid-year budget review including "out-year numbers for SSC that will show how the administration plans to come up with the funds."

The official also reiterated the agency's stance that funding for the project will not come "at the expense" of other high energy research projects. He said there may be some "setasides" from other parts of DOE's budget as well as from other agency budgets to help fund the $35 million.

June 29, 1987

$10-MILLION APPROPRIATION CITED AS 'LINCHPIN' TO $4.5-BILLION SSC

Prospects for foreign participation in the Superconducting Super Collider project could be jeopardized if Congress fails to provide the program with $10 million in construction funds for FY-88, Alvin Trivelpiece, president of the American Assn. for the Advancement of Science, said last week.

Trivelpiece, who resigned as DOE's director of energy research to head AAAS this spring, said a decision by the House Appropriations Committee to withhold $10 million in construction funding requested by the administration for the $4.5-billion SSC could seriously affect the program. The committee, Trivelpiece said, "may not have appreciated the degree to which the $10 million is the linchpin for everything else in the project."

"Potential foreign partners are waiting to see concrete action before getting into any sort of cost-sharing arrangements and this decision may have damaged that," Trivelpiece said. His comments were made at a seminar in Washington sponsored by IIT Research Institute in cooperation with the Technology Transfer Institute.

At a June 17 markup, the panel approved $25 million for continued SSC research. The administration had originally sought $35 million for the program (*IE/FL*, 22 June, 1). The additional funds requested were to be used to purchase what DOE described as "long lead construction items," including cabling machines and other equipment needed to construct SSC components. The agency is convinced that without such funding in the next fiscal year completion of the project could be delayed beyond the 1996

date now targeted.

DOE has expressed disappointment with the committee action and is hoping the money will be included in the final spending package passed by Congress.

"Some one committee . . . is going to have to come out in favor of the $10 million in FY-88," Trivelpiece said. "Otherwise, detailed things that need to be done won't be done. The [need for the money] is more critical than is generally understood."

In response to critics who question whether SSC's cost can be justified by the potential for developing "spin-off" technologies, Trivelpiece said the project is certain to provide a number of benefits.

"If you build SSC, will you have the same benefits accrue as you have had with [research] into high energy physics?" he asked rhetorically. "The truthful answer is that you don't know." More important, he explained, is what opportunties could be missed if the research is not pursued.

July 6, 1987

But States Can Still Make Money Pitch

CONGRESS TELLS DOE TO IGNORE FINANCIAL OFFERS IN SSC SITE SELECTION

DOE would be barred from considering financial incentives offered by any state competing for the administration's proposed $4.5-billion Superconducting Super Collider, under language contained in a compromise FY-87 supplemental appropriations bill. The spending legislation (H.R. 1827) was approved by Congress last week.

The bill, which was reported June 26 by a House-Senate conference committee, would not, however, preclude any state or other group from including financial incentives in their proposals to the department.

The supplemental bill language was approved after conferees were unable to agree completely on an amendment to the legislation offered May 20 by New Mexico Republican Sen. Pete Domenici. Domenici's amendment, which was attached to the Senate version of the supplemental, would have prohibited DOE from spending funds implementing a section of its site-selection plan that encourages local contributions (*IE/FL*, 25 May, 3).

Domenici offered the amendment in an effort to force DOE to select the best site regardless of potential financial incentives that may be offered. During floor debate on the amendment in May, the measure was strongly attacked by senators from Texas and Illinois, where substantial amounts of money have already been invested in an attempt to land the huge project. Barring the department from considering financial incentives, the senators argued, would force the federal government to pay a larger amount of money than necessary and could jeopardize congressional support.

House members on the supplemental conference committee seemed to have concurred. According to bill language, the House agreed with the amendment prohibiting DOE from considering any incentives in its site-selection process but added that the amendment does not preclude any state or other group from including financial incentives in its proposal. Further, the amendment approved by the conferees does not bar a state from "including in its proposal the use of its own resources to improve the suitability of any proposed site."

"The conferees are very mindful that the country faces serious fiscal problems including very large budget deficits and that final and/or total financial arrangement required for construction of this costly research facility have not yet evolved," the bill language explained.

In floor remarks made Tuesday after the House agreed with the Senate provision in the supplemental, Rep. Ralph Hall, D-Texas, said because the amendment does not preclude states from including financial incentives it their site proposals, it leaves "the door open for consideration of such incentives in the final site selection decision to be made by the President."

Hall, who disagreed with the amendment, argued that the "language is confusing in a number of respects; however, one of the most egregious ambiguities is that the amendment seems to leave the door open for DOE to consider existing facilities but does not consider a state's willingness to use state or local funds to construct comparable facilities."

"At a time of record federal deficits, it seems to me that the Congress has a duty to look for all sources of funding, whether they be from state and local political subdivisions, corporate grants, and donations, contributions from foreign governments and other entities. As a nation, we can no longer [afford] to be overly selective about our preferences of funding sources if we are truly serious about building this project," Hall said.

Under existing plans, states are required to submit detailed SSC site proposals to DOE by Aug. 3.

This deadline could change, however, if the House Science, Space and Technology Committee finally meets to approve an FY-88 authorization bill marked up earlier this year by its energy research and development subcommittee.

At least three members of the panel are expected to offer an amendment that would postpone the August deadline to Dec. 31 in an effort to provide some states with what they consider to be necessary additional time to complete site proposals.

July 13, 1987

HERRINGTON SEEN HOLDING TO SSC DEADLINE

Energy Secretary John Herrington is expected to reject a request by House members to extend by 60 days the Aug. 3 deadline for states to submit site proposals for DOE's planned $4.5-billion Superconducting Super Collider, congressional and agency officials said last week.

In a June 25 letter to Herrington, nearly 40 House members, including Reps. Sid Morrison, R-Wash., and Tim Valentine, D-N.C., argued that the August deadline contained in the department's April request for proposals gave states only four months to prepare detailed plans for the project, which the administration itself had not officially endorsed until January.

The members argued that in view of the considerable projected costs of the program, "it does not seem necessary to compress the site selection schedule, thus narrowing the field of serious competitors, just for the sake of starting a few months earlier."

Further, the members claimed that the short time frame could discourage a number of states from competing for the huge project. Moreover, other states, which will be able to meet the deadline, will be forced to spend more money than would be necessary if a longer period were granted.

The members also told Herrington that "there exists a perception that the site selection process is less than completely objective and fair. More specifically, the short deadline for site proposals appears to favor certain states that committed significant resources to preliminary site work in advance of the Administration's endorsement of the project."

The House letter was apparently prompted by complaints by several states that the Aug. 3 deadline provided insufficient time to complete the detailed site proposals requested by DOE. These states, which include Washington, North Carolina and Alabama, among others, fear that at least three states — Illinois, Texas and California, which have already spent large amounts of both time and money in preparing their SSC pitches to the department — would enjoy an advantage they would be unable to match.

Though Herrington has yet to respond formally to the House letter, agency officials privately admitted last week that the secretary is unlikely to agree to any delay. Department officials are concerned that even a delay as short as that proposed by the House members could have a domino effect of sorts on other program milestones, eventually jeopardizing the project's planned 1996 completion date.

Should Herrington reject the request, as expected, House members seeking the extension may have little recourse. While several congressional sources at least held out the possibility that some members may move to force the department to provide additional time through a floor amemdment to an unrelated bill, such an attempt is almost certain to run into stiff opposition from the large Texas, California and Illinois congressional delegations.

Morover, if such a course was pursued, the members supporting an extension of the deadline could well run the risk of providing program opponents with an opportunity to speak against the project, one House source explained.

July 20, 1987

DOE EXTENDS SSC SITE PROPOSAL DEADLINE TO CONFORM TO FUNDING LAW

DOE last week extended the deadline for the submission of states' site proposals for the Superconducting Super Collider for 30 days, until Sept. 2, in order to conform to legislation prohibiting the department from considering "financial or other incentives" in its selection of a site for SSC.

The extension, which came in the form of an amendment to DOE's site selection invitation, was granted to comply with language in the FY-87 supplemental appropriations measure signed July 11 by President Reagan. DOE said the delay to the original Aug. 3 site proposal deadline would provide the contending states additional time to amend their proposals, taking into account the new law's requirements.

The DOE's July 14 amendment represented a half victory for states that had lobbied the department for a 60-day extension of the August deadline. In a June 25 letter to Energy Secretary John Herrington

(*IE/FL*, 13 July, 1), nearly 40 House members had argued that the short deadline for the site proposals favored large states that had done considerable preparatory work well before the $4.4-billion project received the formal go-ahead from Reagan in February.

"We are pleased that DOE granted the 30-day extension," said an aide to Rep. Sid Morrison, R-Wash., one of the signatories to the June letter. Although admitting that he would have preferred a 60-day delay, or the end-of-year extension many states had first sought, Morrison is nevertheless satisfied with the shorter period, according to the aide.

DOE said the remaining timetable for the process will remain unchanged. A 90-day review period will follow the submission of proposals, during which a selection panel of the National Academies of Sciences and Engineering will develop an unranked short list of best-qualified sites. That process will be followed by an in-depth review by DOE of the short list, with the target date for designation of a preferred site set for July of next year. Following an environmental review process, the final site selection is expected to occur in January 1989.

DOE's amendment deletes those sections of the original invitation to the states that provided the department would consider and evaluate offers of financial contributions and incentives in selecting the site. Designed to comply with the legislative requirement authored by Sen. Pete Domenici, R-N.M., the amendment says that those contributions cannot be considered in evaluating the site proposals. The Domenici language stipulates that the final selection should be based "solely on the suitability of the site."

However, the department is allowing the states to submit a "voluntary financial contribution" to help defray the cost of construction and operation of SSC, so long as it is contained in a separate, sealed envelope. The envelope would be opened only if that proposal is ultimately selected, while those belonging to unsuccessful bidders will be returned unopened.

Moreover, DOE will still consider during the assessment process infrastructure improvements offered by the states such as land acquisition and rights-of-way, access roads, sewer systems, water transportation lines and power transmission lines. In a letter to prospective bidders, L. Edward Temple Jr., executive director of the DOE's SSC Site Task Force, explained that a Senate floor discussion had established that the agency was not prohibited from considering such "resources to improve the suitability of the proposed site."

August 3, 1987

AN EDGE IN THE RACE TO LAND DOE'S COVETED SSC PROJECT MAY GO to whichever state is named to host a high-level nuclear waste repository, under action taken last week by the Senate Energy Committee.

In legislation reported to the floor Wednesday, the committee approved an amendment requiring DOE to give "special consideration" to states with waste repositories when siting federal research facilities. The amendment was introduced by Nevada Republican Sen. Chic Hecht (related story elsewhere in this issue).

The proposal was contained in a bill that would allow DOE to select a site in one of three Western states already named by the department for detailed characterization. Should the site prove suitable, DOE could then proceed with plans to develop a repository there. Under current law, the agency is required to carry out simultaneous characterization at all three sites. The bill (S. 1481) was reported as both a separate measure and as part of the committee's budget reconciliation package.

Although the bill stops short of naming the Superconducting Super Collider project, Committee Chairman J. Bennett Johnston, D-La., acknowledged that the provision could include the $4.5-billion facility. DOE is scheduled to select an SSC site well before it determines a final location for the first waste repository, but Johnston suggested that the timetable for the research project could be delayed if the administration is unable to find enough money for the work.

Sen. Mark Hatfield, R-Ore., argued against the amendment, claiming that the legislation, which provides payments of as much as $100 million a year to the repository host, already contains sufficient incentives. Hecht told Hatfield, however, that Nevada deserves such special consideration if it is chosen as a dump site. "I am bargaining for my state," Hecht told Hatfield.

August 10, 1987

SSC BACKERS RALLY FOR $35M FUNDING BILL

House supporters of the Superconducting Super Collider expected to garner over 200 co-sponsors last week for a bill to restore FY-88 funding for SSC to $35 million. The measure was to be introduced last Friday by Rep. Robert Roe, D-N.J., chairman of the Science, Space and Technology Committee, just prior to the beginning of the scheduled congressional recess.

DOE officials and SSC congressional backers say the $10 million is essential to signal government commitment to the $4.4-billion project and thereby attract foreign participation.

Roe's backing assured large-scale Democratic support for the bill, which was authored by New Mexico Rep. Manuel Lujan, ranking Republican member of the committee. Although the House has allocated $25 million for continued r&d work on SSC during FY-88, an additional $10 million sought by DOE to begin construction of the facility was deleted by the Appropriations Committee prior to House passage (*IE/FL*, 22 June, 1). The bill also authorizes "such sums as may be necessary" for SSC in FY-89 and subsequent fiscal years.

In a "Dear Colleague" letter circulated prior to the bill's introduction, Lujan and Rep. Robert Toricelli, D-N.J., wrote that "an expression of congressional intent in support of the SSC is essential in order to move with reasonable confidence to secure commitments on the part of our potential partners." Explaining that DOE intends to seek cost-sharing for the project "with all interested countries," the congressmen noted, "It is vital in meeting with foreign officials that the U.S. be able to project a domestic commitment to the SSC."

Despite bipartisan support for the Roe bill, there is disagreement over whether the SSC issue should be dealt with separately from legislation to authorize other DOE research activities in FY-88. A Roe staffer said the chairman views the SSC bill as a means of assessing the depth of House support for SSC, but that he intends to package it in the broader DOE authorization measure to be marked up by the committee next month.

But Lujan, fearing the Senate will not move a full DOE authorization bill this year, feels the SSC bill should be handled separately, according to an aide. "We think there is a good chance the Senate may act on a separate SSC measure," he noted. Moreover, he explained, the fact that no funds had been authorized for SSC was one reason why the Appropriations Committee turned down the $10 million in the first place. Further, a House bill authorizing the $35 million could be attached to the continuing resolution that is expected to serve as the FY-88 appropriations vehicle.

Roe's aide downplayed the effect of the earlier House appropriation. "It doesn't mean anything yet; it's just a House-passed bill," he said. —*David Kramer*

August 17, 1987

States with DOE Labs May Have Edge

ROE THREATENS TO AGAIN FORCE ADMINISTRATION HAND ON SSC SITE RULES

Concerned that current DOE guidelines for selection of a site for the Superconducting Super Collider will give Illinois an unfair advantage, a key lawmaker has threatened to again force a revision in the procedure. Rep. Robert Roe, D-N.J., chairman of the House Science, Space and Technology Committee, said he was not satisfied with last month's move by the agency to remove financial incentives offered by states from the bidding process and is concerned that states with DOE-owned land will still be favored.

Roe said at an Aug. 14 press conference that DOE's July prohibition against the consideration of "financial and other incentives" during the bid review process was "simply not comprehensive enough to level the playing field" for all contending states. He promised his committee will address the question carefully during its markup of DOE research authorization legislation, which he said will come next month. Congress attached language to its FY-87 supplemental appropriations bill that barring DOE from considering financial incentives offered by states (*IE/FL*, 20 July, 5).

At issue is DOE's stated intention to consider in the evaluation of a proposed site's life cycle cost the savings resulting from use of an existing DOE-owned facility, while denying similar consideration to land offered by the contending states for the SSC site. In answers to questions submitted by prospective bidders for the $4.4-billion facility, the agency said earlier this month any cost impact resulting from the use of a DOE-owned facility for SSC will be considered in the development of the life cycle cost for SCC, since it is already DOE-owned. But existing or proposed improvements on land to be donated by the states for the site can be considered only in the "technical evaluation" process, not in the

calculation of life cycle costs.

A committee aide explained that the effect of the DOE ruling was to "tilt the balance of the bidding toward states like Illinois, and particularly toward Fermilab", the Fermi National Accelerator Laboratory in Batavia, which the state is proposing to incorporate in its SSC site. He said the problem rests with the agency's interpretation of language in a supplemental appropriations law that prohibited consideration of financial and other incentives, but made exceptions for infrastructure improvements to increase the suitability of the proposed site.

DOE on July 14 extended the original Aug. 3 deadline for bid submissions by 30 days, until Sept. 2, in order to conform to that legislation (*IE/FL*, 20 July, 5).

Roe said at a news conference that he would use DOE authorization legislation to try to ensure that the process is made fair. "I believe that the Science, Space and Technology Committee will craft SSC authorization provisions that can assure continued Congressional support of this project by addressing all critical issues," he said.

Committee staff said it's hoped the Senate will consider a companion DOE authorization bill if stronger prohibitions against SSC financial incentives are included in the House bill. Most observers, however, feel there is little chance for a Senate DOE authorization bill this year.

DOE said it has "no objection" to Illinois using the Fermilab site as a location, and the Tevatron superconducting accelerator system as an "injector" for SSC. But it stressed that it "in no way" endorsed the suitability or desirability of that site pending the results of the site review process.

Similarly, DOE said it would not object to the state of Idaho proposing the use of the Idaho Nuclear Engineering Laboratory land, also owned by DOE, as an SSC site. — *David Kramer*

August 17, 1987

Also Clarifies Allowed Contributions

DOE PROJECTS SSC RADIOACTIVE WASTE AT 300 CU. YARDS A YEAR OR LESS

DOE said recently its proposed Superconducting Super Collider will generate a quantity of low-level radioactive waste comparable to that produced by "a major university with a medical facility." In a letter to prospective bidders for the $4.4-billion project, the executive director of the SSC Site Task Force, L. Edward Temple Jr., compared the amount of non-radioactive hazardous waste that would be generated by the facility to that of a small industrial facility producing specialized electronics boards having vehicle and plant maintenance activities.

DOE projected the amount of low-level radioactive waste generated by the SSC at 300 cubic yards per year, but added it could be reduced to 15 yards annually if screening, sorting and recycling techniques employed at DOE's Fermi National Accelerator Laboratory (Fermilab) accelerator prove to be applicable to SSC. The agency pointed out that accelerator tunnel waste is significantly less at a superconducting facility such as Fermilab than at a conventional magnet facility of the same size.

he agency also assured states contending for SSC they would not be obligated to accept these wastes, but added that disposal at a licensed state low-level radioactive waste facility would be considered "if there were a willingness by the state(s) to accept" the waste.

Meanwhile, DOE last week further clarified what types of contributions offered by the states it will consider during its evaluation of the SSC site proposals. Although the agency has been prohibited by congressional action from considering "financial or other incentives" during the evaluation process, (*IE/FL*, 20 July, 5), it says it is permitted to take into account infrastructure improvements offered by the states.

Examples of such infrastructure improvements are civic centers, parks and other recreational facilities, libraries, hospitals, housing and other community development activities and amenities. They could also include increasing the reliability and capability of utility services, providing additional siting flexibility to reduce the risks of construction and tunneling, buildings, roads and excavations, according to DOE. Moreover, evaluations will take into account states' commitments to improve off-site travel and transportation access to the site as well as commitments to improve elementary, secondary and higher level education and educational facilities.

Prohibited from consideration are direct cash contributions or direct sharing in DOE's project costs, subsidization of electric power rates, and preferential tax treatment. But the agency said it would only ignore, not penalize, any bid which inadvertently includes one of the prohibited financial incentives.

Under DOE guidelines to bidders, the state can offer direct contributions to the project, but the offer must be submitted in a separate sealed envelope. That envelope will not be opened unless that site is ultimately selected. The financial offers of all other bidders will be returned unopened, the agency promises.

August 17, 1987

A BI-PARTISAN HOUSE BILL AUTHORIZING $35 MILLION IN FY-88 for DOE's proposed $4.5 billion Superconducting Super Collider has won the support of Energy Secretary John Herrington. The bill, which was introduced Aug. 7 by House Science, Space and Techonology Committee Chairman Robert Roe, D-N.J., and co-signed by some 200 members, would provide the full amount requested by the agency for the project in the next fiscal year.

The House in June approved an FY-88 spending bill that appropriated only $25 million of the $35 million requested by the administration.

In a statement released shortly after the bill was introduced, Herrington called the legislation "an important step for continued American leadership in science and technology." The large number of co-sponsors, he said, "indicates that there is growing recognition in the Congress of this importance — and that support in the Congress is both broad and deep."

At a press conference announcing the authorization bill (*IE/FL*, 10 Aug, 1), Roe said the $4.5-billion estimated cost of the project "would be the largest investment made by this country in a scientific experiment." Roe said, however, that a number of issues must still be addressed by his committee before Congress agrees to authorize the work.

Roe said his panel will "spell out the nature of the authorities granted" to DOE and the arrangements it is authorized to enter into, including cost-sharing agreements with other governments. The committee also wants to ensure that states are able to compete fairly for the project.

August 24, 1987

OMB SETS OUTYEAR SSC FUNDING SSC AT $2.1B

The Reagan administration last week projected expenditures of $2.1 billion on the Superconducting Super Collider from FY-89 through FY-92. The outyear projection, required by Congress, was included as a new line item in the Office of Management and Budget's midsession review of the FY-88 budget, since President Reagan did not okay the SSC project until after submission of his budget proposal last January.

OMB said in the document that the estimated outlays for SSC will be adjusted once cost-sharing agreements are reached with other nations. It said the administration is "committed to obtaining significant amounts of cost-sharing" for the system, but did not elaborate further.

Funding for FY-88 was not mentioned in the revised budget, but the administration has already asked Congress for a total of $35 million to spend on SSC next year (*IE/FL*, 29 June, 7). The project, which is estimated to ultimately cost about $4.4 billion in 1987 dollars, is expected to be completed in 1996.

DOE and OMB spokesmen said the funds represent new money, and thus won't be redirected from other agency activities. OMB said the sum had been agreed upon with DOE for the period through 1992, noting that additional money will be required beyond that period. A DOE spokesman described the five-year budget projections as a "formality," stressing the numbers are likely to change substantially during the FY-89 and future-year budget processes.

According to the revised budget, outlays for SSC are proposed at $200 million in FY-89, $400 million in FY-90, $700 million in FY-91 and $800 million in FY-92. The administration will seek new budget authority of $2.7 billion for SSC during the same period. Budget authority, which authorizes funds to be spent in current and future fiscal years, is broken down as follows: $400 million in FY-89, $700 million in FY-90, $800 million in FY-91 and $800 million in FY-92.

In February, DOE estimated SSC funding at $348 million in FY-89, $679 million in FY-91 and $709 in FY-94. The government hopes to obtain up to half the necessary funds for SSC from abroad.

August 24, 1987

DEUTCH SEES FIVE STATES AS TOP CONTENDERS FOR HOSTING SSC PROJECT

Colorado, Texas, California, Illinois and North Carolina have the best chances of being chosen the host state for the Superconducting Super Collider, in the opinion of John Deutch, a member of the White House Science Council.

Deutch, a former DOE under secretary and former director of DOE's office of energy research, told *Inside Energy/with Federal Lands* that the five states "look like especially strong contenders" for the $4.5-billion SSC. He emphasized that he was not involved in the site selection process and that his assessment was "not based on any inside information." Rather, he said, it was a judgment based on his

years of experience in the scientific community.

Deutch, who is now provost at the Massachusetts Institute of Technology, explained that California has an automatic advantage because of its size and the size of its scientific population, while Texas has "an excellent, centrally located site" near Dallas, has already voted $500 million worth of revenue bonds toward the project and "has a very vigorous scientific community."

Illinois has the existing DOE Fermilab Tevatron accelerator to offer for incorporation into its proposed SSC site, Deutch said, while Colorado offers a location near a major metropolitan area, is a "very desirable part of the country," and has a very active group promoting the site. North Carolina also has a good deal of organization behind its proposal, and has indicated a willingness to undertake infrastructure improvements to its site.

About 24 states are thought to be contending for SSC, and the deadline for submission of their proposals is Sept. 2. A selection panel of the National Academies of Sciences and Engineering will then have 90 days to prepare an unranked short list of best qualified sites. Chairing that panel is Edward Frieman, director of the Scripps Institution of Oceanography, who is vice-chairman of the White House Science Council.

The NAS-NAE review will be followed by a DOE review, and designation of a preferred site is expected by July 1988. Following an environmental review process, the final site selection is expected to occur in January 1989.

September 7, 1987

25 STATES SUBMIT 'BEST' BIDS FOR SSC SITE

More than two dozen states met last week's deadline for submission of site proposals for the Superconducting Super Collider, each one claiming to offer the best combination of geology, amenities and site enhancements to host the mammoth $4.4-billion project.

By the DOE deadline Wednesday, 25 states had delivered their proposals to agency headquarters. At least three — Texas, Mississippi and North Carolina — claim to have offered site enhancements, such as infrastructure improvements, worth $1 billion or more each to attract SSC to their states. Many, including California, Texas, Michigan, New York, Oregon and Utah, offered multiple sites, leaving the internal selection process to DOE. California, considered a major contender from the outset of the SSC project, barely made the deadline after its legislature held up a bill to grant bonding authority for the project in a squabble over quotas for minority contracting during SSC construction.

In addition to state-backed plans, a number of private and local government proposals were received by DOE, bringing to 43 the total number of submissions. Five such "unofficial" proposals were submitted from Texas, while New Mexico, Utah and Washington had one each. An international site located in northern New York and Quebec was proposed, apparently not in conformity with one of DOE's requirements that the site be located entirely in the U.S. That same criteria was also not met by Paul Jablonka, who proposed locating the SSC on the moon.

Although site proposals were submitted from states ranging from Alaska to Florida, many observers feel the primary contenders for SSC are California, Illinois, North Carolina, New York, Ohio, Texas and Colorado.

The following are capsule summaries of the states' proposals, in alphabetical order:

Alaska: The northernmost proposed site is located west of Fairbanks in the central part of the state. According to Eric Laschever, associate director of the governor's Washington office, the state's main selling point is the fact that the site land is already owned by the state and can be immediately conveyed to DOE.

