



FUSION POWER ASSOCIATES

2 PROFESSIONAL DRIVE, SUITE 248 • GAITHERSBURG, MARYLAND 20879

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PROPOSED FUSION FUNDING CUTS

In the FY 1986 budget requests that will be presented to Congress in early February, DOE is expected to propose to cut the magnetic fusion program by nearly \$50 million and to cut the inertial fusion program in half. If so, the action will continue the downward trend in magnetic fusion funding begun several years ago (see our November 1984 newsletter) and cause havoc in the inertial fusion program.

By implementing the magnetic fusion cuts, DOE would forfeit, to Europe and Japan, leadership of the world fusion effort. The demonstration of fusion breakeven conditions, using deuterium-tritium fuel, originally scheduled in the U.S. for 1986, recently had been slipped to 1988 due to the FY 1985 cut and would be further jeopardized by the proposed cuts. The proposed 1986 cuts would also further postpone completion of the Mirror Fusion Test Facility, with a resultant increase in total project cost.

The proposed decimation of the inertial fusion program is a potential tragedy in-the-making on a grand scale. At one point in negotiations DOE and OMB proposed killing off the program entirely. During the past decade and a half the inertial fusion community has created, cost-effectively, the most exciting new advanced technology since the space program. Despite unduly-severe, DOE-imposed, secrecy restrictions, the inertial fusion community has convincingly demonstrated that fusion pellet ignition is within reach (see our October 1984 newsletter). The program has also provided the technical underpinnings of important new programs such as laser isotope separation and "star wars". The myopia that would lead the Executive Branch to propose such a tragedy is beyond comprehension.



FUSION POWER ASSOCIATES VICE PRESIDENTS.
(l. to r.) TOP: BOB GROSS AND GERRY KULCINSKI. BOTTOM: JIM MANISCALCO AND RUTH WATKINS.

FPA VICE PRESIDENTS NAMED

The Fusion Power Associates Board of Directors has named persons to fill three newly-created positions as vice presidents of the Association. Robert A. Gross, Dean of Engineering, Columbia University, will serve as FPA vice president for university relations. In that capacity, he will seek to strengthen the association's ties with universities. James A. Maniscalco, Fusion Program Manager, TRW, will serve as FPA vice president for programs and membership. In that capacity he will guide our activities and member services. Ruth A. Watkins, currently assistant secretary-treasurer of FPA, will serve as vice president for administration and finance. In that capacity she will be responsible for all our day-to-

day administrative and financial transactions. Gerald L. Kulcinski, Professor of Nuclear Engineering, University of Wisconsin, continues in his position as FPA vice president for research. In that capacity he directs the ongoing research and systems studies programs conducted at FPA's office in Madison, Wisconsin. We very much appreciate their assistance and the assistance we receive from all our colleagues in helping the Association to fulfill its purposes and to accomplish its goals. (Your ideas, comments and news items are always welcome.)

NOVA LASER COMPLETE; BEGINS OPERATION

NOVA, the world's largest, most powerful laser (100 kJ, 100 TW, 10 beams) was completed at LLNL in late December on schedule and within its \$176 million budget. Each of the ten amplifier chains produces a laser beam 2.5 feet in diameter, carrying 10 trillion watts of power. We express our admiration and congratulations to all those who made NOVA a success, including John Emmett, Bob Godwin, John Hunt, Dick Foley, John Holzrichter and Eric Storm.

SOLID STATE LASER PROSPECTS SURVEYED

In a recent laboratory report (UCRL-53571, September 1984), LLNL scientists John Emmett, Bill Krupke and Walt Sooy describe "The Potential of High Average-Power Solid State Lasers", and discuss methods of "improving the efficiency of such lasers sufficiently to make them reasonable candidates for a number of demanding applications." The applications include fusion power, x-ray lithography, laser isotope separation, materials fabrication and processing and military applications. The report states that the traditional view of solid state lasers, that they will be limited to low average power and low efficiency, is now obsolete due to "a variety of new design concepts, materials and techniques that have emerged over the past decade." The authors state that "The core idea is configuring the laser medium in relatively thin, large area plates, rather than using the traditional low-aspect ratio rods or blocks." The report concludes that "laser efficiencies of over 10% should be achievable at high average power and radiance."



NOVA LASER: ON TIME, ON COST, ON TARGET

JET EXTENDS CONFINEMENT RECORD

The Joint European Torus (JET) has extended its hold on the world record for plasma confinement to 0.8 seconds. The previous record, also held by JET, was 0.62 seconds (see our October 1984 newsletter). TFTR holds the U.S. high of 0.35 seconds. About 1.0 seconds is needed for a commercial power reactor.

JT-60 CONSTRUCTION ON SCHEDULE

The Japanese large tokamak, JT-60, continues on schedule towards its planned Spring 1985 operation date. In a Christmas card, J. Nagamura at Toshiba Corp., tells us that the electrical tests for the toroidal and poloidal coils of JT-60 began on December 10. The JT-60 is larger than either JET or TFTR.

CHINA OPERATES NEW TOKAMAK

A press release from Peking, published in the November 8 Christian Science Monitor, reports that a new tokamak was recently placed in operation in Sichuan Province, China, achieving first plasma on September 26.

1985 SMALL BUSINESS INNOVATION RESEARCH PROGRAMS (SBIR)

The DOE has issued its solicitation for proposals under the SBIR program. Closing date for submissions is March 15. In the fusion area, proposals are solicited under the topics "plasma diagnostics", "plasma confinement systems technology" and "fusion energy systems." Initial grants are usually for \$50,000 over a six month period. Phase II grants are for \$200,000 to \$500,000 over 24 months. For further information contact the SBIR Program Manager, U.S. DOE, Office of Energy Research, Washington, D. C. 20545.

INDUSTRY GRANTS POSSIBLE

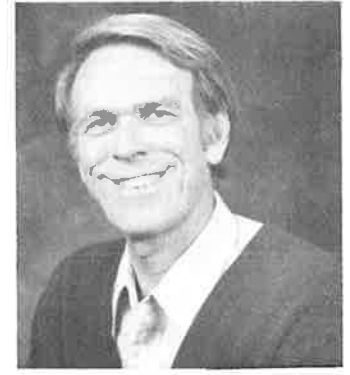
DOE Office of Energy Research has indicated its desire to establish a "Special Research Grant Program" that would make it possible for industries to receive research grants averaging up to \$2 million per year. The DOE "notice of proposal rulemaking" appeared in the Federal Register, Vol. 29, No. 217, pg. 44590, November 7, 1984. The program would remove a major impediment in the DOE procurement system that currently makes it nearly impossible for DOE to contract with industry for research without a competitive bid process. DOE hopes the program will be operational this Spring.

MATHEMATICAL SCIENCES CHANGES NAME

Mathematical Sciences Northwest has changed its corporate name to Spectra Technology, Inc. to more reflect the relation to its parent company, Spectra-Physics, Inc. The company will continue to conduct research in areas such as free-electron lasers, repetitively pulsed gas discharge lasers, solid state lasers, plasma physics and related technology. Peter H. Rose will continue as president.

UNIVERSITY OF MISSOURI MIRROR EXPERIMENT BEGINS

The research group at the University of Missouri-Columbia, has produced their first mirror plasma. This was done in a preliminary experiment with a simple mirror and 2.7 GHz microwave heating. Their eventual goal is the construction of a more powerful superconducting device capable of both cusp and mirror field configurations. The university has been assisted in its work by a grant from the McDonnell Douglas Foundation.



TMX-U RESEARCHERS BICK HOOPER (l.) AND TOM SIMONEN (r.)

MIRROR PROGRAM ADVANCES

During the Spring of 1984, researchers at LLNL succeeded in demonstrating the formation of a "thermal barrier" in the TMX-U experiment, thereby reducing plasma end loss in the tandem mirror experiment. However, to their disappointment, a non-ambipolar radial ion loss was observed. By adding elliptical metal plates to the end walls of the machine, Livermore scientists have now reduced the radial transport to below the level of detectability with existing diagnostics. The results show that nonambipolar transport is driven by the plasma potential and requires electrical current to flow in the walls. These two features offer an opportunity to control the transport through the use of metal plates. These plates can also be used as a diagnostic, by measuring the current to the end wall.

Preliminary results using a small set of plates were reported in *Physics of Fluids* 27, 2264 (1984). In the more recent experiments, with larger plates, the plasma density rose rapidly when the plates were floated to eliminate nonambipolar transport. The density rise continued until ion end-plugging failed and the plasma achieved a new, higher density equilibrium. The LLNL TMX-U team, led by Tom Simonen and Bick Hooper, hopes to further increase density and confinement characteristics in the months ahead.

LOGAN HONORED

Our congratulations to B. Grant Logan of LLNL. Grant was selected by Science Digest Magazine as one of the 100 brightest young scientists in the nation. Our congratulations to Grant for this well-deserved honor.

TRITIUM EXPERIENCE MANUAL PUBLISHED

The Canadian Fusion Fuels Technology Project (CFFTP) has published a multi-volume manual on tritium handling, including treatment of topics such as tritium production and loss, tritiated heavy water management, airborne tritium control, tritium extraction and immobilization, and safety. A complete set costs \$150 (check payable to Ontario Hydro) and can be obtained from Information Retrieval Center, CFFTP, 2700 Lakeshore Road West, Mississauga, Ontario, L5J 1K3.

PLASMA PHYSICS PROJECTS SUMMARIZED

The DOE has published (DOE/ER-0063, September 1984) a document entitled "1984 Review of the Applied Plasma Physics Program" that summarizes the ongoing activities, discusses priorities and gives plans for future directions. Copies can be obtained from Dave Nelson, DOE (202) 353-4596.

PEOPLE

Bruce Twining, former member of the Office of Fusion Energy and DOE/SAN project manager for MFTF-B, has been appointed deputy manager of DOE's Savannah River Operations Office, in Georgia.

J. Nelson Grace, former division director for TFTR in the Office of Fusion Energy and director of DOE's Princeton Area Office, has been named Southeastern Regional Director for the Nuclear Regulatory Commission in Atlanta.

MEETINGS

January 31-February 1 - Fusion Power Associates symposium on "The Search for Attractive Fusion Concepts," La Valencia Hotel, La Jolla, CA. Contact Ruth Watkins (301) 258-0545.

February 2 - Fusion Power Associates' symposium on "Prospects for Alternate Fusion Fuel Cycles", aboard the Viking Princess, sailing from San Diego.

February 25-26 - MFAC meeting, Forrestal Bldg., 1E245, Washington, D. C. (change from February 4-5) Contact John Cowles, DOE, (301) 353-3598.

March 3-7 - Sixth Topical Meeting on the Technology of Fusion Energy, ANS. Sheraton Palace, San Francisco, CA. Contact Carl Henning (415) 846-7195.

March 4-7 - IAEA Workshop on Compact Fusion Concepts, Sydney, Australia. Contact Bill Dove, DOE (301) 353-4598.

March 5 - Fusion Power Associates Board of Directors meeting, Sheraton Palace Hotel, San Francisco. 4:00 P.M.

March 5 - Fusion Power Associates-sponsored reception for ANS Conference, 6:00 P.M. Sheraton Palace Hotel, San Francisco.

March 25-27 - Energy Technology Conference and Exposition. Fusion Session on March 25 (Bob Mills, PPPL, chairman). Sheraton Washington Hotel, D.C. \$295. Contact (301) 251-9250.

April 15-17 - Sherwood Theory conference. Madison, WI. \$45. Contact GayAnn Reed, (608) 262-1192.

April 18-19 - Symposium on "Lasers and Particle Beams For Fusion and Strategic Defense." Co-sponsored by Fusion Power Associates, University of Rochester, and SDI Office of DOD. Rochester, NY. Contact Steve Dean (301) 258-0545 or Bob McCrory (716) 275-5286.

IN MEMORIAM

Fusion researchers worldwide are saddened to learn of the unexpected death of Dr. Werner Heinz of the Karlsruhe (FRG) laboratory, on December 31. Dr. Heinz was a leading expert in the development of superconducting magnets. We will miss him.

QUOTABLE

"It's perfectly natural to want all the facts and to hold out for the research that guarantees a particular program will work. After all, if you're about to spend \$300 million on a new product, you want to be absolutely sure you're on the right track. That's fine in theory, but real life just doesn't work that way. Obviously, you're responsible for gathering as many relevant facts and projections as you possibly can. But at some point, you've got to take that leap of faith."

Lee Iacocca
Chairman, Chrysler Corp.



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NEW MEMBER

Ontario Hydro has upgraded its participation in Fusion Power Associates from affiliate to full member. Tom Drolet will represent the company. Ontario Hydro becomes our first non-U.S. member. In the few years since they entered the fusion field, Ontario Hydro has become widely recognized for their expertise in all aspects of tritium systems for fusion. We welcome their continued support and participation.

INTERNATIONAL IGNITION TOKAMAK STUDIED

U.S., European, Japanese and Canadian officials, meeting in January under IEA auspices, have agreed to conduct two workshops during the coming months aimed at deciding whether or not to embark on joint design for an ignition tokamak, potentially to be constructed as an international project. MIT Professor Bruno Coppi has been urging such a project for several years (see our August 1984 newsletter). Participants in the meeting indicated that the Canadian government offered a site for the project in Quebec. The Europeans and the U.S. also have several potential sites for the project.

Two workshops are planned: one to evaluate the physics basis for the project and one to evaluate its technology requirements. The thrust is to design and build the smallest, lowest cost tokamak that all sides agree has high probability of achieving ignition. Ignition is the condition in which fusion energy released is sufficient to self-sustain the high temperatures required for the production of net fusion power. An intense effort is in progress in the U.S. to define a range of tokamak designs that could fulfill this purpose. No decision to actually construct such a device has yet been reached.



BRUNO COPPI OF MIT: STRONG ADVOCATE OF AN INTERNATIONAL IGNITION TOKAMAK

KEYWORTH TO ATTEND FUSION/SDI MEETING

The President's Science Advisor, George A. (Jay) Keyworth, II, plans to attend the April 18-19 symposium on Lasers and Particle Beams for Fusion and Strategic Defense at the University of Rochester. The symposium is sponsored by Fusion Power Associates, the University of Rochester and the Strategic Defense Initiative Organization of the Defense Department. Keyworth will discuss the topic: The Strategic Defense Initiative--Is it a Research or Development Effort? Contact Ruth Watkins for registration information at (301) 258-0545.

INERTIAL FUSION PANEL CONVENED

In a letter to National Academy of Sciences president Frank Press, George A. Keyworth, Science Advisor to the President, has asked the Academy to review both the classified and unclassified aspects of DOE's inertial confinement fusion program. The charge to

the review committee is as follows: "The Committee will review the scope and objective of the federally funded inertial confinement fusion program. The Committee will assess the program's past, current and potential contributions by examining and evaluating all major areas of the inertial fusion program including the special classified programs conducted by the nuclear weapons laboratories."

The Committee will be chaired by William Happer, Jr. of Princeton University, (609) 452-5584. Lee M. Hunt, staff officer at the National Resource Council, (202) 334-3523, will serve as executive secretary to the Committee. Other members of the Committee are: Harold Agnew (GA Technologies), Luis W. Alvarez (LBL), George Carrier (Harvard), Robert F. Christy (Cal-Tech), Ronald C. Davidson (MIT), John Dawson (UCLA), John Foster (TRW), Conrad L. Longmire (Mission Research Corp.), Charles McDonald (R&D Associates), Wolfgang A. Panofsky (SLAC), and Marshall N. Rosenbluth (University of Texas). The Committee will hold its first meeting March 4-6 in Washington and has been asked to provide a preliminary report by October.

BUDGET-ICF

The DOE has submitted a budget for the Inertial Confinement Fusion Program of \$70M for FY 1986. This is about one-half the FY 85 level. Furthermore, the DOE is attempting to hide its attack on the ICF program by "burying" the ICF funding request in its multi-billion dollar weapons R&D budget (which is expanding by \$500M over FY 1985's record level). We recommend that concerned citizens express their outrage by communicating with the following: the new Secretary of Energy, John S. Herrington; Rep. Samuel S. Stratton, House Armed Services Committee; Rep. Tom Bevill, House Appropriations Committee; Sen. John Warner, Senate Armed Committee; Sen. Mark Hatfield, Senate Appropriations Committee.

MAGNETIC FUSION HEARINGS SET

The House Science and Technology Subcommittee on Energy Research and Production, chaired by Honorable Marilyn Lloyd, will hold hearings on the FY 1986 magnetic fusion budget on March 8 and 11. DOE Director of Energy Research, Alvin W. Trivelpiece, will testify March 8 at 9:00 A.M. in Room 2318, Rayburn Building. On

March 11 at 9:00 A.M. in Room 2318, Rayburn Building, non-government witnesses will testify. These will include Steve Dean (Fusion Power Associates), Ron Davidson (Chairman of DOE's Magnetic Fusion Advisory Committee), Len Reichle (Chairman of HS&T's Fusion Advisory Committee), Ronald Parker (MIT), and Tihiro Ohkawa (GA Technologies), and others not yet identified at press time.

