FUSION POWER ASSOCIATES
EXECUTIVE NEWSLETTER

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PRESIDENT ESTABLISHES ENERGY POLICY GROUP

ENERGY POLICY GROUP

In one of his first acts in office, President George W. Bush set up a cabinet-level Energy Policy Development Group, based in the White House and chaired by Vice President Dick Cheney. Other members of the group include Energy Secretary Spencer Abraham, Treasury Secretary Paul O'Neill, Commerce Secretary Don Evans, Transportation Secretary Norman Mineta, Interior Secretary Gale Norton and Environmental Protection Agency Administrator Christine Todd Whitman. Andrew Lundquist, who headed up the Bush transition team for the Department of Energy has joined the White House staff as executive director for the activity. Lundquist was previously staff director for the Senate Energy Committee, chaired by Senator Frank Murkowski (R-AK). Murkowski announced that Brian Malnak will replace Lundquist as staff director for the Committee. Malnak was previously deputy staff director.

Although Bush asked the group to provide him with a new national energy policy by October, it is generally believed that the group will act more quickly. Also in the group are the director of the Federal Emergency Management Agency, and the assistants to the president for policy, economic policy, and intergovernmental affairs.

In a memo to the group, Bush said, "One of the greatest challenges facing the private sector and Federal, State, and local governments is ensuring that energy resources are available to meet the needs of our citizens and our economy. To help address this challenge, I am asking the Vice President to lead the development of a national energy policy designed to help the private sector, and government at all levels, promote dependable, affordable, and environmentally sound production and distribution of energy for the future." Cheney may also invite Federal Energy Regulatory Commission Chairman Curt Hebert Jr., Secretary of State Colin Powell and other Federal officials to participate in the group on issues involving their agencies, the memo says.

Bush asked the group to give him two reports, including a "near-term" assessment of "the difficulties experienced by the private sector and state and local governments in ensuring that local and regional energy needs are met." The president said he expects a report "as soon thereafter as practicable."

Bush said he wants the national policy to address growing demand for energy in the United States and the world, the potential for disruptions in energy supplies and distribution, the need for responsible policies to protect the environment and promote conservation, and the need for modernization of energy generation, supply and transmission infrastructures.

FESAC RESPONDS TO DOE QUESTIONS

The U.S. DOE Fusion Energy Sciences Advisory Committee (FESAC)has responded to several questions posed to it in a letter received from then DOE Office of Science Director Mildred Dresselhaus. In her letter of November 13, 2000, Dresselhaus asks (1) "Are the priorities and thrust areas called out in the September 1999 Priorities and Balance Report (//wwwofe.er.doe/more_html/FESAC/Reaction.pdf) still valid for this program?" (2) "Does the Integrated Program Planning Activity report (//vlt.ucsd.edu) provide a guide for how to achieve the five-year vision?" (3) "Are the findings and recommendations of the draft NRC report (//fire.pppl.gov) consistent with the priorities of the program as seen by FESAC?"

In a December 5 letter to Dresselhaus, FESAC chairman Richard Hazeltine (University of Texas at Austin) responded: "I will organize our response by paraphrasing the letter.

"1. Updating program priorities.
Are the priorities and thrust areas called out in the September 1999 Priorities and Balance report still valid? Are the strategic vision and five-year goals still valid?

"We find that the priorities and thrust areas of the Priorities and Balance report are still valid and that its strategic vision regarding the next 5 years is still appropriate for the program. The September 1999 FESAC document on Priorities and Balance (PB) has been well received by the fusion energy science community and by the Congress. This study was the result of an extensive multifaceted assessment, involving a large

fraction of the community, through the Snowmass meeting and other venues. We find that the priorities and thrust areas of the PB report are still valid, and that the strategic vision regarding the next 5 years is still appropriate for the program. However, because budgets allocated by the Congress have fallen below the $300 million funding level on which FESAC based its 5-year goals, progress will be slower than anticipated. As pointed out in the PB report, lower funding levels will delay the planned assessment of confinement concepts in Magnetic Fusion Energy (MFE) due to reduced operating time on the major tokamak facilities and slower pace in development of exploratory concepts. Completion of the goals leading to a decision on major new facilities, such as an Integrated Research Experiment for Inertial Fusion Energy (IFE), are also likely to be delayed.

"The charge that led to the PB report was focused primarily on the energy aspects of the program, within the context of a balance between MFE and IFE. Nevertheless, the FESAC response to the charge involved much discussion of the science priorities. The NRC report on the quality of science in the OFES program, discussed in more detail below, reinforces and complements the PB report. Its recommendations will be very valuable in strengthening the program, especially in outreach to the broader scientific community. The continued commitment of the DOE Defense Programs to ignition on the National Ignition Facility (NIF) is a central element of the IFE strategy. FESAC has recommended that the IFE goals be re-examined when the effects of the Defense Programs rebaselining of NIF are better understood.

"Does the Integrated Program Planning Activity (IPPA) report provide a guide for achieving the five-year vision?

"The Integrated Program Planning Activity (IPPA) presents a framework and process to guide the achievement of the 5-year goals listed in the FESAC PB documen — an achievement now slowed by budget limitations. In some cases, such as IFE, the IPPA identifies a detailed set of objectives and priorities in support of the 5-year objectives. In other cases the IPPA specifies a process to obtain the data needed for such detailed planning. Certain features of the IPPA remain subject to revision by OFES; indeed the intent is to update the plan on a regular basis. The IPPA will be applied for the first time to the OFES program for FY02 activities. An assessment of the utility of the IPPA will be made following this initial application.

"2. NRC Assessment of Fusion Science.
"What is the FESAC reaction to the draft NRC report? Are the NRC findings consistent with the priorities of the program as seen by FESAC?

"It is clear that the NRC conducted a thoughtful and penetrating study of the MFE scientific research program. We find the recommendations given in the NRC assessment to be compatible with FESAC's sense of the program priorities. The FESAC heard a presentation from Dr. Robert Rosner regarding the assessment of fusion science conducted by the Fusion Science Assessment Committee of the NRC. We consider the NRC study to be of particular importance, and intend to respond to it in detail when the final version is available and we have had time to study it. The present comments regarding the report, based on Dr. Rosner's remarks and the draft copy that was shown to FESAC, should be regarded as a preliminary response.

"It is clear that the NRC conducted a thoughtful and penetrating study of the MFE scientific research program. Its principal finding, that the quality of science funded by the United States fusion research program in pursuit of a practical fusion power source (the fusion energy goal) is easily on a par with other leading areas of contemporary physical science is noteworthy, and its reinforcement of the fusion community's recent emphasis on the scientific foundations of fusion is welcomed.

"We find the recommendations given in the assessment to be compatible with FESAC's sense of the program priorities. We recognize in particular the importance of improving the ties between fusion science and other scientific research areas. The task of implementing the recommendations, such as the establishment of new Centers, will be a theme of future FESAC discussions. We also expect the recommendations to influence two recently established FESAC sub-panels, one studying burning plasma physics and the other reviewing the fusion science theory program.

"In short the FESAC considers the assessment to be of a quality that deserves serious attention and respect. We are grateful to the NRC for its careful effort and we plan to respond positively to its recommendations.

