EXECUTIVE NEWSLETTER

JANUARY 1986

FUSION POWER ASSOCIATES

2 PROFESSIONAL DRIVE, SUITE 248 • GAITHERSBURG, MARYLAND 20879

(301) 258-0545

BUDGET BLOODBATH

The Office of Management and Budget carried out a massacre on the FY 1987 budget requests of most federal civilian agencies. The civilian R&D programs of the Department of Energy were among the hardest hit. OMB wants to reduce breeder reactors from $251 million this year to $121 million in FY 1987 and to cut "renewable" energy programs from $211 million to $108 million. As they did last year, OMB will try to effectively terminate the inertial confinement fusion program by cutting it from $155 million to $22 million. The magnetic fusion program is earmarked for a $50 million cut, taking it from $383 million to $333 million. OMB took a different approach to the DOE's weapons budget, saying DOE should try "to hold the real growth to 3%."

FPA ANNUAL MEETING DATES SET

Fusion Power Associates will hold its annual meeting and symposium April 24-25 at the new Westin Hotel in Washington, D. C. The theme of the meeting will be "Fusion Energy Development: The International Program." Further information on the meeting will be forthcoming in the near future.

TFTR PROGRESS

During 1985, the Tokamak Fusion Test Reactor (TFTR) at Princeton Plasma Physics Laboratory reached its original design specifications of magnetic field and current (5.2 T and 2.5 MA), approximately matched the Alcator C record density-confinement time product ($7 \times 10^{13} cm^{-3} sec$) and began to explore auxiliary heating. At low densities, temperatures approaching the TFTR design goal of 10 keV were achieved. At high density, temperatures of about 3 keV were achieved, giving $n\tau T$ values of slightly over $10^{14} cm^{-3} sec$ keV. The best results are obtained using pellet injectors developed at ORNL. Oak Ridge scientists are also on-site, actively involved with Princeton scientists in the experiments. The neutral beam power used to date was up to 6 MW, about one-fourth of the ultimate expected value. The maximum energy confinement time achieved without auxiliary heating was about 0.45 sec. With auxiliary heating the energy confinement time is observed to decrease with beam power and increase with plasma current. With beam power used to date, the confinement time typically (at 2.2 MA) drops to 0.22 sec. Plans for 1986 call for increasing the injected neutral beam power aiming at the achievement of equivalent (D-D) breakeven conditions in late 1986 or early 1987. Breakeven using tritium is targeted for late 1988 or early 1989. The two other large tokamaks, JET in Europe and JT-60 in Japan, are also expected to be emphasizing plasma confinement with strong auxiliary heating in 1986. Results from all the major fusion devices will be compared at the next IAEA conference, scheduled for November 13-20, 1986 in Kyoto, Japan.

TFTR LEADER DALE MEADE

MAGNETIC FUSION REVIEW SCHEDULED

The congressionally-sponsored Office of Technology Assessment (OTA) has been asked to "perform an independent review of the Department of Energy's Magnetic Fusion Energy Program with a view to providing a preliminary report to the House Committee on Science and Technology during the FY 1987 authorization cycle." The request was made in a November 14 letter from representative Don Fuqua and Manuel Lujan, Jr. John Blair of the OTA staff is responsible for the review, which is to include "a review of progress to date, the timing and nature of ignition experiments, the disposition of major facilities, the relative merits of advanced concepts, industry involvement and international cooperation."

BOGART TO REAGAN

Writing to President Reagan "to share with you my concern about the current and anticipated policy on Government energy research and development," fusion researcher S. Locke Bogart stated in a letter dated November 4, that "in my view, the current U.S. Regulatory and energy R&D policies are not only deplorable but are absolutely irresponsible." Bogart pointed out that "Government supported energy R&D directed at longer term energy supply systems is evaporating just at the point in time when its need is becoming increasingly clear to energy professionals." Bogart also pointed out that "the private sector will not support long-term energy R&D especially in view of the risk of the technical outcome, the uncertainty of the demand for the product, and, critical for energy, the uncertain and potentially hostile regulatory environment."

He asked that the U.S. maintain "a reasonably balanced energy Research and Development portfolio" both as "an insurance policy against future contingency and an investment in long-term, high-risk and high return energy technology development to economically benefit U.S. and global society in future years." Otherwise, said Bogart, "There will be no cadre of trained technical professionals to do the work and neither will there be students in the pipeline." The present policy "leads to sincere concern that there will be no energy R&D results when they will be most needed by the Nation," Bogart said.

REAGAN TO BOGART

In response to his letter to President Reagan, Bogart received a letter dated December 11 from Alvin W. Trivelpiece, Director of DOE's Office of Energy Research, stating "Please be assured that the principles you stated so clearly in your letter are guiding Federal policy on energy research and development." Trivelpiece stated that present policy "reflects our confidence in the private sector's ability to make the best-informed decisions about the production and use of specific fuels, technologies and energy-efficiency improvements." The federal government's "contribution to the development of future energy resources lies in the prompt and effective transfer of results from Federally funded generic research and development activities to private entrepreneurs, innovators, businesses and industry and in facilitating transfers of technology within the private sector," Trivelpiece said. Trivelpiece concludes: "The Administration will continue to place a high priority on energy research, recognizing the role it will play in contributing to future energy supplies and international competitiveness. Your letter reinforces the Administration's concern and commitment to energy research."

NEW TRAINING OPPORTUNITIES

The DOE Office of Fusion Energy is announcing two new programs to be administered by Oak Ridge Associated Universities: The Fusion Energy Postdoctoral Research Program, and the Fusion Energy Professional Development Program. The Postdoctoral Research Program is open to recent Ph.D. recipients and the Professional Development Program will be for university faculty members, industrial research staff and federal laboratory scientists and engineers. Both programs are designed to support collaboration on magnetic fusion energy R&D projects at fusion energy centers and DOE laboratories. These programs are open to all qualified U.S. citizens or permanent resident aliens. Additional information and applications can be obtained by contacting Linda McCamant, University Programs Division, Oak Ridge Associated Universities, P.O. Box 117, Oak Ridge, TN, 37830. Please request materials by program name. The application deadline is March 1, 1986.

THE WINNERS

From 96 entries, six winners were chosen in the Fusion Energy Essay contest sponsored by the inertial confinement fusion program at the Lawrence Livermore National Laboratory. In the Grades 9-12 category the winners were: Sabrina Ostle (First Place), Alvin Lu (Second Place) and Michelle Thut (Third Place). In the Grades 5-8 category the winners were: Shanda Ostle (First Place), Nikki Griffing (Second Place) and James Kaplan (Third Place). The first place winners received a Commodore 64 personal computer; the second place winners received a scientific calculator; and the third place winners received a solar energy lab. Here is Sabrina's winning essay:

"Did you ever lie on the beach with the sun beating on your skin, thinking that this is the way life should be - warm, content, at ease with the environment? That's nuclear fusion doing its job today. The warmth of the sun's energy captured by the skin and the contentment transmitted by the brain are the feelings we can anticipate when fusion is our main source of energy here on earth.

"The world today stands in a fragile balance at the crossroads of time. There's a choice we're making. The choice in regard to energy is not only technical, but environmental, social, economic and political. Fusion energy could be the answer to solving the worlds energy problems because it is an infinite source of energy, since the basic fuel is deuterium, a heavy form of hydrogen, readily available to all the peoples of the world from ordinary water. Fusion releases a tremendous amount of energy compared to conventional energy sources and promises to be very efficient. Fusion energy promises a greater degree of safety than fission reactions and less environmental pollution than conventional energy production. Fusion energy should eventually become economically competitive with other energy sources because of minimal fusion fuel costs compared with coal, oil and uranium. As depletion of these conventional fuels escalates, the need for fusion energy will be paramount.

"Fusion for the future will mean that man will be able to develop a civilization limited only by his own creativity and ingenuity."

Congratulations, Sabrina. No one ever said it better!

ESSAY CONTEST WINNERS: NIKKI GRIFFING (center front) AND (l to r) ALVIN LU, SABRINA OSTLE, SHANDA OSTLE, JAMES KAPLAN AND MICHELLE THUT

PEOPLE

Mike Monsler, vice president of KMS Fusion, Inc., has left KMS to form Satori Technology, Inc., a research, development and management consulting firm focussed on the technologies of Strategic Defense and Fusion Power. Mike can be reached at Satori Technology Inc., Suite 300, 315 E. Eisenhower Parkway, Ann Arbor, MI, 48104, (313) 769-0156.

Brendan McNamara has left the fusion program at Lawrence Livermore National Laboratory to become executive vice president of the Consortium for Scientific Computing, the new NSF supercomputer center in Princeton, New Jersey. He will continue his association with Trieste School of Plasma Physics. Brendan can be reached at the Consortium for Scientific Computing, John von Neumann Center, P.O. Box 3717, Princeton, New Jersey, 08540, (609) 734-8191.

Paul Robinson has left his position as associate director for national security programs at Los Alamos National Laboratory to become group vice president for advanced technology and special projects and principal scientist at Ebasco Services, Inc., in New York City.

Siegfried S. Hecker has been named director of Los Alamos National Laboratory, replacing Don Kerr who resigned in October. Hecker had been chairman of the Center for Materials Science at Los Alamos and was a recipient of the DOE's 1984 E.O. Lawrence Award.

Tony Chargin has left the Lawrence Livermore National Laboratory to join Cebaf Corp., 12070 Jefferson Avenue, Newport News, VA, (804) 875-7864.

Admiral Sylvester R. Foley, Jr., has been sworn in as DOE Assistant Secretary for Defense Programs, succeeding William Hoover. Foley was commander of the U.S. Pacific Fleet. In his new position he will have line authority over the inertial confinement fusion program.

LIVERMORE LODGING

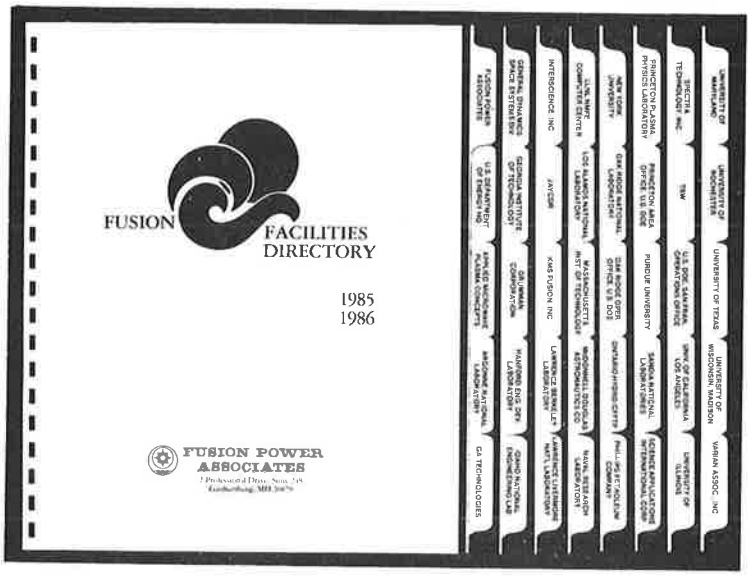
Fusion personnel (non-smokers only) visiting LLNL should consider the Bed and Breakfast accommodations offered by Mrs. Gail Shearer, wife of deceased fusion scientist Jim Shearer. "The Shearer Home" is located three miles from the lab. There are three rooms (at $27, $30 and $40, single) all with desk space, telephones and color TV. For reservations, call (415) 447-9685.

IN MEMORIAM

We were greatly saddened to learn of the Christmas Eve drowning death of Noel Amherd. He was swimming along the San Diego coast. Noel was an outstanding fusion program manager at EPRI and was currently working for Titan Systems. Regrets may be sent to his wife, Charlene, at 1742 Austin Avenue, Los Altos, CA, 94022.

DOE-SDI PRDA

The DOE's San Francisco Office has issued a request for proposals for "new and innovative concepts for the Strategic Defense Initiative." Closing dates for submitting proposals is February 28. Contact Ms. Aundra Richards, U.S. DOE San Francisco Operations Office, 1333 Broadway, Oakland, CA, 94612 and ask for PRDA DE-RA03-86SF16037.



FUSION FACILITIES DIRECTORY

The first printing of the 1986 Fusion Facilities Directory is sold out. So we have made a limited second printing. You can get your personal copy by sending your check for $20 to Fusion Power Associates. The Directory has the telephone numbers of fusion personnel working at 40 institutions, including government, national laboratories, industry and universities. It also contains other useful information, such as mailing and express delivery addresses, telephone numbers, nearby hotel accommodations, organization charts, and local maps. We believe everyone in the program should have his/her own copy.

FUTURE MEETINGS OF NOTE

The next meeting of the Magnetic Fusion Advisory Committee will be held February 19-20 at LLNL. MFTF dedication will be held February 21. Contact Ron Davidson (617) 253-8102 or Ken Fowler (415) 422-9862.

The annual Sherwood Theory Conference will be held April 14-16 at the Penta Hotel, New York City. Contact Malvina Harris (212) 460-7204.

The next International Symposium on Heavy Ion Fusion will be held May 27-29 at the L'Enfant Plaza hotel, Washington, D. C. Contact Martin Reiser (301) 454-3188.

The Sixth International Conference on High Power Particle Beams will be held June 9-12 at the International Conference Center in Kobe, Japan. Contact C. Yamanaka, Osaka Univ., 2-6 Yamada-oka, Suita, Osaka, Japan.

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REAGAN WANTS FUSION REACTOR

A U.S. State Department source involved in followup planning to the November Reagan-Gorbachev Summit Meeting has quoted the President as saying "I want to build a fusion reactor." This comment resulted as officials sought clarification of what the President and Mr. Gorbachev had in mind in the final paragraph of their summit joint statement which read:

"The two leaders emphasized the potential importance of the work aimed at utilizing controlled thermonuclear fusion for peaceful purposes and, in this connection, advocated the widest practicable development of international cooperation in obtaining this source of energy, which is essentially inexhaustible, for the benefit of all mankind."

JOHN F. CLARKE, RECIPIENT OF DOE'S SILVER MEDAL AWARD FOR "ACHIEVEMENTS WHICH SUBSTANTIALLY CONTRIBUTE TO THE ACCOMPLISHMENT OF THE MISSION OR MAJOR PROGRAMS OF THE DEPARTMENT OF ENERGY."

DOE HONORS EMPLOYEES

Secretary of Energy John S. Herrington has announced that 17 Department of Energy employees will be presented medals for outstanding service. Included in the group is magnetic fusion director John F. Clarke who will receive a silver medal and citation "in recognition of his exceptional management ability and innovative style in directing the Magnetic Fusion Energy Program resulting in international cooperation and acceptance of the program's new directions."

Jack Baublitz, a former Office of Fusion Energy official, now working in nuclear waste management, also received a silver medal as did Bill Bibb of DOE's Oak Ridge Operations Office, and ten others. Joe La Grone, manager of DOE's Oak Ridge Office, received a gold medal, the Department's highest award, for "his outstanding leadership and personal commitment to the safeguarding of Department of Energy facilities and materials and to assuring the safety and health of workers and the public, as well as protection of the environment. His proactive and determined approach in addresssing these concerns has set a positive example for both government and industry." A gold medal was also presented to outgoing deputy secretary Danny Boggs.

VANDEVENDER ELECTED TO FPA BOARD

Fusion Power Associates by-laws specify five positions on the Board of Directors to be filled by persons not from member organizations. These positions are by vote of the 13 Board members from our member organizations. J. Pace VanDevender, director of pulsed power sciences at Sandia National Laboratories

was elected to a three-year term beginning February 1, 1986. Reelected to additional three year terms were Ronald C. Davidson (MIT), Melvin B. Gottlieb (Princeton U.), Robert L. Hirsch (ARCO), and Kenneth L. Matson (PSE&G).

