



# FUSION POWER ASSOCIATES

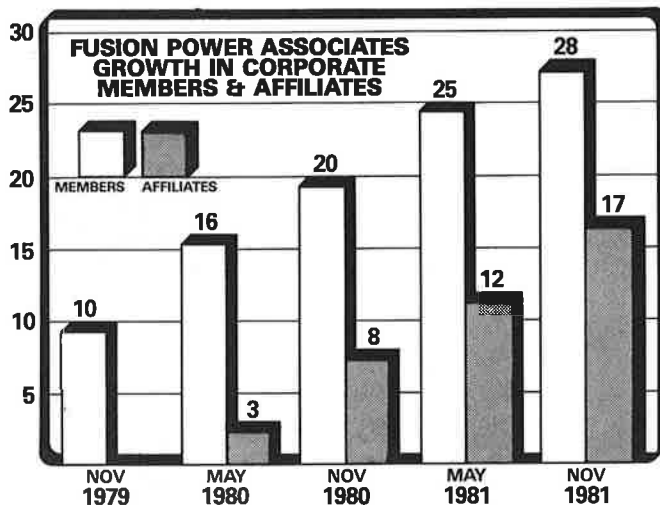
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(301) 258-0545

## MEMBERSHIP GROWTH

Black and Veatch Consulting Engineers, Kansas City, MO, has become the seventeenth affiliate of Fusion Power Associates. Dr. Lawrence F. Drbal will represent the company.

A steady growth in the number of corporate members and affiliates has continued throughout 1981, as shown by the chart below. In addition to our corporate members and affiliates, Fusion Power Associates has 132 individual affiliates.



## KINTNER RESIGNS

Office of Fusion Energy director Ed Kintner has resigned his post as leader of the magnetic fusion effort. In his letter of resignation, Kintner cited his belief that the administration did not intend to carry out a goal-oriented magnetic fusion program as mandated in Public Law 96-386, the Magnetic Fusion Energy Engineering Act of 1980. Stating his view that the administration is making "a national error for which a price far greater than present savings will be paid at some future date," Kintner stated "There is little more I can do except make clear by my leaving that I am not a party to that decision."

Kintner's resignation was the culmination of a series of blunders within DOE throughout most of 1981. Early in the year, DOE Acting Director of Energy Research Douglas Pewitt testified to Congress that the administration's enthusiasm for fast breeder reactor development made the development of fusion "less urgent." (See our March 1 newsletter.) However, Secretary of Energy James Edwards and Deputy Secretary Ken Davis began to support the fusion program and, during the summer, the FY 1983 budget for fusion was looking good. In early July, however, DOE staff got Secretary Edwards to send a planning document to Congress stating that the establishment of a Center for Fusion Engineering was "premature." This provoked the wrath of House Science and Technology Committee chairman Don Fuqua and Subcommittee chairperson Marilyn Bouquard. (See our August 10 newsletter.)

In September, a major fiasco took place, outside of public view. In response to President Reagan's 12% second round of budget cuts for 1982, DOE assumed that the magnetic fusion budget for 1982 would be reduced from the Congressional submission of \$460 million to \$405 million. On this basis, they submitted to OMB a budget of \$445 million for 1983 rather than the \$525 million which OMB and DOE had informally agreed to in the summer. As it turned out, Congress has approved \$454 million for 1982 so that the DOE's 1983 OMB submission is now actually a reduction below 1982. In addition, DOE assumed in September that several projects including EBT-P, ISX-C, and FMIT would have to be cancelled in 1982, and hence, requested no funds for these projects in 1983. DOE did this, they said, so that their 1983 OMB submission would be "consistent" with their 1982 planning assumptions. Although the 1982 planning basis for the 1983 request was

clearly changing during the fall, DOE made no subsequent effort to adapt its 1983 request to the changing 1982 conditions.

Meanwhile, attitudes were developing at the White House Office of Science and Technology Policy which were more comfortable with a slow-paced fusion effort. Their endorsement was a key factor in an OMB staff-initiated recommendation to further slow fusion facility construction in order to emphasize research on completed facilities. This last action was the last straw for Kintner who saw the OMB/OSTP action as undue meddling in the management of the fusion program. Kintner said of their action to shift \$25 million from MFTF-B construction to operating programs, "At worst it is malicious meddling; at best it is ignorance of the broader implications of the action."

KANE TEMPORARY REPLACEMENT FOR KINTNER

Jim Kane, Deputy Director of the Office of Energy Research, has been appointed Acting Director of the Office of Fusion Energy. Kane's appointment is expected to be temporary while Al Trivelpiece considers the appointment of a permanent successor to Ed Kintner. Kane previously managed basic energy science programs in AEC/ERDA and DOE.

FY 1982 BUDGETS

The Congress has passed and the President has signed the FY 1982 appropriations bill for the DOE. The fusion budget (\$ in millions), and a comparison to FY 1981 levels are as follows:

	<u>1981</u>	<u>1982</u>
<u>Magnetic Fusion</u>		
Operating	\$259	\$293
Equipment	37	42
Construction	98	109
Total	\$394	\$454
<u>Inertial Fusion</u>		
Operating	139	122
Equipment	13	11
Construction	57	76
Total	\$208	\$209

ICF SYMPOSIUM SUCCESSFUL

Fusion Power Associates sponsored a very successful symposium on the Status of Inertial Confinement Fusion in San Francisco, December 10-11. About half of the approximately 100 attendees were from U.S. industries, including 10 attendees from the electric utilities. Soviet Academician N. G. Basov called for international collaboration in designing and constructing future ICF test facilities. Professor C. Yamanaka, leader of the Japanese effort, also called for increased international collaboration in the research. In his talk summarizing the conference, KMS Fusion, Inc. President Alexander Glass noted the impressive progress in scientific understanding worldwide which has been characteristic of ICF in the past few years and the optimism in the community that paths to practical applications will emerge.

MEETINGS

The magnetic Fusion Power Coordinating Committee will meet January 26-28 at UCLA in Los Angeles, CA. There will be open sessions on January 26 and 27, at the James A. West Alumni Center beginning at 8:30 A.M. The meeting will focus on a review of UCLA and a few other university programs. Other open session topics include a discussion of the FY 1982 and 1983 budgets, a report on the JFPCC meeting in Moscow and an update on our major laboratory programs. For further information, contact Barbara Davey at UCLA (213) 825-7814, or call Bob Conn (213) 825-4544 or John Dawson (213) 825-7814.

DEAN, PARPART TOUR INDIA, MEET GHANDI

FPA President Steve Dean and FEF Director of Research Uwe Parpart toured research laboratories in India, November 16-26 as guests of India's government. On the final day of their visit, they discussed their impressions in a 20 minute meeting with India's Prime Minister Indira Gandhi. Sponsor for the tour, during which Dean and Parpart gave lectures on fusion, was Professor Nural Hassan, Vice President of the government's Council of Scientific and Industrial Research.

FPA BOARD OF DIRECTORS: Stephen O. Dean, President and CEO; Nicholas A. Krall, Chairman; Leonard F. C. Reichle; Vice Chairman; Donald Kummer, Secretary; Bernard J. Eastlund, Treasurer; Ronald Davidson; Edward T. Gerry; Alexander J. Glass, John W. Landis; Kenneth L. Matson; Sherman Naymark; Tihiro Ohkawa; Paul J. Reardon; Peter H. Rose; Glenn Sorenson; James M. Williams; Gerold Yonas; Donald P. Zeifang.



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### NEW MEMBERS AND AFFILIATES

The Bechtel Group, Inc., San Francisco, has become the twenty-eighth member of Fusion Power Associates. Dr. Harold Forsen will represent the company.

Tokamak Systems, Inc., Van Nuys, CA, has become our twenty-ninth member. Dr. Robert J. Taylor, President, will represent the company.

Quadrex Corporation, San Jose, has shifted its status for 1982 from member to become our eighteenth affiliate. Dr. Sherman Naymark, President of Quadrex, will represent the company.

New England Nuclear Corp., Boston, has become our nineteenth affiliate. Willard E. Jule will represent the company.

We welcome our new members and affiliates to participate in Fusion Power Associates.

### KINTNER HONORED

Our Board of Directors voted to present the 1981 Fusion Power Associates Leadership Award to Edwin E. Kintner, who recently resigned as head of the U.S. magnetic fusion energy program. This was the only leadership award presented in 1981; awards were presented in 1980 to S. J. Buchsbaum, R. L. Hirsch, Congressman Mike McCormack and Senator Paul Tsongas. Kintner's award, which was presented January 7 during the annual meeting of the AAAS, read as follows:

"Fusion Power Associates Leadership Award, 1981, Presented to Edwin E. Kintner in recognition of your outstanding leadership qualities. We commend you for instilling

in the world fusion community a sense of high purpose, mission orientation and historical vision. Through your efforts, a close degree of international cooperation and joint planning for fusion development has emerged worldwide. To the U.S. program you have provided a careful balance between science and engineering, and between research programs and construction projects. In the budgetary and policy storms which continuously have beset the good ship 'fusion,' yours has been the steady hand at the helm guiding us through the uncharted sea."

Kintner will soon be honored as a "distinguished alumnus" by the faculty of the Massachusetts Institute of Technology. A banquet is scheduled February 12 at the MIT Faculty Club.

### BREAKFAST MEETINGS

The second in a series of breakfast meetings for those who frequently represent the fusion viewpoint in Washington was held January 11 at the Capitol Hill Club. If you are interested in attending future breakfast meetings and are not now on our mailing list for notices, please call our office.

### BUDGET OUTLOOK FOR FY 1983

On February 8, President Reagan is expected to announce FY 83 budgets which contain proposed reductions in both magnetic and inertial fusion. The major problem in both areas will be inadequate funds for construction projects. The FMIT, EBT-P, ISX-C and NOVA projects are in jeopardy. Relative to FY 1982, funds for operating devices will be protected in magnetic fusion but are expected to be severely reduced in inertial fusion.

## BOARD ISSUES ICF STATEMENT

The Board of Directors of Fusion Power Associates has authorized the release of the following statement of views on the energy applications of inertial confinement fusion (ICF):

### "Inertial Confinement Fusion - Energy Applications

Congressional and DOE attitudes have resulted in considerable pressure on ICF program managers to eliminate studies aimed at energy applications of inertial fusion. Fusion Power Associates believes that to respond to these pressures by terminating the minimal ongoing studies of potential energy applications of ICF is not in the national interest. Military research and development have historically led to many important contributions to the civilian sector and to the economy. Government sponsors should be proud of, and encourage, these connections. Permitting a reasonable percentage of the ICF funding to continue to be spent on energy applications is the best way to ensure that the nation ultimately derives full benefit from the ICF program."

### CENTER FOR FUSION ENGINEERING

Discussions at the January 25-27 meeting of the magnetic Fusion Power Coordinating Committee indicated continued resistance within the DOE Office of Fusion Energy to implementation of the Magnetic Fusion Energy Engineering Act of 1980. Specifically, FPCC members and consultants were fearful that future budgets would not be sufficient to warrant an industrially-led engineering effort and the establishment of a Center for Fusion Engineering. FPA president Steve Dean was the only one present who advocated the view that the industry initiatives encouraged in the law should be authorized. Other industry representatives present stated their preference to continue the Fusion Engineering Design Center at Oak Ridge under laboratory leadership and management until and unless the government announced more aggressive plans.

### PEOPLE

J. Rand McNally, well known atomic physics expert and advocate of advanced fusion fuel cycles, has retired from his position at ORNL

to become a private consultant on fusion energy. Rand can be reached at 103 Norman Lane, Oak Ridge, TN, 37830, and (615) 483-3183.

Don Steiner has left ORNL and his position as Manager of the Fusion Engineering Design Center (FEDC) to become a member of the Nuclear Engineering faculty at the Rensselaer Polytechnic Institute in Troy, New York. Tom Shannon has replaced Don as leader of the FEDC.

### MEETINGS

April 12-15 in Salt Lake City. "Conference on Fast, Thermal and Fusion Reactor Experiments" sponsored by the American Nuclear Society. Steve Dean, FPA, will present an overview paper. There will be several sessions of fusion engineering papers, especially on blanket, shield and materials problems. Contact Jeff Grovenor, HEDC (509) 376-5908.

April 25-28 in Sante Fe. "Sherwood Theory Conference." Contact Merrily Ross, LANL, (505) 667-7571.

May 13-15 in Ottawa, Canada. "Minicourse on Inertial Confinement Fusion." Precedes the 1982 IEEE International Conference on Plasma Science. Contact George Miley (217) 333-2294.

May 25-27 in Princeton, NJ. Next meeting of magnetic Fusion Power Coordinating Committee. First day and a half are open sessions.

