



FUSION POWER ASSOCIATES

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1979-1994 CELEBRATING OUR FIFTEENTH YEAR

FIFTEEN YEARS OF FPA

Fusion Power Associates was incorporated in California on August 16, 1979 as a public benefit corporation. Its articles of incorporation were signed by Stephen O. Dean, Nicholas A. Krall, and Alvin W. Trivelpiece. Ten U.S. companies became charter members of the association. Of these, four are still full voting members in the association: EBASCO Services, General Atomics, McDonnell Douglas, and SAIC. Currently there are fifteen full voting members, including B&W Nuclear Technologies, Babcock and Wilcox, Bechtel National, General Dynamics, Grumman Aerospace, Hydro-Quebec, Ontario-Hydro, W.J. Schafer Associates, Stone & Webster, TRW, and Varian Associates. In addition, FPA enjoys the participation of 32 non-voting institutional affiliates, including 13 small business affiliates. We have four electric utilities participating. We also have over 250 individual affiliates. We thank all of our participants for their past, present and (hopefully) future support.

On November 7, 1980 Fusion Power Associates received a determination from the U.S. Internal Revenue Service that it qualified under section 501(c)(3) of the Internal Revenue Code as a non-profit, tax-exempt research and educational foundation. We have had one on-site audit by the IRS during the past 15 years, which certified that the activities in which we were engaged entitled us to maintain our exemption. These activities are aimed primarily at promoting research and development of fusion for the benefit of society and providing a medium for coordination, cooperation and the exchange of information among all organizations and persons, public and private. Individuals or corporations may make tax-deductible contributions to Fusion Power Associates.

We are currently conducting a survey of our members and affiliates to assist us in evaluating our past activities and to help us to improve. The results of the survey will be published in the near future.

Our most popular service has been our monthly Executive Newsletter, which has been issued regularly since December 1979. Other popular activities have been our annual meetings/symposia, which have been published in the Journal of Fusion Energy (Plenum Press), our testimonies to Congressional committees and our periodic issuance of the Fusion Facilities Directory. Over the years we have assisted in the production of several television documentaries and a National Geographic educational video, organized fusion presentations for various conferences and schools, and worked with the fusion community in the preparation of policy statements and program evaluations.

A primary theme of our activities has been to foster a spirit of communication among various interest groups: government/industry/laboratory/university and magnetic/inertial fusion program leaders.

The primary hindrance to achieving our goals during the past 15 years has been the lack of a consistent U.S. government fusion policy. Shortly after our formation, we participated in the formulation of a government policy (as codified in the Magnetic Fusion Energy Engineering Act of 1980) which aimed at the operation of a fusion demonstration reactor by the year 2000. We established a Leadership Award program in 1980 to recognize the primary architects of that policy and presented the first awards to Congressman Mike McCormack, Senator Paul Tsongas,

Dr. Solomon J. Buchsbaum and Dr. Robert L. Hirsch. However, in the early 1980's the Administration announced that fusion would be a "science only" program with no specific date for the operation of a demonstration reactor. Edwin Kintner, who was the head of the DOE fusion program at the time, resigned in protest, stating his view that the Administration was making "a national error for which a price far greater than present savings will be paid at some future date." (See our January 1982 newsletter). FPA gave Kintner its Leadership Award. These awards have continued annually since that time. In addition, we have established Distinguished Career and Excellence in Fusion Engineering Award programs. One popular program, our Fusion Energy Educational Development Seminar (FEEDS), for senior secretarial and administrative personnel working in fusion, had to be discontinued in 1990 when DOE abruptly told us (after 10 years of participating) that it would not approve the use of program funds for sending non-scientists on travel to conferences. (We still hope that someday they will see the chauvanism inherent in this stance!)

Space does not permit us to reminisce over all the ups and downs of fusion policy of the past 15 years. They are well-chronicled in our newsletters. Suffice it to say that the most recent government fusion policy (albeit framed by the last Administration) calls for the operation of a demonstration fusion reactor in 2025. It is clear, however, that the funding profiles of the fusion program over the past few years is not consistent with this goal, an inconsistency which history shows does not bother government planners in the least.

An event which had an overwhelming impact on current fusion policy was the Reagan-Gorbachev Summit Meeting in November 1985. The two leaders agreed to collaborate on fusion development and subsequently this collaboration was expanded to include the European Community and Japan. The result is the current focus of the magnetic fusion program worldwide on the design, R&D and potential construction as a joint international project of the International Thermonuclear Experimental Reactor (ITER). Since program budgets in the U.S. have not been expanding (see our December 1993 newsletter), this focus on ITER has resulted in the decline or demise of most alternatives to the tokamak concept as well as hampered research on improvements to the tokamak itself. Fusion Power Associates has consistently maintained that "it would be premature, at this stage, to judge which of the variety of magnetic and inertial fusion concepts will ultimately succeed

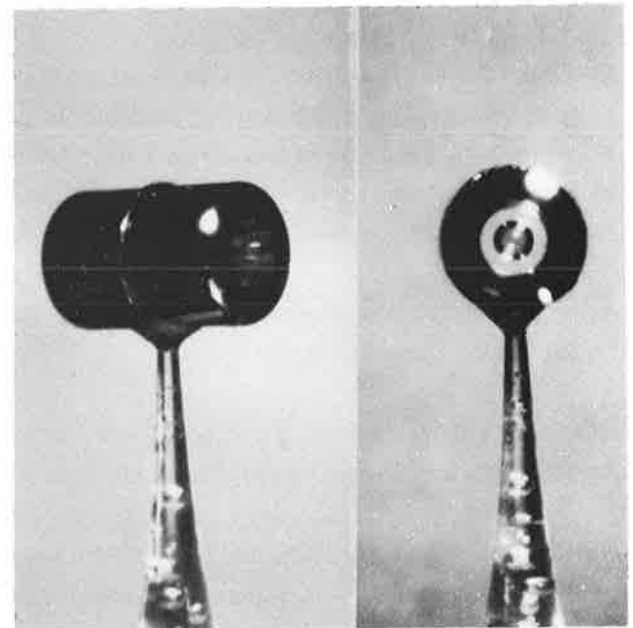
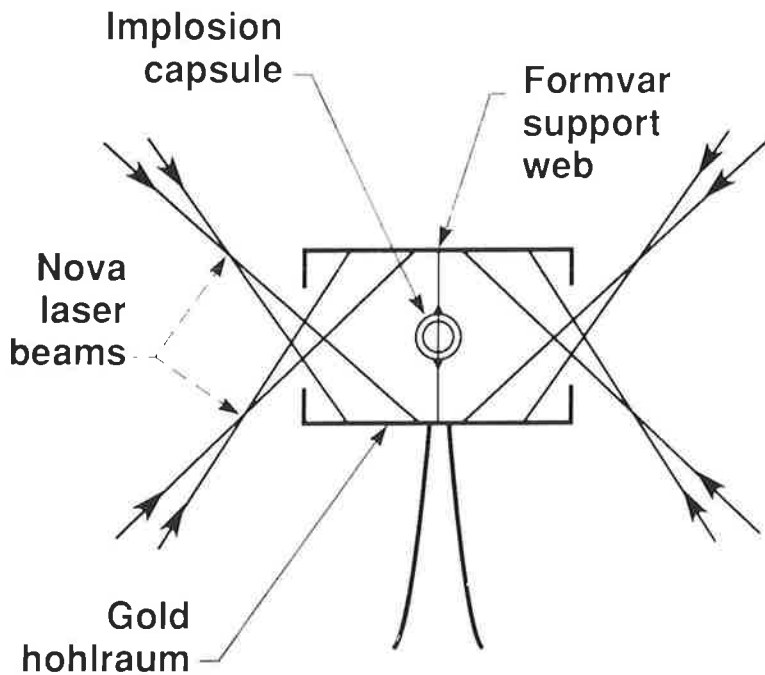
commercially," while also maintaining that "this fact should not discourage use of the best available concepts in the design and construction of needed fusion test facilities." (quotes taken from FPA Board of Directors Policy Statement, available on request) A recent report (November 1993) on this subject by FPA president Steve Dean, entitled "Fusion Power Development Pathways", is available on request.

Inertial confinement fusion policy, which has historically been set within the context of the DOE nuclear weapons programs, has been only slightly more stable than that of the magnetic confinement fusion program, which is managed within DOE's civilian energy research office. Periodically, over the past 15 years, attempts were made to disembowel the program and merge it out of existence within the weapons R&D budgets. Because of the more clandestine management style of the DOE weapons programs, and the clever use of classification to exclude broad participation in program planning and evaluation, it has been more difficult to stay on top of policy issues. For example, Fusion Power Associates was once forced to use the Freedom of Information Act to secure the release of a National Academy of Sciences review report on inertial confinement fusion (see our March 1986 newsletter). Inertial confinement fusion received consistent endorsements from a series of such reviews throughout the past 15 years, and recent DOE declassifications hopefully will permit a more open atmosphere to evolve, both nationally and internationally.

The fusion policy of the "new" Administration is not clear, despite positive statements from Energy Secretary O'Leary and President Clinton. This is due in part to the overwhelming budget-cutting climate and in part to other special interests that covet fusion's budget (see our December 1993 newsletter).

Despite the ups and downs of fusion policy, scientific progress has been steady, including the achievement of record values of plasma density-confinement time product at MIT, record values of plasma temperature at Princeton, record values of plasma beta at General Atomics and record values of plasma pellet compression at Livermore. In late 1991, the Joint European Torus produced almost 2 Megawatts of fusion power and last month the Tokamak Fusion Test Reactor produced over 6 Megawatts. Industry is anxious to participate in the construction of new fusion facilities during the next decade, including the Tokamak

Nova implosion target illustrating beam geometry



1 mm

Physics Experiment, ITER, and the inertial confinement fusion National Ignition Facility.

FIRST DECLASSIFIED ICF PHOTO

The accompanying photo was released by the Lawrence Livermore National Laboratory following the declassification by DOE of parts of its inertial confinement fusion program (see our December 1993 newsletter). On the right, the photo shows a picture of an actual gold micro-canister ("hohlraum") indirect drive target which is placed at the focal spot of the Livermore Nova laser. The dimensions of the hohlraum are approximately 1.5 mm in diameter and 3 mm in length. The laser entrance holes are approximately 1 mm in diameter. The spherical capsule which contains the fusion fuel is approximately 0.5 mm in diameter and is suspended within the hohlraum by a thin Formvar support web as shown by the diagram on the left. The laser beams are focused from two sides through the holes on either end of the hohlraum and aimed to illuminate the inside surface of the cylindrically-shaped hohlraum canister, producing x-rays that fill the inside of the canister and bathe the capsule, heating its surface and creating an implosion which compresses and heats the deuterium-tritium fusion fuel contained inside the hollow capsule.

BUYOUTS

Raytheon Engineers and Constructors, a subsidiary of Raytheon Corporation, has announced its purchase of Ebasco Services Incorporated from ENSERCH Corporation, with the exception of Ebasco's Environmental Division.

Martin Marietta Corporation has announced its plan to purchase the Space Systems Division of General Dynamics Corporation, including the group that develops superconducting magnets for fusion.

Both groups have been members of Fusion Power Associates.

PEOPLE

Russell Kulsrud has been awarded the 1993 Maxwell Prize by the American Physical Society Division of Plasma Physics.

Yoshiaki Kato, Kunioki Mima, Robert Lehmberg, Stephen Obenshain, Stanley Skupsky and John Soures have been awarded the 1993 Award for Excellence in Plasma Physics Research by the American Physical Society Division of Plasma Physics.

Michael Glinsky has been awarded the 1993 Simon Ramo Award for Outstanding Doctoral Thesis Research in Plasma Physics by the American Physical Society Division of Plasma Physics.

Don Correll has been named a Fellow of the American Physical Society "for being actively involved in science education with public audiences, pre-college, and college students and teachers, as well as an effective and committed spokesman for science education."

Ralph Moir has become chairman of the American Nuclear Society Fusion Energy Division.

Ron Miller has been elected Vice-Chair/Chair Elect of the American Nuclear Society Fusion Energy Division.

Bob Bourque, Chuck Flanagan, and Mark Tillack have been elected to the Executive Committee of the American Nuclear Society Fusion Energy Division. Mark will also serve as newsletter editor.

Gene McCall has been appointed to chair the Air Force Scientific Advisory Board. McCall is also a Los Alamos National Laboratory Fellow and recipient of the DOE E.O. Lawrence Award.

Barry Ressler has resigned as president of Universal Voltronics. He will be succeeded by *Dominick Conguisti*.

John Dawson has been appointed Interim Director of the UCLA Institute of Plasma and Fusion Research, replacing *Bob Conn* who has become Dean of Engineering at UC San Diego.

Ravi Sudan has been awarded the Gold Honorary Medal for Merits in the Field of Physical Sciences by the Academy Council of the Academy of Sciences of the Czech Republic.

STARPOWER REPORTS AVAILABLE

Thanks to the thoughtfulness of Gerald Epstein at the Congressional Office of Technology Assessment (OTA), Fusion Power Associates has a limited number of copies of the Summary and full report STARPOWER, the 1987 comprehensive review of fusion conducted by OTA. If you would like a copy of either for your personal library, please call us. They are free while supplies last.

IN MEMORIAM

Oak Ridge National Laboratory fusion pioneer *Wilhelm Gauster* died in Vienna, Austria on May 31, 1993 at the age of 92. His son, Wil, is a well known fusion researcher in his own right at the Sandia National Laboratories in Albuquerque and currently on assignment at the ITER Co-Center in Garching. Gauster was a pioneer in the field of superconducting magnets at Oak Ridge from 1957 until 1975.

Also during 1993, fusion pioneer *George Kelley* died. He was a leader of the Oak Ridge National Laboratory fusion effort during the 1960's.

QUOTABLE

"Companies are eager to 'downsize,' a slimy word that really means: 'Let's fire a few hundred or thousand employees to please Wall Street analysts, which will boost the price of our stock, endear us to our board of directors, make our executive stock options more valuable, and keep our management team intact.'"

Mike Royko
Syndicated Columnist
December 1993

AFFILIATES

Baltimore Gas and Electric Co.	Pitt-Des Moines, Inc.
Chicago Bridge and Iron Co.	Plasma Physics Laboratory
EG&G, Inc.	Princeton University
Fluor Daniel, Inc.	Rockwell International
Fusion Research Center	Rocketdyne Division
University of Texas	Spar Aerospace, Ltd.
Fusion Technology Institute	Toshiba Corporation
University of Wisconsin	United Engineers and Constructors, Inc.
General Electric Co.	Universal Voltronics, Inc.
Martin Marietta Energy Systems, Inc.	University of Rochester
Noell, Inc.	Westinghouse Electric Corp.
Northern States Power Co.	

SMALL BUSINESS AFFILIATES

Advanced Physics Corp.	Lodestar Research Corp.
Creare, Inc.	Rockford Technology Associates
Everson Electric Co.	Spectrum Engineering Corp., Ltd.
General Leasing and Management Co.	Stern Laboratories, Inc.
IGC Advanced Superconductors, Inc.	Thermacore, Inc.
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SURVEY SAYS: 7.5

TFTR PROGRESS

On December 9-10, scientists at Princeton conducted an historic series of experiments on the Tokamak Fusion Test Reactor (TFTR), producing over 6 Megawatts of fusion power (see figure). For the first time in a tokamak, an approximately 50-50 mixture of deuterium and tritium was used as the fusion fuel (see our December 13, 1993 special issue). A total of 99 experimental runs were conducted, of which 59 were "trace tritium" preliminary tests, 13 were tritium gas puffing plasmas (nearly pure tritium plasmas), and 27 were high power shots using tritium injection through the neutral beam heating accelerators.

Preliminary analysis indicates that the confinement in a deuterium-tritium plasma mixture is better than in a deuterium plasma, the ion and electron temperatures are higher, and the plasma stored energy is higher. No enhanced loss of alpha particles (the product of D-T fusion reactions) was observed as the fusion power was increased.

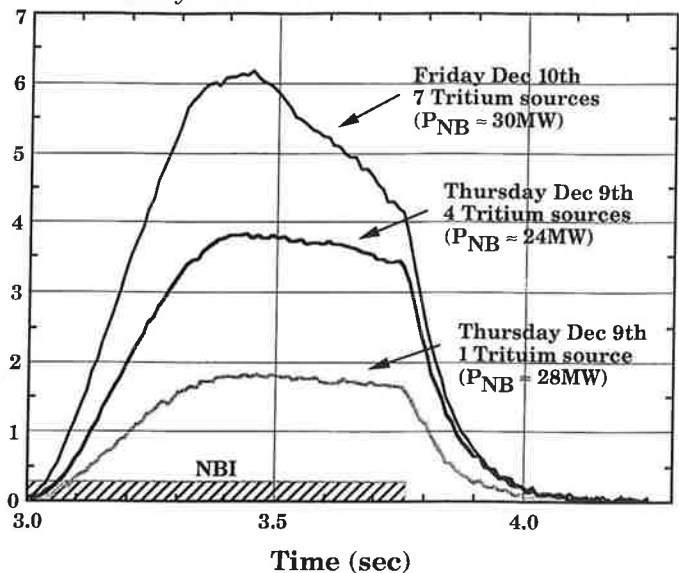
After a shutdown over the holidays and some routine maintenance during January, deuterium operations will begin again in early February, with deuterium-tritium operations expected around mid-February.

A workshop at which the results of the deuterium-tritium experiments will be discussed will be held at the Princeton Plasma Physics Laboratory on March 2-4. Anyone wishing to attend should contact Stewart Zweben at fax (609)243-2874 or e-mail szweben@pppl.gov

Our congratulations to all those at PPPL and elsewhere who have contributed to the success of TFTR over the years.

Fusion Power Megawatts

Preliminary Data



INITIAL D-T RESULTS FROM TFTR

SURVEY SAYS: 7.5

For the past year or so, almost everyone we know in government, laboratories and industry has been running off (or been sent off) to attend "total quality management" training seminars. Consequently, when the opportunity presented itself in the form of a two-day "Total Quality Management for Associations" seminar sponsored by the American Society of Association Executives, Fusion Power Associates president Steve Dean hustled off to attend.

Based on recommendations obtained at the seminar, we sent out a survey questionnaire in November to our "customers" soliciting their opinions on how we were doing, what they liked, what they did not like, etc. Based on the

results of the survey, we are going to try to continue to improve our satisfaction quotient with our constituents.

We defined our "customers" as being our institutional members and affiliates and our individual affiliates, since they are the ones whose annual dues allow us to continue our activities. We first asked the question: "On a scale of 1-10 (10 being best), how would you rate the overall performance of Fusion Power Associates in fulfilling its purpose and meeting its goals?" (See table for statement of our purpose and goals.) The average ratings received from our members, affiliates, and individual affiliates and the spectrum of responses are shown in the figures on page 3. The average of all responses was 7.5, with institutional members and individual affiliates rating FPA's performance slightly higher than did our institutional affiliates. The median rating of all responses was 8.

We then asked three open-ended questions. The questions were: (1) In arriving at your rating, what factors influenced you in a positive direction? (2) In arriving at your rating, what factors influenced you in a negative direction? (3) What aspect or activity of Fusion Power Associates is most important to you? A sampling of typical responses follows.

Positive Factors: "Excellence of conferences, seminars and newsletters," "Leadership of the president," "Excellent forum for the government and industry to work together towards common goals," "Focused communications regarding current activities in the fusion community," "Providing impetus regarding motivating support through awareness of issues," "Availability to give interpretation to current fusion-related events," "Good congressional ties, good public visibility, solid technical base," "Accurate and timely information for immediate business opportunities," "Focus on practical issues; varied membership includes a fair cross-section of those active in the field," "Good public visibility, surprising for such a small group; comes across very credible," "Efforts to initiate more technology/engineering oriented programs, such as Pilot Plant," "Awards to professionals and leaders," "Dedication and drive of FPA management," "Promotion of importance of elements needed to make transition from research phase to engineering development phase," "Impartiality, e.g., magnetic vs. inertial fusion," "knowledgeable, visible, dedicated, and persistent; newsletter is classy, timely, and accurate; you are known to and accessible to the national press."