JET CONFERENCE MARCH 12/13 IN LONDON

To get a first hand look at the Joint European Torus results and its relation to the European program, you may wish to attend a special Royal Society Conference, March 12 and 13 in London. You may register by writing direct to the Royal Society, Carlton House Terrace, London, SWIY 5AG. There is no conference fee. The conference program is as follows:

R. S. Pease: Introduction and Background
P. H. Rebut: JET: Evolution, Status and Prospects
M. Huguet: Manufacture and Assembly of the JET Machine
P. E. Stott: Plasma Measurements for JET
A. Gibson: Ohmic Heating Results
W. Englehardt: Wall Effects and Impurities
J. Jacquinot and G. Duesing: Additional Heating Experiments on JET
M. Kadomtsev: Theoretical Problems of Thermal Insulation
D. F. Duchs: Quantitative Modelling of JET by Computational Methods
R. Hawryluk: Experimental Results for TFTR
F. Troyon: Theoretical Studies of MHD Stability
R. J. Bickerton: Comparison of Experiments and Theory
R. Toschi: Reactor Requirements
D. Palumbo: Nature and Prospects of the Euratom Fusion Program

KEYWORTH LEAVES OSTP

George A. (Jay) Keyworth II, has left his position as presidential science advisor and director of the White House Office of Science and Technology Policy effective December 31 after four and one-half years of service--the longest tenure of any science advisor. According to the Washington Post, Keyworth plans to form a consulting practice with a high level official of the CIA. The purpose of the consulting firm is to provide advice to industry on how to compete against non-U.S. firms, according to the Post.

FUSION AGREEMENT SIGNED

The U.S., Japan and the European Community signed an agreement on January 15 to jointly share and exchange data and operational experience on the three largest tokamaks now in operation: TFTR in the U.S., JET in Europe and JT-60 in Japan. The agreement will be coordinated by the Japan Atomic Energy Research Institute. The signing is one more step in what is becoming a rapid buildup in international agreements to collaborate in fusion development. Fusion Power Associates plans to assist in this process by devoting our annual meeting and symposium to the theme "Fusion Energy Development: An International Effort." The symposium will be held April 24-25, at the new Westin Hotel in Washington, D. C. Contact Ruth Watkins (301) 258-0545 for details.

CANADIAN FUSION PROGRAM MANAGEMENT

Atomic Energy of Canada, Ltd., (AECL) will be assuming the lead role in that country's fusion effort on April 1 as a result of recent federal government decisions calling for the staged transfer of fusion responsibility from the National Research Council to AECL. AECL has named Dave Jackson from Chalk River Nuclear Laboratories as its fusion manager. He will coordinate the transfer from the National Research Council and will ultimately assume the role of director of the fusion program.

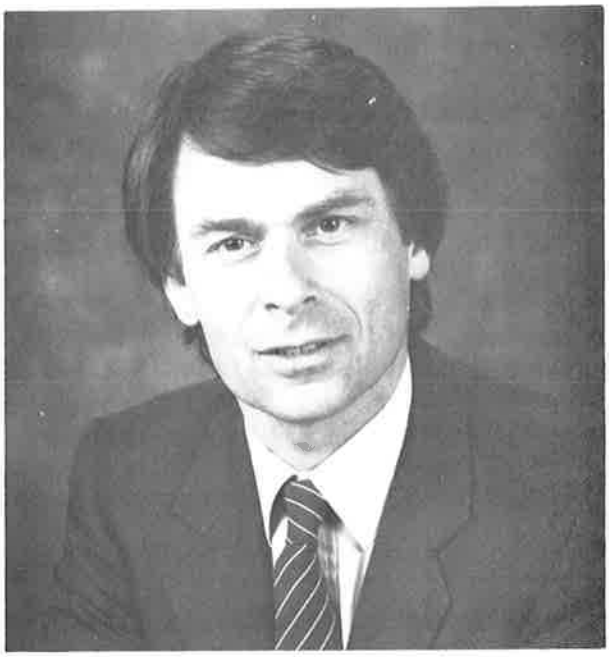
Canada has major efforts on magnetic confinement and fusion fuels technology. The Tokamak de Varennes, located in the Hydro-Quebec IREQ laboratories near Montreal, is scheduled to begin operation by the middle of this year. The aim of the Canadian Fusion Fuel Technology Project (CFFTP) is to extend and adapt existing tritium technology for use in international fusion power development.

TRITIUM SAFE HANDLING COURSE

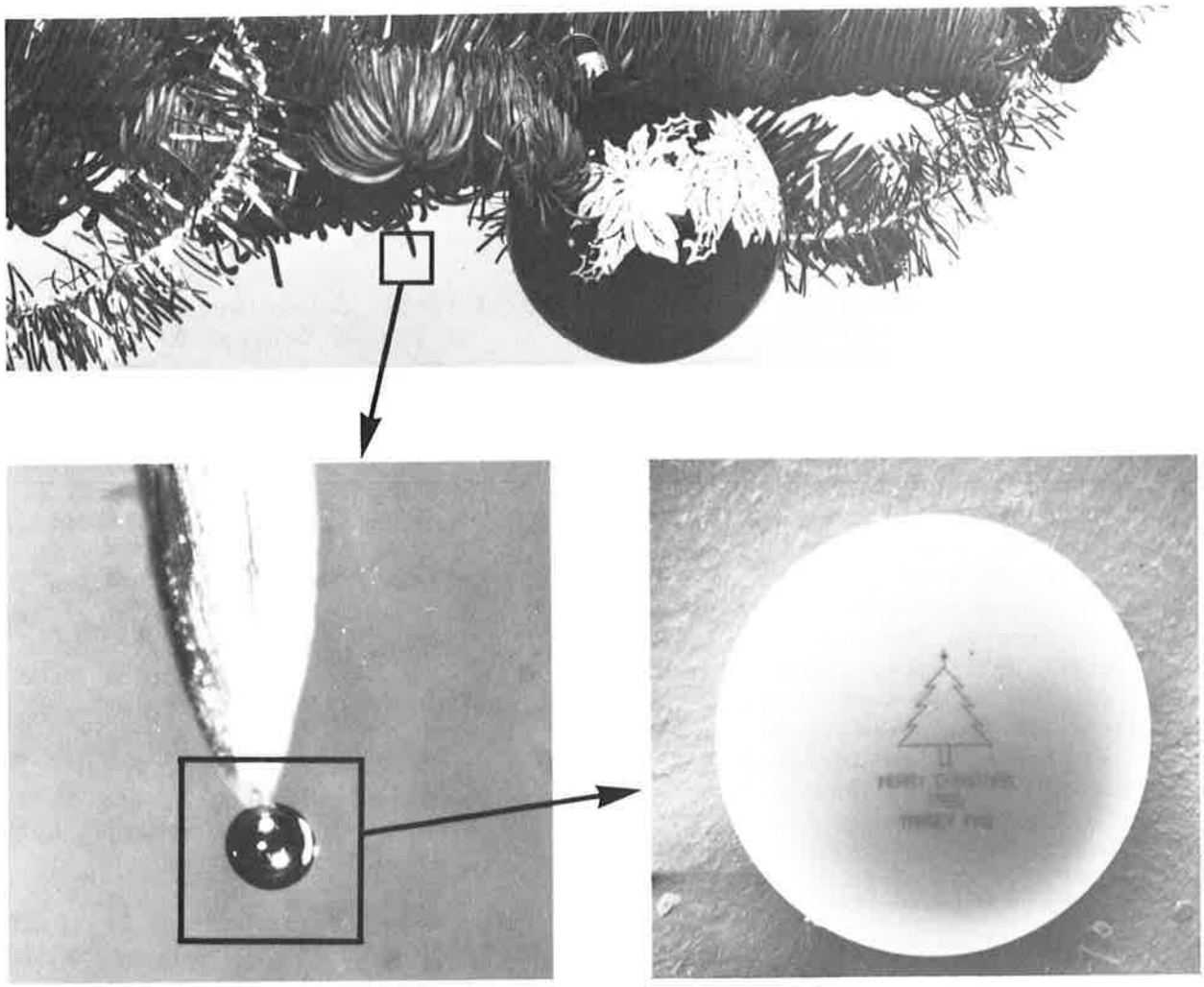
The Canadian Fusion Fuels Technology Project (CFFTP) will again give its popular Tritium Safe Handling Course May 5-9 and again October 20-24, 1986 in Toronto and Chalk River Ontario. Cost is U.S. $1,095. Contact Shayne Smith, Course Coordinator (416) 823-8513.

NOVA MAKES HOT MICROSTAR

Optimizing conditions to make high temperatures rather than high compression, scientists at LLNL using the new NOVA laser created a high temperature microstar while observing the largest burst of fusion neutrons ever achieved from an inertially-confined pellet implosion. Eleven trillion neutrons were produced in the burst. Eric Storm, deputy associate director for laser fusion, said "For an instant we created a tiny pin-point sized star....It's ten times brighter than the previous laser-made star." Eighteen kilojoules of energy was deposited onto the pellet, which was just under one millimeter in diameter with a two micron-thick wall. The hollow sphere contained 12 atmospheres of a deuterium-tritium mixture. The fuel capsule was built by KMS Fusion Inc. of Ann Arbor, Michigan. KMS is a corporate member of Fusion Power Associates.



LIVERMORE LASER FUSION LEADER ERIC STORM



LIVERMORE LASER GROUP SAYS MERRY CHRISTMAS.

George Treiner and John Grens of LLNL used a new computer-controlled ion beam milling machine to put a yuletide message on a laser fusion pellet.

SPAIN MOVING ON FUSION

Spain joined the European Economic Community on January 1 and is seeking EURATOM endorsement of its existing and planned fusion programs. Scientists at Oak Ridge National Laboratory led by Jim Lyon have been assisting Spain in the design of a Heliac compact fusion experiment that is scheduled to operate in 1989. Other spanish fusion interests include robotics and materials research. In October 1985 the spanish Junta de Energia Nuclear signed an agreement with the Canadian Fusion Fuels Project to collaborate on fusion research activities.

IAEA FUSION MEETING PLANS

The Eleventh International Conference on Plasma Physics and Controlled Nuclear Fusion Research, sponsored biannually by the IAEA, will be held November 13-20, 1986, in Kyoto, Japan. All papers must pass a selection committee; synopses for U.S. papers is due April 21 for the selection process. Contact Dave Nelson (301) 353-4596 for detailed instructions.

ENERGY TECHNOLOGY CONFERENCE

The Thirteenth Annual Energy Technology Conference (ET'86) will be held March 17-19 at the Sheraton Washington Hotel, Washington, D. C. A session on Compact Fusion Reactor Concepts will be held on Tuesday, March 18, chaired by Al Mense, who now works as assistant to Gerry Yonas at SDIO. Papers will be presented by John Schmidt (PPPL) on the Compact Copper Coil Ignition Tokamak; by Joe DiMarco (LANL) on the Reversed Field Pinch, and by Alan Hoffman of Spectra Technology, Inc. on the Field Reversed Configuration. Another fusion session, also on March 18, entitled Advanced Energy Projects, chaired by R. Gajewski of DOE will have a paper by Z. Zweig (LANL) on Quark-Catalyzed Fusion and a paper by Steve Jones (Brigham Young University) on Muon-Catalyzed Fusion.

LANDIS ELECTED PRESIDENT OF MACRO-ENGINEERING GROUP

John Landis, Senior Vice President of Stone and Webster Engineering Corp. and Chairman of Fusion Power Associates Board of Directors, has been elected president of the American Society of Macro-Engineering. The Society was established in 1982 as a focal point for professional deliberations related to planning, financing, regulation, engineering, construction and operation of large-scale facilities and systems. The group is hosting a conference March 13-14 at the Hyatt Regency Hotel in Crystal City Virginia. For information on the conference and membership in the Society call (718) 643-7170.

MEETINGS

March 9-13 High Temperature Plasma Diagnostics. Hilton Head, S.C. Contact Janet Hergenhan, PPPL (609) 683-2675.

March 12-13 Discussion Meeting on the JET Project and Its Impact on the Prospects of Nuclear Fusion. London. Contact The Royal Society, 6 Carlton House Terrace, London, SW1Y5AG.

March 13-14 Macro-Engineering: The New Challenge. Washington, D. C. Contact George Schillinger (718) 643-7170.

March 17-19 Thirteenth Annual Energy Technology Conference (ET'86). Washington, D. C. Contact (301) 251-9250.

April 13-17 Second International Conference on Fusion Reactor Materials. Chicago. Contact Dale Smith (ANL) (312) 972-5287.

April 14-16 1986 Sherwood Theory Conference. New York. Contact Malvina Harris (212) 674-7203.

April 14-18 Thirteenth European Conference on Controlled Fusion and Plasma Heating, Schliersee, FRG. Contact M. Kaufmann, Max Planck Institute for Plasma Physics, D-8046, Garching, FRG.

April 24-25 Fusion Power Associates Annual Meeting and Symposium. Washington, D. C. Contact Ruth Watkins (301) 258-0545

April 28-May 1 American Physical Society Spring Meeting. Washington, D. C.

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INTERNATIONAL FUSION CONSENSUS BUILDING

In mid-January meetings, the leaders of the fusion efforts in Europe, Japan, the U.S. and the Soviet Union agreed to a common development strategy which incorporates a proposed international Fusion Engineering Test Reactor (ETR) to be built during the nineties. The agreement represents a radical change from previous plans calling for each group to build its own test device. The idea surfaced at a meeting of the "Summit Working Group on Controlled Thermonuclear Fusion," one of several groups set up after the Versailles Economic Summit of Heads of State of western countries. The fusion proposal was endorsed by the working group and later agreed to by the International Fusion Research Council (IFRC), a United Nations (IAEA) group that consists of the heads of the fusion programs of the U.S., Japan, USSR, and several European countries. Alvin W. Trivelpiece, DOE Director of Energy Research, is the U.S. representative on the Summit Working Group and John F. Clarke, DOE head of the magnetic fusion program sits on the IFRC. The various parties are now engaged in political discussions with their respective governments with a view to possibly formalizing the agreement when President Reagan and other Heads of State meet at the next western Economic Summit meeting in Tokyo in May and when President Reagan meets again with Soviet leader Gorbachev in the U.S. this summer.

If the agreement reaches fruition it will provide fusion development with unprecedented recognition. Fusion advocates have long claimed that fusion development provides an opportunity to enhance peace and global security by reducing national dependencies on geographically-restricted fuel resources such as coal and oil.

DEFENSE DEPARTMENT OPPOSES FUSION AGREEMENT

Pentagon staff reporting to DoD Assistant Secretary for International Security Policy Richard N. Perle are actively seeking, through the National Security Council, to stop President Reagan from concluding a fusion cooperative agreement with the USSR, despite the statement of intent to cooperate made at the conclusion of the Reagan-Gorbachev Summit Meeting in November (see our December newsletter). The reason, they say, is "Technology Transfer," which means they believe that Soviet participation in a joint project of the magnitude and technical sophistication of a Fusion Engineering Test Reactor would provide the Soviets with skills and technology that some Defense Department personnel believe threatens the security of the United States. While the Energy Department and most knowledgeable fusion scientists and engineers disagree with the Pentagon's position, it must be conceded that the Pentagon is skilled at using this emotional issue and usually gets its way. As of this moment at least, the State Department is siding with the Energy Department.

FUSION AGREEMENT

The following are excerpts from the "Summary Conclusions of the Summit Working Group on Controlled Thermonuclear Fusion," January 17, 1986. The complete statement is available on request from Fusion Power Associates.

"The main objective of . . . fusion is the development of a new energy source. The achievement of this objective would be so important for mankind that its benefit would inevitably not be restricted to the nation or group of nations that might reach the goal first by a "do it alone" strategy.

"The Fusion Working Group (FWG) and its Technical Working Party . . . have reached a consensus on the nature and timing of the major facilities and development efforts required to establish the feasibility of fusion, and they have identified the medium-term goal of a possible collaborative program.

"In view of the forthcoming Tokyo Economic Summit, the FWG intends to meet in March to further define a possible collaborative program. This Working Group would be ready to undertake exploratory technical discussions with representatives of the USSR based on guidance following the Tokyo Summit.