### INDIVIDUAL AFFILIATES

In addition to those listed in our September and November newsletters, the following have become Individual Affiliates of FPA:

Alexandros Anastassiadis	Bela Karlovitz
Paul W. Alley	Yim T. Lee
Locke Bogart	Grant Logan
Richard Colchin	H. C. McCurdy
William F. Dove	Susarla S. Murty
Edward C. Fiss	James G. Pierce
Hans H. Fleischmann	H. Ewell Rains
Otto M. Friedrich	R. C. Rozycki
Roger N. Fritzel	John Siambis
Richard Grovatt	Douglas A. Spong
Thomas Hickey	Philip Stone
Charles B. Hood	Nermin A. Uckan
William Jaeger	



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## FPA FINANCIAL REPORT

Fusion Power Associates' financial position as of December 31, 1981, and in comparison to one year earlier, is as follows:

	<u>12/31/80</u>	<u>12/31/81</u>
No. Corporate Members	20	28
No. Corporate Affiliates	8	17
No. Individual Affiliates	0	132
Cash on Hand	\$ 16,185	\$ 56,286
Accts Receivable	15,240	76,987
Accts Payable	9,618	68,783
Income for preceding yr.	72,901	200,275
Research Grants	( 0)	(120,883)
Fees, Dues, etc.	( 72,901)	( 79,392)

Two research projects were performed in 1981: A \$7,700 grant from the National Science Foundation funded a study of the benefits to the U.S. of international cooperation in fusion and \$113,183 was costed for a study in progress of a heavy ion beam fusion reactor design called HIBALL. The latter project is funded by KfK Nuclear Research Center of Karlsruhe, FRG, and is carried out in Madison, Wisconsin, by consultants to FPA from the University of Wisconsin under the direction of Dr. Gerald Kulcinski.

## FUSION MANAGEMENT PLAN?

The Magnetic Fusion Energy Engineering Act of 1980 required the Secretary of Energy to submit a "Comprehensive Program Management Plan" (CPMP) to the Congress on January 1, 1982. The Act required that the CPMP include:

- "(1) a presentation of the program strategy which will be used to achieve the purposes of the act.
- (2) a five-year program implementation schedule, including identification of

detailed milestone goals, with associated budget and program resources requirements.

- (3) risk assessments.
- (4) supporting research and development needed to solve problems which may inhibit or limit development of magnetic fusion energy systems; and
- (5) an analysis of institutional, environmental, and economic considerations which are limiting the national magnetic fusion program."

Secretary Edwards submitted a letter and three page report to Congress January 29 in which he said, "In summary, the enclosure states that the magnetic fusion energy program is continuing to carry out the intent of the Act insofar as is possible with the budgets which can be made available. Nevertheless, the uncertainty which has accompanied development of the budgets for Fiscal Years 1982 and 1983, and the fact that these budgets do not support the pace of program development envisioned in the Act, have made it impossible to prepare a Comprehensive Program Management Plan for fusion by January 1, 1982.

"However, since the Fiscal Year 1982 magnetic fusion energy budget is now established, and since we have a clearer picture of the budget prospects for Fiscal Year 1983, we can now start preparation of the plan and will submit it to Congress by October 1, 1982. This plan will be based on the currently perceived budget constraints which will cause the program to be held at a roughly constant level of effort until the President's economic program has had its positive effects. At that time, we expect that the fusion budget will increase as authorized in the Act for the purpose of establishing engineering feasibility."

Congressman Fuqua, Chairman of the House Committee on Science and Technology, responded on February 23 by saying "Upon review of this submission, I must conclude regretfully that it neither meets the letter nor the intent of the Act." After listing the requirements for the CPMP, Fuqua continued, "The language of the Act and the intent of Congress with regard to the CPMP are clear. It does not seem to me that the fact that the Fiscal Year 1982 budget request for the magnetic fusion energy program was below the level envisioned in the Act and the subsequent uncertainty in the final appropriation process can serve as a basis for ignoring the requirements for the preparation and transmittal of a Comprehensive Program Management Plan. Indeed such times of budget uncertainties and stress argue for more intensive planning efforts, not less. In any event, an abandonment of the planning process with regard to the CPMP is disconcerting to the Committee, and I trust it is a situation which can be easily rectified. The Department's Fiscal Year 1983 budget request of \$444.1 million for the magnetic fusion energy program highlights the fact that it is one of the largest and most visible energy supply research and development programs currently funded. Public confidence in the management of such a large program is essential if it is to receive continued support. The CPMP is a key element in the maintenance of this confidence. Submission of the CPMP by the time the Subcommittee on Energy Research and Production reviews the magnetic fusion energy program's budget request for Fiscal Year 1983 will be essential if the program is to continue to receive the strong support for its request as it has in the immediate past. I urge the Department to submit the required plan to the Committee as expeditiously as possible."

FUSION BUDGETS

The FY 1983 budget requests (\$M) as recently submitted to Congress are as follows:

	<u>1982</u>	<u>1983</u>
<u>Magnetic Fusion</u>		
Operating	\$293	\$359
Equipment	42	39
Construction	109	46
Total	<u>\$454</u>	<u>\$444</u>
<u>Inertial Fusion</u>		
Operating	\$122	\$105
Equipment	11	11
Construction	76	3
Total	<u>\$209</u>	<u>\$119</u>

However, sources indicate that a budget amendment to add approximately \$35M to ICF for the NOVA laser project will soon be sent to Congress.

CONGRESSIONAL HEARINGS

House Science and Technology Subcommittee hearings on fusion have been scheduled for the mornings of March 23 and 24, 9-12 A.M. in Room 2325 of the Rayburn Building. DOE testimony will be heard March 23. Non-government witnesses will testify March 24. Among those invited to testify on March 24 are General Atomic President Harold Agnew, PSE&G Vice President Ken Matson (representing the AIF), former Congressman Mike McCormack; former DOE magnetic fusion director, Ed Kintner; and FPA president, Steve Dean. House Appropriations Subcommittee hearings on fusion have been scheduled for March 25 and April 1 in Room 2362 of the Rayburn Bldg. McCormack, Kintner and Dean have also been invited to testify at these hearings on one of those days.

KEYWORD ADVISORS NAMED

Presidential science advisor Jay Keyworth has named a team of advisors. Among those chosen are several familiar with fusion issues. They include Solomon J. Buchsbaum (who will chair the committee), Ed Frieman (who will be vice-chairman) and Harold Agnew.

FPA BOOK AVAILABLE

We have a limited number of copies of our book "Prospects for Fusion Power" which can be purchased from us for \$15 per copy including postage. Price for direct orders from the publisher (Pergamon Press) is \$19.50

MEETINGS

The Annual Information Meeting of the ORNL Fusion Energy Division will take place April 5-7 at ORNL in Oak Ridge, TN. Persons wishing to attend should contact Bill Morgan at (615) 574-0988.

DOE will host a meeting at the Forrestal auditorium April 22 on the draft generic environmental impact statement for fusion. Persons wishing to attend should contact Jack Baublitz at (301) 353-3734 or Gene Nardella at (301) 353-4956



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## NEW MEMBER

Combustion Engineering, Stamford, CT, has become the thirtieth member of Fusion Power Associates. We have thus tripled our membership since FPA began with 10 members in October 1979. Dr. Christian C. Bolta, Director, Technology Strategy, will represent the company. We welcome Combustion Engineering to membership in Fusion Power Associates.

## CLARKE TO HEAD MAGNETIC FUSION OFFICE

Dr. John F. Clarke has been named by Dr. Alvin Trivelpiece to head the magnetic fusion office at DOE. Clarke has been named Acting Associate Director for Magnetic Fusion of the Office of Energy Research. The title "Acting" is expected to be a temporary expedient while DOE processes the formal appointment. Clarke replaces Ed Kintner who resigned the position several months ago. He was previously Kintner's deputy and earlier headed the Fusion Energy Division at Oak Ridge National Laboratory. During the past two years John has been identified with the activities of the "Technical Management Board" (TMB)--a group he assembled for the purpose of defining a tokamak Fusion Engineering Device (FED). The TMB recently issued a six volume report describing not only the FED design but also describing supporting technology development required to provide an engineering data base for future fusion reactors. Top priority among John's first tasks is a reassessment of existing programs in the light of tight budgets and a clear congressional mandate to implement the engineering initiatives of the fusion Act. We wish John the best of luck in his new assignment and will try to assist him as well as we are able.

## AMERICAN ENERGY WEEK

May 1-8 has been designated American Energy Week. FPA President Steve Dean has been asked to serve as a member of the Energy Advisory Board again this year. The purpose of American Energy Week is to raise the level of public awareness of the importance of energy in our society. If you need ideas or information on how you can participate, contact American Energy Week, 1511 K Street, N.W., Washington, D. C., 20005 (202) 861-0807.



Vice President George Bush examines the "Declaration of Energy Independence" during presentation ceremonies at the White House as FPA's Steve Dean looks on. The ceremony was the culmination of last year's American Energy Week.

## CONGRESSIONAL HEARINGS

DOE Office of Energy Research Director Alvin Trivelpiece testified to the House Committee on Science and Technology March 23, stating that fusion was a "mission-oriented" program whose "ultimate goal is to develop environmentally sound and economically competitive fusion systems." Trivelpiece introduced John Clarke who presented a lengthy briefing on the status of the research. Congressman Fortney H. (Pete) Stark, Jr. of California also testified, saying "Every year we find ourselves in this position: trying to save and improve the magnetic fusion energy budget." "Cost, necessity and promise all point to the wisdom of an immediate commitment to the engineering phase of the magnetic fusion energy program," said Stark, adding "We know that the cost of developing magnetic fusion will not get any cheaper."

On March 24 witnesses from INESCO (Don Repici), General Atomic (Tihiro Ohkawa), AIF (Ken Matson) and FPA (Steve Dean) appeared, in addition to Mike McCormack and Ed Kintner. The Fusion Energy Foundation submitted a statement for the record. Copies of all written statements are available from FPA on request.

Leaders of the international research effort on inertial confinement fusion tour Lawrence Livermore National Laboratory as part of FPA's symposium last December. In the foreground (l. to r.) are Geoffrey Manning (Director, Rutherford Laboratory, U.K.), John Holzrichter (LLNL), N. G. Basov (Director, Lebedev Institute, USSR), and Chiyo Yamanaka (Director, Institute of Laser Engineering, Osaka Univ., Japan.)



## ICF VIDEO TAPES AVAILABLE

Fusion Power Associates has available for loan (specify half or three-quarter inch cassette) videotapes of the presentations at our December 10, 1981, symposium on "Status of World Research on Laser and Particle Beam Fusion." In addition to papers on the efforts in the USSR, Japan and the U.K., Gerald Kulcinski presented an excellent paper on "Commercial Applications" and there were four papers on the status of the U.S. effort, by Richard Schriever, John Emmett, Steve Rockwood, and Gerry Yonas. A conference summary is presented by Alex Glass. FPA also has a written version of the conference summary available on request.

## KINTNER RESIDING AT FPA

Ed Kintner has taken up business residence with Fusion Power Associates and can be reached by mail and phone at our address. His immediate activities have included writing articles and preparing Congressional testimony. An article by Ed will appear in the May issue of MIT's Technology Review Magazine.





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## NEW AFFILIATE

Chevron Research Company, Richmond, CA, has become our twentieth Affiliate. E. Eugene Spittler will represent the company. We welcome our new affiliate to participation in Fusion Power Associates.

## FPCC ABOLISHED

In his first major official action since being named to head the U.S. magnetic fusion program, John Clarke has abolished the Fusion Power Coordinating Committee (FPCC). The FPCC was established in 1972 by Dr. Robert L. Hirsch to ensure broad participation in the consideration of major steps in the magnetic fusion program. It consisted of government and laboratory program managers as members and about a dozen consultants from industry. The Committee met quarterly, on a rotating basis, at each major fusion laboratory. The FPCC was instrumental in advising the government to proceed with the Tokamak Fusion Test Reactor, Mirror Fusion Test Facility and EBT-P projects. In April 1979 the FPCC was the first advisory body to endorse moving ahead with a major new engineering test device.

In his letter abolishing the committee, Clarke said "In thinking back over the history of the last eight years, I am impressed by the number of key decisions which were debated in that forum." "However," Clarke said, "by its size and somewhat informal mode of operation, it is not ideally suited to the type of sustained program analysis which I think we need in the present circumstances."

To replace the function of the FPCC Clarke stated "Al Trivelpiece and I have agreed that the Department should establish a formal committee to advise on long range plans, priorities and strategies for the fusion program." The main difference between the new "formal" committee and FPCC will be that its meetings will have to be advertised in the Federal Register, and minutes must be kept and be publically available. Members

of the public will be entitled to request to make presentations to the new committee. Sources indicate that Ron Davidson, Director of the MIT Plasma Fusion Center, has the inside track to chair the new committee. Harold Forsen, Manager of Engineering and Materials, Bechtel Group, is favored for Vice-Chairman. The committee will start out with senior laboratory fusion program directors and representatives from industry, but the members will have fixed terms "to ensure freshness of viewpoints," according to Clarke.