The state is offering to provide infrastructure and site enhancements, including new roads and bridges, railway, electrical, and sewage improvements, that are valued at $319 million. Other advantages cited in the application include state of the art communications and a demonstrated ability to support major construction projects.

Arizona: The state proposed two sites, one about 35 miles southwest of Phoenix and the other 25 miles southwest of Tucson. Besides meeting all DOE's technical criteria, Arizona offers the climate that could cut up to two years from the construction schedules of SSC, according to Ian Macpherson, state SSC project coordinator. State officials say that the shorter build time could cut project costs by as much as $200 million.

Arizona also boasts that most of land needed for the site is owned either by the state or federal governments, facilitating land acquisition for the project.

California: Two sites were proposed by the state, which managed to get its plans into DOE with just

minutes to spare after a partisan dispute in the legislature over SSC construction and bonding contracts allocated to firms owned by women and minorities held up funding authorization for the project. One site is located just east of Stockton in San Joaquin County, while the other is west of Sacramento in Yolo and Solano counties. State officials say their offer includes a total of $560 million worth of land acquisition, environmental and site enhancements, including a new university-level science institute to be built adjacent to the site.

According to Paul Sweet, director of federal relations for the University of California, the state offers the environment conducive to SSC, specifically "a community of scientists in the San Francisco Bay area that have pioneered work in this area." Both the University of California at Berkeley and Stanford University are nearby.

Colorado: The state's proposal would locate SSC east of Denver in the high plains, which, according to Gov. Roy Romer, is a geologically superior site due to its deep shale formation. "I believe our proposal will prevail if the selection process is limited to technical and scientific criteria," he said last week. "If it gets into a bidding war, we're not in the game; we're just not bringing that kind of money to the table."

Nevertheless, Romer said the state is offering infrastructure improvements and site enhancements valued at about $300 million, and, like many of the other states, is also submitting a sealed envelope containing unspecified financial incentives to attract the project. DOE in July excluded financial incentives from its site selection process, but left the door open for states to submit the incentives, such as offers of direct cash contributions, in a sealed envelope that would be opened only if the state was selected.

Romer also emphasized the attractiveness of the state's lifestyle as a chief consideration in the evaluation process. He asked rhetorically whether a visiting physicist to the site would rather spend his summer in the panhandle of Texas or near the mountains of Colorado.

Florida: The site is located in Nassau County, in the northeastern part of the state. The proposal "culminates the strongest effort in Florida's history to bring a federal project to our state," said Jeb Bush, commerce secretary. Further information on the state's offer was unavailable at press time.

Idaho: The state proposes to use the existing DOE-owned Idaho National Engineering Laboratory for its site, obviating the need for any land acquisition and the attendant litigation. According to Rick Tremblay, the state SSC coordinator, because the land has been so thoroughly surveyed, Idaho can prove to DOE that construction is feasible on time and within budget.

Most of the needed infrastructure and support services are already available at INEL, Tremblay said, including supercomputers, office space, medical facilities, and waste treatment facilities. Some 3,000 nuclear scientists and engineers are currently located at INEL, while Argonne National Laboratory West is also on site.

In addition to the existing facilities, which Idaho figures to be worth $3 billion, the state also offers road improvements that alone are worth more than $80 million, plus other enhancements that Tremblay said would total in the hundreds of millions of dollars.

Illinois: As expected, the Illinois proposal incorporates the Fermi National Accelerator Laboratory in Batavia, and offers the existing $1.4-billion Tevatron particle accelerator as an injector for SSC. State officials say this will save at least $400 million on construction costs, and $60 million in annual operating costs. Gov. James Thompson said the state would also provide site enhancements valued at $570 million, including land acquisition, housing, roads and university fellowships for SSC-related research.

"Building the SSC anywhere else would be a waste of future tax dollars and more than a billion dollars already spent on Fermilab," Thompson said. Illinois, which began its proposal work for SSC in 1983, claims to have been the first state to prepare for the collider, and the state has already approved bonding authorization of $140 million for land acquisition.

Kansas: Kansas, the "heartland" state at the center of the Lower 48, has proposed a site 15 miles south of Topeka, primarily in Osage County, that a state spokesman described as "rural but not remote." Its chief advantages, say state sources, are "superb geology very advantageous for tunneling," an excellent transportation infrastructure that includes state and interstate highways linking the site to nearby urban areas, railroad connections, and an airport 13 miles away (Forbes) with a 12,800-foot runway.

Another prime attraction, the sources say, is the absence of any impediments to such a mammoth construction project. Because it's rural, the site does not present the problem of many landowners who'd have to be relocated, or other potential hitches, and the state has assured DOE it can guarantee smooth delivery of "all the necessary arrangements" for the project. Commitment of state and local resources is "pinned down. . . . If DOE wanted to start construction tomorrow, it could" said a source involved in

the proposal.

Kansas did offer an array of site enhancements "that meet the spirit and letter" of DOE's invitation for site proposals, but spokesmen declined to put a figure on that offer, saying they preferred to follow DOE's practice of discretion about the site proposals.

The site has a lake at the center, a guaranteed water supply although the state has proposed as an alternative piping already-treated water from Topeka. And it's 26 miles from the University of Kansas in Lawrence.

Louisiana: The state is touting its geology, plentiful water supply and zero earthquake probability as principal advantages for its site, located 60 miles north of New Orleans. Gov. Edwin Edwards said Louisiana is "prepared to meet every commitment made by other states" in the area of site enhancements, and Rep. Richard Baker, R-La., said the state would spend "several hundreds of millions of dollars, just like everybody else." Baker noted that when DOE amended its site proposal to exclude consideration of direct financial incentives, "the number two priority [geology] became number one."

Michigan: Two sites are offered, one between Ann Arbor and Lansing and the other 20 miles south of Ann Arbor, home of the University of Michigan. The two were chosen for their geology and proximity to major research institutions. In addition to land acquisition, the state has pledged to provide any infrastructure improvements that may be needed, and will construct a residence for visiting scientists and their families, but a dollar amount was not specified.

Michigan's four major research universities have pledged to implement a "Community of Scholars" program to enable SSC scientists and engineers to utilize the campuses. They will also offer 12 new tenure-track positions in elementary particle physics and accelerator engineering. The sites are also located near "Automation Alley," which the state claims is the nation's fastest growing high technology corridor.

Mississippi: The proposal, which is backed by both Alabama and Arkansas, is the apparent unofficial winner in the value of land acquisition and site enhancements offered. According to Gov. Bill Allain, a total of $1.4 billion has been pledged toward the project by the three states, including $410 million from Alabama. Allain said his office needs no further authority from the state legislature to spend the funds as necessary.

The site would be located 20 miles from the Alabama border, roughly west of Tuscaloosa. The state offers a stable geology composed of chalk, which is easily drilled for tunneling.

Montana: The state's proposed site is in the Comanchie Basin, about 15 miles northwest of Billings. According to Theresa Olcott Cohea, chief of staff to Gov. Ted Schwinden, the site offers a subsurface relatively inexpensive to bore through and with no seismic activity in the last one-million years. The state offers one of the lowest electricity costs in the nation, and its construction unions have signed a "project agreement" that would minimize the potential for labor conflicts throughout the construction period.

Cohea said the state had not placed a dollar value on its offered site enhancements. These include a "center of excellence" at the SSC site to target particle physics research activities by the state's universities and DOE.

Nevada: Located two hours from Reno in the northern county of Humbolt, the site boasts land which is suitable for the low-cost "cut and cover" method of tunneling. The site land is owned 84% by the federal government, with most of the remainder already committed to a negotiated sale to the state. According to R. Leo Penne, director of the governor's Washington, D.C. office, the legislature has already approved $300 million in bonding authority to cover needed infrastructure improvements and land acquisition. Site enhancements would include the upgrading of the local airport and construction of a planned community nearby.

New Mexico: The site is located in the Estancia Valley, 40 miles east of Albuquerque, and is said to be geophysically ideal. It is in close proximity to the University of New Mexico and both the Los Alamos and Sandia national laboratories. So far, the state has authorized $11 million in funding for land acquisition.

Herman Roser, project coordinator, said the site's proximity to Albuquerque provides a good deal of the necessary infrastructure, as well as "high tech" industries. The area also offers labor rates which are well below the estimates used by DOE.

New York: The state has proposed three sites, and is the only one that claims to have gained international support for its plans. The northern site is located in the St. Regis Valley, just south of the Canadian border; another site is located between Rochester and Syracuse; and the third is proposed for

the Hudson Valley. All three are backed by the six New England states and New Jersey, as well as the government of Quebec, which not surprisingly has indicated it prefers the northernmost site.

A spokesman for Lt. Gov. Stan Lundine, who headed the state's SSC effort, said the state had not attached a dollar value to the site enhancements, but noted the state legislature had appropriated $50 million for land acquisition. He said the state had access to some of the least expensive power in the country, and could also purchase Canadian hydropower from Hydro-Quebec.

North Carolina: The state puts a value of $1 billion on the enhancements it's offering with its site, located just north of the Research Triangle area comprised of the cities of Raleigh, Durham and Chapel Hill. According to Bill Dunn, the SSC project manager, enhancements include the annual provision of $10 million in research funds to each of three major universities in the area: North Carolina, North Carolina State and Duke, over the 30-year lifetime of the project. Another $137 million is allocated for road improvements.

Additionally, Dunn said, the state's low labor costs will shave more than $300 million off the estimated $4.4-billion construction cost for the project, since DOE made the cost estimate based on construction occurring in California.

Ohio/West Virginia: Ohio will provide the resources necessary to ensure that the infrastructure needs are met at its site north of Columbus, but Gov. Richard Celeste insists "we don't need $1 billion to get into the ballpark." The governor, who declined to provide a specific dollar total for Ohio's proposed site enhancements, did acknowledge that $260 million was "in the ballpark."

Celeste also stressed the need for the Midwest to obtain its "fair share" of federal dollars as a factor in the site selection process. The choice is likely to be made not on the basis of financial inducements, but on "grounds of sound professional judgment," which include geology and access to the scientific community. West Virginia offers its expertise and skilled workforce in construction as well as West Virginia University.

Oklahoma: Oklahoma's site is 40 miles northwest of Oklahoma City, near the center of the state, that a source in the governor's office describes as "primarily wheat and cattle country." The flatness of the stretch, and the hydrology, geology and stable physical environment, are the chief advantages, since they would allow "backhoe" (dig and cover) installation of most of the SSC ring, a "much cheaper" approach than tunneling. "Only a couple of areas, 200 to 300 feet long, would require tunneling," the source said, adding that's a money-saver site evaluators can't ignore. "If DOE adheres to [its announced intention of] basing selection on technical considerations, we're extremely confident we'll make the short list" of best qualified sites," he said.

The busted oil boom in Oklahoma has left the area with an already-existing infrastructure of roads, housing and other resources that would immediately accommodate 6,000 to 7,000 construction workers, and it offers an excess of 13,000 megawatts of power "available right now," the source said.

The site spans two counties, King Fisher and Blaine, and the local population — which is sparse — is 95% behind the project, he said, meaning the site poses no political impediments. As for academic and cultural inducements, the location is about an hour from the state's two major universities — the University of Oklahoma and Oklahoma State University. Beyond that, the source touted "the tremendous way of life out here. People think of us as mostly cowboys and Indians, but it's just not true." He said the state did include a sealed envelope (money offer) in its proposal.

Oregon: Two sites were offered: in the northwestern part of the state near the Columbia River and the city of Hermiston, and in the Willamette Valley, equi-distant from the University of Oregon in Eugene and Oregon State University in Corvallis. Oregon estimates the value of its site enhancements at between $70 million and $80 million.

Included in the site enhancement proposal is the establishment of an Institute for High Energy Physics that would be located on the "SSC campus." Abundant and inexpensive power is another inducement. There's low-cost power from the Bonneville Power Administration, and officials with Pacific Power & Light have told the state government that they would attempt to identify and provide the site with low cost power, in some cases at prices lower than those charged by the Bonneville Power Administration. In 1988, PP&L said it could offer power at a price of between 1.4 cents/kilowatt-hour and 1.8 cents/Kwhr. Further, the state offers "a good quality of life, a well educated population, and a productive workforce."

South Dakota: Located in the eastern part of the state, between Sioux City and Howard, the site has broad regional support, with backing from the neighboring states of North Dakota, Minnesota, Iowa and

Nebraska. Jim Hill, the state's SSC coordinator, said North Dakota "believes it can offer one of the lowest cost sites in the country in terms of construction, operation and maintenance." Since it is located on virtually level ground, the state is able to use cut and cover construction techniques which Hill said could save two to three years in construction time.

Additionally, the state has obtained an unsubsidized bid from the local utility which it claims could save DOE more tha $1 billion in electricity costs over a 25-year period. Excluding land acquisition costs, the state estimates it will spend $40 million on infrastructure improvements, which include roads, sewer lines, and improved airport facilities.

Tennessee: The ring site is located about 30 miles south of Nashville in what project manager J. Frederick Weinhold described as "the best geology in the state," with a uniform flat bed of strong limestone. The proposal calls for boring of the tunnel at an average of 350 feet below the ground. The cost to the state for site enhancements is placed at between $130 million and $140 million, he said.

Gov. Ned McWherter said the the Tennessee Valley Authority will provide the needed electric power, noting that "by choosing an appropriate combination of options, DOE could obtain some of the least expensive reliable electical power in the country." The state will also endow 10 distinguished scientist positions in high energy physics, and participating public and private universities have indicated their intent to add another 20 faculty positions in elementary particle physics and related fields if SSC is located there.

Texas: The state offers two sites, one near Amarillo in the panhandle and the other in the Dallas-Fort Worth area. In addition to providing up to $1.1 billion in site enhancements, state officials said electricity to the Amarillo site could be provided at virtually no cost, resulting in a potential $1.2-billion savings to DOE over the facility's lifetime.

Edward Bingler, the project manager, said the state should soon have bonding authority totaling $1 billion, while a further $50 million to $100 million is expected to be provided locally at either site. Improvements to the site are expected to cost between $600 million and $700 million, and another $200 million in state funds are to be contributed to the capital of the utility providing the electricity to SSC. Sen Phil Gramm, R-Tex., said the bids represented "a commitment to make Texas a leader in high energy physics."

Utah: Two sites to the west of the Great Salt Lake were offered by the state, both of them on land which is virtually all owned by the federal Bureau of Land Management and, therefore, would require no land acquisition. However, one of the sites, dubbed Ripple Valley, would encroach slightly on Air Force property, and the Air Force has objected to it. Utah Gov. Norman Bangerter said in an Aug. 31 statement he had received a commitment from the Air Force to discuss the disagreement.

Bangerter asserted that "one of DOE's sister agencies has, in their private assessment, ranked Utah as one of the top five sites" for SSC. But he acknowledged the state was far from finished in its competition for the project, since congressional funding remains in doubt, and congressional "monkeybusiness" could make the project "a political football or a prize for the state with the most votes."

Washington: The state is prepared to invest $531.5 million over the lifetime of SSC for land acquisition, site development and enhancements, according to Gov. Booth Gardner. The project would be located in Lincoln County, 40 miles west of Spokane.

The state promises to provide $5 million to create an institute for particle physics at the University of Washington and to fund 10 new physics faculty positions, including three in accelerator physics. Washington also boasts an electricity rate it claims no other state can beat without subsidies, which officials maintain are specifically precluded from consideration under DOE criteria

Wyoming: Because of time and monetary constraints, the state chose to propose only one site. It is located in the extreme southeastern corner of the state in Laramie County, with the edge of the ring located about 20 miles east of the state capital, Cheyenne. According to Bill Tucker, deputy chairman of the state's public service commission, site enhancements are worth roughly $30 million and largely include infrastructure improvements, according to officials. If selected, the state would construct such facilities as a waste water treatment plant, would improve roads and would construct a line carrying potable and cooling water from Cheyenne to the site.

Wyoming offers a quality of life including low crime, low pollution, low taxes and quality education, Tucker said. The state has talked to the local utility and it is more than willing to do whatever it can legally do to provide electricity at the lowest possible cost, he added. — *David Kramer*

September 14, 1987

SENATORS SEEK 'PLAUSIBLE' SSC MONEY PLAN

The Senate Appropriations subcommittee on energy and water development last week voted to restore $10 million in FY-88 funding cut by the House earlier this summer for DOE's proposed Superconducting Super Collider, but issued a sharp warning to the Reagan administration that future congressional support for the $4.4-billion system could collapse unless the White House is able to develop a "plausible" plan for funding the project.

The subcommittee's decision to include the additional $10 million for SSC represents at least a partial victory for DOE, which has argued that the full $35 million requested earlier this year by the administration is essential if the project is to be completed by 1996, as planned. DOE has worked hard to convince the Senate to provide the money after the House in June reduced the administration's request to $25 million (*IE/FL*, 22 June, 1).

In its version of an FY-88 energy and water spending bill, the House in June approved elimination of the $10-million figure, which DOE said it needed to order long lead-time equipment necessary to begin project construction. In cutting the money, the House Appropriations Committee cited the administration's inability to identify future funding sources for SSC.

Despite last week's action by the Senate subcommittee, DOE may still find itself hard-pressed to spend any funds on construction-related items next fiscal year. Under an amendment offered by full Committee Chairman John Stennis, D-Miss., use of the money would be restricted to "general science and research." Specifically, Stennis said, the $10 million would be used by DOE to fund further SSC r&d and to add personnel, largely needed to assist the department in making a final site selection next year.

Stennis' amendment was initially opposed by subcommittee Chairman J. Bennett Johnston, D-La., who argued that the Senate should approve the $25-million figure approved by the House "unless and until DOE and the administration can come up with a plausible way of funding" SSC. Johnston and other panel members are concerned that the administration may be tempted to curtail funding for other science projects to pay the future SSC costs.

Said Johnston: "There are states out there salivating like you can't believe, thinking they are going to get an $8-billion project when there is just no way of funding it." (DOE has estimated a total project cost of $4.4 billion in constant FY-88 dollars.)

Johnston added that even if pending legislation raising taxes passed Congress and was signed by the president — at best a remote possibility, Johnston said — the energy and water development account would see little of the additional money. "By this time next year they will pick a site and enthusiasm levels will be greatly diminished, and we will still face the question of how to pay for it," Johnston added.

Idaho Republican Sen. James McClure, agreeing with Johnston's assessment, told the committee that he has repeatedly warned the administration that "if it wants SSC it must specify where the money is going to come from. Do they want to cut or sacrifice other research projects?"

McClure said he also warned the administration against assuming that the apparent widespread support for SSC in Congress will continue once a preferred site is chosen. "Once a site is picked, political support will be gone. Should we appropriate the entire amount of money for continued research and selection costs? I am very fearful that the effect of the combination of these circumstances will be that once a site is selected, the political support will be gone and [SSC] will not be built," McClure explained. "I don't mean to be gloomy, but we have to be realistic."

Sen. Pete Domenici, R-N.M., argued, however, that the $10-million addition is warranted, and added that the money will not, as DOE had asked, be used for construction. "We don't intend to start the project," Domenici said. — *Jeff Barber*

September 21 , 1987

SENATE PANEL BACKS DOMENICI GUIDELINES FOR SSC COST-SHARING OFFERS

States competing to host DOE's proposed Superconducting Super Collider would be subject to generic guidelines establishing minimum requirements for cost-sharing proposals, under report language attached last week to a Senate version of an FY-88 agency spending bill.

The Senate Appropriations Committee — marking up its energy and water development appropriations bill Tuesday — approved an amendment offered by New Mexico Republican Pete Domenici, which would require DOE to obtain two independent evaluations of the economic benefits provided by the $4.4-billion SSC. These assessments would also include recommendations for a plan

common to all states in sharing program costs.

Domenici, who earlier this summer won congressional support for legislation barring the department from considering financial incentives when selecting a preferred SSC site, has long expressed concerns that wealthier states may have an advantage over those unable to offer lucrative inducements.

Domenici's amendment also specifies that the independent evaluation take into account varying conditions and laws within the states that would affect such a plan. The language states that the goal is "to develop a cost-sharing plan that any of the competing states might . . . reasonably be expected to meet." DOE, according to language included in the bill, is required to complete its cost-sharing plan by Dec. 31, 1988, and should submit it with its FY-90 budget.

In a related matter, senior DOE officials last week discounted statements made earlier this month by William Wallenmeyer, the agency's director of high energy physics. Wallenmeyer, speaking at a meeting of the High Energy Physics Advisory Panel in Germantown, Md., suggested that the SSC project could be left with insufficient r&d funding should it be forced to take $7 million to $8 million needed to evaluate site proposals from the $25-million budget provided by the House in June for FY-88 (*IE/FL*, 14 Sept, 6).

According to a DOE spokesman, the agency currently intends to pay for the $7 million site-selection process from the energy research budget.

Wallenmeyer last week clarified his remarks and explained that his concerns were founded on one of several options his office was then considering. Wallenmeyer said that going solely by the House allocation of $25 million in FY-88, the office would be hard-pressed to continue necessary work on SSC should it be required to use $7 million or more to pay for site studies. The department had asked Congress for $35 million in SSC funds.

The Senate Appropriations Committee, however, may have rendered the entire argument moot when it agreed Tuesday to provide $35 million for SSC in FY-88. The bill, which must be approved by the full Senate and win the endorsement of a House-Senate conference committee, stipulated that the money must be used for r&d activities.

September 28 , 1987

ALL 25 STATES THAT PROPOSED SITES FOR SSC ARE REPRESENTED among the 36 site proposals for the Superconducting Super Collider that DOE has forwarded to the National Academies of Sciences and Engineering for evaluation. Seven proposals were eliminated in the DOE screening process for failing to meet one or more criteria on the basic qualifications list.

The disqualified proposals included one from New York state, for a site that extended into Canada; three from private parties in Texas; one from the Larsen Institute of Technological Evolution in Utah; one from A-Enterprises in Washington state; and one from Paul Jablonka for "Moon Area L-5," with no state given (since he was proposing a lunar site).

The NASE evaluators will weigh technical and cost considerations, with primary emphasis on the technical criteria — geology and tunneling, regional resources, environment, setting, regional suitability, and utilities. Their job is to select but not rank an undetermined number of "best qualified sites," which DOE is scheduled to announce in January. After further evaluation of all the BQ sites by DOE and preparation of an environmental impact statement, Energy Secretary John Herrington is to announce the preferred site next July.

October 19, 1987

HOUSE SCIENCE VOTES 38-6 TO SPEND $1.1B ON SSC IN NEXT THREE YEARS

The House Science, Space and Technology Committee overwhelmingly approved legislation last week that would authorize the federal government to spend nearly $1.1 billion for the Reagan administration's proposed Superconducting Super Collider over the next three fiscal years.

After more than five hours of debate Thursday, the panel reported by a 38-6 margin an authorization bill that would provide SSC with $25 million in operating expenses and $10 million in construction funding in FY-88. The measure, which sets forth project funding levels for the next three fiscal years, would allocate $86 million in operating expenses and $283 million in construction funds in FY-89, and $90 million in operating expenses and $585 million for construction in FY-90.

DOE has estimated that it will require $35 million in this fiscal year, $348 million in FY-89 and $615 million in FY-90 if SSC, which it estimates will carry a final cost of roughly $4.4 billion in FY-88 dollars, is to be completed by the 1996 target date.

While the panel was originally scheduled to vote on a straight authorization bill that would have

provided DOE with its full $35-million request for FY-88 and additional funding determined to be necessary in future years, the committee agreed to act instead on a substitute offered by Chairman Robert Roe, D-N.J., and ranking Republican Manuel Lujan of New Mexico. In addition to setting funding levels for the project, the substitute measure establishes a series of requirements DOE must meet in developing the SSC facility.

Among the major requirements contained in the bill is language directing DOE to place a greater emphasis on technical considerations than on so-called "life-cycle costs." The bill asks that in assigning relative weight to the selection factors, life-cycle costs be set at 25% and technical evaluation criteria at 75%. The bill, moreover, bars DOE from including in its life-cycle project costs any agency-owned site improvements or equipment.

The substitute bill would also require DOE to develop and employ any new or advanced technologies that may be appropriate for SSC and to review and report to Congress each year advances in basic and applied research (including superconductivity) that could reduce the cost or enhance the performance of the system. The bill additionally asks that DOE select, within six months of the bill's enactment, an SSC project manager.

Moreover, the Roe-Lujan bill expressed concern over the high cost associated with SSC and directs DOE to "ascertain the extent and nature of interest" by foreign countries and other parties in cost-sharing.

Finally, the bill requires the president to propose a funding plan for SSC that "supports, and does not in any way diminish, other science and space research activities."

Despite the strong support of committee members for the substitute amendment, a number of representatives raised concern that the potential benefits that may come from the project cannot justify its cost given existing budgetary constraints.

Rep. Jim Chapman, D-Texas, told members that the project is certain to experience sharp cost overruns once work begins. "This project is guaranteed to exceed cost projections if for no other reason than work on technology that is needed still remains to be done," Chapman said.

Chapman said the project supporters have still to provide any compelling evidence that the public will benefit from SSC and joined with others in questioning whether other science projects, including human genome mapping, and the possible construction of a fusion reactor should not receive equal attention. Opponents also questioned whether the panel has attempted to establish priorities on which projects should be pursued.