BUDGET-MAGNETIC FUSION

The following table shows the proposed distribution of funding for magnetic fusion as contained in DOE's FY 1986 budget submission.

By Division:	FY 85	FY 86
Applied Plasma Physics	\$ 85.9	\$ 84.5
Toroidal Confinement Sys.	162.0	158.3
Mirror Confinement Sys.	41.7	41.7
Devel. and Technology	74.2	67.5
Planning and Projects	69.1	34.0
Program Direction	4.1	4.0
Total	\$437.0	\$390.0

By Facility:

Argonne	4.6	4.0
Brookhaven	0.3	0.3
GA Technologies	39.0	39.0
Hanford	5.3	2.4
Idaho	1.9	1.5
Berkeley	7.4	4.4
Livermore	95.0	70.3
Los Alamos	19.7	16.1
MIT	25.5	26.9
NYU	1.2	1.1
Oak Ridge	66.2	62.2
Pacific NW	0.2	0.1
Princeton	116.3	100.2
Sandia	4.7	4.5
U. of Texas	6.0	5.4
Other	43.7	51.6
Total	\$437.0	\$390.0

The budget designates TFTR and MFTF-B hardware items to take the bulk of the funding cuts. The budget indicates that PLT will be shut down but that two new experiments will be built: a reversed field pinch and a field reversed concept.

QUOTABLE

"If someone asks you 'What did you accomplish in your professional life?' the answer shouldn't be 'I went to meetings'."

Robert A. Gross
Dean of Engineering
Columbia University



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NEW MEMBER

Grumman Aerospace Corporation has become the twenty-fifth member of Fusion Power Associates. Grumman's president, Joe Gavin, a strong supporter of fusion, chaired the recent Academy of Sciences review of fusion international collaboration. Bob Botwin, Director, Advanced Energy Systems, will be the company's representative. Grumman has informally assisted us for several years. We very much welcome their formal participation.

DOE WEAPONS TREND CONTINUING

The Department of Energy continues its de-facto transition to become a Department of Nuclear Weapons. In the FY 1986 budget recently submitted to Congress (see table), defense requests account for 64% of the total DOE request, compared to 59% in FY 1985 and 54% in FY 1984.

Within a defense portion that grows from \$7.2B in 1985 to a request of \$7.9B in 1986, DOE proposes to slash the inertial confinement fusion program for \$168M in 1985 to \$70M in 1986 and to slash the sum of all civilian programs by \$600 million.

All civilian programs, whether for energy technology or basic research, are targeted for reductions, with the exception of what the DOE labels as "supporting research." A look at the details, however, shows that the small increase in this category is for "multiprogram laboratories facilities support" and "in-house energy management." Both categories cover general laboratory facilities maintenance and energy efficiency-related modifications, rather than R&D.

DOE FY 1986 BUDGET REQUEST (\$ IN MILLIONS)

	<u>FY 85</u>	<u>FY 86</u>
Weapons and Defense R&D	\$7,172	\$7,919
Nuclear Waste Disposal	527	840
Energy Production	964	748
High Energy Physics	546	510
Basic Energy Sciences	423	410
Magnetic Fusion	437	390
Nuclear Fission	416	372
Conservation	459	371
Fossil Energy	347	243
Environment	231	229
DOE Management	192	229
Solar and Renewables	212	176
Strategic Petrol. Reserve	460	175
General Sciences	185	175
"Other Energy Functions"	150	118
Supporting Research	85	117
Inertial Fusion	168	70
Electrical Energy Systems	40	26
Adjustments	(731)	(669)
Totals	\$12,283	\$12,449

TFTR HITS RECORD 100 MILLION DEGREES

The Tokamak Fusion Test Reactor (TFTR) has produced plasmas with average energies of 20-40 keV corresponding to temperatures exceeding the long-sought magic number of 100 million degrees temperature. This is a new world record for tokamak temperature. The plasma was produced by injecting 4 MW of 80 kV deuterons into a low density, 10^{13}cm^{-3} , background plasma. The resulting plasma, which consists mostly of high energy injected particles, does not have a Maxwellian distribution but has high kinetic energy. Density of the background plasma will be raised as more injected power becomes available.

FUSION DIVISION WINS ORNL DIRECTOR'S AWARD

The Oak Ridge National Laboratory has announced that it will present a "Director's Award" annually to the ORNL division judged to have the most outstanding accomplishments during the preceding year. ORNL director Herman Postma has announced that the first such award has been won by the Fusion Energy Division, directed by Dr. O. B. Morgan.

Postma noted the successful completion of the three-coil test in the Large Coil Program, the successes with pellet injectors, the development of the spherical tokamak, the development of Elmo Bumpy Square, the good progress with design and construction of the ATF and the Radio Frequency Test Facility, the development of negative ion sources for the Strategic Defense Initiative program, and the generic study of fusion reactors. He called particular attention to international activities and recognized the successful beryllium-limiter tests in ISX-B for JET, the development of the flexible heliac in conjunction with the Spanish fusion program, the provision of a new RF feedthrough to Textor, and the collaboration with Japan on materials. Fusion accomplishments of other ORNL divisions were also recognized, including advances in radiation resistant materials and the successful start-up of a multicharged ion source that allows atomic physics studies going far beyond earlier capabilities.

Our congratulations to all our colleagues in the Fusion Energy Division and to all those in other ORNL divisions that regularly participate in fusion activities.

ORNL NEGATIVE ION SOURCE WORK PROGRESSES

Negative ion sources are important for forming neutral particle beams for both fusion and for the Strategic Defense Initiative. A desired feature of such beams is that the ion source temperature be low so that low divergence can be achieved in the accelerated beam. At ORNL, ion temperatures of 0.1 eV have been achieved, which is 1 to 2 orders of magnitude better than achieved elsewhere. The Oak Ridge sources have also run for long times (10 sec) and produced high current densities (up to 8 amp/cm²). Further information on the sources can be obtained from John Whealton at ORNL (615) 574-1130.

SUPERCOMPUTER CENTERS DESIGNATED

Four national supercomputer centers are part of a \$200 million Congressional initiative to stimulate technology development in the U.S. The four centers will be at the University of California at San Diego (UCSD), Princeton University, the University of Illinois and Cornell University. The UCSD center will be operated by GA Technologies. The program will be administered through the National Science Foundation.

LASER PAPERS SOLICITED

Abstracts are due in April for papers to be presented at the 7th International Workshop on Laser Interactions and Related Plasma Phenomena," to be held October 28-November 1, 1995, in Monterey, CA. For information contact George Miley at (217) 333-2294.



MEMBERS OF THE OAK RIDGE NATIONAL LABORATORY FUSION ENERGY DIVISION FOLLOWING THE DIVISION'S WINNING OF THE FIRST ANNUAL LABORATORY DIRECTOR'S AWARD. (1. to r.) JIM LYON; ASSOCIATE DIVISION DIRECTOR JOHN SHEFFIELD; DIVISION DIRECTOR BILL MORGAN; ASSOCIATE DIVISION DIRECTOR LEE BERRY; AND PHIL EDMONDS. (photograph courtesy of Ruth Carey, the Oak Ridger.)

CALTECH PRESIDENT CITES FUSION PROMISE

In an interview appearing in the January 1985 issue of the New York monthly "USA Today", Caltech president Marvin Goldberger was asked: "Are there worthwhile scientific-technology projects that humanity could pursue if significant amounts of money could be diverted from the arms race?"

In response, Goldberger cited fusion as his first example, saying "I believe the time is right for making a serious push on an engineering feasibility study of [controlled thermonuclear] fusion. Some three or four years ago, I was part of a group that recommended that the U.S. Department of Energy undertake construction of a fusion engineering device that would, under very realistic conditions, test the feasibility of a fusion reactor. It wouldn't be a commercial prototype or anything like that. But, judging from the rate of scientific progress in this field, it was our conclusion that we ought to be starting this engineering device. However, no money has been appropriated for it.

"Fusion energy, if it is indeed possible, would have many virtues, as compared with nuclear reactors. And it would guarantee a virtually inexhaustible supply of energy for electrical power generation into the even unforeseeable future.

"We are going to run out of oil. Everybody is swimming in oil right now, but that has nothing to do with the real problem. Nothing has changed. So the fusion project is something that could be done and that I think would be enormously important."

Goldberger also suggested enhanced efforts on climatology, environmental, biotechnology and high energy physics research.

EDMONDS, MIODUSZEWSKI CITED

The DOE presented "Certificates of Appreciation" to Phil Edmonds and Peter Mioduszewski of ORNL for their research on beryllium limiters for the Joint European Torus (JET). The tests were carried out on the ISX-B tokamak at ORNL. The data will be used in the design of limiters for JET. Mioduszewski was physics project manager for the testing program and Edmonds designed the experiment and was responsible for its overall operation.



AWARD WINNER, MIKE ROBERTS

DOE HONORS MIKE ROBERTS

DOE has presented Mike Roberts, director of the Division of Planning and Projects at the Office of Fusion Energy, U.S. DOE, the DOE's third highest honor, an Exceptional Service Award. The award, which consists of a medal and a plaque, was presented by Dr. A. W. Trivelpiece, DOE Director of Energy Research. The award cites Roberts for "his achievements and contributions to the development and negotiation of bilateral and multilateral international cooperation agreements with Japan, the Soviet Union, the European Community and others, and especially for putting the Department in an excellent position to work toward satisfying the Secretary's initiative to enhance international collaboration in fusion."

We might add that, among Mike's many career accomplishments, he was responsible for building the first Oak Ridge tokamak (remember ORMAK?) in the early 1970's. (The rumor is he built it with his bare hands!) He was also responsible for the design of a proposed major DT burning tokamak (remember FBX?) that led directly to the decision to build TFTR. We congratulate Mike on his many accomplishments and extend to him our admiration for his selfless dedication to the cause of fusion throughout his career.

TOP SOVIET FUSION SCIENTISTS VISIT U.S.

The Soviet members of the Joint US-USSR Fusion Power Coordinating Committee visited the U.S. February 13-20, including visits to LLNL, PPPL and ORNL. A scheduled visit to LANL was missed due to an airline reservation screwup. Members of the Soviet delegation included Boris Kadomtsev (Kurchatov), Vladimir Tolok (Kharkov), Dimitrii Ryutov (Novosibirsk), Geornii Eliseev (Kurchatov), Lev Golubchikov (State Committee on Atomic Energy), Lev Kovrizhnykh (Lebedev Institute). Technical exchange visits between U.S. and Soviet scientists for the coming year were negotiated with DOE and U.S. laboratory directors.

CORNELL SYMPOSIUM IN WASHINGTON

A Symposium on "Energy for the Future" will be held at the Mayflower Hotel, 1127 Connecticut Ave. N.W., Washington, D. C. on 25 April 1985 to celebrate the 100th anniversary of Electrical engineering education at Cornell University. Dr. Donald Kerr, Director, LANL, will chair this symposium and the speakers will include: Dr. Harold Furth, Director, PPPL; Dr. Robert Hirsch, VP, Research, ARCO; Mr. Milton Klein, VP, Special Projects, EPRI; Dr. Eric Willis, Director, Energy R&D, International Energy Agency; and Dr. Gerald Wilson, Dean, Engineering, MIT. A Panel Discussion will conclude the symposium. A registration fee of \$50 is payable at the Door. For further details contact Ravi Sudan or Denise Lentini, Cornell University (607) 256-5120.

SDI BUDGET REQUEST UP

The Defense Department has requested an FY 86 budget of \$3.8 billion for the Strategic Defense Initiative (SDI), up from \$1.4 billion in FY 1985. The portion of the SDI program most closely related to fusion technology is the Directed Energy Weapons segment, which in FY 1985 accounted for about 25% of the total. Fusion Power Associates, the University of Rochester and the SDI organization will co-sponsor a symposium on "Lasers and Particle Beams for Fusion and Strategic Defense" April 18-19 at the University of Rochester. For registration information contact Ruth Watkins at (301) 258-0545.



SOVIET SCIENTISTS VISIT OAK RIDGE (l. to r.) D. Ryutov, B. Kadomtsev, V. Tolok, with Murray Rosenthal of ORNL.

MEETINGS

April 15-17 Sherwood Theory Conference, Madison, WI. Contact GayAnn Reed (608) 262-1192.

April 18-19 Symposium on Lasers and Particle Beams for Fusion and Strategic Defense, Rochester, NY. Contact Ruth Watkins (301) 258-0545.

May 21-24 Conference on Lasers and Electro Optics (CLEO), Baltimore Convention Center, Contact (202) 223-8130.

May 26-31 Annual Meeting of AAAS, Los Angeles, CA. Contact Rolf Sinclair (202) 356-7997.

QUOTABLE

"Fusion is a sufficiently important objective that, in the best of all possible worlds, nations would turn their natural and intellectual energies to fusion development rather than to war. Although I have been disassociated from the fusion program for three years now, I still think that it is a tragedy that we would be willing to spend so much money on thermonuclear weapons, and defenses thereof like Star Wars, and so unwilling to work on fusion with the broader perspective and enthusiasm it deserves."

Edwin E. Kintner
February 1, 1985



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LEADERSHIP AWARDS TO OHKAWA AND YONAS

The Board of Directors of Fusion Power Associates has voted to present FPA's 1984 Leadership Awards to Dr. Tihiro Ohkawa and to Dr. Gerold Yonas. Dr. Ohkawa is vice president of GA Technologies. Dr. Yonas is chief scientist, Strategic Defense Initiative Organization, Office of the Secretary of Defense and former director of Pulsed Power Sciences at Sandia National Laboratories.

Both awards are presented to the recipients in recognition of their "outstanding leadership qualities." Dr. Ohkawa's award states that "you have set an outstanding example of the creative role that industry can play in the development of fusion power systems." Dr. Yonas' award states that "your scientific contributions and management actions have resulted in cost-effective development of pulsed power technologies for fusion power and national defense applications."

Previous recipients of the Fusion Power Associates Leadership Award are: Solomon J. Buchsbaum of Bell Laboratories, Robert L. Hirsch of Arco Oil and Gas Co., Congressman Mike McCormack, Senator Paul Tsongas, Edwin E. Kintner of GPU Nuclear Corp., Harold P. Furth of Princeton Plasma Physics Laboratory, John H. Nuckolls, John L. Emmett, and T. Kenneth Fowler all of Lawrence Livermore National Laboratory.

U.S./FRANCE FUSION COLLABORATION

On February 7-8, 1985, representatives from DOE and U.S. fusion laboratories met with a delegation from France led by Dr. F. Prevot to discuss U.S.-France collaboration on the new Tore Supra Tokamak. The meeting was successful and produced a tentative agreement on collaboration that will provide U.S.



T. Ohkawa



G. Yonas

scientists access to the world's only operating superconducting tokamak. The collaboration may include: exchanges of information, personnel and equipment; joint development of systems and components for particle control and auxiliary heating and a fast computer link. Initially, the collaboration will be focused on the following two areas which are of interest to both the U.S. and the French:

- . Particle Control - the U.S. would participate in the design and fabrication of equipment and components needed for fueling the plasma and controlling impurities in the plasma. This would include the development of a pellet injector for fueling the plasma with hydrogen or deuterium, participation in the design and fabrication of pumping structures to control the flow of particles in the edge of the plasma and the possible development of edge plasma diagnostics.

- . Auxiliary Heating - the high toroidal field and good access of Tore Supra make it a unique device for RF experiments. The U.S. would participate in the design of a compact ICRF antenna for Tore Supra and would also participate in RF heating experiments on Tore Supra.

DAWSON, FRIED WRITE CONGRESS

John M. Dawson and Burton D. Fried, professors of physics at UCLA, have written a letter dated March 4 to their senators, Pete Wilson and Alan Cranston and to all California representatives, expressing their "profound concern for the future of controlled fusion budgets." The authors state that "spectacular progress over the last 8 to 10 years . . . has reached the point where a sustained fusion fire can almost certainly be produced." "This new form of fire can be as significant to our future as ordinary fire," the authors state. Noting that the energy crisis is certain to return, Dawson and Fried state "Our country's security rests as much on a secure, acceptable energy supply as on our military might. It is only prudent in times of energy plenty to work to secure this supply for our children." "It would be a classic example of false economy to cut the program . . . just when success is in sight," they say.

We urge all of our readers to write their senators and congressmen on these matters.

ANS FUSION AWARDS

The ANS Fusion Energy Division presented its highest award, for Outstanding (career) Achievement, to Dr. Charles A. Baker of Argonne National Laboratory and to Dr. Donald Steiner of Rensselaer Polytechnic Institute, formerly of Oak Ridge National Laboratory. The awards are made periodically from nominations submitted by the community, evaluated by the awards committee headed by Nermin Uckan and approved by the division's Executive Committee. Persons wishing to nominate people for future awards should contact Nermin for details (615) 574-1354.