"Technically, the FWG acknowledges that a common, medium-term goal for all fusion programs is an Engineering Test Reactor (ETR). They reached a consensus that the joint design, construction, and operation of this ETR is a reasonable objective for international collaboration. The FWG also agreed it is necessary to maintain the breadth of the overall fusion program through strong scientific and technical programs within each of the participants. Within these individual programs there are sizeable projected efforts, supportive to ETR, that could also be the object of international cooperation on an ad-hoc basis. Such efforts include a compact ignition device (which would provide valuable experience for the operation of ETR) as well as blanket, superconducting magnets, and other technological developments. In parallel with ETR, a materials testing facility could be required to complete the data base for future programs.

"While the matter has not been examined in detail, based on our examination of needed fusion technology, it is the view of the FWG that expanded technological cooperation can be successfully pursued with the due regard to proprietary interests and respective national export control limitations."

DEFENSE UP, ENERGY DOWN

The Department of Energy's FY 1987 budget requests about $1 billion more for military activities ($8.15 billion)and about $1 billion less for civilian activities ($3.95 billion) compared to FY 1986. Details are provided in the accompanying table. The

DOE FY 1987 BUDGET REQUEST
($ in millions)

	FY 86	FY 87
Weapons and Defense R&D	$7,082	$8,147
Nuclear Waste Disposal	746	1,070
"Business Enterprises"	727	502
High Energy Physics	491	549
Basic Energy Sciences	434	428
Magnetic Fusion	365	333
Environment	229	274
Nuclear Fission	338	261
Nuclear Physics	165	224
Inertial Fusion (Est.*)	155	155*
DOE Management	150	151
"Other Energy Functions"	386	114
Supporting Research	86	86
Solar and Renewables	174	69
Conservation	171	34
Electric Energy Systems	29	16
Fossil Energy	244	0
Totals	$11,972	$12,100

DOE request mirrors the overall Federal Budget which requested $48 billion more for defense and $38 billion less for civilian programs. Military spending would comprise 69% of all DOE expenditures in FY 87 compared to 60% in FY 86.

Within the Weapons and Defense R&D category DOE is proposing to increase its funding for Strategic Defense Initiative (SDI) technologies from $302 million in FY 86 to $603 million in FY 87.

It is widely reported in the trade press that large defense increases are being deliberately proposed in order to protect defense programs from the effects of the Gramm-Rudman-Hollings deficit reduction Act in FY 1987. According to that law, defense activiites must absorb half of any automatic reductions triggered by a failure of the Executive and Legislative branches to limit spending to the targets specified in the Act. According to published reports, the Executive Branch is trying to protect the defense budget by asking for large increases so as to make it easier to absorb later cuts. This strategy, orchestrated by the OMB, resulted in proposing deep cuts to civilian programs in order to keep the total FY 1987 budget within reasonable bounds.

MAGNETIC FUSION BUDGET

According to the published budget document, the magnetic fusion request of $333 million is $32 million less than the FY 1986 figure of $365 million. This is misleading, however, since Congress appropriated $382 million for magnetic fusion in FY 1986, not $365 million. The $17 million difference is largely the result of the Gramm-Rudman reductions of $14 million scheduled to take effect March 1. (The remaining $3 million is internal DOE taxes, such as small business grants). The proposed cut to $333 million is seen in better perspective if you recall that the FY 1985 budget figure was $437 million.

INERTIAL FUSION BUDGET

The DOE budget pretends that the bulk of its inertial confinement fusion (ICF) program does not exist. Last year DOE requested $70 million for its FY 86 ICF program but Congress appropriated $155M. (The FY 85 figure was $168M.) For FY 87 DOE requests $23.8M for ICF and says this is the program at non-DOE sites (i.e., KMS Fusion, University of Rochester and Naval Research Laboratory). The bulk of the ICF program (at LLNL, LANL and Sandia) is "buried" in a $2 billion line called "weapons, research development and testing."

Meanwhile, the review of ICF called for by the Congress last year and carried out by the National Research Council (see our September, October, and November newsletters) has still not surfaced. Fusion Power Associates filed a Freedom of Information request with the Office of Science and Technology Policy in December to force the public release of the interim report. In a letter to us dated February 10, Jerry D. Jennings, Executive Director of OSTP, stated:

"At the present time we are denying release of the interim report of the National Research Council's panel to review the DOE's inertial confinement fusion program because the report contains information which requires coordination with other agencies. We will notify you as soon as we receive the results of the coordination and of our decision concerning release at that time."

DOE DISTINGUISHED ASSOCIATE AWARD WINNER DONALD J. GROVE

FUSION PROJECT MANAGERS HONORED

The Department of Energy presented its highest honor for contractor employees, the Distinguished Associate Award, to Donald J. Grove of Princeton Plasma Physics Laboratory (and formerly with Westinghouse Corp.) and to Victor N. Karpenko of Lawrence Livermore National Laboratory.

Don Grove has been building fusion devices at Princeton as long as anyone can remember and most recently has been instrumental in the successful completion and operation of the Tokamak Fusion Test Reactor (TFTR).

Vic Karpenko recently brought the Mirror Fusion Test Facility at Livermore to completion of its construction phase. A story and photo of Vic appeared in our October 1985 issue.

We express the admiration and thanks of all those working in the fusion community to Don and Vic for their momumental achievements. Both men have dedicated a substantial portion of their lives solving the difficult problems of constructing complex experimental machines requiring years of dedicated coordination and highly skilled management.

U.S. MIRROR PROGRAM MIGHT END

If the proposed magnetic fusion cut to $333M is accepted by Congress, DOE would propose to "mothball" the Mirror Fusion Test Facility and "phase" out all magnetic mirror research in the United States. According to the DOE budget document, this decision is made in order to consolidate resources to vigorously pursue toroidal concepts. In the $333M budget DOE would emphasize TFTR achieving breakeven conditions and press ahead with advanced ideas, including improved tokamaks, ATF and new RFP and FRC devices.

A variety of options are open to the Lawrence Livermore National Laboratory where mirror research is centered. They will have a major role in the design of an international engineering test reactor and are investigating the possible use of mirror technology for fusion materials testing or tritium production.

RIBE TO HEAD MFAC

Fred Ribe, University of Washington, has assumed the chairmanship of the Magnetic Fusion Advisory Committee, succeeding Ron Davidson of MIT. At its recent meeting at Livermore, MFAC accepted the report of its Panel XIV which reviewed and documented the potential contributions and importance of a compact tokamak ignition device. MFAC sent a letter to DOE Director of Energy Research Al Trivelpiece saying in part:

"Plasma behavior under ignited conditions represents a new frontier of physics that must be explored and understood as part of an assessment of magnetic fusion." They added, "The burning-plasma issues that are most important for the development of fusion are those relating to the confinement of the energetic-alpha particles produced by the fusion reaction and the confinement of reactor-relevant plasmas that are heated mainly by these alpha particles. Other very important issues relate to controlling the profiles, thermal excursions and composition of a burning plasma."

Persons wishing a copy of the full MFAC letter or the Panel XIV report should contact Fred Ribe at (206) 543-0355.

FUSION INFORMATION MEETINGS

On April 8-9 the ORNL Fusion Energy Division will host its popular Annual Information Meeting. Interested parties are welcome to come to hear first hand what is going on at Oak Ridge. Among the many interesting and timely topics you will want to know about are progress on building the ATF device, experiments with the large superconducting coil test facility and various design and theoretical studies. To obtain an invitation and program, contact Bill Morgan or Zee Buchanan at (615) 574-0988.

On May 9, the Princeton Plasma Physics Laboratory will host its Information Meeting. Activities to be presented include research results from TFTR, PBX, PLT, and S-1. Seats are limited so contact Carol Phillips at (609) 683-3553 soon.

EPRI BECOMES FUSION DROPOUT

The Electric Power Research Institute, a non-profit, tax-exempt foundation formed to support long-range electricity-oriented research that will benefit the public, is shifting its emphasis to support short-range research to benefit the electric utilities. Consequently, EPRI management has decided to phase out all research on fusion and to severely cut back on other long-range research. The EPRI actions are in response to pressure from those electric utilities who have cut back their contributions to EPRI in order to increase their own short-term profitability.

SDI FUNDING REQUEST UP

Funding for the DoD's Strategic Defense Initiative would increase from $2.75 billion in FY 86 to $4.8 billion in FY 87 according to the President's budget. Observers predict passage of an SDI budget of about $3.5 billion.

SANDIA MAY GET SDI TEST FACILITY

The DOE has asked for a $70 million SDI facility at Sandia to test kinetic and directed energy weapons concepts. Chances are good that the facility will be approved. The concepts to be tested include particle beams, x-ray lasers, microwaves and high velocity projectiles. The facility is aimed at 1990 operation.

EXECUTIVE NEWSLETTER

SPECIAL EDITION
MARCH 1986

FUSION POWER ASSOCIATES

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(301) 258-0545

TESTIMONY OF PROF. WILLIAM HAPPER, JR. ON THE INTERIM REPORT OF THE NATIONAL ACADEMY OF SCIENCES' COMMITTEE FOR A REVIEW OF THE DEPARTMENT OF ENERGY'S INERTIAL CONFINEMENT FUSION PROGRAM

PRESENTED TO THE
HOUSE ARMED SERVICES COMMITTEE
FEBRUARY 19, 1986

BACKGROUND

The material that follows is taken verbatim from the testimony of Prof. William Happer, Jr., Chairman of the National Academy of Sciences' Committee for a review of the DOE's Inertial Confinement Fusion Program. The Committee provided its interim report to the Executive Branch on July 15, 1985, but since that time the Executive Branch has refused either to make the report public or to forward the report to Congress. The Executive Branch initially refused to permit Dr. Happer to testify. The testimony that follows was presented under threat of supoena. In the interest of brevity the material that follows omits introductory material on the history of the Committee's deliberations. The complete testimony is available from Fusion Power Associates.

TESTIMONY OF PROF. WILLIAM HAPPER, JR.

"Our interim report--resulting from the massive series of briefings, discussions, and documentation received during the March-June period--devoted itself largely to progress in the ICF Program between the time of the last review--the 1979-1981 Foster review--and the present. We did, however, begin to address some of the issues that lie ahead for the program.

"As you know, the goal of the ICF Program is to produce a propagating thermonuclear burn in a small laboratory pellet imploded by a pulsed laser or particle beam. The most immediate application of the achievement of this goal will be to the nuclear weapons technology base. A miniature thermonuclear explosion in the laboratory, with a yield of, say, 1000 megajoules (1/4 ton of high explosive) would supplement the technology base information now gained from expensive and cumbersome underground tests, and in much shorter time. While a single laboratory experiment might be able to expose only one tenth as many objects as an underground test, still, with rapid turnaround, relative ease of experimentation, flexibility, etc., there can be little doubt that a successful ICF facility would benefit the nuclear weapons program by a reduction in costs of the effects testing now done, and by the introduction of experiments now thought unjustifiable by virtue of costs.

"This Committee is in a much better position than we to judge the likelihood of a Comprehensive Test Ban Treaty. If such a treaty should be signed, a successful ICF facility would be of great significance in continuing to add to the technology base, and in holding together the excellent teams of scientists and engineers who have been assembled by the excitement and challenge of the research. One has only to talk to those who lived through the last test ban to fully appreciate the importance of both these points.

"During our review of the progress made since the last review, we found nothing

that would permit us to say with complete confidence that the ICF Program will achieve its stated goal. On the other hand, we know of no physical reason why that goal cannot be achieved. Certainly we were persuaded that the ICF Program is today a vigorous and successful research effort which has made striking progress over the past five years, and that the outlook for success is more optimistic today that at the time of the last review. This increased optimism is due, primarily, to the encouraging results of short-wavelength laser-pellet interactions; to the impressive new information beginning to flow from the Centurion-Halite program; to the near completion of two major new facilities--i.e., the PBFA-II light-ion accelerator at Sandia, and the NOVA laser at Livermore; and to the continued development and application of sophisticated computational codes.

"The Committee was very favorably impressed by the quality of research facilities and the work being carried out. It was particularly impressed by the caliber and the motivation of the research teams assembled at each of the research centers. These teams are a national resource not easily or quickly reassembled once they are disbanded.

"The Committee was also impressed by the many important technological achievements made by the ICF Program, notably the development of extremely high energy glass and CO_2 lasers, and the development of extremely intense particle beams. The program has stimulated the creation of a completely new commercial manufacturing capability for large optical components capable of handling very high optical powers. The large CO_2 laser (Antares) at Los Alamos has proven to be an unusually intense, pulsed source of hot electrons, microwaves and x-rays. The Novette glass lasers at Livermore have been used to drive the first laboratory x-ray laser. Remarkable developments in materials science have resulted from the demands of target designers; for example, the development of ultralight glass and organic foams, and the development of new machinery and welding methods for very small, fragile targets. Significant advances in pulsed power technology have been made; for example, the ability efficiently to add the power from many magnetically insulated vacuum transmission lines with excellent time synchronization. Remarkable new instruments for diagnosing imploding pellets have been developed; for example, ultrahigh-resolution x-ray pinhole cameras. It seems certain that these instruments will find important applications elsewhere. The existing knowledge of laser-plasma interactions has been largely created by the ICF Program, and a rich variety of phenomena has been revealed and quantitatively understood.

"The largest elements of the ICF Program are being carried out at Sandia National Laboratories, Los Alamos National Laboratory, and Lawrence Livermore National Laboratory. The Centurion-Halite program is jointly managed by Los Alamos and Livermore. Smaller, but very vital parts of the program, are being carried out at the Naval Research Laboratory, at the University of Rochester, and at KMS Fusion, Inc. The Committee considers these smaller efforts to be very important to the overall health of the ICF Program and to the progress it has thus far made. This is especially true during this intermediate stage where research is being directed toward the most cost-effective way to build a driver large enough to ignite a thermonuclear burn. Indeed, the most active work on direct drive is going on at the Naval Research Laboratory and at the University of Rochester. These smaller programs have provided important new ideas, insights, and experimental methods, which have been profitably used by the larger laboratories. The University of Rochester serves the vital function of identifying, attracting, and training young researchers, and making them available to the overall research program. The smaller laboratories also provide highly competent, knowledgeable, and constructive criticism of the larger programs; criticism which is especially valuable since it comes from active research participants, not from equally well-intentioned but less well-informed outsiders. Finally, the small laboratories as well as the larger facilities have served to attract and maintain teams of highly qualified and experienced scientists and engineers; a national resource of considerable importance.

Through interaction and transfer, the weapons program has already benefited greatly from this resource.

"I would like to turn now to the future of the ICF Program, at least to the degree this was considered in our interim report. The Committee was convinced that if the campaign now being developed for Centurion-Halite, PBFA-II and NOVA are carried through to completion the anticipated results should provide a clear indication as to whether the program should be stopped or whether it should be pushed forward with renewed interest and support. If this campaign is held to schedule, these results should be available in roughly five years.

"If the decision point referenced earlier is to be reached in a timely fashion, steady, rational funding over the next few years is essential. The ICF Program has traditionally been identified as a line item in the DOE budget. The majority of the Committee feels that this program identity should be maintained. There are serious problems with including the ICF Program in the RDT&E portion of the DOE weapons program. Separate line-item funding of the ICF Program would facilitate the support of the smaller groups at the Naval Research Laboratory, the University of Rochester, and KMS Fusion. Finally, it would make the spotting of failures, as well as successes, of the program easier with priorities adjusted accordingly. To help DOE evaluate, and guide the program through the next five years, we recommended the establishment of a continuous oversight committee.

"Mr. Chairman, that completes my formal testimony, but I would like to include a final comment. The only consistent external criticism of our interim report has been that it is too optimistic and that our credibility will suffer because of it. Since we do not wish to waste the efforts of a group of very busy and very dedicated committee members, nor the work of scores of people who supported our review, we redoubled our effort to find technical, operational, and managerial flaws in the program. Our final report will not be without criticism. However, that redoubled effort produced nothing that would alter my testimony here today."