FPA'S PURPOSE AND GOALS

PURPOSE

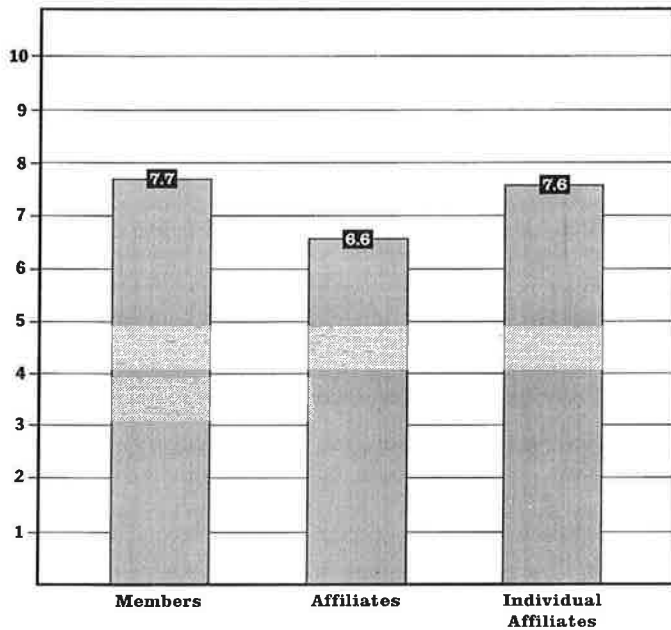
To ensure the timely development and acceptance of fusion as a socially, environmentally and economically attractive source of energy.

GOALS

- To ensure a smooth, timely transition from research on fusion science and technology to engineering development and application.
- 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.
- To foster the use of fusion science and technology in both commercial and government applications, including such areas as energy, space and national security.

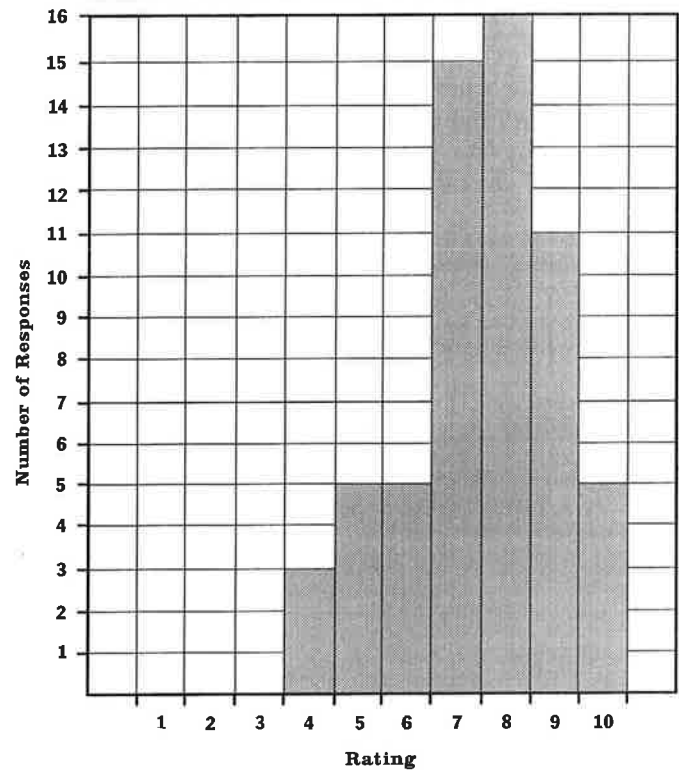
Negative Factors: "Lack of participation from the Board," "Insufficient emphasis on fusion alternate concepts," "I'd like to see more efforts toward public education and trying to whip up interest in fusion in the populace, but I don't know what FPA would do to get a budget to do this," "Achievement of some goals not really within the power of FPA," "Fusion runs at a pace that is hard to influence, thus FPA ability to influence is limited; it is hard to make anything happen," "FPA has not been able to convince the labs and DOE that industry must have prime role if fusion is to prosper (probably an impossible task)," "Insufficient effort in ensuring transition from research to engineering development and in promotion of fusion science for various applications," "Need more exposure at elementary, middle, and high school levels to carry concern to higher academia," "Low level of industry contributions," "Always room for improvement," "The goals you describe are not that important to us; we are an affiliate to reduce our cost in following fusion activities so that we can position ourselves to obtain fusion contracts," "I feel all your goals are still unmet and that you cannot control the events necessary for you to meet them; I also feel that you must keep trying; the

AVERAGE RESPONSE TO QUESTION:
On a scale of 1-10, how would you rate the overall performance of FPA in fulfilling its purpose and meeting its goals?



industry has abrogated control of the program to the government and researchers; the government now appears to be strangling the effort before it can even be born," "Need more involvement from utility companies," "FPA is just surviving, not thriving; perhaps we are not effective enough in advocating our position; on the other hand, the federal deficit, and other external constraints hamper our efforts," "FPA has not expressed any of the dismay of the working scientists over the direction of the program," "FPA mostly adheres to 'party line'; should help steer in best direction independent of major lab objectives and act as industry or public watchdog," "FPA hasn't (yet) changed the way DOE-OFE is still largely controlled by the national labs," "FPA is an OFE lapdog, not a watchdog, as evidenced by endorsement of ITER and lack of concern for the post-tokamak era," "Important topics are often missed or not given more than cursory mention; ITER is not given reasonable attention," "FPA has been of limited effectiveness in getting the message of the importance of fusion to the public or in raising support of new members of Congress and it has not been strongly supportive of universities," "FPA has neglected the utilities or couldn't get them involved; also had to cater to industry that was seeking contracts," "First goal hasn't been met, i.e., fusion is still controlled by physicists," "Too much attention is given to individuals instead of programs," "More attention should be given to heavy ion fusion," "No warning of Penny-Kasich Bill; no linkage or allies with pro-energy groups; no national press,"

SPECTRUM OF RESPONSES
AVERAGE OF ALL RESPONSES: 7.5



"FPA's involvement in technical work is not always useful; should put more effort in figuring out the positive aspects of fusion and how to use them to influence the fusion program and budget," "Tendency to follow and promote a policy that focuses on PPPL activities and positions and not on the overall good of the community," "FPA puts too much emphasis on engineering and not enough on science; I'd say scrub ITER and put the money in science," "FPA has had little political influence and serves mainly as an information center," "Occasionally too glib a presentation or interpretation of some fusion program issues," "Has not given wholehearted support to ITER," "Sometimes a tendency to promote or support nutty elements of fusion; sometimes going too far outside of fusion in newsletter," "lack of public information activity; low media presence," "No critical evaluation of anything," "No longer offering press articles; newsletter coverage too brief; no list of important fusion publications," "I'd like to see more coverage of alternatives to the tokamak," "Overly simple position on industry needs, when various parts of industry have different needs," "A little low on accurate technical review and analysis; lacking technical perspective," "I perceive you lend the FPA imprimatur to projects you are personally involved in more than you should (Pilot Plant, for example)," "The public/congressional programs need to be amplified," "FPA should help guard against the fusion community overselling fusion," "Too much emphasis on big program results; not enough on fundamental discoveries."

Most Important FPA Activities: Newsletter, Annual Meetings/Symposia, Congressional Testimony. "Positive representation of all elements of the fusion program -- universities, national laboratories and industry, magnetic and inertial fusion, fusion physics and technology, etc.," "Representation in Washington," "Comprehensive communications network it provides," "The opportunities FPA provides to meet and rub elbows with other senior managers of the program," "Steve's continuing voice and good sense," "Steve and Ruth," "Providing a sense of unity to the fusion program," "The FPA calendar," "FPA's existence as a voice for fusion."

WAKEFIELD COMMENTS

As part of the survey described above, we received the following commentary from fusion pioneer Ken Wakefield. Ken was engineering manager of the TFTR engineering group. He retired from Princeton Plasma Physics Laboratory in 1985 from his position as chief engineer for technical operations. He began his fusion career in 1958. He can be reached at 31 Blowing Fresh Drive, Keowee Key, Salem, SC, 29676.

Dear Steve:

I think you have kept your eye on the ball and have been skillful in preventing even deeper reductions in the support Congress and the Executive Branch have given to fusion. Your newsletters are informative, to the point and well balanced. This is why I continue to support you.

The powers that be don't pay enough attention. When TFTR went into operation in 1982, I thought we'd spend the next few years preparing for a *meaningful* next step. Instead we've been playing the old DOE (don't rock the boat) game -- with ever reduced goals and *no* increase in real money. Now that TFTR has or will shortly meet all its original goals, one would think there would be great rejoicing -- and upsurge of determination and hope -- but I don't see any of that -- not even from the Princeton people, probably because there wasn't anyone there who had any significant role in TFTR over most of the 20 years.

Maybe FPA can instill some new sense of urgency. But also, maybe I'm just an old codger living in the past. But seriously, maybe you can get the message across to the public -- and Congress -- and the White House -- and the Laboratories -- that the TFTR project and goals were accomplished in 20 years, just twice as long a period as the

Man-to-the-Moon project, at *much* reduced cost, much *greater potential* benefit to life on earth -- and faced with very much greater scientific challenge than the Moon program. In 1961 we *already knew how* to get to the Moon. In 1973, when Furth first spoke of TFTR, it was only faith and hope. Now it's fact -- and no one is telling the story.

I'll be 75 in June -- I wish it were 55.

Keep up the good work -- you're a good man, Charlie Brown.

Sincerely,
Ken Wakefield
10 Jan 94

KERST MEMORIAL FUND

The University of Wisconsin has established the Donald W. Kerst Memorial Fund to honor his memory. Don died on August 19, 1993 at the age of 81 (See our October 1993 newsletter). The fund will be used primarily to bring distinguished visitors to the University to give lectures and discuss topics of common interest with students and faculty. Contributions should be made out to the University of Wisconsin - Madison, with a notation that it is for the Donald W. Kerst Memorial Fund, and sent to L.W. Bruch, Chair, Department of Physics, University of Wisconsin, 1150 University Avenue, Madison, WI 53706.

NOMINATIONS SOUGHT

The Honors and Awards Committee of the American Nuclear Society Fusion Energy Division is seeking nominations for two awards: The Outstanding Technical Accomplishment Award and The Outstanding Achievement Award. Information on the purpose, criteria and procedure for nomination can be obtained from the Committee chair, Don Steiner, (518)276-4016. Nominations must be received by March 25. The awards will be presented at the ANS Eleventh Topical Meeting on the Technology of Fusion Energy, June 19-23 in New Orleans.

PEOPLE

Adam Drobot and Oscar Anderson have been elected to fellowship in the American Physical Society.

Robert Dautray, John Lindl, and Sadao Nakai have been awarded the 1993 Edward Teller Medal for contributions to the development of inertial confinement fusion.



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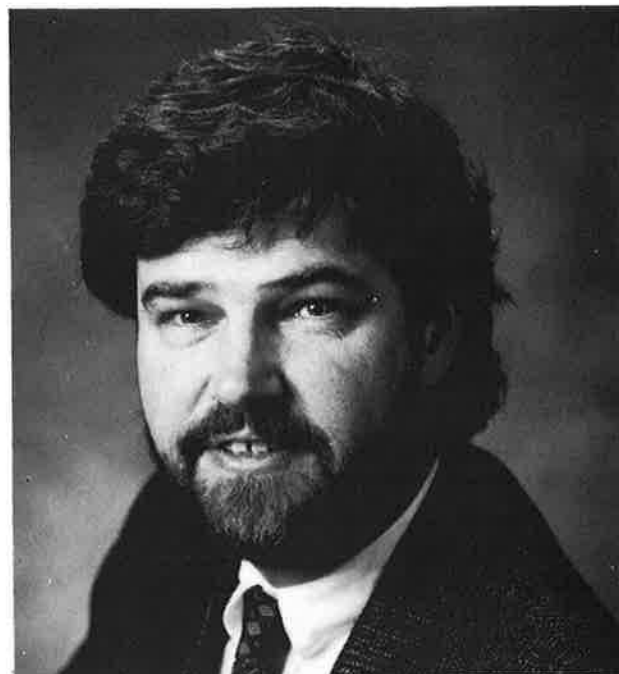
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CLINTON BUDGET REQUEST ENDORSES FUSION

NEW AFFILIATE

Lawrence Berkeley Laboratory (LBL) has joined Fusion Power Associates as an institutional affiliate. LBL has had a long history of participation in fusion energy development, including the development of the neutral beam accelerators used for heating the plasma in the Tokamak Fusion Test Reactor to record temperatures of over 300 million degrees. Currently they are also the center for the development of heavy ion accelerators for use in future inertial confinement fusion reactors.

Dr. Klaus Berkner, associate laboratory director for operations, will represent the laboratory. He can be reached at LBL, MS-50A-5104, 1 Cyclotron Road, Berkeley, CA 94720; tel (510)486-4178; fax (510)486-6060. We welcome the participation of LBL in the activities of Fusion Power Associates.



Dr. Michael Campbell

CAMPBELL DESCRIBES NIF MISSION

Mike Campbell, recently-appointed associate director for lasers at Lawrence Livermore National Laboratory (succeeding Jim Davis), discussed the role of the proposed inertial confinement fusion National Ignition Facility (NIF) at a laboratory seminar February 3 and in an interview with the lab newspaper January 28. The newspaper noted that laboratory director John Nuckolls has called the NIF "the Lab's highest priority over the next two years." Campbell said that the "NIF will define the Laboratory into the next century . . . it will maintain the Lab's reputation of excellence in the weapons program, high density physics and laser science and technology."

The NIF is a proposed 1.8 megajoule, 500 terawatt glass laser that will ignite small pellets containing deuterium-tritium fusion fuel, creating more fusion energy per pulse

than is used to heat and compress the pellet. Its estimated cost is in the range of 500-800 million dollars. Campbell noted that the project is a national project, with other fusion labs participating in its design, although Livermore is the leader of the design effort. Campbell noted that development of the required technology will be accomplished by perfecting it on one "beamlet" before manufacturing the approximately 200 beamlets that will ultimately comprise the NIF, thus allowing a good measure of cost and performance control during construction. He also noted that the NIF is important both to study weapons physics and for commercial energy applications. "I can go to a person concerned with nuclear weapons and make them see the benefit of NIF. I can also turn around and do the same thing with a fusion energy scientist and make the same convincing arguments for NIF. Both are genuine," he said.

FUSION BUDGETS HOLDING WELL IN TOUGH TIMES

In the context of a stringent federal fiscal year 1995 budget submission by President Clinton, the fusion budget figures suggest a serious attempt by the Department of Energy to maintain some momentum. Under the Clinton proposed budget, magnetic fusion funding would grow from \$343.6 million in FY1994 to \$372.6 million in FY1995, an increase of 8.4 percent. The inertial confinement fusion program, part of the DOE's weapons budget, would suffer a 5% decline, from \$185 million in FY94 to \$175.5 million in FY95. Most of the latter reduction comes from a decline in capital equipment expenditures associated with the completion of the OMEGA laser construction project at the University of Rochester.

Within the magnetic fusion request, it is proposed to obtain congressional approval to begin construction of a new tokamak device at the Princeton Plasma Physics Laboratory, the Tokamak Physics Experiment (TPX). The cost of TPX is estimated by DOE at \$624 million, in "as-spent" dollars, with a March 2000 completion date. TPX would replace the present major U.S. tokamak, TFTR, which is scheduled for termination later this year. However, TPX is being set up as a national fusion project, with Princeton being the host laboratory. A TPX National Council oversees the project. FPA president Steve Dean is a member of the Council.

TPX funding is increased from \$19.3 million (design only) in FY94 to \$66.9 million (construction) in FY95. The only other substantial increase is for the support of the International Thermonuclear Experimental Reactor (ITER) project, which increases from \$62.6 million to \$70.6 million, and a small increase (from \$4.4M to \$6.7M) in support for heavy ion accelerator development for inertial confinement fusion energy applications. Essentially all other elements of the magnetic fusion program receive small decreases, including a planned shutdown of the Advanced Toroidal (stellarator) Facility at Oak Ridge National Laboratory.

Within a continued general decline in weapons research and development funding, the DOE provides relatively strong support for continuing research on inertial confinement fusion. The budget submission asserts that "The FY1995 request maintains the FY1994 level of effort." Further, it states that the budget "will provide funding for NOVA (laser) operations, beamlet development, and driver

optimization studies . . . (and) maintains most activities in advanced solid-state laser development . . ." The document says that support is provided for completion of the NIKE krypton fluoride laser facility at the U.S. Naval Research Laboratory, completion of the OMEGA laser facility at the University of Rochester and supports "activities required for initiation of the National Ignition Facility (NIF) project in FY1996. Funds are also provided at roughly the 1994 level of about \$25 million for light ion fusion at the Sandia National Laboratories to "use higher beam intensities to enhance hohlraum temperatures and symmetry in order to assess light ions as an efficient driver."

MAJOR FUSION CONFERENCE COMING UP

The 15th IAEA International Conference on Plasma Physics and Controlled Nuclear Fusion Research is scheduled for September 26 thru October 1, 1994 in Madrid Spain. This conference, held every two years under the sponsorship of the International Atomic Energy Agency, is the major international forum for assessing progress in fusion worldwide. Selection of papers to be presented is very competitive. U.S. persons wishing to submit papers must submit 10 copies of a synopsis by April 8 to Dr. David Crandall, USDOE, Office of Fusion Energy, ER-54, GTN, Washington, DC 20585 or, for Federal Express, 19901 Germantown Road, Germantown, MD 20874. For instructions and application forms for submission of papers or attendance at the meeting, contact Dave Crandall at (301)903-4596 or Gary Chenevert at (301)903-3397.

COLUMBIA UNIVERSITY SCIENTISTS CONDUCT TFTR TESTS

Columbia University scientists Gerald Navratil, Michael Mael, and Steven Sabbagh are conducting a series of experiments on the Tokamak Fusion Test Reactor at Princeton University Plasma Physics Laboratory, aimed at reducing by half the amount of plasma current required for a given level of plasma confinement. To access this so-called high pressure, low current regime, the scientists will adjust the spatial distribution of the current flowing in the plasma. The experiments build on earlier tests conducted in a smaller tokamak device located at Columbia. If successful, the tests could lead to a reduction in the size and cost of future commercial fusion power plants. For further information, contact Prof. Navratil at (212)854-4496; fax -8257; e-mail: navratil@cuplvx.ap.columbia.edu

FPA WELCOMES VISITOR

Fusion Power Associates is pleased to be the host for a visit to the U.S. of Ms. Natalia Poltoratskaya of the D.V Efremov Institute, St. Petersburg, Russia. Ms. Poltoratskaya arrived January 25 for a 6 months visit. She is an assistant to the editor of the international journal Plasma Devices and Operations. The journal is prepared and edited in St. Petersburg, then printed and distributed by Gordon and Breach Science Publishers in Great Britain. The journal's editor-in-chief is Academician V.A. Glukhikh, director of the Efremov Institute; the journal's editor is M. V. Krivosheef, of the same Institute. Other members of the editorial board include O.G. Filatov and others from Russia, Y. Shimomura and S. Shimamoto (Japan), Bruce Montgomery (US), and E. Salpietro, E. Bertolini and R. Aymar (Europe).

In addition to assisting Fusion Power Associates since her arrival, Natalia has spent 4 days at the Princeton Plasma Physics Laboratory with Ms. Ellen Webster, assistant editor of the American Institute of Physics journal Physics of Fluids B, the premier journal for publishing papers on plasma physics in the U.S. During the first week of March, she will be visiting with the staff of the U.S. ITER Home Team in Oak Ridge, Tennessee and, during the period March 17-25, she is scheduled to provide assistance to the staff at the ITER Joint Central Team in San Diego.

She is a 1986 graduate of Ustkamenogorsk University. We are pleased to welcome her on her first visit to the United States.

OBERMAN FUND

Prof. Carl Oberman, one of the pioneers of fusion research at the Princeton Plasma Physics Laboratory, died on April 12 of last year. In his memory a fund has been established to endow a prize for an outstanding incoming Princeton University graduate student. Friends of Carl may send contributions made out to "Princeton University" and indicate "Oberman Fund" on the memo line. Send your contributions to Oberman Fund, c/o Mr. George F. Schmucki, Recording Secretary, Princeton University, P.O. Box 140, Princeton, NJ 08544-0140.



Ms. Natalia Poltoratskaya

ALTERNATE CONCEPTS THEORY BULLETIN BOARD

The AC Theory Bulletin Board is a computer link among persons interested in alternate concepts theory. Information items should be "news bite" in size. Submit your items to "actheory@aa.washington.edu" (Loren Steinhauer manages the system and will redistribute your news items to everyone on the growing list of interested parties.) To get your name added to the distribution list, contact Loren at "steinhauer@aa.washington.edu"

JOURNAL OF FUSION ENERGY

The Journal of Fusion Energy (Plenum Press) seeks papers relevant to the development of fusion as an energy source. In addition to technical papers, the journal also accepts papers on fusion policy. Contact Dr. Manos Chaniotakis, editor, Journal of Fusion Energy, MIT Plasma Fusion Center, 185 Albany Street, Cambridge, MA 02139; (617)253-8450; fax -0700.