The division's Technical Accomplishment award was presented to Stan Milora and Chris Foster of ORNL for the development and application of pellet fueling injectors, now coming into widespread use in the tokamak program.

Both awards were presented during ceremonies at the recent ANS topical meeting on fusion technology in San Francisco.

FUSION HEARINGS VIDEO AVAILABLE

Fusion Power Associates has available for loan VHS video cassette recordings of the March 18 fusion hearings of the House Science and Technology Committee. The tapes cover about 3 1/2 hours of testimony and questioning. Witnesses include Rep. Fortney H. Stark (D-CA), Ron Parker (MIT), Tihiro Ohkawa (GA), Len Reichle (Ebasco), Steve Dean (FPA), Joe Gavin (Grumman), Ron Davidson (MFAC), Allen Mense (IEEE), Pete Staudhammer (TRW) and Paul Koloc (Prometheus). Persons wishing to borrow the tape should contact Ruth Watkins at (301) 258-0545. There is a \$20 charge to cover mailing and handling.

MEETINGS

April 24-27 Spring Meeting of the American Physical Society. Fusion Session 9:00 A.M., April 26. Featuring Eric Storm (LLNL), Dale Meade (PPPL), Tihiro Ohkawa (GA), Glen Wurden (LANL), and Tom Simonen (LLNL). Crystal Gateway Marriott, Arlington, VA.

April 30-May 2 ANS Topical Meeting on Tritium Technology. Stouffers Dayton Plaza Hotel, Dayton, OH. Contact Michael Rogers (513) 865-3081 or FTS 774-3081.

May 9-10 Magnetic Fusion Advisory Committee meeting, at UCLA. Open to public. Contact Ron Davidson (617) 253-8102.

May 13-15 Sixth Topical Conference on Radio-Frequency Plasma Heating. Co-sponsored by DOE, APS, ORNL and Auburn Univ. Contact Gary Swansen (205) 826-4677.

May 19-24 Fifth Fusion Energy Educational Development Seminar for administrative and secretarial personnel. Sponsored by Fusion Power Associates. At MIT, Cambridge, MA May 19-22 and at the University of Rochester May 23-24. Contact Ruth Watkins (301) 258-0545.

May 21-24 Conference on Lasers and Electro-Optics (CLEO). Baltimore Convention Center. Contact (202) 223-8130.



FUSION POWER ASSOCIATES

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NEW AFFILIATE

Martin Marietta Energy Systems Inc., operating contractor for Oak Ridge National Laboratory, has become a corporate Affiliate of Fusion Power Associates. Murray W. Rosenthal, Associate Director of ORNL, Advanced Energy Systems, will be the company's representative. We appreciate having Martin Marietta's participation in the association.

MAGNETIC FUSION PROGRAM PLAN ISSUED

The Secretary of Energy has approved and sent to the Congress the new Magnetic Fusion Program Plan (see our November 1984 newsletter). The document (DOE/ER-0214, February 1985) is available from DOE (Warren Marton (301) 353-4930) or from Fusion Power Associates. The document describes a "strategy" for developing fusion in the near-term that takes into account the current difficult federal budgetary climate and the declining priority for federally-funded energy programs. The plan is based upon the assumption that no billion-dollar class fusion test facilities are likely to be initiated by the federal government during the next decade.

The plan states that the goal of the magnetic fusion program is "to establish the scientific and technological base required for fusion energy." Three "strategy objectives" are established:

Scientific Objective: "to be able to predict the behavior of plasma confined in fusion-relevant magnetic configurations."

Technology Objective: "to develop unique fusion components that can operate under conditions relevant to fusion energy sources."

Technology Transfer Objective: "to provide a range of options for private sector investment and commercial development of fusion."

On the last point, the plan states, "The establishment of the scientific and technological base for fusion requires industrial participants, both to provide expertise in conventional components and to gain experience with the unique aspects of fusion science and technology. The necessary degree of industrial experience is best gained through the technical participation of industrial personnel in the state-of-the-art developments produced by the fusion program."

The plan indicates that R&D priority will be given to achieving adequate scientific and technical understandings in four key technical issue areas:

Magnetic Confinement Systems: "It is essential to explore an appropriate range of possibilities...."

Properties of Burning Plasmas: ". . . at least one burning plasma (must) be produced and studied to complete the scientific base."

Materials: "They are key to realizing the benefits of fusion."

Nuclear Technology: ". . . a certain breadth of technology must be maintained in order to be able to optimize the economic, safety and environmental performance of fusion reactors."

The new strategy will emphasize identification of critical generic issues and the development of understanding of both the science and technology of fusion, as distinguished from the development of particular competitive concepts.

TACTICAL PLANNING

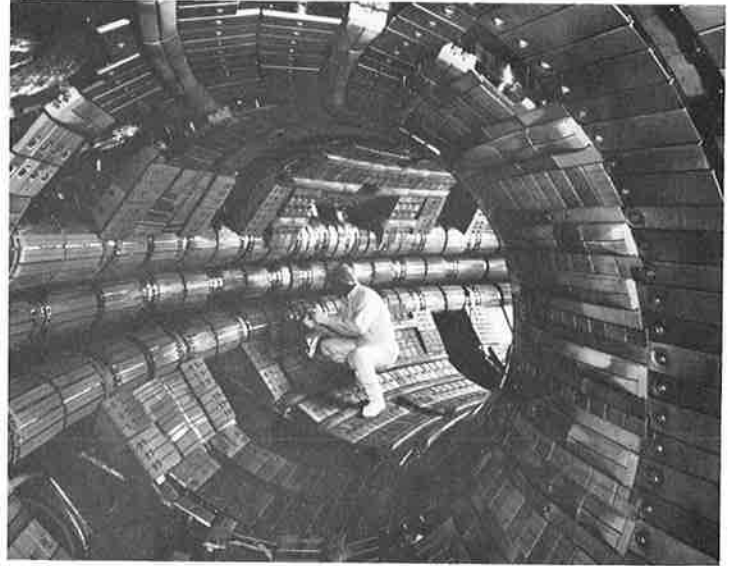
In a letter dated April 26, transmitting the strategic plan to the fusion community, DOE magnetic fusion director John Clarke announced that a new tactical planning activity has been commissioned "to prepare a Technical Program Plan in support of the strategy and policy framework" of the strategic plan. This community-wide effort will be led by Dr. Charles Baker, director of the Fusion Power Division of Argonne National Laboratory. Dr. Baker will describe his approach at the MFAC meeting May 8-9 at UCLA.

DAVIES, WILLIS NAMED TO NEW MFE POSTS

Dr. N. Anne Davies has been named deputy associate director for magnetic fusion of the DOE Office of Energy Research, assisting Dr. John F. Clarke. Dr. Davies was previously director of the Toroidal Systems Division and acting director of the Mirror Systems Division. Dr. John Willis, previously a member of the scientific staff of the Toroidal Systems Division, will serve as acting director of both the Toroidal Systems and Mirror Systems divisions.

PARTICLE BEAM FOCUSING SUCCESS AT SANDIA

Using a small device, Proto I, last summer (see our June and Sept. newsletters) Sandia scientists demonstrated the ability to focus a beam of protons to a small (0.65mm, half-maximum) spot size. Now, using the larger facility PBFA-I, the achievement has been duplicated at ten times higher power. Up to 1.5×10^{12} watts/cm² has been achieved with a 2 MeV proton beam at 4 million amps. Team leader Dan Cook states that "The new scaling experiment indicates that PBFA-II will be able to focus an intense ion beam." PBFA-II, scheduled for operation in January 1986, has higher voltage beams (30 MeV) and the scaling laws predict that 10^{14} watts/cm² should be easily achievable. "As a result of this accomplishment," said Dr. William Brinkman, vice president for research at Sandia, "we have a very reasonable chance of becoming the first lab to achieve fusion ignition."



JT-60

JT-60 TOKAMAK STARTS OPERATION

The JT-60 tokamak began operation on April 8 on schedule at the Japan Atomic Energy Research Institute. JT-60 becomes the world's largest operating tokamak.

FUSION PROPOSED FOR SUMMIT

Former U.S. presidents Jimmy Carter and Gerald Ford recently co-hosted a "Consultation on International Security and Arms Control" at Carter's center at Emory University in Atlanta. According to an op-ed story by Flora Lewis in the April 12, 1985, New York Times, participants, looking "to thaw what Mr. Gorbachev has called the recent 'ice age' in Soviet-American relations," felt that a joint program for fusion energy development would be "an excellent candidate for an exciting, constructive accord" that could be agreed to at the Gorbachev-Reagan summit that both countries hope will occur this Fall. Among the participants from several countries was Evgenii Velikhov, vice president of the USSR Academy of Sciences. Velikhov was quoted as saying that he believes that the Russians "would be glad to join (such) an international effort." In the opinion of op-ed story writer Lewis, "Putting fusion on the (summit) agenda won't avoid the abrasive issues, but it would promise at least one important success and brighten the horizon for the tougher talks."

FPA FINANCIAL STATUS

Fusion Power Associates' financial position as of December 31, 1984 and compared to 1983 and 1982 is as follows:

	<u>1984</u>	<u>1983</u>	<u>1982</u>
<u>Income</u>			
Research	\$214,969	\$170,116	\$446,716
Dues	97,524	80,275	94,720
Other	31,666	17,723	13,125
Prior Year Carryover or (Deficit)	<u>8,553</u>	<u>28,220</u>	<u>(3,360)</u>
Total	<u>\$352,712</u>	<u>\$396,444</u>	<u>\$551,201</u>
<u>Expenses</u>			
Research	214,969	271,169	446,773
Education	52,197	29,009	28,325
Admin.	<u>71,629</u>	<u>87,713</u>	<u>47,883</u>
Total	<u>\$338,795</u>	<u>\$387,891</u>	<u>\$522,981</u>

ABC SETS NUCLEAR EXPOSE, JUNE 6

ABC News has announced that it "will devote all prime time programming on Thursday, June 6 (8:00-11:00 P.M. EST) to network televisions's first assessment of the world nuclear spectre, titled The Fire Unleashed. The program is being produced by ABC News "Closeup" documentary unit. The principal writer is Marshall Frady of ABC News.

A 20-page summary of the story line suggests that the writers are oriented towards emphasizing the more negative and sensationalist aspects of nuclear issues--the draft treatment is filled with false facts and plays on "what if" fears and lack of technical sophistication of the mass audience. The story-line states, for example, that the nuclear industry has "the worst safety record in the world" and asserts that "Three Mile Island, while by far the worst, was just one of a series of serious nuclear power plant accidents in the U.S. in 1983 alone." In discussing nuclear weapons the danger that they will be used is treated but their effectiveness in deterring war is not. As is popular today, ABC plans to end the program by interviewing the "Star Wars" menagerie.

There is a small chance that, by the time the program airs, ABC will end up with a more balanced presentation than the initial

story-line indicates. If you would like to urge ABC to present a balanced view of the good, as well as the bad, on nuclear issues you should write to Mr. Roone Arledge, president, and/or Mr. Marshall Frady, ABC News, 7 West 66th Street, New York, 10023. A copy of the story line can be obtained from Fusion Power Associates.

LASER CONFERENCE SCHEDULED

Abstracts are solicited for the 7th International Workshop on Laser Interaction and Related Plasma Phenomena, to be held October 28-November 1 at the Naval Postgraduate School in Monterey, CA. For information contact Prof. George Miley, University of Illinois, 214 Nuclear Engineering Laboratory, 103 South Goodwin Ave., Urbana, IL 61801 or call Chris Stalker (217) 333-3772.

MILEY HONORED

George H. Miley, Professor of Nuclear and Electrical Engineering, University of Illinois, has received a Guggenheim Fellow Award for 1985-1986. He has simultaneously been appointed to the Center for Advanced Study at Illinois. These awards are based on his achievements and contributions to research on advanced fuel fusion and nuclear pumped lasers. Miley was one of 270 scholars and artists chosen from among 3,548 candidates by the John Simon Guggenheim Memorial Foundation.

SPECTRA TECHNOLOGY, BOEING TO DEVELOP

ADVANCED LASER

Spectra Technology Inc., formerly Mathematical Sciences Northwest, Bellevue, Washington, has signed a contract with Boeing Aerospace Co. under which the two will demonstrate a visible wavelength free electron laser oscillator. The work is being done under a two year, \$10 million contract with the Office of Naval Research, with funds provided by the Army Ballistic Missile Defense Systems Command and the Strategic Defense Initiative Organization. If the project is successful, an expanded experimental program will be established to demonstrate the technology needed for a prototype demonstration in the early 1990s.

NEW LASERS OPERATING

NOVA, the world's largest high power laser, was dedicated at LLNL on April 11. The laser carries 10 kilojoules of energy in ten beams. Each of the ten beams is 2.5 feet in diameter and carries 10 trillion watts of power. Team leader Eric Storm told an audience at the APS meeting in Washington on April 26 that, with NOVA, LLNL scientists expect to be able to compress fusion fuel to 1000 times liquid density, a necessary condition for the design of a high gain, ignited fusion pellet.

OMEGA, the University of Rochester's 24 beam, frequency-converted (red to blue) laser was dedicated April 19. To celebrate the occasion, U. of R. Laboratory for Laser Energetics director Bob McCrory had his team fire at a few pellets and achieved a new world record for fusion neutrons produced from a pellet: 2×10^{11} .

AURORA, Los Alamos' krypton-fluoride laser, has delivered 10,000 joules in an unfocused, 40-inch square, half-microsecond pulse, setting a new world record for short wavelength (1/4 micron) excimer lasers. This was about 3 times the previous energy output achieved in Aurora (see our August 1984 newsletter). Plans call for shortening the pulse length to about 5 nanoseconds. Key scientists in the project include Lou Rosocha, Reed Jensen and George York.

FUSION FACILITIES DIRECTORY

Fusion Power Associates is in the process of soliciting contributions to the Fusion Facilities Directory 1985-1986 edition. Completion is scheduled for the end of summer. Copies will be available from FPA at \$20.00 each, prepaid. Orders should be placed through Ruth Watkins, Fusion Power Associates, 2 Professional Drive, Suite 248, Gaithersburg, MD, 20879.

MEETINGS

May 20-24 Fusion Energy Educational Development Seminar. MIT and University of Rochester. Contact Joyce Cooper (617) 253-8105 or Ruth Watkins (301) 258-0545.

May 21-24 Conference on Lasers and Electro-Optics (CLEO). Baltimore Convention Ctr. Contact (202) 223-8130.

May 28-31 Twenty-Ninth International Symposium on Electrons, Ions and Photon Beams. Sponsored by IEEE, AVS and Electrochemical Society. Portland, OR. Contact John Bruning (716) 377-1882.

June 3-5 Twelfth IEEE International Conference on Plasma Science. Pittsburgh Hilton. Contact Martin Nahemow (412) 256-1644.

June 23-28 Fifteenth Annual Anomalous Absorption Conference. Banff, Alberta, Canada. Contact Jochen Meyer (604) 228-3853.

June 26-28 Twelfth Annual Conference on Plasma Physics. University of Glasgow, Scotland. Contact: Dr. J. Cumming, University of Glasgow, Glasgow, G128QQ (041) 339-8855, x-7390.

July 28-Aug 10 Summer School of Laser Plasma Interaction. St. Andrews, Scotland. Contact: Dr. R. A. Cairns, Dept. of Applied Mathematics, University of St. Andrews, North Hough, St. Andrews, Fife, KY169SS.

August 5-9 Second N.C. Christofilos International Conference on Pulsed Power and Its Applications. Island of Spetses, Greece. Contact Michael Mazarakis, Sandia National Laboratory (505) 846-2943.

August 12-16 Cryogenic Engineering Conference. MIT, Cambridge, MA. Contact Ms. A.M. Dawson (617) 253-5547.

August 19-23 Eighth International Conference on Structural Mechanics in Reactor Technology. Sessions on Mechanical and Thermal Problems of Fusion Reactors. Brussels. Contact Bob Conn (213) 825-4544.

Sept. 2-6 Twelfth European Conference on Controlled Fusion and Applied Plasma Physics. Budapest, Hungary. Contact KFKI, Fusion Conference, P.O. Box 49, H-1525 Budapest, Hungary. Telex: 224721 KFKI H.