NRL SCIENTISTS ADD IDEAS/SUPPORT TO LASER FUSION PROGRESS/PROMISE

To reach the goal of inertial confinement fusion (ICF), a tiny pellet containing fusion fuel must first be compressed to about 1000 times the density of ordinary liquids. To do this requires that a few megajoules of energy be focused onto the surface of the pellet with a high degree of uniformity. Illumination uniformities of one to a few percent have been estimated as being required. An ordinary laser beam has intensity nonuniformities in its beam that have made it seem nearly impossible to achieve the desired degree of uniformity without resorting to an undesirably high number of beam lines. The ICF program has addressed the problem by using a technique called "indirect drive", which means that the laser beam is first converted to x-rays which then irradiate the pellet uniformly.

Although successful, the indirect drive approach is not without its problems. For example, the technique by which the laser energy is converted to x-rays requires a tiny capsule to surround the pellet. This capsule is complicated and expensive to design and make. Also the techniques for making optimum indirect drive capsules uses data and experience from thermonuclear weapons design and hence much of the work in the area has been considered to be classified secret.

Scientists at the U.S. Naval Research Laboratory, however, have developed and demonstrated a technique that allows the ICF program to again consider using "direct drive" of a pellet by a laser beam. They have called the technique "I.S.I." for Induced Spatial Incoherence. The ideas were first proposed and described by R. H. Lehmberg and S. P. Obenschain of NRL (Optics Communication, 46, 27, 1983). During the past year the technique was demonstrated on the NRL PHAROS III laser by Obenschain and other members of Steve Bodner's Laser Plasma Branch, including J. Grun, M. J. Herbst, K. J. Kearney, C. K. Manka, E. A. McLean, A. N. Mostovych, J. A. Stamper, Bodner, J. H. Gardner, R. H. Lehmberg, M. S. Pronko, B. H. Ripin and A. J. Schmitt.

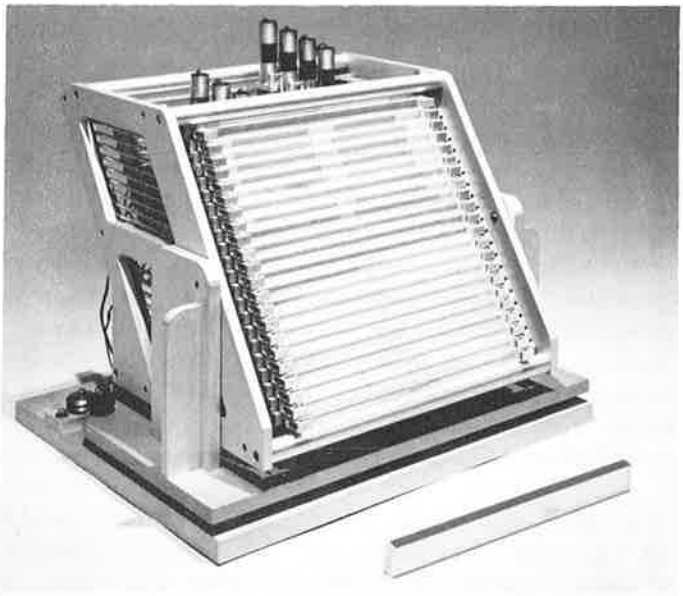
What Obenschain and his colleagues have done is to construct relatively simple reflecting echelons (see photo) that easily

divided the original laser beam into several hundred independent beamlets. The echelons are adjusted so that different optical delays are imposed on different transverse sections of the beam. If the delay increments are chosen to be larger than the laser coherence time then, when the beamlets are focused through an ordinary lens, the interference among the overlapped beamlets disappears and a very uniform focal pattern is obtained. The NRL scientists observed about a factor of 100 improvement in the focal intensity using I.S.I. An example is shown in the accompanying figure.

These results, for which we congratulate Dr. Bodner and his group, are only the latest of a series of important contributions made by NRL to the ICF program. For example, they were pioneers in the study of stimulated Brillouin scattering effects, which contributed to the current program emphasis on short wavelength. The group also developed and demonstrated many novel diagnostic techniques for studying Rayleigh-Taylor instabilities, etc.

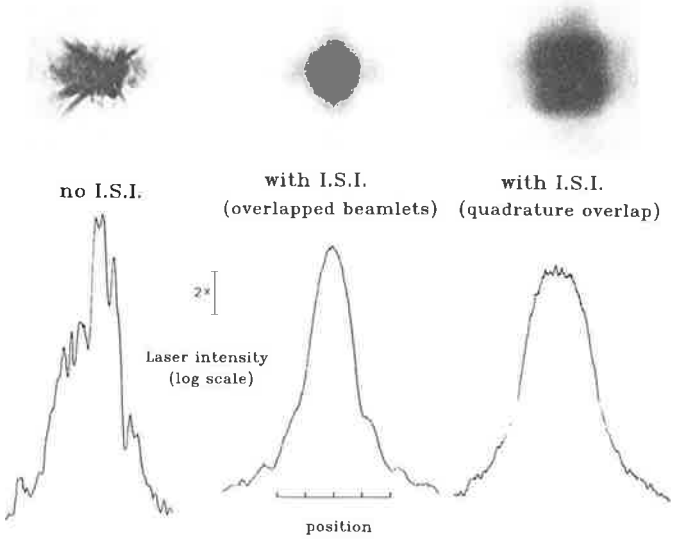
The NRL work described is only one example of the outstanding and novel physics being performed at all the ICF laboratories: LLNL, LANL, SANDIA, University of Rochester and KMS Fusion, Inc.

Fusion Power Associates takes its hat off to Prof. Happer and his committee for reminding us of the outstanding quality of ICF research and the high calibre of its people.



NRL ECHELON USED TO PRODUCE LASER BEAMLETS

Focal Distributions with and without I.S.I.
(green laser)



Members of Academy of Sciences' Committee to Keview DOE's Inertial Confinement Fusion Program:

William Happer, Jr.
Princeton University
Harold Agnew (retired)
GA Technologies, Inc.
George Carrier
Harvard University
Robert F. Christy
California Inst. of Technology
Ronald C. Davidson
Massachusetts Inst. of Technology
John Dawson
Univ. of California, Los Angeles
John Foster
TRW, Inc.
Conrad Longmire
Mission Research Corp.
Charles McDonald
R&D Associates
Marshall N. Rosenbluth
University of Texas

EXECUTIVE NEWSLETTER

APRIL 1986

FUSION POWER ASSOCIATES

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NEW AFFILIATE

Energy Applications and Systems, Inc. (EASI) of Del Mar, California, has become an Affiliate of Fusion Power Associates. S. Locke Bogart, president of EASI, will represent the company. EASI carries out conceptual and engineering design activities for high technology systems and components. A major current activity at the company concerns modularization designs for tokamaks. We welcome their participation in Fusion Power Associates.

GA DEDICATES "BIG-D"

On March 3 in San Diego, GA Technologies dedicated the DIII-D tokamak, popularly referred to as "Big D." The device is a major upgrade of the original Doublet III tokamak. The project took 18 months to complete and cost $45 million. The project is a joint project of the U.S. and Japan. The device is capable of sustaining hydrogen plasma at equivalent fusion reactor temperature and densities for up to 5 seconds, based on the injection of up to 10 megawatts of neutral beam power into the 3.5 megampere device. Our congratulations to all the GA crew led by Tihiro Ohkawa, John Gilleland, Dave Overskei and DIII-D project manager Larry Davis.

GA NAMES GILLELAND SENIOR VICE PRESIDENT

GA Technologies has named John Gilleland Senior Vice President for Fusion and Advanced Technologies. In his new position, John will be responsible for several fusion science and technology programs including DIII-D and OHTE as well as a Kinetic Energy Systems group headed by Ken Partain. Gilleland began his distinguished career in fusion as the project manager for the original Doublet III device.

DOE TO FUND OHTE AT GA

The Department of Energy will provide $470,000 to fund the OHTE group headed by Teruo Tamano at GA Technologies. The project was invented by T. Ohkawa and was previously supported by private funding from GA and Phillips Petroleum. The OHTE is a toroidal concept which combines several attractive features of the reversed field pinch and stellarator concepts.

PLASMA TECHNOLOGY BECOMES BIG BUSINESS

Barry Mazor, associate editor of Science and Technology for the Executive, published by the Research Institute of America, says of plasma technology "Experts say it will be a $10.6 billion industry over the next decade. It's a broad field, comparable to laser technology, in the sheer scope of its applications. Plasma's development will be fueled by an explosive growth in such areas as computer chip etching and the effective destruction of toxic waste." Mazor's remarks are quoted in the January 1986 issue of Western Airlines magazine Western's World. The article refers the affluent reader to a comprehensive study "New Developments in Plasma Technology" published by Business Communications Company in Stamford, Connecticut and available for a mere $1,500.

According to the projections reported, plasma etching devices will be a $3.6 billion business by 1995. Plasma coating technologies will be a minimum $200 million business in 10 years according to the article, while plasma display technologies for use in computer display terminals is projected to be nearly a billion dollar business. Other applications include plasma cutting tools, plasma cleaning, plasma welding and plasma metallurgies.

But the really big application may come from plasma disposal of toxic waste. Although still experimental, the EPA, Canada and New York have been testing an early plasma pyrolysis system at Love Canal in Niagara Falls, NY, for the past two years with a 99 percent success rate. Contact with the plasma destroys dioxin and PCB.

JAPAN PLANS NEW FUSION FACILITIES

The Science Council of the Ministry of Education of Japan announced in February, plans to construct a major new toroidal fusion research device of the heliotron type. The estimated cost of the device given was 60 billion Yen ($300 million.) Construction is to begin in about two years; operation is expected in 1992. The device is intended for the joint usage of the several universities in Japan involved in fusion research. The device is similar to, but much larger than, the Advanced Toroidal Facility (ATF) now under construction in the U.S. at Oak Ridge National Laboratory.

At the same time the Atomic Energy Committee of Japan announced that construction of a fusion engineering test reactor with a 100 second deuterium-tritium burn was to be planned as the follow-on facility to the large JT-60 tokamak now in operation. The estimated cost of the facility was given as 400 billion Yen ($2 billion). According to the 15 February NIKKANKOGYO (Industrial Daily Press) "The plan will proceed in three stages: basic design, detail design, and manufacturing/construction." "In addition," the report said, "the nuclear fusion group is going to seek international cooperation from European countries and the United States on the basis of the plan and to take a strong posture based on the results of research that has been obtained thus far." The article concluded, "There is great possibility that it will evolve into an internationally cooperated project at the Tokyo Summit to be held this May."

CORRECTION

The Princeton Plasma Physics Laboratory Information Meeting is scheduled for May 29, not May 9 as was stated in our last newsletter. We regret the error. Contact Carol Phillips at PPPL for more information (609) 683-3553.

MEETINGS

April 24-25 Fusion Power Associates Annual Meeting and Symposium, "Fusion Energy Development: An International Effort", Washington, D. C. Contact Ruth Watkins (301) 258-0545.

May 5-9 Seventh International Conference on Plasma-Surface Interactions, Hyatt Regency, Princeton, NJ. Contact Carol Phillips (609) 683-3553.

May 21-22 Magnetic Fusion Advisory Committee public meeting at Argonne National Laboratory. Contact Dick Nygren at DOE (301) 353-3288.

May 25-30 American Association for the Advancement of Science. Philadelphia. Contact Rolf Sinclair at NSF (202) 357-7997.

May 29 Princeton Plasma Physics Laboratory Information Meeting. Princeton, NJ. Contact Carol Phillips (609) 683-3553.

May 26-June 6 IAEA Fourth Technical Committee Meeting and Workshop on Fusion Reactor Design and Technology. Yalta, USSR. Contact Phil Stone at DOE (301) 353-4952.

May 27-30 Thirtieth International Symposium on Electron, Ion and Photon Beams. Boston. Contact Andrew Neureuther (415) 643-8167.

May 27-29 International Symposium on Heavy Ion Fusion. L'Enfant Plaza Hotel, Washington, D. C. Contact Martin Reiser (301) 454-3188.

June 9-12 Sixth International Conference on High Power Particle Beams. Kobe, Japan. Contact C. Yamanaka. Inst. of Laser Engineering, Osaka University, 2-6 Yamada-oka, Suita, Osaka, Japan.

June 15-19 Seventh Topical Meeting on the Technology of Fusion Energy. ANS. Reno. Contact Donna Schreiber (415) 423-1405.

EXECUTIVE NEWSLETTER

MAY 1986

FUSION POWER ASSOCIATES

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NEW AFFILIATES

Denki Kogyo Co., Ltd. has become an affiliate participant in Fusion Power Associates. Mr. Kazuhiko Harada, High Frequency Applications Division, will represent the company. Denki Kogyo is providing high frequency heating equipment for the JT-60 tokamak and also manufactures a wide array of commercial high frequency and telecommunications equipment. They can be reached at 4052-1 Sakuradai, Nakatsu, Aikawa-cho, Aiko-Gun, Kanagawa-Ken, 243-03, Japan. Phone 0462-85-1411; telex 2226078 DEKO J.

Commonwealth Technology, Inc., of Alexandria, Virginia, has become an affiliate participant of Fusion Power Associates. Robert A. Hunsicker, Director of Engineering, will represent the company. Commonwealth Technology provides a range of R&D services including electromechanical and optical support equipment and was responsible for the Naval Research Laboratory's echelon shown in our March 1986 special edition newsletter. They can be contacted at 5380B Eisenhower Ave., Alexandria, VA, 22304, (703) 823-3700.

The Fusion Technology Institute, University of Wisconsin, has become an affiliate participant in Fusion Power Associates. Gerald L. Kulcinski, Director, will represent the Institute. The activities of the Institute cover a wide range of fusion systems studies and conceptual design activities. They can be contacted at 439 Engineering Research Blvd., 1500 Johnson Drive, Madison, WI, 53706, (608) 263-4798.

We welcome the participation of our new affiliates in Fusion Power Associates.

NEW FUSION RECORDS SET

Scientists at the Lawrence Livermore National Laboratory, using the Nova laser, have set a new record for the product of density-temperature-confinement time ($n\tau T$) of $3 \times 10^{14} cm^{-3} sec$ keV at a temperature of 1.5 keV. The resulting density-confinement product ($n\tau$) of $2 \times 10^{14} cm^{-3} sec$ also represents the first surpassing of the Lawson product ($n\tau \approx 10^{14} cm^{-3} sec$) in inertial confinement fusion experiments.

Scientists at KMS Fusion, Inc. announced record values of pellet compression of about 160 times liquid density using the Chroma laser with only 160 joules of energy. A minimum compression of about 700 is believed necessary for pellet ignition. The results bode well for hopes that compression of about 1000 will be achievable with the Nova laser.

ADVANCED FUSION FUEL CYCLES BREAKTHROUGH

In a paper to be published in the September 1986 issue of Fusion Technology (ANS), L. J. Wittenberg, J. F. Santarius and G. L. Kulcinski of the University of Wisconsin report on the prospects for D-He^3 reactions for fusion power. This fuel cycle has long been considered ideal because the reaction products (protons and alpha particles) are both charged. This leads to the possibility of high efficiency direct power conversion and drastic reduction in neutron production which damages materials and also requires conventional lower efficiency heat transfer systems. The problem has always been that there was no known practical source of He^3. The authors have investigated the amount of He^3 due to solar wind bombardment on lunar surface layers and

calculated the cost of recovery and delivery to the earth. They find the resource to be so large and inexpensive to recover that it could provide for the entire world's electricity needs for centuries. The amount of He^3 required to provide electricity to the entire U.S. for a year would fit in the cargo bay of one space shuttle. Preprints are available from the authors (608) 263-2308.

ANNUAL MEETING SUCCESS

Over 100 persons from nine countries attended Fusion Power Associates annual meeting and symposium in Washington, D. C., April 24-25. The theme of the symposium was Fusion Energy Development: An International Effort. Dr. Alvin W. Trivelpiece, Director of Energy Research at the U.S. Department of Energy, was the keynote speaker. He described the history of international cooperation in fusion, including the ongoing activities of the western Economic Summit process and the followup to the Reagan-Gorbachev Summit. Further details were provided by Dr. Michael Roberts of DOE's Office of Fusion Energy. The technical status of activities around the world were described and there were panel discussions on "Prospects for Fusion Power," "Prospects for International Collaboration," and "Industry and University Roles in Fusion Development."