FUSION AT APS ANNUAL MEETING

A special symposium organized by the Division of Plasma Physics will be a part of the annual meeting of the American Physical Society April 18-22 in Washington, D. C. The symposium is tentatively scheduled for the morning of April 22. Featured speakers are John Holdren, Mike Campbell, Dale Meade, and John Sheffield. The symposium was organized by Barrie Ripin of the Naval Research Laboratory.

EPRI PRAISES TFTR RESULT

Dr. Richard E. Balzhiser, president of the Electric Power Research Institute (EPRI), in a December 22 letter to PPPL director Ron Davidson, said "Your demonstration of over five megawatts of fusion power in the TFTR is a magnificent achievement. We in the utility industry applaud your efforts and this very promising result. It is my sincere hope that this development will provide further impetus to the programs' goal of economic, environmentally attractive fusion electric power beyond the turn of the century."

TFTR PROGRESS

Plasma operations resumed in early February in the Tokamak Fusion Test Reactor (TFTR). Using 3.5 MW of radiofrequency power, the electron temperature of the plasma was raised from 3 to 6.5 keV, using mode conversion in a He-3/He4 plasma. Also, studies were performed in support of ITER MHD analysis, demonstrating the plasma rotation induced by ICRF. With 6 MW of power, the plasma was observed to rotate in the counter direction with a velocity of 40 km/s.

All twelve neutral beam ion sources are operational with an average voltage of 95 keV. All six RF power sources are operational. Deuterium-tritium test began again in late February.

FELLOWS

The following have been elected to the rank of Fellow in the American Physical Society: S. Bernabei, A. Bhattacharjee, B. Buti, A.W. Fliflet, G. Grieger, R.S. Hulse, P. N. Guzdar, E. Mazzucato, S. Nakai, A. Reiman, S. Skupsky, R. L. Stenzel, P.W. Terry, K-L. Wong, S.J. Zweben and Jay Davis.

Greg Moses has been elected Fellow of the American Nuclear Society.

PEOPLE

Roger Bangerter has been named head of the Fusion Energy Research Program at Lawrence Berkeley Laboratory, a move that consolidates all fusion work at LBL.

Mike Campbell has been named Associate Laboratory Director for Lasers at the Lawrence Livermore National Laboratory, succeeding *Jim Davis* who retired.

William S. Cooper, former head of the magnetic fusion energy program at LBL, has retired from the Laboratory.

Chuck Flanagan has announced his intention to retire from the Martin Marietta Energy Systems Company at the end of March.

John Lindl has been named acting ICF Program Leader at the Lawrence Livermore National Laboratory.

Ralph Moir has completed the conceptual design of HYLIFE-II, a molten salt inertial fusion energy power plant. (See January issue of Fusion Technology.)

MEETINGS

In addition to the meetings listed in our December 1993 newsletter, the following meetings are of interest:

June 7-10 Fifteenth International Cryogenic Engineering Conference. Genova, Italy. Contact Piera Ponta, fax 39-10-6503801.

June 27-July 1 Twenty-first European Physical Society Conference on Controlled Fusion and Plasma Physics. Montpellier, France. Contact E. Joffrin, fax 33-42-25-62-55.

August 22-26 Eighteenth Symposium on Fusion Technology. Karlsruhe, Germany. Contact SOFT Conference Secretarial fax 0-7247-825467.

QUOTABLES

"An hypothesis is always more satisfactory than the truth, because we can put into the hypothesis what we want to be, whereas the truth is only its own clumsy self."

Dixie Lee Ray
Speech to the ANS
June 20, 1993

Editors Note: Dr. Dixie Lee Ray, former chairperson of the U.S. Atomic Energy Commission and former governor of the State of Washington, died January 2 at the age of 79. She presided at the AEC (1973-75) during the years of rapid fusion budget buildups.



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FUSION SCIENTISTS CAUTION DOE ON DECLINE OF FUSION SCIENCE BASE

DAVIDSON URGES PRESIDENTIAL INITIATIVE

37 SCIENTISTS WRITE KREBS/DAVIES

In a letter dated February 28 to DOE director of energy research Martha Krebs and Office of Fusion Energy director N. Anne Davies, 37 fusion scientists from 21 institutions "who have dedicated our careers to the fusion quest" wrote to call attention to the fact that "U.S. funding for fusion has steadily decreased: it is now roughly half its level of 1980. This peculiar and painful circumstance has forced the program to contract drastically, losing skilled technical personnel, even as it faces its most exciting opportunities." The group states that the first purpose of its letter is "to emphasize that the fusion energy research program, now at a critical scientific and technical threshold, deserves major reinvestment." "However," the group states, "our letter has an additional purpose." They warn that "fusion science, including both fusion plasma physics and basic plasma technology, is now endangered," due to a steady decline in support for such activities over the past several years. They state that "every success that fusion energy has enjoyed -- and the successes of the past two decades are impressive -- it owes to creative research" in these areas.

The letter asserts that "today one detects at some levels the notion that only a few large facilities are needed prior to commercialization in 2040, and that additional research is an unnecessary luxury. This attitude threatens the success of fusion." The group states that the fusion program "will necessarily include large, integrated facilities, such as TPX and ITER, but it will also need a complement of smaller

experiments, along with broadly directed theoretical research. They state that the emphasis on large facilities "is a reasonable approach only in the presence of a vigorous underlying research program. Now, when the essential nourishment provided by broad-based research is shrinking, its survival becomes the top priority." They urged Drs. Krebs and Davies "to establish the means for preserving the scientific basis required for a successful fusion energy program," noting that "to enforce such narrowing of the program is analogous to terminating aviation research at the Wright airplane, or computer research at the first vacuum tube computer."

Preparation of the letter was coordinated by Prof. Richard Hazeltine of the University of Texas and Prof. Stewart Prager of the University of Wisconsin. Dr. Stephen Dean, president of Fusion Power Associates, was a signatory. Copies are available from Fusion Power Associates.

FUSION COMMUNITY HOSTS RECEPTION

Thirty-two institutions, including Fusion Power Associates and 17 industries, hosted a reception for members of Congress and their staffs on March 3 at the Library of Congress. The reception featured exhibits and informational materials from all the institutions. Over 150 persons attended. Comments indicated that our guests felt the information and discussions were very valuable.

In addition to the evening reception, a morning breakfast for Senate staff was also hosted by the fusion community on

March 3. Proctor Jones, from the Senate Appropriations Committee staff, and Mike Rodemeyer, from the House Science, Space, and Technology Committee, were featured speakers.

WITHER FUSION?

A special afternoon session entitled "Wither Fusion 1994" has been scheduled June 22 during the American Nuclear Society annual meeting in New Orleans. Dr. Stephen Dean of Fusion Power Associates will chair the session. Featured presentations will include Dr. Robert Hirsch of the Electric Power Research Institute, Dr. John Sheffield of Oak Ridge National Laboratory, Dr. John Perkins and Dr. Grant Logan of the Lawrence Livermore National Laboratory, and Dr. Paul-Henri Rebut, director of the ITER project. Topics will include the characteristics desired of fusion by the electric utilities; the prospects for the tokamak as a commercial power plant; alternatives to the tokamak, including inertial confinement fusion; and the role of ITER along the path to commercial fusion. The session will run from 4:30 - 6:30 PM at the New Orleans Hilton, as part of the Eleventh Topical Meeting on the Technology of Fusion Energy. For further information on the meeting, contact John Gilligan (FAX 919-515-5115) or Wayne Houlberg (FAX 615-576-7926).

FUSION SESSIONS AT APS MEETING

Several sessions on plasma physics and fusion are scheduled during the 1994 Joint Meeting of the American Physical Society and the American Association of Physics Teachers, April 21-22 at the Hyatt Regency in Crystal City, VA, near Washington, DC. On Friday, April 22, 11:00 AM - 1:30 PM in the Regency Ballroom, there will be a session entitled "Fusion Energy," chaired by Dr. Barrett Ripin of the Naval Research Laboratory. There will be four featured talks. John Holdren (UC, Berkeley) will speak on "Fusion in the 21st Century Global Energy Environment," Mike Campbell (LLNL) will speak on "Inertial Confinement Fusion Progress," Dale Meade (PPPL) will speak on "Magnetic Fusion Energy Progress: DT Experiments," and John Sheffield (ORNL) will speak on "Fusion Energy and Technology Development." The session is noteworthy as containing the first public presentations at a major scientific conference of the recent experiments producing 6 Megawatts of fusion power in the Tokamak Fusion Test Reactor (see our special December 13, 1993 and February 1994 newsletters) and the presentation of previously classified

information on inertial confinement fusion (see our December 1993 newsletter).

Two other fusion sessions are scheduled on Thursday, April 21 in Regency Ballroom E. The first, from 8 AM - 10:30 AM, is the Donald W. Kerst memorial session on "Plasmas and Beams." The second, from 11:00 AM - 1:30 PM is on "Intense Laser-Plasma Interactions."

HAZELTINE TESTIFIES TO CONGRESS

Prof. Richard D. Hazeltine, director of the Institute for Fusion Studies at the University of Texas at Austin, testified before the Energy and Water Subcommittee (Tom Beville, chairman) of the House Appropriations Committee on April 11. He was one of several fusion community spokespersons to do so. In his testimony, he stated that "the University of Texas is excited about fusion -- about its potential to transform the nature of the world's energy production. The university wants to be part of what it sees as an extraordinary and historic quest." In his testimony, he emphasized the importance of "fundamental fusion science," noting that "the day-to-day rewards of fundamental research are not always visible, especially to observers outside the community," and saying that "fundamental research is an intellectual investment, justified by the simple notion that you can make something work better if you first figure how it works at all." He said, "As trite as these statements sound, they are not always appreciated in policy or legislation." He urged Congress to take the long view, comparing the length of the fusion quest to solving the problems of global climate change or seeking a cure for cancer. He stated that fusion "addresses (energy) demands that will not become acute for several decades and it progresses at a pace consistent with that time scale." He said, "I would not be here if I were not confident that fusion will make truly gigantic contributions to human productivity and well being."

UKRAINE NAMES FUSION DIRECTOR

By decree of the President of the Ukraine, the Institute of Plasma Physics (IPP) was established on January 3, 1994 as a part of the National Science Center "Kharkov Institute of Physics and Technology." Prof. Oleg Pavlichenko was named director of the Institute. The main programs at the Institute are the development of the stellarator concept and quasistationary plasma accelerators. Pavlichenko can be reached at FAX 7-057-235-2664.

DAVIDSON URGES PRESIDENTIAL FUSION INITIATIVE

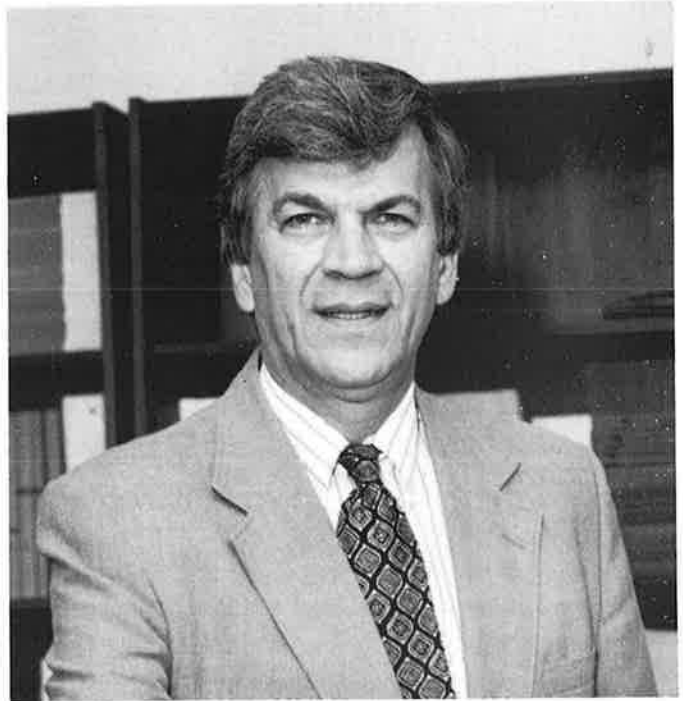
In a letter dated March 30 to Energy Secretary Hazel O'Leary and Presidential Science Advisor Jack Gibbons, Princeton Plasma Physics Laboratory director Ron Davidson provided them with a "white paper" entitled "A Proposed Presidential Initiative on Fusion Energy Development." In it, Davidson urges the President to issue an executive order to establish an interagency working group on fusion, charged to (1) identify a candidate U.S. site for ITER by September 1995, (2) develop and implement a process leading to selection of an international site for ITER construction by September 1996, (3) work with Congress to establish a treaty framework for ITER construction, 4) develop plans for fusion development under two scenarios, i.e., ITER is sited in the U.S., or ITER is sited elsewhere, 5) develop U.S. fusion funding requirements through 2005.

Davidson also called upon the President to place fusion on the agenda for the July 1994 "Group of 7" meeting "so that the international community can begin consultations on the ITER construction issues," and to "appoint a Special Negotiator to act on his behalf in these international discussions."

Copies of the white paper are available from Fusion Power Associates or from Dr. Davidson at PPPL.

O'LEARY VISITS PPPL

Energy Secretary Hazel O'Leary visited the Princeton Plasma Physics Laboratory on March 3. It was her first visit to the facility. According to press accounts, she pledged the Administration's long-term commitment to the lab and applauded its record-breaking fusion energy experiment of last December. She compared the investment in fusion research with long-term medical research. "In 60 years, when the world's oil is gone, we need to have fusion in place as one of our choices," she said. "In my mind, the DOE has no bigger mission." She warned the scientists that they had to stop speaking in sentences "where you have to read down three lines before you find a verb," and said that scientists must engage the imagination of the American public in the long-term vision for expensive projects like fusion energy, or "see their funding disappear." "Good business, good science, good economics, and a reliable energy source. That's the way we sell it," she said.



Dr. Ronald C. Davidson

ICFAC REPORTS

The DOE Inertial Confinement Fusion Advisory Committee (ICFAC) issued a letter report, dated February 15, to DOE Assistant Secretary for Defense Programs, Victor Reis, based on its January 6-7 meeting at LLNL. In their report, the Committee says "The progress in validating the NIF (National Ignition Facility) design assumptions has been substantial." The Committee states "assuming that advances continue as anticipated over the next few months in resolving the key technical issues of NOVA related to laser-plasma coupling at large scale length, we expect to recommend proceeding with KD-1 (key decision 1) in a timely manner." (DOE currently anticipates making the KD-1 decision in late May. This decision is prerequisite to DOE including the NIF as a line item construction project in the FY 1996 budget.)

The Committee expressed its "impression that (Inertial Confinement Fusion) is, and should be, a high priority goal of DP (DOE's Defense Programs) to build a successful NIF . . . We know of no other part of (Defense Programs) which shares all of the key attributes necessary for the future: i.e., exciting science, effectiveness in attracting and keeping first class scientists, weapons physics and effects studies, and dual-use energy applications." They also state that "it is very important to maintain breadth in the ICF program to reduce the risk for NIF, and for longer term LMF (Laboratory Microfusion Facility) and energy applications.

In this context, we are disappointed that a result of the most recent budget cut is to have substantially reduced the rate at which direct drive and ion beam options will make progress."

PEOPLE

Ron Davidson has been awarded the Kaul Foundation 1993 Award for Excellence in science, education and physics.

James L. Anderson, Dale M. Meade, and James Sennis have been awarded DOE Distinguished Associate Awards "for their personal and professional achievements in fusion research."

Mohamed Sawan has been selected as a recipient of the University of Wisconsin Chancellor's Award for excellence in teaching, research, leadership, and public service.

Gunther Kessler and Gregory Moses have been elected Fellows of the American Nuclear Society.

BROCHURES AVAILABLE

Three brochures are available from Fusion Power Associates or from the issuing institutions.

MIT has prepared a 10-page color brochure on "The Alcator C-Mod Experiments." Contact Steve Fairfax at MIT, FAX 617-253-7227.

PPPL has an 8-page brochure on the "Tokamak Physics Experiment."

Fusion Power Associates has an 8-page brochure entitled "Fusion Energy."

CALENDAR

April 18-22 Joint Meeting of APS/AAPT. Fusion Session, April 21-22. Hyatt Regency, Crystal City, VA.

May 8-12 10th Annual High Temperature Diagnostic Conference, Rochester, URLLE. Contact Ms. Jean Steve, 716-275-5286.

June 5-8 Canadian Nuclear Society Annual Conference. Montreal, Canada. Contact Mr. H. M. Huynh, Hydro-Quebec, FAX 514-344-1538.

June 6-8 IEEE Int'l. Conference on Plasma Science. Santa Fe. Contact Ms. Frances White, FAX 505-989-8608.

June 7-10 Fifteenth International Cryogenic Engineering Conference. Genova, Italy. Contact Piera Ponta, FAX 39-10-6503801.

June 19-23 Eleventh Topical Meeting on the Technology of Fusion Energy (American Nuclear Society). New Orleans. Contact John Gilligan, FAX 919-515-5115 or Wayne Houlberg, FAX 615-576-7926.

June 20-24 Tenth International Conference on High Power Particle Beams. San Diego. Contact Amanda Ness, FAX 619-576-7659.

June 27-Jul 1 Third International Symposium on Fusion Nuclear Technology. UCLA, Los Angeles. Contact Mark Tillack, FAX 310-825-2599; e-mail MST@fusion.ucla.edu

June 27-Jul 1 Twenty-first European Physical Society Conference on Controlled Fusion and Plasma Physics. Montpellier, France. Contact E. Joffrin, FAX 33-42-25-62-55.

August 22-26 Eighteenth Symposium on Fusion Technology. Karlsruhe, Germany. Contact SOFT Conference Secretarial, FAX 0-7247-825467.

September 8-9 Fusion Power Associates Annual Meeting and Symposium. San Diego, CA. Contact Ruth Watkins, FAX 301-975-9869.

September 19-23 23rd European Conference on Laser Interaction with Matter. Oxford, England. Contact Ms. Susan Humphreys, Rutherton Appleton Laboratory, FAX 44-235-446665; e-mail sh3@ib.rl.ac.uk

QUOTABLE

"The easiest way! Sometimes it is not the best way! And this applies to everything--even to fusion."

Natalia Poltoratskaya
March 9, 1994
Oak Ridge, TN



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OVERSKEI TO KEYNOTE FPA SYMPOSIUM ON FUTURE FACILITIES AND THE ROLE OF INDUSTRY IN FUSION POWER DEVELOPMENT SEPTEMBER 8-9 IN SAN DIEGO

ANNUAL MEETING

Fusion Power Associates annual meeting and symposium will be held September 8-9 in San Diego. The theme of the meeting will be the role of industry in fusion power development, with emphasis on projected new major fusion facilities, such as the TPX, ITER and the inertial confinement fusion National Ignition Facility (NIF).

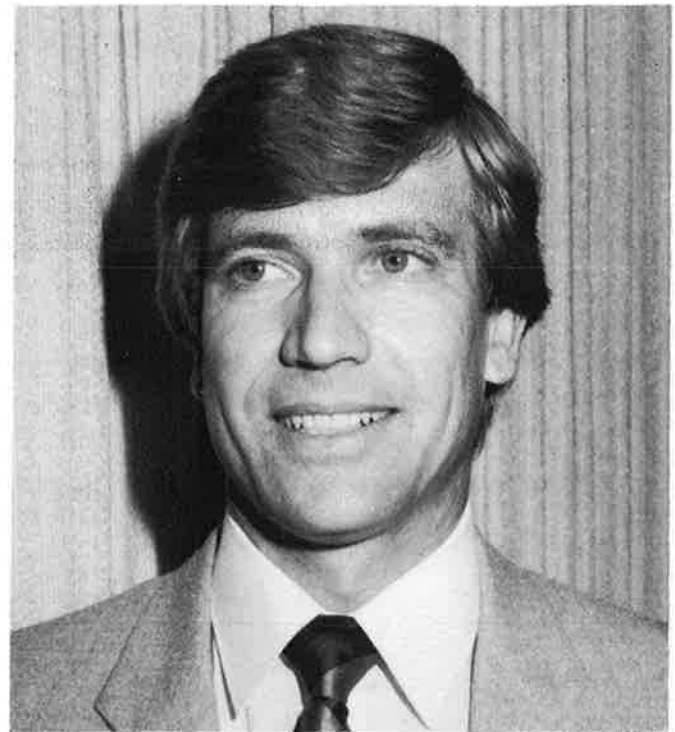
Dr. David O. Overskei, senior vice president, General Atomics, will be the keynote speaker. An additional highlight of the meeting will be tours of the DIIIID tokamak and inertial confinement fusion pellet fabrication facilities at General Atomics.