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GEORGE A. KEYWORTH, SCIENCE ADVISOR TO THE PRESIDENT, ADDRESSES FPA SYMPOSIUM ON LASERS AND PARTICLE BEAMS

LASERS AND PARTICLE BEAMS SYMPOSIUM

Over 200 persons attended the symposium on Lasers and Particle Beams for Fusion and Strategic Defense on April 18-19 in Rochester, N.Y. The event was co-sponsored by Fusion Power Associates, the University of Rochester and the Strategic Defense Initiative Organization of the U.S. Department of Defense. Hon. George A. Keyworth, Director of the White House Office of Science and Technology Policy, was one of many distinguished scientists who addressed the Conference. Keyworth told the audience that the purpose of the Strategic Defense Initiative was to create a technology that was "incapable of initiating armed conflict or causing mass destruction, and yet effective in preventing war." He contrasted this against the present system of nuclear-armed missiles. He stated his opinion that nuclear-pumped x-ray lasers would not become part of an SDI system, saying that use of

such lasers would mean continuing "to rely upon nuclear weapons as defensive means" and that this would be "potentially as damaging as the threat they confront."

Dr. Louis Marquet, director of the SDI Directed Energy Weapons Office told the participants that the present goal is to determine the feasibility of the technology and that any decision to deploy would be made at some future point in time.

INERTIAL FUSION REVIEW PROGRESS

The Inertial Fusion Review Committee (see our February newsletter), convened by the National Research Council at the request of Office of Science and Technology Policy and the Congress, has visited all the major ICF sites. They are next scheduled for a one week retreat-type meeting at the end of July. FPA president Steve Dean met with the Panel at the University of Rochester in April and again at LLNL in late May. He stated that "ICF is a very impressive, cost-effective program," pointed out major achievements such as laser and particle beam technology, computer codes, diagnostics and target fabrication development as well as achievement of high compression and understanding of the physics of absorption. He also noted "the spin-off benefit of laser isotope separation technology and the people/technology base that is now available for SDI." He noted recent progress in identifying development paths for high efficiency, repeatable drivers and, stating that ICF has "a real potential for eventually becoming a commercial power source," he called for "enhanced efforts on reactor design studies."

FUSION GOALS RECOMMENDED

The Magnetic Fusion Advisory Committee has accepted and sent to DOE the report of its "Panel X" on "High Power Density Fusion Systems." The Panel, chaired by Bob Conn of UCLA, made far-reaching recommendations on the future directions of the magnetic fusion program. Fusion Power Associates president Steve Dean commented that "acceptance of their recommendations would indicate that the fusion program had not lost its focus and its determination to develop a practical product." He urged that the recommendations be accepted and used in the implementation of the "strategic plan" for fusion that DOE recently approved and sent to the Congress (see our May Newsletter.)

Panel X, recognizing that it was essential that the fusion program both have a practical end goal and find an affordable development path, made two "central recommendations." These were:

- "In setting fusion program priorities, increased emphasis should be given to improving the mass power density of fusion systems, aiming at a minimum target of 100 kWe/tonne."
- "Increased emphasis should be given to concepts that offer the potential to reduce substantially the cost of development steps in physics and technology." "The Panel recommends establishing a methodology to evaluate pathways and costs for fusion power development."

In making the central recommendations, the Panel states that this "increased emphasis should be applied to all aspects of the fusion program, including confinement research, fusion reactor design and system studies, and technology research and development."

The Panel also recommended that

- "Reactor studies focusing on the issues of achieving high mass power density should be pursued."

The Panel said that the reactor studies "should seek ways to significantly increase mass power density while retaining the advantageous environmental, safety and waste disposal attributes of fusion. Inter-comparison of various fusion concepts should be done."

Mass power density was defined by the Panel as the net electric power of the plant divided by the mass of the fusion power core. The fusion power core mass was defined to include the mass of the fusion reactor and all its components but excluding auxiliary systems such as power supplies, auxiliary heating equipment, etc. The Panel recognized that mass power density was not an all-inclusive figure of merit and that, ultimately, capital cost of the entire plant, cost of electricity and availability would determine the commercial attractiveness of a given fusion reactor design. Nevertheless, they believed that using a target goal of at least 100 kWe/tonne for mass power density, as defined by the Panel, would provide a useful and meaningful goal for guiding the fusion R&D program toward a practical product.

The Panel made specific recommendations for each of the current concepts, as well as for a variety of technology areas. For tokamaks, for example, they recommended that "increased emphasis...should be placed on the achievement of higher beta."

In addition to Bob Conn, the members of the Panel were: Bob Gross (Co-Chairman), Columbia University; Mohamed Abdou, UCLA; Charles Baker, ANL; Lee Berry, ORNL; Don Dobrott, SAIC; Harold Furth, PPPL; James Gordon, TRW; Robert Krakowski, LANL; Nick Krall, Jaycor; Rulon Linford, LANL; Grant Logan, LLNL; Pete Rose, Spectra Technology; Ramy Shanny, Private Consultant; Teruo Tamano, GA Technologies; Shoichi Yoshikawa, PPPL.

Copies of the Panel report can be obtained from Bob Conn (213) 825-4544 or from Ron Davidson (617) 253-8102.

FUSION AND ENERGY DEMAND

In a letter to Fusion Power Associates president Steve Dean, following the April hearings of the House Subcommittee on Energy Research and Production, Subcommittee chairperson Hon. Marilyn Lloyd asked for comments on "forecasts for world energy supply into the next century" as they relate to "the need to develop long-term, abundant energy sources, such as fusion...." Here is Dean's reply:

"It takes a long time to develop a new energy technology to the point of commer-

cial application and even longer for it to penetrate the market enough to make a difference. Power plant construction lead times are also long compared with characteristic periods of demand fluctuation. In 1980 the total installed electric capacity of the U.S. was 570 GWe. This will have to be replaced during the first half of the next century, in addition to building new plants to accommodate the population growth. One can argue about growth rates but even a conservative estimate like 1-2% would lead one to conclude that something like 20 to 50 new gigawatt level power plants will have to be initiated every year during the first 50 years of the next century. This is a big market since each plant will cost about \$2 billion dollars regardless of technology. Since there are many unresolved social issues associated with the use of fossil and nuclear fuels, the public has a right to expect that new technologies, like fusion, will be developed to the point where a fusion option exists for the above market. Even with an accelerated effort on fusion, it will take 15-20 years to demonstrate the commercial viability of fusion. Thus, in my opinion, it is cost-effective from a public funding point-of-view to develop fusion expeditiously now."

GRANTS PROGRAM

The Department of Energy has announced (Federal Register Vol. 50, No. 72, April 15, 1985, pg. 14856 ff) that, effective May 15, they will implement a "program of special research grants for basic and applied research and related activities." A unique feature of the program is that industry as well as universities and non-profit corporations are eligible to receive these grants, on the basis of proposals submitted in areas that have been designated by DOE as areas of programmatic interest. Such a listing was also published in the April 15 Federal Register, pg. 14865 ff. All areas of Energy Research, including fusion, are covered. Grants may average up to \$2 million/year for three years.

For more information, contact Robert A. Zich, Director, Acquisition Management Division, Office of Energy Research, ER-64, DOE, Washington, D. C. 20545. Telephone (301) 353-5544.

PEOPLE

Dan Cohn, head of the Fusion Systems Division at the MIT Plasma Fusion Center, will be leaving MIT in the fall to become Director of the Center for Fusion Engineering and a faculty member of the EE Department at the University of Texas.

Hattice Cullingford has joined the staff of NASA'S Johnson Space Center in Houston where she will be managing three test laboratories in the Crew System Division. She can be reached at (713)483-4941.

Michael Hathaway has left his position as Staff Director, U.S. Senate Committee on Energy and Natural Resources and joined GA Technologies in Washington, D. C. to manage the company's technical liaison with the Department of Energy.

R. Jay Fries, LANL, has been elected chairman of the American Vacuum Society, Fusion Technology Division; Angus Hunt, LLNL, has been elected Chairman-elect. Three new members elected to the Executive Committee are: R. Bastaasz (SNL), R. Livesy (ORNL) and W. Pickles (LLNL). Other members of the Executive Committee are J. Cecchi (PPPL), W. Gauster (SNC) and T. Henderson (KMS).

AVS OFFERS STUDENT TRAVEL GRANTS

The AVS Fusion Technology Division is offering up to five awards of \$1,000 each to students for travel to the 1985 National Symposium to be held in Houston, November 18-22. For information, contact J. B. Whitley (505)844-5353.

FUSION GLOSSARY AVAILABLE

The Department of Energy's Office of Scientific and Technical Information has published a revised Glossary of Fusion Energy (DOE/TIC-10192, February 1985) that gives brief descriptions of the terminology being used by the fusion community. In addition to definitions for approximately 600 terms, schematic diagrams and photographs are included for most of the major U.S. fusion experiments and some of the major foreign experiments. For information on availability contact M. O. Whitsen, U.S.DOE, P.O. Box 62, Oak Ridge, TN 37831.

NUCLEAR POWER PASSES HYDROELECTRIC

According to statistics from the Energy Information Administration, for the first time more electricity was produced from nuclear power plants in 1984 than was produced from hydroelectric plants in the U.S. Nuclear ranked second, after coal. Nuclear plants produced over 325 billion kilowatt hours, or almost 14% of the U.S. total. Coal was used to generate 56% of the total.

JAPANESE - CANADIAN FUSION COOPERATION

A cooperation agreement has been put in place that links the fusion power development programs of Canada and Japan. In November 1984 a memorandum of understanding was signed by both the National Research Council of Canada (NRCC) and the Japanese Atomic Energy Research Institute (JAERI).

This agreement couples the two national programs in the areas of fusion physics and in development of fusion fuels technology. The agreement to cooperate has a duration of two years, and can be extended by mutual agreement. No work on inertial confinement fusion is contemplated under this agreement.

The agreement provides for the two countries to exchange expert staff, to share scientific and engineering information, and to participate in aspects of each others' programs. Small joint projects are anticipated in the early phases of cooperation.

The inaugural meeting under the agreement took place in November 1984 at JAERI. Tom Drolet of CFFTP represented Canada. Principals for Japan were Dr. Y. Kawashima who is Executive Director of JAERI, and Dr. Y. Ibata, also of JAERI.

For further information, contact Tom Drolet (416)823-6654.

KMS FUSION AWARDED NASA/AFWL CONTRACTS

The National Aeronautics and Space Administration and the Air Force Weapons Laboratory have announced that KMS Fusion, Inc. of Ann Arbor, Michigan will receive two separate contracts totaling \$875,000 for the development of a solar powered, chemically pumped iodine laser and a solid phase singlet oxygen generator. The NASA contract

is a \$500,000 Phase II Small Business Innovative Research Award (SBIR) to be used to develop a solar powered, chemically pumped iodine laser. The system offers a unique method of producing and transmitting power in space. KMS Fusion has also been awarded a \$375,000 contract with the Air Force Weapons Laboratory for the development of a solid phase singlet oxygen generator. The generator uses the same process of storing energy from excited oxygen molecules, but does not rely on solar power to excite the oxygen molecules. The principal investigators for the contracts will be Allen Twarowski and George Busch.

NASA has also announced a four year, \$3.3 million contract award to KMS for the design and development of an ultra-sensitive instrument to measure minute forces encountered by the Space Shuttle. The instrument package is called the Orbital Acceleration Research Experiment (OARE).

MEETINGS

August 5-9 - Second N.C. Christofilos International Conference on Pulsed Power and Its Applications. Island of Spetses, Greece. Contact Michael Mazarakis, Sandia National Laboratory (505)846-2943

August 12-16 - Cryogenic Engineering Conference. MIT, Cambridge, MA. Contact Ms. A.M. Dawson (617)253-5547.

August 19-23 - Eighth International Conference on Structural Mechanics in Reactor Technology. Sessions on Mechanical and Thermal Problems of Fusion Reactors. Brussels. Contact Bob Conn (213)825-4544.

IN MEMORIAM

Ray Grimm, formerly of PPPL, recently died unexpectedly in Australia. To honor his memory, his colleagues at Princeton have established the Ray Grimm Memorial Prize to be awarded to a Princeton University graduate student for significant achievement in Computational Physics. Tax-deductible contributions, payable to Princeton University (with a note that it is intended for the Ray Grimm Memorial Prize) can be sent to: David Dodge, Recording Secretary, Princeton University, P.O. Box 140, Princeton, NJ, 08544.



FUSION POWER ASSOCIATES

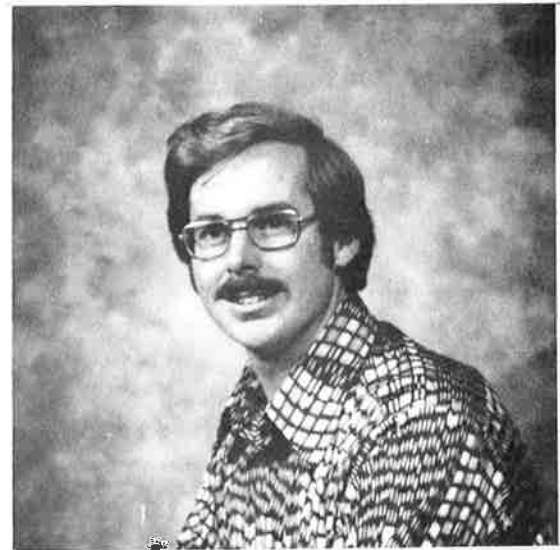
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LOGAN INVENTS ENERGY CONCEPT

B. Grant Logan of the Lawrence Livermore National Laboratory has invented and filed a patent disclosure for an idea that could dramatically reduce the cost and simplify the energy conversion system for fusion, and possibly other, power plants. For fusion, the concept involves using radiation (bremsstrahlung and synchrotron) from the core plasma to ionize a conducting vapor that then expands through an MHD channel. Use of MHD energy conversion to electricity would allow simplifications in the plant, such as the elimination of rotating machinery and minimization of nuclear-grade piping and heat exchangers.

Past work on MHD generators indicated that these systems would be limited to economically-marginal topping cycles, based on combustion-gas, open-cycle MHD and two-phase, liquid metal, closed-cycle MHD that extracted less than 10% of the enthalpy input with small pressure ratios (less than 3). In Logan's embodiment, the plasma radiation allows maintenance of more uniform nonequilibrium ionization over a wide range of pressure along the MHD channel. This, combined with the natural presence of large volumes of high magnetic fields, permits over 30% of the enthalpy to be extracted with pressure ratios greater than 100. In Logan's scheme, the bremsstrahlung radiation would pass through the first wall by making the wall of a low Z material; the synchrotron radiation would exit the vacuum chamber into the MHD channel through ceramic windows. Logan is proposing a small experiment to test the basic concepts. He believes the ideas are applicable to both magnetic and inertial fusion concepts as well as possibly to advanced fission reactors, like HTGR's. For more information contact Grant at (415) 422-9816.



B. GRANT LOGAN OF LLNL

U.S. GOVERNMENT OIL, INC.

The U.S. government has quietly formed a new nationalized oil industry. According to a June 26 DOE press release, the government's business venture will result in net revenues of over \$1.3 billion this fiscal year and total net revenues of over \$10.5 billion since 1976. According to DOE, "the revenues are derived from the sales and exchange of the government share of petroleum from the Elk Hills and Buena Vista oilfields near Bakersfield, California and the Teapot Dome field north of Casper, Wyoming." "Crude oil is sold on the open market as well as to the Department of Defense. Natural gas and associated liquids, including propane, butane and natural gas, are also sold competitively," according to DOE. It is interesting to note that DOE has been cutting back on energy R&D, claiming that the private sector should fund more of it, while at the same time entering into the competitive commercial oil business on its own.

COMMERCIAL TOKAMAK PROSPECTS ANALYZED

In a clearly-written paper, "Options for Commercial Tokamaks," to be published in Fusion Technology, authors Ali Dabiri of SAIC, Don Keeton of TVA and Scott Thomson of Bechtel, working at the ORNL Fusion Engineering Design Center, have analyzed the economics of potential commercial tokamak fusion reactors. One part of the study investigates the economics of high-beta operation and predicts an optimum operating range of 10-20% beta. A second part of the study investigates the conditions under which small, low power tokamaks can be economically aggregated into a large (1200 MWe) multiplex power plant. The studies are contributing to a broader effort at the FEDC of tokamak designs using modular maintenance configurations. A preprint of the paper is available from the authors (615) 576-5501.

TOROIDAL SYSTEM INNOVATIONS SOUGHT

The DOE Office of Fusion Energy's Applied Plasma Physics Division is setting aside \$2 million in FY 1986 to fund tests of concepts for the improvement of tokamaks and similar toroidal approaches. Priority will be given to proposals that would test "innovative and creative" ideas suitable for being studied in small scale experiments. The experiments could be proposed for tests on existing large devices or be separate small scale experiments. DOE would like to receive proposals by September 1 and will fund the projects through the newly-established "Special Research Grants Program" (see our June newsletter or the April 15 Federal Register, pg. 14856 ff). Further information can be obtained from Dr. Charles R. Finfgeld at DOE (301) 353-3421.