Audio cassettes of the papers are available for purchase at $84.00 for the whole two-day symposium. Individual tapes are $7.50. Order forms can be obtained from Fusion Power Associates.

ACADEMY ICF REPORT OBTAINED

After a lengthy Freedom of Information Act process Fusion Power Associates has obtained from OSTP the Interim Report of the National Academy Fusion Review of the DOE Inertial Confinement Fusion Program. Copies of the entire report are available from Fusion Power Associates. The following excerpts from the report are items we consider to be highlights.

- "Based on its work to date, the Committee is convinced that the ICF Program is a vigorous and successful research effort which has made striking progress over the past few years. Discussions with those who participated in previous reviews clearly indicate that the outlook for ICF is today more optimistic than at the time of the last major review (1979-1981)."

- "There have been many important technological achievements made by the ICF Program, notably the development of extremely high energy glass and CO_2 lasers, and the development of extremely intense particle beams. The program has stimulated the creation of a completely new commercial manufacturing capability for large optical components capable of handling very high optical powers.

- "Classification of much of the ICF Program is a difficult problem which is hindering progress by restricting the flow of information. These restrictions are hurting the morale of imaginative scientists .... Classification also keeps the scientific public from fully appreciating the important progress which has been made by the ICF Program, or from criticizing its weaker parts. A more widespread understanding of the achievements of ICF would make it easier to support the higher-priority parts and to deemphasize the less urgent parts of the program. We recommend the formation of a high-level committee to review the issue of ICF classification and to formulate new, more realistic and flexible classification guidelines.

- "The ICF Program has traditionally been identified as a line item in the DOE budget. The Committee feels that this program identity should be maintained. There are serious problems with including the ICF Program in the RDT&E portion of the DOE weapons program. Separate line item funding of the ICF Program would facilitate the support of the smaller groups at the Naval Research Laboratory, the University of Rochester, and KMS Fusion. Finally, it would make the spotting of failures, as well as successes, of the program easier with priorities adjusted accordingly."

EXECUTIVE NEWSLETTER

JUNE 1986

FUSION POWER ASSOCIATES

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FPA FINANCIAL STATUS

	1985	1984	1983
Income			
Research ..	$201,476	$214,967	$270,226
Dues	108,891	97,524	80,535
Other	66,751	31,666	17,463
Prior Yr. Carryover..	13,918	8,553	28,220
Total	$391,036	$352,710	$396,444
Expenses			
Research...	$201,333	$214,969	$271,169
Education..	80,464	52,197	29,009
Admin.	96,037	71,626	87,713
Total	$377,834	$338,792	$387,891

MFAC SAYS KEEP MIRRORS

The Magnetic Fusion Advisory Committee (MFAC), at its May 21-22 meeting at Argonne National Laboratory, advised the Department of Energy not to phase out magnetic mirror research in the U.S. (see our March newsletter). It acted on the advice of a panel chaired by Harold Forsen of Bechtel, set up to study the matter. MFAC then set up a subcommittee, chaired by Melvin Gottlieb of Grumman Corp., to discuss with DOE how this could be done within the tight budgets now available. DOE has made no commitment to follow the MFAC advice.

ACADEMY ISSUES FINAL ICF REPORT

The National Academy of Sciences, National Research Council Committee for a Review of the Department of Energy's Inertial Confinement Fusion Program has issued its final report in both classified and unclassified versions. Copies of the report can be obtained from Lee Hunt (202) 334-3523. Ron Davidson, a member of the committee, summarized the content of the report at Fusion Power Associates annual meeting and symposium on April 25. Findings and recommendations not previously reported (see our March special edition and May newsletters) were:

- "If pellet yields of 100 to 1000 MJ are attained, ICF microexplosions could replace certain underground tests and would allow studies of weapons physics and weapons effects to proceed much more quickly and inexpensively."

- "The challenges of ICF are providing unique new tools for the scientific and technological community and for other programs of national importance like SDI."

- "ICF may eventually lead to commercial power."

- "Approximately five years will be required to assess ICF feasibility."

- "The Committee unanimously recommends that the budget should be stable during this five-year period and at a level adequate to achieve the highest priority objectives, which, we believe, is approximately at the current level ($155 million/year)."

- "The majority of the Committee believes that line item status for ICF in the nuclear weapons R&D budget is the best way to achieve the major goals of the program in the next five years."

ICF CLASSIFICATION

The Academy Committee on ICF made the following comment on classification:

- "Classification of some parts of ICF is a difficult problem. It hurts the morale

of imaginative scientists who are unable to take credit for their creative work, and often must endure the vexation of seeing nearly identical work published in the open literature . . . . Classification impedes progress by restricting the flow of information, and does not allow all ICF work to benefit from open scientific scrutiny. A review of classification policy was last made in 1980. We recommend that a high-level committee take a fresh look at the issue of classification with the aim of keeping classified only those aspects of the ICF Program that are closely related to weapon design and are not already common knowledge in the international ICF community."

In response to a letter from Fusion Power Associates president Steve Dean in which he asked for major ICF declassification, Dr. F. Charles Gilbert, Acting Director, Office of Classification, replied,

"With respect to your comments on Inertial Confinement Fusion (ICF) classification policy, I share your concern that we may not be realistic in some areas of that program. To that end, we have begun this month (April) a review of the Department of Energy ICF classification policy."

ICF IDENTITY

The Department of Energy is actively trying to suppress the national identity of its inertial confinement fusion (ICF) program by eliminating its "line item" status in the DOE budget and "burying" its funding in its weapons budget (see our March newsletter). Fusion Power Associates has strongly condemned this subterfuge in testimony to both the House and Senate Armed Services Committees (copies available upon request).

The National Academy Committee on ICF makes the following comments on this subject:

"For the past several years the ICF Program has been a sizeable part (abouy 10 percent) of the weapons research and development budget and it has been listed as a separate line item. The issue of line item status of the ICF Program and the related management implications was brought up to the Committee in its earliest briefings. The Committee believed this issue was important, and in subsequent meetings there were several discussions of the pros and cons of maintaining this status. As a separate line item the ICF Program has been subject to management problems associated with salesmanship. On the other hand, if the line item status were removed, and ICF lost its separate visibility in the nuclear weapons program, it would be subject to pressures for more immediate needs of the weapons program and it would be difficult to prioritize between laboratories. While unable to come to agreement on the matter of line item status, the committee did agree that a continuing technical advisory committee could be helpful in maintaining an appropriate degree of program identity and a steady course and momentum for priority ICF activities, and that the budget for ICF should remain stable and adequate for the high priority ICF activities.

"The Committee's arguments about line item status may be of some interest, and are summarized below.

"One argument for continuation of line item status is related to the committee recommendation that the ICF program continue for approximately five years until definitive results from the Centurion-Halite program are available, the performance of PFBA II and the physics experiments of Nova have been evaluated, the potential of direct drive and ISI have been established, and more is known about the feasibility of advanced drivers, should they be needed. The majority of the Committee felt that a line item status would give greater likelihood of achieving these goals within the five years. The Committee believes that at the end of this period a decision on whether to continue ICF as a line item, to abandon it, or to absorb it into the nuclear weapons research and development program should be possible.

"This argument is related to the fact that ICF is a long-range program and, if buried in the weapons R&D budget, would have the characteristic vulnerability of such programs to "raids" to satisfy more immediate weapons R&D needs. These raids would add another level of instability to the budget, leading to further erosion of morale and productivity of the capable ICF teams at the laboratories. The next few years, we believe, are very critical to the ICF Program, magnifying the impact of budget instability in this period.

"During the next few years, the Committee also believes there will be a greater need for coordination and cooperation than hitherto. If each laboratory were authorized to make its own decisions about the ICF component of its activities, it would be difficult to prioritize between laboratories, and cooperation could also be impeded.

"There is also an argument that ICF is a unique DOE program with potential in both the weapons and energy areas. The energy potential, while longer range, is nevertheless important. There is considerable evidence also that the weapons program has had a very real, if indirect benefit from the ICF energy potential, since that potential has been one of the strong incentives for young and highly talented scientists to work at the weapons laboratories. The Committee believes that ICF is appropriately located in the general weapons R&D budget at the present time. But if ICF were not separately identified in that budget, the energy potential aspect of ICF would be obscured and might not receive adequate attention, and could be less attractive to young scientists than it has been in the past.

"The current program has also benefitted a great deal from the contributions of the smaller programs at NRL, UR, and KMSF. There is still a strong need for the new ideas and independent viewpoints of the smaller laboratories. If the program were not a separate line item managed by DOE Headquarters, the smaller programs might not be funded in any effective way.

"Those against the line item status maintain that the ICF budget should not be treated differently from funding in other parts of the nuclear weapons R&D program. Briefly, their argument was that since the ICF Program was justified by DOE as contributing to the weapons program, it should compete with other parts of that program, and the best forum for decisions in such a competition was within the weapons laboratories.

"After consideration of these arguments, opinion among the Committee members remained divided. The majority view held that ICF research should remain a separate line item, at least for the next five years, as the best way to achieve the major goals of the program in that time. The minority view held that the priorities of the ICF Program, which is agreed to be most relevant to the nuclear weapons program, would receive the most balanced review in the context of that total.

"Besides the uncertainty whether this topic was in its charter, the Committee had some doubt about whether it could significantly influence the decision of the government on this point in any case. Whichever way the decision goes, the Committee agrees unanimously that a continuing technical advisory committee could be helpful in maintaining an appropriate degree of program identity and a steady course and momentum for priority activities, and that the ICF budget should be steady and in reasonable proportion to its long-range importance to nuclear weapons, which the Committee sees as substantial as stated in other places in this report. The Committee believes that support for the ICF Program at the present level ($155 million per year) is approximately correct over the next five years."

FPA POSITION

Fusion Power Associates president Steve Dean wrote to Energy Secretary Herrington on April 7, asking in part, "that you insist that the total budget for inertial confinement fusion remain separately identifiable in the DOE budget and that your staff be held accountable for the progress of this program and for assessing its potential."

In response, he received a letter dated April 17 from Major General George K. Withers, stating in part, " "We do not agree with the National Academy of Sciences committee's recommendation for a separate line item providing for inertial confinement fusion. Inertial confinement fusion must be viewed as an integral part of the weapons research, development, and testing account with funding levels established based on technological benefits and overall research and development requirements and priorities. The funds we have requested for fiscal year 1987, within the overall research, development, and testing account, will continue the inertial fusion activities now under way at the national weapons laboratories. This manner of funding inertial fusion activities will maximize our ability to meet weapon-related commitments while maintaining the unique

scientific capabilities of the national weapons laboratories, including those the Congress has previously funded specifically for the inertial fusion program."

ERAB FUSION STUDY

The DOE's Energy Research Advisory Board has begun its tri-annual review of the magnetic fusion program. DOE says it is obligated to conduct the study by the Magnetic Fusion Energy Engineering Act of 1980. DOE's position is curious because the tri-annual ERAB review is the only part of the Act under which DOE acknowledges obligations. The rest of the Act it conveniently ignores.

The new ERAB study will be headed by Joseph Gavin, recently retired president of Grumman Corporation and new member of ERAB. Other members of the panel are Ronald Davidson, Melvin Gottlieb, Richard DeLauer, Ralph Gens, Thomas Johnson, Manning Muntzing, Lawrence Papay, Janice Phillips, and John Scholettler. Meetings of the panel are scheduled for May 29, June 25 and September 22. The final report is due at the November 5-6 ERAB meeting. All meetings are scheduled at DOE's Forrestal Headquarters in Washington. For further information contact Sarah Goldman (202) 252-5779.

FOUR CONGRESSMEN PRESS DOE ON FUSION

In a letter dated December 4, 1985, but only now just released in response to an inquiry by Fusion Power Associates, four members of Congress wrote to Energy Secretary John Herrington expressing "concern about the funding level and direction of the DOE Magnetic Fusion Energy Program (MFE)."

Representatives Don Fuqua, Marilyn Lloyd, Manuel Lujan and Sid Morrison stated "We believe that to ensure progress in MFE, a budget of roughly $400M is required (adjusted for inflation) beginning with the FY 1987 Administration request. We also believe that to sustain this level will require your direct program advocacy with the OMB and all appropriate congressional committees." DOE subsequently sent a request to Congress for $333M.

The representatives asked Herrington to actively support a fusion ignition experiment and stated, "We also ask that you consider the upgrade possibilities of the ignition device site, since there is considerable industrial interest in the engineering development aspects of a reactor-type device which could be later collocated with the Ignition Experiment if the site permits." The letter ended, "We look forward to hearing from you on these important matters and to constructive discussion among the DOE and all appropriate committees." Congressional staff told Fusion Power Associates that it appears that DOE does not intend to respond to the Congressional letter.

KMS GETS NRL CONTRACT

KMS Fusion, Inc. of Ann Arbor, MI, has been awarded a $132,000 contract by the U.S. Naval Research Laboratory to develop techniques for high-pressure materials processing. The technique uses a proprietary laser-ignited chemical explosive process. Dr. Frederick J. Mayer of KMS will direct the project. Dr. Earl F. Shelton of NRL will be the contract monitor. KMS chairman Pat Long also announced that 1985 non-fusion revenues in the company rose to $3.8 million, from $2.1 million in 1984. Fusion revenues also rose from $12.0 million to $13.8 million.

PEOPLE

John Willis has been named Director of the Confinement Systems Division of DOE's Office of Fusion Energy (OFE). He has been Acting Director for the past year following the appointment of N. Anne Davies as Deputy Director of OFE.

Charles C. Damm has retired from the Lawrence Livermore National Laboratory due to a serious illness. Charlie is one of the pioneers of experimental fusion research. All his friends wish him well.

Jim Callen of the University of Wisconsin has been awarded a Guggenheim Fellowship. Beginning in early August he will be a Culham Visiting Scientist assigned to the JET project in England for a year.

Dale Smith has been promoted to Senior Nuclear Engineer at Argonne National Laboratory. The designation is the highest technical level at Argonne. This distinction was also given last year to Charlie Baker, director of the Fusion Power Program at ANL.

EXECUTIVE NEWSLETTER

JULY 1986

FUSION POWER ASSOCIATES

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US-JAPAN ACCORD

"The eighth meeting of the US-Japan Fusion Energy Coordinating Committee was held in Tokyo, Japan on May 8 and 9, 1986. Robert Dowling, DOE Office of Fusion Energy, led the U.S. delegation. The Japanese delegation was led by Professor T. Miyazima, President of the Nuclear Fusion Council of Japan. The two leaders signed a protocol approving 118 items of exchange for the coming year, which stated:

"The Committee reviewed the extensive activities in the various task agreements and program planning areas. The greatest amount of time was devoted to an open discussion of the mutual interests in the major new initiatives, namely, the Japanese helical system, the U.S. compact ignition tokamak, and the preparations for the FER/ETR class of facility. Agreements were reached on further meetings to address these mutual interests and to identify specific collaborative tasks. The meeting was marked by a continuation an strengthening of the mutual understanding required to develop effective collaboration."

One new concept approved was the establishment of a Tokamak Physics Coordination Group, to be composed of 2-3 people from each side. Three objectives were established for the Group: 1.) To identify issues in Tokamak Physics over a broad range of technical topics; 2.) To plan experiments to resolve those issues using small and medium size experiments; 3.) To develop proposals for appropriate activities for consideration at the Executive Secretaries Meeting.

ROBERT DOWLING AND PROF. T. MIYAZIMA SIGN THE U.S.-JAPAN PROTOCOL, MAY 9, 1986

HEAVY ION FUSION--COMING OF AGE

A close-knit, focused and enthusiastic international community of scientists has quietly established a serious effort to develop the heavy-ion fusion approach. Over 100 persons, about one-third of whom were from outside the U.S., attended a successful symposium in Washington, D. C., May 27-29.