Contact Ruth Watkins at Fusion Power Associates for further information.

NUCKOLLS RESIGNS AT LLNL

John Nuckolls, director of the Lawrence Livermore National Laboratory for the past six years, has resigned. C. Bruce Tartar, the Lab's deputy director under Nuckolls, has been named acting director effective May 1.

Nuckolls, who had completed a 5-year appointment as director, had been continuing to serve as director, pending a decision making process that was underway within the University of California, which operates the Laboratory under contract with the Department of Energy. In a March 18 statement to Laboratory employees, Nuckolls had indicated that he did not seek or intend to serve out a new



Dr. David O. Overskei

5-year term.

Recently, Nuckolls had testified to Congress on the need to maintain a strong research program at the nation's three nuclear weapons laboratories, in order to maintain a "safe, secure, and reliable stockpile without nuclear testing." He advocated "vastly more advanced computational and experimental facilities" capability, including the construction of the inertial confinement fusion National Ignition Facility (NIF).

On the NIF, he stated that it would "allow us to access physics regimes of interest in nuclear weapon-related physics data, particularly in the area of secondary design and fusion physics for comparison with advanced numerical simulations." NIF is also "essential for the development of inertial fusion power for civilian power production, which could provide energy security for the U.S. in the 21st Century," he said.

Nuckolls was a pioneer in the field of inertial confinement fusion during the 1960's and was a recipient of Fusion Power Associates Leadership Award in 1982.

DEAN STATEMENT TO CONGRESS

FPA president Steve Dean has presented a statement on fusion energy development to the Appropriation Committees of the House and Senate. In his statement, Dean urged the committees "to provide the full funding requested by the President for Department of Energy Programs of the Office of Fusion Energy within the Office of Energy Research and the Office of Inertial Confinement Fusion within the Office of Defense Programs."

Dean noted that "fusion is one of only a few options the world has to provide essentially unlimited energy supply for future generations," and that "although the science is still evolving and the technology is advanced, fusion research and development has made systematic and impressive progress." "Fusion and other advanced energy technologies are absolutely necessary for the survival of advanced industrial civilization," he said.

Dean noted that "the importance of fusion is recognized by all countries," citing the joint effort to "design and develop the technology for the International Thermonuclear Experimental Reactor (ITER). He endorsed the construction of a new national facility, the Tokamak Physics Experiment (TPX), saying "it is imperative that this project be funded for construction now." He stated that "U.S. industry must play an essential and growing role in the DOE's fusion programs if these programs are to result in commercial products," and noted the many commercial spinoffs from fusion research that were described at FPA's annual meeting in October 1993. He stated, also, that "it is also imperative to maintain a strong national program in the fundamental science of fusion and the search for improved and innovative fusion concepts," and said that for all of these reasons "it is important that the overall fusion budget not be

allowed to decline further."

Copies of Dr. Dean's statement are available from Fusion Power Associates.

BAKER TESTIFIES AT HOUSE HEARING

Dr. Charles C. Baker, U.S. ITER Home Team Leader, was one of several who testified on fusion at an April 21 hearing of the Subcommittee on Energy, of the House Committee on Science, Space and Technology. Baker stated that "ITER is a necessary and critical step towards the commercial application of fusion energy." During the present six-year engineering design phase, which ends in 1998, "an engineering design will be established, research and development to support that design will be carried out, planning schedules for construction and operation will be developed, site requirements will be prepared, cost and resource estimates will be produced, and proposals for approaches to implement construction will be completed," he said. He said that in March 1995, "an interim design report will be presented which will include a preliminary cost estimate, an initial safety analysis and proposed site requirements.

Baker said that, in addition to support for ITER, the U.S. "needs a strong domestic program of plasma science research, materials development and technology demonstration." He stated that "TPX fits well with ITER in that TPX will demonstrate modes of operation in a tokamak that will result in substantially improved tokamak reactor concepts." He stated "I believe that the tokamak concept can be developed into a viable reactor concept. However, I also believe that a modest amount of effort should be devoted to non-tokamak concepts. At this stage of fusion development, it is not prudent to put all effort on a single confinement concept."

Copies of his full statement may be requested from Dr. Baker, fax (615) 576-4170.

CONGRESSMAN SWETT ATTACKS FUSION

Congressman Dick Swett (D-NH), a member of the House Science, Space, and Technology Committee, presented testimony at a hearing of the House Committee on Appropriations April 12, at which he said he is "very concerned about the direction of the DOE's current fusion program." He said that the "magnetic fusion energy



Milt Johnson (l) and Martha Krebs (r) of DOE look on as Energy Secretary Hazel O'Leary presents the DOE's Distinguished Associate Award to Princeton Plasma Physics Laboratory deputy director Dale Meade for his "personal and professional achievements in fusion research."

program needs to be fundamentally restructured," and challenged the program's focus on tokamaks. He told the committee that the fusion budget request was "unnecessarily and inappropriately high," and he advocated a shifting of funds into conservation and solar energy alternatives. Swett also made a statement March 22 on the floor of the House, in which he charged that "no one has held DOE accountable for the results from their fusion program." He stated that "we are continuing to waste hundreds of millions of dollars annually on something which, according to utilities, will not lead to a commercially feasible reactor."

IFE NEWS

Lawrence Berkeley Laboratory issues a periodic newsletter called "IFE News" to report progress on their inertial fusion energy (IFE) program, which is centered on the development of heavy ion accelerators. Persons wishing to receive the newsletter should request a copy of the March and April 1994 issues and request to be added to the distribution by contacting "IFE Newsletter", Bldg 47, LBL, Berkeley, CA, 94720; fax (510) 486-5392; e-mail bowen@lbl.gov

ICFAC MEETS AT UR MAY 18-20

The Department of Energy's Inertial Confinement Fusion Advisory Committee (ICFAC) will meet May 18-20 at the University of Rochester Laboratory for Laser Energetics, Rochester, NY. The meeting will be open to the public,



Jim Anderson, LANL, and Jim Sinnis (not shown), were also recipient's of DOE's Distinguished Associate Award.

although portions of the meeting will be closed. Persons wishing to attend should contact the office of Dr. Robert McCrory (716) 275-4973. You may also request from the same office, a copy of the recently issued 1993 annual report of the UR laser work.

NOMINATIONS FOR TELLER MEDAL

Nominations are being solicited for the 1995 Edward Teller Medal, presented "in recognition of pioneering research and leadership in the use of laser and ion-particle beams to produce high-density matter for scientific research and for controlled thermonuclear fusion." Nominations should include the name and address of the nominee, a brief curriculum vitae, and a one-page narrative of the nominee's key achievements in the field. Send nominations by July 15 to Selection Committee, 1995 Teller Medal, Fusion Studies Laboratory, University of Illinois, 100 NEL, 103 South Goodwin AV, Urbana, IL, 61801-2984. For further information contact by e-mail: miley@uiucvmd.bitnet

NUCLEAR ENERGY INSTITUTE FORMED

Washington-based trade associations representing the nuclear industry have consolidated into a single organization called the Nuclear Energy Institute. The Institute began operations on March 16, combining the functions previously performed by the American Nuclear Energy Council, the Nuclear Management and Resources Council, the U.S. Council for Energy Awareness, and the nuclear activities of the Edison Electric Institute. E. Linn Draper, chairman and CEO of American Electric Power Service Corp., chairs NEI's Board of Directors; Philip Bayne is president and

CEO. NEI can be contacted at 1776 I Street NW, Suite 400, Washington, DC 20006-3708, (202) 739-8000; fax (202) 785-4019.

SCHAFFER ASSOCIATES REPORT

W.J. Schafer Associates has completed a study and issued a report entitled "An Integrated Test Facility (ITF) for the Development of Inertial Fusion Energy" (WJSA-94-01). The work was sponsored by the Lawrence Livermore National Laboratory and includes efforts by WJSA, LLNL, LBL, UCB, and General Atomics. For further information, contact Wayne Meier, (510) 447-0555; fax -0544.

VARIAN REBUILDS KLYSTRONS

Varian Associates will rebuild used Klystron tubes and provide customers with repaired tubes that are as "good as new, but for half the price," according to Earl McCune, Varian's manager of TV klystron engineering. Typical turnaround time is six weeks unless faster delivery is required. Customers send in their tubes for free evaluation. For further information, contact Annette Havens, Varian Customer Service Dept., 811 Hansen Way, Palo Alto, CA, 94304-1031, tel (800) 843-8780.

ITER INFO

Fact sheets and other information on the ITER project are available from Julie Van Fleet at the San Diego Joint Work Site, fax (619) 587-8559; e-mail vanflej@iterus.org

Among the recently issued materials are the 4-page "ITER EDA JCT Background," and the 4-page "ITER EDA JCT Fact Sheet." The first describes the objectives of ITER and the various "phases" planned for its design, construction and operation. The second describes the organization, present parameters of the design, and estimated costs.

Julie is in charge of external relations, Office of the Director, Paul-Henri Rebut.

NOMINATIONS SOLICITED

Nominations are solicited for three Fusion Power Associates annual awards: Leadership; Distinguished Career; and Excellence in Fusion Engineering. Please send your nominations for the first two with a brief justification to FPA by June 15. The Excellence in Fusion Engineering Award is aimed toward persons early in their careers who have shown outstanding technical ability in the field of

engineering and possess leadership skills. Please send a resume of that person, and ask others familiar with his/her work to write supporting letters. This is not necessary for the other awards, which are aimed at honoring persons well-known in the field. Leadership Awards honor those who have shown outstanding leadership qualities in accelerating the development of fusion. Distinguished Career Awards honor those late in their careers who have made outstanding lifelong contributions to the field.

A listing of previous recipients was published in the October 1993 newsletter.

ITER INDUSTRY COUNCIL

Harold Forsen, Bechtel National, has resigned as chairman of the U.S. ITER Industry Council. The action is part of Harold's "winding down" toward a planned retirement from Bechtel later this year. John Landis, Stone & Webster, has replaced Forsen as chairman. The Council advises U.S. ITER Home Team Leader Charlie Baker on the role of U.S. industry in developing ITER technology.

ITER PROTOCOL 2 SIGNED

Representatives of the U.S., Europe, Japan and Russia signed so-called "Protocol 2" of the ITER agreement on March 21, thereby committing the parties to collaborate on the ITER engineering design activities through July 20, 1998. Under the original "Protocol 1," signed on July 21, 1992, each of the four parties retained the right to drop out of the collaboration this year. Thus the signing of the new protocol is considered to be a major milestone in the evolution of the ITER project, indicating that the parties feel the collaboration continues to be beneficial. Copies of Protocol 2 may be requested from Michael Roberts at DOE, fax (301) 903-2791.

QUOTABLE

"Stop swimming so hard and climb in the boat with Noah."

Jalaloddin Rumi
13th Century Poet



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BAKER MOVING TO UCSD ITER MANAGEMENT UNDER REVIEW

BAKER TO UCSD

Dr. Charles C. Baker, U.S. ITER Home Team Leader, is moving his operations June 20 from the Oak Ridge National Laboratory (ORNL) to the University of California at San Diego (UCSD). Charlie will hold a management appointment in the School of Engineering. Prior to joining ORNL in May 1989, he was director of the Fusion Power Program at the Argonne National Laboratory. He will be joined at UCSD by Terrence A. Davies, who will serve as project coordinator. Terry was previously at the University of California at Los Angeles where, among other things, he served as executive secretary to the DOE Fusion Energy Advisory Committee. Mail for the U.S. ITER Home team should continue to be sent to their ORNL address until a new address is announced.

ITER MANAGEMENT REVIEW

At its fifth meeting (IC5), January 1994, the international ITER Council (IC) appointed a subcommittee of its members, consisting of the four national fusion program directors, to review the management arrangements for the ITER Engineering Design Activities (EDA). IC chairman Evgenii Velikhov serves as chairman of the subcommittee. During the last several months, the subcommittee visited each of the 3 ITER Co-centers and interviewed senior Joint Central Team members, Home Team Leaders, and chairs of ITER advisory committees. On May 4-5, in Paris, the subcommittee was joined by the other IC members to discuss, informally, the subcommittee's draft conclusions and to formulate a draft ITER Management Assessment paper, in preparation for possible adoption at their next scheduled meeting in late July.



Dr. Charles C. Baker

Although the assessment recommendations are still being formulated, the DOE representative, fusion director Dr. N. Anne Davies, distributed a one page summary of the May 4-5 meeting, which states that the members of the ITER Council "came to the following common views:

"The management of the ITER EDA is particularly challenging because of the wide geographic distribution of the team, the complexity of the Joint Central Team/Home Teams arrangement, the time consuming nature of the Task agreement process, the slow build-up of the Joint Central Team staff, and the technical challenge of the design itself. Under these difficult conditions, the Joint Central Team has produced an Outline Design that is serving as a point of

departure for proceeding into Protocol 2 of the EDA, and measures have been taken since IC5 to make progress on several management issues. Nevertheless, a substantial improvement in the management of the EDA is still needed.

"Work for ITER is an integral part of the Fusion Programmes of the 4 parties and the success of the EDA is vital for each of the Parties. The consensus among the Parties and the full exploitation of the strength of the Home Teams and of the 3 co-centers are a necessity. This leads to the requirement of collegiality in decision making, and of a well defined delegation of responsibilities.

"The Director is a man of outstanding technical capability, commitment, and vision. However, the load on the Director is too high, as he performs personally several functions:

- * representation towards the outside world;
- * responsibility towards ITER Council;
- * scientific and technical direction of the project;
- * management

"A redistribution of these functions seems appropriate, and is given in annex 2 (in preparation)."

TPX INDUSTRY COUNCIL FORMED

Princeton Plasma Physics Laboratory has announced the formation of a "TPX Industrial Council" (TIC). The group plans to meet in conjunction with meetings of the ITER Industry Council (IIC); many persons are members of both Councils.

The purpose of the Council is "to advise the PPPL Director (Ronald Davidson) on issues related to industrial participation in the TPX Project." Issues that will be given "particular attention" by the Council include technology transfer; preparation of U.S. industry to compete for significant roles in ITER; TPX management approaches; and assuring the constructability and maintainability of the TPX design.

Members of the Council are S. Locke Bogart (Martin Marietta), Stephen O. Dean (Fusion Power Associates), John R. Gilleland (Bechtel), Sam Harkness (Westinghouse), Robert C. Iotti (Ratheon/Ebasco), Robert J. Krieger (McDonnell Douglas Aerospace - East), John W. Landis (Stone & Webster), Chester G. Lob (Varian Associates), Peter McCourt (Rockwell/Rocketdyne), David O. Overskei (General Atomics), Thomas Romesser (TRW), Joseph R.

Sudol (Burns & Roe), John Taylor (EPRI), and Robert Weber (Northrup Grumman).

FORSEN TESTIMONY

Dr. Harold Forsen, senior vice president, Bechtel National, Inc., and past chairman of the U.S. ITER Industrial Council, testified April 21 to the House Committee on Science, Space, and Technology, Subcommittee on Energy.

Commenting on the difficulties of ITER as a potential international construction project, Forsen said "United States industries have had considerable experience in managing and constructing large and complex international projects." He cited several examples, including international consortia to build fission power plants in Taiwan and Korea. He stated that "The ITER is a very important project in the development of fusion power reactors. It will, for the first time, give us experience in a fusion radiation and power production environment that will permit the engineering and operating side of fusion systems to begin to unfold. These are the real issues of fusion power production as we move beyond the importance of plasma physics to the practical side of engineering and economics."

Forsen also supported the construction of the proposed Tokamak Physics Experiment (TPX) at Princeton, calling it "another key experiment along the way to better enable the very conservatively designed ITER to be brought down in size and scaled ultimately to a more economic and competitive reactor concept."

In addition, Forsen stated that it was important to identify the host country for ITER construction "as soon as possible," because of the "regulatory and priority requirements of that country." He said the same about the urgency to identify a specific site, "because this will also impact design details." He urged that the TPX approvals proceed independent of ITER. "Making TPX hostage to this (ITER) is inappropriate," he said, "because of the international aspects of ITER, its approval and funding could be stretched out and delayed. The U.S. needs a vigorous program complementing ITER, and the TPX keeps us in the competition."

"Alternate concepts are important to retain as an anchor to the wind, protection that there could be a simpler, cheaper approach to improve on or replace the tokamak as a power reactor," he said, "The program currently is so tight for

funds that not much of this kind of activity is possible." He urged that a percent, "say five to ten," of the total program be devoted to non-tokamak concept research.

Commenting on a fusion bill (S.646) passed last year by the Senate (see our September 1993 newsletter), he said that although "the bill does some positive things," it "brings focus to the ITER at the expense of everything else not directly connected (to ITER)." The bill "seems to lack in understanding the difficult international issues and the different driving forces of the independent parties," he said. It "would result in a destruction of the U.S. program if this bill were made law," he said.

Finally, he said that while "the development of fusion power reactors has been more difficult than anyone imagined . . . we believe fusion will provide a long-term, acceptable energy source for future generations."

CORRELL URGES INERTIAL FUSION ENERGY

Speaking also to the House Energy Subcommittee, Don Correll, Lawrence Livermore National Laboratory, told the committee that the Inertial Fusion Energy (IFE) Program "has a credible plan to answer all scientific questions by a date no later than 2010, as directed by the National Energy Policy Act." "A 10 year total investment of 400 million dollars between 1995 and 2004 will allow the IFE Program to sufficiently develop the heavy-ion driver, target fabrication, and fusion chamber power plant technologies for a fusion energy engineering decision in 2005," he said.

He also commented that "cost sharing between Defense Programs funding for Inertial Confinement Fusion and Energy Research Programs funding for IFE represents a national security and energy "dual benefits" approach to Congressionally approved DOE research."

HIRSCH LEAVES EPRI

Dr. Robert L. Hirsch, vice president, Washington Operations, Electric Power Research Institute (EPRI), left EPRI at the end of April. He can be reached at 4066 Mansion Drive, N.W., Washington, D. C. 20007.

In a letter dated April 25, EPRI president Richard Balzhiser stated that he has asked Jack Kaslow, EPRI's executive



Dr. Donald Correll

director, Northeast Region, to serve as a spokesman for the findings of EPRI's fusion panel, which Hirsch had formed. Jack can be reached at (603)894-6345; fax 893-8216.

Bob Hirsch will, however, participate in a panel, "Wither Fusion 1994?", on June 22 at the American Nuclear Society Eleventh Topical Meeting on the Technology of Fusion Energy in New Orleans.

In his April 25 letter, Balzhiser states that "Bob and the (fusion) panel have made a sincere effort to assess what it will take to make fusion a significant contributor to the world's energy needs. Unfortunately, we are still not far enough along in the scientific area to assess the operational reality so that there is room for many interpretations of what the optimal interim steps and commitments should be. I believe the panel has acknowledged the importance of the TFTR contributions to date and those that can continue to be made through a properly balanced global research and development program."

In Congressional testimony, April 21, Hirsch said that "The utilities have not developed a single view of fusion." However, he said, two recent utility groups "both have generally said that extrapolation of the tokamak in its present form to an electricity generator raises economic concerns because of the related very high capital costs, among other things. Both groups have indicated that design concepts with greater economic potential should be explored." He said that speaking personally, "as someone

who has been heavily involved in fusion research for roughly 30 years," he believed "that fusion power is feasible and can be made into a very attractive power system that will provide mankind with clean energy essentially forever." However, he said, in his view "Because of the very serious economic concerns related to the tokamak as presently defined, a major effort is needed to identify alternate approaches with potential for much lower capital costs, as well as to deal with a number of other very significant issues." "The enormous challenge is to create a system that savvy investors will want to buy," he said.