"We should look carefully at our experience in previous projects this committee has authorized, such as the SST (Supersonic Transport) and the Clinch River Breeder Reactor," Rep. Buddy MacKay, D-Fla., told the members. "In both cases the consensus was: 'Let's rush to get it authorized and worry about the consequences later.' "

Project supporters, including Roe, appeared unswayed. "This [SSC] is an issue whose time has come. Does this country wish to be on the cutting edge of high energy physics or doesn't it?" Roe asked. "This is a major decision toward rekindling the effort in pure scientific research in this country."

October 19, 1987

NEW YORK WITHDREW ONE OF ITS THREE SSC SITE PROPOSALS last week after residents of the mid-Hudson Valley vigorously protested locating the Superconductor Super Collider near Walkill in Orange County. The protests were voiced at a recent hearing held by New York Lt. Gov. Stan Lundine, a former congressman who has been heading the state's effort to win the $4.4-billion accelerator project requested by DOE and now being considered by Congress.

Lundine announced the site withdrawal Thursday. A Washington source explained that the Walkill location had been a second-choice selection for that region after an earlier Hudson Valley site was ruled out, and that apparently there wasn't enough time to canvass the residents thoroughly before the proposal was offered.

The remaining New York locations in the running are the so-called "Rochester site," in Wayne and Monroe counties, and "Northern site," in St. Lawrence and Franklin counties. A fourth New York site that straddled the Canadian border was disqualified by DOE early on.

November 23, 1987

SSC BACKERS CONSIDER STALLING LEGISLATION

Concerns were expressed last week that stock-market-driven budget-cutting efforts in Washington will further imperil the $4.5-billion Superconducting Super Collider. Although the full House is prepared to act on an authorization bill for SSC as early as next week, congressional backers fear that bringing it onto the floor at that time will risk making SSC a high-profile target for the axe, according to a key House staffer.

Rep. Robert Roe, D-N.J., who chairs the Science, Space and Technology Committee, may decide to hold the measure until the budget-cutting fever abates.

The committee-passed bill would restore the full $35 million requested by the Reagan administration for SSC in FY-88. The House Appropriations Committee earlier had lowered that request by $10 million, the amount the White House request had earmarked for construction. An appropriations committee staffer acknowledged last week that the cut was made partly because SSC had not specifically been authorized by Congress. The panel, he explained, did not want to be "burned" as it had with some other large projects, like the Clinch River Breeder Reactor, where the "plug was pulled" after funds had been appropriated.

Roe, in addition to wanting to restore the full $35 million administration request for SSC in the House, feels the project still needs to be formally authorized by Congress. The bill would also authorize nearly $1.1 billion in federal expenditures for SSC in FY-89 and FY-90. Moreover, the committee-passed authorization bill also attaches several conditions to approval of the administration's SSC program. These include requirements that the the funding for SSC not be made at the expense of other science programs, that technical evaluation criteria account for the bulk of the evaluation process, that DOE appoint a project manager and that DOE develop and employ any new or advanced technology that may be appropriate for SSC.

Meanwhile, the Senate last week passed its energy and water development appropriations bill, containing the full $35 million requested for SSC in FY-88. The Senate, however, stipulated that none of the funds are to be used for construction, directing instead that they be used for continuing r&d, site selection studies and other support activities.

The Senate and House versions of the appropriations bill will need to be reconciled by a conference committee. There is considerable doubt whether a stand-alone appropriations bill will ultimately emerge. The more likely outcome is that the bill will be folded into an omnibus one-year continuing resolution.

A Senate Energy staffer said the committee feels no specific authorization is needed for SSC. The secretary of energy is authorized to initiate SSC-type projects under general authorization legislation passed in the 1970s, he explained.— *David Kramer*

November 23, 1987

CALIFORNIANS SPLIT OVER SSC SITING IN STATE, TAKE FIGHT TO HILL, DOE

California, generally viewed as a leading contender among candidate sites for the Superconducting Super Collider, has become the battleground for a highly visible fight between pro-development, pro-SSC forces and those who want the huge machine to be located in another state. Both sides are doing their best to influence the SSC site selection, a process that was designed to be kept well-insulated from political influences.

Last week, pro-SSC forces staged a lobbying blitz on Washington, meeting with members of the California congressional delegation as well as officials of DOE and the Office of Management and Budget. The purpose: to counter the impression left by SSC opponents that the state does not want the collider. That negative perception is magnified by the fact that a comparable degree of opposition to SSC has yet to arise in any other state, with the exception of New York, where one of the state's three site proposals was withdrawn from consideration in the face of local opposition.

For their part, the anti-SSC forces in California have already put their arguments forth in a "statement of disqualification" sent to DOE officials. The statement urged that one of the proposed locations, straddling Yolo and Solano counties, near Davis, be invalidated and deleted from the selection process. Led by Craig McNamara, son of former Defense Secretary Robert McNamara, the opponents argue the collider would "irreparably impact 600 square miles of prime agriculture with a land value of $1 billion."

But the site selection process is currently in the hands of a technical evaluation committee formed by the National Academy of Sciences/National Academy of Engineering. California SSC supporters in

town last week acknowledged they do not think it proper to try to influence the technical evaluation process, which is now expected to be completed by around the first of the year.

The 20-member NAS/NAR panel has been given the task of coming up with an unranked short list of sites for DOE's further consideration. DOE is supposed to narrow the list to one site by next July.

Both sides claim to represent the majority of farmers and other residents in the area of the two proposed California sites. The pro-SSC forces at the site near Davis say their polls indicate up to 82% support for SSC. While the anti-SSC group has no comparable poll, they claim to have gained the signatures of nearly 20,000 local petitioners opposed to the facility. The proponents, in turn, charge that many of those signatures represent children and therefore are invalid.

SSC supporters such as Gaye Lopez, director of community relations for the Yolo-Solano SSC, say they hope last week's lobbying effort will sway lawmakers and policymakers after the NAS/NAR review is completed. Their visit was timed to coincide with a Washington visit by California Gov. George Deukmejian. Naturally, the California SSC proponents cannot conceive of the possibility their state might be left off that list.

SSC opponent Alberta Lewallan, who represents the Coalition Against the Super Collider Site at the Stockton location, says the anti-SSC forces will stage their own Washington lobbying trip at some point. She feels proponents have misrepresented the amount of cropland that would have to be removed from production as a consequence of SSC. Supporters have maintained the figure is only around 250 acres, but Lewallan claims the actual acreage figure is 7,690. Moreover, harvesting of one of the major crops in the area, walnuts, would be hampered in the area adjacent to the tunnel because the machines used to shake nuts off the trees would disturb the sensitive collider experiments.

"This belongs in the desert, not on prime farmland," Lewallan said.

But supporters counter that most of the land to be acquired by DOE could remain in agricultural usage, and they add that SSC could even preserve farmland by protecting it from other development. The two sides have also squared off on other issues, including safety, disposal of low-level nuclear waste generated at the facility, development and the resulting pollution.

DOE officials who met with the pro-SSC forces last week included C. Anson Franklin, acting assistant secretary for congressional, intergovernmental and public affairs; Regina Borchard, executive director for SSC coordination; and Robert Diebold, SSC division director. — *David Kramer*

November 30, 1987

INDUSTRY GROUP FORMS TO ADVANCE COLLIDER

A new industry group has been formed to help spur the Superconducting Super Collider over the political and fiscal hurdles it faces in the coming year. Called the SSC Industry Group, the ad hoc organization was formed in September and has held three meetings to date.

Jerry Staub, corporate manager of legislative affairs at General Dynamics, who organized the group, described it as an informal collection of 50 or so companies, all with a vested interest in seeing the $4.5-billion project move forward. Although there is no formal membership list and no dues, companies that have attended meetings include General Electric, Grumman, Air Products, Teledyne, Westinghouse, Union Carbide, Brown Boveri, GA Technologies and Bechtel.

Staub said the group will hold its next meeting in January, when it will attempt to put together an operating strategy. While noting "something needs to be done by industry" to keep the project going strong, he admitted the group so far is unsure what that effort should entail. Meetings to date have been primarily informational in nature, with DOE officials and key congressmen giving their views on the megaproject. Sen. Pete Domenici, R-N.M., addressed the most recent meeting, reportedly telling attendees he felt SSC funding was relatively safe for the current fiscal year at least, due to the small size of the request ($35 million).

"There's a lot of support for the project right now," Staub said. "But we don't think the program is home free. As the sites are narrowed and the amount [of funding required for the project] increases, the battle will continue." Next year will be "critical," since the SSC site will be selected and the required funding level for the project will jump "by an order of magnitude" to $345 million in FY-89, he noted.

The group is keeping in close contact with Universities Research Assn., the DOE contractor for the design of SSC. Staub feels there is no potential for conflict between the two groups, since URA would be interested only in operating SSC, not building it. "If they want to operate it after it's built, that's fine with us," he said. — *David Kramer*

November 30, 1987

BUDGET ACCORD EFFECT ON SSC FUNDING UNCLEAR BUT PROBABLY MINIMAL

Congressional and DOE sources last week said it remained uncertain whether and by how much the $4.5-billion Superconducting Super Collider will be affected under the budget accord reached between lawmakers and the administration. Under that compromise, the specific program-by-program cuts were left for Senate and House appropriations committees and their subcommittees to determine in the coming weeks.

While most sources felt SSC will get by with minimal, if any, impact during the current fiscal year, the outlook for FY-89 money and beyond was made more murky than ever by the budget accord. That's because SSC funding is supposed to jump by an order of magnitude in FY-89, to $345 million, from a mere $25 million to $35 million this year. Meanwhile, the FY-89 deficit-cutting target rises to $45.8 billion, from $30.2 billion in FY-88.

Several sources quoted Sen. Pete Domenici, R-N.M., as telling a recent SSC gathering that the project would not be significantly affected by the budget cuts this year, since the funding level was relatively small. But Domenici's office was unable to confirm the remarks and said the senator could not be reached.

As it now stands, a total of $2.6 billion is supposed to be cut from all federal non-defense discretionary spending programs. Spread across all the agencies, this amounts to about a 3% reduction. It remained unclear last week whether the appropriations panels will spread those cuts uniformly through all federal programs, or selectively apply the cuts.

But sources pointed out that one of the primary reasons for the budget accord was to avert the automatic across-the-boards cuts called for under the Gramm-Rudman-Hollings Act. They reasoned that selective cuts therefore are more likely to result.

November 30, 1987

ILLINOIS' PROPOSED SITE FOR THE SUPERCONDUCTING SUPER COLLIDER has no particular advantage over other states', even though the Tevatron collider at Fermi National Accelerator Laboratory could be incorporated into the new machine, according to the head of the consortium that operates Fermilab for DOE.

Edward Knapp, president of the Universities Research Assn., said last week that the advantages Fermilab offers for SSC would be offset by the need to remove the accelerator from operation for an extended period during conversion. Knapp told a group of California SSC supporters that Fermilab is expected to be the center for high energy physics research for the next 10 to 15 years, and taking it out of commission "would have a severe impact on scientists who want to continue this work during that period."

Use of the Tevatron, which could serve as a proton injector for SSC, could save up to $400 million in the cost of SSC, according to Illinois officials. But the existing accelerator would first require substantial modification, since the beam focuses of the two machines differ. Such modification reportedly would take several years.

The Illinois site is said to be at a further disadvantage because its geology would require boring a tunnel several hundred feet below the surface. That would sharply increase construction costs as compared with a site where tunneling could be completed with a minimum of 30 feet of soil cover.

URA operates not only Fermilab but also the SSC Central Design Group, which developed the design for the $4.5-billion collider. Knapp stressed, however, that the consortium of 56 universities "has been careful to stay as far away from the site selection process as we can." He told *Inside Energy/with Federal Lands* that the group was "absolutely neutral in the site business," and has gone out of its way to ensure that there is no perception of conflict of interest in its dual roles.

December 7, 1987

HERRINGTON PITCH FOR SSC FUNDING DOESN'T MENTION LIKELY SOURCES

Energy Secretary John Herrington last week defended the federal government's role in financing the Superconducting Super Collider even while acknowledging the growing uncertainty over where the money will come from. In a speech to an SSC conference in Denver Dec. 3, he said budget belt-tightening would create "serious obstacles" to SSC, and urged attendees to "spread the message of the importance of [SSC] and work on its behalf until it becomes a reality."

"It has become clear that the rapid acceleration and benefits of science could not take place without

sustained financial support by the federal government," Herrington said in remarks prepared for the conference. "Involvement of federal tax dollars in the construction of the super collider, therefore, is not only essential, it will continue a long and needed tradition of prudent federal investment in science." And, he noted, "the real question is not: can we afford to construct the super collider? It is: can we afford not to?"

But Herrington's remarks shed no new light on how or from where DOE proposes to obtain the necessary funds, which are due to climb to $345 million in FY-89. Repeating earlier assertions that foreign governments "will be willing to make a significant investment" in SSC, he also reiterated the government's position that Congress must first provide a "concrete, visible commitment" that domestic funding is assured before the U.S. will approach other countries.

In that light, he applauded the widespread support exhibited by House members for an SSC authorization bill, and asserted that Senate sponsors for a similar measure are now being solicited. DOE is also "hopeful" that Congress will soon provide it with its full $35 million FY-88 SSC funding request, Herrington said.

Pointing to the existing"track record" of commercial spinoffs resulting from earlier accelerators — including the television, electron microscope, integrated circuits and new techniques for medical diagnosis — the energy secretary said the chances for equally valuable spinoffs from SSC are "excellent." He also warned that other countries' commitments to high energy physics will draw U.S. physicists abroad if the nation "relinquishes its half century of leadership.

DOE remains "absolutely committed" to determining the SSC site on the basis of the selection process it laid out earlier this year, he said, assuring the audience the process will be "fair and equitable to all parties." The National Academy of Sciences and the National Academy of Engineering will deliver their assessment of the best qualified sites to DOE next month, he noted.

SSC is one element of President Reagan's "massive commitment" to basic scientific r&d, which has resulted in a 50% increase in federal support for science since 1982, Herrington maintained. Taken together with Reagan's proposed doubling of the National Science Foundation's budget over the next 10 years, the $4.5-billion SSC "represents an unprecedented growth potential for United States science."

December 14, 1987

DOUBTS GROW OVER FUNDS FOR SUPER COLLIDER

Amid growing gloom over prospects for funding the Superconducting Super Collider, Sen. Pete Domenici, R-N.M., and seven other senators met with Energy Secretary John Herrington last week to hear the DOE chief renew his personal commitment to the project. The meetings came one week after Domenici told a group of SSC supporters he was unable to leave them "with a great deal of hope" for getting outyear funding for the $4.5-billion project.

Domenici warned an SSC symposium in Denver Dec. 3 there was "little chance" of getting $500 million to $600 million for the collider next year. Aides to the senator last week acknowledged the figures cited were higher than the actual administration request for next year, but were unable to explain the dicrepancy. The Reagan administration has proposed funding of $348 million in FY-89, followed by $615 million in FY-90.

Domenici's remarks to the SSC conference were taken by many as a particularly heavy blow to SSC, since the senator has been something of a champion for increased federal support for r&d activities. Peter Carruthers, head of the physics department at the University of Arizona, said Domenici "really shook everybody up," while another attendee said his remarks "threw a barrel of cold water" on the project.

Echoing other lawmakers, such as Ohio Gov. Richard Celeste, Domenici noted that support for SSC is likely to diminish rapidly once the field of states is narrowed in the DOE site selection process. He suggested that Herrington string out the process in order to keep the political support for SSC as strong as possible for the longest period possible.

One of Herrington's breakfast sessions last week included Domenici, Sens. Wendell Ford, D-Ky., Timothy Wirth, D-Colo., Don Nickles, R-Okla., and Daniel Evans, R-Wash. The other session was held with Sens. Dennis DeConcini, D-Ariz., J. Bennett Johnston, D-La., and Arlen Specter, R-Pa., all members of the Senate Appropriations subcommittee on energy and water development.

A DOE spokesman said Thursday only that Herrington renewed his personal commitment to the project at last week's meetings. A staffer for one of the senators in attendance said Herrington was "testing the waters" of Senate support for SSC funding, while also trying to "clear up the confusion" generated by reports that the National Academy of Sciences and the National Academy of Engineering

had completed their list of finalists for the SSC site (related story elsewhere in this issue).

A second aide said Johnston, who chairs both the authorizing and appropriating panels for the project, told Herrington the administration must come up with a financing plan for the project, and must also become more demonstrably supportive of SSC.

Although the Senate has included the full $35 million requested by the administration for SSC in FY-88 in its appropriations bill, many observers feel the House version, which allocated just $25 million for the project, could be favored in the conference committee that will reconcile the two versions.

Rep. Ralph Hall, D-Texas, who chairs House Science, Space and Technology's subcommittee on international scientific cooperation, told the Denver conference a $1-billion SSC authorization bill which has been approved by the full committee requires "considerably more groundwork" before it will have a chance of clearing the full House. "Given the current budget climate in the House, now is not the time to bring a major new spending measure to the floor," he said.

Hall pointed out that the science committee has already supported several very costly programs, including NASA's space station, estimated to cost between $16 billion and $30 billion; the human genome project, projected to require up to $3 billion; a doubling of the National Science Foundation budget, at a cost of $1 billion annually for 10 years, and the proposed University Research Facility Revitalization Act, expected to run $2.5 billion annually.

At present, total federal spending for civilian science is $10.7 billion. In peak funding years, SSC and the space station could cost $5 billion alone, accounting for nearly half of that entire budget. "There is a general recognition in the committee that considerably more needs to be done to establish spending priorities and examine the timing of expenditures before the [authorization] bill moves forward," Hall said.

The lawmaker is co-sponsor of a bill to direct DOE to consult closely with congressional committees in determining the extent of international cooperation. — *David Kramer*

December 14, 1987

REPORTS OF NAS 'SHORT LIST' OF SSC STATES DENIED BY ACADEMY, DOE

DOE and National Academy of Sciences officials last week denied published reports that NAS and the National Academy of Engineering had compiled an eagerly awaited short list of best qualified states for the Superconducting Super Collider. Several so-called lists have surfaced in recent weeks, all citing Colorado, Illinois, New Mexico, North Carolina, Texas and Utah as finalists. But some reports also added Arizona, California, Mississippi and Ohio as possible candidates.

NAS/NAE are supposed to deliver the short list to DOE by Jan. 4, and congressional and industry sources acknowledged it is possible that the academies have indeed made the selection by now. Sources attached varying degrees of credibility to the purported short list, with some pointing out that most of the states named have actually been rumored to be finalists for several weeks.

Separately last week, DOE congressional affairs and SSC project officials met with Illinois Gov. James Thompson and the state's congressional delegation. According to state sources, Thompson was told that Illinois' proposal to incorporate the Tevatron accelerator at Fermi National Accelerator Laboratory into SSC as a particle injector was feasible and could cut $350 million from the project's cost. That credit was less than the $500 million the state had estimated in its proposal.

DOE spokesmen declined to confirm the credit, saying it was part of the non-public NAS/NAE evaluation process. But they confirmed that agency officials had met with Thompson on the issue.

DOE issued a statement last week calling the short list reports "incorrect," and asserting it had received no list from NAS/NAE. The academies will provide their assessment "in the next few weeks," DOE said, and it will be reviewed "to confirm that the evaluation was conducted against the technical criteria and cost considerations as specified by DOE." The agency will then determine the best qualified list, it said, announcing the decision in January.

A spokesman for NAS/NAE confirmed its supercollider site evaluation committee had not completed preparation of its list of recommended sites for SSC. "Reports in the press purporting to disclose the committee's list of recommended sites are not accurate and should not be attributed to the academies' committee." The panel is working "intensively" to complete its report and list of best qualified sites by Jan. 4, he said.

Several sources last week pointed out that, given the increasingly dire funding prospects for the $4.4-billion SSC, it would be politically unwise to exclude such powerful states as New York and California at this stage. In recent remarks, Sen. Pete Domenici, R-N.M., and Ohio Democratic Gov.

Richard Celeste both pointed to the need to keep the political support base for SSC as broad as possible for the longest time possible.

But the NAS/NAE committee is not supposed to include political considerations in its evaluation process, and some sources pointed out that the rumored short list did appear valid from the standpoint of technical criteria. The panel's deliberations are to include geology and tunneling, regional resources, environment, setting, regional conditions and utilities in its evaluation of the states' proposals.

December 21, 1987

SSC GETS SEPARATE OFFICE AT DOE, EQUAL STATUS WITH HEP PROGRAMS

DOE has established a new office for the Superconducting Super Collider, splitting it off from other high energy physics activities within the Office of Energy Research. Providing SSC equal status with HEP and nuclear physics is seen as a prelude to a separate line item in the DOE budget request for FY-89. Through FY-88, SSC funds are to come from the HEP program.

Named director of the new office is Robert Diebold, formerly the staffer on SSC within HEP. Diebold reports directly to Wilmot Hess, the associate director of energy research for high energy and nuclear physics. Raymond Fricken, who is also acting director of high energy physics, was named executive officer of the new division and Guy John Scango, project engineer. Other personnel will include a magnet program manager, a program analyst, a detector program manager, an accelerator physicist and an international specialist.

Diebold, who revealed the new office at last week's meeting of the High Energy Physics Advisory Panel, said the mission of the new office will include providing technical and management direction for SSC activities; assisting in the establishment of research policies for SSC; and formulating long-range plans and project goals and priorities. The office will also draft SSC budget submissions and justification, and will assist in the defense of those requests through DOE, the Office of Management and Budget and congressional committees.

The SSC office will also develop plans for advanced technology r&d required for the machine itself and for initial and future detectors. It will fund and administer SSC advanced technology r&d activities conducted at universities and other federal laboratories, organize conferences and workshops, participate in negotiating international collaborative agreements, direct SSC construction activities, and monitor operation of the completed facility.

Diebold said that funding for generic detector r&d, which is now coming out of the HEP technology program, will shift to the SSC office as prototype detectors are built. As the new office accumulates technical experience, it is expected to reduce its heavy dependence on HEP division expertise, he added.

The SSC office will publish a monthly newsletter, with the first issue expected sometime this month, Diebold said. It will also send periodic mailings on the collider to more than 2,100 members of government, educational institutions, industry, media and the scientific community. In addition, an SSC speakers bureau has been established within DOE to address public forums on the collider.

December 21, 1987

SSC DOWN $10M IN '88; DEEP CUT IN '89?

Prospects for the Superconducting Super Collider grew darker again last week as Congress cut the first year's appropriation for the project to $25 million and reports surfaced that Reagan administration budget officials had slashed FY-89 funds substantially below the original request of $348 million.

House and Senate conferees working on an omnibus continuing resolution agreed to provide $25 million for SSC in FY-88, $10 million below the administration's request. The Senate, which had approved the full $35 million with the stipulation that none of the money be used for construction of the facility, bowed to the House version in the face of severe deficit reduction pressures.

Acknowledging the congressional action on SSC, Energy Secretary John Herrington last week told *Inside Energy/with Federal Lands* that the cut will "force us to change priorities." He did not elaborate.

More ominously for the $4.5-billion project, congressional and industry sources last week said that the Office of Management and Budget is believed to have substantially cut DOE's SSC funding proposal for FY-89. The amount of the cut, which reportedly took place during the internal budget-drafting process, could not be determined.

Several DOE officials, including Herrington, insisted last week they had not received their "pass-

back" of DOE's budget from OMB, and would have no idea what it contained for SSC until it is released in early January. But several congressional and industry sources said the SSC FY-89 request may be as low as $100 million, far below the original proposal of $348 million.

Herrington stressed that the project will continue, regardless of budgetary circumstances. "The SSC is a natural; it's just a question of timing," he said. "It may be me, it may be the next secretary of energy, but it'll happen. And I believe that we have gotten off to a very good start with SSC."

Herrington again laid the blame for SSC's uncertain future on Congress, which he said had failed to establish the project as "a national priority." He added, "Until that happens, SSC is going to limp along."

Another DOE source acknowledged that SSC construction may have to be left to the next administration. Funding for operating existing DOE accelerators is difficult enough to find, even without the huge additional demands SSC will place on the high energy and nuclear physics budget. "You don't build new toys when you can't use the one's you've got," he noted.

A House aide last week said that DOE, in response to OMB pressure, agreed to slice $37 million from its FY-89 request for its high energy and nuclear physics programs. But James Decker, acting director of energy research, said he had no knowledge of such a cut. The reduction reportedly was made prior to any across-the-board cuts that might be mandated by the recent deficit reduction compromise between Congress and the administration.

The exact amount of DOE's request to OMB for the high energy and nuclear physics program for FY-89 has not been released. The administration's FY-88 budget request of $814 million for the two programs was cut by House and Senate conferees late last week to $804.5 million.

Operators of DOE's high energy physics facilities complained last week they are unable to utilize their labs at currently contemplated FY-88 funding levels. And at least two new facilities, the Continuous Electron Beam Accelerator Facility, under construction in Newport News, Va., and the Relativistic Heavy Ion Collider, slated to be built at Brookhaven National Laboratory beginning in FY-89, have already been delayed or stretched out as a result of budgeting difficulties. — *David Kramer*

January 5, 1987

BATTELLE FORECASTS 4.3% RISE IN 1987 R&D SPENDING, HEAVY ON DEFENSE

The overall U.S. outlay for r&d is expected to rise this year to $127.4 billion, with a real (as opposed to inflationary) increase in private and public expenditures of 4.33%, slightly higher than the 10-year average rate of 4.26%. Industry will continue to conduct the lion's share of it — $94 billion worth, or 73.5%.

That 1987 forecast comes from Battelle Memorial Institute in its annual comprehensive report on r&d funding prospects for the coming year. It's release last month also preceded release of the Reagan administration's proposed budget for the fiscal year beginning next October.