ICF FUNDING COMEBACK

Although the FY 1986 appropriations process is far from complete, it appears virtually certain that DOE will be prevented by Congress from imposing the drastic funding cut to \$70M in inertial fusion proposed in the President's budget (see our January, February and March newsletters.) The House Armed Services Committee, in its May 10 report, states "The committee views the ICF request of only \$70 million as very poor management of resources and a waste of

scarce scientific talent" and recommended a budget of \$145M. This amount is still less than the current year budget of \$158M. The report states "The Committee has strongly supported the national ICF program for almost a decade, with cumulative appropriations of more than \$1.7 billion, because of the significant technical contributions the program could make to the understanding of nuclear weapon physics, nuclear weapon radiation effects, and directed energy weapon efforts, and for its potential contribution in the long term, to fusion energy production. In addition, the committee believes that the existence of significant programs at the nuclear weapon laboratories that push the leading edge of both science and technology and are closely related to the national nuclear weapons program are both beneficial and essential in maintaining the overall viability and technical excellence of these institutions over the long term."

The report notes that several large facilities such as NOVA and OMEGA and PBFA-II are coming into operation and states that, "The President's proposed budget of \$70 million would require abandoning most experiments at these facilities, recently completed at over \$200 million in cost. The committee believes that it is reasonable to close a facility when the technical data it was built to produce have been collected, but it is not good sense to close facilities before they are used."

TOROIDAL PROGRAMS REVIEWED

A committee chaired by Bob Gross of Columbia University reviewed the DOE's toroidal fusion program on May 21-23. While finding "the quality of the toroidal fusion program to be excellent," the panel expressed concern that "the vast majority of the larger U.S. toroidal experiments are growing old." The panel viewed the program as consisting of "two major lines of research": (1) breakeven and ignition experiments and (2) concept improvement experiments. The group recommended that "TFTR proceed to the equivalent of Q=1 in DD as rapidly as possible" and "if this test is judged to be successful, then the TFTR group should proceed directly to the Q=1 experiment in D-T." Following that D-T demonstration, the panel recommended that

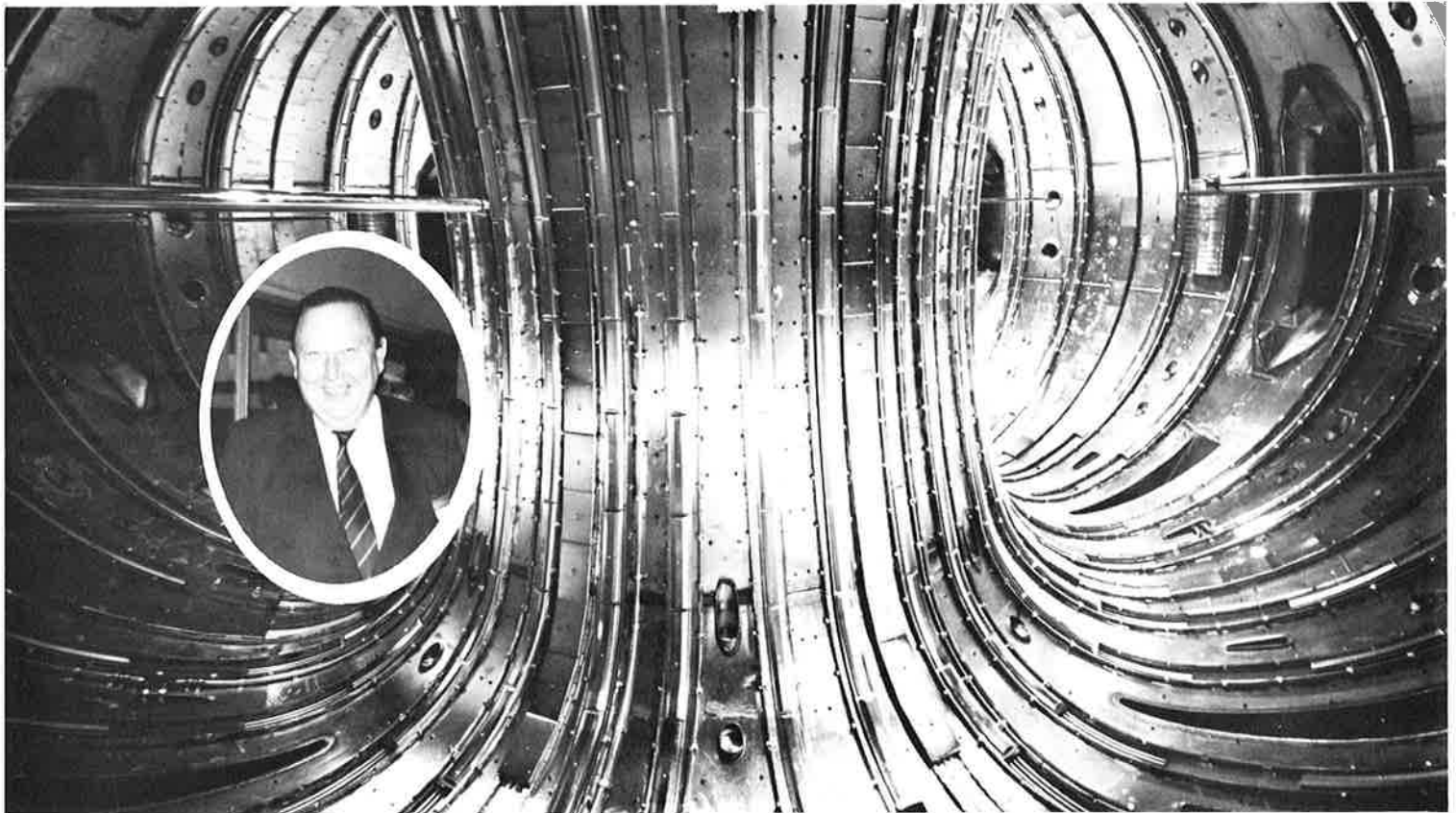
"TFTR should then be shut down and removed from the facility." The panel recommended that procurement for a "compact, relatively low-cost ignition experiment" should begin as soon as the D-D, Q=1 experiment has been done."

"Concurrent with breakeven and ignition experiments", the panel recommended that "new toroidal concept improvement experiments should be conducted with emphasis given to the ideas which offer . . . more attractive fusion power reactor designs." Examples cited were "simplicity, compactness

and the feasibility of developing moderate size, steady state fusion power plants...."

The panel recommended, if a conflict arose between the funding for the ignition experiment and the funding for the concept improvement program, that "the ignition experiment should be postponed and the concept improvement program preserved."

Other members of the panel were Dave Baldwin (LLNL), Burt Fried (UCLA), Ken Gentle (U. Texas), Paulette Liewer (Cal. Tech.) and Don Steiner (RPI).



IN MEMORIAM Hans Otto Wuster, the "giant of JET", died suddenly of a heart attack June 30 in England. He had just returned the day before from a trip to the U.S. where he testified at the House Science and Technology Committee hearings on large scientific projects. Hans Otto, as his friends called him, was a giant of the international fusion community, having been Director of the Joint European Torus (JET) project since 1978. JET stands today as a monument to his leadership. Prior to joining the JET team he was, from 1971-1978, deputy director to the late John Adams at the CERN high energy physics facility. A native of Hamburg, and a graduate of the University of Cologne, Hans Otto, who had just turned 58, is survived by a wife and a son, who just this year graduated from Cambridge University with a degree in biology.

The world fusion community feels a deep sense of grief over the loss of this great leader. In the words of his friend Alan Gibson of Culham, "Hans Otto accomplished many great things in his life and would have accomplished many more great things." Friends may send letters expressing their regrets to the JET Project, Culham Laboratory, Abingdon, Oxfordshire, OX14 3DB, England. These expressions will be transmitted to the family.

ABC'S NUCLEAR NIGHTMARE

On June 6, ABC news "Closeup" unit devoted its entire evening prime time coverage to a program entitled "The Fire Unleashed" (see our May newsletter). ABC billed the program as "network television's first assessment of the world nuclear spectre." Moderator Peter Jennings opened the show by calling the topics to be covered "the most crucial issues ever to confront the human species." Alerted by advanced copies of the "story line" distributed by several scientific and engineering societies, many scientists wrote to ABC president Roone Arledge expressing their concern that ABC present a fair and balanced point of view. In response to one such letter, Robert R. Siegenthaler, Vice President, News Practice, at ABC wrote back "You may be assured that I have carefully examined this program and that it is an in-depth and evenhanded look at the atom and our 40 year relationship with it. . . both in war and in peace." Siegenthaler went on to state "Our first priority at ABC News is to provide fair and balanced coverage of the issues. We believe that we have done so in "The Fire Unleashed."

But those of us who watched the program found it to be otherwise. As we predicted in May, the program was filled with false "facts" and played on "what if" fears and lack of technical sophistication of the mass audience. Here is a sample of what newspaper reviewers thought of ABC's effort.

The New York Times, John Corry: "'The Fire Unleashed' is not so much a documentary as a sermon." "This is a documentary overcome by its own sense of mission. It wants not to inform but to proselytize. We must oppose the nuclear demon and all its works." "'The Fire Unleashed' undermines its own case. There is no balance. The attacks are diffuse and one-sided."

The Wall Street Journal, Martha Bayle: "And as the program surges ahead, we see dazzling lakes, leaping antelopes, praying priests and laughing children -- emblems of 'life'. When anything 'nuclear' is mentioned, however, we see forbidding-looking buildings, evil hardware, blasted landscapes, boiling mushroom clouds and (for good measure) unrelated images of destructive power such as lightning, volcanoes, avalanches, and an occasional closeup of Niagara Falls. Clearly ABC does well to

broadcast this extravagantly manipulative film, if it can be used to manipulate all those fools out there whose antiquated 'modes of thinking' are responsible for pushing our lovely technicolored planet to the brink. The trouble is, the program is so emotional, it doesn't appeal to any mode of thinking, old or new. The script makes a stab at journalistic fairness, quoting various sides of the various debates. But the qualified statements of a few talking heads shrivel like matchsticks in the firestorm of emotions brought on by the visuals and the music."

"Intellectually tricky, paradoxical, and based on highly disputable evidence, the arguments surrounding nuclear issues are notoriously hard for the educated to grasp, much less the great majority who get most of the public-affairs information from television. 'The Fire Unleashed' does these people a terrible disservice by discrediting those who, over the last 40 years, have thought long and hard about the perils we face. And by its style, the film suggests not new thinking but ancient emotion: the 'us' of frightened, thinking citizens versus the 'them' of mentally backward authorities."

Associated Press, Matt Yancey: "Nearly one-third of the segment devoted to atomic power is taken up by the claims of people who live near the Three Mile Island plant in Pennsylvania that the March 1979 accident there has caused widespread incidences of cancer and genetic mutations. People shunned by such mainline anti-nuclear groups as the Union of Concerned Scientists get an ABC platform for stories of milk-dry cows, giant dandelions, a spastic cat and informal surveys of neighbors purportedly stricken by TMI-caused cancer. Years of research by the Nuclear Regulatory Commission, the federal Center for Disease Control in Atlanta and the Pennsylvania Department of Health -- all finding no link between the accident and cancer figures in central Pennsylvania -- are dismissed as 'official disclaimers'."

"But more troubling than the occasional misrepresentation of an assertion as fact is a slick production that appears to be aimed more at tugging at emotions rather than the mind."



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ACADEMY MAKES INTERIM ICF REPORT

The National Academy of Sciences Committee to review the Inertial Confinement Fusion (ICF) Program (see our February newsletter) has submitted an interim report that strongly praises the technical accomplishments, progress and prospects for success of the ICF program and certifies that the program has made, and continues to make, important contributions to the DOE's weapons program (from whence ICF derives its funding). The draft report was not well received at the White House Office of Science and Technology (OSTP) which had sought to reduce the ICF budget by over 50% in FY 1986 (see our January and March newsletters). Academy of Science panels are supposed to be above political pressures and are convened to give objective scientific advice, but this panel's high regard for the ICF work did not fit the Executive Branch's preconceived opinions of the program and, hence, the OSTP is requesting the panel to "tone down" its report.

In addition, the DOE's Division of Classification, in reviewing an earlier draft of the panel's report, objected to the panel's view that ICF is overclassified to the detriment of scientific progress. The panel reportedly also agreed to "tone down" its draft report in deference to DOE's view on classification.

Fusion Power Associates believes that it is not in the national interest for Academy of Science panels to "tone down" their reports to suit the preconceived opinions of Executive Branch staff, particularly in cases where the panels have been convened to review Executive Branch policies. Unfortunately, the Academy receives its funding for most of these panels from the Executive Branch, thereby placing the Academy in an awkward position.

FPA PURPOSE AND GOALS

The Fusion Power Associates Board of Directors has approved a new statement of purpose and goals for the association, designed to better reflect our interests in a broad range of applications of fusion science and technology. The statement is as follows:

Fusion Power Associates is a non-profit, tax-exempt corporation established to ensure the timely development and application of fusion science and technology. To fulfill this purpose, we have adopted four primary goals:

- To foster the use of fusion science and technology in both commercial and government applications.
- To ensure a smooth, timely transition from research on fusion science and technology to engineering development and applications.
- To foster cooperation in research, development and applications of fusion science and technology among all public and private organizations including government, universities, national laboratories and industry.
- To establish increased public awareness and understanding of the potential applications of fusion science and technology.

US-USSR HYBRID EXCHANGE

Seven U.S. scientists visited the Soviet Union recently to discuss mutual interests in fusion-fission hybrid reactor studies.

The group included R. W. Moir and J. D. Lee (LLNL), D. H. Berwald (TRW), A. L. Opdenaker (DOE), L. G. Miller (EG&G/INEL), K. R. Schultz (GA), and J. H. DeVan (ORNL).

In his introductory remarks to the group, V. V. Orlov of the Kurchatov Institute suggested that a fusion-fission hybrid reactor could be operational in the 2010 time-frame and that an engineering test reactor with a hybrid test blanket module could be operational around the year 2000. He stated that the blanket module might consist of a uranium molybdenum alloy and be helium-cooled, with a liquid lithium tritium breeder and heat transfer agent. Orlov and Moir signed a memo on the results of the workshop calling the exchange "useful" and recommending "the continuation and development of contacts on hybrid reactors." The memo specifically calls attention to the need for experiments unique to hybrid applications.

FPA SYMPOSIUM PROCEEDINGS PUBLISHED

The proceedings of Fusion Power Associates' two symposia (April and October, 1984) have been published in the latest issue of the Journal of Fusion Energy (Vol. 4, Nos. 2/3, June 1985, Plenum Press). The symposia themes were "Fusion Power Development--the Next Decade" and "New Directions in Magnetic Fusion," respectively. The proceedings include the transcripts of panel discussions on "Progress and Directions in Magnetic Fusion" by Harold Furth, Ken Fowler and Harry Dreicer and "Progress and Directions in Inertial Fusion" by Rick Schriever, John Emmett, Bob McCrory, Damon Giovannielli, Steve Bodner, and Gerry Yonas. Presentations on various fusion technology topics are given by Bob Dowling, Mohamed Abdou, Charlie Baker, Greg Haas, Jim Maniscalco, Jim Anderson, Gerry Kulcinski, and Ray Beuligmann. Views on planning for the future and fusion economics are given by John Clarke, John Nuckolls and John Sheffield. Panel discussions on the role of industry, the role of tokamak ignition devices and the role of improved concepts are also contained in the proceedings. Copies of the proceedings can be obtained from Fusion Power Associates for \$15.00.

VARIAN SETS NEW GYROTRON RECORD

Varian Associates in Palo Alto, under contract to the Oak Ridge National

Laboratory, has operated its first experimental 140 GHz gyrotron tube at 100 kw for short pulses (400 microseconds). This same tube is expected to reach 50 kw CW. The ultimate goal of the program is to perfect 100 kw CW tubes at the 140 GHz frequency. Previous developments have successfully developed record-breaking 200 kw CW tubes at 20 GHz and 60 GHz. These tubes are in widespread use throughout the world for fusion plasma heating. L. Jack Craig of Varian Associates leads the development team. The program has also been aided by DOE-sponsored research at the Massachusetts Institute of Technology and the U.S. Naval Research Laboratory.

IGNITION TOKAMAK DESIGNS REVIEWED

A panel of senior tokamak scientists and engineers from U.S., Canada, Europe, and Japan conducted an assessment of the "Ignition Design Point Workshop" at MIT, June 11-13. The panel, chaired by Ron Davidson of MIT, concluded that "the present data base is sufficient to guide the conceptual design of a tokamak ignition experiment" and that "the ignition experiment could provide unique and highly useful information." The panel did not show a preference among the three design options being discussed; rather they concluded that "there are feasible designs within this class of options." For two of the designs, the range of cost estimates was \$260-290M, in addition to site credits of \$250M if the project were located at the TFTR site. Advocates of the third design thought their concept could be significantly cheaper. The panel recommended proceeding with "conceptual design of a compact ignition device."