NEW FUSION TEXT PUBLISHED

Leslie v. Szirmay, professor, Chemical and Nuclear Engineering, Youngstown (Ohio) State University has published a textbook entitled "Nuclear Fusion Reactor Design Fundamentals." The text is written at the advanced undergraduate level and provides a good introduction to elements of nuclear and plasma physics, electromagnetism, fusion concepts and fusion technology. Copies may be ordered (\$37.50) from Bookmasters Distribution Center, P.O. Box 2039, Mansfield, OH 44903. The book is published by Colas Publishing, Inc., Youngstown, OH.

TRITIUM SAFE HANDLING COURSE

For the eleventh straight year, the Canadian Fusion Fuels Technology Project (CFFTP) is offering its Basic Tritium Safe Handling Course. The course is scheduled for October 17-21 at the Atomic Energy of Canada Laboratory at Chalk River, Ontario. For course registration information, contact Maryann Zito; for technical information on the course, contact Ron Matsugu; both at fax (905)823-8020.

TRITIUM RELEASE TEST PLANNED

Canadian and Japanese scientists will release a small amount of tritium (700 Curies) into the atmosphere in a steady stream over a two week period at a test site in Chalk River, Ontario, during the Summer of 1994. The objective of the test is to measure steady state relationships between tritium gas (HT) concentrations in the air, and the consequent equilibrium concentrations of tritiated water (HTO) in the air, soil and vegetation exposed to the tritium release. The tests are part of a four-party International Energy Agency (IEA) program (Canada, Japan, Europe and US) to study the environmental and safety aspects of fusion power. For information on the field tests, contact Phil Davis, AECL Chalk River, fax (613)584-1221.

CANADIANS "TURN OFF" TOKAMAK CURRENT

Experimenters at Hydro Quebec, using the Tokamak de Varennes (TdeV) device have driven the full 210,000 amperes of current in the device with no assistance from the tokamak's inductive ohmic transformer, by using radiofrequency waves at the lower hybrid frequency (LHCD). This achievement was one of the experimental targets of the campaign. Driving full plasma current via LHCD means that all plasma current is being driven through acceleration of the plasma electrons via the 3.7 GHz lower hybrid plasma waves. For information on TdeV, contact Richard Bolton, fax (514)652-8625.

NATIONAL IGNITION FACILITY DESIGN PROGRESS

On April 15, the Lawrence Livermore Laboratory shipped to DOE a 19-volume draft Conceptual Design Report for the inertial fusion National Ignition Facility (NIF). The report projects that the facility would cost \$840 million and be operational in 2002. DOE must now decide whether to incorporate the project in its FY 1996 budget submissions. A favorable decision is expected.

The conceptual design was carried out by a multilaboratory design team, consisting of scientists from Livermore, Los Alamos, Sandia and the University of Rochester. For further information, contact NIF project manager Jeff Paisner at LLNL, fax (510)423-6506.

PEOPLE

Elected to the rank of Fellow in the American Physical Society: *Stefano Berabei, David Book, Russell Hulse, Ernesto Mazzucato, Allan Reiman, Philip Sprangle, William Tang, King-Lap Wong, and Stewart Zweben.*

QUOTABLE

"While performance is often the focus of early development, in the long term it is not dominant; simplicity, reliability, and robustness are as likely to determine the success or failure of a development effort."

Lee Berry
FPA Annual Meeting,
"Near-Term Applications of Plasma and Fusion
Technology," October 1993; Published in
J. Fusion Energy, December 1993.



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U.S. FUSION INDUSTRY COUNCIL FORMED GORE ENDORSES FUSION EFFORT

NEW AFFILIATES

Parsons Brinckerhoff, Inc. has become an Affiliate of Fusion Power Associates. William Reddan, vice president, will represent the company. He can be reached at One Penn Plaza, New York, NY 10019, tel (212)465-5454; fax (212)465-5655. Parsons Brinckerhoff is a major architect-engineer corporation.

Foster-Miller, Inc. has become a Small Business Affiliate of Fusion Power Associates. Richard Rio, Business Development Manager, Power Systems Technology Group, will represent the company. He can be reached at 350 Second Avenue, Waltham, MA, 01701, tel (617)890-3200; fax (617)890-8515. Foster-Miller manufactures specialized robotic equipment.

"FICUS" FORMED

The Board of Directors of Fusion Power Associates has voted to form an industrial council, called the "Fusion Industrial Council, U.S." (FICUS). The function of the council is "to provide consensual industrial views on matters pertaining to the domestic and international fusion power programs." Members of FICUS will be appointed by the Fusion Power Associates Board of Directors. The president of Fusion Power Associates will serve as an ex-officio, non-voting member of FICUS.

The FPA Board of Directors will annually review the activities and membership of FICUS. However, the FICUS is intended to develop its own independent points of view, reflecting the interests of U.S. industry. The purpose of Fusion Power Associates remains to represent the public interest, both nationally and internationally. The FPA

Board will consider persons and companies for FICUS participation regardless of whether or not they are members of Fusion Power Associates.

John W. Landis, senior vice president (retired), Stone & Webster Engineering Corporation, will serve as chairman of FICUS for the remainder of 1994. Thereafter, FICUS will elect its own chairman annually. Other initial members of FICUS are: Robert Botwin (Northrup-Grumman Aerospace & Electronics), Stephen O. Dean (FPA, ex-officio), Harold Forsen (Bechtel Hanford), Sam Harkness (Westinghouse), Clyde Hopkins (Martin Marietta Energy Group), Robert Iotti (Raytheon-Ebasco), Robert Krieger (McDonnell Douglas), Chester Lob (Varian Associates), Peter McCourt (Rockwell-Rocketdyne), David Overskei (General Atomics), Stephen Rockwood (SAIC), Peter Staudhammer (TRW), and Stephen Toth (CBI Industries). William Ellis (Raytheon-Ebasco), John Gilleland (Bechtel), and Paul Korkmaz (McDonnell Douglas) are designated alternates. S. Locke Bogart (Martin Marietta) is Executive Secretary.

A subgroup of FICUS, consisting of John Landis, Robert Iotti, and David Overskei met with Senator J. Bennett Johnston on June 8 to discuss his views on the future of the U.S. fusion program. The first full meeting of FICUS is scheduled for July 15 in Washington, DC.

GORE ENDORSES FUSION PROGRAM

In a letter dated June 16 to Senator Frank Lautenberg, U.S. Vice President Albert Gore stated that the Administration had a "commitment to a strong, balanced program for the development of fusion energy" and said that fusion was "an

important part of this Administration's energy strategy." Gore said, in his letter, that "the Tokamak Physics Experiment (TPX) and the International Thermonuclear Experimental Reactor (ITER) are important, and complementary, elements of our nation's long-term fusion development strategy -- a strategy that relies heavily on international collaboration. Gore said, "As we continue our support of this international collaboration on ITER, we need to support a vital domestic fusion program." "Both ITER and TPX will contribute to the ultimate goal of demonstrating that fusion power can be a commercially attractive energy source," Gore said.

Gore's letter did not satisfy Senator J. Bennett Johnston, who had demanded a clear statement of commitment to ITER from the Administration as his price for allowing the TPX project to go into construction. Johnston's Appropriations Subcommittee subsequently (see following article) cut the fusion budget request by \$10 million and limited TPX funding to design and long-lead procurements only, as he had also done last year.

SENATE CUTS FUSION REQUEST

On June 23, the Senate Appropriations Committee cut President Clinton's FY 1995 DOE fusion budget request by \$10 million and reduced the \$67 million requested for TPX to \$28 million, limiting TPX to continuation of preliminary design. The House of Representatives (see following article) had previously provided the full \$68 million and full construction authorization for the project. The fate of TPX will now be decided in a House-Senate conference committee, planned to meet sometime in July.

In a report accompanying the mark, the Senate Subcommittee stated that it was "very concerned that the Department (of Energy) has failed to report to the Congress on how it intends to move forward with the International Thermonuclear Experimental Reactor (ITER) and to address the complex domestic and international issues associated with a project of its magnitude. The Department was directed last year to provide a plan that would describe the selection process for a candidate site within the United States for ITER, the necessary steps that will lead to the final selection of a host site for ITER and the schedule and critical path including milestones and budgets that would be necessary for the design, construction, and beginning operation of ITER by 2005. These plans are essential to assure an orderly transition from the engineering design of

ITER to the beginning of construction, now scheduled for 1998. The Administration's reluctance to put forward a framework jeopardizes the future of the U.S. fusion program."

The report claims that "As TPX's primary purpose is linked to ITER and a demonstration reactor, without ITER, TPX's contribution to the Department's fusion program would be questionable."

In an inconsistent bit of arithmetic, the report states that "It is widely expected that the ITER host country would have to foot about 60 - 70 percent of the ITER costs. If ITER is built outside of the United States we could be expected to provide about 25 percent of the cost." (ITER costs are expected to be shared by the four parties: Europe, Japan, Russia and the U.S.)

The report states, "We strongly believe we should not pursue TPX unless and until both the President and the Congress have made a full commitment to ITER. To proceed without such a commitment is to invite another SSC debacle." The logic of the committee is obscure, since both the President and Congress had made a full commitment to the SSC and this did not prevent the "SSC debacle." Since a commitment to construct ITER can only be arrived at by the four governments acting in harmony, a process that is ongoing and scheduled to require several more years of design and negotiation, the net effect of the Senate action is to destroy the integrity and momentum of the U.S. national fusion program and the hopes that an improved physics basis can emerge for the design of cost-effective tokamak fusion power plants in the future.

HOUSE INCREASES FUSION BUDGET

Contrary to the negative budget action in the Senate, the House of Representatives added \$4 million to the President's FY 1995 fusion budget request and provided the full \$67 million and construction authorization for the TPX project. In securing the House endorsement, the fusion program withstood an amendment offered on the floor of the House by Rep. Dick Swett (D-NH) in which he sought specifically to cut the \$67 million earmarked for TPX.

In its report, the House Subcommittee on Energy and Water stated that it "is pleased with the outstanding results of the deuterium-tritium (D-T) experiments conducted on the Tokamak Fusion Test Reactor (TFTR) . . . is very concerned

that the Department (of Energy) has failed to report to the Congress on how it intends to move forward with the complex and detailed negotiations on ITER construction-related issues . . . provides \$66,700,000 to begin construction activities on the Tokamak Physics Experiment (TPX) . . . (and) instructs the Department to begin an aggressive low activation fusion materials program"

In his attack on fusion, Rep Swett, joined by Reps. Colin Peterson (D-MN), Christopher Shays (R-CT), and Karen Thurman (D-FL), stated that "Fusion makes sense. Building another tokamak does not." They stated that tokamaks "are not going to succeed as a commercially-viable energy source because of problems with cost, complexity, unreliability, and radioactive waste." "DOE should invest in cleaner, cheaper fusion concepts," he said.

A number of Representatives spoke against the "Swett amendment," which subsequently lost by a voice vote. They included Reps Dean Gallo (R-NJ), Tom Bevill (D-AL), George Brown (D-CA), Roscoe Bartlett (R-MD), Randy Cunningham (R-CA), Vic Fazio (D-CA), Duncan Hunter (R-CA), William Hughes (D-NJ), Herbert Klein (D-NJ), Marilyn Lloyd (D-TN), Ron Packard (R-CA), Lynn Schenk (D-CA), Christopher Smith (R-NJ), Robert Torricelli (D-NJ), and Dick Zimmer (R-NJ). Also submitting pro-fusion statements for the record were Reps. Bob Franks (R-NJ), Tim Roemer (D-IN), Marge Roukema (R-NJ), and Jim Saxton (R-NJ).

In the few days leading up to the offering of the Swett Amendment, a number of self-described environmental groups issued statements supporting Swett. These included the U.S. Public Interest Research Group (USPIRG), the Safe Energy Communication Council, Citizens United to Terminate Subsidies, and Public Citizen. Swett claimed that the following groups also supported his position: National Taxpayers Union, Friends of the Earth, Natural Resources Defense Council, Citizens Against Government Waste, Sierra Club, Nuclear Information and Resource Service, and Electric Power Research Institute (EPRI). Swett also cited Los Alamos and Livermore National Laboratory research reports critical of the tokamak.

EPRI ENDORSES FUSION PROGRAM

In two separate letters, the Electric Power Research Institute (EPRI) tried to dispel widespread reports that they are dissatisfied with the U.S. fusion program. In a letter

dated April 25, 1994 to Princeton Plasma Physics Laboratory assistant director Rush Holt, EPRI president Richard Balzhiser said he had asked Bob Hirsch, former vice president, EPRI Washington Operations, in his congressional testimony, to "differentiate his personal opinion from the EPRI management and (EPRI) fusion panel's conclusions as regards the merits of the ITER project. From the discussion I had with Bob regarding the testimony, I have every reason to believe his comments will be more sensitive to the problems created and used by critics of the overall fusion program." Balzhiser said, "I wish that EPRI were in a position to make a more substantial contribution to the (fusion) reactor engineering design and assessment program. Unfortunately, the forces of competition are making it more difficult for all of us, government included, to think as far and robustly into the future as was possible in the past." He said that he had asked Jack Kaslow "to serve as spokesperson for inquiries relating to the (EPRI) fusion panel's findings."

In a letter dated June 8, 1994 to Rep Tom Bevill, chair of the House Appropriations Subcommittee on Energy and Water, Jack Kaslow, chair of the EPRI Fusion Working Group, stated "I have been told that some of our positions are being used in an unintended way -- one that might undermine the funding for the Princeton TPX and the ITER experiments, and I wish to provide related clarification." He stated that "Our first report was brief and strongly supportive of fusion research." "We supported the ITER experiment and did not comment on TPX," he said. However, he noted that they stated that "improvements beyond the current line of research on tokamak are needed," and said that "It is our understanding that TPX is aimed in that direction, but because we have not considered TPX specifically, we can say no more at this time."

O'LEARY ENDORSES FUSION EFFORT

In a letter dated June 13, 1994 to Rep. Tom Bevill chair of the House Appropriations Subcommittee on Energy and Water, Energy Secretary Hazel R. O'Leary stated, "I am writing to express my strong support for the fusion energy program, and particularly for the Tokamak Physics Experiment. We believe that the development of fusion energy is important for the Nation's economic future and we are firmly committed to establishing the scientific and technical foundation for commercialization of fusion power in the most timely and cost-effective manner possible. This is the kind of program that exemplifies the Department's

mission to provide the Nation with the means necessary to achieve diversity in energy resource, a more productive and competitive economy, and improved environmental quality." O'Leary said that TPX "offers a unique opportunity to move fusion science and technology down the path toward an economically attractive demonstration fusion power plant."

Sources indicate that O'Leary was prepared to send a similar letter to Senator J. Bennett Johnston, but that Johnston told O'Leary's representatives that he would only be responsive to a letter from President Clinton. For reasons unknown, DOE was either unwilling or unable to secure a letter from Clinton. A letter from vice president Gore was sent to Senator Lautenberg, however, stating the Administration's position on fusion (see earlier article).

President Clinton did send a letter to Rep James Sensenbrenner (R-WI) urging him not to vote against funding for the Space Station. In that letter, dated June 22, Clinton assured Sensenbrenner that "in keeping with the concerns raised by you and other Members of the House and Senate, I want to assure you that the United States will maintain in-line autonomous U.S. flight and life support capability during all phases of station assembly." Sensenbrenner was concerned about U.S. reliance on Russian support and was leading a group opposed to the U.S. - Russian collaboration. After Sensenbrenner received Clinton's letter, he withdrew his opposition.

BROWN SPONSORS FUSION BILL

Rep. George Brown, chair of the House Science, Space and Technology Committee, introduced a bill (H.R. 4553), the "Fusion Energy Research Authorization Act of 1994," calling it a "next decade blueprint for DOE fusion programs." In introducing the bill, Brown said "The prospects of a world of 10 billion people fighting for scarce energy resources should not be a prospect to appeal to any of us. Fusion energy research holds the prospect of harnessing the power of the sun to provide abundant, affordable, and dependable energy. With the fusion energy research budget now down to half of what it was only 10 years ago, and given continuing budget pressures, it is more important now than ever that DOE's fusion research program be focused and carefully invested in ways that are most likely to contribute to the longer-term goal of developing fusion as a commercially-viable energy source." The bill states that "The Federal Government has a responsibility to fund research in energy technologies to help meet future expected energy demand where the

technical or economic risks of developing such technologies are too high to be borne solely by the private sector."

The bill calls for research on "alternative fusion concepts," in addition to the primary effort on "toroidal magnetic fusion concepts;" an "accelerated commitment to United States participation in ITER;" for "selection of a host country and establish a site selection process for ITER;" and the "establishment of a trust fund" to "provide a stable basis of funding for multi-year fusion energy research facility construction commitments."

The bill instructs the DOE to contract with the National Academy of Sciences "to conduct a study which examines the various magnetic fusion technologies and alternative fusion concepts to assess their current state of development, evaluates the potential of such technologies and concepts to become commercially viable sources of energy in the future and identifies research and development goals and priorities, and the range of probable costs and time scales, needed to achieve commercial viability."

The bill calls for DOE to submit to Congress the results of a study of the relative advantages and disadvantages of siting ITER in the U.S. and for the Secretary of Energy to seek agreement among the international partners for selecting a host country for the ITER site by October 1995. The bill also establishes a trust fund for fusion facility construction by levying a 0.1 mills per kilowatt-hour fee on electricity consumption. The bill earmarks \$26 million in FY 1995 for alternate concepts research out of a total authorization of \$380 million.

TPX AWARDS INDUSTRY CONTRACTS

Princeton Plasma Physics Laboratory has announced the awards of two industrial support contracts for the Tokamak Physics Experiment (TPX). A \$26 million contract has been awarded for the design of plasma facing components to General Atomics, teamed with McDonnell Douglas Corporation, Rocketdyne Division of Rockwell International Corporation, and the Ebasco Division of Raytheon Engineers and Constructors, Inc. An \$8.3 million contract for the design of the vacuum vessel was awarded to Ebasco Division of Raytheon Engineers and Constructors, Inc., teamed with McDonnell Douglas Corporation and General Atomics. All the industrial firms are members of Fusion Power Associates.



FUSION POWER ASSOCIATES

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AYMAR SUCCEEDS REBUT MELISSA CRAY TO DESCRIBE ICF DECLASSIFICATION CLINTON ENDORSES FUSION PROGRAM

AYMAR NAMED ITER HEAD

The international ITER Council, headed by Acad. E.P. Velikhov, has asked Robert Aymar to become Director of the ITER project, replacing Paul-Henri Rebut, effective immediately. The move is the result of a review of ITER management by the Council (See our June newsletter). Aymar is currently director of science programs for the French Atomic Energy Commission (CEA); previously he was director of the French "Tore Supra" superconducting tokamak project. Aymar has accepted the position and is expected to take up full time residence in San Diego in September.

Rebut was notified by Velikhov on June 29 that the IC would ask him to step down. Rebut issued a statement on June 30 stating that he would "try to ensure a proper transition." Rebut stated that "A successful international collaboration must have a real project structure, a legal entity, and project funding. ITER does not yet have such a project structure." He said that he "will continue to support the construction of an experimental reactor. For me, the real goal of the world fusion program is not any one specific experiment, however important, but the establishment of fusion as a major source of energy."

MELISSA CRAY TO SPEAK AT FPA ANNUAL MEETING SEPTEMBER 8-9 IN SAN DIEGO

Dr. Melissa Cray, Program Manager, Inertial Confinement Fusion, Los Alamos National Laboratory, will discuss recent declassification of key information on inertial confinement fusion (See our December 1993 and January 1994 newsletters) at the Fusion Power Associates annual meeting



MELISSA CRAY

and symposium, September 8-9 in San Diego. She is expected to describe how the declassification will allow increased collaboration with universities, industry and international researchers. In particular, she is expected to indicate that there has been a significant relaxation of restrictions on the publication of data on capsule and hohlraum design, hydrodynamic instabilities and mix, target output spectra and target fabrication. (Attendees at FPA's meeting will have an opportunity to tour the ICF target fabrication facilities at General Atomics.)

BILL CLINTON ENDORSES FUSION PLANS

In a letter dated July 13, 1994 to New Jersey governor Christine Todd Whitman, U.S. president Bill Clinton stated, "I am committed to pursuing a strong, balanced program for the development of fusion energy, and I'm encouraged by

your support for this promising area of science." Clinton said, "The TPX project at Princeton is the next major step for the U.S. fusion program, and I am confident that it will prove fusion technology to be a safe and commercially attractive form of power for the future. My budget for fiscal 1995 includes funding for the construction of TPX." "I look forward to working with you in the future to help our nation realize the great possibilities of fusion power," Clinton said.