Heavy-ion fusion involves the focusing of a beam of heavy ions from an accelerator, like an induction linac, onto the surface of a small capsule containing deuterium-tritium fuel. Funding for the U.S. program is provided primarily by the Office of Inertial Fusion and the Office of Energy Research. The concepts were originally proposed in 1975 by members of the High Energy Physics community. Fusion Power Associates and the University of Wisconsin have completed a study of a heavy ion fusion reactor concept, called HIBALL, under grants from the Karlsruhe Nuclear Research Center.

A highlight of the May symposium was a report that the Federal Republic of Germany will add the capability to perform heavy ion fusion tests to a recently funded $120 million nuclear physics accelerator complex. Other highlights were reports on the first results from the Multiple Beam Experiment at the Lawrence Berkeley Laboratory and the initiation of experimental programs in France to study the interaction of energetic heavy ions with dense plasmas.

A two year heavy ion fusion systems assessment is nearing completion under the leadership of Don Dudziak of Los Alamos. Personnel from McDonnell Douglas Astronautics Company, the University of Wisconsin and LLNL also participate in the study. The study receives guidance from a steering committee chaired by Bill Herrmannsfeldt of the Stanford Linear Accelerator Center and has also received funding from EPRI.

A significant recent achievement has been the realization that concepts using multiply-charged ions, rather than singly-charged ions, were feasible and would lead to large decreases in the projected costs of reactor facilities. The studies suggest that power plants down to the desired 500 MWe can be designed and that plants having competitive costs of electricity can be anticipated.

Further information can be obtained from Don Dudziak (LANL) Denis Keefe (LBL), Bill Herrmannsfeldt (SLAC) and Les Waganer (MDAC).

PEOPLE

Don Grove of PPPL has received the American Nuclear Society Fusion Energy Division's award for outstanding lifetime contributions to the development of fusion power. Don is especially recognized for his project management contributions to PLT and TFTR.

Nermin Uckan of ORNL has been honored for "Distinguished Achievements in Science" by the East Tennessee Chapter of the Association for Women in Science.

AWARD WINNERS NERMIN UCKAN AND DON GROVE

Roxanne Engelstad of the University of Wisconsin has received two American Nuclear Society Fusion Energy Division awards, for Best Paper and Best Student Paper, presented at the 6th Topical Meeting on the Technology of Fusion Energy.

Jim Crocker of Idaho National Engineering Laboratory has been named manager of Energy Programs. His responsibilities will include fusion, electron vehicles, hydro, geothermal, conservation and energy economic analysis.

ROXANNE ENGELSTAD, WINNER OF TWO ANS FUSION AWARDS, ACCOMPANIED BY HER FATHER AT THE AWARDS CEREMONY

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AUGUST 1986

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LINFORD NAMED LANL LEADER

Dr. Rulon K. Linford has been named Magnetic Fusion Energy (MFE) Program Director at Los Alamos National Laboratory. Rulon will head the newly created MFE Program office in the Energy and Research Applications Directorate headed by laboratory Associate Director John T. Whetten. In his new position Rulon will be responsible for all MFE program activities at the Laboratory and is the primary contact for those activities.

ANS FUSION ENERGY DIVISION ELECTS LEADERS

Dan Cohn of MIT has taken over as chairman of the ANS Fusion Energy Division for 1986-87. Other officers, newly elected, are Bob Krakowski of LANL as Vice Chair/Chair-Elect, Jim Gordon of TRW as Secretary/Treasurer and three new members of the Executive Committee: Don Grove (PPPL), John Sheffield (ORNL) and Don Steiner (RPI).

KILLEEN NAMED ASSOCIATE DEAN

John Killeen, director of the National Magnetic Fusion Energy Computer Center, has been named Associate Dean for Graduate Studies and Research of the University of California, Davis. In his new post, Killeen will oversee all UC-Davis graduate study and research programs taking place at LLNL. John will also continue in his post as director of the Computer Center.

OTA NAMES FUSION ADVISORY PANEL

The congressional Office of Technology Assessment has named an Advisory Panel to assist in its review of the U.S. fusion program (see our January newsletter). The panel will be chaired by William D. Carey, chairman of the American Association for the Advancement of Science. Other members are:

DR. RULON K. LINFORD, NEW FUSION PROGRAM DIRECTOR AT LANL

Ms. Ellen Berman (Consumer Energy Council of America); Dr. Linda Cohen (University of Washington); Dr. Paul Craig (University of California, Davis); Dr. Harold Forsen (Bechtel National, Inc.); Dr. T. Kenneth Fowler (Lawrence Livermore National Laboratory); Dr. Edward A. Frieman (SAIC); Dr. Melvin B. Gottlieb (Princeton); Mr. William Gould (Southern California Edison Company); Dr. L. Charles Hebel (Xerox Palo Alto Research Center); Dr. Robert L. Hirsch (Arco Oil and Gas Company); Mr. Leonard Hyman (Merrill Lynch Capital Markets); Dr. Betty Jensen (PSE&G); Mr. Hans Landsberg (Resources for the Future); Dr. Larry Lidsky (Massachusetts Inst. of Technology); Dr. Irving Mintzer (World Resources Inst.); Dr. Robert Park (American Physical Society); Dr. Murray Rosenthal (Oak Ridge National Laboratory); Dr. Eugene Skolnikoff (Massachusetts Inst. of Technology); Dr. Herbert Woodson (University of Texas).

The review is scheduled to be complete in March 1987.

MARTIN NAMED DOE DEPUTY SECRETARY

William F. Martin, 35, of Tulsa Oklahoma has been named Deputy Secretary of Energy. Martin has been on the White House staff since 1982, most recently holding the position of Executive Secretary to the National Security Council and Special Assistant to the President for National Security Affairs. From 1981-1982 he was Special Assistant to the Undersecretary for Economic Affairs, Dept. of State. From 1977-81 he worked on energy studies with the IEA in Paris. He holds a B.S. from the Wharton School of the University of Pennsylvania and an S.M. from MIT.

NEW SCIENCE ADVISOR NAMED

President Reagan has named William R. Graham to be his Science Advisor and head of the Office of Science and Technology Policy, replacing George A. Keyworth II, who resigned last December. Graham had been acting administrator of NASA. Graham came to government from R&D Associates, Marina del Rey, CA, a company he helped to found in 1971. His research has been primarily in the areas of nuclear weapons technology and defense. He holds a B.S. degree in physics from Caltech and a Ph.D. in nuclear engineering from Stanford.

JOHN SHEFFIELD (left), ASSOCIATE DIRECTOR OF THE OAK RIDGE NATIONAL LABORATORY'S FUSION ENERGY DIVISION, DESCRIBES THE DESIGN OF THE DIVISION'S ADVANCED TOROIDAL FACILITY (ATF), NOW UNDER CONSTRUCTION, TO U.S. REPRESENTATIVE MARILYN LLOYD OF TENNESSEE'S THIRD DISTRICT. WITH THEM ARE OAK RIDGE VICE MAYOR LARRY DICKENS (second from left) AND LABORATORY DIRECTOR HERMAN POSTMA. THE ATF, ONE OF A FAMILY OF FUSION DEVICES KNOWN AS STELLARATORS, IS SCHEDULED TO GO INTO OPERATION EARLY NEXT YEAR.

EXECUTIVE NEWSLETTER

SEPTEMBER 1986

FUSION POWER ASSOCIATES

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TFTR CONFINEMENT ENHANCED

By moving the plasma so that the injected neutral beams reach the center, scientists at Princeton achieved a peaked density profile and found that the energy confinement was three times better than achieved previously. The improved energy confinement allowed the ion temperature to soar to 20 keV, the highest ever achieved in a tokamak, using only half the available beam heating power. The plasma conditions achieved were only about four times short of breakeven.

Typical plasma parameters were: $n(o) = 6\text{-}7 \times 10^{13} cm^{-3}$, $\tau_E = 150$ ms, $T_i(o) = 20$ keV, $T_e(o) = 7$ keV, $I = 1$ MA, $P_{in} = 15$ MW. Observations that the loop voltage went negative during the experiments suggest that the plasma may be generating part of its own current.

The plasma conditions achieved meet or exceed the original minimum design goals of TFTR. During the coming months Princeton scientists will seek to maintain the observed enhanced energy confinement while increasing the plasma current, density and injected beam power. The achievement of plasma breakeven conditions in TFTR is now projected for the summer of 1987.

INTERNATIONAL COIL TESTS SUCCEED

The six large superconducting coils, built by the U.S., Europe and Japan have been simultaneously energized in the Large Coil Test Facility at Oak Ridge National Laboratory. The project is the first large scale collaboration fusion technology project undertaken jointly by the three groups.

GA PURCHASE COMPLETED

Chevron Corp. has completed the sale of General Atomic Technologies Corp. to Neal and Linden Blue of Denver, Colorado. GA thus becomes a privately-held corporation. The Blue brothers' other interests include gas utilities companies in Ohio, Utah, Colorado and real estate in Colorado. The new owners have established a board of overseers including Alexander Haig, Simon Ramo, William Gould, Harold Agnew and John Vessey.

In addition to maintaining the largest industry fusion program, the new owners have indicated their intention to rapidly commercialize new technologies. These include high temperature gas cooled reactors, incineration technologies for toxic waste and superconducting magnets for medical equipment. GA also intends to expand its national defense activities.

Kerry Dance, president of GA, also indicated that the company plans to offer supercomputer services to its industrial and government clients modeled on the successful San Diego Supercomputer Center, operated by GA for the National Science Foundation.

VARIAN ADVANCES MICROWAVE TUBES

Only a few years ago the highest frequency high power microwave tubes available were 28 GHz. Now, Varian Associates has successfully produced tubes at over 100 GHz. A 140 GHz tube has operated continuously at 100 kw; for 100 ms at 150 kw and for short pulses at 200 kw. Varian hopes to operate the tube continously at 200 kw this year. The tubes will eventually be available in 1 MW versions. For further information, contact Jack Craig at (415) 424-5634.

FREE ELECTRON LASER TESTS SET

Free electron laser (FEL) component testing and sub-scale validation experiments will be conducted at LLNL prior to building a full scale laser at White Sands Missile Range in New Mexico. The laser will be based on the induction linear accelerator concept that was originally developed for the ASTRON fusion concept. A smaller FEL will also be tested at White Sands based on radiofrequency accelerator technology, developed by Los Alamos for the fusion program. The programs graphically illustrate the importance of fusion technology to the Strategic Defense Initiative.

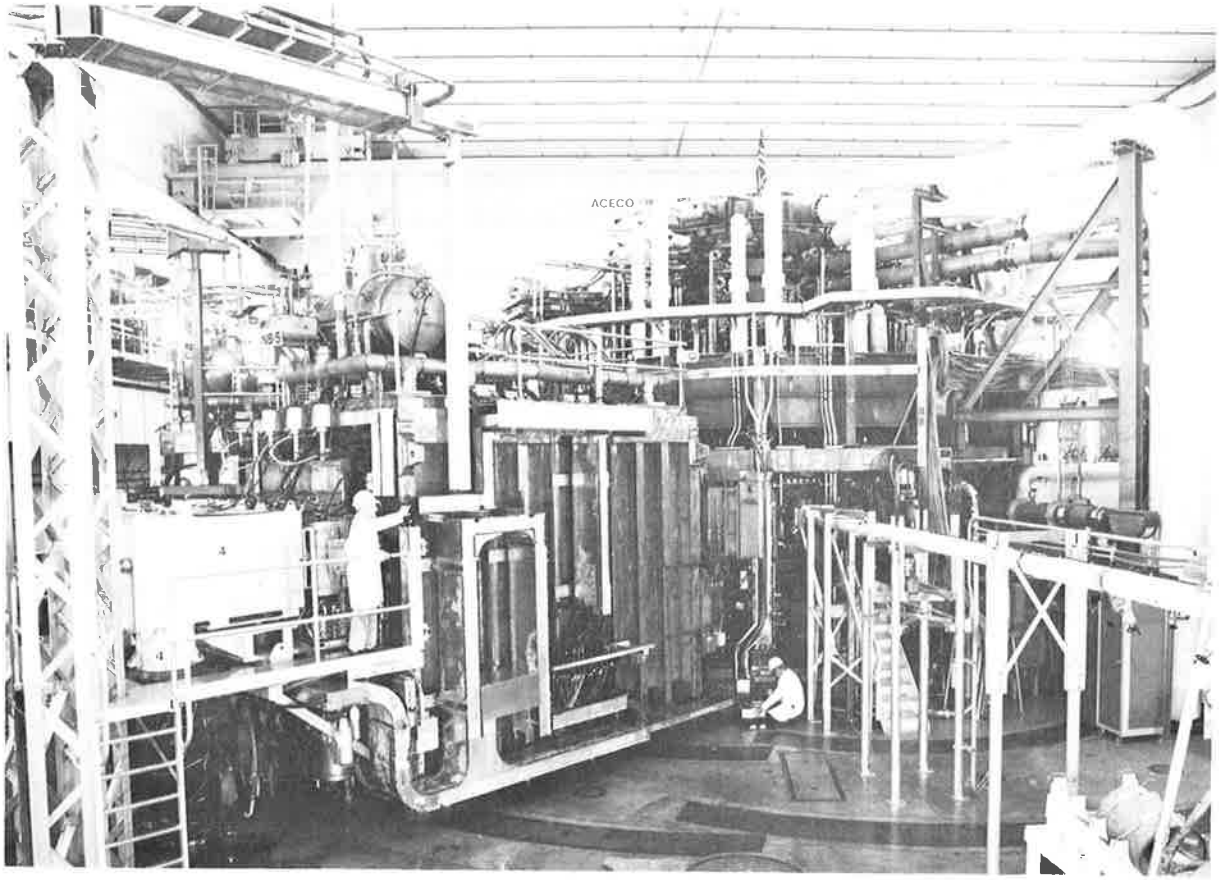
The Livermore fusion program has also proposed to test free electron lasers as a technology for driving steady-state current drive in tokamaks. Consideration is being given by DOE to moving the Alcator C tokamak to LLNL from MIT. MIT has proposed to build a new tokamak to replace Alcator C.

CULHAM GETS SDI TASKS

Culham Laboratories, the major fusion laboratory in the United Kingdom, has been awarded a $4.3 million contract by the U.S. Strategic Defense (SDI) program to develop high-brightness negative ion sources and neutralizers for use in neutral particle beam systems. The SDI program is interested in neutral beams to detect decoys. The fusion program has been interested in negative ion-based neutral beams as a way of heating high temperature plasmas and as a possible way to drive current in tokamaks.

TRITIUM SAFE HANDLING COURSE

The Ontario Hydro Canadian Fusion Fuels Technology Project will sponsor its popular 5-day Tritium Safe Handling Course, October 20-24 in Toronto and Chalk River, Canada. The course covers both lecture and laboratory work. Tuition is $1095. For information, contact Robert Stasko (416) 823-8513.



THE TOKAMAK FUSION TEST REACTOR (TFTR) AT PRINCETON, SHOWING THE NEUTRAL BEAM HEATING SYSTEM AT THE LEFT.

CONGRESS SUPPORTS ICF

The Armed Services and the Appropriations Committees of both House and Senate and the Science and Technology Committee in the House have all endorsed the nation's inertial confinement fusion program. The appropriations committees have earmarked $154 million for the program. DOE had proposed not to identify the major fraction of the inertial fusion effort separately from its weapons activities but had indicated that it would spend about $118 million unless Congress intervened. Fortunately Congress has intervened. Meanwhile the Science and Technology Committee in the House, which oversees civilian energy programs, showed its interest in inertial fusion by recommending an additional $3 million, stating "In fiscal year 1987, the Committee directs the Department of Energy to investigate the civilian application potential of inertial confinement fusion in view of the recent terrestial progress achieved in the ICF laser program as well as in complementary underground tests." (House Report 99-719, Part 1).