The Battelle forecast puts the federal contribution at $14.7 billion, or 11.5%, and shows a sizable climb in the share of that to be spent by the Defense Dept. — from 65% of the estimated federal r&d spending for 1986 to 69.7% in 1987. DOE's share is predicted to drop from 9.5% in 1986 to 7.6% in 1987, and the two other federal agencies also dominant in r&d spending — Health and Human Services and NASA — are seen as losing ground, too.

The report notes that the increases in defense spending will go primarily to long-term acquisition of major weapons systems, including the Strategic Defense Initiative, and advanced aircraft, along with r&d to support them.

In contrast, spending for energy supply and conservation will decline, the report says, but not funds for energy programs related to national defense or DOE's general science programs. According to a release accompanying the forecast, "Stabilization of prices and increased supplies have reduced the apparent short-term urgency for R&D in support of programs on fossil and alternative energy sources. Energy projects involving short-term or low-risk R&D likely will be financed by industry."

Other areas expected to suffer cuts are biological and health sciences and the so-called "soft" sciences, such as environmental and ecological research.

Battelle sees growing industry support for r&d in electronics, communications, sensors and advanced machinery, and in "those fields most directly influenced by the need for more energy-efficient products and processes." The private research firm expects the aerospace industry to retain leadership in total r&d, spending approximately $23.6 billion (almost 75% of that in federal funds), and the electrical machinery and communications industry to spend the second largest chunk — about $21.3 billion (66% from industry).

The industrial sectors expected to spend more than $1 billion this year on r&d include:

— Petroleum products — $2.4 billion, almost all by industry.
— Chemicals: $10.8 billion, 97.1% by industry.
— Machinery: $10.1 billion, 89.7% by industry.
— Autos, trucks and parts, and other transportation equipment: $8.7 billion, 81.3% by industry.
— Professional and scientific instruments: $6.1 billion, 87.8% by industry.
— Rubber products: $1.2 billion, 85.8% by industry.
— Food and beverage products: $1.04 billion, almost all by industry.

The forecast, according to Battelle's press release, "indicates that industry is taking over short-term R&D projects and is reacting to the growing pressure from foreign technological competition. While industrial support for R&D has been growing substantially in recent years, [the report] says there are indications that a shift in patterns may be developing. Increased industrial expenditures have resulted from an improved business climate, higher sales and profits, and tax policies. Some shift in performance of industrial R&D is leading toward a greater percentage being carried out by consortia of industry, both within the universities and in specially created entities."

But the report also warns that increasing tendencies toward mergers, acquisitions and "restructuring" efforts can significantly affect total r&d funding by industry and ultimately industry's health.

In its look at long-term trends, the report concludes that federal support has shifted in the past few years toward more "development" and less research, but that within the category of research spending, the trend has been away from applied science and toward basic research. An increase in industrial support of basic research is expected, "largely through cooperative programs between universities and con-

sortia of industry," Battelle says.

The report draws data from the National Science Foundation and the McGraw-Hill Annual Survey of Business Plans for R&D Expenditures, among many sources. It was prepared by Dr. Jules Duga of Battelle's Columbus Division, 505 King Avenue, Columbus, Ohio, 43201-2693.

January 12, 1987

DOE BOOSTS GENERAL SCIENCE 13% IN FY-88 REQUEST; SSC'S FATE PENDING

The fate of the Superconducting Super Collider still hangs in limbo, pending a decision by the White House later this month on whether to add $60 million to DOE's FY-88 budget request for start of SSC construction. Otherwise, civilian basic-science programs funded by DOE came off far better than most in the administration's summary budget document sent to the Hill last week.

DOE Under Secretary Joseph Salgado announced at a Monday press conference that the department is requesting a 13% increase for basic research in high energy and nuclear physics, and substantial increases for two biological and environmental research projects — an additional $11.6 million for genome mapping and another $10 million for radon research.

SSC, a $4-billion particle accelerator, comes under high energy physics, but the 13%-plus increase in that category includes no funds for the huge collider. The department is asking for about $66.9 million more than the FY-87 appropriation of $499.7 million chiefly to make use of newly upgraded facilities at Stanford Linear Accelerator Center (home of the linear collider) and the Fermi National Accelerator Laboratory (home of Tevatron I and II). The money would go to facility operations, expanded physics research and additional capital equipment, says a DOE budget officer.

In fact, Salgado made no mention of SSC in his formal presentation. When questioned about it, he said the matter of construction funding "is currently under active discussion within the administration" and that "funds are available or will be made available" if DOE gets approval for an FY-88 construction start. Pressed for details, he said only that he was talking about "a modest amount of dollars necessary to go forward with SSC . . . $60 million, more or less."

A budget officer at the press conference told *Inside Energy/with Federal Lands* that the $60 million does not exist in the DOE request package now. "We would have to amend the budget to include it," he said.

The Domestic Policy Council took up the SSC question in late December (*IE/FL*, 22 Dec, 3) but word from outside the department is that the council has suspended judgment and suggested that DOE takes its appeal to the top, presumably to the president or one of his top advisers.

One congressional committee source who follows SSC noted Reagan might be hard to reach, given his surgery last week and the need to recuperate, but the source said, "If they [DOE management] could get to the old man, he might buy it." He suggested Vice President Bush is another possible avenue, since members of the Texas congressional delegation "have an in" with him and have shown considerable interest in the project. But he added he wasn't aware of any current stirrings by the Texans on this front.

A spokesman for DOE's energy research office said he couldn't say when or if the White House decision on SSC would be publicly announced, and implied a no-go outcome might emerge simply by default.

Most of the $28.1-million increase in the nuclear physics budget would go toward continued construction of the Continuous Electron Beam Accelerator Facility — that line items jumps from $16.2 million (FY-87 appropriation) to $33.5 million (FY-88 request) and the construction line item moves up from $24.1 million to $41.5 million. Other items show only slight increases, chiefly reflecting inflation.

The magnetic fusion budget is essentially flat, but Salgado announced that the total ($345.6 million) includes funds for the two top priorities of program management — construction of the Compact Ignition Tokamak and international collaboration on design of a world engineering test reactor (ETR). He said the budget request specifies $8 million to get started on CIT construction, which will cost about $300 million in all. The amount earmarked for international collaboration is up from $4.3 million to about $16 million.

A senior aide on the House Science and Technology Committee staff found the fusion-budget news "mixed," calling the CIT funding "gratifying" and the international funding an item "we have to look at . . . carefully." Rep. Marilyn Lloyd, D-Tenn, who chairs the subcommittee on energy research and production, has expressed concern, he said, about "the illusion" that an international effort means shared r&d costs and thus lowered costs for the U.S., when it's not yet clear that's the case nor that the institutional difficulties of collaboration can be worked out. "She would worry about people being

deluded," he said.

The same source thinks it unlikely Congress will endorse the "hefty" increases for high energy and nuclear physics. "They really stand out" amongst the reductions, he said, and will probably get "whittled by both the authorizing and appropriations committees." —*Amelia Manning*

January 26, 1987

PATENT MEASURE WOULD AID DOE CONTRACTORS

Legislation requiring DOE to grant class patent waivers to its contractors for new technology developed at the agency's national laboratories has been urged on Rep. Marilyn Lloyd by aides to the House Science and Technology subcommittee on energy research and production.

Lloyd, D-Tenn., was asked to consider introducing such legislation this month after subcommittee aides failed to reach an agreement with DOE officials that would have resulted in the agency's issuing its own regulations under a law approved by Congress in 1984.

Aides to the congresswoman said she is "seriously" considering the staff recommendation.

The 1984 measure — informally known as the Bayh-Dole Act — granted small businesses and universities operating national laboratories under non-profit agreements automatic patent rights to new inventions or technologies developed in the course of federal research. DOE, has not proposed implementing regulations, arguing that such a step could compromise much of the agency's classified research.

The department's reluctance to provide class waivers has forced it to rely instead on what research and congressional sources say is a time-consuming case-by-case approach in determining whether contractors can obtain rights of transfer to exclusive patents. Resulting delays, critics contend, have reduced the ability of U.S. firms to commercialize developments pioneered by federal scientists and may be depriving the agency of resulting royalty revenues (*IE/FL*, 3 Nov, 1).

Lloyd, who is expected to retain her position as chairman of the energy research subcommittee in the 100th Congress, wrote DOE officials last October to express concern over what she termed the "snail's pace" at which inventions occurring at the Oak Ridge National Laboratory and elsewhere were moving to the commercial sector. In particular, Lloyd said that Martin Marietta Energy Systems, which operates the Oak Ridge facility, had recorded a significant backlog in its attempts to obtain patent transfer rights.

DOE later moved to expedite Martin Marietta requests, but was unable to provide Lloyd's subcommittee with any commitment on when or whether the department would adopt a class waiver rule, an aide on the panel said.

Subcommittee sources said last week that DOE has insisted that it is interpreting the regulations correctly, but that the staff had hoped to convince the agency to adopt a position that would allow it to grant waivers unless it could show that a specific transfer was inappropriate. Under current procedures, contractors must in effect prove that a right to a patent should be granted.

"There's an impatience to do something tangible," a staff source said, "and we have asked the chairman [Lloyd] to consider introducing the legislation."

In addition to opposition from the agency, any such legislation may be received coldly by members of the House Armed Services Committee, among others, who have in the past expressed concern over any rules that could possibly increase access to classified defense technology. The issue, however, could attract some support this year from the House, which appears to be preoccupied with trade and the international competitiveness of U.S. companies, some sources said.

Although no firm legislative proposals have been worked out by Lloyd's staff, aides are at least examining whether a bill could be structured to require class waivers on research activities under the committee's jurisdiction, the sources said. Further, such legislation may not be proposed as a stand-alone measure, but could be included as language in the committee's budget authorization bill.

—*Jeff Barber*

February 2, 1987

REAGAN TO ISSUE ORDER BROADENING ACCESS TO FEDERAL TECHNOLOGIES

President Reagan, in an effort to spur the competitiveness of U.S. industry, last week announced he will issue an executive order designed to provide the commercial sector with greater access to technologies developed by researchers at DOE and other federal facilities.

The new policies, which were outlined in an administration briefing paper released after the president's State of the Union Address Tuesday, are intended to aid in the commercialization of new

technologies and inventions pioneered by scientists working in federal research facilties.

According to the White House paper, the executive order will "encourage scientists working in federal laboratories to patent, license and commercialize their research so that the private sector, including consumers, can benefit." Further, the order will direct government agencies to seek out what are described as "science entrepreneurs", who will serve as liaisons between the federal labs and private businesses or venture capitalists, who will in turn develop the patents for commercial use.

The order will also require federal agencies to implement royalty sharing programs with federal inventors. Royalty sharing arrangements are, however, already in place under provisions contained in the Federal Technology Transfer Act of 1986 that established a 15% royalty level for federal researchers.

The president's announcement comes as additional evidence that the administration shares the concerns of a number of members of Congress, who have criticized the reluctance of federal agencies, particularly DOE, to ease the ability of its researchers to transfer new patents to private industry.

Rep. Marilyn Lloyd, D-Tenn., is now considering whether to introduce legislation that would require DOE to grant class patent waivers to its laboratory contractors (*IE/FL*, 27 Jan, 1). Lloyd, among others, is concerned that DOE's restrictions have damaged the ability of U.S. industry to develop and market new inventions developed at national research facilities. DOE, however, has resisted attempts to ease current patent waiver procedures, arguing that less restrictive rules could compromise the results of its classified research programs.

Congressional sources said last week that while much of what is contained in the administration's plan is already in place, the order could bring additional pressure on agency directors to justify current policy.

The White House announcement may not, however, satisfy congressional critics, including Lloyd. In a hearing before her House Science and Technology subcommittee Tuesday, Lloyd asked White House Science Advisor William Graham whether the administration was concerned with DOE's reluctance to grant class patent waivers. "These issues," the congresswoman said, "are at the heart of any technological competitiveness and in this climate we must get the most out of every federal dollar."

"I am seriously considering legislation mandating class waivers for patents . . . we must insist that the burden remain on the [agency] to show why waivers should not be granted," Lloyd added.

February 16, 1987

GAO FINDS INDUSTRY HAS NOT COMPENSATED FOR CUTS IN DOE'S RESEARCH

Private industry has failed to compensate for funding cuts in DOE's energy r&d programs, contributing to delays in the development of a number of technologies and an erosion of U.S. leadership in such areas as breeder reactor and photovoltaic energy research, a General Accounting Office study has concluded.

While such delays may have little effect on national security if energy continues to be available at a reasonable cost, the inability to quickly develop new technologies could be harmful should fuel prices again rise rapidly, the report said.

The study (GAO/RCED-87-26), which was released Wednesday by the House Energy subcommittee on energy and power, examined DOE's policy of concentrating federal r&d funding on what the agency views as "long-term, high-risk, high-payoff" technologies. Under this program, the administration has reduced its support for technologies it believes are close to commercialization and best completed by the private sector.

Opponents of the policy, the GAO study said, argue that DOE has applied its criteria for "high-risk" program selectively, and has based its funding determinations on technologies it philosophically supports. In addition, the critics charge the cutbacks have not been picked up by private industry.

While it agreed with the latter criticism, the study found that the agency has generally applied its high-risk criteria "consistently across energy r&d technologies, reorienting most r&d activities toward the early stages of the innovation process."

DOE has, however, largely insulated civilian nuclear r&d programs from major cuts in the early 1980s, reflecting what the study described as an explicit policy of encouraging the nuclear power option. Though funding for civilian nuclear r&d has been reduced consistently since FY-84, the reductions were based on considerations other than the "long-term, high-risk" test, such as a "perceived need to address safety issues associated with reactors currently operating" and an emphasis on military nuclear programs, the report said.

The study explained that the clearest evidence of DOE's reliance on the "long-term, high-risk"

policy has been its "strong funding of the General Science and Basic Energy Sciences programs." The agency's FY-87 budget request for these programs marked a 63% increase over FY-81 appropriations, while funding requests for fossil energy, renewable energy, conservation and nuclear reactor r&d decreased over the same period by 76%.

GAO found little indication that the private sector has compensated for DOE's reduced support for energy r&d, largely because of such market factors as falling oil prices and reduced demand for electricity, the high risk of investing in demonstration projects and the lack of a "strong industry infrastructure in some technology areas" needed to pursue r&d without continued government support.

In fossil energy research, GAO found that the elimination of federal support for large coal conversion demonstration projects accounted for the lion's share of cuts in the fossil energy budget. None of these projects, the study noted, have been picked up by the private sector. "In other areas, such as utility-related applications of coal and natural gas research, congressional restoration of funds deleted by DOE has kept many affected industry research programs alive, although at reduced levels."

In renewable energy r&d, the study said that while the U.S. photovoltaic industry has undertaken considerable r&d despite federal cutbacks, its "relative position in the world market has fallen because of foreign competition . . . . solar and thermal central receivers and active solar heating and cooling are technologies that have depended more heavily on DOE for their development and that have been affected substantially by declining DOE r&d support."

GAO also found that most curtailed nuclear reactor r&d involved long-term research related to future generations of reactors, such as breeders. "This r&d," the study said, "has generally not been picked up by the private sector because the nuclear industry, reacting to a lack of demand for new reactor orders, has focused its own resources on ways to improve existing nuclear power plants."

DOE's FY-87 budget proposed that much of the remaining long-term reactor work be directed toward military applications, which may have little "significant applications to civilian reactor needs," the report said.

February 23, 1987

ERAB LAUNCHES ENERGY COMPETITIVENESS STUDY

Under a charge from Energy Secretary John Herrington, the Energy Research Advisory Board last week launched a study of r&d initiatives for U.S. energy competitiveness, joining a soul-searching exercise that is now epidemic in Washington.

And board members got their final briefing from Energy Research Director Alvin Trivelpiece, who will leave DOE in "five or six weeks," he told them, to become executive officer of the American Assn. for the Advancement of Science. News of his departure, which began circulating in December (*IE/FL*, 8 Dec, 3), was confirmed by an AAAS announcement in Chicago Feb. 15. He is staying at DOE through March to "complete the [congressional] hearing season," he said.

The occasion was ERAB's first quarterly meeting of 1987, and Trivelpiece notified the members of two other studies Herrington wants them to undertake this year — one on research and technology utilization (technology transfer), the other on science and engineering education.

Board members who gathered for the two-day session devoted most of their time to the competitiveness project, struggling to shape an administration rallying cry into a manageable study agenda. Herrington's Feb. 12 charge letter provided some guidelines:

"Improved energy technologies are needed at every step including exploration, extraction, conversion, transport, storage and end-use applications. Taking this into account, I would like the ERAB to examine the prospects for practical energy R&D initiatives that might have a significant impact within the next decade," the secretary wrote ERAB Chairman John Schoettler.

"In particular, please identify and recommend those specific activities that DOE might undertake that could significantly improve the nation's competitiveness through improved energy use and reliability. In making your recommendations, keep in mind the fact that substantial growth of energy program budgets in the Department is not likely."

Herrington asked ERAB also to "consider those institutional barriers that would make it difficult to conduct the activities or implement their results," and said that "To be most useful," the board's conclusions should be delivered to him by Dec. 1.

The secretary called on the board to be selective and sparse in its choice of initiatives, saying, "Given the present need for deficit reduction, the Federal Government can afford to support only a limited number of energy R&D programs that might contribute to our near-term competitiveness. In its

recent report 'Guidelines for DOE Long-Term Civilian R&D' [the board] identified a need for some efforts to be directed toward the nearer-term. However, the Board did not specify just which energy R&D areas appear to have the greatest nearer-term leverage and therefore might be given the greatest emphasis."

Board member Robert Fri, president of Resources for the Future, was appointed to chair the study and by meeting's end had established three subpanels — on supply, demand, and institutional constraints and opportunities — and a steering committee to develop criteria for assessing initiatives. Named to that committee were Henry Linden, Robert Hirsh (supply panel chair), Clifford Hayden (demand panel chair), and — tentatively, since they were not present — Ralph Gens, to chair the institutional panel, and Roger Noll.

The board arrived at a general consensus that the highest short-term priority item, and the one that probably will receive greatest attention in the competitiveness report, is the availability/cost of storable liquid fuels.

One of the speakers at the meeting was Donna Fitzpatrick, DOE Assistant Secretary for conservation and renewable energy (CE), who focused her remarks on the competitiveness study. She said the applied science projects in CE's domain all have relevance to competitiveness because they relate so directly to "the nuts and bolts of industrial processes." The improved processes, instrumentation and materials yielded by DOE r&d "very often improve overall production" as well as contribute to secure and stable energy supplies, she said.

Fitzpatrick questioned the common assertion of a shift from manufacturing to service sectors of the economy, saying "the manufacturing share is still 21-22% of the Gross National Product" and that "the shift is within" the manufacturing sector, from heavier to lighter industry.

But Fitzpatrick warned that the "still strong industrial base" she sees now may erode if energy planners don't prepare adequately for the potential power demand 10 years away. She stressed that she was talking about potential, not actual, demand, noting that "the demand won't develop" if the power isn't put in place. "We'll never actually see what we lost — all the things that could have happened if we'd planned properly."

Fitzpatrick called it government's responsibility "to provide the technology base" but said "it's up to industry to identify markets and do product engineering." As to industry pickup on technology, she observed, "Nobody wants to be first sometimes."

Under Secretary Joseph Salgado also addressed ERAB, briefing them on the FY-88 budget request DOE submitted to Congress last month. Both he and Trivelpiece, who outlined the site-selection process for the Superconducting Super Collider that Herrington unveiled Feb. 10, were questioned by board members about SSC costs and state competition for the project. But the queries were mild and unchallenging — largely, said one observer, because Trivelpiece "has become so persuasive" on that subject.

In other business, the board approved an ERAB review of the National Research Council Report: Physics Through the 1990's, a report completed by ERAB's physics review panel last month. That panel, chaired by Betsy Ancker-Johnson of General Motors, concluded in its 48-page review that:

— The great importance of physics to the nation justifies a 50% increase in total funding of the DOE physics programs between FY-86 and FY-92, *not* counting funds for SSC construction.

— A no-growth budget over this period would be "devastating" to DOE's mission.

— If severe budget constraints do occur, current funding should be reallocated to nourish small research groups at universities and to complete major facilities now under construction.

The physics panel made six recommendations and, unlike the NRC report it was reviewing, ranked them in order of importance. They are: 1) provide new funds for research and instrumentation to a number of small academic groups performing research of high quality; 2) allocate enough funding to assure adequate operation of facilities and upgrades of associated instrumentation; 3) consider SSC funding in a national context beyond DOE and independent of facilities recommended next; 4) construct the Compact Ignition Tokamak, 6-7GeV Advanced Photon Source, the Relativistic Heavy-Ion Collider and the Advanced Neutron Source, new facilities identified by respective user communities as of paramount importance and listed in the order of their proposed starting dates; 5) don't allow financing of new facilities to undermine the basic research programs on which their achievements will depend, and in particular, maintain a balanced program in plasma and fusion physics; 6) address the potential imbalance between supply and demand for trained manpower by initiating fellowship programs at pre- and post-doctoral levels. — *Amelia Manning*

May 18, 1987

CONGRESS MOVES TO EASE DOE PATENT POLICY

The Senate Armed Services Committee, in an apparent response to growing concern over DOE's reluctance to grant its contractors patent rights to inventions developed in federal laboratories, has included a provision in its defense authorization bill that would automatically cede patents to contractors unless the agency acts to deny the request within a six-month period.

In a related matter, the House Science, Space and Technology Committee is expected to act Tuesday (May 19) on a DOE FY-88 authorization bill reported out in March by its energy research and development subcommittee that also contains a provision aimed as speeding the department's patent transfer prolicy.

The Senate committee action, which was included in report language accompanying the panel's FY-88 and FY-89 defense authorization bill, would require DOE to respond within six months to a contractor's request for title to an invention or discovery. While the department may deny such a request if the invention is considered classified or sensitive, the patent rights will revert to the contractor if no action is taken. The bill (S. 1174) was approved by the committee earlier this month.

DOE, the committee noted, "currently pursues a more restrictive policy on [the] allocation of patent rights in inventions made by its contractors than other federal agencies, including the Department of Defense. While it is important to protect classified and sensitive inventions, it is important that DOE not create a disincentive for employees of contrators to apply for patents."

The patent provision approved by the committee appears to be in line with an executive order announced in February by the White House, which is designed to provide the commercial sector with greater access to technologies developed by researchers at DOE and other federal agencies (*IE/FL*, 2 Feb, 3).

Among the various federal agencies, DOE has most often been singled out by federal contractors for its reluctance to follow a number of federal directives and laws aimed at easing the movement of patent rights from the federal sector to commercial interests. While DOE has long argued against a less restrictive policy, particularly in its defense-related r&d programs out of concern that sensitive material could be compromised, the action taken by the Armed Services panel appears to have undercut some of the agency's ground.

The House science committee language, which was offered by Rep. Marilyn Lloyd, D-Tenn., would require the energy secretary to develop by July 1, 1987, regulations necessary to issue class waivers for non-defense inventions or copyrighted material developed in the performance of a federally funded civilian r&d contract, grant or cooperative agreement award.

June 29, 1987

DEFENSE SPECIALIST TO FILL RESEARCH SLOT

Robert Hunter Jr., a former research physicist and founder of a San Diego defense firm, is in line to become DOE's next energy research director. The White House announced last week its intention to nominate Hunter, 40, who would replace Alvin Trivelpiece. Trivelpiece left the agency this spring to become president of the American Assn. for the Advancement of Science.

Hunter would join DOE at a time when the administration has made a strong commitment to increasing federal support for basic science r&d and has proposed the construction of the $4.5-billion Superconducting Super Collider. The administration has claimed that the project, which was strongly championed by Trivelpiece, is essential if the U.S. is to maintain its world lead in high energy physics.

While there appears to be a great deal of congressional support for SSC, Hunter would be forced eventually to address several tough program issues, including selection of a suitable SSC site and funding the project as its costs escalate.

Since 1978, Hunter has been president of Western Research Corp., a San Diego-based firm engaged in classified defense r&d programs. Company officials refused to describe what work the firm performs for the government.

Prior to founding Western Research, Hunter was employed by Maxwell Laboratories, San Diego, a private research firm, which is working on the development of electromagnetic pulse power systems for the administration's Strategic Defense Initiative. While with Maxwell, Hunter served as manager of the company's laser r&d department.

Hunter, who received a doctorate degree in plasma physics from the Univesity of California at Irvine in 1981, was named the following year to the White House Science Council, on which he served until 1984. He obtained his bachelor's degree from Stanford University in 1967. Hunter served in the U.S.

Air Force from 1967 to 1972.

Sources in the Washington science community said last week that Hunter, whose brother is California Republican Rep. Duncan Hunter, could face tough questioning during confirmation hearings before the Senate Energy Committee because of his affiliation with defense r&d programs. DOE in recent years has come under harsh criticism from many in Congress for shifting increasing amounts of civilian r&d funding to the defense sector.

Hunter's confirmation hearings are considered unlikely to begin until after Congress returns from its August recess. This timing could further complicate his appointment since various senators could elect to block a floor vote as a means of winning concessions on unrelated DOE legislation, sources explained.

June 29, 1987

TRIVELPIECE: U.S. PATENT POLICY NO IMPEDIMENT TO COMPETITIVENESS

Congressional concern over laws governing the transfer of federally developed patents to the private sector is misplaced and fails to recognize that financial and technical problems have limited the ability of U.S. firms to develop and market many emerging technologies, American Assn. for the Advancement of Science President Alvin Trivelpiece said last week.