TPX LETS MORE INDUSTRY CONTRACTS

Princeton Plasma Physics Laboratory has announced the awards of contracts for the Tokamak Physics Experiment's (TPX) two major superconducting magnet systems.

Babcock and Wilcox, a McDermott Company in Lynchburg, VA, was awarded a \$3.26 million contract for preliminary design of the 16 magnet system that forms the main toroidal confining field. General Atomics will be a subcontractor to Babcock and Wilcox for these magnets.

Westinghouse Electric Corporation, Marine Division in Sunnyvale, CA, was awarded a \$3.99 million contract for preliminary design of the 14 ring shaped magnets that form the poloidal field system. These magnets provide plasma current during startup, and help confine and shape the plasma. Northrup Grumman Aerospace & Electronics, of Bethpage, NY, and Everson Electric Company of Bethlehem, PA are subcontractors to Westinghouse.

When preliminary design is complete, in about 10 months, Babcock and Wilcox and Westinghouse will compete to conduct the remaining design and fabrication work on both magnet systems, with one or both expected to continue working on the project to completion.

The above contracts complement contracts let earlier (See last months newsletter) to General Atomics (teamed with McDonnell Douglas, Rocketdyne Division of Rockwell International Corporation, and Raytheon Engineers and Constructors) for the design of plasma facing components, and to Raytheon Engineers and Constructors (teamed with McDonnell Douglas Corporation and General Atomics) for the design of the vacuum vessel system.

All the above industries are members or affiliates of Fusion Power Associates.



GA VICE PRESIDENT DAVID OVERSKEI, PPPL DIRECTOR RONALD DAVIDSON, AND RAYTHEON VICE PRESIDENT ROBERT IOTTI JOIN HANDS FOLLOWING SIGNING OF TPX INDUSTRY CONTRACTS

Proposals have been solicited for a systems integration support contractor and a construction manager. Awards for those contracts is expected in the Fall. Solicitations are also expected next year for the TPX heating and remote handling systems. Those contracts will be let through the Oak Ridge National Laboratory. A small contract has also recently been let by Princeton to CVI for the testing of the MFTF-B refrigerator at Livermore, as a step leading to its use for TPX.

SENATORS FOR/AGAINST FUSION

As reported last month, the Senate Appropriations Committee, on June 23, voted to delete funds for the construction of the Tokamak Physics Experiment (TPX). However, in a surprise development, funding for the construction of TPX was restored by a recorded vote on the floor of the Senate on June 30. The vote was 69-30, with one Senator not present (Bryan of NV). The senators who voted AGAINST the construction of TPX were as follows: Brown (R-CO), Burns (R-MT), Campbell (D-CO), Coats (R-IN), Cohen (R-ME), Coverdell (R-GA), Craig (R-ID), D'Amato (R-NY), Faircloth (R-NC), Ford (D-KY), Gramm (R-TX), Grassley (R-IA), Gregg (R-NH), Helms (R-NC), Hutchison (R-TX), Jeffords (R-VT), Kassebaum (R-KS), Kempthorne (R-ID), Lott (R-MS), Lugar (R-IN), McCain (R-AZ), Murkowski (R-AK), Nickles (R-OK), Nunn

(D-GA), Reid (D-NV), Roth (R-DE), Smith (R-NH), Thurmond (R-SC), Wallop (R-WY), and Warner (R-VA).

(Editors note to readers: If your senator voted against the TPX, please write to him/her, provide some positive perspective on fusion, and ask that they support the fusion program in the future. If your senator voted for the TPX, write to thank him/her and ask for continued support.)

ANS ANNOUNCES FUSION AWARDS

The Fusion Energy Division of the American Nuclear Society has presented its Outstanding Achievement Award to Dr. John R. Gilleland (Bechtel Corporation) and Dr. Nermin A. Uckan (Oak Ridge National Laboratory). Dr. Gilleland was recognized for "over 20 years of significant technical leadership in the World fusion program," including his role as project manager for the Doublet III tokamak and his service as managing director of the U.S. ITER conceptual design activities. Dr. Uckan was recognized for her "leadership role in developing the discipline of plasma engineering," including her "important contributions to the study of ignition and burn physics as applied to the design of national and international projects."

The Division also presented its Outstanding Technical Accomplishment Award to Dr. Charles Bathke of Los Alamos National Laboratory and its Student Award to Dr. Ali Shajii of MIT. Dr. Bathke was cited for "his outstanding accomplishments in the area of fusion reactor systems studies," including his contributions to the ARIES studies. Dr. Shajii was nominated by Prof. Jeff Freidberg for his thesis entitled "Theory and Modeling of Quench in Cable-in-Conduit Superconducting Magnets."

LANL/LLNL CLARIFY STANCE

In our last month's newsletter we reported that Congressman Swett (R-NH) had cited Los Alamos and Livermore research reports critical of the tokamak during a debate in the House of Representatives on his amendment (defeated by voice vote) to delete funding for the Tokamak Physics Experiment. We neglected to note that fusion managers at both Los Alamos and Livermore National Laboratories had written to their respective congressmen stating their support for TPX.

In a June 13 letter to Rep. Steven Schiff, Los Alamos fusion program manager Richard Siemon stated, "This would be a



ANS AWARD WINNERS JOHN GILLELAND AND NERMIN UCKAN WITH FPA PRES. STEVE DEAN

terrible time for a major redirection of the program towards non-tokamak research as proposed by Swett." In a June 14 letter to Rep. Bill Baker, Livermore Associate Director for Energy Programs Dave Baldwin stated that Swett's use of the Livermore report "misconstrues both the content and intent of our work." "Livermore supports the tokamak program and to see our views used as an argument for abandoning that which is succeeding, the tokamak, before it is tested is to truly misunderstand our intent."

ITEMS TO NOTE

A video of the approximately 50-minute debate on fusion in the House of Representatives on June 14 is available from the office of Dr. Ronald C. Davidson, FAX (609)243-2749.

The Department of Energy has available a 5-year program plan (FY 1994-FY 1998) for the Inertial Confinement Fusion Program, dated April 20, 1994. Copies available from Gary Chenevert, FAX (301)903-3888.

MIT has been awarded an "R&D 100 Award" for the development of an "Active Millimeter Wave Pyrometer," used to make temperature measurements in a hostile processing environment. The device has been used in the Mark 2 plasma furnace at MIT in studies of processes for deactivation of toxic waste. The work is a spinoff of fusion diagnostics, where millimeter wave radiometry has been used for electron cyclotron emission studies. Contact Paul Woskov or Dan Cohn, FAX: (617)253-0700.

Northrup Corporation has purchased Grumman Corporation. The company is now called Northrup Grumman. Fusion is carried out in the Aerospace & Electronics Division under Bob Botwin, Director, Technical Operations - Advanced Development. He can be reached at (516)575-8988.

The name Ebasco Division has been eliminated. What was Ebasco is now known as Ratheon Engineers & Constructors, address, etc. unchanged.

The U.S. ITER Home Team has completed its move from ORNL to the University of California at San Diego. Charlie Baker, U.S. ITER Home Team Leader can be reached at (619)534-6207; FAX - 4771. His mailing addresses are Division of Engineering, UCSD, 9500 Gilman Drive, La Jolla, CA 92093-0403. For Federal Express deliveries use Engineering Building Unit 1, Seventh Floor, 9500 Gilman Dr., etc.

Dr. Terrence A. (Terry) Davies has joined Charlie Baker at UCSD as ITER Project Coordinator. He can be reached at (619)534-9830.

According to DOE's Martha Krebs, there are now 700 CRADAs in place between DOE laboratories and industry, with a combined value of \$600 million.

NEUTRON SOURCE DESIGN LAUNCHED

Under the auspices of the International Energy Agency (IEA), an international activity has been launched to design a neutron source facility to test materials for use in fusion devices. The study will be headed by Dr. Tatsuo Kondo of Japan. Dr. Tom Shannon will head the U.S. participation. Scientists from Europe and Russia will also join in the design activity. The neutrons will be produced by aiming an accelerated beam of deuterons onto a lithium target, resulting in the production of neutrons at about the same energy (14 MeV) and intensity expected in a fusion plant, but over only a small volume (about 1 liter). The cost of the facility was estimated in a DOE announcement as "in the billion dollar range." The conceptual design is expected to be completed in January 1997. There is no commitment for construction. (Editors note: The official DOE "U.S. Magnetic Fusion Strategy" Chart shows operation of such a facility in 2005.)



Ruth Watkins

RUTH WATKINS DANCES AT DISNEY WORLD'S MAGIC MUSIC DAYS

Ruth Watkins, Fusion Power Associates Vice President, Administration and Finance, will perform at Disney World with the Dawn Crafton Dancers during the week of August 9. The group is composed of dancers in all age groups; they perform annually for the benefit of Children's Hospital in Washington, DC. The dance troupe was invited to perform at Epcot Center and the Magic Kingdom as part of Disney World's "Magic Music Days." Ruth will be dancing with the "Classics," a part of the group comprised of adult women who love to dance as a hobby. They will be tap dancing to a variety of songs.

PEOPLE

In Memoriam: Fusion pioneer Angus Hunt died June 17 at his home in California at the age of 68. Angus worked in the fusion program at the Lawrence Livermore National Laboratory for 30 years. He was a pioneer in the field of high vacuum technology. Memorial gifts can be made to the American Cancer Society, P.O. Box 4295, Walnut Creek, CA, 94596. He is survived by his wife, Patricia, two daughters, one son and eight grandchildren.

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FPA 1994 AWARDS ANNOUNCED**LEADERSHIP****CHARLES C. BAKER
STEVEN E. KOONIN****DISTINGUISHED CAREER****CHARLES A. FLANAGAN
WULF B. KUNKEL****EXCELLENCE IN ENGINEERING****CHARLES E. KESSEL
KATHRYN A. McCARTHY****LEADERSHIP AWARDS**

Dr. Charles C. Baker and Prof. Steven E. Koonin have been selected by Fusion Power Associates Board of Directors to receive FPA's 1994 Leadership Awards, in recognition of the outstanding leadership qualities they have demonstrated in accelerating the development of fusion.

Dr. Baker has been a leader in the magnetic fusion community for many years. As director of the fusion program at Argonne National Laboratory during the 1980's, he was responsible for the STARFIRE fusion power plant design study, which remained the standard for tokamak power plant designs until the recent ARIES design studies. His group made major contributions to the issues of fusion energy conversion technologies and associated materials and coolants. He led the 1985-87 program-wide Technical Planning Activity. After transferring to the Oak Ridge National Laboratory, he led the fusion technology efforts there and became the U.S. Home Team Leader for the ITER effort, a position he

still holds after recently transferring to the University of California at San Diego.

Professor Koonin, of the California Institute of Technology, has had a major impact on the programs and plans of the inertial confinement fusion program. As chairman of the National Academy of Sciences fusion review committee in 1990, he specified the technical program issues and milestone achievements that should be required before initiating next step major facilities construction. These requirements continue to guide the DOE in managing the program. Prof. Koonin maintains a strong influence on the course of the inertial confinement fusion program through his membership on the Inertial Confinement Fusion Advisory Committee, where he chairs the subcommittee on target physics.

DISTINGUISHED CAREER AWARDS

FPA's Board of Directors has voted to present its 1994 Distinguished Career Awards to Charles A. Flanagan and



Charles C. Baker

Wulf B. Kunkel, in recognition of their lifelong career contributions to the development of fusion.

Chuck Flanagan recently retired from Oak Ridge National Laboratory, where he has served as deputy U.S. ITER Home Team Leader and Project Coordinator since 1990. From 1980-1990, as an employee of Westinghouse Corporation, he served as deputy manager of the Fusion Engineering Design Center, in Oak Ridge, TN. From 1975-1980, he was manager of fusion projects at the Westinghouse Fusion Power Systems Department, in Pittsburgh. From 1956-1975, he worked on a variety of nuclear engineering programs at Westinghouse.

Wulf Kunkel recently retired from the Lawrence Berkeley Laboratory, where he had been group leader of the Magnetic Fusion Energy Group since 1970. He is a pioneer of the fusion program, having joined the staff of the laboratory in 1951. He became a professor of physics at UC-Berkeley in 1967. Over the years, he was active in most aspects of experimental plasma physics, as well as being a Fellow of the American Physical Society and an active participant in many committees of the APS Division of Plasma Physics.

ENGINEERING AWARDS

FPA's Board of Directors has voted to present its 1994 Excellence in Fusion Engineering Awards to Charles E. Kessel and Kathryn A. McCarthy. These awards were established in 1987 in memory of MIT professor David J. Rose to recognize individuals in the early part of their careers who have shown outstanding technical



Charles A. Flanagan



Wulf B. Kunkel



Charles E. Kessel



Kathryn A. McCarthy

accomplishment and leadership potential in the field of fusion engineering.

Charles Kessel received his Ph.D. degree in engineering from UCLA. Since then he has worked at the Princeton Plasma Physics Laboratory. His primary contributions to fusion have been in the area of application of theoretical codes to tokamak design, including key contributions to the ARIES, TPX, PULSAR, and Princeton Spherical Torus designs. He has also been active in the ASDEX-U collaboration.

Kathryn McCarthy received her Ph.D. degree in engineering from UCLA. Since then she has worked at the EG&G Idaho National Engineering Laboratory, where she directs the liquid metal safety experimental research program and the activation product volatility program. She is also providing data for use in the ITER safety analysis. She is an expert in the application of computer codes to fusion reactor safety analysis and participates in fusion power plant design studies such as PULSAR.

AYMAR, IOTTI JOIN ITER PROJECT

Dr. Robert Aymar has taken over as director of the ITER project (see our August newsletter). In accepting the post, Aymar made an address to the ITER council at its meeting July 27. In that address, Aymar stated his view that "the consensus among the Parties is the fundamental principle of the ITER collaboration." He indicated that there would be extensive sharing of responsibilities with the "Home Teams" of the Parties. He indicated his intention to meet regularly with the Home Team Leaders. In the near term, Aymar is visiting the Co-Centers in Germany and Japan and undertaking a review of the design and R&D plans accomplished to date. As a consequence of the management change, he has requested a slippage in schedule for delivering the Interim Design Report from March until June 1995.

As part of the effort to strengthen the ITER organization, the ITER Council has appointed Dr. Robert C. Iotti to be Administrative Officer of the ITER project. Dr. Iotti is Vice President of Raytheon Engineers and Constructors (formerly Ebasco Services) and a former chairman of Fusion Power Associates Board of Directors.

LEGISLATIVE UPDATE

The House of Representatives passed a fusion energy authorization bill (HR 4908) on August 19. The provisions of the bill are essentially as described in our July newsletter. Key features of the bill are "to ensure that alternative fusion concepts receive adequate funding; to provide an accelerated commitment to United States participation in ITER; and to provide for the selection of a host country and establish a site selection process for ITER." The bill also authorizes up to \$700 million "to complete the design, development, and construction of the Tokamak Physics Experiment," and calls for a National Academy of Sciences review to evaluate the potential of "various magnetic fusion technologies and alternative fusion concepts" to become "commercially viable sources of energy in the future." The bill must now be reconciled with a Senate bill passed last year which called for the elimination of research on all magnetic fusion concepts except the tokamak (see our September 1993 newsletter).

The Congress has passed the DOE FY1995 fusion appropriations bill, including funds designated for fusion development. The bill provides the full amount of funding

for fusion requested by the President, albeit distributed somewhat differently.

The Tokamak Physics Experiment continues to be limited to design, with construction authorization withheld. The conference report calls for a review of fusion policy by the President's Council on Science and Technology.

ICFAC REPORTS

DOE'S Inertial Confinement Fusion Advisory Committee (ICFAC) reported, in an 8 August letter to DOE Assistant Secretary for Defense Programs Victor Reis, it found that the inertial confinement fusion (ICF) program at the University of Rochester "plays an important role in the ICF program and can be expected to do so based upon the quality of the work and the variety of ways it contributes to the ICF program." ICFAC commended the University of Rochester for important contributions, including the testing of the "direct drive approach," the training of students, the construction of the Omega Upgrade laser, the operation of the National Laser Users Facility, and for bringing "an independent group of scientists with a university perspective rather than a national laboratory perspective to the problem of laser-driven ICF."

ICFAC chairman V. Narayanamurti also noted in his letter that "all but one" of the ICFAC members had recommended that the DOE proceed into engineering design of the National Ignition Facility (NIF). The committee believed "that the laser can be built to satisfy the requirements of NIF," in part because key elements of the design "have been successfully tested in the beamlet facility at LLNL," and in part because, in their opinion, the NIF laser conceptual design "will provide sufficient flexibility in capability and margin in energy to realize the present design goal of 1.8 MJ reliably." The DOE has not yet authorized proceeding with engineering design of the NIF, although it must soon decide whether to request funds for construction in the FY 1996 budget. Foes of the NIF have surfaced among groups seeking to further downsize the DOE weapons program. They are concerned that the NIF will encourage DOE to maintain a larger than necessary weapons research program. In order to give these groups an opportunity to air their views, DOE has scheduled a public workshop for September 8 at the Washington Hilton hotel.

FUSION POWER ASSOCIATES AWARD PROGRAMS

LEADERSHIP AWARDS

Leadership Awards are presented by the Fusion Power Associates Board of Directors to those individuals who have shown outstanding leadership qualities in accelerating the development of fusion. Recipients are:

1980	S. J. Buchsbaum R. L. Hirsch M. McCormack P. Tsongas
1981	E. E. Kintner
1982	H. P. Furth J. H. Nuckolls
1983	J. L. Emmett T. K. Fowler
1984	T. Ohkawa G. Yonas
1985	E. P. Velikhov C. Yamanaka
1986	R. C. Davidson
1987	M. N. Rosenbluth
1988	J. F. Clarke
1989	P-H. Rebut
1990	B. B. Kadomtsev
1991	B. Coppi E. Storm
1992	R. W. Conn G. L. Kulcinski
1993	D. L. Cook J. Sheffield
1994	C. C. Baker S. E. Koonin

DISTINGUISHED CAREER AWARDS

Distinguished Career Awards are presented to those individuals who have made distinguished lifelong career contributions that directly or indirectly have benefitted fusion. Recipients are:

1987	M. B. Gottlieb D. Kerst R. F. Post L. Spitzer, Jr.	1991	H. K. Forsen J. W. Landis R. L. Sproull H. G. Stever
1988	K. Husimi D. Palumbo R. S. Pease	1992	R. Bickerton A. Bishop V. Glukhikh S. Mori
1989	F. H. Coensgen D. J. Grove F. L. Ribe	1993	R. A. Gross M. W. Rosenthal
1990	N. G. Basov T. Sekiguchi		

EXCELLENCE IN ENGINEERING AWARDS

1987	Steven J. Piet
1988	Michael A. Ulrichson
1989	David Ehst Y-K. Martin Peng
1990	Wayne Reiersen
1991	John Santarius
1992	Oleg Filatov Steven Zinkle
1993	John D. Galambos Scott W. Haney
1994	C. E. Kessel K. A. McCarthy

SPECIAL AWARDS

1980	J. R. Beyster, Jr.
1981	E. A. Frieman
1987	A. W. Trivelpiece
1990	G. S. Clemens
1990	J. Killeen



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FPA HONORS REP. DEAN A. GALLO JASON ENDORSES NATIONAL IGNITION FACILITY ANS ENDORSES FUSION PROGRAM

FPA HONORS GALLO

Fusion Power Associates' Board of Directors has voted to present a Special Award to Representative Dean A. Gallo (R-NJ) "for outstanding public service in advancing the development of fusion energy." In announcing the award, FPA president Steve Dean said the Board felt that Gallo had been "an extraordinarily effective advocate in the United States Congress for programs to ensure a secure energy future for future generations of Americans."

Gallo, a member of the House Committee on Appropriations, has been a member of Congress since 1985. He argued forcefully for adequate funding for fusion development programs. In the recent floor debate on fusion (see our July 1994 newsletter), Gallo orchestrated the response to fusion critics. During the course of that debate Mr. Gallo stated, in part, "Energy is fundamental to everything we do. Unfortunately, energy use strains the environment, and that is why scientists around the country and around the world are working to harness fusion energy." "Energy security is at the heart of this program. But harnessing the energy of the Sun and stars is not easy. The Wright brothers didn't invent the passenger airplane, but they took the first huge step." "Future generations are going to need a stable, environmentally clean source of energy. If we shortchange our research and development programs, we will pass along to the next generation, energy problems that could be solved if we invest in new technologies now. Fusion is that investment."