"3. Comparing the U.S. fusion program to programs abroad. Given the contraction of the program, are we still among the world leaders in fusion science?

"Despite the different emphasis of its program and its smaller budget, the U.S. remains among the leaders in certain key areas of fusion energy science. The U.S. fusion program is one of a number of fusion programs around the world; our budgetary contribution is roughly 16% of the total international investment. Consequently the U.S. does not aim to be the undisputed leader in all technical areas. Rather, it strives to be among the leaders in selective areas, while working in a mutually supportive manner with other world programs.

"It should be noted that the emphases of the various international programs differ. The U.S. carries out a science program supporting the energy objective, while the European, Japanese and Russian programs, although scientifically strong, focus more directly on the energy mission. The European andthe Japanese programs operate the two largest tokamaks in the

world, with possible upgrades under discussion. Japan has recently brought into operation the world's largest stellarator, and a stellarator of comparable size is under construction in Germany. In contrast, the U.S. has not invested in new major facilities on this scale in roughly two decades; indeed, budget constraints have even prevented significant upgrades of existing facilities. Meanwhile the Europeans, Japanese and Russians are completing the design of an integrated burning plasma experiment and have begun to explore the possibility of its construction.

"Despite the different emphasis of its program and its smaller budget, the U.S. remains among the leaders in certain key areas of fusion energy science. In MFE, the focus on science and innovation has allowed the U.S. to play a leading role in theory and computing, and in exploiting the synergies between experiments and theory. The U.S. is among the leaders in MFE experimental research, with strong scientific emphasis on such topics as macroscopic stability, transport and advanced tokamak physics. The U.S. supports an exceptionally broad program in innovative confinement research, although the largest non-tokamak devices are found in other countries. The U.S. is also a leader in materials research, advanced design studies, safety research and innovative fusion technologies.

"Because of the large DOE Defense Programs (DP) investment, the U.S. has clear international leadership in the science of Inertial Confinement Fusion. .This DP investment has given the U.S. the opportunity to explore the possibility of the inertial confinement approach to fusion energy for a relatively modest increase in investment in fusion energy science. Integration of IFE into the U.S. Fusion Energy Science Program was a major result of the FESAC Priorities and Balance recommendations. Increased co-ordination of the Inertial Confinement Fusion program conducted by DP and the IFE research conducted by OFES, as recommended by SEAB, is desirable.

"The U.S. position in international fusion science can be attributed to previous investment in advanced computing, innovative diagnostics, and enabling technologies, such as plasma control. In addition, an effective international collaboration infrastructure has allowed U.S. scientists and engineers to keep up with developments abroad, and to work closely with our international partners through coordinated experiments on multiple facilities. The U.S. participation in joint, leading-edge activities with other nations is evidence of the strength of the U.S. program, since the collaborations must be deemed mutually beneficial.

"Nonetheless, the U.S. position in MFE is being eroded. Fusion programs abroad, even if focused on energy, have strong science components whose quality and value compete with those of the U.S. program. They also have facilities that enable science studies at scales inaccessible here. The European and Japanese programs are moving towards leadership in research involving long-pulse and high-auxiliary heating power, and they have much larger facilities for exploring innovative confinement strategies. In the critical area of long-pulse confinement, South Korea is now constructing a superconducting tokamak nearly identical to one proposed several years ago in the U.S. and deemed desirable but too expensive.

"Are we capable of responding quickly to breakthroughs in fusion research abroad?

"The U.S. may be losing its capability to rapidly respond to breakthroughs in fusion research abroad, because of contraction of the MFE program and limited participation in programs on the leading facilities worldwide. This is especially true if the response requires modification of existing facilities or development of new technologies.

"In experimental research, the U.S. program can respond to foreign breakthroughs only if it maintains a critical investment in the development of diagnostic and plasma control tools, aimed at critical-path and hitherto unexplored areas. An example is the study of electron energy transport, which requires the probing of turbulence with an order of magnitude smaller spatial scale. Increased use of existing facilities, coupled with upgraded diagnostic, heating and current-drive capabilities, will be required.

"In theory and computing, an opportunity exists for the program to make significant progress in fundamental understanding and predictive modeling capability of fusion energy confinement systems, through a strong partnership with the Advanced Computing Initiative of the Office of Science. Doing so will enable the U.S. to maintain a leadership position in some key areas and to continue its mutually beneficial collaborations with other world programs."

NRDC ATTACKS NIF PROCESS, AGAIN

The National Resources Defense Council (NRDC), in a continuation of its attempts to halt construction of the National Ignition Facility (NIF) by legal means (see October 1997 newsletter), has filed a lawsuit against the Department of Energy seeking to bar the use by the agency of last August's review (see Sep/Oct 2000 newsletter) certifying the new cost and schedule for the project. The NRDC is joined in the lawsuit by Tri-Valley Communities Against a Radioactive Environment, Livermore, CA, (Tri-Valley CARES) a group that has attempted for years to close down the laboratory. The lawsuit claims that DOE stacked the review panel with people favorable to NIF and who, in some cases, had financial conflicts of interest.

The groups asked the court to prohibit DOE from using the "Rebaseline Validation Review" that was completed in August. The groups said DOE acted inappropriately by using the reportto secure $199.1 million in FY-01 funding for the project, which has come under DOE and congressional scrutiny since

September 1999, when officials at the Lawrence Livermore National Laboratory, home of the NIF, said the project was over budget and behind schedule.

To develop a more reliable cost and time schedule for NIF, DOE established a review panel in August that was chaired by Nevada Operations Office Manager Kathleen Carlson and Daniel Lehman, director of the Construction Management Support Division in the Department's Office of Science. But NRDC and Tri-Valley CAREs claim many of the panel members had previously served as consultants to LLNL and therefore had a conflict-of-interest.

NRDC, in a previous lawsuit, succeeded in getting a court order preventing DOE from using the results of a National Academy study because the Academy failed to follow procedures for public access mandated by the Federal Advisory Committee Act (FACA). The two groups claim that DOE committed similar violations of FACA in carrying out the August review. DOE had no immediate comment on the lawsuit, but knowledgeable sources said that it was unlikely to result in slowdown or cancellation of NIF construction.

FUSION RESEARCHER BECOMES IEEE-USA PRESIDENT

Fusion researcher Dr. Ned Sauthoff of the Princeton Plasma Physics Laboratory (PPPL) became president of The Institute of Electrical and Electronics Engineers - United States of America (IEEE-USA) on January 1, 2001. He served the past year as president-elect of the organization. IEEE-USA has more than 230,000 members.

As president, Dr. Sauthoff is the highest-ranking volunteer member of IEEE-USA and will chair its board of directors. He will also serve at the international level on the IEEE executive committee and board of directors. Dr. Sauthoff said he plans to work with IEEE-USA volunteers and staff to realize the great potential for electrotechnology and information technology to improve the quality of life. "We will address that mission both by building careers and by shaping public policy," he said. "IEEE, as the leading technological professional society in the world, has a responsibility to serve by providing both authoritative perspectives to decision makers and professional development tools to our members.