Clarke also indicated that, in addition to the new formal committee "the internal program business can be more efficiently carried out in working meetings with the concerned parties." How this latter function will take place is not completely clear, but on April 21 a closed door meeting of the laboratory program directors and the DOE division directors took place in Washington to discuss program strategy and budget priority issues.



*Times Past: First Meeting of the Joint (U.S.-USSR) Fusion Power Coordinating Committee (JFPCC) in the USSR in May 1974. L. to R., John F. Clarke, Robert L. Hirsch, Alvin W. Trivelpiece, Stephen O. Dean.*

## CONGRESSIONAL ACTIVITIES

Congressman Don Fuqua, Chairman of the House Committee on Science and Technology, which authorizes the magnetic fusion budget, has recommended, in testimony April 1 to the House Committee on Appropriations, that \$15-20 million be added to the administration's request for magnetic fusion. The money should be used, Fuqua said, to enhance the EBT-P, MFTF-B, and ZT-40 projects. Fuqua also indicated support for TFTR and Doublet III and for maintaining industrial involvement.

On the ICF side, OMB and DOE sent to Congress an "amendment" to the FY 83 budget request asking for an additional \$34 million to complete the NOVA at LLNL as a 10 beam laser facility. The request was included as part of a \$400 million supplemental request for DOE weapons programs. The NOVA request is expected to be well received on the hill.

Senate budget hearings are proceeding expeditiously. Al Trivelpiece testified April 23 to the Senate Appropriations Subcommittee (Senator Hatfield), and Mike McCormack, Alex Glass (KMS), John Gilleland (GA), and Steve Dean appeared before the Senate Authorization subcommittee (Senator Domenici) on April 26.

## INDUSTRY-GOVERNMENT FUSION SEMINAR

As a result of discussions last December at the FPA Board meeting between Steve Dean and Sid Law, Chairman of the AIF Fusion committee, a jointly sponsored (FPA/AIF/EPRI) one-day seminar will be held at the University Club in Washington, D. C. on June 22. Three panel discussions will take place (1) Goals for the U.S. Fusion Program, (2) Scientific and Engineering Issues and (3) Systems Management--Can It be Applied to Fusion? Bob Hirsch will give the keynote address and Energy Secretary Edwards is expected to give a luncheon address. Other panel participants include Harold Agnew, John Clarke, Ron Davidson, Harold Forsen, John Foster, Joe Gavin, John Marcum, Paul Reardon, Len Reichle, Gen. Bernard Schriever, John Simpson, Tom Varljen, Herb Woodsen, and John Yardley. The seminar is by invitation and will be limited to 70 persons. Those desiring to attend should contact either Steve Dean at FPA, Frank Graham at AIF, or Bob Scott at EPRI.

## INDUSTRIAL FUSION CONSORTIUM

Litton Industries and Alaskan Interstate Oil Company are attempting to form a limited partnership of companies interested in developing the field-reversed mirror concept into a commercial fusion reactor. The first activities of the private venture would be to take over funding for the BETA-II at LLNL. Companies interested in further information should contact Dr. John Scudder at (415) 828-1243, or Dr. Bob Salter at (213) 859-5404, both of Litton.

## CONGRESSIONAL ADVISORY COMMITTEE

The Fusion Advisory Committee to HS&T, formerly chaired by Bob Hirsch and now chaired by Len Reichle met in Washington March 30. In a letter report to Mrs. Bouquard following the meeting, Reichle reported, "Because other nations have a firmer conviction in regard to the economic and industrial potential of fusion power, our leadership role and our future ability to benefit from international cooperation are in clear danger." In addition Reichle wrote, "The Panel reaffirms its previous position that the state of the art is ready for expanded engineering effort...."

## ANS MEETING

The Annual Meeting of the American Nuclear Society will take place June 6-10 at the Westin Bonaventure Hotel in Los Angeles. There will be a session of invited papers on fusion on Tuesday afternoon June 8. The papers will be by John Cummins (EPRI) Ken Fowler (LLNL), M. Okabayashi (PPPL), John Holzrichter (LLNL), D. L. Cook (Sandia) and Don Baker (LANL).

## HS STUDENT HONORED

Ronny Kantor, a high school senior at Riverdale Country Day School, Bronx, New York, won second prize in the annual Westinghouse Science Talent Search for his work on the stability of axisymmetric mirror machines. Ronny worked with Harold Weitzner and Don Stevens of the Courant Institute of Mathematical Sciences, New York University. He was able to construct stable very low beta axisymmetric mirror equilibria. Next year he will be a freshman at Princeton University. He will continue his work on fusion this summer at New York University.



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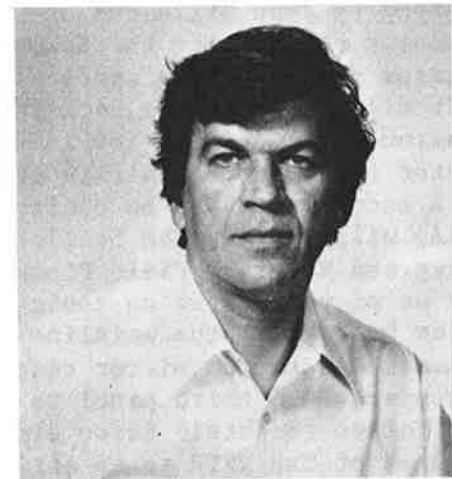
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## FUSION COMMITTEE FORMED

The DOE formed a "Magnetic Fusion Advisory Committee" (MFAC) in late May and then, on short notice, held the first Committee meeting on June 1-2 in Washington. MIT's Ron Davidson and Harold Forsen of Bechtel are chairman and vice-chairman respectively. Davidson is Director of the Plasma Fusion Center at MIT and a member of FPA's Board of Directors. Other members of the committee are: Ray Beuligmann (General Dynamics/Convair), Bob Conn (UCLA), John Cummings (EPRI), Ken Fowler (LLNL), Harold Furth (PPPL), John Gilleland (General Atomic Co.), Bob Gross (Columbia Univ.), Don Kummer (McDonnell Douglas Astronautics Co.), Rulon Linford (LANL), Peter Murray (Westinghouse), Marshall Rosenbluth (Univ. of Texas), Murray Rosenthal (ORNL) and Maury Tigner (Cornell Univ.). Tigner, a high energy physicist, and Murray, a nuclear fission expert, are the only members of the committee from outside the fusion community. Meetings are required to be announced in the Federal Register and are open to the public. The next meeting is scheduled for August 30-31 in Washington.

## KEYWORTH, TRIVELPIECE OPEN MFAC MEETING

Presidential Science Advisor Jay Keyworth and DOE Director of Energy Research Al Trivelpiece keynoted the MFAC meeting. Keyworth stated "The budget that we did support last year was one that is symbolic of the very high priority and the very high profile that the program does carry and will continue to carry." Keyworth also stated "It (fusion) is so difficult that we must maintain some kind of steady and adequate level that will put us on an asymptotic approach." With regard to future budget prospects Keyworth stated "It is going to be very difficult to provide a convincing argument for really new large increases in the program in the near future. I am not saying there won't be one. I'm not saying not to think about it. I am saying that there will have to



*Ronald C. Davidson--to head new  
DOE fusion advisory committee*

be a thrust presented for program help that is different from the one presented last year." Keyworth's remarks were considerably more encouraging than guidance provided by DOE staff who, one week earlier, told the fusion community in no uncertain terms they had to plan on flat budgets and no new facilities for the rest of the decade.

In his prepared remarks, Al Trivelpiece stated "I believe that the development of fusion energy is an important objective for the science and technology enterprise of the United States to pursue. I also believe that fusion will work." Trivelpiece said he believed the program is "at a kind of cross-road." "In addition," he said, "there is a keen awareness that, as a mission-oriented program, fusion must eventually deliver a product. Exactly what, to whom, how and when seems not to have obvious answers. I believe that the time has come to refine our ability to answer these questions." With regard to budgets, Trivelpiece stated "We have just completed one phase of our initial planning for FY 1984. As we move through the

additional phases and develop our submission to OMB, we need to have an excellent case to justify the existing program and an even better case if there is to be any substantial increase over FY 83."

#### COMMITTEE TASKS

The DOE asked the MFAC to address themselves to three questions and to provide a preliminary report in three months and a final report in six months. Davidson established three panels to address the questions as follows. A panel to be chaired by John Gilleland of General Atomic Company to evaluate the tokamak and tandem mirror programs with particular emphasis on what it will take to "evaluate their possible consideration as candidates for an Experimental Test Reactor (ETR) Project within the next decade. A second panel to be chaired by Bob Conn (UCLA) will "review the Stellarator, Elmo Bumpy Torus and Reversed Field Pinch concepts to advise us of your views on their relative priority as backups to the mainline steady state tokamak and tandem mirror reactor development programs." A third panel to be chaired by Harold Forsen (Bechtel) is to evaluate the possible uses of the TFTR as an engineering development facility as a possible substitute for proceeding with a new Fusion Engineering Device (FED).

A fourth panel will also be established to address the definition of the new concept of an ETR and to consider the nuclear engineering data base which must be developed in the 1980's to underpin an ETR.

#### DOE, FED AND THE FUSION ACT

At the MFAC meeting and at a planning meeting of 100 fusion scientists sponsored by DOE on May 24-25, it was clear that the most difficult problem the fusion program faces remains the nature and timing of the next major facility in the fusion program. Previous advisory committees had recommended, and the Magnetic Fusion Engineering Act of 1980 mandated, the early construction of a Fusion Engineering Device (FED), an an approximate cost of \$1 billion, to be operational by 1990. In the 18 months since the passage of the Act, however, DOE has failed to get OMB approval to put such a project in the budget. Of even more concern, the fusion community was unable to agree on a superconducting tokamak FED design costing much less than \$3 billion. A mirror-based FED was suggested estimated at less than \$1 billion but design of this

facility is still at a very early stage. Some tokamak specialists also claimed that a copper magnet tokamak FED could be built for less than \$1 billion.

On May 24-25 DOE staff surfaced a so-called "new strategy" which would delay the decision on a next major facility until late in the decade or even into the early 1990's. This facility they called ETR and is to be more ambitious than FED. Experts estimated the cost of ETR as likely to be over \$5 billion of today's dollars. Attendees at this meeting were taken by surprise by the new DOE "strategy." Many attendees questioned the wisdom and technical credibility of this approach feeling that it was primarily motivated by DOE's desire to justify not having to request near-term budget increases for the program. Concerns included (1) DOE's unilateral abandonment of a key feature (FED) of the fusion Act, (2) the possible harmful effect of focusing the fusion program on a decision point so far in the future, (3) how the nuclear data required to justify an ETR could be developed in the absence of a FED, and (4) whether the fusion program could justify a \$5 billion project later in the light of its inability to justify a less ambitious project now. There was a worry that the new DOE approach might create in the community a false sense of security that Congress would be willing to fund the program through the decade based only on the capability of current facilities and their upgrades --in short the program could run out of the accomplishments required to justify its existence. DOE officials have remained steadfast in their new approach however and as of now the "ETR" seems destined to become the latest acronym in a long series of unconsummated, ever-changing potential next step projects.

#### DEAN'S STATEMENT TO MFAC

MFAC procedures provide for statements by members of the public. These statements may be made either in person at the meeting or in writing. Written statements can be submitted to Ms. Lenore Ledman, Office of Fusion Energy, Mail Stop G-258, U.S. DOE, Washington, D. C. 20545.

FPA President Steve Dean attended the MFAC meeting and made an oral presentation. He stressed that due to the short notice available on the meeting, he had not had time to clear a

statement on behalf of FPA and would therefore state his personal views. Dean said in part that he saw two fundamental problems with the "new strategy" that had been presented by DOE. First, he said, he thought it gave the very strong impression that "the focus of the fusion program becomes one of preparing for a decision which is ten years in the future" and second, that "the size of step which is envisioned at that time (ETR), is not technically credible based on what is proposed to be done during the 1980's." "The program definitely needs to start, at the earliest possible time, a machine which makes a large amount of fusion power. Unless you do this, this program is not going to be perceived to be worth \$500 million a year for very many more years," Dean said. A copy of Dean's complete statement is available on request.

#### CONGRESSIONAL JOINT RESOLUTION ON FUSION

Members of Congress continue to be concerned that DOE does not take seriously the mandates of the Magnetic Fusion Energy Engineering Act of 1980. Consequently Rep. Marilyn Bouquard (D-TN) and Sen. John Danforth (R-MO) have prepared a joint resolution "to express the sense of the Congress of the United States that the Nation reaffirm its commitment to the expeditious development of magnetic fusion energy." The resolution which is being circulated for co-sponsorship prior to introduction, had 20 co-sponsors in the House and 5 in the Senate as of June 1. Fusion supporters should contact their representatives and senators suggesting they co-sponsor this important resolution. The complete text of the resolution is as follows:

"Whereas the Congress of the United States overwhelmingly approved and enacted into law the Magnetic Fusion Energy Engineering Act of 1980 to establish a national commitment to an aggressive and accelerated research, development and demonstration program on magnetic fusion energy;

"Whereas several prestigious review panels have concluded that magnetic fusion energy is technically ready to move into a significant engineering research and development phase;

"Whereas the initiation, at this time, of an orderly engineering effort with industry would augment the high quality research efforts of our National Laboratories and universities;

"Whereas it is timely to proceed with the construction of experimental facilities in order to derive the necessary engineering and scientific knowledge to bring fusion energy to practical fruition; and

"Whereas the long-range, high-risk, high-payoff potential of magnetic fusion energy requires that the Federal Government assume a direct responsibility to demonstrate the scientific and engineering feasibility of the technology: Now, therefore, be it

"Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That the Government of the United States should maintain a consistent, continuing commitment to the research and development and engineering of fusion energy as embodied in the intent of the Magnetic Fusion Energy Engineering Act of 1890.