The House Armed Services Committee, in its report (99-718) states, "The committee is concerned that the DOE budget request for fiscal year 1987 once again proposes to disestablish the Inertial Confinement Fusion (ICF) program. Only $22.5 million for operating expenses and $1.3 million for capital equipment is identified for the fiscal year 1987 program as compared to a total adjusted appropriations of $147.4 million for fiscal year 1986 and $155 million for fiscal year 1985. Although DOE witnesses identified a total of $109 million in operating expenses, including the $22.5 million specifically requested, for the ICF program, this amount is to be allocated, if at all, from the weapons research and development (R&D) account assuming that the R&D amount is fully funded.

"Under the DOE approach, ICF would cease to exist as an entity, its programmatic goals abandoned, its past accomplishments consigned to oblivion and its promising future left in doubt. The ICF program has been authorized by the Congress as a separate line item since 1977 because it has required central dedicated management and research teams and adequate annual funding. To merge the program's management and funding at this point with that of the overall weapons research and development programs, as proposed by the Department of Energy, would consign the ICF program to administrative extinction. The committee can not agree with this approach.

"The committee recommends that the Congress continue to authorize appropriations for the ICF program as a separate line item. Further, the committee recommends authorization of $148.2 million for ICF operating expense to be allocated as indicated in the bill. This will permit pursuit of major program goals and continuation of the Centurion and Halite programs. In addition, the committee recommends $25.2 million for ICF supporting service which would allow for contract extensions with the University of Rochester and its users ($9.0 million), the Naval Research Laboratory ($2.5 million) and KMS Fusion ($13.7 million). The committee recommends a line item authorization of $9.5 million for capital equipment to support the ICF program. The weapons activities line item is decreased accordingly."

LLNL HEADS FUSION ENGINEERING DEVICE STUDY

Lawrence Livermore National Laboratory has been designated by the DOE Office of Fusion Energy to lead the effort to plan for and design a fusion engineering test reactor that could be built during the 1990's. T. K. Fowler is chairing a national overview committee and Carl Henning is leading the design effort. In a recent 2-day meeting at LLNL, design group participants reviewed the status of the various subsystems design activities. The engineering test reactor is becoming the focal point for the possibility of a world-wide collaboration to develop fusion energy.

ARTICLES OF NOTE

Recent popular publications on fusion of special interest include: Inertial Confinement Fusion with Light Ion Beams, by J. Pace VanDevender and Donald L. Cook, in the 16 May, 1986 issue of Science.

Progress in Laser Fusion by R. Stephen Craxton, Robert L. McCrory and John M. Soures, in the August 1986 Scientific American.

Fusion '86--The European Scene by Simon Rippon, in the August 1986 Nuclear News.

CANADIAN TOKAMAK CONSTRUCTION PROGRESSING

Scientists at the Institut de recherche d'Hydro-Quebec are beginning the final assembly of the "Tokamak de Varennes" at the Hydro-Quebec facility near Montreal. Operation is planned in early 1987. The project is jointly funded by the National Research Council of Canada and Hydro-Quebec. Other collaborators in the project are the University of Quebec, the University of Montreal, Canatom, Inc., and MPB Technologies, Inc. The stated mission of the project is "to build up technical competence and know-how in the field of nuclear fusion for the strategic purposes of Hydro-Quebec and Canada."

SMALL BUSINESS PROPOSALS SOLICITED

DOE has announced solicitations for proposals under the Small Business Innovation Research (SBIR) program. Typical Phase I grants are for $50,000. The closing date for receipt of proposals is November 3, 1986. Further information can be obtained from SBIR Program Manager, U.S. Department of Energy, Washington, D. C., 20545, (301) 353-5707.

PEOPLE

Ed Frieman has taken over as director of the Scripps Institution of Oceanography. Ed has been an executive vice president of Science Applications International Corp. Previously Ed was director of energy research at the U.S. DOE and deputy director of Princeton Plasma Physics Laboratory.

Al Mense has been named acting chief scientist of the Strategic Defense Initiative Office (SDIO) in the Defense Department. Al had been assistant to the chief scientist and previously had worked for McDonnell Douglas Astronautics Co., the House Science and Technology Committee and Oak Ridge National Laboratory.

Gerry Yonas has joined Titan Corporation, La Jolla, CA, as vice president. Gerry was previously chief scientist of SDIO and previously was head of pulsed power programs at Sandia National Laboratory. Gerry was also a member of Fusion Power Associates first Board of Directors. Gerry can be reached at (619) 546-9743.

Steve Rockwood will soon join Science Applications International Corp. as senior vice president. Steve had been associate director for Defense Research and Applications at Los Alamos National Laboratory.

Arthur Sleeper has completed his first year of an accelerated 2-year program leading to the M.D. degree at the University of Miami medical school. Art recently passed 13 hours of comprehensive examinations and will spend the next year in primarily clinical studies. He was previously a fusion scientist at GA Technologies and in the DOE Office of Fusion Energy. Arthur can be reached at 1160 NW N River Dri., #5, Miami, Florida, 33136-2922.

DIALCOM ACCESS

Persons with electronic mail access through DIALCOM can send us messages by accessing System 64 and typing S.DEAN at the "To:" prompt.

KMS FUSION WINS AWARD

KMS Fusion, Ann Arbor, MI, has been awarded a $479,000 contract by the U.S. DOE for the development of a highly efficient neutron detection and measurement system. The contract is a Phase II Small Business Innovative Research Award. The neutron detection system operates by measuring pulses of light generated by neutrons passing through the detection unit. An individual can then record and relate these light pulses to the neutrons entering the detector for measurement purposes. The system will be capable of recording neutron signals up to 100 times faster than conventional units with the same efficiency.

Dr. Tim Henderson, Chief Scientist for KMS, will act as principal investigator for the project.

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OCTOBER 1986

FUSION POWER ASSOCIATES

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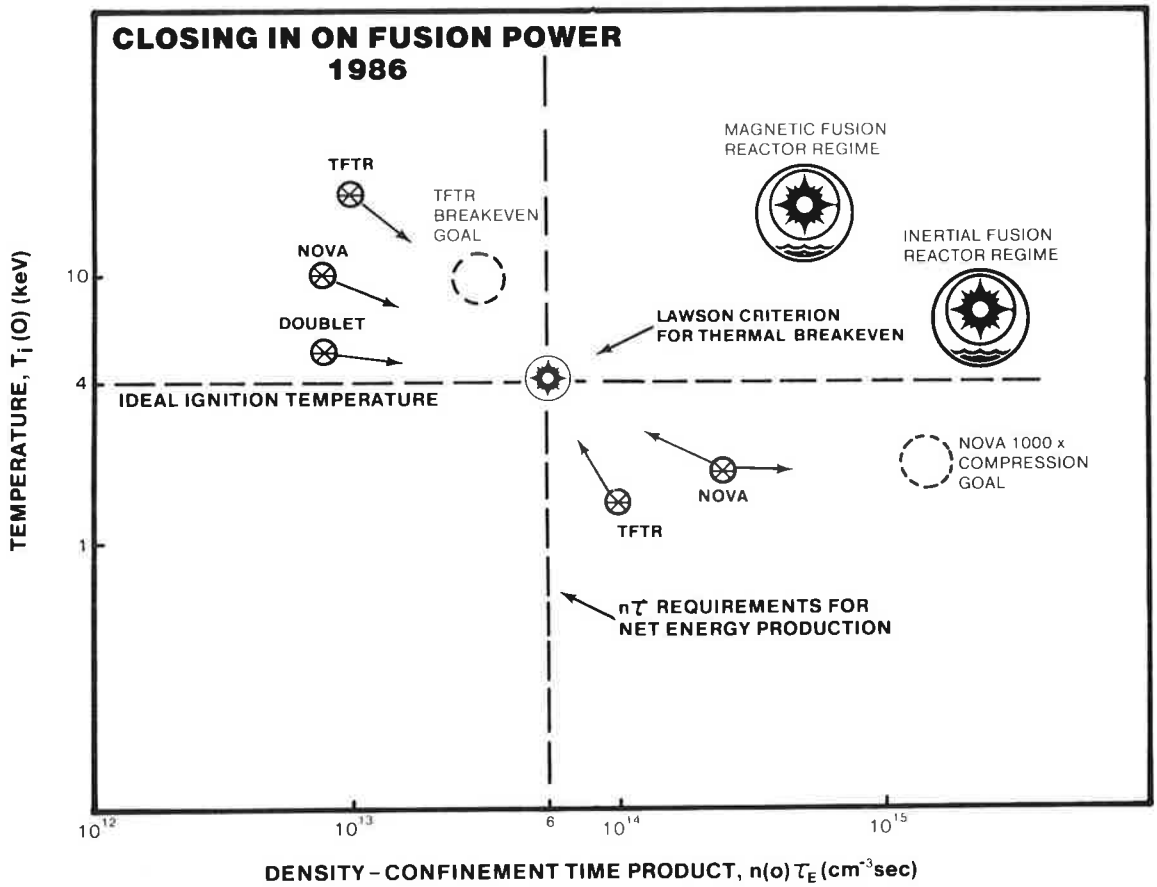
APPROACH TO FUSION CONDITIONS

During the past year the pace of fusion progress has demonstrably accelerated. Experiments in progress world-wide should continue to show a rapid succession of achievements. The accompanying graph shows the traditional goal of fusion thermal breakeven (the so-called Lawson Criterion) as the intersection of the two dashed lines. This point represents the simultaneous achievement of the ideal ignition temperature (4 keV) and the required product of density and confinement ($6 \times 10^{13} cm^{-3} sec$). Experiments like TFTR, Doublet and NOVA in the U.S. and (not shown) JET in Europe and JT-60 in Japan are exploring operating regimes near the Lawson Criterion.

Fusion breakeven may be approached and surpassed in a variety of ways; for example, in unthermalized plasmas at higher temperatures, shown on the graph as the TFTR breakeven goal. In the case of inertial confinement fusion (the NOVA points shown) the preferred approach to fusion power is to keep the temperature low while continuing to increase density. This leads to the NOVA goal shown of achieving 1000 times compression over liquid density. As the graph also indicates, magnetic and inertial confinement operating reactor regimes are expected to be optimized at different values of temperature and density-confinement time product. The further development of fusion power now requires physics optimizations and commercially-viable, environmentally-attractive, engineering demonstrations.



DON DAUTOVICH

DAUTOVICH HEADS ONTARIO FUSION PROJECT

Effective July 1, Dr. Don Dautovich has succeeded Dr. Tom Drolet as head of the Canadian Fusion Fuels Technology Project at Ontario Hydro. Tom has accepted a new position at Ontario Hydro as manager of a project to develop technology spinoffs from the nuclear industry. Don has been Technology Development Manager for the fusion fuels project since its inception in 1982. We wish them both well in their new responsibilities.

EXECUTIVE BRANCH ENERGY REVIEW

President Reagan has ordered a high-level review of U.S. energy policy in the context of national security concerns. An inter-agency review group has been established under the chairmanship of DOE Deputy Secretary William Martin. The group will have members from DOE, Interior, State, Defense, Commerce, Treasury, the National Security Council, OMB, and EPA. The group is to report to the President by the end of the year.

LASER PROPOSALS SOLICITED

The National Laser Users Facility at the University of Rochester will accept proposals until 15 December 1986 for conducting experiments using high power lasers at the Laboratory for Laser Energetics. Funds are available to support user experiments. For further information contact James Knauer (716) 275-2074.

ART SHERWOOD AND PHIL THULLEN

THULLEN, SHERWOOD NAMED TO LANL POSTS

Rulon Linford, fusion program director at Los Alamos, has announced the appointment of Philip Thullen as program manager for the Confinement Physics Research Facility construction and Arthur Sherwood as program manager for magnetic fusion energy. Thullen, who joined LANL in 1976 from MIT, will be in charge of setting up the $52.5 million facility aimed at operation in the early 1990's. Sherwood will be responsible for assisting Linford in overseeing other laboratory projects relating to fusion.

SPECTRA TECHNOLOGY TO BUILD NEW FIELD REVERSED EXPERIMENT

Spectra Technology, Inc., Bellevue, WA, has received a $14 million, four year, contract from DOE to build and operate a new, scaled-up field reversed concept (FRC) experiment. The concept is one of several promising new approaches to fusion development. The project is managed by Alan Hoffman, director of plasma physics and fusion technology. The experiment, which is four times larger than previous FRC's, is aimed at proving the scientific principles that could lead to simpler, smaller and hence more commercially attractive, fusion reactors.

PROCEEDINGS PUBLISHED

Proceedings of Fusion Power Associates two 1985 symposia have been published in the Journal of Fusion Energy, Vol. 5, Nos. 1 and 2.

EXECUTIVE NEWSLETTER

NOVEMBER 1986

FUSION POWER ASSOCIATES

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SUPER-HIGH-FIELD TOKAMAK PATH URGED

Speaking to a special evening session on "Future Directions in Fusion Research" at the American Vacuum Society conference in Baltimore October 30, MIT's Dan Cohn proposed that the fusion community seriously analyze a fusion development path based upon super-high-field tokamaks. Tokamaks using copper magnets producing 13-25T at the plasma axis and superconducting magnets producing 10-13T were described. According to Cohn such tokamaks might be used for both near-term physics tests, longer-term test reactors and possibly even for commercial reactors. Because of their high field, the copper magnet devices could have high performance with small plasma volume and relatively low cost.

The concepts are based upon the well-established "neo-Alcator" scaling for ohmically-heated, high density plasmas. All would either be ohmically-heated to ignition or have a strong ohmic heating component. Cohn believes that Alcator C and CIT design-type magnets could produce super-high fields by using larger aspect ratio to keep stresses at acceptable levels. Further increases in performance could be achieved with more innovative and aggressive magnet design and development.

Such an approach to fusion power development would suggest a shift in program balance to place more emphasis on technology development as a pacing item. From the Alcator observation that $n\tau$ is proportional to n^2R^2a and that n scales as BR^{-1}, Cohn suggests that the critical scaling law for evaluating performance is $n\tau \sim B^2a$, with a further possible enhancement from elongation. He points out that the ratio of the field at the plasma to the field at the coil can be increased by going to high aspect ratio. Typically B^2a for the new

DAN COHN OF MIT: SUPER-HIGH-FIELD ADVOCATE

class of tokamaks would be in the 50-200 (T^2M) range, with densities greater than $2 \times 10^{14} cm^{-3}$ and aspect ratios 4-8. In present day tokamaks typical values of B^2a are 15-20. The new concept differs from earlier high field approaches like Ignitor and Riggatron® by employing higher field, higher aspect ratio and by being compatible with large major radius. For further information contact Dan at (617) 253-5524.

FUSION INTERNATIONAL COLLABORATION UPDATE

It has been no secret (see our March newsletter and Mark Crawford's articles in the May 23 and Nov. 7 issues of Science) that Richard Perle's office at the Pentagon has been objecting to the potential agreement to build an international fusion engineering test reactor, claiming that such a project would give the USSR access to US advanced technology. The idea for such a project originated at the Reagan-Gorbachev summit in Geneva (see our December 1985 newsletter). It did however come as a

shock when the McGraw Hill weekly Inside Energy reported (October 20) that energy secretary John Herrington had sided with the Defense Department. A classified memorandum reportedly exists that specifies the positions developed by DOE, Defense, State, Commerce, OSTP and NSC staff. According to Inside Energy, an unnamed DOE spokesperson also reported that Herrington felt that a large international fusion initiative would conflict with the Administration's desire to fund a multibillion dollar high energy physics facility, the SSC, in the 1990's.

However, Alvin W. Trivelpiece, DOE director of Energy Research, told a group of industry representatives that Herrington has been supportive of his efforts to resolve issues with the DOD and that specific issues on technology transfer did not need to be resolved until further work on design of such a facility was undertaken. Furthermore, Trivelpiece said, the international fusion ETR is not viewed as being in competition for funds with the SSC since the SSC decision is likely to be made at least 4-5 years earlier (the ETR start is not envisioned before 1993). Trivelpiece and Office of Fusion Energy director John Clarke indicated that a position had now been agreed to among the various U.S. government agencies and that discussions with Europe and Japan are underway prior to further discussions with the Soviets. Fusion collaboration was discussed at the Iceland summit meeting, according to Trivelpiece and Clarke, and the result was a reconfirmation of intent to enhance collaboration in the world fusion effort.