"In 2001, we will provide improved tools to a greater number of our members and will enhance our public-policy grassroots outreach by engaging our geographically dispersed membership in all U.S Congressional districts," Sauthoff said.

Dr. Sauthoff, a physicist, heads the Off-site Research Department of PPPL He began his career there after he earned a Ph.D. in astrophysics from Princeton University in 1975. He has headed numerous departments at PPPL, including the Physics Department from 1992-94, and the Plasma Science and Technology Department from 1994-97.

TWO HISTORIC DOCUMENTS PUBLISHED

Two previously unpublished U.S. government reports, of historic significance to the rapid acceleration of the U.S. fusion program in the 1970s, have been published in the Journal of Fusion Energy (Kluwer Academic/Plenum), Vol. 17, No. 4.

"Status and Objectives of Tokamak Systems for Fusion Research," (U.S. Atomic Energy Commission Report, WASH-1295, 1974) by S. O. Dean, J. D. Callen, H. P. Furth, J. F. Clarke, T. Ohkawa and P. H. Rutherford, describes the scientific basis for a series of large tokamak facilities built in the U.S. during the 1970s and provides scientific objectives for the U.S tokamak program in the areas of configurational stability, plasma transport and scaling, heating, and boundary effects. The report, which contains 218 references to published papers in peer-reviewed scientific journals, illustrates the importance attached to developing "an understanding of plasma transport." The report states that while a "phenomenological approach" is a "reasonable strategy, it would be clearly more desirable to be guided by physical understanding of the tokamak transport." The report states, "Only if the physics is known can one be certain about extrapolating over large factors; if the physics is known, one may be able to take effective measures to optimize confinement. In this sense, the mechanics of the transport in present-day and future tokamak plasmas would provide the most helpful benchmark of all for the tokamak research program."

"Fusion Power by Magnetic Confinement Program Plan," (U.S. Energy Research and Development Administration Report, ERDA-76/110, 1976) is the summary volume of a five-volume, long-range plan for fusion development in the U.S., prepared by a national team of U.S. fusion researchers and managers. It treats, in detail, the technical, schedular and budgetary projections for the development of a commercial fusion demonstration power plant based on magnetic confinement. Several alternative technical paths to the mainline tokamak path are maintained and 5 different paces, called Logics, are described that would result in operation of demonstration plants within 15 to 30 years, depending on funding levels provided. The plan illustrates the necessity of both major "stepping stone" experimental power-producing facilities, as well as supporting facilities. In addition to describing the facilities and budgets needed, the plan provides for a strong program in plasma physics throughout the development, that "seeks the body of knowledge that predicts the behavior of fusion plasma confinement experiments and the operating characteristics of fusion power plants." The report describes the importance of using both "roll-forward" and "roll-back" planning in managing the fusion program. History shows that neither the funding levels required nor the "stepping stone" facilities needed to meet those potential schedules were subsequently provided.

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LOGAN NAMED HEAVY ION VNL DIRECTOR
DAHLBURG LEADS INERTIAL FUSION AT GA
FPA ANNUAL MEETING SET FOR SEP 25-26 IN DC

LOGAN HEADS HIF VNL

On March 9, Dr. B. Grant Logan, Lawrence Livermore National Laboratory (LLNL), was named director of the Heavy Ion Fusion Virtual National Laboratory (VNL), succeeding Roger O. Bangerter, who has retired. Bangerter will continue to engage in research part time at the Lawrence Berkeley National Laboratory (LBNL). Logan will be located at LBNL.

The Heavy Ion Fusion VNL is a collaborative venture of LBNL, LLNL and the Princeton Plasma Physics Laboratory. The purpose of the VNL is to advance heavy ion fusion research through synergistic coordination and management of staff and experimental facilities across the three lab groups. The collaboration includes "the conduct of heavy ion driver development and related topics in the common pursuit of inertial fusion energy (IFE), and to promote more rapid progress in the development of heavy ion drivers through technical management integration of the Laboratories' scientific staff, equipment, and experimental facilities." The collaboration does not directly cover research on IFE target design, power plant chamber development, materials and target fabrication/injection R&D, which will "be carried out in a separate inertial fusion technology program for both laser and ion approaches to IFE." The VNL has an oversight board appointed by the respective laboratory directors and a program advisory committee, reporting to the oversight board.

Grant has worked in all parts of the US fusion program. He worked on both magnetic mirrors and tokamaks in the magnetic fusion energy (MFE) program at LLNL from 1975 until 1992. He received the US Department of Energy's prestigious E. O. Lawrence Award in 1980 for his co-invention of the tandem mirror. He joined the Laser Directorate at LLNL in 1992, working in support of the laser National Ignition Facility (NIF) and on both heavy-ion and laser IFE. He was a recipient of the 1999 Fusion Power Associates Leadership Award for his outstanding leadership contributions to both magnetic and inertial fusion energy research.

B. Grant Logan ***Jill Dahlburg***

Grant can be reached at LBNL MS-47-112 ,1 Cyclotron Rd, Berkeley CA 94720. Phone: (510) 486-7206; email: bglogan@lbl.gov

DAHLBURG JOINS GENERAL ATOMICS

Dr. Jill Dahlburg, formerly of the U. S. Naval Research Laboratory (NRL), has joined the General Atomics Fusion Group. Her responsibilities at General Atomics will be divided between Director of GA's Division of Inertial Fusion Technology and Co-Director with Dr. Vincent Chan of GA's Center for Fusion Theory and Computations. In the former position, she will work with senior management and the technical team to further realize the vision of a Center of Excellence in target fabrication science and technology, as well as develop the fast-ignition fusion approach with GA's national and international colleagues. As Co-Directors of the T/C Center, Jill and Vince will work to expand and strengthen GA's capability in this important area, enabling GA to pursue new computational opportunities and to develop the tools supporting its work in fast ignition and other photonics topics.

During her 15-year career at NRL, Jill made significant contributions to plasma physics and inertial confinement

fusion (ICF). She spearheaded the development of RAD3D, the first three-dimensional multi-group radiation transport hydro-code appropriate for laser-plasma modeling. RAD3D has remained a premier simulation code in that field for more than a decade. Using this and other laser matter interaction simulation tools, Jill worked on and contributed to the understanding of the Raleigh Taylor instability, implosion and coronal hydrodynamics, and laser beam imprinting. Her collaborations have included scientists in both the national and international ICF communities.

Because of her work and reputation in the field, Jill has served on numerous review and other committees for the Department of Energy, the National Academy of Sciences/ National Research Council, the National Science Foundation, and the American Physical Society. Her awards include the NRL Alan Berman Research Publication Awards in 1991, 1994, 1996 and 2000; and being named APS Centennial Speaker for 1998-99 and APS/DPP Distinguished Lecturer for 1999-00. Most recently, Jill has been Head of the Distributed Sensor Technology Office for the Tactical Electronic Warfare Division at NRL.

SCHULTZ GETS NEW POST AT GA

Dr. Ken Schultz will have a new assignment as Director for Operations, Lasers and Inertial Fusion(L&IF) at General Atomics. Ken has led GA's participation in the national ICF Program for the past 12 years. In his new position, he will be part of the L&IF senior management team, including Mike Campbell, Mike Perry (who will continue as Director of the GA Photonics Division) and Jill Dahlburg, that will manage and oversee this important and growing effort.