#### ENGINEERING REVIEW COMMISSIONED

The DOE Office of Fusion Energy is funding the National Research Council (NRC) "to plan a workshop on the identification of the future engineering development needs for fusion." To carry out this task, NRC has appointed a "Committee on Magnetic Fusion" chaired by Herb Woodsen of the University of Texas. Other members of the committee are Everett Bloom (ORNL), Melvin Gottlieb (PPPL and Brookings), John Landis (Stone & Webster) William Manly (Cabot Corp.), Bill Stacey (Georgia Tech) and John Stekly (Magnetic Corporation of America). The workshop is scheduled for August 3-4. Information can be obtained from John Richardson at NRC (202) 334-3361.

#### TFTR MEETING, JUNE 24-25

Princeton Plasma Physics Laboratory will host an information meeting June 24-25 to present the current status of TFTR and to discuss potential upgrades of the facility to accomplish engineering objectives for the overall fusion program. Persons interested in attending should contact Pam Johnson at (609) 683-2205.

#### COMPACT FUSION CONCEPT WORKSHOP

The National Science Foundation Division of Policy Research and Analysis has asked Fusion Power Associates to organize a workshop on "Implications of Compact Fusion Concepts and

Their Relationship with the Federal Program." The workshop is tentatively scheduled to be held at NSF on September 30-October 1. The NSF is currently in the process of commissioning the preparation of review papers on all aspects of the topic. Persons interested in being kept advised of plans for the workshop should contact Steve Dean at FPA.



*Neil Armstrong is host of  
FUSION: ENERGY'S SPACE PROGRAM*

FUSION FILM

A 30-minute film "Fusion: Energy's Space Program" has been completed by Playback Associates and the Society to Advance Fusion Energy. It was shown in late April at the American Physical Society meeting and in a special Washington showing May 25 at the National Academy of Sciences. The film is narrated by former astronaut Neil Armstrong and will be shown in Washington again on June 13 at 12:30 P.M. on the local ABC affiliate, Channel 7. Extensive TV showings around the country are scheduled. Copies of the film can be purchased (\$200) from Playback Associates, 708 Third Avenue, New York, NY, 10017 (Attn: Jo Rosenthal). The film has been widely praised by fusion scientists who have seen it as being both technically accurate, inspiring, and very suitable for both technical and non-technical audiences.

BOARD OF DIRECTORS MEETING

The Board of Directors of Fusion Power Associates will meet Tuesday, June 22 beginning at 6:00 P.M. at the University Club, 1135 Sixteenth Street, N.W., Washington, D. C. Topics to be covered will include discussion of DOE fusion policies, FPA finances and FPA past and future activities. Participation will be limited to Board members unless prior arrangements are made for guest attendance.

HISTORY OF FUSION BUDGETS

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

<u>Fusion Budgets \$M</u>		
<u>FY 19</u>	<u>Magnetic</u>	<u>Inertial</u>
51-53..	\$ 1.1	
54 ....	1.8	
55 ....	6.1	
56 ....	7.4	
57 ....	11.6	
58 ....	29.2	
59 ....	28.9	
60 ....	33.7	
61 ....	30.0	
62 ....	24.8	
63 ....	25.5	\$ 0.26
64 ....	22.6	1.40
65 ....	23.1	1.36
66 ....	23.1	1.20
67 ....	23.9	1.46
68 ....	26.6	1.30
69 ....	29.7	2.35
70 ....	34.3	3.55
71 ....	32.2	11.30
72 ....	36.3	20.10
73 ....	43.4	36.10
74 ....	62.8	49.45
75 ....	118.2	65.10
76 ....	219.1	102.99
77 ....	316.3	111.89
78 ....	332.4	130.55
79 ....	355.9	144.13
80 ....	350.2	194.89
81 ....	394.1	208.80
82 ....	453.8	209.10
	<u>\$3,098.1</u>	<u>\$1,297.28</u>

IN MEMORIAM

Soviet Academician M. S. Rabinovich of the Lebedev Institute, Moscow, died in mid-May. He had been in declining health. World-renown as an outstanding scientist and advocate of stellarator research, Rabinovich will be greatly missed by his colleagues around the world. A warm and sincere human being, he was both highly respected and loved. Those who knew him are deeply saddened by the passing of this unique, brilliant, charming, witty and lovable man.



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## KULCINSKI NAMED FPA VICE PRESIDENT

The Board of Directors of Fusion Power Associates has named Dr. Gerald L. Kulcinski Vice President for Research. The appointment will occupy a small fraction of Gerry's time; he will retain his full-time position as a Professor of Nuclear Engineering at the University of Wisconsin. In his new position with FPA, Gerry will guide and assist us in the development of our research activities. Presently we have three fusion reactor design studies in progress, sponsored by KfK Nuclear Research Centre, Karlsruhe, FRG. These three designs are of light ion beam, heavy ion beam and magnetic mirror fusion reactors. Gerry can be reached c/o Fusion Power Associates, 6515 Grand Teton Plaza, Madison, WI, 53719, (608) 833-3388. Persons wishing to be on the mailing list to receive technical reports from these activities should call the above number.

## INDUSTRY-GOVERNMENT FUSION SEMINAR

On June 22 in Washington, about 100 persons from government, industry, universities and national laboratories attended the "Industry-Government Seminar on Fusion Energy Development." The seminar was announced in our May newsletter and was sponsored jointly by Fusion Power Associates, Atomic Industrial Forum and the Electric Power Research Institute.

In his keynote address, Dr. Robert L. Hirsch, Manager of Exxon's Baytown Research and Development Center, proposed certain principles of management which he believed should be applied to fusion and to most development programs. These were:

- A GOAL OF COMMERCIAL READINESS
  - defined as a state of knowledge, data and experience from which all elements of a commercial plant can be designed, built and operated with acceptable risk.

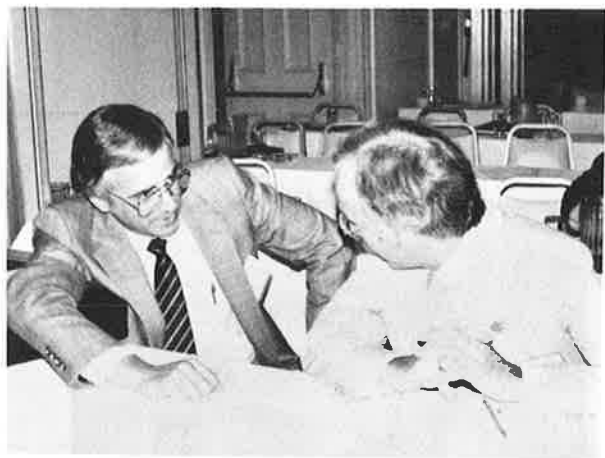


*Dr. Gerald L. Kulcinski,  
newly-appointed Vice President of  
Fusion Power Associates*

- INTEGRATED LABORATORY RESEARCH AND ENGINEERING ACTIVITIES
- HEAVY RELIANCE ON COMMERCIAL PLANT STUDIES
  - to ensure that continued development is justified; to define economically important parameters and data needs; for judging the value of process improvement; and for judging the debits associated with negative findings.
- A COORDINATED MANAGEMENT SYSTEM
  - to focus the effort of a number of separate organizational entities.

In the discussion period, Hirsch expressed his dismay at the present circumstances fusion finds itself in, saying "I frankly am sorry that you are not moving ahead with a power producing system because when you get to that point I believe that you can fix the physics

problems that come up, you will be addressing the real physics problems that occur at that stage and, more importantly, you will be getting into the engineering that will turn out to be one of the most difficult aspects of making fusion power. If you expect and wait for the ultimate you are never going to get there."



*Bob Hirsch talks to DOE fusion director John Clarke*

Introducing the three panel discussion programs which followed the keynote address, Dr. Stephen Dean, president of Fusion Power Associates stated "Its very important that the program have clearly understood, clearly stated goals and that these goal statements not change every six months or every year or every two years." With respect to scientific and engineering issues, Dean stated "There are always going to be uncertainties. It is important to get them stated but not allow the program to be held up unnecessarily because a certain problem has not been solved yet." With respect to management, Dean said "How you manage the program does make a difference to progress. There is a difference between a program which is carried out from a management attitude that it is a research program and one with a management attitude that it is a development program in which the research aspect is only one element of many that have to be solved in a systems integrated manner."

DOE Director of Energy Research Alvin W. Trivelpiece gave the luncheon address, substituting for Secretary James Edwards who was the scheduled speaker. Trivelpiece said that he established the Magnetic Fusion Advisory Committee (MFAC) [see our June newsletter] to get responsibility, accountability and perspective into the spectrum of unsolicited advice he was getting on fusion from a myriad of quarters. "A committee is not a substitute for effective management

leadership," he said, "but it can certainly be a helpful tool." Trivelpiece said that because of the federal budget difficulties "the idea that we may be able to proceed immediately with a Fusion Engineering Device is a little bit hard to imagine." Such a next generation device might be possible later, he said, adding that "some kind of a decision with respect to tokamaks and mirrors may have to be made in the '86-'87 timeframe." Trivelpiece reiterated the statement he made to MFAC (see our June newsletter) on the importance of the fusion research program and on the administration's interest in fusion international cooperation.



*DOE Director of Energy Research Al Trivelpiece delivers the seminar luncheon address*

#### FUSION GOALS

The first panel, on "Goals for the Fusion Program," was moderated by Dr. John M. Marcum, Assistant Director for Energy and Natural Resources of the White House Office of Science and Technology Policy (OSTP). The panelists were former Congressman Mike McCormack (author of the Magnetic Fusion Energy Engineering Act of 1980), Joseph G. Gavin, Jr., President of Grumman Corp., Corwin Rickard, Executive Vice President of General Atomic Company, and Alexander Glass, President of KMS Fusion, Inc.

The panelists agreed on the importance of having a clear, practical goal statement. McCormack stated: "There is only one meaningful goal for the nations fusion program: the demonstration of competitive generation of electricity from fusion energy at the earliest possible date." Rickard suggested "the development of an inexhaustible, environmentally benign, of reasonable cost, universally available energy source capable of easy conversion



into various forms of secondary energy carriers." Glass stated "the long-term goal must be the commercial readiness of fusion electricity." Gavin stated that we should have "a long term program that has been laid down and agreed to" and that the U.S. "should strive to be the leader in this new technology."

Marcum stated that the administration expected fusion power plants to be contributing 10-15% of the U.S. electricity supply by the middle of the next century. Fusion research, he said, "is an investment for posterity." Because we have at least "50 years supply of oil and gas at current production levels" and even larger supplies of coal and uranium, Marcum said the administration feels that fusion development "is not an urgent matter." "On the other hand," Marcum said, "It is a matter which, on the basis of prudence alone, clearly is something that should continue to enjoy high priority in terms of our energy research objectives."



*Dr. John Marcum of OSTP introduces the panel on "Goals for the Fusion Program"*

Gavin stressed the "importance of pressing on." "First of all," he said, "a shorter program will cost less than a long program. If you plan it for 50 years, it will take 50 years. If you plan it for 10 years it might take 12 but at least it will be 12 instead of 50." "We should be looking toward having something accomplished from which the utilities could then proceed within the next 20 years," Gavin said.

Speaking up from the audience, former Princeton lab director Melvin Gottlieb stated "you have to set yourself goals that are not easy." Having difficult to achieve goals can easily make a difference of a "factor of two" in the rate of progress," Gottlieb said.



*Panelists Gavin, Rickard, Glass and McCormack discussed "Goals for the Fusion Program"*

#### FUSION ISSUES

The second panel at the seminar addressed the subject of what scientific and engineering issues were holding up progress (as opposed to budgetary constraints). John Clarke, magnetic fusion director at DOE, was moderator of a panel consisting of Ron Davidson, Director of MIT's Plasma Fusion Center; Harold Forsen, Manager of Engineering and Materials at Bechtel Group, Inc.; Tom Varljen, Engineering Manager of the Advanced Reactors Division of Westinghouse Electric Corp. and Herb Woodsen, Director of the Center for Energy Studies at the University of Texas.