We couldn't have said it better ourselves!



Rep. Dean A. Gallo

ANS ENDORSES FUSION

The Board of Directors of the American Nuclear Society has approved a "Position Statement" on fusion energy. The statement reads, in part, "The American Nuclear Society supports a vigorous research and development program for fusion energy. Fusion represents a sustainable source with favorable safety and environmental features. Even with substantial conservation efforts and improvements in end-use efficiency, the future world demand for energy is expected to increase as a result of population growth and economic development. The timely advent of fusion as a practical energy source may be crucial." Copies of the complete statement may be requested from the ANS, 555 N.

Kensington AV, LaGrange Park, IL 60525.

FUSION COMMITTEE REACTIVATED

The Department of Energy has reactivated its Fusion Energy Advisory Committee (FEAC) and appointed mostly new members. The 15-member group will hold its first meeting December 1-2 in the Washington, DC area. All meetings are announced in the Federal Register and open to the public. Time is allotted for "public comment."

The University of California at San Diego (UCSD), Battelle Pacific Northwest Laboratory, and Martin Marietta Energy Systems, Inc (manager of Oak Ridge National Laboratory) each placed two persons on the FEAC. Robert W. Conn, dean of engineering at UCSD, will continue to chair the committee. Other members of the FEAC are: John Clarke (Battelle), Tom Cochran (Natural Resources Defense Council), Harold Forsen (Bechtel Hanford), Joe Gavin (retired former president of Grumman Corp.), Katherine Gebbie (National Institute of Standards and Technology), Beverly Hartline (Continuous Electron Beam Accelerator Facility), George Jasny (Martin Marietta), Michael Knotek (Battelle), John Landis (Stone & Webster), Stephen Rosen (Houston Lighting & Power Company), Marshall Rosenbluth (UCSD), Floyd Thomas (Martin Marietta), James Thompson (Orbital Sciences Corp.), and Demetrius Venable (Hampton University).

MORE ON DECLASSIFICATION

Late last year DOE declassified portions of its inertial confinement fusion (ICF) program (see our December 1993 and January 1994 newsletters). Speaking on behalf of Los Alamos ICF program manager Melissa Cray at Fusion Power Associates annual meeting last month in San Diego, Los Alamos scientist Larry Foreman described many details of the newly declassified information.

DOE now permits ICF scientists to describe fabrication techniques for ICF targets, provided the techniques do not divulge otherwise classified weapons information and to openly discuss "all information" on laboratory ICF targets which meet all of the following conditions: fuel capsule dimensions no larger than 1 cm, fuel capsule absorbed energy no greater than 10 MJ, driving temperature no greater than 350 eV, no fissile material and not revealing classified weapons physics or material properties. Scientists can describe the results of classified code calculations but the

codes used for ICF remain largely classified and details of the calculations cannot be revealed.

The September issue of Physics Today also contains (p.17-19) a brief description of newly declassified ICF information. The article quotes Osaka University ICF scientist Hiroshi Azechi as saying that, before declassification, scientific communication with Livermore was "like scratching one's foot through a shoe." The article summarizes four ICF papers which are soon to appear in the journal Physical Review Letters.

DOE HOLDS NIF WORKSHOP

The National Ignition Facility has come under fire from various anti-nuclear anti-weapons groups, causing Energy Secretary O'Leary to delay her decision to proceed to the next phase of the NIF design. The decision, which was expected in late May, was postponed while a paper was prepared within the DOE addressing the issues involved.

The issues being raised by critics were summarized in a June 29 letter from California congressman Ron Dellums to Secretary O'Leary. In it he states that "groups and individuals with whom I have had longstanding working relationship and shared values have challenged these representations (on which the NIF is based)." Dellum said, "They dispute the wisdom of fusion energy as a long-term energy source and believe the NIF is too expensive an experiment to undertake to move forward on the investigation of this question; they dispute NIF's relevance to their view of the fundamental mission of the (nuclear weapons stockpile) stewardship program (the safety of nuclear weapons); and they have profound concerns that the NIF, (because they believe it will facilitate the designing and modelling of new weapons without having to test them and the maintenance of a large weapons design team at LLNL) will prevent the successful completion of the CTB (comprehensive test ban) negotiations, thereby derailing the extremely important element of our national security policy on pursuing non-proliferation." A number of meetings were held over the summer, culminating in a DOE-sponsored, by invitation only, workshop held in Washington, DC on September 8.

Approximately 60 people attended the workshop, of which 18 were from what DOE has dubbed "NGO's" (non-governmental organizations). An additional 12 came from DOE laboratories; 5 Congressional staff; 14 DOE; 8 other

federal agencies. Sidney Drell, chairman of JASON, was an "invited speaker," and V. Narayanamurti, chairman of the DOE Inertial Confinement Fusion Advisory Committee was an "invited guest."

In a letter dated September 20, DOE Assistant Secretary for Defense Programs Victor Reis sent, to all those who had been invited (including FPA president Steve Dean), a document entitled "Report on the Department of Energy National Ignition Facility Workshop held at the Washington, DC Hilton." In his letter, Reis states "It was a new experience for many of us and I think we had some good, frank, and open discussion of the issues concerning the NIF." The report states that "The purpose of the workshop was to develop issues and associated pros and cons for the National Ignition Facility, (and) review and comment on the Department procedures for ensuring effective public interface subsequent to any Key Decision 1." The report states that "the group broke into four facilitated working groups, where each group dealt with all of the workshop issues." An appendix to the report lists four "facilitators," one from Success Resources of Atlanta, and three from Westinghouse, Savannah River.

The report states that 6 major issues were "identified by the workshop attendees, while together in the opening session." These were "the role of the National Ignition Facility in 1) non-proliferation; 2) the Stockpile Stewardship program; 3) the Department's programs for science and technology; 4) the Department's programs for energy; 5) the Department's budget; 6) the environment, safety, and health at the site selected." The report then goes on to list the pros and cons identified by the participants. The report states that "It was NOT the purpose of the workshop to reach consensus on issues." It also states that "Current plans are for four or five workshops to be held, each potentially dealing with one subject area."

Copies of the workshop report, its appendices and material distributed at the workshop may be requested from Victor Reis, Assistant Secretary for Defense Programs, U.S. Department of Energy, Washington, DC 20585.

JASON GROUP ENDORSES NIF

For several decades, a group of university scientists under contract to the MITRE Corporation, and calling themselves the JASON group, have spent a good fraction of their summers studying defense issues for the government.



Prof. Steven E. Koonin

Currently they have been analyzing the DOE National Security Strategic Plan which calls for a "Science-Based Stockpile Stewardship (SBSS) program, the purpose of which is "to assure confidence that the (nuclear weapons) stockpile is safe, secure, reliable, and flexible without underground testing." As a part of their analysis, JASON has reviewed the role of the proposed National Ignition Facility in that program.

Prof. Steven E. Koonin, winner of Fusion Power Associates 1994 Leadership Award, and Prof. Marshall Rosenbluth, winner of FPA's 1987 Leadership Award, are JASON members. At a DOE NIF Workshop September 8, JASON chairman Sidney Drell presented the JASON view of NIF. He called the NIF "the most scientifically exciting program proposed by the national laboratories for Science-Based Stockpile Stewardship." He said that JASON feels "that the NIF has an essential role to play in maintaining 'the core intellectual competency' mandated by the 1994 National Defense Authorization Act." He said that JASON believes that NIF "does not represent a significant proliferation risk." Drell said that "The attainment of ignition in NIF will demonstrate an integrated mastery of forefront areas in hydrodynamics, radiation transport, computational physics, atomic physics, and plasma and non-linear physics. It is this overall challenge that is so exciting scientifically." Further, the JASON report states, "The NIF technology is not a nuclear weapon, cannot be adapted to become a nuclear weapon, and demands a technological sophistication far more advanced and difficult than required for nuclear weapons."

NATIONAL IGNITION FACILITY

The National Ignition Facility (NIF) is a 192 beam, frequency-tripled, multi-pass architecture, Neodymium glass laser facility which is capable of focussing 1.8 Megajoules of 0.35 micron light onto a small target. The NIF is generally agreed to be the logical next step in demonstrating the physics and technology of inertial confinement fusion and is aimed at studying the ignition of the tiny fuel capsules. It is a proposed project within the DOE Defense Programs, aimed at studying weapons physics issues, simulating nuclear weapon effects, etc.; with long-term potential application to electric power generation. The cost of the NIF is estimated at \$1.1 billion, with operation proposed to begin in 2002, presuming DOE asks for construction authorization in FY 1996.

PEOPLE

John Dawson of UCLA was the first visiting lecturer sponsored by the Don Kerst memorial fund at the University of Wisconsin. He spoke on "plasma accelerators" September 23.

Andy Faltens has been named Program Deputy of the Fusion Program at the Lawrence Berkeley Laboratory, reporting to *Roger Bangerter*. He replaces *Tom Fessendon*, who stepped down a few months ago.

Nasr Ghoniem of UCLA has been elected a Fellow of the American Nuclear Society.

Robert L. Hirsch, former VP, Washington Office of EPRI, has been named Senior Vice President, General Atomics, in charge of GA's Washington DC office. He replaces *Norvel Carey* who retires November 1 after 25 years of service.

John Holdren has been named to the newly-created President's Council of Advisors on Science and Technology (PCAST) by President Clinton.

Russell Hulse, *James Strachan*, and *Roscoe White* are the recipients of the newly-created Distinguished Research Fellowships at the Princeton Plasma Physics Laboratory.

Robert C. Iotti, VP, Ratheon Engineers & Constructors, and a former member and chairman of Fusion Power Associates Board of Directors, has become Administrative Officer for the ITER Joint Central Team, reporting to ITER Director

Robert Aymar.

Don Rej, of Los Alamos National Laboratory, was presented the 1994 Award for Excellence in Technology Transfer, for his work on developing a pilot plant for plasma-source ion implantation. The project is the subject of a \$14 million joint project between Los Alamos and General Motors (see our July 1993 newsletter).

Tom Shannon has been named Acting Director of the Fusion Energy Division at the Oak Ridge National Laboratory. Tom has also announced his planned retirement from ORNL and his acceptance of a faculty position at the University of Tennessee effective in January.

John Sheffield has been named Acting Associate Director for Energy, and Environmental Technology at Oak Ridge National Laboratory. He replaces *Bill Fulkerson* who has announced his planned retirement.

Members of the American Nuclear Society Fusion Energy Division have elected *Douglass Post* vice chair/chair elect, Robert Mayo secretary/treasurer, and also *Jim Anderson*, *Laila El-Guebaly*, *John Haines* and *Ken Schultz* to the Executive Committee. *Ron Miller* is the current chairman.

E-MAIL ANYONE?

Those with nothing better to do may wish to send an e-mail message on some important topic to one or all of the following: hazeloleary@hq.doe.gov; president@whitehouse.gov; vicepresident@whitehouse.gov

QUOTABLE

"I am concerned that the current climate of intense (DOE) oversight combined with overbearing audits makes it very difficult for us to implement continuous quality improvement, enhance organizational effectiveness and increase productivity. In addition, new procurement reforms are jeopardizing a long and productive relationship between the Department of Energy and the University of California, which I believe has been central to five decades of scientific excellence and exceptional public service."

Sig Hecker, Director
Los Alamos National Laboratory
LANL Newsbulletin, May 6, 1994



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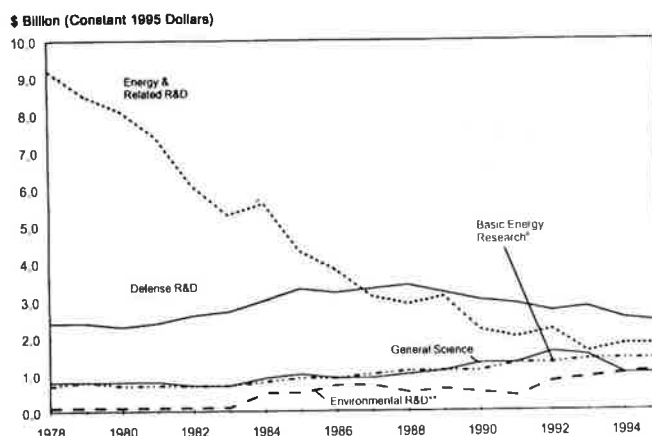
DOE ENERGY R&D DECLINED FIVEFOLD SINCE 1978 SECRETARY OF ENERGY FORMS R&D TASK FORCE O'LEARY ENDORSES NATIONAL IGNITION FACILITY

TASK FORCE FORMED

Fusion Power Associates' president Steve Dean was one of 31 persons named by Energy Secretary Hazel O'Leary to a "Task Force on Strategic Energy Research and Development of the Secretary of Energy Advisory Board (SEAB)." O'Leary said that she was calling for "a high level review of the department's \$1.8 billion portfolio of applied energy programs" in order "to get an independent assessment of whether the department has a coherent and effective plan for getting energy technologies into the marketplace."

At the first meeting of the Task Force on October 12, O'Leary told the Task Force that funding for the energy programs involved (fossil, efficiency, renewables, fusion, and civilian nuclear) had declined fivefold since 1978, from \$9.2 billion to \$1.8 billion (see figure), even though world energy use had nearly doubled during this period and U.S. oil imports were currently running over \$40 billion per year. Furthermore, O'Leary estimated that the world market for new and improved energy technologies would be well over a trillion dollars a year by the year 2000. This prompted some members of the Task Force to suggest that the DOE R&D budget was much too small and that DOE needed to see programs through to completion rather than ramping programs up and down based on their current political popularity. This latter habit was dubbed by some Task Force members as supporting "technologies du jour."

The Task Force is headed by Daniel Yergin, president of Cambridge Energy Research Associates and author of the Pulitzer Prize winning book, "The Prize," a history of the oil



*Includes Basic Energy Sciences and Biological and Environmental Research
**Includes Env Tech Development, Civilian Radioactive Waste, and ES&H R&D

DOE Science and Technology Funding, 1978-1995

Source: U.S.DOE

and gas industry. Secretary O'Leary asked the Task Force for an interim report by June 1, 1995 and a final report by October 1, 1995. The Task Force plans to hold a meeting in mid December on DOE's coal and nuclear programs, in late January on renewables and fusion, in late February on oil and gas, and in March on efficiency programs. For further information and a complete list of the Task Force members, contact Peter Didisheim, Office of the Secretary of Energy, U.S.DOE, fax (202)586-9626.

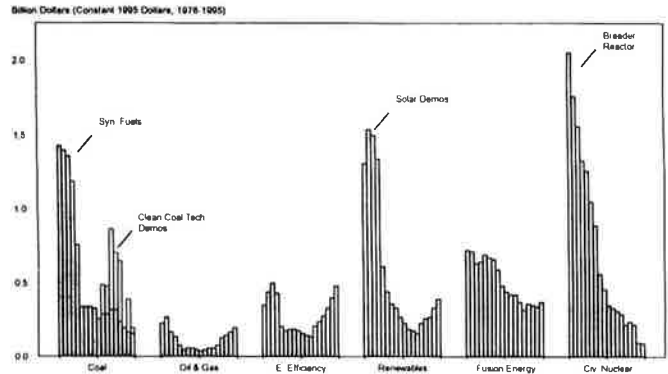
TECHNOLOGIES DU JOUR

Since 1978, DOE funding for civilian nuclear power research and development has undergone a steady decline from the largest DOE energy program at around \$2 billion per year

(converted to 1995 dollars) to become the smallest, at around \$100 million per year, according to data presented to the SEAB Energy R&D Task Force by Energy Secretary Hazel O'Leary (see figure). Renewable energy technologies underwent a similar steep decline during the 1980's, but has been making a comeback in recent years. Fusion funding was cut by about a factor of two in the late 1980's and has been holding steady. O'Leary asked the Task Force to review these and the other technologies shown in the figure and to provide her with "guidance on whether the department as a whole has established reasonable priorities in our energy R&D programs, and whether these priorities are aligned with national needs." "I need answers," O'Leary said. At its October 12 meeting, the Task Force was given presentations by Sue Tierney, Assistant Secretary, DOE Office of Policy, who told the Task Force that, in addition to the \$1.8 billion DOE was spending on energy R&D, DOE was spending over \$6 billion on "environment," over \$5 billion on "national security," and over \$2 billion on "general science and basic energy research," out of a total FY 1995 budget of \$17.2 billion. The Task Force also received briefings from DOE top management responsible for the programs involved in the review, including Dr. James Decker, deputy director of the Office of Energy Research.

DOE APPROVES NATIONAL IGNITION FACILITY

Energy Secretary Hazel R. O'Leary announced October 21 the go-ahead (so-called Key Decision 1) to the engineering design of the laser-based National Ignition Facility (see our October newsletter). The \$1.1 billion facility is aimed at igniting small pellets containing deuterium-tritium fusion fuel, producing fusion energy approximately equal to the 1.8 Megajoule laser input. It should operate in 2002 as an intermediate step towards a Laboratory Microfusion Facility which would produce about 100 times more energy than the driver energy in a single shot. The primary mission of the NIF is to study weapons physics, but it is also a critical step on the path to a commercial power plant based on inertial confinement fusion. Commercial power requires a new type of driver, one that can pulse several times a second rather than in single pulses as the NIF is designed to do. DOE has several promising types of repetitively-pulsed drivers in early stages of development, including heavy ion accelerators, light ion pulsed power accelerators, and advanced lasers. Lawrence Livermore National Laboratory is leading a multi-laboratory team to design the NIF.



DOE Energy R&D Budgets, 1978-1995

Source: U.S. DOE

JAPAN SETS NEW FUSION RECORD

Japanese scientists working on the JT-60 tokamak have extended their world record value (see our April 1993 newsletter) of the fusion triple product (product of plasma density, temperature and confinement time) to a new high value of $1.2 \times 10^{21} \text{m}^{-3} \text{keVs}$, thirteen percent higher than the previous record value. The fusion triple product is widely used as the primary indicator of progress toward achieving the conditions required for an operating fusion power plant. Such a plant would require approximately a factor of 3 higher value of the triple product than that achieved in JT-60. A power plant also would require sustaining plasma conditions in steady state as contrasted with the several seconds achieved in today's experiments. Achieving steady state is one of the goals of the Tokamak Physics Experiment (TPX), a national U.S. facility proposed for construction at the Princeton University Plasma Physics Laboratory. The JT-60 results were reported last month at the IAEA biennial fusion conference in Spain. For further information contact Hiroshi Kishimoto, director, Department of Fusion Plasma Research, JAERI, fax 81-292-70-7419.

RUSSIAN FUSION PROGRAM STRUGGLES

Reliable high level sources in the U.S. and Russia have indicated that Russia is currently unable to sustain its promised one-fourth contribution to the International Thermonuclear Experimental Reactor (ITER) project, although they are hoping that they might be able to compensate by a larger effort towards the end of the 6 year design and R&D phase, scheduled to end in 1998. The problem is partly due to a shortage of "hard currency," required to send Russian scientists to work at the ITER design centers in Germany, Japan and the U.S., and partly

due to a shortage of internal funding for fusion research and development centers in Russia. Russian research laboratories, previously fully funded by the government, have had their budgets severely reduced, with the attendant pressure on every institution to become largely self-sufficient by securing non-government contracts. A discussion of the cost and schedule implications of this problem is planned at the next ITER Council meeting, December 14-15 in Japan. Academician Evgeny Velikhov chairs the ITER Council.

ITER SITING

The economic impact of constructing an ITER-like reactor at a Canadian site has been assessed in a preliminary study, sponsored by the Canadian Fusion Fuels Technology Project (CFFTP). The study was intended to produce a first-look assessment of the economic benefits to Canada, in the hypothetical case that a fusion reactor similar to ITER were to be sited in Canada. The economic impact study was performed by Wardrop Engineering, Inc. It concluded that there could be a large positive economic impact for Canada, assuming certain constraints. (Source: Fusion Canada, August 1994 issue) For further information contact Don Dautovich (CFFTP) (905)855-4700.

A similar DOE-funded study has been underway at Argonne National Laboratory. DOE held two workshops on the study October 12-13 with the ITER International Steering Committee, U.S. (ISCUS) and the U.S. ITER Industry Council (IIC), respectively. A public presentation of the results is expected at a meeting of the DOE Fusion Energy Advisory Committee, December 1-2 in Washington, DC. For information on the FEAC meeting, contact Al Opendaker, (301)903-4927.