SDI FUNDING PROJECTIONS

The House Armed Services Committee recommended that the funding increase for the Strategic Defense Initiative (SDI) be limited to \$2.47 billion, up from \$1.4 billion in FY 1985. The President had requested \$3.7 billion. The Committee indicated that it "strongly supported the SDI program and that "testimony has demonstrated to the committee's satisfaction that major technological progress is being made in the various SDI elements." Nevertheless, the Committee report calls the large requested increases "without precedent and cause for concern," and

states that the recommended level of \$2.47 billion "provides for a very significant program." For more details see accompanying table. Senate and House authorizing committee conferees agreed on a higher mark for SDI: \$2.75 billion. The conference report reportedly will not contain restriction on how the money is spent. The authorization bill will set limits on the total spending; an appropriations bill must still be passed.

SDI FUNDING

(\$ Millions)

	FY 85 <u>Actual</u>	FY 86 <u>Request</u>	FY 86 House Comm. <u>Mark</u>
Surveillance, Tracking, etc.	\$ 568	\$1,386	\$ 890
Directed Energy Weapons Tech.	358	996	725
Kinetic Energy Weapons Tech.	252	860	510
System Concepts, Battle Mgmt.	99	243	173
Survivability, Key Technologies	<u>112</u>	<u>258</u>	<u>174</u>
Total	\$1,389	\$3,743	\$2,472

project in October. Our congratulations to project manager Vic Karpenko who master-minded the project to completion despite a pattern of government year-to-year funding shortfalls. Unfortunately the experiment cannot begin until at least early 1988 due to continued uncertainties in funding for the neutral beam injectors and diagnostics.



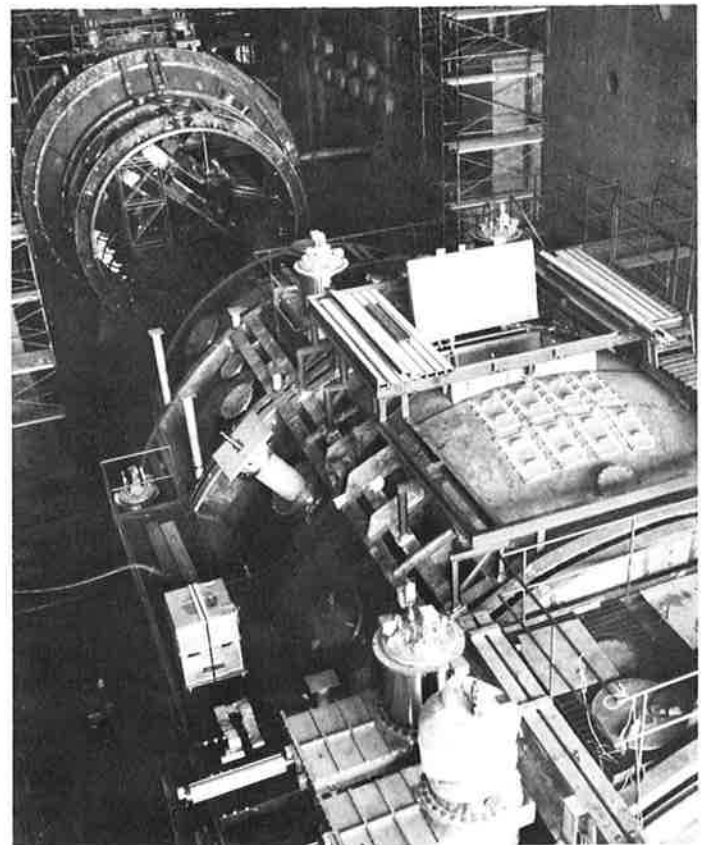
MFTF PROJECT MANAGER, VIC KARPENKO

STARWARS NEWSLETTER

Business Publishers has just instituted a new monthly newsletter called "Starwars Intelligence Report." Format and content of the newsletter will be similar to "Fusion Power Report". Pat Maio is editor. The first issue discusses the present status of SDI funding, university attitudes, contract actions and opportunities. The issue also contains a two page interview with FPA president, Steve Dean. The subscription rate is \$302.72 for one year. For further information contact Star Wars Intelligence Report, 951 Pershing Drive, Silver Spring, MD 20910 (301) 587-6300.

MFTF CONSTRUCTION PROGRESS

The Mirror Fusion Test Facility (MFTF) at the Lawrence Livermore National Laboratory has arrived at its scheduled mid-August milestone for completion of the basic construction project, which includes the vacuum vessel and superconducting magnets completely installed and ready for integrated testing. Forty five days of system checking is scheduled, leading to the official completion of the construction



MIRROR FUSION TEST FACILITY

GEORGIA TECH FORMS FUSION CENTER

The Georgia Institute of Technology has recently established a Fusion Research Center. Weston M. (Bill) Stacey, Jr., has been named director. The Institute will concentrate its efforts initially in impurity control, plasma wall interactions, diagnostics, atomic data, electromagnetics and reactor design.

LASER PROPOSALS SOUGHT BY ROCHESTER

Proposals to do experiments at the University of Rochester's National Laser Users Facility are due by December 15, 1985. Research funds of approximately \$650,000 are available to support the work. Proposals are accepted from any competent group, including university, industry and government laboratories. More information about proposal guidelines and the resources available can be obtained from Thomas C. Bristow, Manager, National Laser User Facility, Laboratory for Laser Energetics, University of Rochester, 250 East River Road, Rochester, NY 14623 (716) 275-2074.

FUSION BUDGETS

No FY 1986 appropriation bill has yet passed Congress. The status of committee marks are as follows. For magnetic fusion, House Appropriations has recommended \$385M, Senate has recommended \$382M, the President's request was \$390M. For inertial fusion, House Appropriations has recommended \$155M, Senate made no specific recommendation, the President's request was \$70M.

NEWS ITEMS REQUESTED

If you sometimes wonder why a certain event is reported in this newsletter while something of equal (or greater!) importance from your institution goes unnoticed, it is probable (no, likely!), that neither you nor anyone from your institution told us about it. We are not omnipresent! Send us news items and photos. Thanks for your help.

PEOPLE

Don Kerr, Director, Los Alamos National Laboratory will leave the laboratory on or about October 1 to become Government Systems and Services Group Executive and a senior vice president for EG&G Inc. in Wellesley, Massachusetts. Don has been LANL director since 1979.

Harry Dreicer and Don Kerr of LANL have been elected Fellows of the American Association for the Advancement of Science (AAAS). Harry is head of LANL's magnetic fusion program.

Klaus Berkner has been named associate director and head of the Accelerator and Fusion Research Division of the Lawrence Berkeley Laboratory. Klaus has worked in fusion at LBL since 1964.

David Roberts, son of DOE Office of Fusion Energy's Mike Roberts was selected as one of 52 students from the 50 states, the District of Columbia and Puerto Rico, to attend the DOE's first High School Supercomputer Honors Program. The students will spend August 11-24 at the National Magnetic Fusion Energy Computer Center at LLNL. The students were selected by the governors of their respective states, based upon scholastic aptitude and competence in science and mathematics.

The American Nuclear Society Fusion Energy Division has elected the following officers for 1985-1986: Steve Dean, chairman; Dan Cohn, chair-elect; Jim Anderson, secretary/treasurer; and executive committee members: Bob Krakowski, Lewis Masson and Nermin Uckan.

QUOTABLES

From our recent annual meeting in La Jolla come these gems of wisdom.

Harold Furth: "Fear not. That if a concept, a humble concept, is found which ever can prove more or less conservatively that there is a viable solution to fusion, fear not that that is a threat to you. That is not a threat to you. The threat to you is that in a reasonable time, no such concepts will be demonstrated and the government will lose faith that there is any such concept. That is the threat to you."

Tom Heppenheimer: "Its worth remembering that when Queen Elizabeth was preparing to fight the Spanish Armada, she was not framing policy initiatives that would reach fruition during the time of Margaret Thatcher."



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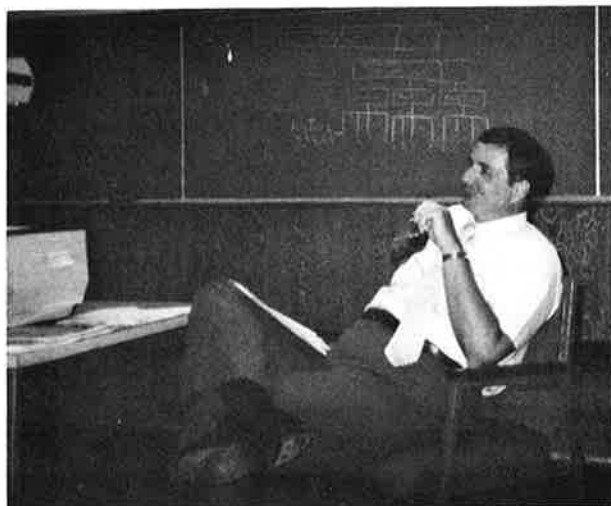
ACADEMY PANEL STANDS FIRM ON ICF

According to a member of the National Academy of Sciences Committee to review the Inertial Confinement Fusion Program (ICF), "The Committee has not and will not change a word in its interim report," a report that praises the accomplishments and significance of the ICF program. As we reported in our August newsletter, some staff members of the White House Office of Science and Technology Policy (OSTP) and the DOE Office of Classification were not pleased with some aspects of the report, since the report did not support recent Executive Branch policies on ICF.

"We listened to the Office of Classification's views for two hours and, when the session ended, we were more convinced than ever that we were right in criticizing their policies," according to a panel member. Miffed by what a source called "nitpicking by an OSTP staff member," the Academy requested that OSTP "put its criticisms in writing." "After receiving and discussing the written OSTP criticisms, the panel decided not to change its interim report in response to OSTP either," according to a panel member.

It is not clear whether the panel will prepare a formal letter response to OSTP or simply hold informal discussions with OSTP staff. The Academy has not released the interim report for distribution "because it is under contract to deliver the report to OSTP," according to another source. "It is up to OSTP whether to distribute it further," he said. At press time OSTP was still sitting on the report and had even recalled a copy from the Department of Energy.

Meanwhile, the panel itself is deliberating in more detail so that it can make specific programmatic recommendations in its final report, due around the end of the year.



DR. CHARLES BAKER HEADS PLANNING STUDY

MAGNETIC FUSION PLANNING EFFORT DEFINED

The magnetic fusion community is engaged in a significant effort to prepare technical planning documents to describe in detail how the policies and strategies of the recently-issued Magnetic Fusion Program Plan (DOE/ER-0214) will be implemented. Dr. Charles Baker, director of the Fusion Power Division of Argonne National Laboratory heads the effort. Draft analyses are being prepared by a Steering Committee consisting of approximately 25 leaders of the community, organized into three groups: Plasma Science (headed by Jim Callen of the University of Wisconsin), Fusion Technology (headed by Mohamed Abdou of UCLA), and Fusion Systems (headed by Steve Dean of Fusion Power Associates).

The effort, called the Technical Planning Activity (TPA), now has a mission statement from the DOE Office of Fusion Energy. It states that "The purpose of the Technical Planning Activity is to assist the Office of Fusion Energy by developing a methodology for planning the national magnetic fusion program and by preparing technical

planning documents in support of the strategic and policy framework of the Magnetic Fusion Program Plan (MFPP)."

The mission statement says "The TPA will define program elements and subelements that provide a basis for developing program plans that solve the four key MFPP technical issues (Confinement Systems, Burning Plasmas, Materials, and Nuclear Technology). The TPA will also prepare program plans for completing the program in such a way that the three MFPP strategic objectives (Science Development, Technology Development, and Technology Transfer) are fully satisfied. The following items describe the scope of this activity.

- Identify technical issues that must be resolved to fully resolve the four key technical issues.
- Identify program elements and subelements to resolve the technical issues.
- Prepare statements of objectives for program elements and subelements and attributes that measure progress toward achieving those objectives.
- Develop technical plans for each program element that include research activities, experiments, and test facilities and identify decision points and milestones. These plans should:
 - Consider existing programs and facilities in the U.S. and abroad and possible modifications.
 - Identify necessary and/or desired characteristics of new facilities.
- Develop logic networks to show interdependence among the various program elements or subelements.
- Identify resource requirements for technical plans.
- Stimulate the development of community consensus and recommendations for priorities within program elements."

FUSION NOVEL PUBLISHED

Bari Wood, author of the best sellers The Killing Gift and Twins, has published a new novel called LIGHTSOURCE, the name given by her to the fusion project (New American Library, 1984). The book describes how the key pieces of the fusion puzzle fall into place in the late 1980's through the efforts of Emily Brand, "a brilliant physicist and vibrantly individual woman who refuses to play society's games." While attempting to bring the significance of her discoveries to the attention of the President, she experiences the wrath of government bureaucrats and oil company executives who, the novel asserts, control them. In desperation, Emily sends her materials to the science editor of the New York Times, who in turn asks a consultant to evaluate the ideas. The consultant, who also turns out to be in the employ of the oil company, downplays the significance of the work, asserting "This stuff is hardly new. It's good enough work, but it was done--by which I mean built and tried--four years ago at Livermore."

Drama is provided by having physicist Brand desperately seeking to avoid assassins hired to kill her by the villainous oil baron. In the end, she is more than a match for them, although they do manage to blow up a small plane carrying Brand's laboratory director, maverick scientist "Marvin Lipsky."

You can obtain a copy of the novel from Fusion Power Associates for \$17.50, including postage. It will make a great gift for your relatives and friends!

NUCLEAR STRATEGY PLAN COMMISSIONED

Secretary of Energy John Herrington has asked the Energy Research Advisory Board (ERAB) to prepare a strategic national plan for civilian nuclear power. John Landis, senior vice president of Stone and Webster Engineering Corp., will head an ad hoc panel to prepare the report. Landis is newly appointed vice-chairman of ERAB and is also a member of Fusion Power Associates' Board of Directors. In what observers see as an unusually accelerated study schedule, Herrington has asked to have a draft report by October 1, an interim report in November and a final report in February.

SYSTEMS STUDIES PANEL REPORTS TO MFAC

A panel, chaired by Bill Stacey of Georgia Tech, that was commissioned by the Magnetic Fusion Advisory Committee (MFAC) last February to review DOE's Magnetic Fusion Systems Studies Program, has submitted a 34-page report with 18 recommendations: In its most important and controversial recommendation, the panel stated:

- "Relative to the present funding level for the Systems Studies Program, funding of commercial reactor studies should be approximately doubled (to ~\$5M annually), funding for integrated fusion facilities and near-term studies other than the ignition experiment should be maintained at about the present level (~\$2M annually), and funding for critical technical issues should be maintained at about the present level (~\$3M annually)."

This recommendation of the panel reflects a widespread feeling in the systems community that it was being burdened unfairly with the costs of designing a potential near-term tokamak ignition device to the detriment of its traditional role of looking at the long-term systems aspects of fusion engineering and commercial fusion power reactors.

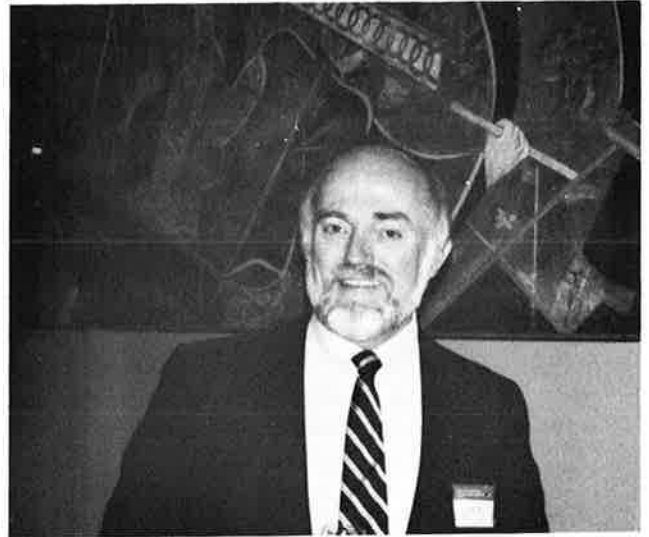
The panel report states:

"When near-term design activities develop a greater sense of immediacy, as for example in the case of the compact ignition device, there is pressure for these activities to dominate the systems studies budget, to the detriment of the other activities."

The above statement led to the second panel recommendation:

- "Only the present, conceptual design phase of the ignition experiment should be funded entirely out of the Systems Studies budget. During the transition to detailed design, substantial additional funding must be provided in order to maintain the funding distribution recommended above."

In related recommendations, the panel criticized the DOE's management practice of carrying out near-term and long-term commercial designs by coordinating the activities of small groups all over the country. It called for consolidation under a responsible institution.