Clarke opened the session by stating that our uncertainties were "bounded", which he said meant that "we are able to state with a fair degree of assurance that we could build, in a finite period of time, with a fair degree of confidence that it would work, a fusion power producing system." "Unfortunately," he said, "the uncertainty is such that we really can't do that for a small cost. We have to leave margin in the device that we would build today, based on today's knowledge, to encompass that uncertainty."

Davidson said that "from a scientific viewpoint the technical reasons for moving ahead promptly with an expanded engineering development program, as espoused by the recommendations of ERAB and the Fusion Engineering Act, are better founded today than two years ago." He cited recent achievement in getting higher plasma pressure at Oak Ridge and General Atomic, the demonstration of radio-frequency heating and current drive at Princeton, and continued conceptual advances in mirrors at Livermore. Davidson cautioned that "there is a large and

probably very natural fixation on the general budget climate and concomitant planning exercises, and a corresponding tendency to overlook the significance of the existing data base for fusion. I think its very important that we turn the context of the program back to the positive climate that it deserves on a technical basis," Davidson said.

Forsen recalled the striking progress that is evident by comparing what we are able to do today in fusion as compared to ten years ago and twenty years ago. Noting that much of the current program centers on solving today's physics problems, Forsen noted that "In the engineering area the problems or issues are nearly as formidable, but here there lacks a well identified, reasonably well funded program to get there. To the scientist some of this will sound trivial, but to the reactor manufacturer, engineering constructor or utility operator they are very real." Enumerating important engineering issues, Forsen cited neutron effects on plant materials, chemical processing in the balnket and many others. He called for the program managers to better balance the scientific and engineering effort within any budget context. Woodson and Varljen emphasized the importance of building a device which would make a lot of fusion energy available. When that happens, they said, clever engineers would find lots of ways to improve the system and invent practical applications.



*Harold Forsen (Bechtel Group, Inc.) and Steve Dean (FPA) with Tom Shannon, Director of the Fusion Engineering Design Center discuss scientific and engineering issues at the Seminar*

The final panel at the seminar addressed the subject "Systems Management--Can It Be Applied to Fusion."

Howard Drew, Executive Vice President of the Texas Atomic Energy Research Foundation, was moderator of the panel. Panelists were John Yardley, President of McDonnell Douglas Astronautics Co.; Leonard Reichle, Executive Vice President of Ebasco Services, Inc.; and Paul Reardon, TFTR Program Head at Princeton Plasma Physics Laboratory.

Yardley defined systems management as "an organized method of constantly directing all the factors that accommplish a mission, to assure success in the shortest time and at least cost." He said that "systems management not only applies to fusion but must be used to the greatest extent." Yardley recounted his experience in managing the development of manned spacecraft, including the Space Shuttle. Yardley said that "Plans are the backbone of systems management. Plans constitute a model by which the mission will be accomplished. Like any model, they can be iterated with different assumptions of policies, criteria etc. The impact of these changes can be assessed and used for decision making. Plans provide control and a measure of effectiveness for the program manager." Yardley also emphasized the importance of providing clear lines of authority and corresponding responsibility to program managers. "The fusion program seems to have far more diffuse authority than I've experienced in either NASA or DOD where centralized authority is established," Yardley said. Unless lines of authority are dilineated, "hard decisions cannot be made, resources will be dissipated and management performance cannot be measured," he said. Reichle agreed, but cautioned that there was no need to apply systems management to that small percentage of the program which should be devoted to innovative basic research. Reichle described a typical "industry-type" management system. He emphasized that "systems management should not be engaged in as a thing apart from responsibility for performance. By that I mean don't assign responsibility to organization A and then assign responsibility for systems management to organization B. Systems management should be an integral part of the management and technical direction of fusion applied research, engineering, development and project work." Reardon recounted the successful application of systems management to the TFTR project and said he thought about 5% of program resources should be devoted to it in the future, although only 1.7% was spent on systems management for TFTR.



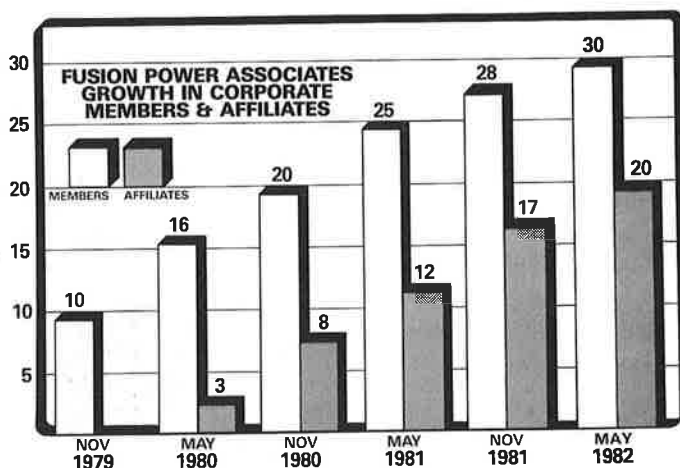
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## GROWTH IN MEMBERS AND AFFILIATES

A steady growth in the number of corporate members and affiliates continues, and we now have a total of 50, compared to 10 when we began in the fall of 1979. In addition, we also now have a total of 250 individual affiliates. We thank all our members and affiliates for their continued interest and support.



## NATIONAL RESEARCH COUNCIL WORKSHOP

As announced in our June newsletter the National Research Council, the principal operating agency of the National Academy of Sciences and the National Academy of Engineering, held a two-day workshop August 3-4 in Washington on "The Future Engineering Development Needs of Magnetic Fusion." Emphasis at the meeting was on systems definition, subsystem development needs, systems integration and management.

The session on systems definition was organized by Bill Stacey (Georgia Institute of Technology) and included presentations by Don Steiner (formerly of ORNL and now at RPI), Bob Conn (UCLA), Keith Thomassen (LLNL) and Bob Krakowski (LANL). The speakers described the critical role played by

reactor design studies in identifying important engineering development tasks. While substantial further development is required in all subsystems areas, e.g., magnets, heating, materials, etc., there was general agreement that the technology required for fusion could be developed successfully. The most difficult areas appeared to be materials, particle injection and removal systems and first wall protection systems. A less difficult area, but still one requiring considerable development, is the need for detailed engineering data for blanket and shield design. By comparison, magnets, rf technology development and tritium handling appeared relatively straightforward.

A major difference between present DOE practices and the ideas presented by workshop participants like Joe Gavin, president of Grumman Corp., and Bill Kennedy, vice president of Stone and Webster, was the emphasis placed on the importance of having a disciplined systems management organization. Workshop participants believed such discipline was necessary so that maximum progress at minimum cost is achieved on subsystems in a manner consistent with integrating the component and subsystems accomplishments into the overall system development schedule. DOE and OSTP have recently deemphasized the importance of schedule and goals and seem more disposed to develop the subsystems technologies as general functional R&D areas. DOE's lack of interest in establishing a Center for Fusion Engineering is one aspect of this attitude.

## ANS FUSION POLICY STATEMENT

The Board of Directors of the American Nuclear Society has issued a policy statement entitled "Fusion Energy and Its Potential." The statement reads in part "The long-term benefits of fusion energy appear sufficiently great to warrant a sustained national and international effort aimed at advancing fusion at least to the point where its commercial potential can

be accurately assessed. Recent scientific progress in fusion energy has been sufficiently encouraging to warrant proceeding with a fusion energy development program." The report states that "the present state of the fusion program warrants increased study of possible practical applications of fusion energy."

#### JOINT CONGRESSIONAL RESOLUTION

The Joint Congressional Resolution (see our June newsletter) expressing continued congressional endorsement of the Magnetic Fusion Energy Engineering Act of 1980 now has 40 cosponsors in the House and 18 in the Senate. Fusion supporters are urged to write to their congressmen and senators asking them to co-sponsor the measure (H.J. Res 513 in the House and S.J. Res 202 in the Senate). Your representatives can sign up by contacting Rep. Marilyn Bouquard or Harlan Watson of the HS&T staff at (202) 224-3472. Your senator should contact Sen. John Danforth or Reid Detchon of his staff at (202) 224-0211.

#### MFAC TO MEET AUGUST 30-31

The next meeting of the Magnetic Fusion Advisory Committee (MFAC) will take place August 30-31 beginning at 9:00 A.M. in the DOE auditorium in Germantown, MD. The committee will receive reports from the three panels they established at their first meeting (see our June newsletter). MFAC is scheduled to formulate its own "interim report" to DOE at the meeting and to receive "new or renewed" charges. The meeting is open to the public and public comment will be allowed at the meeting.

#### MEETINGS

August 25-27: Fourth APS Topical Conference on High Temperature Plasma Diagnostics, Park Plaza Hotel, Boston. Contact Ms. Lisa DiMauro (617) 253-5369

Sept. 1-8 : Ninth International Conference on Plasma Physics and Controlled Nuclear Fusion Research, Convention Center, Baltimore. Contact Dr. James Decker (301) 353-4596

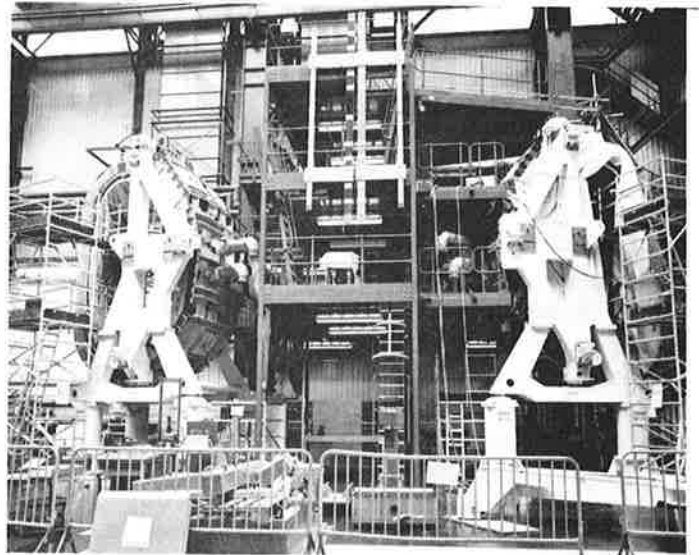
Oct. 25-29 : Sixth International Workshop on Laser Interaction and Related Plasma Phenomena. Naval Postgraduate School, Monterey, CA. Contact George Miley (217) 333-3772.

#### AWARDS

Dr. Mohamed A. Abdou of Argonne National Laboratory has received the American Nuclear Society's Young Members Engineering Achievement Award for 1982. Dr. Abdou was selected in recognition of his contributions to fusion technology and engineering in the fields of neutronics and shielding and reactor design and system analysis. We are proud that Dr. Abdou is an individual affiliate of Fusion Power Associates.

#### PROGRESS ON JET

Steve Dean visited the fusion facilities at Culham and Rutherford Laboratories in England on July 26-27. During that visit he was especially impressed with progress on the Joint European Torus (JET), the European competitor to Princeton's Tokamak Fusion Test Reactor (TFTR). The JET assembly is now moving ahead rapidly and Dean concluded that "the race toward first plasma operations is very close between JET and TFTR." JET is a physically larger facility and now has financial commitment from the European Community for fully upgrading its capability. The scientist Dean spoke to expressed the belief that they would eventually achieve "ignition conditions" in JET--an operating condition which would represent a greater achievement than the "breakeven condition" which is the goal of TFTR.



*Two of the eight sections being assembled for insertion into the JET facility in England. Completion of assembly is scheduled for December of this year.*



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## NEW MEMBER

General Dynamics Convair Division, San Diego, CA, has become the thirty-first member of Fusion Power Associates. Dr. Ray Beuligmann, Energy Systems Program Director, will represent the company. Dr. Beuligmann is also a member of DOE's Magnetic Fusion Advisory Committee. In recent years General Dynamics has become the leading supplier of superconducting magnets to U.S. fusion devices and test facilities. We welcome their participation.

## FY 1984 FUSION BUDGET

The DOE sends their FY 1984 budget requests to the Office of Management and Budget in mid-September. Despite tight budgetary guidelines and months of talk about "flat budgets," DOE is reportedly requesting an increase of about 15% for magnetic fusion and a modest increase for inertial fusion. Sources indicate that the DOE request will include funds for continuation of a variety of construction projects, including EBT-P, FMIT, MFTF-B, PBFA-II and NOVA.



*GA vice president Tihiro Ohkawa and GA's fusion program liaison person Kathrynne Bruner seem especially happy, just prior to the announcement of new fusion record set at GA in Doublet III.*

## GA REPORTS MAJOR FUSION ADVANCE

Scientists at General Atomic Company, working on the Doublet III, have set a new world record for achieving high fusion power density conditions in a tokamak. They reported achieving values up to 4.6% in the parameter called "beta" (the ratio of plasma pressure to magnetic field pressure), about twice the previous record set by the ISX-B tokamak at Oak Ridge National Laboratory. This demonstration ensured that the Fusion Engineering Device called for in the Magnetic Fusion Energy Engineering Act of 1980 could have successfully reached ignition conditions. Such a device has been postponed by the administration. The GA result leaves tokamak achievements only about one more factor of two short of the value needed for a full-scale commercial fusion power reactor. The results were reported jubilantly by Dr. Tihiro Ohkawa, leader of the GA effort, at the Ninth International Conference on Plasma Physics and Controlled Nuclear Fusion Research in Baltimore on September 1.