FUSION AND ENERGY POLICY

A statement on "Fusion and Energy Policy, signed by almost 200 individuals from both within and outside the fusion community, has been sent to the members of the White House Energy Policy Group, including its chair VP Dick Cheney and Energy Secretary Spencer Abraham (Jan/Feb Executive Newsletter). The statement urges the group "In addition to acting to ameliorate the immediate problems, we urge you to address the nation's long-term energy needs through creation and funding of a focused R&D effort to expand our future commercial energy options." The statement says, "We advocate an expanded, sustained energy R&D effort to provide the United States and the world with the energy it will need for the 21st century. The focus of this effort should be to provide new economic and environmentally acceptable energy technologies as soon as practical. The options that present themselves for mid-term application include advanced technologies for improving energy end-use efficiency, cleaner burning of fossil fuels, improvements in nuclear fission technologies, and less costly and more efficient renewable energy options. For the long-term we urge an accelerated effort to develop fusion energy.

The statement says, "We urge the U.S. to strengthen greatly its research into the fundamental science and advanced technology of fusion energy and to prepare a strategic plan for the realization of practical fusion energy as an important element in a long-term, environmentally responsible energy development strategy."

The complete statement and list of signatories is available from Fusion Power Associates or on-line at //fusionpower.org/ click on Fusion Program Notes, click on FPN01-11.

In a March 26 response letter, Secretary of Energy Spencer Abraham told Fusion Power Associates "As I noted at my confirmation hearing in January, I am deeply committed to developing an energy policy that includes increasing domestic production of energy in an environmentally responsible manner, increasing our use of renewable energy, decreasing our reliance on imported oil, and developing new technologies that will reduce energy-related pollution. I also noted the importance to the Nation of the Department's support to science and technology. The Office of Fusion Energy Sciences' work to provide the knowledge needed for an economically and environmentally attractive source of energy and to advance our understanding of plasma science and fusion science is an important part of our efforts in science and technology.

"I appreciate your views on the important role fusion energy can play in the long-term energy mix of the Nation and your organization's support of the Department's Fusion Energy Science Program."

Responding for Treasury Secretary Paul O'Neill, also a member of the Energy Policy Group, John C. Hambor, Director, Office of Microeconomic Analysis, told FPA "I agree that energy supply is a long-term issue and that R&D is key to the long-term health of the industry, and I am familiar with the promise of fusion power. We will keep this in mind in our coming efforts to craft an effective forward-looking energy policy."

CULHAM OPENS INNOVATION CENTRE

On February 12, the UKAEA Culham Science Centre, Abingdon, Oxfordshire, UK, officially opened the Culham Innovation Centre. The principal aim of the Centre is to provide small high technology start-up companies access to the skills and engineering technologies developed at the Culham Laboratory over many years of fusion research. Dr. Cleve Forty (cleve.forty@ukaea.org.uk), Manager, Fusion and Industry Programme, says that, depending on their needs, the companies could receive consultancy or "access to mechanical, electrical and electronic engineering skills, as well as computer modeling, plasma technology and diagnostics, cryogenic systems and microwave systems, for example. They are entering a community where three key ingredients needed to turn a bright idea into a commercially sound business are in plentiful supply: a determination to succeed, a commitment to innovate and most important a culture where problem solving is second nature." Forty says participation in the Centre is open to companies in the UK and throughout Western Europe.

The Centre will be managed by Oxford Innovation, Ltd, a company that is currently managing several other innovation centres in the UK. David Kingman, managing director of

Oxford Innovation said, "Another benefit of the site, of course, is its links with UK and European industry and the international fusion research community. New technology-based businesses usually have international partnerships and world-wide markets to address. Being located on a site with an international reputation can help significantly."

CARD NAMED DOE UNDER SECRETARY

President Bush has nominated Robert Gordon Card, 48, to be Under Secretary of Energy. In that position, he will have line management responsibility over the U. S. fusion program. He has been President and CEO of Kaiser-Hill Company in Colorado, and was previously Executive Vice President of CH2M Hill, Inc. A native of Yakima, Washington, he is a graduate of the University of Washington and received his Master's degree in Environmental and Civil Engineering from Stanford University.

Card was chief operating officer at Kaiser-Hill when DOE named it management contractor at its Rocky Flats Environmental Technology Site in 1995 and later became the company's president and chief executive. As Under Secretary, he will serve as the department's chief operating officer and oversee its environmental management and science programs. He succeeds MIT's Ernest Moniz, who held the position until the Clinton administration ended in January.

BURNING PLASMA WORKSHOP

The second University Fusion Association Burning Plasma Science Workshop, BPS Workshop II, will be held 1-3 May 2001 at General Atomics in San Diego.

The first UFA BPS Workshop, held at the University of Texas in Austin, 11-13 December 2000, focused on burning plasma science issues and the physics of burning plasmas. BPS Workshop II will focus on burning plasma technology and specific burning plasma experiment concepts. The Purpose, Scope and Format for Workshop II are summarized below. Details can be found at http://lithos.gat.com/bps2

The purpose of the workshops is to identify possible experimental approaches that would permit exploration of the science of burning plasmas to begin near the end of this decade. Burning Plasma Science Workshop II will explore various experimental opportunities for pursing the science of burning plasmas and, for each approach, its capability to explore the scientific issues of burning plasmas identified in the first Burning Plasma Workshop. The Workshop will also seek to identify technological opportunities which could measurably improve the performance, reliability or operational flexibility of burning plasma experiments.

For Workshop II, a boundary condition is imposed limiting approaches to those that could be put into operation within about 10 years. If sufficient interest warrants, a future Workshop could look beyond the 10-year time frame and/or at "low-cost/high-risk" concepts.

Details of what will be covered and the Workshop agenda are being developed by the Organizing Committee: Ronald Parker, MIT (Chair), Mohamed Abdou, UCLA, Farrokh Najmabadi, UCSD, Gerald Navratil, Columbia University, Raffi Nazikian, Princeton University, John Perkins, LLNL, David Ruzic, University of Illinois, and John Wesley, General Atomics.

NIF LASER GLASS ON SCHEDULE

A major technological milestone in optical glass melting for the National Ignition Facility (NIF) has been achieved by Hoya Corporation USA, at their laser glass manufacturing plant in Fremont, CA. Using a novel continuous glass melting system approximately 150 feet long and two stories high, Hoya is producing 20 tons of high quality laser glass per month. To date, Hoya has produced about a thousand neodymium-doped laser glass slabs for the NIF and several hundred for the French Laser Megajoule (LMJ) project. Hoya is scheduled to produce 4000 of the 8000 slabs needed for NIF and LMJ. Schott Glass Technologies is producing the other 4000 slabs. Between Hoya and Schott, approximately 1500 slabs will be produced annually.

NIF project manager Ed Moses said, "Hoya's work in this area is outstanding. Along with the glass slabs produced by Schott Glass Technologies, roughly half of the total glass slabs need for NIF have been produced."