FUSION BUDGETS

The FY 1987 federal budget, recently passed by Congress, contains a $12.5 million increase for magnetic fusion above the $333 million requested by the President. The total of $345.5, however, is still lower than the FY 1986 total of $365 million. The inertial confinement fusion program received a line appropriation of $154 million compared to $155 million in FY 1986. The Administration had proposed to cut line funding for inertial fusion to $23.8 million for non-DOE sites and to bury funding at DOE sites in its military R&D budget. Congress emphatically rejected that approach. (Nevertheless we hear that DOE will attempt to do the same thing in FY 1988.)

MIRROR PROGRAM SAVED

One of the results of the budget add-on in the magnetic fusion program is that the U.S. will not have to totally abandon the magnetic mirror program (see our March newsletter). TARA at MIT will receive a full year of funding and it is hoped that the results to be achieved might be sufficiently encouraging to warrant a rejuvenation of the mirror approach in FY 1988 and beyond. The Phaedrus mirror experiment at the University of Wisconsin will also be preserved. However, the MFTF-B at Livermore will remain "mothballed" and experiments on the TMX-U at Livermore have ended. A group of experimentalists from Livermore, led by TMX-U leader Tom Simonen, will go on assignment to GA Technologies to assist with experimentation in the DIII-D.

AIR FORCE REVIEWING ADVANCED FUSION FUELS

In response to an informal request of the Commander, Air Force Systems Command, the National Research Council, through its Air Force Studies Board, has commissioned a study of fusion power sources based upon fuel cycles other than the traditional deuterium-tritium cycle. The Air Force is interested in fusion systems in which only a small fraction of the energy output is carried by neutrons, as a potential for multimegawatt, spaceborne prime power. A committee has been formed, chaired by George Miley of the University of Illinois, to review related research and studies and to provide an assessment of developing a power source. For further information contact Vernon H. Miles at (202) 334-3531 or George Miley at (217) 333-2294.

DOE SOLICITS INNOVATIVE SDI IDEAS

DOE San Francisco Operations Office has issued a Program Research and Development Announcement (PRDA), DE-RA03-87SF16612, soliciting proposals of new ideas relating to the Strategic Defense Initiative (SDI). Areas of interest include (1) directed energy weapons, (2) space-based and ground-based power, (3) lethality, vulnerability, survivability, and countermeasures, and (4) systems analyses. Proposals must be submitted by January 16, 1987. For further information contact Bettyanne Moore at (415) 273-4428.

OVERSKEI NAMED GA VICE PRESIDENT

David O. Overskei has been named senior vice president in charge of fusion activities at GA Technologies, according to an announcement by GA chairman and CEO Neal Blue. The appointment was part of a reorganization "designed to increase organizational efficiency by minimizing management layering, consolidating redundant activities, and creating a dynamic environment for the genesis, growth, and application of technologies, many of which may ultimately be developed as subsidiary enterprises" according to the announcement.

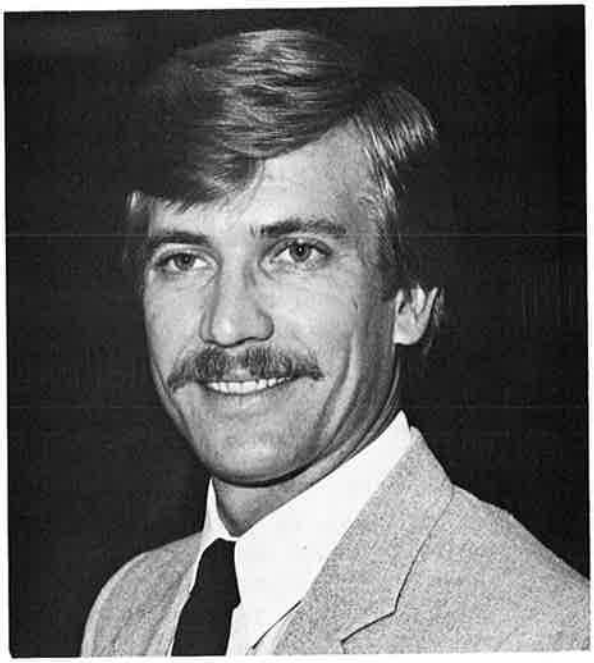
Blue also announced that Tihiro Ohkawa was named Vice Chairman and Senior Vice President in charge of an Institute for Development and Application of Advanced Technologies "which will function as a generator of innovative technology initiatives and as a resource available to all company divisions in addressing the application of their respective technologies." Ohkawa will also serve on the Board of Advisors, which includes Harold Agnew, William Gould, Alexander Haig, Simon Ramo and others.

Reporting to Overskei will be six groups: Physics and Technology, headed by Richard Freeman; Theoretical Science, headed by Vincent Chan (Acting); OHTE, headed by Teruo Tamano; DIII-D Engineering and Support, headed by Larry Davis; DIII-D Physics, headed by Ron Stambaugh, and DIII-D Operation, headed by Richard Callis.

KMS FUSION WINS LASER PATENT

After a long and somtimes bitter fight with the Department of Energy and its predecessor agencies (ERDA and AEC), KMS Fusion, Inc. has been awarded a patent on the laser fusion concept which Keith Brueckner originally filed July 10, 1973. The patent will be in effect until the year 2003. The patent number is 4,608,222 and its abstract reads:

"A method of achieving the controlled release of thermonuclear energy by illuminating a minute, solid density, hollow shell of a mixture of material such as deuterium and tritium with a high intensity, uniformly converging laser wave to effect an extremely rapid build-up of energy in inwardly traveling shock waves to implode the shell creating thermonuclear conditions causing a reaction of deuterons and tritons and a resultant high energy thermonuclear burn. Utilizing the resulting energy as a thermal source and to breed tritium or plutonium. The invention also contemplates a laser source wherein the flux level is increased with time to reduce the initial shock heating of fuel and provide maximum compression after implosions; and, in addition, computations and an equation are provided to enable the selection of a design having a high degree of stability and a dependable fusion performance by establishing a proper relationship between the laser energy input and the size and character of the selected material for the fusion capsule."



DAVID O. OVERSKEI, GA VP FOR FUSION

In a press release dated September 29, 1986, KMS states "Under the patent, KMS Fusion will retain all rights to the laser fusion process, but has agreed to allow the government and its laboratories licensefree use. However, private companies will not be allowed to utilize the process without the consent of the Company."

DOE HONORS HASELTON, FOSTER AND MILORA

Three Oak Ridge National Laboratory scientists, Hal Haselton, Christopher Foster, and Stan Milora, were honored as "Distinguished Associates" by the U.S.

Department of Energy for "outstanding contributions" to the Nation's magnetic fusion energy research and development program.

Haselton was honored for "development, design, fabrication, installation, and operation of plasma heating and fueling equipment on many fusion devices throughout the world over the last 12 years." Under his leadership Oak Ridge-built neutral particle beam injectors on the Princeton Large Torus experiment were responsible in 1978 for the first heating of a plasma to fusion temperatures. He heads the Plasma Technology Section responsible for important recent advances in plasma heating with neutral particle beams and radio waves, and for developing the technique of hydrogen pellet injection. These developments contributed directly to the successful achievement last July, at Princeton's Tokamak Fusion Test Reactor, of a new record 200 million degree plasma temperature. Under Haselton's direction, ORNL in 1985 started-up a $5 million Radio Frequency Test Facility, now the focus for a collaborative international effort to develop high-power antennas that could deliver 20 to 30 megawatts of power to ignite the "solar fire" in future fusion reactors.

Foster and Milora were cited for their "design, development, fabrication, installation, and experimental demonstration of hydrogen pellet injectors in pursuit of fusion research and associated remarkable benefits to the U.S. fusion program." The Oak Ridge injectors, novel repeating pneumatic (gun-type) and centrifugal designs capable of accelerating frozen pellets of deuterium to velocities of 1,000 meters per second or more, now are used on fusion experiments throughout the world. Foster and Milora shared the American Nuclear Society's 1984/85 Outstanding Technical Accomplishment Award for their work on the theory and development of pellet fueling.

ERAB PANEL ENDORSES FUSION THRUST

A "Technical Panel on Magnetic Fusion of the Energy Research Advisory Board" (ERAB) of the DOE, chaired by retired Grumman Corporation president Joe Gavin, has recommended that "the Secretary of Energy press vigorously for a higher national priority (for fusion) within the Administration." The panel cites the lack of public acceptance of fission and the potential global CO_2 buildup problem posed by continued burning of fossil fuels as reasons for pursuing vigorously future energy options such as fusion and notes that "incremental funding will be needed" in magnetic fusion in order to accommodate needed new experimental facilities. The panel recommends that DOE "proceed expeditiously with an ignited plasma experiment," but cautions also that "exploration of selected non-tokamak concepts as well as tokamak improvements should be pursued." The panel also endorsed proceeding "with the required negotiations to establish major international collaboration in fusion R&D."

The panel's recommendations were part of a draft final report presented at a meeting of ERAB on November 5. Some minor editorial changes are expected before a final report is issued. In addition, ERAB may make additional comments in a covering letter to the Secretary of Energy, who is then obligated by the Magnetic Fusion Energy Engineering Act of 1980 to forward the report to Congress.

During a discussion of the panel's report, ERAB members generally endorsed the conclusions. Several members pointed out however that neither DOE nor the panel had clarified past criticisms of the fusion program related to whether fusion was coming up with conceptual designs that would be attractive to the electric utilities.

PEOPLE

Lester K. Price has been named director of the energy programs division of DOE's Oak Ridge Operations Office. He will be responsible for oversight of energy programs at Oak Ridge National Laboratory, including the areas of fusion, fission, fossil, conservation, nuclear physics, basic energy sciences, production and distribution of isotopes, the Strategic Defense Initiative and technology transfer. He was formerly chief of the fusion and basic energy sciences branch.

Mike Gauge has joined the fusion program at ORNL in the pellet injector development program. Mike previously worked with Les Price at the DOE Oak Ridge Operations Office.

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DECEMBER 1986

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ANNUAL MEETING DATES SET

Fusion Power Associates' annual meeting and symposium will be held April 8-9 at the Hilton Hotel, Pleasanton, CA. The theme of the symposium will be "Applications of Laser, Particle Beam and RF Power Technologies." The meeting will include a tour of facilities at Lawrence Livermore National Laboratory. Further information will be available in the near future.

MIT WILL BUILD A NEW TOKAMAK

A new high-field tokamak, dubbed "Alcator C-Mod," will be built at MIT, extending the very successful line of Alcator devices. Alcator C was the first fusion device to surpass, in 1983, the threshold required product of plasma density and confinement time. The new device operation date is targeted for 1989. Although it will have the same major radius as Alcator C, the new device will have a 2:1 elongation, have a divertor, and have higher current. It is designed to be heated by ICRF and to be prototypical of the proposed Compact Ignition Tokamak (CIT). DOE is expected to propose inclusion of a Princeton-based CIT in the FY 1988 budget to be submitted to Congress in January. Information on the Alcator C-Mod can be obtained from Ron Parker (617) 253-5553. Information on CIT can be obtained from John Schmidt (609) 683-2538.

LIVERMORE TO GET ALCATOR C TOKAMAK

As MIT gears up for a new tokamak, its existing tokamak, Alcator C, will be crated up and sent to the Lawrence Livermore National Laboratory. There, a new experiment called the Microwave Tokamak Experiment (MTX) will be set up, in which 2 MW of variable frequency (100-300 GHz) microwave power will be coupled to the tokamak plasma using Livermore's free electron laser technology. The MTX will share the Experimental Test Accelerator (ETA-II) with the SDI programs at the Lab. The MTX will be under the direction of Keith Thomassen (415) 422-1166. The ETA-II is under the direction of Dick Briggs (415) 422-7880.

SDI TO BUILD LASER AT WHITE SANDS

The Strategic Defense Initiative Organization (SDIO) and the U.S. Army Strategic Defense Command (USASDC) have announced preparations for establishing a major new laser research project at White Sands Missile Range, NM. This program incorporates work currently being performed at the Lawrence Livermore National Laboratory in Livermore, CA, and Los Alamos National Laboratory in Los Alamos, NM.

The Ground-Based Free Electron Laser technology integrator experiment will involve conducting a series of laser experiments at White Sands. The experiments, if successful, would provide technology which could eventually contribute to the development of a laser system capable of destroying incoming enemy missiles and warheads. The project is one part of the President's Strategic Defense Initiative research program.

A free electron laser uses a linear accelerator to speed electrons through magnetic fields to generate its high power beam. Currently, two candidate accelerator concepts are being developed in connection with this experiment: the radio frequency linear accelerator and the induction linear accelerator, which are being developed at Los Alamos and Lawrence Livermore, respectively.

JOURNAL OF FUSION ENERGY SEEKS PAPERS

The Journal of Fusion Energy (Plenum Press) seeks technical manuscripts on all aspects of fusion research and technology. New policies recently established by the editorial board promise to expedite review and publication of papers. For information, contact the editor, Dan Cohn, (617) 253-5524.

POSTDOCTORAL RESEARCH AND PROFESSIONAL DEVELOPMENT

DOE's Office of Fusion Energy is sponsoring the Fusion Energy Postdoctoral Research Program and the Fusion Energy Professional Development Program. Both programs are designed to support collaborative research on fusion R&D projects at universities, DOE laboratories, and other fusion energy centers. The Postdoctoral Research Program is for recent PhD recipients or for those who will receive a degree before October 1987. The Professional Development Program is for university faculty members and employees of DOE/OFE contractors. U.S. citizenship or permanent alien status is required. These programs are administered by Oak Ridge Associated Universities, a DOE contractor. Additional information and applications may be obtained by contacting Linda McCamant, University Programs Division, Oak Ridge Associated Universities, P.O. Box 117, Oak Ridge, TN, 37831 or by calling (615) 576-3190. (Please request materials by program name.) The application deadline is January 20, 1987.

MEETINGS

Feb 14-18 Annual Meeting of the American Association for the Advancement of Science. Hyatt Regency, Chicago. Contact AAAS (202), 326-6448.

Apr 6-8 Annual Sherwood Theory Conference. San Diego. Contact Don Dobrott (619) 456-6452.

Apr 8-9 FPA Annual Meeting and Symposium. Pleasanton, CA. Contact Ruth Watkins (301) 258-0545.

Apr 27-May 1 Conference on Lasers and Electro-Optics (CLEO). Baltimore. Contact (202) 223-0920.

May 26-29 IEEE/AVS International Symposium on Electron, Ion and Photon Beams. Woodland Hills, CA. IEEE-AVS. Contact Richard Howard (201) 949-8084.

June 1-4 IEEE International Conference on Plasma Science. Hyatt Regency, Crystal City, VA. Contact Frank Young (505) 846-6228.

June 3-5 IEEE Minicourse on "Computer Applications in Plasma Science." Contact Adam Drobot (703) 634-5840.

June 4-5 Symposium on Compact Toroid Research. College Park, MD. Contact Al DeSilva (301) 454-7092.

June 14-18 Cryogenic Engineering Conference Pheasant Run Resort, IL. Contact (312) 840-3682.

Oct 4-8 International Conference on Fusion Reactor Materials. Karlsruhe FRG. Contact Karl Ehrlich, Kfk, Postfach 3640, D-7500, Karlsruhe 1, FRG.

Oct 24-28 International Conference on Lasers. Peoples Republic of China. Contact Prof. Deng Ximing, P.O. Box 8211, Shanghai, China

PEOPLE

Bill Stacey has been named chairman of the nuclear engineering and health programs at the Georgia Institute of Technology. He will have primary responsibility for all aspects of the graduate and undergraduate programs, including curriculum and degree requirements, faculty recruitment and evaluation, and development of research.

Dave Nelson has been named Director for Supercomputers at DOE. He will make a transition from his current position as Director, Applied Plasma Physics Division.

Ron Davidson has received the DOE's Distinguished Associates Award in recognition of his acomplishments as first chairman of the Magnetic Fusion Advisory Committee.