## PUBLIC INFORMATION SPECIALISTS WORKSHOP

On October 19-20, Fusion Power Associates will sponsor a workshop for personnel active in fusion public information activities. Princeton Plasma Physics Laboratory will be the site of the workshop and will serve as host. The purpose of the workshop is to promote greater understanding and cooperation among fusion public information activities nationwide. Participants are asked to bring copies of recent press releases, newsletters, brochures, etc. for distribution and each participating organization will be asked to give a 20 minute summary of its activities, including experience with providing speakers to media or other groups. As a minimum goal, it is expected that the workshop will result in the formation of an informal network of personnel, with agreements to keep each other informed through mailings.

Possibly a sequence of periodic meetings may result and/or agreements to initiate some new activities. A registration fee of \$35 will be charged to cover expenses. Please contact Ruth Watkins at (301) 258-0545 if you wish to attend.

#### CONGRESSIONAL JOINT RESOLUTION

If you have not yet contacted your senators and representatives urging them to support H.J. RES 513 and S.J. RES 202, now is the time to do so. Congress will be in session just a few short weeks before adjourning for the elections and it is important to pass this resolution expressing continued congressional endorsement of the fusion program.

#### MAGNETIC FUSION PLAN

Out of the ashes of the widely-criticized May draft of the "Comprehensive Program Management Plan (CPMP)" has risen a vastly superior document. Architects of the new draft are members of an Office of Fusion Energy task force headed by Dr. Phil Stone, Chief of the Experimental Plasma Research Branch, Division of Applied Plasma Physics. Others on the task force were Steve Eckstrand, Tom James, Stacey Luke, and Don Beard.

Although the 13-page draft is hardly "comprehensive," it does contain clearly delineated sections on goals and objectives, program status, strategy, implementation approach, management activities, risk/benefits and accelerated options. DOE intends to submit the document to Congress on October 1. FPA president Steve Dean, an outspoken critic of the earlier draft, said that he was "relieved and pleased" to be able to endorse the new draft. He cautioned, however, that the draft was still being "massaged" by others in the government and that we still have to await the final document.

The draft plan states that "The goal of the magnetic fusion energy program is to develop a magnetic fusion reactor concept to the point where commercial development of fusion can begin." The objectives of the program, the draft plan states, "are to: (1) provide the scientific and engineering data necessary to support the design and construction of an engineering device; (2) operate an engineering device that integrates the components and systems needed for a reactor, indicates power production capability, and, most importantly, demonstrates engineering feasibility; (3) provide the detailed scientific and engineering

data, cost data, and the evaluations and understanding necessary for commercialization decisions; and (4) transfer fusion technology to industry in preparation for the commercial development of magnetic fusion energy."

A unique and important feature of the draft plan is the presentation of two accelerated option cases, the second of which "closely carries out the strategy contained in the Magnetic Fusion Energy Engineering Act of 1980."



*Dr. Phil Stone, who turned near-disaster to triumph as chairman of a DOE task force to re-write the CPMP.*

#### MFAC MEETING

The DOE's Magnetic Fusion Advisory Committee (MFAC) met August 30-31 to discuss its ongoing review in response to the three questions posed to them by DOE (see our June newsletter). No report was finalized at the meeting. Much of the meeting was spent discussing the role and relative priorities of the so-called "alternate concepts:" Reversed field pinch, EBT and stellarators. Several committee members emphasized the complementary aspects of these programs in adding to our general knowledge base and felt that the DOE question to the committee had overdramatized the competitive aspect of these concepts. There was widespread support for maintaining broad support for these and other concepts which complement the so-called "mainline" tokamak and tandem mirror programs.

Persons wishing to receive copies of the minutes of the MFAC meeting should contact Ms. Lenore Ledman, Office of Fusion Energy, Mail Stop G-256, U.S. Department of Energy, Washington, D. C., 20545.



*Ron Davidson talks to Harold Furth during a break at the Aug. 30-31 meeting of DOE's Magnetic Fusion Advisory Committee.*

#### JOINT CONGRESSIONAL FUSION WORKSHOP

Sen. Pete V. Domenici, Chairman of the Senate Subcommittee on Energy Research and Development and Rep. Marilyn L. Bouquard, Chairman of the House Subcommittee on Energy Research and Production, announced on August 26 that they would co-sponsor a Joint (House-Senate) Workshop on Fusion Energy September 8. Organizers of the workshop arranged for Euratom fusion chief D. Palumbo and Japanese fusion director S. Mori to present synopses of the European and Japanese programs. Other participants included J. Clarke, H. Woodsen, R. Davidson, F. Graham, F. R. Scott, M. Gottlieb, S. Rockwood, R. Schreiber, L. Reichle, J. Gavin, S. Dean and others.

Commenting that he was "genuinely interested in the field," Sen. Domenici stated: "Congress approved an aggressive fusion research bill during the 96th Congress. The administration proposes a program which is a step up from past activities but which is not as aggressive as many would like. I appreciate and understand the administration's need to balance an aggressive program with its overall efforts for fiscal restraint. In its more conservative approach to the construction of a device into engineering problems, the department claimed that a large investment in a particular device would be premature. Instead a smaller, more flexible device would be sought while the scientific questions about what type of devices to pursue in the future were investigated in existing machines and ones under construction. While I tend to support that approach, obviously we are here today to learn more from the department and more from distinguished experts from the United States and the world on that approach and what it might hold in the future."

House subcommittee staff director, Dr. Jack Dugan, representing Mrs. Bouquard, said "Our committee is very concerned about maintaining some significant industry involvement in the program under what appears to be flat funding future projections for the program."

#### CLARKE KEYNOTES WORKSHOP

DOE Office of Fusion Energy director John Clarke opened the workshop with a clear and comprehensive briefing on the nature and status of the program and DOE's planned responses to the fusion Act within the restraints of OMB budget guidelines. Clarke stated: "The administration recognizes that fusion is the principal energy option for the United States in the next century and it recognizes the importance of this program. The administration feels that the fusion programs are a federal responsibility." "However," Clarke said, "because of the constraint on federal budgets, we must be prepared to carry out the fusion program in a cost effective and economical fashion, which means that we will have to make what are laughingly referred to as 'difficult choices'." Clarke said, "We must plan on relatively constant budgets for the FY 84-88 period. This means that we will have to very carefully look at the activities within the fusion program and choose those activities which will allow us to make progress within that budget constraint. Our approach to these boundary conditions is to design a program which focusses on critical feasibility issues. What that means is that we will not necessarily take every aspect of plasma physics or technology and push it to the ultimate development required for commercial power. But we will carry out research and development on the critical issues which will determine the ultimate feasibility of realizing fusion power."

In describing the consequences of the flat budget assumption in the near term, Clarke said: "We have separated the program into two stages. The first stage being the definition of the product that we want to develop--putting off the actual focussed product development until after we have defined the product. This approach will force us to make early choices among reactor concepts and, clearly, if we are going to make early choices among reactor concepts, we must concentrate a lot of effort in developing those concepts to the point where a rational choice can be made. It will force us to focus our attention on technology but only on those critical technology issues that may make the difference between the product

working or not working. We will have to put off the demonstration at the reactor scale to a later stage of the program. And finally, we will have to drop this generic engineering facility and replace it at a later time by an equivalent facility. Obviously, since the new facility will be started later, we will have a greater breadth of technology on which to base it. We will have a greater understanding of scientific issues and consequently we would hope that that engineering system would have higher performance. We are hoping that, by following this route, we can accommodate ourselves to the near-term budget constraint but that we will still force the program to an as early a demonstration of scientific feasibility as is possible. We think, having gone over the elements of the program required to carry out this program, that we will still be able to reach the stage of engineering feasibility by the turn of the century, which was the intent of the magnetic fusion engineering Act." [ed. note: The Act calls for "a national goal of demonstrating the engineering feasibility of magnetic fusion by the early 1990's."]

#### CLARKE COMMENTS ON INDUSTRY

In response to a question by House staff scientist Harlan Watson on what Clarke envisaged to be the roles of industry, Clarke said: "We view the role of industry with the fusion program during this next decade as one of transition. In the past we have had lots of involvement with industry. In terms of dollars we have spent approximately half of the fusion budget with industry. But in the past this has been using industry in the role of supplier of subsystems and components. Now, the role of industry has been very clear in the past because the fusion program was being defined and developed in the national laboratories. It is very clear in the decade of the 90's because during that period of time we will presumably be building an engineering test reactor and developing those final technologies that will be needed for establishing the commercial viability of fusion. Clearly that is the time when industry will be carrying the major role and major load in the program. The problem of course is defining what we will do during the 80's. Given a level budget for the fusion program during this period we don't see large opportunities for industry in the program in the sense of taking over large sections of the program. There are opportunities, and we will have to make sure that these are used, to involve

industry in a substantive way in directing portions of the program and becoming sufficiently involved in carrying out the program in the laboratories so that they will be prepared to participate in a major way in the 90's."

#### RESPONSE REQUESTED

Harlan Watson asked FPA president Steve Dean to comment on what Clarke had presented. Dean said: "I think that the program as layed out by John is a good one based on the assumptions under which he is constrained to operate, which he stated at the beginning as being flat budgets through '88 and a very rapid rampup after that. The net result of that, it seems to me, is to put the role of industry, as envisaged in the Act, off by ten years. The role that John describes as taking place in the 1990's was envisaged in the Act to occur in the 1980's. I think that is unfortunate. Not being a member of the executive branch, I don't personally have to take as 'god-given' the assumption of flat budgets through '88 and the promise of rapid rampups thereafter. I don't think that is realistic. In fact, if flat budgets hold through FY 88 I don't have any reason to believe that in '88, all of a sudden everybody will change their minds and ramp us up then. So I believe that we have to question, and I hope the Congress will question, this assumption of flat budgets."

Dean continued, "In response to a question which you asked earlier, Senator, about the attitude at the OMB (which I think is dominated at the present time by Dr. Keyworth's office) I think there has been a fundamental change in the view there, as compared to what is in the Act. At a recent meeting we had, Dr. Marcum, who works for Dr. Keyworth, stated that, in their view, there was an adequate supply of fossil fuels, etc. for a long period of time and that, therefore, there was no urgency to the development of fusion and that we really didn't need fusion for a long time. Now that was not the assumption that was made in laying out the fusion Act."

Dean concluded, "Whereas I congratulate John for doing the best that possibly could be done in terms of laying out a strategy under a flat budget assumption, I hope that the country will not simply accept that assumption. So I hope there is some intermediate budget case that would allow industry to play a more responsible role earlier than is layed out in Clarke's chart."





# FUSION POWER ASSOCIATES

2 PROFESSIONAL DRIVE, SUITE 248 • GAITHERSBURG, MARYLAND 20780

(301) 258-0545

## NEW AFFILIATE

Ontario Hydro, Toronto, Ontario, Canada has become a Corporate Affiliate of Fusion Power Associates. Tom Drolet, Program Manager, Canadian Fusion Fuel Technology Project, will represent the company. Ontario Hydro is cosponsoring, with the National Research Council of Canada and the Ontario government, a research and development program aimed at positioning Canadian industry as suppliers for fusion fuels and as component suppliers for associated technology for fusion fuels management. Ontario Hydro is expected to become the world's dominant, non-military producer of tritium. Ontario Hydro is our twelfth electric utility participant and second Canadian affiliate. (The other is Hydro-Quebec.) We welcome their participation in Fusion Power Associates.

## BOARD MEMBERS ELECTED

The member representatives of Fusion Power Associates have elected three new members to our Board of Directors and re-elected six current members to three year terms beginning November 1. The three new directors are: Christian C. Bolta, Director, Technology Strategy, Combustion Engineering, Inc.; Harold K. Forsen, Manager, Engineering and Materials, Bechtel Group, Inc.; and Peter Staudhammer, Manager, Energy Systems Operations, TRW, Inc. The six current directors re-elected are: Stephen O. Dean, President and CEO, Fusion Power Associates; Nicholas A. Krall, Vice President, JAYCOR and Chairman of the Board, FPA; Donald L. Kummer, Director, Program Engineering, McDonnell Douglas Astronautics Co. and Secretary, FPA; Tihiro Ohkawa, Vice President, General Atomic Co.; Leonard F. C. Reichle, Executive Vice President, Ebasco Services, Inc. and Vice Chairman of the Board, FPA; and Peter H. Rose, President, Mathematical Sciences Northwest.