Trivelpiece said the popularly-held belief that Japan is making money developing and selling technologies pioneered by U.S. researchers is false. "There is a belief that the government is withholding patents and that our problems would be fixed if the patents would just get out the door. That is simple nonsense," he said.

Since 1980, Congress has enacted at least two pieces of legislation aimed at increasing private sector access to patents developed at federal laboratories. Several members of Congress contend that some federal agencies — most notably DOE — have failed to follow guidelines contained in those laws and have shown reluctance to transfer non-classified patent rights to entrepreneurs willing to develop the technologies for commercial applications.

The administration, as well, has joined the debate. Earlier this year, President Reagan issued an executive order designed to improve U.S. industrial competitiveness by providing the commercial sector with greater access to technologies developed by federal researchers (*IE/FL*, 2 Feb, 3).

Such solutions to the perceived problems of patent transfer will not help the U.S. to regain competitiveness, Trivelpiece told a Washington seminar. "U.S. industry is not starved for good ideas to invest in and develop," he said.

The true impediment to greater U.S. development of new technologies, Trivelpiece said, may well be financial. "The cost of money in this country is 10% and in Japan it is 5% . . . . it's hard to prove, but it must have some influence. We can talk about such things as getting rid of the corporate income tax, but that is simply not politically possible," he said. "Tax reform actually took the wrong direction and shifted $120 billion from private citizens to companies, and that has to show up somewhere."

One method of alleviating the current difficulty, he said, could be the creation of tax credits for research.

"What needs to be done is to get in place a process that maximizes human interaction — we have to get people with problems and people with [the] capabilities [to solve those problems] together so transfers can take place," Trivelpiece added. "To suggest that to solve the patent problem will make the whole thing better does a disservice. It is a very complex problem."

August 3, 1987

AFTER FOUR MONTHS, REAGAN TECH-TRANSFER ORDER REMAINS UNFULFILLED

More than four months after President Reagan directed the agencies to take broad steps to facilitate technology transfer from the federal sector to industry and universities, some agencies are still not totally familiar with the presidential order, according to White House and federal laboratory officials.

But several federal laboratory officials now involved in superconductivity research said they have moved within the last year to open up their facilities to the public. Alan Schriesheim, director of DOE's Argonne National Laboratory, said at last week's superconductivity conference that "if you can think of a way to interact with a national laboratory, it is probably possible to do so." And Herman Postma, director of the Oak Ridge National Laboratory, pointed out that each lab is now required to have a full-time person to act as a contact for outsiders interested in using the lab facilities.

Nonetheless, Eugene McAllister, special assistant to the president and executive secretary of the

Economic Policy Council, admitted that administration officials have not been doing enough to spread the word about Executive Order 12591, issued last April 10.

The order directs agency heads to encourage collaboration between the federal laboratories, state and local governments, universities and the private sector, with an emphasis on small business. The aim is to assist in the transfer of technology to the marketplace.

Under the order, the agencies were instructed to enter into cooperative r&d agreements and to license, assign or waive rights to intellectual property developed by the laboratory under those agreements. The order also directs them to identify "ferrets," or persons to act as conduits for technology transfer between and among federal laboratories, universities and the private sector.

The government is also supposed to ensure the private sector is provided with information on the technology, expertise and facilities available in federal labs, and to take other steps to deal expeditiously with the patent and royalty questions involved in joint r&d efforts. Agencies operating federal labs were told to select one or more of their facilities to participate in a "Technology Share Program," under which r&d areas of potential importance to long-term national economic competitiveness are identified and addressed through a joint industry-governmenment-university consortium.

According to Postma, 25% of Oak Ridge personnel are visitors at any given time. Some $20-million worth of r&d work has been subcontracted by Oak Ridge to universities this year, while an additional $15 million has been subcontracted to industries. He acknowledged, however, that improvements still need to be made in expediting approval for patents and waivers, in the formation of consortia, in reaching small firms and in getting lawyers to accept the changes that have been made in the law.

Argonne has formed a separate subsidiary to conduct patent transfers, licensing, joint ventures and other business transactions related to technology transfer from the lab, Schriesheim said. The subsidiary is wholly-owned by the University of Chicago, which is the Argonne contractor.

Schriesheim agreed that the "cultural relationship" necessary for private industry to turn to the labs on research questions has been lacking, but added "that's in the past." New innovative approaches still need to be developed to tie industry and government together while maintaining "some independent infrastructure on both sides," he said.

Each of the national and federal laboratories have user facilities available for industry use, and proprietary technology can be protected fully if necessary through payment to the lab for use of the facility. Lyle Schwartz, director of the center for materials science at the National Bureau of Standards, noted that the charge for use of the equipment does not factor in depreciation, and so it is in fact a bargain. The daily user cost for one complex piece of NBS equipment, a neutron scatterer, is only $150.

All the lab officials agreed that direct contact between the individual lab researchers involved in a particular aspect of r&d was the preferable route for the private sector to take. Postma noted that a private sector potential user of the labs is never more than a few phone calls away from reaching the lab researcher he wants. — *David Kramer*

September 7, 1987

TRIVELPIECE SAYS SCIENTISTS ALOOF FROM POLITICS CARRY LITTLE WEIGHT

Science and technology advice to key government figures must originate at the "political grass roots level" in order to be more effective, according to Alvin Trivelpiece, former director of energy research at DOE and currently executive officer of the American Assn. for the Advancement of Science.

Speaking to a conference on fusion at Princeton, N.J., Trivelpiece asserted that government is "awash in scientific advice," but that "having that advice taken seriously is another matter." The key, he explained, is building a relationship of trust between the adviser and the advisee, a relationship that necessarily takes a good deal of time to develop.

Unlike other key administration figures, such as Cabinet officers, the White House science adviser is generally not a member of the presidential transition team and therefore is not around when the position papers are prepared. In contrast to other advisers, scientists and engineers "tend to be aloof from the political process," and the traditional animosity between science and politics makes it even more difficult for the two sides to communicate, he said.

Science advice to the president doesn't always lead to direct action, Trivelpiece said. Frequently it must be implemented by a Cabinet- or subCabinet-level official, and that official can block action if he or she doesn't agree with the chosen policy. This occurs despite the fact that the Cabinet official will lack the authority to develop an alternative program.

Acknowledging that involvement in politics will be "distasteful to us," Trivelpiece warned the

audience of physicists that increasing competition for resources makes it essential. "You'd be surprised how easy it was to get [Energy Secretary John] Herrington to go to Stanford [University] because there was a political event nearby," Trivelpiece said. By contrast, he said, he was unable throughout his six-year tenure at DOE to convince Herrington to visit the Princeton Plasma Physics Laboratory because there was no perceived political benefit in doing so. — *David Kramer*

September 28, 1987

AUSTERITY IS THREATENING HIGH ENERGY PHYSICS ACTIVITIES at DOE, an advisory panel was told recently. Leon Lederman, director of the Fermi National Accelerator Laboratory in Batavia, Ill., said manpower at the DOE facility's Tevatron accelerator is too low and must be raised by more than 50 persons from the current 2,018.

Staffers at the accelerator are already overworked, Lederman told DOE's High Energy Physics Advisory Panel, and further staff losses are expected over the next three years as scientists and engineers migrate to work on the Superconducting Super Collider. CERN, a somewhat larger European accelerator located in Switzerland and France, has twice the staffing level as Fermilab, and at one point had three times the number of employees, he said.

Fermilab requires a minimum of $11.6 million more than the $186.5 million contained in its initial funding plan (IFP) for FY-88, Lederman asserted. The lab will overshoot its FY-87 budget authority by $3 million due to its operation of a full fixed target run at the accelerator during a period of high summer energy costs. Part of the needed funding is merely meant to recoup that overrun, he said, while $3 million is needed for collider upgrading r&d. Absent that r&d, the facility will be unable to acheive its design speed, while CERN will probably reach comparable speeds late this year.

"How do we keep to our IFP and operate the world's highest energy machine?" he asked. "We've had severe austerity in 1986, '87 and '88 in initiating operation of the Tevatron."

"Everybody wants more money," said a spokesman for Energy Secretary John Herrington in response to Lederman's remarks. "But energy research and its associated programs have fared very well compared to other programs."

Charles Prescott, associate director of the Stanford Linear Accelerator Center, described FY-87 as "a very difficult year" for the facility. The lab received only $88 million of $97 million in operating funds originally contained in the president's budget request, and had to cut its staff by 5%. But Prescott said SLAC could "live with" its FY-88 IFP of $126.6 million, which compares to $110.7 million for the current year

Robert Adair, of the Brookhaven National Laboratory, said the lab's Alternating Gradient Synchrotron recently gained two extra weeks operating time with the help of funding from the Defense Dept.'s Strategic Defense Initiative. In the current fiscal year, AGS will operate a total of about 20 weeks, down from more than 30 weeks in 1986 and almost 40 in 1985.

Brookhaven's IFP for HEP activities in FY-88 is $65.2 million, up 3%, or less than the rate of inflation, from $63.3 million this year. The budget for physics research is $7.3 million, up from $7.1 million last year, a level Adair described as "something we can live with, but not without difficulty."

October 5, 1987

INTEREST IN HYDROGEN RISES ON CAPITOL HILL, BUT NOT AT DEPARTMENT

Interest in hydrogen as an alternative energy source is reviving on Capitol Hill, with bills to encourage its development and use pending. But the Reagan administration opposes the bills, making the outlook for their passage uncertain.

The question is "not whether the nation can use hydrogen for many applications now served by electricity or other energy carriers," said DOE's Donna Fitzpatrick at recent congressional hearings, "but whether should we use it in this way." Fitzpatrick, assistant secretary for conservation and renewable energy, said the department also questions the cost of manufacturing hydrogen, particularly since the "energy to be derived from hydrogen will always be less than the energy required to produce it."

Considerable knowledge on use of hydrogen as an energy source has been achieved already, and DOE is continuing to support research into the production, storage and transportation of the element, Fitzpatrick said. The "spirit" of the pending legislation is already carried out in existing departmental efforts, she argued, and thus the bills are not needed. Until DOE progresses further on the longer-range generic research, demonstration and commercialization activities by the private sector will not be

feasible, she said.

Pending are two bills: one (H.R. 2541) by Rep. George Brown, Jr., D-Calif., to encourage research into the development and use of hydrogen. Sen. Spark Matsunaga, D-Hawaii, long an advocate of hydrogen development, also is continuing his efforts with his latest bill, S. 1296. Matsunaga told the Senate Energy subcommittee on energy research and development Sept. 23 that he is encouraged by an increased number of cosponsors for his bill.

Hawaii Natural Energy Institute Director Patrick Takahashi and Florida Solar Energy Center Director David Block testified before the House Science subcommittee on energy research and development Sept. 23 that hydrogen could prove to be the "best energy option" and an "ideal replacement for fossil fuels" because it is nonpolluting and can be produced from renewable resources. They also cited a competitive concern: "R&D on hydrogen energy is a classic example of a technological area where the U.S. is again watching its once firmly anchored position of leadership drift overseas.

October 5, 1987

Senate Votes $60M For Initiatives

DOMENICI ADDS SEMICONDUCTORS, COAL TO LIST OF NEW LAB PROGRAMS

Prodding DOE's national laboratories into more clearly-defined roles in high technology areas, Sen. Pete Domenici, R-N.M., recently acted to funnel $60 million in federal funds to the labs in two areas: advanced semiconductor manufacturing and coal science.

Domenici, who has already succeeded in pressuring DOE into a more active research program in human genome mapping, as well as providing his state's Los Alamos National Laboratory with a lead role in the department's high temperature superconductivity commercialization efforts, last week had the Senate's Interior and related agencies appropriations bill amended to add $10 million for a national laboratory coal science initiative.

Earlier, Domenici succeeded in amending the Defense Dept. authorization bill to include $25 million in new funding in both FY-88 and FY-89 for a DOE effort in semiconductor manufacturing. The senator described the DOE semiconductor role as being complementary to the industry's cooperative efforts with the Defense Dept. in this area, which have come to be known as Sematech. Senate debate on the full authorization bill was continuing last week.

Domenici's semiconductor ammendment, which was co-sponsored by Sens. Jeff Bingaman, D-N.M., and James McClure, R-Idaho, would direct the energy secretary to initiate and carry out a program of research on semiconductor manufacturing technology and the practical applications of that technology. According to Domenici, the national labs would conduct r&d activities relating to silicon and compound semiconductors, including research of such advanced semiconductor manufacturing techniques as ultra-clean processing, processing for ultra-high density silicon circuits and improved compound semiconductors and devices.

The projects would be entered into through cost-sharing agreements with private firms and universities, he explained. The agreements would allow access to the labs' facilities and equipment, while providing for exchanges of personnel.

Although the ammendment does not single out any specific lab for the work, Domenici noted his state's Sandia National Laboratory has proposed a center for compound semiconductor technology and a center for ultra-clean semiconductor processing. Sandia, he added, has also been a leader in the area of radiation-hardened compound semiconductors over the past decade, having transferred its know-how to several firms, including National Semiconductor Corp., which are now manufacturing their own radiation-hardened semiconductors.

Two industry groups, the Semiconductor Industry Association and the Semiconductor Research Corp., have indicated their support for the Domenici measure. The ammendment was adopted from a broader bill the lawmaker introduced in July that included the genome mapping and superconductor initiatives.

Under Domenici's coal r&d ammendment to the Interior appropriations bill, $10 million in budget authority and $3.8 million in outlays are included in FY-88 for a "national coal science initiative." Its r&d program will be planned in coordination with the National Laboratory Coal Science Consortium, a group of national laboratories comprised of the Idaho National Engineering Laboratory, the Lawrence Berkeley, Lawrence Livermore, Los Alamos, and Sandia national laboratories. Sandia, located in Albuquerque, is to chair and coordinate the consortium, which will also entail industry and university

cooperative efforts.

DOE is required to develop a comprehensive 10-year research plan within six months of the measure's enactment. The ammendment, also co-sponsored by McClure and Bingaman, is supposed to provide a balance to DOE's current clean coal technology demonstration program "by expanding on the examination of fundamental questions underlying coal utilization and conversion," Domenici explained.

"Current research in the U.S. focuses on improvements to known systems. My proposal looks beyond that toward revolutionary breakthroughs in the way we use and burn coal," the lawmaker said. "This program will bring several disciplines within the sceintific and engineering community together with the latest analytical and computational tools available at the national laboratories to examine coal structure, chemistry and reactivity."

The full Interior appropriations bill containing the coal measure was passed by the Senate last week. It must now be reconciled with the House version, which contains no similar provision.

A DOE spokesman said the agency would have no comment on the measures pending further action on the legislation.

October 19, 1987

BASIC ENERGY SCIENCES ASKED FOR $63M IN NEW EFFORTS — FOR $39M

DOE's Office of Basic Energy Sciences has been instructed by the House to add more than $63 million worth of new projects to its FY-88 program, but has been appropriated only $39 million to cover them. Donald Stevens, associate director of energy research, said BES could have to "eat" the $24-million shortfall — redirecting the funds from other existing programs — if the House-passed appropriations measure becomes law. The Senate appropriations bill covering BES includes a $10-million shortfall between additional projects mandated and funds appropriated.

Stevens, outlining the FY-88 BES budget figures before the Basic Energy Sciences Advisory Committee, pointed out that the House bill uppped the administration's $480-million request for BES by $77.3 million, to $556.4 million. The Senate Appropriations Committee's bill increased the administration's request by $47.7 million , to $526.8 million.

New programs directed by the committees in materials sciences include a national program in ceramic superconductors, the initiation of a technology program in X-ray lithography, and expanded projects and programs in materials processing. In chemical sciences, the committees directed more expenditures on the high flux isotope reactor, advanced neutron soucre r&d and for National Academy of Sciences/National Research Council recommendations in the field.

October 26, 1987

LABS: RED TAPE HOBBLES TECHNOLOGY TRANSFER

DOE's national laboratories have had notable successes in transferring technologies to the private sector, but red tape and legal questions continue to hamstring commercialization efforts.

That was the picture that emerged last week from an all-day hearing before an Energy Research Advisory Board panel studying research and technology utilization. Lab representatives complained they are frequently caught between directives from Washington to move their technologies into the marketplace and a cumbersome DOE bureaucracy that discourages speedy technology transfer. A second major problem, they said, is the legal ambiguity surrounding assignment of patent rights in laboratory-private sector collaborative efforts.

Laboratory officials also complained about DOE's refusal so far to permit the commercialization of lab-generated computer software. And several pointed to very low funding allocated by DOE for technology transfer efforts as a further constraint.

The technology transfer process is "long and arduous" and "takes twice as long as you think it will," said Donald Edwards, director of Technology Transfer at Pacific Northwest Laboratories. His remarks were echoed by John Whetten, associate director for energy and research applications at Los Alamos National Laboratory, who noted all the labs' interactions with industry have to be approved by DOE, a process that takes "an enormous amount of time."

Apart from the lengthy review process, there is concern over national security information, and inconsistent policy relating to industrial research facilities on DOE property. Whetten suggested that DOE streamline the review process by developing a "menu of acceptable boilerplate" to replace the current standard boilerplate that "makes it almost impossible to get an agreement." Moreover, DOE

should set up an "agency-wide champion" for technology transfer, possibly creating an assistant secretary for technology transfer.

John Wilson, executive officer of the Morgantown Energy Technology Center, said one collaborative project with industry involving examination of fluid bed erosion in coal gasification has been hung up for 18 months due to DOE's insistence that it is entitled to the patent rights stemming from the project. Harvey Drucker, associate director of Argonne National Laboratory, said a collaborative r&d effort on advanced steelmaking technology has been delayed now by paperwork for two years.

Richard Wood, assistant manager of projects and energy programs at DOE's Idaho Operations Office, said one of the Idaho National Engineering Laboratory's contractors asked for DOE waiver of rights to three patents to support technology transfer at INEL. Although the requests were granted, the DOE took one year to complete its review.

"This lengthy process is currently seen as the biggest barrier to transfer of truly innovative technologies to industry," Wood said. "Because of the time lag while the contractor is attempting to transfer an invention, only qualified exclusivity can be offered pending the outcome of the request for waiver. Not surprisingly, this only reinforces any misgivings a company would have about basing products on a federal technology."

Last week's hearing by the ERAB panel grew out of Energy Secretary John Herrington's request of the board last February for an examination of the technology transfer process and its effectiveness. He asked ERAB to make recommendations to improve those activities. The report, originally scheduled for completion in January, is now expected to be finished next July.

Despite the impediments, most labs could cite some significant examples where their technology had been successfully commercialized. Argonne had one of the longest lists, with examples ranging from cooperation with single companies to industry-wide initiatives, like the steel project. ANL has helped Cabot Corp. with its powder metallurgy, McDonalds Corp. with heat transfer in the deep frying process, and Gould Inc. with its electric vehicle battery. It has also licensed a variety of technologies developed at the facility, ranging from a helium dilution refrigerator to a toxic gas detector.

Argonne has developed a system it calls ASPIRE to evaluate the commercial potential of lab inventions. It also has formed a non-profit entity called ARCH to take title to and assign the rights to inventions and patents developed by the lab and its contractor, the University of Chicago. For technology transfer to small businesses, ANL has received a state grant, and has subcontracted with a local community college to improve automation and robotics in local manufacturing firms. Businesses started by ANL employees utilizing lab-developed technology totaled 10 in each of 1985 and 1986, compared with only two during 1982.

At Oak Ridge National Laboratory, licenses granted to ARCO, Dow Chemical and other companies for whisker alumina ceramic technology may help the U.S. recapture the $200-million annual cutting tool market from Japan, according to ORNL's William Carpenter. Other licensed technologies include anaerobic waste treatment, software for managing large volume chemical analyses, and nickel aluminides, a high-temperature superalloy for large diesel engines and heating elements.

Over the next five years, ORNL hopes to gain 50 additional licensing agreements, producing sales of $100 million and royalty incomes of $4 million. It also aims to establish 25 spinoff companies during the same period, Carpenter said.

PNL, in collaboration with six Northwest aluminum firms, developed an energy-efficient anode for aluminum smelting that it claims uses 30% less electricity. Inventions at the lab have soared from 68 in 1985 to an anticipated 140 this year, but Edwards acknowledged he was "disappointed" with the number of patents — eight — issued to the lab this year. Other technologies licensed recently include sludge to oil conversion, sampling pumps and biobarriers, and PNL expects to license other technologies shortly, including a DNA probe and a security system.

Spinoffs by the lab include Advanced Nuclear Fuels, a company that now employs 700, and others totaling several thousand employees. New technologies it hopes to spin off next year are in situ vitrification — a process developed for nuclear waste disposal that glassifies the soil of the dump site, and a technology dubbed "moo chew" that converts cattle feed to a high protein product.

Los Alamos is hoping to complete within two years its viability assessment of a technology for extraction of geothermal energy from hot, dry rock. The project, in which Bechtel Inc. is reported to have a strong interest, has already resulted in one direct spinoff company, called Hot Hole Instruments, which makes high-temperature well-logging instruments. Additionally, some 20 companies have conducted collaborative r&d with LANL on various aspects of the project.

Technology transfer has also been accomplished at some of DOE's single purpose labs, such as the Solar Energy Research Institute and the Princeton Plasma Physics Laboratory. SERI is involved in an

ongoing collaborative initiative called the Amorphous Silicon Research Project. This $18-million three-year project involves a promising material for photovoltaic energy technology, and has other possibilities in xerography, laser technology and other semiconductor applications. According to SERI Director H.M. Hubbard, the future commercialization activities could involve vacuum insulated windows with five times the thermal efficiency of a conventional double-pane window, other vacuum insulation applications and an atmospheric optical calibration system. It's expected that most of the lab's efforts will be achieved through licensing of patents.

At PPPL, two potentially successful examples of commercialized technology are a soft X-ray laser, which may achieve greater resolution than currently available magnetic resonance imaging, and microwave plasma discharges used for surface modifications, primarily wear-hardening of materials. But Joseph File, head of the office of technology transfer at PPPL, warned that diversion of laboratory operating funds into technology transfer efforts might detract from the lab's mission of advancing fusion technology. — *David Kramer*

October 26, 1987

A NEW LABORATORY FOR MOLECULAR MODELING HAS BEEN ESTABLISHED by DOE's Pacific Northwest Laboratory as the first phase of its planned $120-million Molecular Science Research Center. J.T.A. Roberts, deputy director of research for Battelle Memorial Institute, which operates PNL, said MSRC will be the only U.S. facility dedicated to molecular research when it is completed in 1992. The molecular modeling lab is equipped with advanced computer graphic stations and software capable of modeling molecular structures ranging from superconducting materials to proteins, said B. Ray Stultz, interim MSRC manager.

A permanent facility of 140,000 square foot will house a full-time staff of about 160, including 50 researchers and an equal number of visiting scientists from universities, industry and other national laboratories. Roberts said the goal is to develop a facility that will match molecular science institutes in Okazaki, Japan, and Stuttgart, West Germany.

Better understanding of the interaction of new materials at the molecular level can lead to the discovery and development of new technologies in applications such as biotechnology or materials design, chemical kinetics and surface phenomena, Roberts noted.

October 26, 1987

DOE WAIVES ITS PATENT RIGHTS TO SPEED TECHNOLOGY TRANSFER, a congressional panel was told last week. Richard Constant, DOE assistant general counsel for patents, said the agency has approved about 1,200 of more than 1,900 individual identified and advance waiver requests received since 1974. Some 160 of the requests are pending, with the remainder either withdrawn or denied.

Since each advance waiver may cover a large number of inventions, the granted requests translate into more than 1,700 waived inventions between 1980 and 1986 alone. During the same time period, Constant told the House Science subcommittee on energy research and development, DOE granted 131 licenses, including 28 exclusive and 103 non-exclusive ones, to department-owned inventions.

The agency's nonprofit contractors have retained title to 162 inventions in the past year, more than five times the number of any previous year. The rights to a further 10 or more inventions are expected to be transferred to them shortly. Progress has been made in cutting the review time for waivers, from an average of 14 months in 1986 to nine to 10 months in 1987.

"It can thus be seen that DOE is actively working to improve its performance in treatment of waiver requests through administrative practices while continuing the current practices of transferring technology through use of intellectual property," Constant said.

November 2, 1987

DOE URGED TO LIFT SOFTWARE COPYRIGHT BAN

Efforts to commercialize valuable sophisticated computer software developed at DOE's national laboratories are being hampered by the labs' inability to copyright the material, lab officials say. Unlike other technical information, software may not be copyrighted by lab contractors without specific DOE approval.

The result, the officials say, is that labs cannot assign exclusive rights to lab-developed software to outside firms or institutions, as they can with most lab technologies through licensing or joint ventures.

Although DOE is working on a policy to address the problem, lab officials complain that the effort

has been going on for several years with no tangible results. DOE officials could not be reached for comment, but most lab technology transfer officials interviewed in a spot survey say they would welcome a DOE policy providing the same status to computer software as is presently assigned to those lab developments that can be copyrighted.

Since 1983, DOE has officially mandated that software developed by the labs be disseminated to the private sector through the National Energy Software Center, located at Argonne National Laboratory. Software is available to the public through NESC, but only on a non-exclusive basis.

While several examples of successful software commercialization have occurred in recent years, notably at Lawrence Livermore National Laboratory and at Oak Ridge National Laboratory, some of those instances have involved skirting the 1983 directive in one way or another. In one case, Lawrence Livermore moved last year to copyright major "gateway" software that enables computer users to interface with other users regardless of their hardware. LLNL then licensed the software to Digital Equipment Corp., which markets it under the trade name "Assent."