The glass produced by Hoya's continuous melting system has successfully achieved all of the stringent glass specifications required for NIF and LMJ. In particular, the glass contains essentially no microscopic platinum particles that could produce laser-induced damage within the glass at NIF and LMJ's high operating fluence. The optical homogeneity surpasses the transmitted wavefront specification by about a factor of two."

"We appreciate the opportunity to work with LLNL and the French Government on these very important projects," said Gerald Bottero, president and chief executive officer of Hoya Corporation USA. "We've worked with this special glass since 1973 and we commend our employees for their dedication and commitment to perfecting this technology."

Further information can be found at http://www.llnl.gov/nif

EC ADOPTS ENERGY PAPER

The European Commission(EC) recently adopted a Green Paper "Towards a European Strategy for the Security of Energy Supply," in order to launch a debate on the security of the European energy supply. This is a comprehensive 118 page report on energy supplies and future energy strategies that could simultaneously reduce energy dependency and CO2 emissions for Europe.

In section II (page 86) on Tomorrow's Priorities on Nuclear Energy, the report recommends "Supporting research into reactors of the future, notably nuclear fusion, and continuing and stepping up research into irradiated fuel management and waste storage." The report can be downloaded at http://fire.pppl.gov/EC_green_paper.pdf

A Green paper is an Official Document of the European Commission. Green Papers are communications published by the Commission on a specific policy area. Primarily they are documents addressed to interested parties, organisations and individuals, who are
invited to participate in a process of consultation and debate. In some cases they provide an impetus for subsequent legislation.

In a press release (http://fire.pppl.gov/EC_PR_green_paper.pdf) accompanying the adoption of the report, the EC quotes Loyola de Palacio, vice-president in charge of Energy and Transport, as saying "Confronted with both increasing external dependence and the urgency of the fight against climate change, the European Union cannot be complacent. We have to be aware of the efforts needed and try and define a real European strategy, more coherent and responsible: it means a wider energy supply and a genuine policy of rationalisation of energy consumption, particularly in the building and transport sectors." The press release lists 13 points under the heading "Orientation of the Debate." Point 8 states, "Seeing that nuclear energy is one of the elements in the debate on tackling climate change and energy autonomy, how can the Community find a solution to the problem of nuclear waste, reinforcing nuclear safety and developing research into reactors of the future, in particular fusion technology?"

The press release states, "The European Union produces only half of its needs. If nothing is done, between now and 20 to 30 years, the Union will meet its energy needs with 70% by the products imported against 50% currently." It notes that "Current energy consumption is covered 41% by oil, 22% by natural gas, 16% by solid fuels (coal, lignite, peat), 15% by nuclear power and 6% by renewable." The release comments that nuclear power provides 35% of electricity consumption.

ITER PROCESS MOVES AHEAD IN JAPAN

The Special Committee on ITER in Japan completed its draft report on March 30. Its release for a period of public comment was approved on April 3 by the Japanese Atomic Energy Commission (JAEC). The Special Committee will meet again in early May to consider public comment received and to submit the report for final JAEC approval shortly thereafter. The report will then go to the Council for Science and Technology, chaired by the Prime Minister. In parallel the Government of Japan will proceed with the site selection process.

The draft report concludes that "hosting the ITER in our country is of great significance, as well as taking a main role in the ITER project." The report says, "If our country takes the initiative to construct the ITER, the only facility in the world, it will be possible to maintain for a long period a highest level of scientific and technological potential and industrial technologies in the relevant fields." It says, "From a viewpoint of investment, the activities regarding the national security, in a broad sense, for the whole nation and those regarding an international function executed in a national scale should be considered to have higher priority in allocating the financial resources among the research programs. The ITER project is categorized in such a domain. At present, it is difficult to accurately estimate the overall cost for the realization of fusion energy. Moreover, it is almost impossible to estimate the profit from the realization of fusion energy. It can be understood that the investment in developing fusion energy is regarded as a sort of insurance premium for securing wider degree of freedom of humankind in the future."

The report says, "In this Committee, knowledgeable people from various communities have made discussions and thorough review from wider viewpoints. Through the discussions, a number of issues have been pointed out, which need due consideration in promoting the ITER project. Among them, it is essential to minimize the project cost, by keeping a balance among the technical objectives, the risk in development and the cost. Furthermore, it is the most important to incorporate in the project the possibility to maximize the significance and benefits independent of the project results."

The report says, "The Committee calls for steady efforts and implementation by the Government Administration of our country in:

- acquiring public understanding on the ITER project by providing sufficient and correct information including safety;
- fostering human resources who can take a leading role in promoting the project;
- preparing safety regulation on the ITER project.

"The Committee considers that, in order to make a final decision by the Government, it is necessary to further assess candidate sites in terms of compliance to the ITER site requirements and how to secure financial resources."

For further information, contact H. Takatsu (takatsu@naka.jaeri.go.jp).

ANNUAL MEETING

Fusion Power Associates Annual Meeting and Symposium will take place September 25-26, 2001 at the Canadian Embassy in Washington, DC. The theme of this year's symposium will be "Frontiers in Fusion Research." Details of the program and logistics are in process and will be made available at a later date.

PEOPLE

Marshall N. Rosenbluth, UCSD, is the recipient of the American Physical Society's Nicholson Medal for Humanitarian Assistance, citing his "inspirational leadership and personal caring in the development of skills and commitment of the succeeding generation of scientific leaders in plasma physics..."

Dieter Sigmar, MIT, is the recipient of a USDOE Distinguished Associate Award for his many contributions to fusion research in general and fusion theory in particular.

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BUSH ENERGY POLICY URGES FUSION
83 MEMBERS OF CONGRESS SIGN FUSION LETTER

BUSH ENERGY POLICY

President Bush issued his anticipated National Energy Policy May 17. The report was prepared by a National Energy Policy Development (NEPD) Group chaired by Vice President Dick Cheney. The report focuses primarily on near- and mid- term energy sources, conservation and efficiency. However, the report also addresses fusion, saying "The NEPD Group recommends that the President direct the Secretary of Energy to develop next generation technology -- including hydrogen and fusion." The Group also recommended that the Secretary of Energy be directed to "develop an education campaign that communicates the benefits of alternative forms of energy, including hydrogen and fusion." The full statement on fusion contained in the main text is:

"Fusion — the energy source of the sun — has the long-range potential to serve as an abundant and clean source of energy. The basic fuels, deuterium (a heavy form of hydrogen) and lithium, are abundantly available to all nations for thousands of years. There are no emissions from fusion, and the radioactive wastes from fusion are short-lived, only requiring burial and oversight for about 100 years. In addition, there is no risk of a melt-down accident because only a small amount of fuel is present in the system at any time. Finally, there is little risk of nuclear proliferation because special nuclear materials, such as uranium and plutonium, are not required for fusion energy. Fusion systems could power an energy supply chain based on hydrogen and fuel cells, as well as provide electricity directly.

"Although still in its early stages of development, fusion research has made some advances. In the early 1970s, fusion research achieved the milestone of producing 1/10 watt of fusion power, for 1/100 of a second. Today the energy produced from fusion is 10 billion times greater, and has been demonstrated in the laboratory at powers over 10 million watts in the range of a second.