*Leonard F. C. Reichle and Peter H. Rose are two of six current directors re-elected to the FPA Board.*

## CLARKE TOURS

Office of Fusion Energy director John Clarke went on a whirlwind "barnstorming tour" of his major contractors in late September, making one-day "whistle stops" at Hanford, Livermore, General Atomic, Oak Ridge, Princeton, and MIT. A mid-October stop at Los Alamos is also scheduled. During his visits, Clarke made presentations of his management plans to assemblies of scientists and engineers working at the various sites. A telephone sampling of those attending gives Clarke high marks for the clarity of his presentations and for his forthright handling of questions. Clarke's bleak outlook on budgets reportedly dampened morale, however.

In his presentations, Clarke outlined the general features of his planning assumptions. A decision in 1988 to construct an Engineering Test Reactor (ETR) remains the cornerstone (see our June newsletter). Mirrors and tokamaks would compete for this ETR. Responsibility to define this ETR and to coordinate

the design efforts will be vested in the Fusion Engineering Design Center (FEDC) at Oak Ridge. Maximum use of existing experimental facilities will receive funding priority. Funding for concepts other than tokamaks and mirrors will be maintained at about present levels. The EBT-P project will be re-examined to see if projected cost estimates can be reduced. A concerted effort to obtain international participation in FMIT is underway.

#### STONE TO HEAD REACTOR STUDIES

Dr. Philip M. Stone has been named to take charge of fusion reactor systems studies in the Office of Fusion Energy, DOE. Activities of the Fusion Engineering Design Center at Oak Ridge will report to Stone. Primary attention is being given to definition of the so-called Engineering Test Reactor (ETR) which has become the planning focus of the Office of Fusion Energy. DOE envisages the ETR to be initiated in the FY 1988 budget cycle and to represent a selection between tokamak and magnetic mirror concepts.

#### COMMENTARY

In a letter dated Sept. 30, 1982, to Steve Dean, Phil Stone points out that "the basic strategy presented in the latest draft (of the Comprehensive Program Management Plan [see our Sept. newsletter]) has not changed from that of the original draft last May."

Unfortunately this is true. Stone's version of the CPMP is vastly superior in style to the May draft and adds important new features, such as goals and objectives and accelerated options which were not present in the May draft. But the weaknesses of the original (and still current) "new strategy" are still present. These weaknesses are as follows:

- o On what basis are we to believe that a program receiving "flat budgets" from now until 1988 will receive large budget increases thereafter?
- o On what basis are we to believe that an ETR will be marketable in 1988? Past experience has been forcing us to propose less ambitious devices.
- o Are we really to believe that in 1988 we will desire to proclaim either the tokamak or the magnetic mirror as the winner in our 30-plus year quest for a commercial fusion product?

The format and stated goals of the new CPMP document are responsive to the requirement of the fusion Act but the strategy is totally unresponsive. This strategy may indeed be the best that we can have, given the present attitudes and economic problems of the current administration. But the strategy will have to change long before 1988 or the U.S. fusion program will be in a sorry state. We must keep reminding ourselves, and all who will listen, that continuing impressive progress is being made and that no major new magnetic fusion devices have been initiated since 1976!!

#### REARDON RESIGNS

Paul Reardon, Head of TFTR and Fusion Technology at Princeton Plasma Physics Laboratory, has announced his intention to take a position at Brookhaven National Laboratory as Associate Director for High Energy Facilities effective January 1. Reardon's leaving is reflective of the absence of opportunities for new initiatives in technology and facilities in the fusion program. As head of the TFTR project, Paul demonstrated outstanding skill in merging physics with engineering and industry skills with those of laboratories. His contributions will become increasingly evident as TFTR comes into operation.

#### BORCHERS NAMED FOWLER DEPUTY

Dr. Robert R. Borchers has been named deputy to Livermore magnetic fusion director T. K. Fowler. Bob has been directing the magnetic fusion development and technology activities at Livermore. He came to Livermore in April 1979 from the University of Wisconsin where he was Vice-Chancellor for Academic Affairs.

#### MEETINGS

October 21 - MIT Luncheon Club. Speaker: Hugh F. Loweth, Assoc. Dir. for Energy and Science, OMB. At George Washington University Club, Washington, D. C. Contact David Moore (202) 755-6900.

November 1 - Special Meeting of Magnetic Fusion Advisory Committee. New Orleans, LA. Time and place not yet determined at press time. Contact Lenore Ledman (301) 353-3598.

November 1-5 - Annual Meeting of the APS Division of Plasma Physics at the Hyatt Regency Hotel, New Orleans, LA.

November 8-12 - IAEA Mirror Fusion Workshop, Livermore, CA. Contact R. Borchers (415) 422-9870.

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## Interview: Fusion Power Associates president

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# Stephen O. Dean: 'Nuclear fusion is ready for the engineering stage now'

*Dr. Stephen O. Dean is the president of Fusion Power Associates of Gaithersburg, Maryland. He was in government service with the Atomic Energy Commission, the Energy Research and Development Agency, and the Department of Energy for 17 years, and held the post of director of Confinement Systems Division of the Office of Fusion Energy in the U.S. Department of Energy until early 1979. Dr. Dean was interviewed for EIR by Steven Bardwell.*

**EIR:** At the International Atomic Energy Agency's Ninth conference on Plasma Physics and Nuclear Fusion in Baltimore during the first week in September, new results in tokamak physics were reported. Will you summarize what you see as the most important developments?

**Dean:** I think this meeting was particularly interesting in that advances were reported on problems which the tokamak was perceived to have by some people, on issues associated with whether they would make attractive commercial reactors, specifically the problems of raising the power density in these machines and, secondly, finding a means of running them in a continuous, (rather than pulsed), mode. I think the most important and impressive results were the ones reported by General Atomic. They reported 4.6 percent beta, [the critical determinant of commercial power density in a fusion reactor] which is about twice what the previous record had been, of about 2.5 percent.

I think the importance of their result was not just that it was a higher number but that the earlier experiments seemed to be showing some kind of saturation or beta limit. General Atomic went well beyond the values at which the other experiments were saturating with modest amounts of input power. They still have a couple of megawatts reserved there so they may go up even further, and they have now reached values which are about what's needed to build the fusion engineering device. This is still somewhat short, in my opinion, of what will be used in a commercial reactor, but even within a factor of two of what I think would make a very nice, reasonable, compact and high-powered type of tokamak, the conventional type of tokamak.

**EIR:** Were these in the ballpark of what was predicted for noncircular cross-section machines like the D-shaped Doublet III at General Atomic?

**Dean:** Nobody really knew what kind of beta values would be reached in these various machines. The power that's available for these machines is sufficient in the long run to run the

machines up into the 10 to 15 percent range. We don't have full power on any of the machines yet, so we haven't really gotten to those values. I think in terms of expectations this is consistent with the original expectation for this amount of power input, but it is beyond what most people thought was going to happen in view of the saturation factor that was being observed elsewhere. I feel that for those reasons the General Atomic results bode well for continued progress toward a higher power density plasma. They also saw evidence that the non-circularity of the plasma was in fact contributing to enhanced plasma conditions and hence confinement, and I think there again it was the first time we have seen definite results that show the advantages of non-circularity.

In addition, on the question of continuous operation, results from MIT, where they showed lower hybrid coupling of radio frequency waves into the plasma at higher density, show that perhaps we can drive the currents in tokamak by non-inductive means so that we could imagine perhaps eventually a steady-state tokamak or one which doesn't require pulsed transformers. This has important engineering implications.

**EIR:** At this meeting I noticed there were a number of results relating to the question of lower hybrid heating, ion cyclotron resonance heating, and other radio frequency heating. Can you give any idea of the relative significance of these?

**Dean:** I think what these results show is that only in the past couple of years have we started to seriously investigate putting large amounts of radio frequency power in a variety of frequencies into plasma. We've almost always simply used neutral beams for heating. Now, all over the world, we're starting to see the effect of putting large amounts of radio frequency power at various frequencies into the plasma. I think without exception we are finding better conditions as we do this. I don't know what frequency we'll eventually choose in a reactor, but I think the significance is that we may have a variety of possibilities. If it doesn't work well at one frequency, we'll be able to use a different frequency. We'll be able to tailor the plasma to behave in a variety of ways.

**EIR:** There are two results of other magnetic confinement machines which generated considerable interest at the IAEA meeting. One is the progress of the mirror machine, and the other is the dramatic change in the assessment of the significance of reverse field pinches.

**Dean:** The mirror experiments I think presented a nice step forward in demonstrating that in the larger tandem mirror we are able to enhance confinement time by something like a factor of three beyond that in the smaller tandem mirror, which of course was itself a factor of a couple above what had been achieved in simple mirrors. So, the mirror program, as we make the machines bigger and change their design, is showing the ability to enhance the confinement and reduce the end-losses.

We don't yet have a full demonstration of thermal barriers, and this is the objective of the mirror program at Lawrence Livermore Laboratory during the next six to eight months. At that point we will be able to make an assessment of what a real tandem mirror reactor will look like. Right now we don't have sufficient fundamental data to verify our assumptions on thermal barriers. But that should all clear up in the next year, and certainly I think we are going in a positive direction. . . .

On the reverse field pinch, we've had the emergence, as a surprise in the last year, of a fairly small experiment doing considerably better than it was designed to do, for reasons which weren't predicted in advance and aren't fully understood but are quite dramatic. One of these is the "dynamo effect," in which the plasma seems able to continue to exist because of its own dynamics in a confined state, independent of what we're doing to it from the outside.

**EIR:** I was impressed by the statements of Dr. Donato Palumbo, the head of the European Community's fusion program, and Dr. Shigeru Mori, the head of the Japanese fusion program, on their continued optimism on the prospects for commercial fusion development and on the broad-based commitment that they've made to fusion research. They reported on a number of impressive experiments. How do these programs fit together with the prospects for progress in the United States?

**Dean:** I think that it's clear that both the Japanese and the Europeans are now committed to fusion as a development program, as opposed to just a research program. They both have program plans that lead to power reactors; both seem to have a more reliable financial commitment to carrying these programs out than we have in the United States. . . . Palumbo said, for example, that he has a five-year budget and he knows that his available funds will not be less than specified in this budget during that entire five years. . . . This gives him the ability to plan his program with some confidence. Mori stated that in Japan, fusion was elevated a few years ago to what they call a national project, and that means that it's not something that is played around with in the budget every year. It means that the country is committed to funding it at the levels required to carry out the objectives of the project and those objectives are quite ambitious.

I think that both the Europeans and Japan have their programs on a par with, at least, and maybe somewhat more aggressive than what the United States has, even though I think Americans could still argue that we are turning out more

interesting results by and large. This is more because we've put more commitment in the past rather than where we stand today. The new European and Japanese machines are comparable to or maybe bigger and better than our TFTR, and they are clearly organized to go the rest of the way.

However, I don't think that there is any likelihood that Japan and Europe will break into the lead in terms of building a power reactor several years before the United States. I think that they are not quite confident of themselves to run away from us in that regard.

**EIR:** You have alluded several times to the uncertainties and the fluctuations in U.S. political commitment to fusion power. In the last year, budget cuts have hit the inertial confinement programs even harder than the magnetic confinement programs, although both areas have suffered cuts in real dollar levels of funding. Will you hazard a guess as to what the future funding profile for U.S. fusion research and development might be?

**Dean:** I am optimistic that things are beginning to improve. I think that it is typical of a new administration that it comes in not knowing what it likes and doesn't like, or liking some things and not having heard of other things. Fusion was one of those areas of ambiguity, and we suffered in the first year of the Reagan administration. But our situation will improve in the third and fourth year as the administration gradually becomes aware at the highest levels what a good program fusion is, and how much it has to benefit in its international activities by pushing fusion. Fusion has a very good reputation internationally, at the highest levels of government in Europe and Japan, and that information is filtering back to the United States' system through the State Department and other channels. There are many international meetings on technology going on right now, and fusion keeps coming up as the example of a good program, well managed, in which there is something to benefit from pushing. This is starting to have an effect on the attitudes of the administration. . . .

So I am optimistic that things are slowly but steadily improving. And there is one thing that I would like to add. Consider the invention of the laser: the laser could have been invented in 1910 by Western man, instead of 1960. And the new developments in polarized fusion could have been realized when the fusion program was started 25 years ago, but they weren't. This and many other things are starting to bubble up now because people are thinking about the program and they will all become incorporated as the program evolves. Fusion still needs much improvement before we can credibly claim that this technology is going to produce electricity more cheaply than coal or nuclear power. But I think what we definitely don't want to do is to wait until all these things sort themselves out at the laboratory level before moving ahead with machines that produce large amounts of fusion power. By moving ahead as quickly as possible, we will put ourselves in the position to really start to learn of the more interesting potentials of the technology, its power handling, and its impact on the engineering.



# FUSION POWER ASSOCIATES

2 PROFESSIONAL DRIVE, SUITE 248 • GAITHERSBURG, MARYLAND 20879

(301) 258-0545

## NEW MEMBER

Applied Microwave Plasma Concepts, Inc. (AMPC) of Encinitas, CA, has become the thirty-second member of Fusion Power Associates. Ray A. Dandl, president of AMPC, will represent the company. AMPC is providing expert services on the applications of microwave power to fusion experiments. We welcome their participation.