The University of California, which operates LLNL, as well as the Lawrence Berkeley and Los Alamos national labs, claimed that its contract with DOE permitted it to copyright and license software, a point that DOE disputes. Since then, a new contract has been negotiated between the university and DOE that specifically excludes software from the university's copyright powers.

As with other national labs, LLNL will now be required to obtain approval from DOE for any exclusive licensing of software it has developed. This process is cumbersome and takes a good deal of time — typically on the order of a year, lab officials say. During that period, the software may become obsolete or the potential partner may lose interest. As one source noted, "These things change so fast, you only have a one- or two-year window."

James Stottlemyre, who has been on special assignment to the Energy Research Advisory Board, notes that software is "becoming the textbook of the future." Labs therefore argue that software should be treated no differently from published material, which can be copyrighted.

A Sandia National Laboratories official pointed out that current DOE mechanisms may be suitable for situations where a particular software is to be widely disseminated to the public. But the labs, he added, are "frustrated when cases come along where exclusivity is the right way" to transfer the technology.

"The big discrepancy is that software is being treated so differently from other technical information," he said.

Software marketed through NESC frequently needs to be accompanied by instruction manuals, which the labs are not set up to prepare, he noted. And since the software is not available on an exclusive basis, private companies have no incentive to prepare such manuals. There have been cases where companies have bought Sandia software from NESC, then come back to Sandia for assistance in learning how to use it, a process the source described as "very awkward."

Another successful commercialization of lab-generated software occurred at Pacific Northwest Laboratory, where a computer aided design simulation program for genetic engineering was made available to several universities under license. But Don Williams, PNL's director of technology transfer, explained that the money involved in developing the software belonged to Battelle, the lab contractor. If the funds were from DOE, "it is just not clear how software would be treated," he said.

Williams and the other lab officials do believe DOE is trying to address the issue, and all agree that the ideal solution would be to permit the labs as much discretion in commercializing software as DOE has recently provided through the election of waivers for patents and copyrights.

According to Stottlemyre, the software industry would especially like to get from the labs what he termed the very expensive packages that are "extremely computationally intensive." For example, a two-dimensional model of how a train crumples when hitting a wall is the same sort of simulation an automobile company would like to have for crash modeling its vehicles, and simulations of complex chemical reactions could be of great value to biotechnology firms. — *David Kramer*

November 16, 1987

DEPARTMENT GIVES QUALIFIED SUPPORT TO SCIENTIFIC DRILLING MEASURE

DOE joined other agencies last week in backing a House bill designed to strengthen the coordination of federal scientific drilling efforts. But DOE qualified its support for the measure, saying a provision requiring the setting of target expenditure levels for the research activity should be removed.

The measure, dubbed the Continental Scientific Drilling and Exploration Act, was sponsored by Reps. Claudine Schneider, R-R.I., Manuel Lujan, R-N.M., and George Brown, D-Calif. An identical bill

has already been passed by the full Senate, complete with the target provisions DOE finds objectionable.

Testifying to a joint hearing of Science, Space and Technology's subcommittee on science, research and technology and Interior and Insular Affairs' subcommittee on mining and natural resources, Donald Stevens, DOE associate director for basic engineering sciences, said the interagency planning process called for in the bill (H.R. 2737) will be useful to each of the agencies involved. Besides DOE, Interior's U.S. Geological Survey and the National Science Foundation are active in scientific drilling activity.

Stevens pointed out the three agencies have been coordinating their activities in the area since 1984, when they signed an accord on continental scientific drilling at DOE's initiative. DOE itself has supported scientific drilling on continents since 1979.

But Stevens and officials of both NSF and USGS objected to a requirement that the agencies develop advance spending plans for the activity. "We must all recognize that the funding resources for continental scientific drilling should be determined on a year-by-year basis in full consideration of other administration priorities and the competing requirements for funds in the normal budgetary process," Stevens said. Accordingly, he recommended that the section dealing with funding be deleted from the bill.

Schneider said the bill would not cost the federal government "one additional penny." It would give the three agencies 180 days to prepare a program plan for scientific drilling activities, including proposed funding levels and plans for international cooperation.

According to Barry Raleigh, chairman of the Deep Observation and Sampling of the Earth's Continental Crust Inc., which manages NSF's ocean drilling program, drilling and directly related costs in the DOE, Defense Dept., USGS and NSF total about $100 million annually. Reasons range from scientific research to geothermal energy resources to studies for underground radioactive waste storage and earthquake hazards research.

"The scientific drilling effort is a potential treasure trove of economic and technological spinoffs but we will not realize those rewards without a concentrated attempt to make that federal investment work to the nation's advantage," he said.

Carel Otte, president of Unocal Corp.'s geothermal division, told the panels an inadequate understanding of the earth's crust and the origin and occurrence of geothermal resources, has been the main impediment to the geothermal industry's growth.

Apart from attaining a better understanding of the earth's processes leading to the current chemical and physical structure of the continental crust, the scientific drilling program will lead to the development of improved drilling techniques, and better drilling and logging instruments and tools, Otte said.

Robert Schock, energy program leader at Lawrence Livermore National Laboratory, said drilling is the only feasible way to study the active processes going on within the earth's crust. Spinoffs to the private sector from development of new drilling techniques are expected to be substantial.

"I firmly believe that [the bill] is the essential first step if the United States is to continue to play a leadership role in the technical world in exploring these great depths; to increase our ability to supply our energy needs, thus decreasing our dependence on foreign resources; to develop national technical means to verify test ban treaty compliance and to safely dispose of the hazardous waste products of our society," Schock said.

November 23, 1987

SENATE VOTES RESTRICTIONS ON LOBBYING BY NATIONAL LAB CONTRACTORS

Limits on lobbying by contractors at DOE's national laboratories were voted by the Senate Nov. 13. An amendment to the FY-88 energy and water appropriations bill (H.R. 2700) bars the contractors from charging the federal government for visits to Congress or state legislatures unless invited by a legislator. Offered by Sen. Howard Metzenbaum, D-Ohio, it replaces a provision that would have spared the department's contractors from lobbying restrictions applied to federal contractors generally.

In floor comments Nov. 13, Metzenbaum said his decision to propose the clampdown was prompted by a lobbying campaign by DOE against a nuclear test ban, in which the department summoned national lab contractors to support its effort. The incident led to questions about lobbying by DOE and its contractors and, following a congressional request, a General Accounting Office probe. GAO, Metzenbaum said, suggested that Congress consider precluding DOE contractors from spending public funds on such lobbying efforts.

"If we allow lab contractors to lobby Congress at whim with taxpayer dollars, we divert funds away

from essential research and into political activities," Metzenbaum said. "Keep in mind that no other contractor is free to expend contract dollars without restriction."

Officials of the Sierra Club, the U.S. Public Interest Research Group and the Environmental Policy Institute, in a Nov. 10 letter to Metzenbaum, complained that similar lobbying tactics were employed during a debate over Price-Anderson nuclear liability legislation. "Some national labs, using tax dollars, successfully lobbied the Senate Energy Committee to exempt them from any financial responsibility for nuclear accidents," they said.

Metzenbaum was joined by Sens. Charles Grassley, R-Iowa, and Carl Levin, D-Mich. He said the amendment had been endorsed by the National Taxpayer's Union, Public Citizen, the U.S. Public Interest Research Group, the Sierra Club, and the Environmental Policy Institute.

Sen. J. Bennett Johnston, D-La., said he designed the original provision freeing DOE contractors from lobbying restrictions out of concern over what he viewed as attempts by the department to "muzzle employees" of national labs, who he said had been supplying him and other senators with "scientific information" on the Strategic Defense Initiative, on the Advanced Vapor Laser Isotope Separation technology for uranium enrichment and on "a whole series of very vital scientific information."

"They came out with these new regulations that would have, in effect, required prior clearance by DOE before they could talk to us or come to Washington," Johnston said. The senator added, however, said that Metzenbaum's amendment would meet his objectives of assuring that information on lab programs sought by Congress will be delivered.

Sen. James McClure, R-Idaho, warned that the measure might stir trouble later, especially over whether a visit to Capitol Hill by a contractor amounts to "impermissible lobbying" or "essential information transfer."

December 21, 1987

'SSC Tax' Part Of The Problem

FERMI, STANFORD LABS WARN CUTS THREATEN ACCELERATOR EXPERIMENTS

aDirectors of DOE's accelerator laboratories last week implored the agency to provide them with more funding this fiscal year, maintaining they are unable to fulfill their experimental roles on the money that has been allocated to them.

Leon Lederman, director of the Fermi National Accelerator Laboratory, told the High Energy Physics Advisory Panel that DOE's Initial Financial Plan for Fermilab jeopardized its ability to run the Tevatron accelerator. Further cuts envisioned by the White House-congressional budget compromise worsen the crisis, Lederman said, adding Fermilab will be forced to cancel an important collider run originally scheduled for March unless provided with additional money from reallocations or additional allocations.

Lederman said his "bottom line" request for FY-88 is $185 million, which he said would enable the Tevatron to be utilized. DOE's initial financial plan in October allocated $183.1 million for the facility, but that was prior to the cuts mandated by the deficit-cutting agreement between the administration and Congress, and did not include funds to be used for the Superconducting Super Collider.

Lederman's remarks were echoed by Burt Richter, director of the Stanford Linear Accelerator Center, who asserted that budget cuts in FY-87 had already reduced the number of users of the facility by 30% and resulted in layoffs. "It's hard to be a lab director in times like this," Richter said. "No new physics" resulted at SLAC during FY-87, partly because of technical problems in bringing the machine into operation but also because of the limited funds, Richter said.

Also hurting the finances of SLAC and Fermilab is the so-called "SSC tax." To meet the FY-88 request of $35 million for SSC, funds were internally reallocated from the other HEP programs. For SLAC, that meant a cut of $7 million from its original budget this year, while Fermilab's ante is $4.4 million. SLAC's initial financial plan for FY-88 is $129.7 million, representing a 4.6% increase over its FY-87 level, which Richter noted was already low.

Lederman pointed to a Nov. 17 letter in which Reps. Robert Roe, D-N.J., chairman of the House Science, Space and Technology Committee, and Marilyn Lloyd, D-Tenn., chairwoman of its subcommittee on energy research and development, expressed to Energy Secretary John Herrington their "deep concern" over the low funding levels for SLAC and Fermilab. "In view of the overwhelming urgency to achieve deficit reduction and recognizing the evident goal of the DOE to maintain significant progress on SSC r&d, the committee is concerned that the large investment in the major new high energy physics facilities not be wasted," the lawmakers wrote.

The letter urged that the "highest priority" be assigned to utilization of the two accelerator facilities,

recommending that their operating funds be given precedence in the distribution of FY-88 high energy physics monies. "It would be a sad commentary on the implementation of our national science policy if these world class machines are not used to their optimum," they said.

Lederman also pointed to competition from the European collider project, CERN, warning that Fermilab will soon be surpassed if adequate funds are not provided for experimentation. — *David Kramer*

December 21, 1987

ADMINISTRATION SAYS EFFORT TO 'BALANCE' TECHNOLOGY FLOW UNNEEDED

Reagan administration science officials recently came out in opposition to a little known provision of the Senate's trade bill proposing an interagency panel to try and balance the flow of technology between the U.S. and its trading partners, principally Japan.

Section 3871 of the Senate-passed trade bill (H.R. 3) would establish a committee, chaired by the Commerce Dept., to study and define the concept of "symmetrical access" to technology and research of other nations and also to recommend to the U.S. Trade Representative specific negotiating goals for regaining the balance. The measure was prompted by complaints from the U.S. scientific and research community that Japan, in particular, does not offer the same kind of access to its research and technology information for American researchers that its scientists are able to obtain from U.S. sources.

But administration officials, such as Peter Jon De Vos, deputy assistant secretary of state for science and technology affairs, argued that the trade bill provision would "needlessly duplicate" existing procedures and processes for redressing the imbalance. He and Thomas Rona, assistant director of the Office of Science and Technology Policy, said President Reagan's April executive order on technology transfer, taken together with other mechanisms already in place, make such a new interagency group redundant. The officials were testifying before House Science, Space and Technology's subcommittee on international scientific cooperation on Dec. 10.

Moreover, De Vos said, the monitoring procedure envisioned in the bill "lacks definition and could prove unfeasible." Most of those who would be charged with the monitoring task lack important scientific and technological expertise, he maintained, and the recommendations produced by the panel would not take into account the numerous other factors involved in government-to-government relationships.

"The committee envisioned by Section 3871 was not necessary to identify a lack of symmetry in our [science and technology] relationship with Japan, nor was it necessary to begin our negotiating effort to restore it. Existing procedures and processes sufficed," De Vos stated.

The concept of symmetrical access arose out of the second annual U.S.-Japan conference on high technology and the international environment in November 1986. The conference, sponsored by the National Academy of Sciences and the National Academy of Engineering and, on the Japanese side, by the Japan Society for the Promotion of Science, blamed the relative inaccessibility of Japanese research institutions to Americans and the existence of different copyright and patent policies in Japan for exacerbating perceptions of unfair trading practices.

The U.S. delegation, headed by former Defense Secretary Harold Brown, concluded that symmetrical access, or the availability of equivalently valued knowledge, technology, financing and markets within the two countries is needed to prevent a cycle of adversarial trade actions that would be damaging to both nations.

But De Vos argued at the hearing that efforts by an interagency committee to define and explain the terms contained in the trade bill "would prove enormously complicated, time-consuming and expensive," adding that the panel's results would likely be inconclusive. The assymetry of the Japanese-American relationship is one that is properly dealt with through bilateral trade negotiations, he said.

An interagency group is already addressing the symmetrical access question, according to Rona. Under OSTP's leadership, the Committee on International Science, Engineering and Technology, is operating with a composition that is "very similar" to that envisioned under the trade measure's proposal, he noted.

Mitchell Wallerstein, associate executive director, office of international affairs at the National Research Council, said the U.S. academies proposed to the Japanese side last April a joint follow-on activity designed to identify specific fields of science and technology in which assymetries exist. Various mechanisms would then be developed to promote a more balanced flow of information and people. The Japanese have tentatively agreed on a range of cooperative activities which are expected to begin early

next year.

Skepticism over the Senate proposal was also voiced by industry. S. Allen Heininger, corporate vice president for resource planning at Monsanto Co., told the subcommittee he was not sure the monitoring system envisioned in the measure is feasible. "There are an enormous number of individual transactions to monitor — they take widely varying form from countertrade to product swaps to payment-in-kind to the normal royalty-bearing licenses. In many instances, the quid pro quo is simply open technology exchanges between laboratory groups. These would be meaningless is simply counted, and nearly impossible to quantify in monetary value," he said.

TEXT OF REMARKS BY THE PRESIDENT
TO THE FEDERAL CONFERENCE ON COMMERCIAL
APPLICATIONS OF SUPERCONDUCTIVITY

Washington Hilton Hotel
Washington, D.C.

July 28, 1987

It's a great pleasure to welcome you to Washington and an honor to address this assembly of some of the foremost members of our scientific and business community.

We are privileged here today to have with us many of those scientists whose pioneering work made this conference on superconductivity a possibility. Congratulations to you all. And it's a safe bet that this conference room also contains many of the minds and spirits who will carry this revolution forward, who will open up a whole new realm of heretofore unimagined possibilities and practical applications.

It's hard to believe that it's been less than one year since we first heard news of the startling breakthrough in superconductivity by two scientists in the I.B.M. labs in Zurich. Since then, it's seemed as if the papers have had to struggle to keep up with the rapid advance up the Kelvin scale.

You know, it's been said that there are three stages of reaction to any new idea: One: It won't work. Two: Even if it works, it's not useful. And Three: I said it was a great idea all along.

Well, to most of us laymen, superconductivity was a completely new term, but it wasn't long before we learned of the great promise it held out to alter our world for the better -- a quantum leap in energy efficiency that would bring with it a host of benefits, not least among them a reduced dependence on foreign oil, a cleaner environment, and a stronger national economy.

I have been accused of being an incurable optimist, but lately I have been playing catch-up ball with the usually more staid science profession. The other day, I met with Dr. Graham and the members of the White House Science Council for a briefing on superconductivity. Edward Teller told me that we have seen discoveries in the laboratory these last eight months that the optimists had thought we wouldn't make for 200 years. One theorist was quoted as saying, "It shows all the dreams we have had can come true. The sky is the limit."

There are predictions of high-speed trains levitated above their tracks, supercomputers on a single silicon chip, cheaper and more effective medical imaging devices -- but I suspect that we haven't even begun to dream the possibilities or imagine the potential. Just as no one imagined 747's making transatlantic commercial flights when the Wright brothers first flew at Kitty Hawk, and no one dreamt of the computer or the communications satellite when Ben Franklin first captured electricity from a lightening bolt.

It was Ben Franklin who wrote, "I have sometimes almost wished it had been my destiny to be born two or three centuries hence. For invention and improvement are prolific, and beget more of their kind. The present progress is rapid. Many of great importance, now unthought of, will before that period be produced; and then I might not only enjoy their advantages, but have my curiosity gratified in knowing what they are to be."

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The present progress is rapid -- and, it seems, constantly accelerating. One can imagine how gratified Ben Franklin would be if he were alive today. But you know, I bet he would join me, and I'm sure most others in this room, in wishing that we had a window to the future -- 10, 20, and 100 years hence -- so that we too could see the marvels of the coming age.

There is something universal in that sentiment, I'm sure, but I can't help but feel that there is something especially American in the optimism, the certainty of hope and faith with which we look to the future.

Two hundred years ago, Thomas Jefferson said, "I like the dreams of the future better than the history of the past." Since that time, we have built here something entirely new, a history in which Thomas Jefferson would have felt more at home. It is a history that is constructed of dreams -- dreamt in freedom and realized in a land of opportunity.

Science tells us that the breakthroughs in superconductivity bring us to the threshold of a new age. It is our task at this conference to herald in that new age with a rush -- if you will, it's our business to discover ways to turn our dreams into history as quickly as possible.

The laboratory breakthroughs into high-temperature superconductivity are an historic achievement. But for the promise of superconductivity to become real, it must bridge the gap from the laboratory to the marketplace, it must make the transition from a scientific phenomenon to an everyday reality, from a specialty item to a commodity.

That's why we're here in this conference, so that business and science can cross-fertilize, can begin at these early stages to dream and plan together -- because this new age of superconductivity is a new arena for the spirit of enterprise, one that we can't even guess the limits of. We also want to see how we in Government can do our part in helping this process along.

Now, I have to confess that I'm one of those people who, when the Government offers to help, gets very nervous. We've learned from experience that the helping hand of Government too often has a crushing weight. I'm reminded of what Wernher von Braun once said about America's space program: "We can lick gravity, but sometimes the paperwork is overwhelming."

This is not to say Government doesn't have an important role -- especially at the basic research level. We must continue to support our outstanding researchers in all disciplines, giving them the freedom, resources, and flexibility they need to dream their dreams and make their experiments. One key for doing this is the National Science Foundation, and we have proposed to double its budget over the next five years. As you may know, the National Science Foundation and NASA provided funding for Dr. Paul Chu's landmark experiments at the University of Houston.

Increasingly, in this last part of the 20th century, information is becoming the most valuable commodity. We have begun major initiatives at our national laboratories to improve communication, and, last April, I signed an Executive Order ensuring that all Federal agencies and laboratories become partners with the private sector in moving research from the laboratories to the marketplace.

The message of Government is simple -- we have an open door policy to the private sector; cooperation, wherever and whenever possible, is the order of the day. We must also move to protect intellectual property and write protections into the freedom of information act for scientific and technical information generated by government laboratories. We need to strengthen patent laws to increase protection for manufacturing processes and speed up the patent process so that it can keep pace with the

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fast-paced world of high technology. And of critical importance, we must modernize our antiquated anti-trust laws -- laws designed for a previous century that only hold America back and give our foreign competition an unfair advantage.

If we're serious about improving American competitiveness, the way to do it isn't through protectionist trade legislation that closes markets and throws people out of work.

One good place to start is bringing anti-trust laws up-to-speed with the modern world. This is no longer the era of the so-called Robber Barons -- it is the age if high-tech and global competition. Let's stop penalizing American business and treating it like an enemy. Let's give ourselves a fair shake in the world marketplace.

I will soon send a legislative initiative to Congress addressing these three issues -- anti-trust, patents, and the freedom of information act -- as they relate to the commerical application of superconductor technology. This package of reforms will go a long way toward preserving the competitive advantage of U.S. industries in this field.

These and other actions are part of an 11-point "Superconductivity Initiative" that will also include a "Wise Men's" advisory group on Federal policies and regulations that effect superconductivity research and commercialization; the "quick start" grants for good ideas on processing superconducting materials into useful forms; the establishment of a number of superconductivity research centers; and a nearly $150-million R & D effort by the Department of Defense over 3 years.

Funding basic research, sharing information, removing the impediments to commercialization -- in this way Government can be a catalyst to the future. But we have an even more important role that we must be sure to accomplish. It is a fundamental role that not only looks forward to the 21st century but harks back to the first principles enunciated in our Constitution 200 years ago.

First, we must recognize that just as recent breakthroughs in superconductivity have outrun existing theories and brought us to the threshold of a new world of opportunities, so, too, the world around us is in the process of a radical transformation, a revolution of shattered paradigms and long-held certainties. This transformation, too, is opening for us new horizons of possibility.

In a recent article, "The New American Challenge," the economist, George Gilder, describes this new reality and how we must respond to it. The information age has only just begun, he says. Increasingly, we are moving from the economy of the Industrial Revolution, an economy tied to the Earth's natural resources, to an economy based on information where that old cliche, knowledge is power, is truer than ever.

It's estimated that raw materials account for 80 percent of the cost of pots and pans, 40 percent of automobiles, and less than two percent for an integrated circuit. The value of a silicon chip doesn't lie in the sand from which it comes, but in the microscopic architecture engraved upon it by ingenious human minds. The most promising superconductors are made from ceramics -- their value doesn't come from their material, but from the brilliant inspiration of a few scientists. It is the human imagination that is building the 21st century out of sand and clay.

We are increasingly moving from an age of things to an age of thoughts, an age of mind over matter. In this new age, it is the mind of man, free to invent, free to experiment, free to dream, that is our most precious resource.

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Gold, steel, oil -- these were the treasures of the past that made people rich and nations strong. Today, the premium is on the human heart and mind. They can't be locked in a vault, nationalized, or expropriated. They can only be let free -- and then really, the sky is the only limit.

That is the American challenge: Will we continue the policies of economic freedom -- of non-inflationary growth, of low and flatter tax rates, and deregulation? Will we strengthen them with an Economic Bill of Rights so that they will never again be lost?

When I signed our tax reform legislation into law, I noted that the last 20 years had witnessed an expansion of many of our civil liberties, but that our economic liberties had been too often neglected, even abused. We protect the freedom of expression of the author, as we should, but what of the freedom of expression of the entrepreneur, whose pen and paper are capital and profits, whose book may be a new invention or small business? What of the creators of our economic life, whose contributions may not only delight the mind but improve the condition of man by feeding the poor with new grains, bringing hope to the sick with new cures, vanquishing ignorance with wondrous new information technologies?

When our forefathers wrote guarantees of life, liberty, and property into our Constitution, they tapped a wellspring of hope and creativity that has transformed history. That basic blueprint they laid down -- the Constitution whose 200th birthday we celebrate this year -- is, if anything, more vital than ever. That secular trinity of "life, liberty, and property" is the key to the future, the key to meeting -- and winning -- the new American challenge.

Archibald MacLeish once said: "There are those, I know, who will reply that the liberation of humanity, the freedom of man and mind, is nothing but a dream. They are right. It is the American dream."

You here today will be among the pioneers carrying on that American dream into the future -- a day when this 20th century of ours may seem no more than a rough prototype of the 21st. I wish you well with the rest of your conference -- you have captured the imagination of the American people, and I'm sure I can speak for them all when I say our hearts and hopes and best wishes go with you.

# # #

THE WHITE HOUSE

Office of the Press Secretary

For Immediate Release July 28, 1987

The President's Superconductivity Initiative

Fact Sheet

The President has announced an eleven-point initiative to promote further work in the field of superconductivity and ensure U.S. readiness in commercializing technologies resulting from recent and anticipated scientific advances.

The U.S. has been a leader for years in the field of superconductivity -- the phenomenon of conducting electricity without resistance. U.S. private and Government researchers have also been at the forefront of recent laboratory discoveries allowing superconductivity to occur at higher temperatures and with greater current-carrying capacity than was previously possible.

The Federal Government has played a key role in these developments through the funding of basic research. The National Science Foundation (NSF) and the National Aeronautics and Space Administration (NASA) both provided funding for Dr. Paul Chu at the University of Houston in his landmark efforts in raising the temperature at which superconductivity occurs. In addition, the Department of Energy (DOE), which is the principal Federal supporter in the field of superconductivity, has been a leader in the search for the mechanism that produces high-temperature superconductivity and in research into the practical uses of these new materials. The Federal Government is currently spending approximately $55 million in superconductivity research, with more than one-half of that reallocated within the last six months.

The President's initiative reflects his belief that it is critical that the U.S. translate our leadership in science into leadership in commerce. While the U.S. private sector must take the lead, the Administration is taking important actions to facilitate and speed the process, including increasing funding for basic research and removing impediments to procompetitive collaboration on generic research and production and to the swift transfer of technology and technical information from the Government to the private sector.