"Internationally, an effort is underway in Europe, Japan and Russia to develop plans for constructing a large-scale fusion science and engineering test facility. This test facility may someday be capable of steady operation with fusion power in the range of hundreds of megawatts.

"Both hydrogen and fusion must make significant progress before they can become viable sources of energy. However, the technological advances experienced over the last decade and the advances yet to come will hopefully transform the energy sources of the distant future."

The full report can be accessed at:
http://www.whitehouse.gov and click on "News."

83 MEMBERS OF CONGRESS URGE FUSION

Eighty-three members of the U.S. House of Representatives signed a letter sent to Rep. Sonny Callahan, Chairman of the House Appropriations Subcommittee on Energy and Water Development, endorsing the fusion program and its budget. Representatives Randy "Duke" Cunningham (R-CA) and Rush Holt (D-NJ) led the effort to secure 81 additional signatures from their colleagues in the House. The text of the letter is as follows:

"Dear Chairman Callahan:

"We are writing to highlight the importance of the U.S. Fusion Energy Sciences program and to request that you increase the funding available for this research.

"For many years, researchers in the U.S. and around the world have been attempting to conquer what many scientists have identified as one of the most difficult and important scientific and technological challenges ever undertaken: creating practical fusion energy here on earth. Meeting this challenge involves re-creating the conditions of the sun and stars here on earth as the basis for a safe, environmentally benign and virtually unlimited energy source.

"In the past six years, the U.S. fusion energy sciences program has received high level reviews from the President's Committee of Advisors on Science and Technology (PCAST), the Secretary's Energy Advisory Board (SEAB),

the National Research Council (NRC), and the Fusion Energy Sciences Advisory Committee (FESAC). Each of these reviews has been clear as to the scientific progress and merits of fusion research.

> "– The July, 1995 PCAST Study entitled "The U.S. Program of Fusion Energy Research and Development" concluded: "Funding for fusion energy R&D by the Federal government is an important investment in the development of an attractive and possibly essential new energy source for this country and the world in the middle of the next century and beyond".
>
> "– The August, 1999 report of the Secretary's Energy Advisory Board entitled "Realizing the Promise of Fusion Energy" concludes: "The threshold scientific question - - namely, whether a fusion system producing net energy gain to be attractive as a commercial power source can be sustained and controlled - - can and will be solved.
>
> "– The October, 2000 report of the National Academy of Sciences entitled "An Assessment of the Department of Energy's Office of Fusion Energy Sciences Program" concludes that "the quality of the science funded by the United States fusion research program in pursuit of a practical source of power from fusion (the fusion energy goal) is easily on a par with the quality in other leading areas of contemporary physical science."

"In addition to these endorsements of the scientific value, progress and promise of fusion research, PCAST, SEAB and FESAC have thoroughly examined the issue of funding for the fusion program and have concluded that at existing budgetary levels, the program is substantially underfunded. Indeed, PCAST stated in its 1997 review of federal energy research programs that funding for fusion research should be on the order of $320 million in Fiscal Year 2002 — this compares to the approximately $250 million available for the Office of Fusion Energy Sciences available in this fiscal year. These studies have made it clear that existing fusion research facilities at universities and laboratories are severely underutilized due to budgetary constraints, that more dollars must be expended for theory and computation, for broadening the connections to other areas of science, for international collaborations and for enabling materials and technology work.

"Therefore, we ask that you increase funding for the fusion energy sciences program to at least $300 million in FY 2002. This level of funding will ensure that existing facilities are more fully utilized and that important investments are made in the intellectual and physical infrastructure underlying this critically important and timely area of science.

"In addition, we wish to thank the subcommittee for the support in FY2001 of $25 million for high average power laser research. in the Department of Energy's stockpile stewardship program This funding is vitally important for the development of the inertial fusion energy (IFE) path, has the potential to greatly enhance the nation's capability in high-energy laser technology and may have important implications for the stockpile stewardship program. For FY 2002 we ask the subcommittee to continue this support with an additional $5M (total of $30M) to enhance laser IFE related science and technology in such areas as target fabrication, advanced optics, and reactor chamber development. With this funding this new program should develop, over the next 5 years, the most essential technologies and underlying science needed for the design of laser IFE reactors.

"Thank you for your consideration in this important matter."

[A list of Signers of April 9th, 2001 letter to Chairman Callahan is available at http://fusionpower.org Click on Fusion Program Notes; click on FPN01-31.]

U.S.–EU SIGN FUSION AGREEMENT

Meeting in Brussels May 14, U.S. Secretary of Energy Spencer Abraham and European Commissioner for Research Philippe Busquin signed agreements to conduct joint research in the areas of fusion energy and non-nuclear energy.

Secretary Abrahams said, "This arrangement provides us with an opportunity to pursue alternatives to our mounting energy demands and help secure our needs for the future. With the signing of the new umbrella fusion agreement, we look forward to continuing our many years of successful collaboration in the field of fusion research. This agreement also provides the opportunity to pursue new initiatives."

A DOE press release accompanying the signing states "Areas of cooperation under the agreement may include tokamaks, alternatives to tokamaks, magnetic fusion energy technology, plasma theory and applied plasma physics."

Under the agreement, the U.S Department of Energy plans to contribute $1.3 million over two years to develop hardware for use at the Joint European Torus (JET) fusion device in the United Kingdom. Following the shutdown of the U.S. TFTR facility 3 years ago, JET is the only operating magnetic fusion facility with the capability of using fusion fuels deuterium and tritium and producing large amounts of fusion energy at near energy breakeven conditions. A next generation facility, ITER, capable of producing 5–10 times more fusion energy than used to heat the fuel, awaits site selection and construction decisions. The U.S. is not currently a party to that ambitious international project.

NATIONAL ACADEMY ENDORSES FUSION EFFORT

Four years after it was first requested by the U.S. Department of Energy to review the quality of its Fusion Energy Sciences program, the National Research Council, an arm of the National Academies, has issued its final report. After a one year delay while the Academy opened up and

revised its review process under court order, the DOE again requested the review in an April 17, 1998 letter from Office of Science Director Martha Krebs to Academy of Sciences President Bruce Alberts. An Interim Report was issued in September 1999.

In the final report just released, titled "An Assessment of the Department of Energy's Office of Fusion Energy Sciences Program," the report authors state, "Fusion research carried out in the United States under the sponsorship of the Office of Fusion Energy Sciences (OFES) has made remarkable strides over the years and recently passed several important milestones." They state, "The Committee concludes, therefore, that the quality of the science funded by the United States fusion research program in pursuit of a practical source of power from fusion (the fusion energy goal) is easily on a par with the quality in other leading areas of contemporary physical science." The committee report states, "A strong case can also be made that a program organized around critical science goals will also maximize progress toward a practical fusion power source," though nowhere in the report do they make that case. The 19-member "Fusion Science Assessment Committee" was chaired by Dr. Charles Kennel, Director of the Scripps Institution of Oceanography, San Diego.

The Committee addresses fusion issues under three topics: (1) Assessment of Quality: Scientific Progress and the Development of Predictive Capability, (2) Program Development: Plasma Confinement Configurations and (3) Institutional Considerations: Interactions of the Fusion Program With Allied Areas of Science and Technology.