## ANNUAL MEETING DATE SET

Fusion Power Associates' third annual meeting will take place January 6-8, 1983, at the Sheraton Harbor Island Hotel in San Diego, CA. The theme of the meeting will be "Fusion 1983: A Symposium on the Readiness and Reasons for An Accelerated National Development Program." As part of the meeting and symposium, there will be tours of the fusion facilities at General Atomic Company and General Dynamics Convair Division. On January 8 (Saturday) a 6-hour optional whale watching cruise has been arranged aboard the brigantine sailing ship "Rendezvous." We hope all our members, affiliates and friends will join with us on this occasion. The dates were selected for the convenience of those who may also wish to attend the next regular meeting of the Magnetic Fusion Advisory Committee, January 10-11 in the San Francisco Bay area.

## WESTINGHOUSE DEDICATES FUSION FACILITY

On October 18, Westinghouse officials dedicated a new research facility designed to study the effects of high thermal heat loads on materials which may be used in the construction of future fusion reactors. The program at Westinghouse will be managed for DOE by the Argonne National Laboratory as part of a national effort to begin to develop the technology required to handle large amounts of fusion power. The test facility, valued at \$2.5 million, was constructed by Westinghouse at company expense. The research program will be conducted under

government contract. In the facility, test pieces of materials up to 10,000 cm<sup>2</sup> will be bombarded by a high power electron beam and subsequently analyzed for stress cracks and embrittlement. In dedicating the facility, Westinghouse officials stated that the company "believes that fusion has the potential to become a principal energy option in the 21st century. Therefore, it is necessary to solve long lead time basic engineering problems like the design of first walls that can withstand the extremely high temperatures of the fusion reaction. This issue is, to a large extent, independent of the specific magnetic confinement approach employed and therefore can be addressed in parallel with ongoing problems to demonstrate the scientific feasibility and potential of specific confinement concepts."



*Fusion Power Associates functions frequently bring inertial fusion and magnetic fusion leaders together in a common forum. At this recent FPA event John Holtzrichter, Deputy Associate Director for Lasers, and Ken Fowler, Associate Director for Magnetic Fusion Energy, Lawrence Livermore National Laboratory, talk to DOE Office of Fusion Energy Director John Clarke.*

### TRITIUM FACILITY DEDICATED AT LANL

Another technology development milestone was reached October 14 when officials at Los Alamos National Laboratory dedicated the Tritium Systems Test Facility (TSTA). The facility is designed to mock-up the complete tritium handling system of a fusion reactor so that our ability to safely handle this weakly radioactive gas will not be in doubt when the time comes to design and build fusion power plants.

### MIT TOKAMAK ADVANCES

Alcator C at MIT continues to be one of the most productive devices in the U.S. tokamak program. Recently scientists there have delved more deeply into the so-called "Alcator scaling law" of plasma confinement. By varying the plasma major and minor radius they have shown a dependence on major as well as minor radius. Other new results are coming out, as hundreds of kilowatts of radiofrequency power are fed into the plasma at the lower hybrid frequency. These results are demonstrating a new frequency regime for effective plasma heating and also the feasibility of driving current in the plasma at reactor-level plasma density.

### FUSION INFORMATION NETWORK FORMED

Participants at the October 19-20 FPA-sponsored workshop for fusion information specialists (see our September newsletter) agreed to form a Fusion Information Network (FIN). The purpose of the network is to disseminate information on fusion energy; to ensure the accuracy and timeliness of that information; and to enhance the quality of the information and the effectiveness of its distribution.

Members of the network agreed to keep each other informed of their individual activities so that cross-fertilization of ideas and techniques could occur more easily; to exchange mailing lists and media contacts and to plan joint projects. First on the list of joint projects will be the creation of a national speakers bureau for fusion. Future potential projects may include regional educational workshops for science teachers and science writers. Fusion information specialists who were unable to attend the October 19-20 workshop but who wish to participate in the network should contact the Fusion Power Associates office (301) 258-0545.

### BOOKS

FUSION - Science, Policies and the Invention of a New Energy Source. Joan Bromberg's long-awaited history of the fusion program. MIT Press, \$30.00

NUCLEAR POWER - BOTH SIDES edited by Michio Kaku and Jennifer Trainer. Contains chapters on fusion by Steve Dean; on breeders by Hans Bethe, and other chapters by Ralph Nader, Amory Lovins and others. W. W. Norton Co., \$14.95.

### MEETINGS

November 16-18: Fifth Symposium on Physics and Technology of Compact Toroids in the Magnetic Fusion Energy Program. Bellevue, WA. Contact Dr. Richard Milroy, Mathematical Sciences Northwest, Inc. (206) 827-0460.

November 14-18: Winter meeting of the American Nuclear Society, Sheraton Washington Hotel, Washington, D. C.

November 14-17: Annual Conference of the Atomic Industrial Forum, Washington Hilton Hotel, Washington, D. C.

November 15-19: Twenty-Ninth National Symposium of the American Vacuum Society. Baltimore, MD. Convention Center.

December 18: MIT Luncheon Club. Speaker John M. Deutch. "Comments on Current Energy Policy." At George Washington University Club, Washington, D. C. Contact David Moore (202) 755-6900.

### IN MEMORIAM

Craig Hosmer, former ranking minority member of the Joint Committee on Atomic Energy, counsellor to the law firm of Doub and Muntzing, and advisor to Fusion Power Associates, died of a heart attack October 12. He was 67. Craig wrote the introduction to our book "Prospects for Fusion Power" in which he said: "Islands on a lake appear as isolated geographic features but, when the lake is drained, their common connection comes into view. Similarly, fusion research during the last 25 years has begun to reveal the common characteristics of that technology." Craig was a regular attendee at our various functions. We will miss his spirit and wisdom.



## FUSION POWER ASSOCIATES

2 PROFESSIONAL DRIVE, SUITE 248 • GAITHERSBURG, MARYLAND 20879

(301) 258-0545

### NEW MEMBER AND AFFILIATE

Varian Associates, Inc., Palo Alto, CA, has become the thirty-second member of Fusion Power Associates. Robert B. Berry, Sales Manager, will represent the company.

EG&G Idaho, Inc., Idaho Falls, ID, has become our nineteenth affiliate. J. G. Crocker, Manager, Fusion Reactor Safety Research, will represent the company.

We welcome our new member and new affiliate to participation in Fusion Power Associates.

### MAGNETIC FUSION REORGANIZATION

Significant changes in personnel assignments have recently occurred in the Office of Fusion Energy. Dr. James Decker, Director, Division of Applied Plasma Physics (APP) has accepted a three month assignment as special assistant to Office of Energy Research director Alvin W. Trivelpiece. Dr. David Nelson, Chief of the Theory Branch, has been named to fill Decker's post during this period, while Dr. Walter Sadowski will take over day-to-day responsibility for the fusion theory programs. The APP division has also lost the services of Dr. Phillip Stone who (as reported in our September newsletter) is vacating his post as Chief of the Experimental Plasma Research Branch of APP to head a new systems studies branch in the Development and Technology Division (D&T). Stone will be responsible for laying the groundwork for the so-called Engineering Test Reactor (ETR) which is the focus of fusion planning. Dr. William Dove is shepharding Stone's previous responsibilities while a replacement is sought. Dove also continues in his capacity as Chief of the Advanced Fusion Concepts Branch. Another new branch in D&T will be formed under Dr. Gregory Haas, who has been chief of the Component Development Branch in D&T. Haas'

responsibilities will cover all nuclear technologies, including the materials and tritium systems development programs. Don Beard is acting as head of the Component Branch and will be responsible for the plasma technologies, including heating and magnet development.

### NEXT MFAC MEETING

The next meeting of the Magnetic Fusion Advisory Committee will be held at the Lawrence Livermore National Laboratory on January 10-11, 1983. The meeting is open to the public. Prime business will be the report of "Subpanel 3," Harold Forsen's panel on the potential engineering uses for the TFTR facility. Following its last meeting November 1 in New Orleans, MFAC submitted a report to DOE on the tokamak, mirror and alternate concept programs. Copies of the executive summary of that report are available from Fusion Power Associates.

### ANNUAL MEETING

Plans are set for Fusion Power Associates Third Annual Meeting and Symposium, January 6-8, 1982 in San Diego. Dr. Herbert Woodson, Director of the Center for Energy Studies, University of Texas will keynote the symposium. His talk will be entitled "The Future Engineering Needs of Magnetic Fusion--Report of the National Research Council Committee on Magnetic Fusion."

Dr. Robert Sproull, President of the University of Rochester will present the luncheon address. His talk will be entitled "Fusion R&D as a Cooperative Government-Industry-University Venture."

In addition to talks by leaders on all aspects of fusion, there will be a special panel discussion on January 7 on the "Pace of Fusion Development." Dr. Edward A. Frieman, Executive Vice President of Science Applications, Inc.,

will be moderator of the discussion. Panelists will include Ronald C. Davidson, John L. Emmett, Edwin E. Kintner, Mike McCormack, and Robert L. Hirsch. Tours of GA Technologies, Inc. and General Dynamics Convair Division are scheduled on the afternoon of Friday, January 7. Attendees will have the opportunity to go on a 4-hour whale-watching sail Saturday morning, January 8. For registration information, contact Ruth Watkins (301) 258-0545.

#### U.S.-JAPAN MIRROR EXCHANGE

A team of Japanese scientists visited Livermore November 7-12 to discuss coordination of experimental plans in magnetic mirror research in the U.S. and Japan. A U.S. team will visit Japan December 6-10 for more in-depth discussions of the Japanese magnetic mirror program. FPA president Steve Dean was among the U.S. attendees at both workshops. Others making the trip to Japan are Bill Ellis, Director of the Magnetic Mirror Systems Division at DOE; Dave Baldwin, Bob Borchers and Fred Coensgen of LLNL; Ron Davidson, Dick Post and Dan Cohn of MIT; Jim Callen of the University of Wisconsin; Don Dobrott and Dick Aamodt of SAI, Pete Staudhammer of TRW, Lee Berry of ORNL and John Dawson of UCLA.

#### U.S.-USSR MIRROR EXCHANGE

A team of soviet scientists visited LLNL November 7-16 to discuss recent experimental results on TMX-Upgrade. The soviet delegation included G. I. Dimov, V. G. Dudnikov, O. G. Filatov, D. A. Panov, V. P. Pastukhov, and D. D. Ryutov.

#### TFTR: READY, SET, ....

The Tokamak Fusion Test Reactor is undergoing final assembly and checkout at Princeton. First plasma may be achieved before you receive your next newsletter. A four year, progressively more ambitious test program is planned, leading to an energy breakeven demonstration in 1986.

#### PEOPLE

Edwin E. Kintner, former director of the magnetic fusion program at DOE, has joined Titan Systems, Inc. as Assistant Vice President for Advanced Technology. He is currently on an assignment at DOE as chairman of a task force to assess laser technologies for plutonium isotope separation. He can be reached at (301) 353-5498.

Barry Ressler, president of Universal Voltronics Corp. has announced the appointment of Jack W. Beal to be Vice President and Technical Director of the company. Jack is well-known to the fusion community from his work at Lawrence Livermore National Laboratory, DOE, and General Atomic Company. He has been with UVC for the past several years.

#### LIVERMORE MAGNET TEAM GETS ANS AWARD

The MFTF-B superconducting magnet team, led by Richard A. Balmer, Carl D. Henning and Theodore A. Korman was named to received the American Nuclear Society Fusion Energy Division's 1982 Outstanding Technical Accomplishment Award. The team built and successfully tested the world's largest superconducting magnet as part of the MFTF-B construction project.

#### GA: WHAT'S IN A NAME?

General Atomic Company, previously the property of a Gulf-Royal Dutch Shell partnership is now a wholly-owned subsidiary of Gulf Oil Corp. As part of the transition, GA will henceforth be known as GA Technologies, Inc. No personnel changes are expected. Tihiro Ohkawa remains vice president, heading up the fusion activities, reporting to Harold Agnew, GA's president.

#### RF HEATING MEETING PLANNED

The Fifth Topical Conference on Radio Frequency Plasma Heating will take place February 21-23, 1983, at the University of Wisconsin, Madison, WI. For information contact J. L. Shohet (808) 262-1191. Registration fee is \$50.

#### NEUTRONLESS FUSION

Though fusion systems pose much less of a radioactivity problem than today's fission plants, fusion scientists occasionally hold out hope for developing a fusion system with no radioactivity. Radioactivity in fusion systems comes from the use of deuterium and tritium and the resultant neutrons generated when the fusion reaction occurs. The neutron and radioactivity can, in principle, be eliminated by using other fuels, such as protons and boron. Unfortunately such reactions require large energy investment and have relatively low fusion energy yield. An article in the November/December 1982 MIT Technology Review describes recent progress at Aneutronics, Inc. (previously known as Fusion Energy Corp.) using an approach pioneered by Dr. Bogdan Maglich. Significant progress is reported.