WESTON (BILL) STACEY HEADS SYSTEMS PANEL

On the near-term device, the panel recommended:

- "The conceptual design of a burning plasma (ignition) tokamak experiment should be carried out by a design team managed by the responsible laboratory so as to provide continuity into the detailed design and construction phases."

On commercial reactor studies, the panel recommended:

- "Commercial reactor studies should be carried out by advocacy groups located at the confinement laboratories within which the confinement concept is being developed, who have the technical expertise and a strong incentive to find innovations that would lead to an attractive reactor concept. Such studies should also be carried out by groups in 'neutral' institutions to obtain an overall balance in perspective."

The panel thought that coordinated, multi-institutional studies were acceptable for studies of mid-term integrated fusion facilities. They recommended that:

- "The planning, preconceptual design and R&D assessment for candidate integrated fusion facilities should be carried out by a multi-institutional design team(s). This activity must be closely coupled to the long-range strategies of foreign fusion programs. Laboratory, industry and university participation should be established."

the panel commented that magnetic fusion and inertial fusion systems aspects "have a significant degree of commonality." They recommended that additional effort be put into joint program planning and into joint assessment of the results.

MFAC itself was not able to agree on whether the systems studies effort in general, or the long-term studies aspects in particular, should be expanded at the expense of other parts of the fusion program. In a covering letter transmitting the panel report to DOE Director of Energy Research Alvin Trivelpiece, MFAC chairman Ron Davidson said that, "additional time would be required to formulate detailed recommendations based on the Panel's findings. While some members of the Committee differ with the Panel on the details of recommended funding levels, we agree with the overall priorities outlined in the Panel Report." Davidson said further, "In particular, it is important to maintain an adequate level of effort on commercial reactor studies, critical issues studies and studies of integrated fusion facilities at a time when an increased effort is required to define the technical issues for a compact ignition experiment. However, MFAC does not believe that it is appropriate to make specific recommendations on funding increases for the Fusion Systems Studies Program without further assessment and discussion." Davidson appointed a subcommittee of MFAC to study the matter further and promised a final MFAC position statement in late November.

HEAVY ION FUSION STUDY

In a report entitled "Identifying Heavy-Ion Beam Fusion Design and System Features with High Economic Leverage" (UCID-20420) dated March 3, 1985, Wayne Meier and Bill Hogan of LLNL have conducted parametric economic studies for heavy-ion beam fusion electric power plants. They examined the effects on the cost of electricity of several design parameters: maximum achievable chamber pulse rate, driver cost, target gain, electric conversion efficiency, and net electric power. They found, with reasonable assumptions on driver cost, target gain, and electric conversion efficiency, a 2-3 GWe heavy-ion beam fusion power plant, with a chamber pulse rate of 5-10 Hz, can be competitive with nuclear and coal power plants. For further information, contact Wayne on (415) 422-5473 or Bill on (415) 422-1344.

PEOPLE

William Hoover, Assistant Secretary for Defense Programs, whose responsibilities have included inertial confinement fusion, has announced his resignation from DOE effective October 1.

Tom Martin of Sandia National Laboratory, Albuquerque, has been designated to receive the IEEE's Erwin Marx award for his contributions "in the field of high power accelerators and the techniques for generating and transporting terawatt electrical pulses."

Peter H. Rose has departed his position as president of Spectra Technology, Inc. effective August 1, 1985. Robert E. Center has assumed the role of Acting General Manager. Pete can be reached at 2115 East Crescent Drive, Seattle, WA, 98112, (206) 325-8442.

MEETINGS

4-8 November - American Physical Society, Division of Plasma Physics, Town and Country Hotel, San Diego, CA.

10-14 November - American Nuclear Society Winter Meeting, Hilton Hotel, San Francisco

12 November - ANS Fusion Energy Division Executive Committee Meeting, San Francisco Hilton, Teakwood Suite A, 5:00-7:00P.M.

18-22 November - IEEE Eleventh Symposium on Engineering Problems in Fusion Research, Austin, TX. Contact Ms. Dawn East, Fusion Research Center, University of Texas at Austin, Austin, TX, 78712

19-22 November - First International Conference on Fusion Reactor Materials, Tokyo, Japan. Contact Prof. R. R. Hasiguti, Science University of Tokyo, Shinjuka-ku, Tokyo, Japan, 162.

2-6 December - Eighth International Conference on Lasers '85, Sahara Hotel, Las Vegas, NV. Contact (703) 241-8909.



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ACADEMY'S ICF REPORT STILL UNDER WRAPS

The Executive Branch continues to keep from the public the Academy of Sciences' interim report on the review of DOE's inertial confinement fusion program. The report was to be sent to the Congress in July, but neither the Congress nor the public has seen it yet. The Academy submitted an unclassified report on schedule to the White House Office of Science and Technology Policy (OSTP) more than two months ago. Executive Branch officials responding to inquiries on the whereabouts of the report give responses ranging from "The report is classified," to "The interim report doesn't say anything and is not important." One official told us that the Executive Branch was going to prepare its own interim report and considered the Academy's report to be only "input information." Another told us that the Executive Branch expected the Academy's final report to be more critical of the inertial fusion program and felt that to release the interim report, which is very positive, would be "misleading." In any case, for reasons that are unclear, it seems that the Executive Branch does not wish the interim report to be distributed.

NEW HIGH DENSITY TEST FACILITY PLANNED

The DOE Office of Fusion Energy has decided to develop a central facility for testing high power density (compact) fusion concepts. The facility will be located at Los Alamos National Laboratory. The facility will be designed to test concepts such as the Reversed Field Pinch concept developed at Los Alamos and the OHTE concept developed at GA Technologies and Phillips Petroleum. The facility is also to be designed, however, so that tests of advanced versions of field reversed concepts (FRC's) and spheromaks will be possible in the future.



MIKE ROBERTS AND E.P. VELIKHOV HEADED THE U.S.-U.S.S.R. DELEGATIONS

US-USSR FUSION COORDINATION MEETING

The eleventh meeting of the US-USSR Joint Fusion Power Coordinating Committee was held in Moscow on September 19 and 20. The initial exchanges of the 1985 program were reviewed. Special recognition was given to the significant mutual benefits derived from the stellarator visit to Kharkov by Dick Colchin (ORNL) and John Treffert (University of Wisconsin).

It was agreed to continue the level of six visits each way in 1986, including activities in the tokamak, stellarator and mirror programs, both experimental and theoretical. The 1986 program will be enhanced over the 1985 program by increased emphasis on long-term participation in major experiments and participation in a set of component acceptance tests on TFTR and T-15. In addition, the two sides also introduced

and discussed new ways to improve communications and to strengthen and broaden the cooperative work. Both sides agreed that the planned 1986 program represents an equitable balance of mutual and significant benefits.

The U.S. delegation was headed by Michael Roberts (DOE) and included T. K. Fowler (LLNL), H. P. Furth (PPPL), D. B. Nelson (DOE), M. W. Rosenthal (ORNL) and J. W. Willis (DOE). The formal meeting was preceded by visits to Soviet laboratories in Novosibirsk, Leningrad, Kharkov, and Moscow. The Soviet delegation was headed by E. P. Velikhov.

THE US-USSR STELLARATOR COOPERATION

Recent visits of U.S. fusion scientists to the USSR provide an example of the US-USSR scientific and technical cooperation at work.

Over a year ago, Jim Rome and Jeff Harris of ORNL's Fusion Energy Division began to consider how best to make magnetic field measurements to assure proper coil alignment on the ATF torsatron, scheduled for operation at ORNL late in 1986. Confinement in this and in other stellarator-like devices can easily be spoiled by the field errors introduced by small misalignments. They devised a novel technique for aligning coil dipole moments that would eliminate the most likely sources of large-scale field errors. While the concept was attractive for use on ATF, a number of uncertainties needed to be resolved, and this could be accomplished best by a full scale test.

While on a US-USSR exchange to the Kharkov Physico-Technical Institute in November 1984, Rome and Harris heard a Soviet report that the plasma radius in the URAGAN-3 torsatron was about half that anticipated. Coil misalignment was suspected. Rome and Harris suggested that their technique be used in diagnosing the problem. Arrangements were made for joint work on URAGAN-3 to make the required field measurements. The Soviets supplied detailed specifications on the URAGAN-3 coil arrangement. Harris and Doug Lee (of Martin Marietta Energy Systems' Computing and Telecommunications Division) made calculations that predicted the outcome of various misalignments.

This summer, Dick Colchin, ORNL-FED, and John Treffert, a graduate student from the University of Wisconsin, went to the USSR. The URAGAN-3 group, under Oleg Pavlichenko, had prepared a probe positioning device and a magnetic field probe, and the U.S. participants arrived with other probes and the results of the Harris-Lee calculations. The measurements were performed over a 10-day period. Results agreed closely with one of the data sets provided by Harris and Lee, and indicated that the vertical field coils were horizontally shifted approximately 10 mm with respect to the helical field coils. Less precise mechanical measurements of the coil positions supported this conclusion. Moreover, with this error, ORNL calculated the same reduced plasma radius as was measured by the Soviets. The coils are currently being realigned.

This cooperative venture should result in improved performance for URAGAN-3, and it provided a real-world validation of a technique developed and proposed for ensuring precise coil alignments on ATF. The technique can now be applied with confidence that it will do the required job.

SBIR SOLICITATIONS

Small businesses wishing to submit proposals for 1986 awards should send proposals to appropriate government agencies by January 15, 1986. Those wishing details on how to submit proposals should contact SBIR Program Manager, U.S. DOE, Washington, D.C., 20545, (301) 353-5707 for DOE programs or Defense Technical Information Center (202) 274-6902 for Strategic Defense Initiative and other DOD opportunities.

ANS/FED AWARDS

The Fusion Energy Division of the American Nuclear Society is soliciting nominations for two classes of awards. Nominations should be submitted no later than January 15, 1986 for the 1986 Outstanding Technical Accomplishment Award and the 1986 Outstanding Achievement Award. The first award is generally given to an individual with a track record of many years of outstanding contributions to fusion. The second award is usually given to an individual or team for a specific recent

outstanding contribution. There is no set documentation required to make nominations. Your letter should describe the reasons for your nomination in sufficient detail so that the awards committee can take action. Send your nominations to Nermin Uckan, ORNL, P.O. Box Y, Oak Ridge, TN, 37831 (615) 574-1354.

CLARKE REORGANIZES OFFICE

Office of Fusion Energy Director John Clarke has announced a reorganization of his office, consolidating the Toroidal Confinement Systems and Mirror Confinement Systems into the Confinement Systems Division (CS). John W. Willis will act as Director. Also, the Division of Planning and Projects will be replaced by International Programs (IP). Michael Roberts will act as Director. Responsibility for project management and facility operations oversight will be assumed by the CS Division. Thomas R. James, Warren A. Marton and Ernest R. Jones will transfer, with those functions, to CS. James M. Turner will move permanently to IP. The planning and program strategy functions will be the responsibility of the Associate Director's office.

The functions and structure of Applied Plasma Physics and Development and Technology (D&T) will remain the same. However, within D&T, the Reactor Technology Branch and the Reactor Systems Branch will be retitled the Fusion Technology Branch and the Fusion Systems Design Branch, respectively.

MATERIALS CONFERENCE SET

The Second International Conference on Fusion Reactor Materials (ICFRM-2) will be held on April 13-17, 1986, Marriott Hotel, Chicago, Illinois. It is sponsored by Argonne National Laboratory and cosponsored by ANS, the Nuclear Metallurgy Committee of TMS/AIME, and ASM, several learned societies in Japan and Europe, and the U.S. Department of Energy. Papers are solicited in the following subject areas that relate to fusion applications: structural, magnet, special-purpose and high-heat flux materials; tritium breeding; fundamental radiation effects; safety and environment; and materials engineering. Abstracts and requests for more information should be sent to General Chairman, D. L. Smith, Fusion

Power Program, Argonne National Laboratory, Building 205, 9700 South Cass Avenue, Argonne, Illinois 60439, USA.

SUPERCONDUCTING MAGNETS ALL IN PLACE

On August 23 the sixth and final large superconducting coil arrived at ORNL and testing of all coils is now set to begin. The latest coil was designed and built for DOE by Westinghouse at its East Pittsburgh plant between 1977 and 1985. It joins five other test magnets already in place at the facility. Two of these were produced for DOE by General Dynamics Convair Division at San Diego and by the General Electric Company at Schenectady.

The other three magnets were produced under terms of an agreement arranged by the International Energy Agency. One was built by Hitachi for the Japan Atomic Energy Research Institute; one by Siemens AG under the direction of the Nuclear Research Center, Karlsruhe, West Germany, for the European Atomic Energy Community (EURATOM); and one under a contract between the Swiss Federal Office for Education and Science, Brown Boveri & Company, Ltd., and the Swiss Institute for Nuclear Research.

With the installation of the new Westinghouse magnet in ORNL's International Fusion Superconducting Magnet Test Facility, researchers have begun final preparations for a two-year test program aimed at developing large superconducting magnets for fusion power reactors of the future.

The \$36 million facility is a key technology testing site in the Department of Energy's national fusion program. ORNL is operated for the Energy Department by Martin Marietta Energy Systems, Inc.

MFAC IGNITION PANEL

A new panel has been established by the Magnetic Fusion Advisory Committee (MFAC) to review the justification for a new compact tokamak ignition experiment. The panel is being chaired by Dale Meade (PPPL), a member of MFAC. In his charge letter to MFAC, DOE Director of Energy Research Al Trivelpiece asked for MFAC's views by January 10, 1986, on the following questions:

- The importance and comprehensiveness of burning plasma phenomena likely to be acceptable in a compact tokamak experiment as well as phenomena that cannot be addressed in such a device.
- The quality of understanding of these phenomena that can be gained from experimental diagnostics and interpretive theory over the range in operating conditions expected to be available to a compact tokamak ignition experiment.
- The extent to which information gained in a compact tokamak ignition experiment is applicable to understanding burning plasma conditions in other toroidal and non-toroidal magnetic confinement systems.

RICK SCHRIEVER RECOVERING

Office of Inertial Fusion Director Rick Schriever is at home recovering from a successful kidney transplant. Get well wishes can be sent to Rick at 10833 Tuckahoe Way, Gaithersburg, MD, 20878.

DAVE ROSE HOSPITALIZED

Fusion pioneer Dave Rose, professor of Nuclear Engineering at MIT, underwent surgery in early October and is in serious but stable condition at press time. Get well wishes can be sent to Dave at Mt. Auburn Hospital, 330 Mt. Auburn St., Cambridge, MA 02238.

MAGNETIC FUSION ACCOMPLISHMENTS SURVEYED

Office of Energy Research Director Al Trivelpiece has asked the DOE's Office of Program Analysis to survey and report on the accomplishments of magnetic fusion energy research, in terms of contributions to the scientific, economic, environmental and defense activities of the U.S. An interim report is due in January 1986. The final report is due in mid-1986. The study is under the direction of Charles R. Mandelbaum (301) 353-3159.

FUSION FACILITIES DIRECTORY

The 1985-1986 Fusion Facilities Directory is now being distributed. If you haven't already ordered a copy, you should do so as soon as possible, as copies are limited and requests will be filled on a first-come basis. The purchase price per copy is \$20.00 which includes shipping. Send

your prepaid order to Ruth Watkins at 2 Professional Drive, Suite 248, Gaithersburg, MD 20879. Don't miss out on having this invaluable office tool!

IN MEMORIAM

British physicist and fusion pioneer Keith Roberts died last month after a long bout with cancer. Keith was a member of the original group that founded the Culham Laboratory. He was head of the theory group at Culham when he retired due to illness last year. He is best known for his many contributions to computational physics. Expressions of sympathy can be sent to his wife, Ann Roberts, at 5 Ethelred Court, Old Headington, Oxford, England.

MEETINGS

- 4-8 November - American Physical Society, Division of Plasma Physics, Town and Country Hotel, San Diego, CA.
- 10-14 November - American Nuclear Society Winter Meeting, Hilton Hotel, San Francisco
- 12 November - ANS Fusion Energy Division Executive Committee Meeting, San Francisco Hilton, Teakwood Suite A, 5:00-7:00P.M.
- 18-22 November - IEEE Eleventh Symposium on Engineering Problems in Fusion Research, Austin, TX. Contact Ms. Dawn East, Fusion Research Center, University of Texas at Austin, Austin, TX, 78712
- 19-22 November - First International Conference on Fusion Reactor Materials, Tokyo, Japan. Contact Prof. R. R. Hasiguti, Science University of Tokyo, Shinjuka-ku, Tokyo, Japan, 162.
- 19-22 November - Thirty Second National Symposium of the American Vacuum Society, Hyatt Regency, Houston, TX. Contact Marion Churchill (212) 661-9404
- 21-22 November - Magnetic Fusion Advisory Committee (MFAC) open meeting at Los Alamos National Laboratory. Contact Ron Davidson (617) 253-8102



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NEW AFFILIATE

Advanced Engineering Plastics (AEP), Freehold, NJ, has become the twenty-second Affiliate of Fusion Power Associates. AEP president Jeff Hubrig will be the company's representative. AEP has been providing support to the fusion programs at Oak Ridge National Laboratory and Princeton Plasma Physics Laboratory.