Although the title of the report might lead one to believe that the entire OFES program was assessed, the preface of the document makes the following disclaimers: "The report focuses on the science of magnetically confined plasma and the programmatic strategy for long-term progress in this area, but it does not directly address inertially confined plasmas . . . . Also, this assessment does not directly address issues surrounding specific technology development and engineering research sponsored by the program . . . because the committee chose to focus on elements of the program related to basic plasma physics research."

The Committee makes seven primary recommendations:

1. Increasing our scientific understanding of fusion-relevant plasmas should become a central goal of the U.S. fusion energy program on a par with goal of developing fusion energy technology, and decision making should reflect these dual and related goals.

2. A systematic effort to reduce the scientific isolation of the fusion research community from the rest of the scientific community is urgently needed.

3. The fusion science program should be broadened in terms of both its institutional base and its reach into the wider scientific community; it should also be open to evolution in its content and structure as it strengthens its research portfolio.

4. Several new centers, selected through a competitive, peer-review process and devoted to exploring the frontiers of fusion science, are needed for both scientific and institutional reasons.

5. Solid support should be developed within the broad scientific community for U.S. investment in a fusion burning experiment.

6. The National Science Foundation should play a role in extending the reach of fusion science and in sponsoring general plasma science.

7. There should be continuing broad assessments of the outlook for fusion energy and periodic reviews of fusion energy science.

The Committee acknowledges that "Consonant with its charge, the committee has not taken up the many critical-path issues associated with basic technology development for fusion, nor has it looked at the engineering of fusion energy devices and power plants, yet it is the combined progress made in science and engineering that will determine the pace of advancement toward the energy goal."

The entire report has been posted at http://fire.pppl.gov

NIF FUNDS RELEASED

In the FY2001 Energy and Water Appropriations Act (FPN00-48), Congress appropriated $199.1 million to the continued construction of the National Ignition Facility (NIF) at the Lawrence Livermore National Laboratory, of which $130 million was made available immediately (October 27, 2000) and $69.1 million would be made available only upon a certification to the Congress after March 31, 2001 regarding six specific points. On April 6, 2001, the U.S. Department of Energy, National Nuclear Security Administration (NNSA) forwarded the required certification. Clarifying letters from NNSA were also sent April 13 and April 19 and subsequently, the additional $69.1 million was released to the NIF project. The complete set of letters and supporting documentation is available at:

http://www.dp.doe.gov/dp_web/news_f.htm

With respect to the six points at issue, the NNSA responded as follows:

1. "Completion of the full 192-beam NIF on the current cost and schedule baseline is an appropriate path forward and I (NNSA Administrator John A. Gordon) recommend that path. I strongly believe that deviations from the current baseline will increase risk to the project and would adversely impact the Stockpile Stewardship Program as a whole."

2. "Measured against the approved NIF baseline, the established project and technical milestones have been met on schedule and cost."

3. "Through the second quarter of Fiscal Year 2001, ongoing monthly reviews complemented by the March 2001 Defense Programs NIF Status Review have confirmed that the Project is performing within the baseline schedule and cost." (NNSA puts a footnote disclaimer that the review process did not follow the requirements of the Federal Advisory Committee Act,).

4. "A High-Energy-Density Physics (HEDP) Workshop was held to study the requirements for, and alternatives to, a 192-beam ignition facility. A Study was prepared with input from the Workshop. The Study concluded that completing the 192-beam NIF on the approved baseline meets the Stockpile Stewardship Program requirements for maintaining the safety and reliability of the current nuclear weapons stockpile."

5. "The Project has implemented and is using and earned-value management system as one of its management tools."

6. "The National Nuclear Security Administration's Future-Years Nuclear Security Program for FY 2002 through 2007 is currently undergoing review and will be submitted to Congress after completion of the President's strategic review of national security-related activities. Funding the National Ignition Facility is included in this proposed plan."

Administrator Gordon said, "I have come to the following conclusions.

"1. The NIF Project should continue along the approved 192-beam baseline at a Total Project and Related Cost of $3,448 million with Project completion at the end of Fiscal Year 2008.

"2. Defense Programs should continue with the current HEDP Program, including the Omega laser at the University of Rochester, the Z-machine at Sandia National Laboratories, the 192-beam NIF with the goal of ignition at Lawrence Livermore.

"3. People are the most important asset of the NNSA. The HEDP Program and NIF play an important role in attracting, training, and retaining the outstanding talent who will serve as the next generation of stockpile stewards.

"4. The proposed refurbishment of the Z-machine shows promise to enhance the HEDP Program, but it cannot provide the same capabilities as NIF.

"5. The NIF Project team is capable of managing the Project so as to assure a high probability of successful execution."

IN MEMORIAM: TOM STIX

Thomas Howard Stix, one of the most original thinkers and leading developers of the field of plasma physics, died April 16 in Princeton, NJ. He was 76 years old and professor emeritus in astrophysical sciences at Princeton University. The cause of death was leukemia. Professor Stix will be remembered not only as an outstanding scientist, educator, innovator and inventor; he will also be remembered for his warmth, for his humor, and for his genuine concern for people.

After receiving his BS from the California Institute of Technology in 1948 and his Ph.D. from Princeton in 1953, he joined Project Matterhorn, then a small, classified project on Princeton's Forrestal Campus. The project aimed to harness fusion energy for peacetime use. Project Matterhorn grew fast, and, in 1961, when Thomas Stix headed the experimental division, its name was changed to the Princeton Plasma Physics Laboratory.

Stix's work revolutionized research in plasma physics by showing how waves could heat plasma. This early work was presented at the Second International Atoms for Peace Conference in Geneva in 1958, held soon after the major nations working on controlled thermonuclear fusion research had agreed to declassify their work.

In 1962, Stix published his classic text, "The Theory of Plasma Waves," the same year in which he received appointment to Professor of Astrophysical Sciences at Princeton University. Enormously influential, this textbook both explored and formalized the growing subject of waves in plasma, both for laboratory and astrophysical applications. It was the book that served to educate and inspire more than one generation of plasma physicists.

Recipient of numerous awards, including a Guggenheim Fellowship in 1969, Professor Stix was awarded the 1980 James Clerk Maxwell Prize, the American Physical Society's highest award in the field of plasma physics. This award recognized his pioneering role in developing and formalizing the theory of wave propagation and wave heating in plasmas. In 1999, he was awarded Fusion Power Associates Distinguished Career Award.

In 1991, Princeton University recognized his contributions as a teacher and educator in its awarding him its first "University Award for Distinguished Teaching."

Among his professional responsibilities, he was elected in 1962 Chair of the Division of Plasma Physics of the American Physical Society. In 1978, Stix was appointed Associate Director for Academic Affairs at PPPL, and for many years he was Director of the Program in Plasma Physics at Princeton University. .

Expressions of sympathy may be sent to Hazel Stix, 231 Brookstone Drive, Princeton, NJ 08540.