FUSION SPINOFF

Princeton University Plasma Physics Laboratory and Vertere, a woman-owned Rhode Island small business have entered into a Cooperative Research and Development (CRADA) agreement to develop software for the management of chemical inventories and waste products. The software allows you to call up a floor plan that "shows you right where the cabinet storing the chemical is located in the building," according to Peter Del Gandio, a PPPL engineer who was instrumental in developing the software. The CRADA was conceived by Del Gandio and Sharon Stasko, president of Vertere. The system will make it simpler for users of chemicals to track their inventories

from cradle to grave and to electronically generate documents required for regulatory compliance. For further information contact Tony DeMeo (609)243-2750 of Carol Phillips (609)243-2754.

NEW FICUS MEMBERS NAMED

The Fusion Power Associates Board of Directors has named three additional persons to the Fusion Industry Council, U.S. (FICUS). They are James A. (Buddy) Conner (Babcock and Wilcox), John C. Bradburne, Jr. (Fluor Daniel), and David B. Everson (Everson Electric). FICUS was formed "to provide consensual industrial views on matters pertaining to the domestic and international fusion power programs." (See our July 1994 newsletter.)

CHANGE OF ADDRESS

The U.S. ITER Home Team Office (Charles C. Baker, Home Team Leader) has relocated to the School of Engineering at the University of California, San Diego. They can be reached at U.S. ITER Project Office, UCSD, 9500 Gilman Drive, Building 302, La Jolla, CA 92093-0035 (The OO35 mail code is very important). phone (619)534-4957/4971; fax -5440. Delivery address is the same.

FUSION INDUSTRY STAKEHOLDERS CONFERENCE

Fusion Power Associates will organize and sponsor a Fusion Industry Stakeholders Conference to be held March 29-30 in Washington DC. The conference will highlight the technical contributions that industry is making to fusion development. Although the program is in the early stages of formulation, it is expected to highlight work being performed for ITER, TPX, and NIF as well as ongoing general R&D in other fusion areas. Persons wishing to present papers at the conference should contact FPA president Steve Dean at the phone/fax/e-mail addresses shown on page 1.

ICFAC REPORTS

In a letter dated October 3 to DOE Assistant Secretary for Defense Programs Victor Reis, V. Narayanamurti, chairman of the DOE Inertial Confinement Fusion Advisory Committee (ICFAC) reported on the results of their August 2-4 meeting at Los Alamos National Laboratory. The principal focus of the meeting was "to develop a committee consensus on the research priorities for the ICF program in the context of the Science-Based Stockpile Stewardship

(SBSS) program of DOE Defense Programs." Narayanamurti told Reis that "the primary ICF goals are affected by placing them in the context of SBSS only in the urgency of achieving them." Those goals, according to ICFAC, are the ultimate goal of operating a Laboratory Microfusion Facility in which 100 times the driver energy is produced in fusion yield, and the "intermediate step," the National Ignition Facility (NIF), in which "ignition and gain greater than 1" is achieved using a 1.8 Megajoule glass laser. "There are several secondary goals that assume greater importance because of the underground test moratorium and the resulting needs of SBSS," Narayanamurti said. "These include assuring that the weapons program is characterized by high quality science carried out by top quality people, that the necessary weapons physics experiments can be carried out on facilities available to the weapons program, and that the needs of the Armed Services for weapons effects testing can be met. Finally, because of our country's overall interest in 'dual use' of military-related research, we also include the long term achievement of fusion energy and the economic value of the ICF program in terms of spin-offs in our goals for it."

The ICFAC assigned "highest priority" to achieving ignition in NIF, "second priority" to technology development projects, and "third priority" to alternate driver technology for the long range goals of LMF and energy. However, Narayanamurti cautioned, "All of these priorities must be pursued at some level if the ICF program is to achieve its ultimate objective of high gain pellet implosions."

ICFAC is not expected to meet again until March 1995, when it will revisit the light ion fusion program at Sandia National Laboratories (see our June 1993 newsletter).

ENERGY FACTOIDS

World oil demand is expected to rise by about 1% in 1994 compared to 1993, while U.S. demand is expected to rise by about 3% over the same period. Over 45% of U.S. demand is expected to be satisfied by oil imports, contributing over \$40 billion to the U.S. trade deficit. U.S. natural gas demand is expected to rise by about 5% and coal production by over 8% over the same period. Electricity demand increased by 4.7% in the U.S. during the first 6 months of 1994. (Source: U.S. Energy Information Administration, August 12 Press Release)

Shipments of photovoltaic cells and modules totaled 21 peak megawatts in 1993, 34% more than in 1992. Since 1988, shipments have increased at an average annual rate of 17 percent. The value of photovoltaic shipments increased 26% in 1993 to a total of \$110 million. Of the total shipments, 14.8 peak megawatts, or 71%, were for export. Since 1988, export shipments have increased at an average rate of 23 percent. (Source: U.S. Energy Information Administration, June 9 Press Release)

Energy represents 5 percent of the world's Gross Domestic Product. Energy projects presently account for approximately 15 percent of total worldwide capital investment. About \$30 trillion will be required in global investments by the year 2020 to finance new energy systems. This represents 50 percent more than the world's entire Gross Domestic Product in 1989. About 85 percent of the increased demand for energy between now and 2020 will occur in developing countries. (Source: World Energy Update, September 1994, P.O.Box 482, Fort Worth TX 76101)

Under a law kicking in this Fall, any workplace with more than 100 employees must develop ways to curb solo car trips. Non-complying employers may be fined up to \$25,000 per day. (Source: Wall Street Journal, front page report, September 8, 1994)

In the mid-1950's, U.S. motorists released total emissions of 9.6 million tons a year while driving 57 million passenger cars a combined 570 billion miles. In the U.S. today, 143 million passenger cars release about 3.5 million tons of emissions a year while travelling a combined 1.6 trillion miles per year. (Source: World Energy Update, July 1994)

One-third of the electricity for the whole of western Europe is now generated by 147 nuclear reactors, producing 117 Gigawatts, in nine countries. France leads the list with 56 operating reactors producing 54 Gigawatts, or 78 percent of national capacity. By contrast there are 29 operating nuclear reactors in Russia, producing 20 Gigawatts, or 13 percent of national capacity; there are 22 operating reactors in Canada producing 15, Gigawatts or 17 percent of national capacity; and there are 109 reactors in the U.S. producing 100 Gigawatts, or 21 percent of national electricity production. (Source: Nuclear News, September 1994)



FUSION POWER ASSOCIATES

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FUSION OVER 10 MEGAWATTS ACHIEVED IN TFTR LITHIUM BEAM FOCUSED ON FUSION TARGET IN PBFA

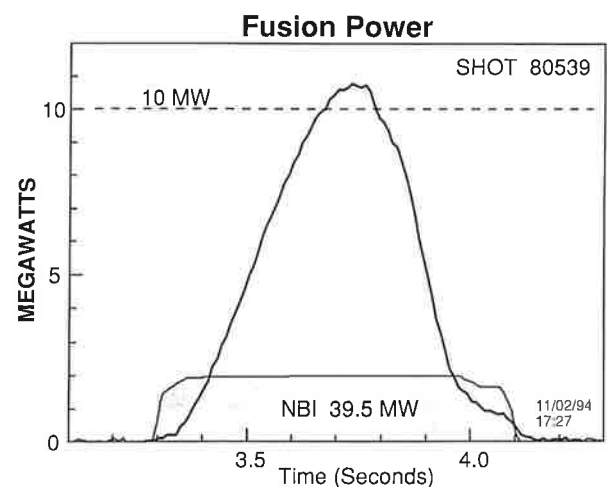
TEN MEGAWATTS IN TFTR

Scientists at the Princeton Plasma Physics Laboratory achieved a record 10.7 Megawatts of fusion power in early November and sustained a power of over 10 MW for 0.1 seconds. The input neutral beam heating power was 39.5 MW, central electron density was 10^{14} cm⁻³, central ion temperature was 32 keV and confinement time was 0.21 sec. The experiments represented the successful achievement of a major TFTR milestone of producing 10 MW of fusion power by the end of the year. Ron Davidson, director of PPPL, said in a statement "The TFTR team has demonstrated successful use of practical fusion fuels, exceeded fusion power goals, and reached world record temperatures." Davidson said the results will help scientists and engineers design future reactors. "The better information that we can provide as input to the design of these facilities, the better their design will be, and the sooner practical fusion will be developed and the more attractive the power source will be," Davidson said. For further information contact Richard Hawryluk at fax (609)243-3248; e-mail rhawryluk@pppl.gov

FUSION RADIOACTIVITY

In a paper presented at the recent IAEA fusion conference in Spain, fusion researcher Bill Stacey of Georgia Tech reported that even if fusion demonstration power plants were built using conventional 316 stainless steel, the blanket and shield wastes would qualify as "low level" radioactive waste (qualifying for shallow land burial) within ten years after shutdown and the vacuum vessel shortly thereafter.

The first wall and divertor wastes would also qualify as low level waste at some intermediate time between 10 and 100



10 Megawatts of Fusion Power

years. Thus, even if so-called advanced "low activation" materials are not available for the first generation of fusion power plants, fusion would still have substantial quantitative and qualitative advantages relative to today's nuclear fission power plants. If vanadium alloys were used, Stacey estimates that all fusion wastes would qualify for shallow land burial within ten years of shutdown. For further information, contact Prof. Weston M. Stacey at fax (404)894-3733.

TPX COUNCIL WRITES O'LEARY

Members of the National TPX Council, the national oversight board for the TPX project, wrote Energy Secretary O'Leary October 26, 1994 to "alert" her "to a rapidly evolving situation relating to the projected TPX cost and schedule." The Council members noted that the congressional action in cutting the FY 1995 TPX funding by \$25 million and the rumored DOE/OMB plan to request only about half the funding in FY 1996 required to keep the

project on schedule would result in a total project cost increase of \$48 million and a slippage in its schedule. "These actions on the part of government, both Congress and DOE, are in stark contrast to the stringent effort within the TPX project to prevent cost increases," the group said.

The group told O'Leary, "We know that you are well aware of the cost increases that result when construction projects are stretched out in time in order to reduce annual expenditures. It is far more cost-effective and technically rewarding to build new facilities expeditiously. Consequently, we ask that you reconsider the FY 1996 plans for TPX in an effort to expedite the construction of this important national fusion project. This will require an enhanced budget for the national fusion program. However, in this way, not only will effective cost control of the project be maintained, but the benefits of the TPX project will become available at an earlier time." The group also asked O'Leary to consider a supplemental appropriation for FY 1995 "to raise TPX funding to the level of the President's budget request."

The letter was signed by members of the National TPX Council: David Baldwin, Ronald Davidson, John Dawson, Steve Dean, Gerald Navratil, Miklos Porkolab, Stewart Prager, Paul Rutherford, John Sheffield, and Richard Siemon. Copies of the complete letter are available from Fusion Power Associates.

JAPAN UNVEILS PLAN FOR "SUPER" TOKAMAK

In a paper presented at the recent IAEA fusion conference in Spain, scientists from the Japan Atomic Energy Research Institute described the "Conceptual Design of the JT-60 Super Upgrade." The new tokamak would "fully utilize" equipment at the existing JT-60 facility. The mission of the proposed steady-state device would be "to establish the integrated basis of physics and technology for steady-state tokamak reactors." The main parameters of the device are: major radius of 4.8 m, minor radius of 1.3 - 1.4 m, plasma current of 10 MA, toroidal field at 4.8 m of 6.25 T, elongation of 1.8, pulse length greater than 2000 s for full current drive, heating power of 85 MW. For further information contact H. Ninomiya at fax 81-292-70-7419.

CONGRESSMAN DEAN GALLO DIES

U.S. Representative Dean A. Gallo (R-NJ) died of prostate cancer November 6. He was 58. Congressman Gallo had served in Congress since 1984, was a member of the House Appropriations Subcommittee on Energy and Water Development, and was a strong supporter of fusion. He was the recipient of a special award for public service presented by the Fusion Power Associates Board of Directors (see our October newsletter). Fusion has lost a friend and the country has lost a dedicated public servant.

LITHIUM BEAM HITS TARGET

Sandia National Laboratories Light Ion Fusion program manager Jeff Quintenz reported at the recent IAEA fusion conference in Spain that he and his co-workers had, for the first time, driven a fusion hohlraum with a powerful lithium beam. The scientists reported achieving a hohlraum temperature of 58 eV and a record specific power deposition of 1400 TW/gm compared to previously reported proton-driven hohlraums of 35 eV and 120 TW/gm. The lithium beam intensity was 1.4 TW/cm², limited by beam divergence and available beam power. "Our next milestone is 100 eV, which we estimate will require about a 5 TW/cm² lithium beam of 10 MeV kinetic energy," Quintenz said. Achieving high fusion yield would require a facility capable of producing a lithium beam of about 30 MeV with intensities of about 50 TW/cm². Since 1990, scientists at Sandia have been successful in reducing the lithium beam divergence by a factor of two from 45 to 22 milliradians and increasing the beam intensity by a factor of ten from 0.1 to 1.4 TW/cm².

Future applications of light ion fusion for both high yield weapons physics studies and civilian fusion power requires the development of methods to transport the ion beams several meters from the diode region to the target. The baseline approach to this problem is to use ballistic transport over a distance of about 3 m, followed by focusing in a solenoidal lens over the final 1 m. Computer simulations show that this technique will be successful if the beam divergence can be reduced to about 6 milliradians. An alternative method, applicable to both light and heavy ion beams, is to use self-pinch beam propagation in a low-density gas. A residual net current is established in the beam that creates a magnetic field that confines the beam within a radius that approximates the target diameter.

Declassification of many aspects of inertial fusion (see our December 1993 and October 1994 newsletters) allowed Sandia scientist Keith Matzen to describe progress in the design of fusion hohlraums and targets for use with light ion beams. According to Matzen, "The fusion capsule is embedded within a foam-filled hohlraum. The ions penetrate the hohlraum wall and deposit the bulk of their energy in the low density foam. When heated, the foam becomes a low-density plasma that is transparent to the x-rays. The radiation is trapped within the hohlraum by the dense, high-Z hohlraum wall and bathes the fusion capsule with a symmetric x-ray drive."

For copies of the Sandia IAEA conference papers, contact Jeff Quintenz, fax (505)845-7245.

FUSION LIGHTING

Fusion Lighting Inc., a spinoff company from Fusion Systems Corporation of Rockville, MD, recently announced the development of a highly-efficient system, consisting of a powerful Sulfur lamp coupled to a large semi-transparent light pipe. When activated by microwave energy, the lamp produces a very bright, near-sunlight quality light. The long luminous tubes provide efficient illumination to large indoor or outdoor spaces. Demonstration versions of the system are in operation in the lobby of the DOE Forrestal Building and at the Smithsonian's National Air and Space Museum in Washington, DC. In an October 20 press release, DOE called the development a "scientific and technological breakthrough." Christine Ervin, Assistant Secretary for Energy Efficiency and Renewable Energy at DOE, said, "It can save large amounts of energy and at the same time deliver more quantity and better quality light."

Fusion Systems Corporation was founded in 1971 by five scientists who had been working in fusion research: Ben Eastlund, Les Levine, Marshal Greenblatt, Michael Ury, and Donald Spero. Levine is currently president of Fusion Systems. The company has developed a \$50 million a year business using electrodeless microwave discharge ultraviolet light sources to dry special inks, coatings, and adhesives. A few years ago, employees of Fusion Systems discovered that by replacing the Mercury in their light sources with Sulfur an efficient visible light source could be produced.

The success story of Fusion Systems Corporation and the beginnings of Fusion Lighting, Inc., were described by Fusion Systems' president Les Levine at Fusion Power



Carl D. Henning

Associates annual meeting and symposium in October 1993. The proceedings of that symposium, describing a variety of near-term applications of fusion science and technology, have been published in the December 1993 issue of the *Journal of Fusion Energy* (Plenum Press). For more information on the fusion light source, contact Les Levine at (301)251-0300.

HENNING ELECTED ANS FELLOW

Carl D. Henning of Lawrence Livermore National Laboratory, has been elected a Fellow of the American Nuclear Society. Carl is a well-known, experienced fusion engineer and manager, having worked in both the magnetic and inertial confinement fusion programs. Carl's efforts on the organizing and funding of fusion engineering conferences is legendary.

Carl joined LLNL in 1965 after receiving a Ph.D. in Mechanical Engineering from the University of Michigan. From 1973-1976 he was vice president of Intermagnetics General Corp. He rejoined the Lab in 1978 to become deputy project manager for the Mirror Fusion Test Facility, became head of the Lab's Mirror Fusion Program Office in 1982; became U.S. deputy managing director for ITER in 1986; and transferred to inertial confinement fusion as deputy program leader for Laser Science and Technology in 1990. Since 1993 he has been deputy manager for the National Ignition Facility concept design report and, since September 1993, he has been on assignment at DOE

Headquarters, assisting in the coordination of the decision process for the National Ignition Facility.

In making the announcement, ANS president Alan Waltar noted that Fellow is the highest membership grade of the Society and that Henning was being recognized for the contributions he has made to the advancement of nuclear science and technology over the years. Waltar noted that Henning's selection "comes as a result of nomination by your peers, careful review by the Honors and Awards Committee, and election by the Society's Board of Directors. FPA president Steve Dean was among those who wrote letters to the ANS supporting Carl's nomination.

PEOPLE

Prof. Roy W. Gould, California Institute of Technology, has been awarded the James Clerk Maxwell Prize by the American Physical Society Division of Plasma Physics for "his contributions to the knowledge of plasma physics, pioneering research in beam-plasma interactions, plasma waves, cyclotron and plasma-wave echoes, resonance cones, and for the dissemination of knowledge about plasma physics through more than 30 years of teaching."

The APS Division of Plasma Physics Excellence in Plasma Physics Research Award was presented to four scientists from General Atomics: **Lang Lao**, **Ronald Stambaugh**, **Edward Strait** and **Tony Taylor**, for "experimental validation of theoretically predicted beta-stability limits and for demonstration of extremely high-beta operation of tokamaks."

Richard E. Siemon, magnetic fusion program head at Los Alamos National Laboratory, has accepted a one-year appointment at Dow Chemical Company in Midland, Michigan, as part of a new pilot program at LANL called the Industrial Fellows Program. During Dick's absence, **Kurt Schoenberg** and **Jim Anderson** will share responsibility for providing leadership to LANL's magnetic fusion program. Dick Siemon will continue to receive e-mail at rsiemon@lanl.gov

Allen Boozer has been appointed professor of applied physics at Columbia University. Since 1986 he has been a professor at the College of William and Mary; from 1974 to 1986, he was a research physicist at Princeton University Plasma Physics Laboratory.

Cary B. Forest, Princeton University, has been presented the Simon Ramo Award for Outstanding Doctoral Thesis Research in Plasma Physics, by the APS Division of Plasma Physics "for the invention of a method to create and sustain the tokamak configuration by the innovative use of electron cyclotron heating alone."

PPPL graduate students **Sherrie Preische** and **Robert Heeter** organized an exhibit and open house on fusion energy at the Science Museum of Minnesota during November 5-17. The exhibit featured a video game and hands-on demonstrations that allowed participants to play with a real plasma and view the inside of a fluorescent bulb. The open house featured a series of short lectures by **Dale Meade**, **Michael Mauel**, and **Don Correll**.

Fusion nemesis **Rep. Dick Swett** (see our July newsletter) lost his bid to be re-elected to the U.S. Congress.

Robert L. Hirsch has resigned his position as Senior Vice President, General Atomics, in charge of GA's Washington, DC office.

THE NEW CONGRESS

Republicans will be taking over from Democrats as chairs of committees and subcommittees. Republican leaders say they will make large cutbacks in the size of committee staffs, now composed mostly of Democratic aides.

Frank Murkowski (R-AL) is expected to chair the Senate Energy Committee, replacing J. Bennett Johnston. The trade journal, *Inside Energy*, quotes a DOE source as saying that Murkowski "has a good relationship" with Energy Secretary O'Leary compared to Johnston who "fought us at every turn." Mark Hatfield (R-OR) is expected to replace Robert Byrd as chair of Senate Appropriations and also to chair the subcommittee on Energy and Water Development, which Johnston now chairs.

John Myers (R-IN) is expected to take over the House Appropriations subcommittee on Energy and Water from Tom Bevill, although Myers could wind up as chair of the full committee. At the House Science, Space and Technology Committee, either Robert Walker (R-PA), or Sherwood Boehlert (R-NY) is expected to take over from George Brown.