The President's Superconductivity Initiative has three objectives:

1. Promoting greater cooperation among the Federal Government, academia, and U.S. industry in the basic and enabling research that is necessary to continue scientific breakthroughs in superconductivity;

2. Enabling the U.S. private sector to convert more rapidly scientific advances into new and improved products and processes; and

3. Better protecting the intellectual property rights of scientists, engineers, and businessmen working in superconductivity.

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The Superconductivity Initiative includes both legislative and administrative proposals. The former will be forwarded in a single bill. The major components of the Initiative are:

Legislative

1. Amending the National Cooperative Research Act (NCRA) to expand the concept of a permissible joint venture to include some types of joint production ventures. This is a particularly important step that would ease the risk of antitrust litigation perceived by U.S. businesses that could otherwise benefit from procompetitive joint ventures. If enacted, it could benefit not just developments using superconductivity, but other high technology products as well.

2. Amending U.S. patent laws to increase protection for manufacturing process patents. This would enable U.S. owners of process patents to obtain damages for infringement where products made with those processes are imported into the U.S.

3. Authorizing Federal agencies to withhold from release under the Freedom of Information Act (FOIA) commercially valuable scientific and technical information generated in Government owned and operated laboratories that, if released, will harm U.S. economic competitiveness.

Administrative

4. Establishing a "Wise Men" Advisory Group on Superconductivity under the auspices of the White House Science Council. This would be a small group of three to five people from industry and academia that would advise the Administration on research and commercialization policies.

5. Establishing a number of "Superconductivity Research Centers" (SRCs) and other similar groups that would: (1) conduct important basic research in superconductivity; and (2) serve as repositories of information to be disseminated throughout the scientific community.

   a. The Department of Energy will establish three SRCs, as well as a computer data base:

      -- Center for Superconductivity Applications at the Argonne National Laboratory;

      -- Center for Thin Film Applications at the Lawrence Berkeley Laboratory;

      -- Center for Basic Scientific Information at the Ames Laboratory; and

      -- Computer Data Base on Superconductivity at the DOE Office of Scientific & Technology Information.

   b. The Department of Commerce (DOC) will establish a Superconductivity Center at the National Bureau of Standards (NBS) laboratory in Boulder, Colorado. The center will focus on electronic applications of high temperature superconductivity.

   c. The National Aeronautics and Space Administration (NASA) is establishing a coordinating group on superconductivity activities at its office of Aeronautics and Space Technology.

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d. The National Science Foundation (NSF) will augment its support for research in high temperature superconductivity programs at three of its materials research laboratories. In addition, NSF is initiating a series of "quick start" grants for research into processing superconducting materials into useful forms including wires, rods, tubes, films, and ribbons.

e. The Department of Defense is developing a multi-year plan to ensure use of superconductivity technologies in military systems as soon as possible. DoD will spend nearly $150 million over three years.

DoD will build upon its long experience in superconductivity R&D to systematically: define the engineering parameters for high-temperature superconducting materials; develop the required processing and manufacturing capabilities; and accomplish the necessary development, engineering, and operational prototype testing of superconductors.

Small scale applications with commercial spin-off potential include sensors and electronics. Potential large-scale applications include compact, high-efficiency electric ship drive; electrical energy storage; pulsed power systems; and free electron lasers.

6. Urging all Federal agencies to implement quickly the steps outlined in Executive Order 12591 designed to: (1) transfer technology developed in Federal laboratories into the private sector; and (2) encourage Federal, university, and industry cooperation in research. The White House Science Advisor will report to the President by December 1, 1987 on progress in implementing the Executive Order, particularly with regards to superconductivity.

7. Directing the Patent and Trademark Office to accelerate the processing of patent applications and adjudication of disputes involving superconductivity technologies when requested by the applicants to do so.

8. Directing the NBS to accelerate its efforts to develop and coordinate common standards (e.g. measurement methods, standard reference materials, and supporting technical data) in the U.S. and internationally for superconductors and related devices.

9. Encouraging Federal agencies to continue to reallocate FY 1987 funds into superconductivity basic research, applied research in enabling technologies, and prototype development. Agencies are directed to place a high priority for this area in FY 1988 funding and FY 1989 planning.

10. Requesting that DoD accelerate prototype work in sensor, electronic, and superconducting magnet-based military applications and that the Department of Commerce accelerate development of prototype devices in detection and measurement of weak magnetic fields.

11. Taking advantage of the opportunity presented by the current negotiations for renewing the U.S. - Japan Agreement on Science and Technology to seek reciprocal U.S. opportunities to participate in Japanese government supported research and development, including superconductivity.

In April, the President issued Executive Order 12591 Facilitating Access to Science and Technology directed at encouraging increased commercialization of the U.S. science and technology enterprise.

# # #

U.S. DEPARTMENT OF ENERGY
OFFICE OF THE PRESS SECRETARY
WASHINGTON, DC 20585

DOE NEWS:

SUPERCONDUCTIVITY

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FOR IMMEDIATE RELEASE
July 31, 1987

HERRINGTON ORDERS SWIFT DOE ACTION ON PRESIDENT'S SUPERCONDUCTIVITY INITIATIVE

Secretary of Energy John S. Herrington today directed Department of Energy officials to move immediately to implement DOE-related elements of the Superconductivity Initiative announced by the President this week at the Federal Conference on Commercial Applications of Superconductivity.

In conjunction with the President's initiative, Herrington announced that he has asked Los Alamos National Laboratory to explore private sector interest in the establishment of cooperative research programs to develop enabling technologies for commercial applications of superconductivity.

"Along with our traditional support for basic research, we must lay the foundation for commercial applications. I believe we can and should play a leading role in promoting a partnership between the private sector and the laboratory and encouraging collaboration at all levels," Herrington said.

Los Alamos is being asked to lead the effort to explore the development of partnerships with U.S. industry. Their effort could lead to establishment of a pilot program that, if successful, will be expanded to other DOE laboratories.

As part of this effort, the department will expedite an ongoing effort to remove impediments to the transfer of technology developed in federal laboratories into the private sector.

(MORE)

DOE laboratories have been asked to place a high priority on superconductivity research in FY 1988 funding and FY 1989 budget planning. New high temperature-related superconductor materials research is presently underway at the Argonne, Brookhaven, Los Alamos, Sandia, and Oak Ridge National Laboratories and at the Lawrence Berkeley and Ames Laboratories.

Two consortia of laboratories have been organized to conduct research aimed at particular aspects of materials processing: Los Alamos, Oak Ridge, and Lawrence Berkeley on synthesis, thin films, and alternate processing materials; Argonne, Brookhaven, and Ames on conductor development.

As part of the President's initiative, the Department will also establish three Superconductivity Research Centers, as well as a Computer Data Base on Superconductivity at the DOE Office of Scientific and Technical Information at Oak Ridge, Tennessee. The Centers will facilitate transfer to the private sector of information and research developed by all the national laboratories involved with superconductivity research.

"These centers will complement the important work that is being performed at our laboratories," Herrington said. The centers will provide a mechanism for a more efficient and smooth dissemination of research and information pertinent to superconductivity. The three centers will be the Center for Superconductivity Applications at the Argonne National Laboratory; the Center for Thin Film Applications at the Lawrence Berkeley Laboratory; and the Center for Basic Scientific Information at the Ames Laboratory.

These centers are expected to be operational in a few months. Telephone numbers and procedures regarding access to these centers will be announced in the next several weeks. In addition, the President, in his July 28 initiative, called for the establishment of a Computer Data Base on Superconductivity by the DOE Office of Scientific and Technical Information. The office already has begun a trial operation of information exchange among Department reseachers and will now study the concept of a computerized data base to coordinate the dissemination of information on an on-line system.

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HIGH TEMPERATURE SUPERCONDUCTIVITY

DARPA

Chronology

- Reports at December 1986 Materials Research Society (Boston) meeting called attention to discovery of high temperature superconductors (HTS)

DARPA's Response

- Approximately six of our contractors working in the area of ceramic processing redirected portions of their research to HTS by April 1987
- $1.5 M of FY 87 funds were reprogrammed to fund ten unsolicited proposals (four universities, three industries, and three government labs). Contracts let by August 1987
- DARPA and ONR planned and initiated a program on "Processing, Fabrication, and Demonstration of High Temperature Superconductors"
  - Broad agency announcements in *Commerce Business Daily* (April 28, 1987 and June 8, 1987)
  - Industry/university briefing on June 26, 1987
  - Receipt of 203 proposals requesting a total of about $300 M by July 24, 1987 deadline
  - Review of proposals and selection of winners to be completed by November 15, 1987
  - Contract start target date is not later than January 1, 1988

HIGH TEMPERATURE CERAMIC SUPERCONDUCTORS

RESEARCH SOLICITATION

DARPA

- With the Office of Naval Research
- 203 proposals received July 24, 1987
- Requested $330 million over 3 years
- Expect pre-contract awards to begin by November 1
- Expect contracts by January 1

- From 35 states and Washington, D.C.
- 120 companies, 60 universities, DoD laboratories, DoE national labs, NBS, other non-profit organizations
- 68% of industry response from small businesses
- 63% of industry response from companies that do not traditionally participate in DoD R&D programs

- 79 proposals on bulk materials
- Ideas:
  - Chemical approaches to manufactured powders and fibers
  - Superconducting fiber composites with metal and/or polymers
  - Microwave sintering
- Applications:
  - Large scale transmission cables
  - Magnets, magnetic shielding
  - Actuators, energy storage devices
  - Solenoids, motors
  - Magnetic bearings

- 68 proposals on thin and thick films
- Ideas:
  - Novel sputtering and deposition techniques
  - Laser flash evaporation
  - Molecular Beam Expitaxy
  - Metal-organic chemical vapor deposition
- Applications:
  - Microelectronic transmission lines and interconnects
  - Ultra-sensitive magnetic detectors
  - Microwave and millimeter wave phase shifters, RF cavities
  - Electronic frequency filters, circuits
  - Josephson Junction Devices

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HIGH TEMPERATURE CERAMIC SUPERCONDUCTORS

DARPA

- ► Projects initiated in FY 87
- ► Emphasis on advanced and novel processing

• Penn State	• Suprconducting composites for toughness, ceramic powders in polymer matrix
• Stanford	• Electrochemical approach to make superconducting films and wires
• U.C. Santa Barbara	• Thin film electronic devices based on superconductor/ semiconductor junctions. Electron beam and sputter deposition
• MIT	• Sol gel processing of ceramic monoliths
• NBS	• Phase diagram studies; composites
• Argonne National Lab	• Slip casting of tapes and composites
• NRL	• Microstructural and magnetic/electrical characterization
• Ceramic Processing Systems, Inc.	• Metal clad wire of superconducting ceramics
• General Electric Co.	• Processing to optimize critical current densities, controlled precipitates, grain size, and porosity
• Rockwell International	• Thin films by magnetron sputtering and metal organic chemical vapor deposition

NATIONAL ACADEMY OF SCIENCES
NATIONAL ACADEMY OF ENGINEERING INSTITUTE OF MEDICINE

COMMITTEE ON SCIENCE, ENGINEERING,
AND PUBLIC POLICY

2101 Constitution Avenue Washington, D.C. 20418
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Date: September 21, 1987
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PANEL OUTLINES NATIONAL RESEARCH STRATEGY FOR HIGH-TEMPERATURE SUPERCONDUCTING MATERIALS

FOR IMMEDIATE RELEASE

WASHINGTON -- Capitalizing on the "enormous scientific opportunity" and the important commercial potential presented by recently discovered high-temperature superconductors -- in the face of stiff international competition -- will require a coordinated U.S. national research program stretching over "a decade or more," a panel of scientific and technical experts said* today.

The group recommended that the federal government proceed with current plans to provide about $100 million in fiscal 1988 for high-temperature superconductivity research and development and identified major scientific and technical objectives for such a program. It also urged the federal government to help U.S. industry meet the challenge of foreign competition in the field through enhanced university/industry interaction, cost-sharing on proof-of-concept projects, and improved programs for transferring new technologies from national laboratories to industry.

"The short-term problems and long-term potential of high temperature superconductivity may both be easily underestimated," the panel commented. Major problem areas include developing fabrication and processing methods and improving understanding of the essential physical properties of the brittle, superconducting materials. Initial applications for the materials will most likely be

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*Copies of the committee's report, Report of the Research Briefing Panel on High-Temperature Superconductivity, are available from the Committee on Science, Engineering, and Public Policy at the letterhead address. Reporters may obtain copies from the Office of News and Public Information, also at the letterhead address.

extrapolations of technology already being considered for lower temperature superconductors, it said. Near-term examples cited included magnetic shielding, detectors of magnetic fields and infrared radiation, high-speed electronic signal processors, and voltage standards. Longer term applications include power transmission lines and magnets in generators; energy storage equipment; magnets for high-energy accelerators; magnets for medical imaging machines; superconducting/ semiconducting hybrid computer devices; and levitated vehicles, such as trains that ride on a magnetic field above their tracks.

A FUNDAMENTAL CHALLENGE

The discovery of mixed ceramic oxides that become superconducting at temperatures as high as -178 degrees Celsius has "fundamentally challenged" previous theories designed to explain the phenomena, in which materials lose all resistance to electric current. The fact that the new materials may be cooled with liquid nitrogen, rather than the much more expensive liquid helium, "will lead to improvements but it is not revolutionary," noted the panel. "If room-temperature superconductors become available, we can expect a truly revolutionary expansion of superconducting applications in electrotechnology."

The panel conducted its study of superconductivity under the aegis of the Committee on Science, Engineering, and Public Policy (COSEPUP), a joint unit of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. The panel's study is one of five requested by the White House Office of Science and Technology Policy and the National Science Foundation as part of an annual COSEPUP program to assist the federal government in the setting of budget priorities. Other topics covered in research briefings this year include chemical and materials processing for information storage and handling; biological control of managed ecosystems; order, chaos, patterns; and changing patterns of funding for the research enterprise.

(MORE)

CRITICAL PROPERTIES

A superconducting material must possess a number of important properties in order to be useful in electronics and other products. These properties include superconductive behavior at an attainable temperature, the ability to sustain superconductivity in the presence of high magnetic fields, and the ability to maintain superconductivity while carrying high electrical current densities. This last property is still lacking in the bulk forms of the new superconducting materials, the panel pointed out, and "must be a principal focus of research on fabrication processes."

In addition, researchers will need to find ways to form the brittle new materials into wires, thin films, and other more complicated shapes, as well as to protect them from chemical degradation.

INTERNATIONAL COMPETITION

The panel found that the United States is "in a good competitive position in the science of this field" and that U.S. researchers have made important contributions to current knowledge about the new materials. At the same time, it observed that several other countries, including Japan, Western European nations, and the U.S.S.R., have launched substantial scientific and technical efforts in high-temperature superconductivity.

The success of U.S. efforts to commercialize superconductivity technologies, the panel continued, "will depend not only upon technological factors, but also upon company business strategies and upon a range of government policies." It suggested that these federal government policies include monitoring the need for increases in scientific and technical manpower, coordinating planning for superconductivity programs among the various federal agencies, and reviewing progress in the field after 12 months as a guide for future funding.

It also advised the United States to "maintain an open and cooperative international posture."

(OVER)

The Research Briefing Panel on High-Temperature Superconductivity was chaired by John K. Hulm, director, Corporate Research and R&D Planning, Westinghouse R&D Center, Pittsburgh.

Other members were: Neil W. Ashcroft, department of physics, Cornell University; Roger W. Boom, professor and director, Applied Superconductivity Center, Nuclear Engineering and Metallurgical Engineering, College of Engineering, University of Wisconsin, Madison; Judy L. Bostock, budget examiner, nuclear energy branch, energy and science division, Office of Management and Budget, Executive Office of the President; H. Kent Bowen, Ford Professor of Engineering, Massachusetts Institute of Technology, Cambridge; Robert J. Cava, technical staff, AT&T Bell Laboratories, Murray Hill, N.J.; Paul C.W. Chu, department of physics, University of Houston, Texas; John Clarke, professor of physics, University of California, Berkeley, and principal investigator, Lawrence Berkeley Laboratory; Marvin Cohen, professor of physics, University of California, Berkeley; James S. Edmonds, senior project manager, Electric Power Research Institute, Palo Alto, Calif.; and Douglas K. Finnemore, associate director, science and technology division, Ames Laboratory, U.S. Department of Energy, Ames, Iowa.

Also serving were: Eric B. Forsyth, chairman, accelerator development department, Brookhaven National Laboratory, Upton, N.Y.; Theodore H. Geballe, professor of applied physics, Stanford University, Stanford, Calif.; David C. Larbalestier, associate director, Applied Superconductivity Center, department of metallurgical engineering, University of Wisconsin, Madison; Charles Laverick, private consultant, Patchogue, N.Y.; Alexis P. Malozemoff, division coordinator for high-temperature superconductivity, T.J. Watson Research Center, IBM Corp., Yorktown Heights, N.Y.; James H. Parker, private consultant, Penn Hills, Penn.; David H. Pines, professor, Loomis Laboratory of Physics, University of Illinois, Urbana; Carl Rosner, president, Intermagnetics General Corporation, Guilderland, N.Y.; John Rowell, assistant vice president, Solid State Science and Technology Research Laboratory, Bell Communications Research, Red Bank, N.J.; Arthur Sleight, Central Research and Development Department, Experimental Station, E.I. duPont de Nemours & Co., Wilmington, Del.; James L. Smith, senior scientific advisor, Center for Materials Science, Los Alamos National Laboratory, Los Alamos, N.M.; Masaki Suenaga, senior metallurgist, department of applied sciences, Brookhaven National Laboratory; Maury Tigner, Newman Laboratory, Cornell University, Ithaca, N.Y.; Michael Tinkham, physics department, Harvard University, Cambridge, Mass.; and John Williams, head, magnet technology division, National Magnet Laboratory, Massachusetts Insitute of Technology, Cambridge.

Allan R. Hoffman, executive director of the Committee on Science, Engineering and Public Policy, served as the study director.

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DOE OFFICE OF ENERGY STORAGE & DISTRIBUTION HIGH TEMPERATURE SUPERCONDUCTING MATERIALS FOR APPLICATION ON ELECTRIC POWER SYSTEMS

The Office of Energy Storage and Distribution (OESD) of the Department of Energy has concluded the preliminary phase of its analysis of power system applications for the new high temperature superconductors. Results of the study and goals for further research are contained in a report, "Advances in Applied Superconductivity: Goals and Impacts, a Preliminary Evaluation." This report documents the basis of the statements in this summary and outlines in some detail the potential impact resulting from the use of high temperature superconducting materials in power system applications.

In April 1987, the OESD began this process by convening key individuals to review the new high temperature (Hi Tc) superconducting materials, and to begin an initial assessment of the use of these materials in electric power system applications. This analysis is an overview assessment of how the Hi Tc materials might replace the niobium class, helium temperature materials. A complete analysis of the Hi Tc class materials must include consideration of new smaller sized alternative designs, which are potentially more marketable than the large devices used as models for this study. Each of the applications also will require a more thorough investigation on how to optimize for the new material. This will be a future task. Currently, there is only limited knowledge of the electrical and mechanical properties of the Hi Tc materials for power application field. Therefore, this work should give the research community sufficient direction for future goals. By and large, the results stated in this assessment are consistent with the results of similar assessments prepared by other nations. Therefore, one could conclude that other nations are working toward similar goals.

SUMMARY OF RESULTS

To take advantage of liquid nitrogen, the Hi Tc materials are assumed to operate at about 77 kelvin, with characteristics similar to niobium materials. With this in mind, to be successfully applied to power system devices, such as generators, cables, magnetic storage, transformers, motors, etc., the Hi Tc materials must meet the following criteria:

MATERIAL REQUIREMENTS FOR BULK Hi Tc MATERIALS

Application	Operating Current Density (Jop) KA/sq. cm. (present design)	Minimum Operating Current Density $kA/cm.^2$	Estimated Minimum Critical Current Density $kA/cm.^2$	Operating Magnetic Field Tesla	Strain Tolerance %
1. Generator	30	30	45	2	.2
2. Magnetic Storage	600	200	250	5	.2
3. A.C. Transmission Cable	230 (500 A/cm)	190(a) (400 A/cm)	380(a) (800 A/cm)	1	.2
4. Transformer	40	40	50	0.3	.2
5. Motors	10	5	50	2-3	.2
6. Mag.Separation	10	5		2-5	.2

(a) Current Density is based on assumption that the superconductor will not carry full fault current

NOTE: Items 1-3 above must have a life expectancy of 30 years.
Items 4-7 above must have a life expectancy of 10 years.
All use conductor wire except the Cable (#3), which used tape.

There has been substantial R&D in the OESD program in the first three applications.

PRIORITIES

From the above table, it is obvious that the most important task for the research scientists is to increase the current density at high temperatures, which is of greater importance for these devices than higher transition temperatures. The higher critical current density (Jc) must be chemically, mechanically and electromagnetically stable in operating fields.

The following indicates the near term research priorities for the OESD program, in order of importance:

1. To conduct focused research to increase the Jc in wires and tapes, with special emphasis on the chemical and anisotropy issues.

2. To conduct a more in depth technical assessment and market analysis to identify the most promising designs and applications using the Hi Tc materials as a base, and to consider the most appropriate sized devices.

3. To assess the cooling approach, especially at the conductor surface, and to develop new electrical stability criteria.

4. To devise processing and fabrication techniques, to include working samples of wires and tapes.

5. To characterize the mechanical behavior required for each application.

6. To develop techniques to assure the adhesion of the Hi Tc superconductors to various mechanical and electrical stabilizers.

100TH CONGRESS
1ST SESSION

H. R. 3024

To establish a National Superconductor Manufacturing and Processing Technology Initiative, and for other purposes.

IN THE HOUSE OF REPRESENTATIVES

JULY 28, 1987

Mr. RITTER (for himself, Mr. LUJAN, Mr. BROWN of California, Miss SCHNEIDER, Mr. BOEHLERT, Mr. LEWIS of Florida, Mr. FAWELL, Mr. HENRY, Mr. FISH, and Mr. HOUGHTON) introduced the following bill; which was referred jointly to the Committees on Science, Space, and Technology and Armed Services

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A BILL

To establish a National Superconductor Manufacturing and Processing Technology Initiative, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the "National Superconductor Manufacturing and Processing Technology Act of 1987".

SEC. 2. FINDINGS.

The Congress finds and declares the following:

(1) Recent discoveries of high-temperature superconducting materials could significantly increase the efficiency and utility in many applications involving the way electricity is used in such areas as microelectronics, computers, power systems, transportation, medical imaging, and nuclear fusion. As is the case with revolutionary scientific advances, most potential applications lie beyond our ability to predict them.

(2) The United States manufacturing industries are confronting strong competition in both domestic and world markets. Leading foreign industrial countries as well as emerging and developing nations are increasingly taking advantage of modern technology and production techniques, innovative management focused on quality, less expensive labor, and favorable government support to produce manufactured products which are competitive and often less expensive than products manufactured in the United States.

(3) United States competitors have learned to accelerate the development of new products based on United States Government and private sector research and development, in many cases faster and better than United States industries. Increasingly, these foreign products are produced using technologies and processes developed outside the United States.

(4) If the United States is to regain its competitive advantage, once enjoyed and unrivaled for decades, it must commit sufficient resources directed toward solving processing and manufacturing problems in parallel with basic research and development. The United States does not have the luxury of waiting for basic research and development to be completed before beginning this work. If it does, it will lose the race to commercialize superconductors. Thus, timely commercialization of scientific advances in superconductivity will be critical to the future industrial competitiveness of the United States.

(5) In the field of high-temperature superconductors, the United States and its competitors are attempting to commercialize a scientific advance with no nation having a significant headstart. This effort offers a model situation where the Federal Government can cooperate with industry to accelerate the applications of scientific advances. There is a great need to promote greater precommercial stage collaboration among United States industrial players and to reduce potentially wasteful duplicative efforts while simultaneously advancing the basic science and processing and manufacturing potential of high-temperature superconductors.

(6) Federal agencies have quickly responded to this exciting challenge by reprogramming funds into basic superconductivity science and research and informally coordinating their efforts to avoid unnecessary duplication. However, there seems to be an insufficient commitment of Federal research money and effort directed to manufacturing, ceramics processing, and fabrication technologies, which are essential to develop in parallel with the basic scientific discoveries so that commercial production of high-temperature ceramic superconductors is facilitated once the scientific problems are solved.

(7) Currently, there is no civilian Federal agency which focuses mainly on processing and manufacturing research, technology development, and applications. Rather, these functions are supported on an independent basis and only to a minimum extent by several civilian departments and agencies, primarily the Department of Energy, the National Science Foundation, and the National Bureau of Standards.

(8) The Defense Advanced Research Projects Agency has a successful record of managing and coordinating programs for the development of technologies relevant to both commercial and defense industries, such as Strategic Computing, composite materials, phased-array radar, and for large-scale program management involving industry in manufacturing and

processing. The Defense Advanced Research Projects Agency's program management expertise in coordinating industry, government, and academe in manufacturing and processing programs would greatly contribute to United States progress in commercializing superconductivity advances.

(9) The Defense Advanced Research Projects Agency is the appropriate agency to manage the majority of new Federal manufacturing and processing technology research and development, not only because of its experience and expertise, but because no other Federal agency has a similar capability, or could be established in a timely manner. If the United States does not now begin to research and develop new processes and manufacturing technologies relating to high-temperature superconductors, the United States will have wasted invaluable time that could put United States industries at a permanent disadvantage with foreign competitors. The Defense Advanced Research Projects Agency has the capability to begin much needed work immediately.