The Company has developed a proprietary process for non-destructively removing resin-based, dielectric insulation systems that are typically used to encapsulate electronic components. Engineers who have used the technique are calling it "revolutionary." The procedure, which is non-corrosive to aluminum, copper, brass, steel, gold and silver surfaces, allows access for fatigue/failure analysis or reliable recovery of costly electronic components.

More information can be obtained by writing the company at P.O. Box 889, Red Bank, NJ, 07701, (201) 780-6660. We welcome their participation in Fusion Power Associates.

LANDIS, STAUDHAMMER ELECTED

The Fusion Power Associates Board of Directors has elected John Landis to be Chairman and Peter Staudhammer to be Vice Chairman of the FPA Board of Directors. Landis is senior vice president of Stone and Webster Engineering Corp. Staudhammer is Manager, Energy Systems Operations, at TRW. The Board also re-elected Stephen O. Dean to be president and CEO and approved Ruth Ann Watkins as Secretary-Treasurer. All appointments are for two year terms commencing November 1, 1985.



JOHN LANDIS (l.) AND PETER STAUDHAMMER (r.), NEWLY-ELECTED CHAIRMAN AND VICE CHAIRMAN OF FPA'S BOARD OF DIRECTORS

CAPORALI, DEFREECE, DROLET ELECTED

The representatives of FPA's member companies elected Renzo Caporali, Dale DeFreece and Tom Drolet to three-year terms on FPA's Board of Directors. Caporali is president, Aircraft Systems Division, Grumman Aerospace Corp.; DeFreece is program manager, nuclear technology, McDonnell Douglas Astronautics Co.; Drolet is program manager, Canadian Fusion Fuels Project, Ontario Hydro. The member representatives also re-elected for additional three-year terms: Christian C. Bolta (Combustion Engineering), Stephen O. Dean (Fusion Power Associates), Harold Forsen (Bechtel), Nicholas A. Krall (JAYCOR), Leonard Reichle (Ebasco Services), and Peter Staudhammer (TRW). There are nine other members of the Board whose terms expire at a future date. They are: Ray Beuligmann (General Dynamics), Ron Davidson (MIT), Ken Fowler (LLNL), Mel Gottlieb (Princeton), Bob Hirsch (ARCO), John Landis (Stone and Webster), Ken Matson (PSE&G), Bob McCrory (U. Rochester), and John Nuckolls (LLNL).

FUSION BUDGETS

The Congress has passed, and the President has signed, the first appropriations bill of FY 1986. The bill includes the Department of Energy budget. It contains \$382 million for magnetic confinement fusion and \$155 million for inertial confinement fusion. These amounts are \$8 million less for magnetic fusion, and \$85 million more for inertial fusion than the President's request. Compared to FY 1985, however, they represent a \$55 million reduction for magnetic fusion and a \$14 million reduction for inertial fusion. Although the bill has been signed, there remains the very real possibility that both programs could receive further cutbacks as part of a general "deficit reduction" bill that may pass the Congress in the near future.

HISTORY OF FUSION BUDGETS

We occasionally get requests for information on the history of fusion budgets. Here, to the best of our knowledge, are the facts:

Fusion Budgets (\$M)

<u>FY 19</u>	<u>Magnetic</u>	<u>Inertial</u>
51-59	\$86.1	
60	33.7	
61	30.0	
62	24.8	
63	25.5	\$ 0.26
64	22.6	1.40
65	23.1	1.36
66	23.1	1.20
67	23.9	1.46
68	26.6	1.30
69	29.7	2.35
70	34.3	3.55
71	32.2	11.30
72	36.3	20.10
73	43.4	36.10
74	62.8	49.45
75	118.2	65.10
76	219.1	102.99
77	316.3	111.89
78	332.4	130.55
79	355.9	144.13
80	350.2	194.9
81	394.1	208.8
82	453.8	209.1
83	447.1	190.0
84	468.5	169.7
85	437.0	169.3
	<u>\$4,450.7</u>	<u>\$1,726.3</u>

WHAT THE COMPETITION IS UP TO, PART I

The DOE has prepared a draft 45 page "Strategic Plan for the Civilian Reactor Development Program." The plan has been given for review to an ERAB working group under John Landis. DOE says that, since the demise of the Clinch River Breeder project in 1983, its civilian reactor program has "lacked focus." DOE says its proposed new "strategic plan" is better than its old, focused, breeder reactor development strategy because the new plan "offers several new directions." The first "direction" is for DOE to support utility efforts to evolve a standardized, pre-licensed Light Water Reactor. The second "direction" is to set up an evaluation process for advanced reactor concepts such as "innovative LWR's, modular HTGR's, LMR's and other designs." The third "direction" is to seek international agreements to collaborate on breeder reactor development.

WHAT THE COMPETITION IS UP TO, PART II

The High Energy Physics Advisory Panel (HEPAP), in a mid-October report to DOE Director of Energy Research Al Trivelpiece, has re-affirmed its view that the U.S. needs a Superconducting Super Collider. The device is estimated to cost \$3-6 billion and be about 100 miles in circumference. The panel recommended that DOE adhere to the original schedule which calls for a siting decision in 1987, start of construction in 1988 and operation in 1995.

The HEPAP says that by 1995 most of the existing U.S. accelerators will be obsolete. The reason the U.S. must move expeditiously, according to the panel, is that the more modern European accelerators have upgrade capabilities superior to existing U.S. machines.

FUSION FACILITIES DIRECTORY

The 1985-1986 FPA Fusion Facilities directories are back from the printer and ready for mailing. The Directory contains the names and phone numbers of most people working in fusion in the U.S., tabbed by institution. The directory also contains organization charts for the fusion programs at 25 institutions as well as maps and travel information such as lodging rates. Every scientist, engineer, administrator,

and secretary working in fusion should have a personal copy of this valuable directory. Pre-paid orders (\$20.00 per copy) should be placed with Ruth Watkins at Fusion Power Associates.

CHARLES HARTMAN, LLNL, PURSUES NOVEL CONCEPT

Long-time fusion researcher Charles Hartman of LLNL, in collaboration with P. J. Meeker and J. H. Hammer, also of LLNL, is pursuing a novel concept that is appealing to a wide variety of interests ranging from basic energy sciences to fusion and defense. The concept involves the acceleration of magnetized plasma rings to produce high directionality plasma jets. The experiments have been given the name RACE (for Ring Accelerator Experiment). The concepts involve formation of a compact toroid from a plasma gun. The compact toroids can be accelerated over distances many times their own dimensions and to directed kinetic energies much greater than their stored magnetic and thermal energies. A magnetic fusion reactor design based on the concept is possible, but Hartman et al. have looked at many other applications. For example, they say the rings can be focussed onto an inertial fusion pellet, providing a cost-effective, multi-megajoule ion beam driver for ICF. The toroids could also be flung through space, becoming an effective kinetic energy weapon for the Strategic Defense Initiative. The concept can also be developed as fast opening (fractions of a nanosecond) switches. Other applications envisaged by the investigators range from a high fluence neutron source to the mass production of transuranic elements.

Experimental tests are planned at LLNL using the 2X-IIB magnetic mirror fusion facility. Those wishing more information on the fascinating array of ideas and calculations on these concepts should contact Charlie at (415) 422-1568.

FUSION-TRAINED ASTRONAUT

Dr. Franklin Chang-Diaz, who received his Ph.D. in fusion engineering at MIT under Professor David J. Rose is scheduled to be one of the scientist-astronauts aboard the December 20 space shuttle. Frank has been working with NASA for the past 5 years. The group plans to deploy two communications satellites and to conduct a variety of materials science experiments.



DAVID J. ROSE

IN MEMORIAM

DAVID J. ROSE, Professor of Nuclear Engineering at MIT and one of the originators of fusion engineering as a university discipline died October 24 in Cambridge at the age of 63. The fusion community, especially those of us who were privileged to be among his students, mourn the passing of this empathetic, brilliant and genuine individual. By his example, he taught us not to be satisfied with the status quo. Whenever the fusion community acted as though it had found "the way", Dave would put his inquisitive mind to work and propose other ways. He kept us on our toes. We will all miss him.

Expressions of sympathy may be sent to Mrs. Renate Rose, 100 Memorial Drive, Apt. 11-2C, Cambridge, MA, 02139. Charitable contributions in lieu of flowers may be made out to the Council for a Livable World or the Fellowship for Reconciliation. A memorial service will be held at the MIT Chapel on November 8 at 3:30 P.M.

DOE WORRIES ABOUT URANIUM INDUSTRY

The U.S. Department of Energy claims that it is not responsible for the development of new energy sources--this is the job of the private sector. Nevertheless, in a DOE press released dated September 26, 1985, on the U.S. uranium industry, Secretary of Energy, John S. Herrington stated "I have taken steps to help the miners and millers in this important industry that is currently under a great deal of strain." It may come as a surprise to the Secretary, but the fledgling fusion industry is also under a great deal of strain, and many of the fusion skills developed by industry during the past 10 years that could be used to accelerate the engineering development of fusion for practical application are being lost from the current program.

* CONGRATULATIONS JOHN AND LENORE CLARKE *
* *
* On the birth of your daughter Anna *
* Catherine (October 22, 1985, 7lbs.15ozs.) *
* Nice Work! *

CALL FOR PAPERS

Abstracts of papers are due December 15, 1985, for the Sixth International Conference on High Power Particle Beams (Kobe, Japan, June 9-12, 1986). Send to Dr. Chiyoe Yamanaka, Institute of Laser Engineering, Osaka University, 2-6 Yamadaoka, Suita, Osaka, Japan.

Abstracts (200-300 words, 12 copies) are due January 15, 1986, for the Thirteenth International Symposium on Electron, Ion and Photon Beams (IEEE/AVS, Boston, May 27-30, 1986). Send to Prof. Andrew R. Neureuther, Dept. EECS 231 Cory Hall, UC Berkeley, CA, 94720 (415) 643-8167.

Summaries are due January 10, 1986, for the Seventh Topical Meeting on the Technology of Fusion Energy (ANS, June 15-19, 1986, Reno NV). Send to Carl Henning, LLNL, P.O. Box 5511, L-644, Livermore, CA, 94550 (415) 422-0235.



JAPANESE SCIENTISTS VISIT ORNL

Tsuneo Fuginami and other officials of the Japanese Atomic Energy Research Institute (JAERI) visited Oak Ridge National Laboratory recently to discuss cooperative programs and to receive briefings in a variety of laboratory research areas, including the recently completed International Fusion Superconducting Magnet Test Facility. JAERI is one of three international participants in the project. Shown in the accompanying photo are (l. to r.) Murray Rosenthal, ORNL associate director for Advanced Energy Systems; ORNL director Herman Postma; Fujinami; Kiyoshi Yoshizawa, manager of the Secretariate Service Division in JAERI's Department of General Affairs and Takashi Takeda, manager of JAERI in Washington, D. C.

MEETINGS

20-21 November. Magnetic Fusion Advisory Committee (MFAC) open meeting. Sheraton Hotel, Santa Fe, NM. Contact Ron Davidson (617) 253-8102.

1-6 December. Lasers '85. Society for Optical and Quantum Electronics. Sahara Hotel, Las Vegas. Contact (800) 634-6666

9-11 December. Seventh International Conference on Alternative Energy Sources, University of Miami. Contact (305) 284-4666.



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RASMUSSEN AND ROSENBLUTH HONORED

Fusion scientist Marshall N. Rosenbluth of the University of Texas and MIT nuclear engineering professor Norman Rasmussen have been selected to receive the highest scientific honor bestowed by the U.S. Department of Energy, the Enrico Fermi Award.

The award, named in honor of the man who achieved the first nuclear chain reaction, consists of a presidential citation, a gold medal and a tax-free \$100,000.

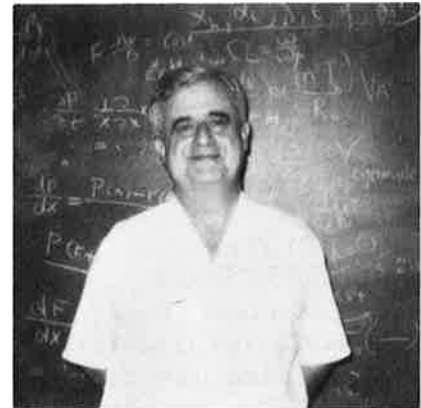
Rosenbluth, fondly known in the international fusion community as "the Pope of Plasma Physics" is being honored "for his leadership in the development of modern plasma theory." Rasmussen is honored "in recognition of his pioneering . . . development of probabilistic risk assessment that . . . led to new developments in nuclear power plant safety."

In a press announcement of the selections, DOE cites Rosenbluth's "rich and prolific output of research" and states that he "has profoundly advanced the understanding of controlled thermonuclear fusion, particularly in regard to stability and confinement."

FUSION AT THE SUMMIT

President Reagan and Soviet leader Gorbachev gave joint recognition to the long-standing US-USSR record of successful cooperation in fusion research by advocating fusion cooperation in the final paragraph of their official joint statement. Their statement reads as follows:

"The two leaders emphasized the potential importance of the work aimed at utilizing controlled thermonuclear



**FERMI AWARD WINNER
MARSHALL N. ROSENBLUTH**

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."

The president followed up his endorsement in his nationally-televised report to a joint session of Congress, saying:

"As a potential way of dealing with the energy needs of the world of the future, we have also advocated international cooperation to explore the feasibility of developing fusion energy."

To our knowledge, it is the first time in history that a president of the United States has publically advocated fusion in a nationally-televised address. President Nixon created some concern in the fission reactor community in the early '70's by predicting, in a west coast speech, that

fusion would "leapfrog the breeder." And President Carter advocated fusion in a White House ceremony while signing the Magnetic Fusion Energy Engineering Act of 1980.

The modern era of extensive US-USSR cooperation began formally in 1973. Since that time, a US-USSR Joint Fusion Power Coordinating Committee has met annually to review progress and plan scientific exchanges. In the past six years the extent of the cooperation has declined as a result of political factors, but the depth of good will between fusion scientists in both countries has remained. The activities of the International Atomic Energy Agency (IAEA) in Vienna has been a major contributor to worldwide cooperation in fusion through sponsorship of biennial fusion conferences and the international design effort of a major fusion engineering device called INTOR (for International Tokamak Reactor).

PBFA-II READY TO FIRE

Sandia Laboratories' new 3.5 megajoule Particle Beam Fusion Accelerator (PBFA-II) is expected to fire its first test shot in mid-December. The device is designed to eventually focus a beam of lithium ions onto a small pellet containing a deuterium-tritium mixture with sufficient intensity to create a self-sustaining fusion reaction.

During the first stage of testing, the facility will operate without pellets, testing instead the technique for focusing the beams. This stage is expected to take about 2 years. Sandia was successful in focusing a beam of protons in the smaller PBFA-I facility (see our May 1985 newsletter) and the scaling information obtained in that experiment has given Sandia researchers confidence in PBFA's ultimate potential. The Sandia work is under the general direction of pulsed power manager J. Pace VanDevender. Gerry Barr is Project Manager for the PBFA-II project; fusion research is managed by Don Cook.

NEW ACADEMY FUSION STUDY

The DOE has commissioned the National Research Council of the National Academy of Sciences to carry out a study of the "technical status and potential applications" of fusion-fission hybrid reactors based on magnetic confinement. A committee has been



SANDIA RESEARCHERS GERRY BARR (l.)
AND DON COOK

formed under the chairmanship of retired Westinghouse executive John W. Simpson. Simpson has a distinguished career background as a leader in the development of naval reactors.

The committee was requested to consider the following questions:

- . "What are future energy circumstances in which the hybrid might offer significant advantages?"
- . "What is the status and what are the prospects of technology in the United States and elsewhere relevant to hybrids?"
- . "What is the range of technical options for the hybrid application of fusion energy, and what are the economic and environmental risks and benefits of these options?"
- . "What is a reasonable timetable for development and deployment of the hybrid?"
- . "If the hybrid application appears to have merit in future U.S. energy circumstances, how might it best be approached?"

The committee will hold its first meeting in Washington on December 16-17 and will take nine months to complete its activities. Other members of the committee are: M. Abdou (UCLA), D. Cohn (MIT), H. Feiveson (Princeton Univ.), R. Gould (CalTech), H. Kouts (Brookhaven), C. Max (LLNL), T. Pigford (UC/Berkeley), R. Priory (Duke Power), H. Reinsch (Bechtel). Information on the activities of the committee can be obtained from the National Research Council's John Richardson (202) 334-3344.