(10) The National Science Foundation has shown itself to be the Federal Government's leader in sponsoring individuals to do basic research in superconductivity at United States universities and, in general, in

bringing about United States industry interactions with university programs such as Material Research Laboratories, Engineering Research Centers, and the new Science and Technology Centers. The National Science Foundation has a major contribution to make in a superconductivity initiative as it pursues answers to basic scientific questions critical to the eventual commercialization of high-temperature superconductors.

(11) The Department of Energy, particularly in some of its National Laboratories, offers significant capability in superconductivity research and development, and has both the personnel and the facilities to aid in commercializing advances in high-temperature superconductors.

(12) The National Bureau of Standards has developed collaborative programs with United States industry encompassing standards, measurements, sensors, materials properties, and other areas. The facilities and personnel of the National Bureau of Standards present significant potential for contributing to a nationwide superconductivity effort.

SEC. 3. PURPOSES.

It is the purpose of this Act, through the National Superconductor Manufacturing and Processing Technology Initiative—

(1) to complement basic superconductivity research by promoting the rapid development of manufacturing and processing technologies necessary for the commercialization of high-temperature superconductors;

(2) to promote collaborative arrangements and consortia of industry (including small business) which may also involve universities and independent research organizations;

(3) to coordinate the management of manufacturing and processing technology research and development programs conducted by the Defense Advanced Research Projects Agency, the Department of Energy, the National Science Foundation, and the National Bureau of Standards; and

(4) to augment basic and applied superconductivity research.

SEC. 4. NATIONAL SUPERCONDUCTOR MANUFACTURING AND PROCESSING TECHNOLOGY INITIATIVE.

There shall be established a National Superconductor Manufacturing and Processing Technology Initiative (hereafter in this Act referred to as the "Initiative"). The Initiative shall be implemented by the Defense Advanced Research Projects Agency, the Department of Energy, the National Science Foundation, and the National Bureau of Standards. These agencies, with the advice and assistance of the Coordi-

nating Council established under section 5, shall coordinate their efforts to implement the Initiative.

SEC. 5. SUPERCONDUCTIVITY MANUFACTURING AND PROCESSING TECHNOLOGY COORDINATING COUNCIL.

(a) ESTABLISHMENT.—There shall be established a Superconductivity Manufacturing and Processing Technology Coordinating Council (hereafter in this Act referred to as the "Coordinating Council").

(b) FUNCTIONS.—The Coordinating Council shall—

(1) serve as a forum for the coordination of the Federal Government's activities with respect to superconductivity manufacturing and processing technology research and development;

(2) work closely with the agencies charged with implementing the Initiative under this Act, and with other Government agencies, private organizations, private industry, and universities, where appropriate, to formulate superconductivity applications research and development priorities, strategies, and agendas in order to best utilize American expertise in high-temperature superconductors;

(3) provide advice to the agencies charged with implementing the Initiative under this Act with respect

to the establishment and management of the superconductivity programs of such agencies; and

(4) establish a private sector advisory body, drawn from members of the National Commission on Superconductivity established under section 7, to comment on—

(A) the priorities, strategies, and agendas developed by the Coordinating Council; and

(B) the activities carried out under the Initiative.

(c) MEMBERSHIP.—The members of the Coordinating Council shall be—

(1) the Director of the Defense Advanced Research Projects Agency;

(2) the Assistant Secretary of Energy for Conservation and Renewable Energy;

(3) the Director of the Office of Energy Research for the Department of Energy;

(4) the Director of the National Science Foundation;

(5) the Director of the National Bureau of Standards; and

(6) the Assistant Secretary of Commerce for Productivity, Technology, and Innovation,

or their designees.

(d) STAFF.—The Coordinating Council shall be supported by staff from each of the member agencies, as appropriate.

(e) REPORTS TO CONGRESS.—(1) The Coordinating Council shall, within one year after the date of the enactment of this Act and annually thereafter, prepare and submit to the Congress a long-range plan of activities for the Initiative.

(2) Each plan submitted to the Congress under this subsection shall as fully as possible prioritize the full range of research activities appropriate to the Initiative, including the current status of each activity. These plans may include assessments and recommendations regarding impediments, including legal and regulatory impediments and barriers, which prevent the efficient implementation of this Act.

SEC. 6. IMPLEMENTATION OF INITIATIVE.

Each of the agencies charged with the implementation of the Initiative under this Act, to the extent necessary to implement the Initiative and as appropriate to the mission of such agency—

(1) shall encourage industry, including small business, government, and universities to develop processing, fabrication, manufacturing, and other appropriate technologies necessary for the application and commercialization of scientific advances in superconductivity technology;

(2) shall develop team approaches to overcome key technological hurdles, and seek collaborative arrangements of industry, including small business, and others, such as the National Laboratories, independent research organizations, and universities;

(3) shall utilize Federal resources and facilities where appropriate, including the Department of Energy National Laboratories, Engineering Research Centers, and Science and Technology Centers, for designation as superconductivity centers which seek private sector involvement in the form of consortia and collaborative efforts and for other purposes;

(4) shall work closely with the private sector to ensure that the private sector has significant input to the Initiative and that the Initiative is responsive to the needs of the private sector;

(5) may provide grants and contracts to individual firms and collaborative team efforts of industry, or of industry in combination with universities and independent research organizations, for superconductivity research, development, processing, manufacturing, and applications research; and

(6) shall facilitate Government, academic, and private sector efforts to transfer information on superconductivity science and technology advances made in the United States and foreign countries.

SEC. 7. NATIONAL COMMISSION ON SUPERCONDUCTIVITY.

(a) IN GENERAL.—The President shall appoint a National Commission on Superconductivity to review all major policy issues regarding United States applications of recent research advances in superconductors in order to assist the Congress in devising a national strategy, including research and development priorities, the development of which will assure United States leadership in the development and application of superconducting technologies.

(b) MEMBERSHIP.—The membership of the National Commission on Superconductivity shall include representatives of—

(1) the National Critical Materials Council, the National Academy of Sciences, the National Academy of Engineering, the National Science Foundation, the National Aeronautics and Space Administration, the Department of Energy, the Department of Justice, the Department of Commerce (including the National Institutes of Technology and Standards), the Department of Transportation, and the Department of Defense;

(2) organizations whose membership is comprised of physicists, engineers, chemical scientists, and material scientists; and

(3) industries, universities, and national laboratories engaged in superconductivity research.

(c) COORDINATION.—The National Critical Materials Council shall be the coordinating body of the National Commission on Superconductivity.

(d) REPORT.—Within 6 months after the date of the enactment of this Act, the National Commission on Superconductivity shall submit a report to the President and the Congress with recommendations regarding methods of enhancing the research, development, and implementation of improved superconductor technologies in all major applications. Upon submitting its report and recommendations under the preceding sentence the Commission shall disband.

(e) SCOPE OF REVIEW.—In preparing the report required by subsection (d), the Commission shall consider addressing, but need not limit, its review to—

(1) the state of United States competitiveness in the development of improved superconductors;

(2) methods to improve and coordinate the collection and dissemination of research data relating to superconductivity;

(3) the appropriateness and scope of United States efforts regarding research on and development of improved superconductors and the level of consultation

among United States organizations doing research in this field;

(4) methods to improve and coordinate the development of viable applications of improved superconductors;

(5) foreign government activities designed to promote research, development, and application of improved superconductors;

(6) the need to provide increased Federal funding of research and development of improved superconductors;

(7) the impact on the United States national security if the United States must rely on foreign producers of superconductors; and

(8) any statutory changes that would increase the likelihood that applications of promising superconductivity technologies will occur within the United States.

SEC. 8. AUTHORIZATION OF APPROPRIATIONS.

There is authorized to be appropriated—

(1) to the Defense Advanced Research Projects Agency for carrying out this Act, not to exceed $50,000,000 for each of the fiscal years 1988, 1989, 1990, 1991, and 1992;

(2) to the National Science Foundation for carrying out this Act, not to exceed $12,500,000 for each of the fiscal years 1988, 1989, 1990, 1991, and 1992;

(3) to the Department of Energy for carrying out this Act, not to exceed $12,500,000 for each of the fiscal years 1988, 1989, 1990, 1991, and 1992; and

(4) to the National Bureau of Standards for carrying out this Act, not to exceed $5,000,000 for each of the fiscal years 1988, 1989, 1990, 1991, and 1992.

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100TH CONGRESS
1ST SESSION

H. R. 3217

To establish a national Federal program effort in close collaboration with the private sector to develop as rapidly as possible the applications of superconductivity to enhance the Nation's economic competitiveness and strategic well-being, and for other purposes.

IN THE HOUSE OF REPRESENTATIVES

AUGUST 7, 1987

Mr. MCCURDY (for himself, Mr. BROWN of California, and Miss SCHNEIDER) introduced the following bill; which was referred jointly to the Committees on Science, Space, and Technology and Armed Services

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A BILL

To establish a national Federal program effort in close collaboration with the private sector to develop as rapidly as possible the applications of superconductivity to enhance the Nation's economic competitiveness and strategic well-being, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the "National Superconductivity, Competitiveness and National Security Act of 1987".

SEC. 2. FINDINGS AND PURPOSES.

(a) FINDINGS.—The Congress finds and declares that—

(1) the discovery of new high-temperature superconductivity materials opens the way for a potential new industrial revolution;

(2) successful application of the new superconducting materials could provide for new economic forms of transportation, more powerful supercomputers and electronic devices, new medical scanning devices, and immensely improved generation, storage, and transmission of electricity, among other technological and societal opportunities;

(3) the Nation's economic competitiveness and strategic well-being depends substantially on the development and application of critical advanced technologies such as those anticipated to evolve from the new superconducting materials;

(4) whereas we have as a Nation been highly successful in the conduct of basic research in a variety of scientific areas, including superconductivity, other nations have been highly successful in the commercial and military application of the results of such fundamental research;

(5) United States research and development efforts in superconducting materials has focused primarily on basic and fundamental scientific knowledge of these materials and further efforts are required in the

processing and applications of the new superconducting materials;

(6) successful development and application of the new superconducting materials will require close collaboration between the Federal Government and the industrial and academic components of the private sector, as well as coherent coordination between the major departments and agencies of the Federal Government, including the Department of Energy, the Department of Defense, the Department of Commerce, the National Science Foundation, and the National Bureau of Standards; and

(7) a national Federal program effort with appropriate goals, priorities, and resources is necessary for the rapid development and applications of the new superconducting materials.

(b) SPECIFIC PURPOSES.—The purposes of this Act are—

(1) to establish a 5-year national Federal program effort to develop and apply new high-temperature superconducting materials with appropriate goals, priorities, and resources; and

(2) to designate the appropriate roles, mechanisms, and responsibilities of various Federal depart-

ments and agencies in implementing such a national Federal program effort.

SEC. 3. RESPONSIBILITIES OF THE NATIONAL CRITICAL MATERIALS COUNCIL; NATIONAL FEDERAL PROGRAM ON SUPERCONDUCTIVITY RESEARCH AND DEVELOPMENT.

(a) ESTABLISHMENT OF PROGRAM.—(1) The President, working through the National Critical Materials Council, shall establish a 5-year National Federal Program on Superconductivity Research and Development (hereafter referred to as the "Superconductivity Program").

(2) The National Critical Materials Council shall draw upon the recommendations and advice of the National Commission on Superconductivity established in section 4, and shall work in close collaboration with the Office of Science and Technology Policy and the Office of Management and Budget, in developing the Superconductivity Program.

(b) CONTENT AND SCOPE OF PROGRAM.—The Superconductivity Program shall include (but need not be limited to)—

(1) goals and priorities for superconductivity research and development to be carried out by individual departments and agencies, as well as the goals and priorities for superconductivity research and development

of program elements within individual departments and agencies;

(2) the technical milestones and requirements to achieve those goals and milestones;

(3) the assignment of responsibility for the conduct of the research and development involved among the departments, agencies, and individual institutional elements of the departments and agencies;

(4) a description of the methodology of obtaining private sector advice, coordination of the Superconductivity Program, and transfer of technology resulting from the Superconductivity Program;

(5) a description of current and proposed funding levels for the 5 years following the enactment of this Act for each of the participating departments, agencies, and institutional elements of the departments and agencies; and

(6) the proposed participation by industry and academia in the planning and implementation of the program.

(c) PRESENTATION OF PROGRAM PLAN.—The Superconductivity Program plan shall be presented to the Committees on Science, Space, and Technology and Armed Services of the House of Representatives, and to the Committees on Energy and Natural Resources, Armed Services, and Commerce, Science, and Transportation of the Senate, within 6 months after the date of the enactment of this Act.

SEC. 4. ESTABLISHMENT OF PRESIDENTIAL NATIONAL ADVISORY COMMISSION ON SUPERCONDUCTIVITY.

(a) APPOINTMENT OF COMMISSION.—The Chairman of the National Critical Materials Council shall appoint, within 60 days after the date of the enactment of this Act, a National Advisory Commission on Superconductivity (hereafter referred to as the "Advisory Commission") to review all major policy issues regarding United States applications of recent research advances in superconductors, including research and development priorities, the development of which will assure United States leadership in the development and application of superconducting technologies.

(b) MEMBERSHIP.—The membership of the Advisory Commission shall include—

(1) representatives of the National Academy of Sciences, the National Academy of Engineering, the National Science Foundation, the National Aeronautics and Space Administration, the Department of Energy, the Department of Justice, the Department of Commerce, the Department of Transportation, and the Department of Defense;

(2) representatives of organizations whose membership is comprised of physicists, engineers, chemical scientists, and/or materials scientists;

(3) representatives of industries, research organizations, and universities engaged in superconductivity research; and

(4) a representative of the private sector shall be designated as Chairman of the Advisory Commission.

(c) COORDINATION AND STAFF SUPPORT.—The National Critical Materials Council shall coordinate the activities of the Advisory Commission with any other relevant activities of the Federal Government, and in addition shall provide staff support for the Advisory Commission.

(d) REPORT.—Within 6 months after the date of the enactment of this Act, the Advisory Commission shall submit a report to the Chairman of the National Critical Materials Council with recommendations regarding methods of enhancing the research, development, and implementation of improved superconductor technologies in all major applications.

(e) CONTENTS OF REPORT.—In preparing the report required by subsection (d), the Advisory Commission shall address, but not limit, its review to—

(1) the state of United States competitiveness in the development of improved superconductors;

(2) methods to improve and coordinate the collection and dissemination of research data relating to superconductivity;

(3) the appropriateness and scope of United States efforts regarding research on and development of improved superconductors and the level of consultation among the United States organizations doing research in this field;

(4) methods to improve and coordinate the development of viable applications of improved superconductors;

(5) foreign government activities designed to promote research, development, and application of improved superconductors;

(6) the need to provide increased Federal funding of research and development of improved superconductors;

(7) the impact on United States national security if the United States must rely on foreign producers of superconductors; and

(8) any statutory changes that would increase the likelihood that applications of promising superconductivity technologies will occur within the United States.

(f) TERMINATION.—Unless hereafter otherwise provided by law, the Advisory Commission shall cease to exist 60 days after the submission of its report under subsection (d).

SEC. 5. RESPONSIBILITIES, ACTIVITIES, AND ORGANIZATION OF THE DEPARTMENT OF ENERGY.

(a) DEPARTMENT OF ENERGY OFFICE OF SUPERCONDUCTIVITY.—(1) In conformance with the Superconductivity Program, the Secretary of Energy (in this section referred to as the "Secretary") shall establish within 60 days after the date of the enactment of this Act an Office of Superconductivity to coordinate and direct all activities of the Department of Energy (in this section referred to as the "Department") in implementing the Superconductivity Program under the Department's responsibility.

(2) A Director of the Office of Superconductivity shall be designated by the Secretary and shall report directly to him.

(3) The Director shall have responsibility for establishing such research and development programs as may be necessary to implement the Department's activities under the Superconductivity Program; and

(4) The Director shall be responsible for the coordination and direction of all superconductivity research and development activities provided for under this section and, in particular, shall be responsible for the administration, direction,

and coordination of the Consortia for Enabling Superconductivity Technologies established under subsection (b).

(b) CONSORTIA FOR ENABLING SUPERCONDUCTIVITY TECHNOLOGIES.—(1) Operating primarily through the Department's National Federal Research Laboratories, the Secretary shall establish within 6 months one or more Consortia for Enabling Superconductivity Technologies (hereafter referred to as the "Consortia"). Each Consortium shall be led by an appropriate National Federal Research Laboratory designated by the Secretary.

(2) The designated lead laboratory shall have appropriate university and industry connections and have demonstrable expertise in—

(A) superconductivity research; and

(B) research in associated technologies, including (i) materials synthesis, processing, and manufacture, and (ii) characterization and development of physical, chemical, and structural properties in materials.

(3) In addition to the designated lead laboratory, each Consortium shall consist of appropriate industry, university, and/or other research institutions, including other National Federal Research Laboratories.

(4) Each Consortium created by the Secretary pursuant to the provisions of this section shall be considered a joint research and development venture within the meaning of sec-

tion 2(a)(6) of the National Cooperative Research Act of 1984 (15 U.S.C. 4301 et seq.), for purposes of this Act.

(5) To the extent possible, the costs for conducting the research and development under the Consortia shall be shared by the participants.

(6) Temporary exchanges of personnel between members of the Consortia described under this subsection pursuant to the purposes of this Act shall be authorized, subject to such restrictions and terms as may be considered necessary by the Secretary.

(7) Up to 25 percent of the funds made available under this Act for each Consortium may be used to conduct superconductivity research and development activities under the discretion of the Director of the designated lead laboratory of such Consortium.

(c) FOCUS OF RESEARCH.—(1) In conformance with the Superconductivity Program, the Department's superconductivity research and development activities shall focus on fundamental research, materials processing, and applications of new superconducting materials.

(2) Such research and development programs shall include but not be limited to—

(A) the development of single crystals, thin films, wire cable, and other forms of superconducting materials; and

(B) development up to and including prototype and demonstration devices for transmission, generation, and storage of electrical energy, transportation, energy conservation, fusion, and high energy physics accelerators.

(d) INDUSTRIAL FELLOWSHIPS.—(1) The Secretary shall create a program of Industrial Fellowship to support the education and training of graduate engineers and scientists in the area of superconductivity and related academic fields.

(2) Recipients of the Industrial Fellowship shall be selected from qualified applicants seeking degrees from member institutions of the Consortia created under subsection (b).

(3) To the extent possible, research by Industrial Fellowship recipients shall be conducted in close collaboration with the industry and National Federal Research Laboratory participants in the Consortia.

(e) COORDINATION.—The Department, working primarily through the National Critical Materials Council, shall coordinate its programs with those of the Department of Commerce, the Department of Defense, the National Science Foundation, and such other departments and agencies as may be considered appropriate.

SEC. 6. RESPONSIBILITIES, ACTIVITIES, AND ORGANIZATION OF THE DEPARTMENT OF DEFENSE.

(a) DEPARTMENT OF DEFENSE OFFICE OF SUPERCONDUCTIVITY.—(1) In conformance with the Superconductivity Program, the Secretary of Defense (in this section referred to as the "Secretary") shall establish within 60 days after the date of the enactment of this Act an Office of Superconductivity to coordinate and direct all research activities of the Department of Defense (in this section referred to as the "Department") in implementing the Superconductivity Program under the Department's responsibility.

(2) A Director of the Office of Superconductivity shall be designated by the Secretary and shall report directly to him.

(3) The Director shall have responsibility for establishing such research and development programs as may be necessary to implement the Department's activities under the Superconductivity Program.

(4) The Director shall be responsible for the coordination and direction of all superconductivity research and development activities provided for under this section.

(b) FOCUS OF RESEARCH.—(1) In conformance with the Superconductivity Program, the Department's superconductivity research and development activities shall focus on fundamental research, materials processing, and applications of new superconducting materials.

(2) Such research and development activities shall include but not be limited to—

(A) the application of new superconducting materials for microelectronic logic and sensory devices;

(B) compact, high-efficiency electric ship drives, pulsed power systems, and free electron lasers; and

(C) such other applications and developments as may be appropriate to the strategic mission of the Department.

(3) In conducting this research, the Department shall systematically define the engineering parameters for high-temperature, superconducting materials, develop with industry such required processing and manufacturing capabilities as may be considered necessary, and conduct the necessary development, engineering, and operational prototype testing considered appropriate to the overall mission of the Department.

(c) COORDINATION.—The Department, working primarily through the National Critical Materials Council, shall coordinate its programs with those of the Department of Commerce, the Department of Energy, the National Science Foundation, and such other departments and agencies as may be considered appropriate.

SEC. 7. RESPONSIBILITIES, ACTIVITIES, AND ORGANIZATION OF THE NATIONAL SCIENCE FOUNDATION.

(a) NATIONAL SCIENCE FOUNDATION OFFICE OF SUPERCONDUCTIVITY.—(1) In conformance with the Superconductivity Program, the Director of the National Science Foundation (in this section referred to as the "Director") shall establish within 60 days after the date of the enactment of this Act an Office of Superconductivity to coordinate and direct all activities of the Foundation in implementing the Superconductivity Program under the Foundation's responsibility.

(2) An Administrator of the Office of Superconductivity shall be designated by the Director and shall report directly to him.

(3) The Administrator shall have responsibility for establishing such research and development programs as may be necessary to implement the Foundation's activities under the Superconductivity Program.

(4) The Administrator shall be responsible for the administration, direction, and coordination of the National Superconductivity Research Centers created under subsection (b).

(b) NATIONAL SUPERCONDUCTIVITY RESEARCH CENTERS.—(1) The Director, in conformity with the Superconductivity Program, shall establish a program of National Superconductivity Research Centers (hereafter referred to as the "Centers").

(2) An appropriate number of universities shall be selected as sites for Centers based on their scientific and technical qualifications, as well as such other considerations as may be determined to be appropriate by the Director.

(3) The Centers shall focus efforts in the development and support of manufacturing science and processing as it applies to superconducting materials.

(4) To the extent possible, the Centers shall operate in an interdisciplinary manner to integrate scientific and engineering fields such as physics, chemistry, materials, and manufacturing and process engineering.

(5) The Centers and Centers' programs shall supplement the other activities of the Foundation in the conduct of its superconductivity research and development programs.

(c) INDIVIDUAL GRANTS AND FUNDAMENTAL RESEARCH.—The National Science Foundation shall continue to operate primarily through individual and block-fund grants with the university community and shall have responsibility for maintaining an appropriate balance of such grants for support of basic and fundamental research on superconducting materials.

(d) COORDINATION.—The National Science Foundation, working primarily through the National Critical Materi-

als Council, shall coordinate its programs with those of the Department of Energy, the Department of Defense, the Department of Commerce, and such other departments and agencies as may be considered appropriate, taking appropriate steps to ensure the existence of a comprehensive program of fundamental superconductivity research.

(e) GRADUATE FELLOWSHIPS.—The Director shall establish a program of graduate fellowships to support the education and training of advanced degreed research engineers and scientists in the area of superconductivity, manufacturing science and processing, and related academic fields.

SEC. 8. RESPONSIBILITIES, ACTIVITIES, AND ORGANIZATION OF THE DEPARTMENT OF COMMERCE.

(a) DEPARTMENT OF COMMERCE OFFICE OF SUPERCONDUCTIVITY.—(1) In conformance with the Superconductivity Program, the Secretary of Commerce (in this section referred to as the "Secretary") shall establish within 60 days after the date of the enactment of this Act an Office of Superconductivity to coordinate and direct all activities of the Department of Commerce in implementing the Department's responsibility under the Superconductivity Program.

(2) An Administrator of the Office of Superconductivity shall be designated by the Secretary and will report directly to him.

(3) The Administrator, working with the Director of the National Bureau of Standards, shall have responsibility for establishing such research and development programs as may be necessary to implement the Department's activities under the Superconductivity Program.

(4) The Administrator shall be responsible for the coordination and direction of all superconducting research and development activities provided for under this section.

(b) TECHNOLOGY TRANSFER.—The Secretary shall, through the provisions of the Stevenson-Wydler Innovation and Productivity Act of 1980, work to ensure the accelerated transfer of superconductivity technology resulting from the research and development activities provided for in this Act and for the application of such technology by the United States private and public sectors.

(c) NBS PROGRAM.—In pursuance of the goals of this Act, the National Bureau of Standards, in coordination with the Department of Energy, the National Science Foundation, and such other departments or agencies as may be considered appropriate, shall establish and conduct a program of fundamental research and materials standards to accelerate the use and application of the new superconducting materials.

(d) COORDINATION.—The Department of Commerce, working primarily through the National Critical Materials Council, shall coordinate its programs with those of the De-

partment of Energy, the Department of Defense, the National Science Foundation, and such other departments and agencies as may be considered appropriate.

SEC. 9. INTERNATIONAL COOPERATION.

The President, as part of the Superconductivity Program, shall include and establish a program of international cooperation in the conduct of fundamental and basic research on superconducting materials. Such program of international cooperation shall include the exchange of basic information and data, as well as the development of international standards for the use and application of superconducting materials.

SEC. 10. AUTHORIZATION OF FUNDS.

There is hereby authorized to be appropriated for the fiscal year 1989, and for each of the 4 succeeding fiscal years, the sum of $150,000,000 of which—

(1) $1,000,000 shall be for the purpose of carrying out section 3;

(2) $1,000,000 shall be for the purpose of carrying out section 4;

(3) $48,000,000 shall be for the purpose of carrying out section 5;

(4) $50,000,000 shall be for the purpose of carrying out section 6;

(5) $40,000,000 shall be for the purpose of carrying out section 7; and

(6) $10,000,000 shall be for the purpose of carrying out section 8.

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