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DIII-D MAKES MAJOR FUSION ADVANCE CANADA BIDS TO HOST ITER

FUSION ADVANCE IN DIII-D

Scientists working on the DIII-D tokamak experiment, a national facility located at General Atomics in San Diego, have announced a doubling of the fusion power density over what previous experiments and theory had identified as an upper limit to the allowable plasma pressure. The advance was made by using small control magnets to correct for small imperfections in the main magnetic field that confines the hot fusion plasma fuel. The advance should result in fusion power plant designs having lower cost of electricity than predicted by previous designs. Information related to the advance is posted at: http://fusion.gat.com/diii-d/releases/.

General Atomics issued a press release July 2 stating, "Researchers at the U.S. Department of Energy funded DIII-D National Fusion Facility at General Atomics, the largest fusion energy experiment in the United States, have nearly doubled the usual limits on pressure in a fusion energy device by spinning the hot, fusion fuel very rapidly. A significant scientific advance in understanding the pressure limit in fusion energy devices made these higher limits possible. These results are an important step towards controlled fusion power production that is feasible, economical, and attractive."

The release states, "High pressure in the fusion fuel is critical because the power released from fusion reactions increases very rapidly with increasing pressure. However, previous experiments and theory have identified an upper limit to the allowable pressure, called the free-boundary pressure limit. Beyond this pressure limit the hot fusion fuel becomes unstable, bulges outward, contacts the metal chamber wall, and cools rapidly."

In the early 1990's, theoretical and experimental work had suggested that the plasma pressure might be increased beyond the usual free-boundary pressure limit by rapidly spinning the fusion fuel. Current experimental plasmas are easily spun at extremely high rates (10 to 100 miles/second) like a spinning top. In the initial experiments on DIII-D that sought to raise the plasma pressure while spinning the fusion fuel, the spin rate would always slow down and the hot plasma would become unstable and be lost. "Scientists felt that the free-boundary pressure limit was unavoidable - we could not get beyond it. Sustaining the pressure beyond this limit is a significant scientific breakthrough," said Dr. Ronald D. Stambaugh, Program Director at the DIII-D. "The observed slow-down of the spinning plasma was a big mystery to us initially, and we were concerned that more aggressive stabilization methods would be needed to raise the plasma pressure," said Prof. Gerald A. Navratil of Columbia University, one of the leaders of the multi-institutional team from Columbia University, Princeton Plasma Physics Laboratory, and General Atomics studying stabilization of high pressure plasmas on the DIII-D.

The recent experiments on DIII-D clearly demonstrated that the slow-down of the spinning plasma was due to a tendency of the plasma to amplify very small imperfections in the magnetic field (at the level of the Earth's magnetic field). By applying new controls that automatically correct these small magnetic field imperfections the team was able to maintain the necessary high rate of spin needed for stability at high plasma pressure. These techniques have been used to sustain the pressure above the free-boundary limit in a variety of conditions, reaching levels nearly double the free-boundary limit in some cases.

Pioneering work on stabilizing plasmas using metal walls and control coils was done on a small tokamak at Columbia University. This research work on DIII-D is led by some of those same Columbia scientists, as well as scientists from Princeton Plasma Physics Laboratory (PPPL) and General Atomics (GA). Their work is supported by many collaborators from about 25 national laboratories and 25 universities worldwide that make up the DIII-D national research team. In addition, PPPL and GA provided major equipment for this research. Results of this research were briefly reported on behalf of the DIII-D team last week in a paper presented by Dr. Larry Johnson of PPPL at the European Physical Society meeting in Madeira, Portugal. A full report of these results will

be made in an invited paper by Dr. Andrea Garofalo of Columbia University at the American Physical Society Division of Plasma Physics Meeting in Long Beach, California in October.

The capability to double the pressure limits in fusion devices by spinning the fuel will have broad application to a range of approaches to fusion energy. These results will increase the emphasis on developing methods to spin the fusion fuel in a fusion power source. The DIII-D research team expects this advance could ultimately allow the design of more economical fusion power sources and reduce the time required to develop and deploy reliable sources of fusion energy.

CANADA BIDS TO HOST ITER

On June 7, Canada became the first country to formally bid to host the planned multi-billion dollar international fusion engineering test reactor called "Iter" ("The Way"). The project would be a joint venture of the European Union, Japan and Russia. It would be the first fusion device designed to produced net fusion energy. If Canada's bid is accepted by the Parties, the Iter device would be located at Clarington, on Lake Ontario just outside Toronto. Clarington is the site of some of Canada's heavy water nuclear (fission) power plants.

Canada's bid was presented in Moscow by Canada's Ambassador to Russia, Rod Irwin, to delegations from Russia, Japan, and the European Union. Representatives from the United States were also present. The US dropped out of the ITER collaboration in 1998, but hope was expressed by the other Parties that the US might rejoin as the project proceeds into construction. Canada has been participating in the project as part of the team headed by the European Union.

A press release issued by Iter Canada, the organization leading Canada's effort to host the Iter project, noted "The goal of this centre is to develop fusion energy as a safe, clean and sustainable energy source for our planet. The Iter project will be the second largest research and development project in the world after the International Space Station."

In addition to Canada, it is expected that the European Union and Japan will also offer sites.

Dr. Peter Barnard, Chairman and CEO of Iter Canada, said "With the support of the Government of Canada, the endorsement we have received from the Government of Ontario, and the continuing commitment of our private sector, labour, university and local community members, we believe Iter Canada is in a very strong position to win this project for our country. As host of the Iter project, Canada will become a world centre of excellence for research and development in the high tech energy field. Iter will be the largest "brain gain" in Canadian project history "

"The Ontario Government supports and fully endorses the Canadian effort to have Ontario host the international Iter fusion energy project," said Jim Wilson, Ontario's Minister of Energy, Science and Technology. "The Ontario Government is confident that Canada can win this bid, and has indicated a willingness to commit $10 million per year for 30 years." If Canada's bid succeeds, this research and development project would bring to Ontario 250 of the brightest minds in nuclear energy science, help diversify Ontario's high-tech industry and inject billions of dollars into the provincial economy."

The local community is also very supportive. "The Council of Clarington has been involved in this project since 1995 and we are now very excited about the prospect of locating such a large-scale, fusion energy development project in our community," said Clarington Mayor John Mutton.

Beyond Clarington itself, support for the project is very strong. "As a resident of the region surrounding Clarington, I am excited about the prospect of hosting the Iter project in our community, said Gary Polonsky, President of Durham College and Chairman of the Iter Community Council, a grass-roots organization representing the interests of all communities around the site. "The potential impact and benefits are tremendous, and it is critical we participate in the process of bringing this project to our region." The Durham College campus will house the Ontario Institute of Technology, a proposed new university that will serve the area and offer a degree program in nuclear technology and safety.

With the presentation of Iter Canada's Plan in Moscow, Canadian participants will begin negotiations with the other Iter Party delegations. These negotiations are scheduled to be completed next year with the finalization of an international treaty for building the project and funding the 20-year research and development program.

Iter Canada is a not-for-profit corporation established in 1997 with members from industry, governments, labour, and universities. It is committed to locating the world's Iter Fusion Research and Development Centre in Canada. For more information contact: Laura Ferguson, Director of Communications, Iter Canada (laura@itercanada.com), or visit the Iter Canada website at www.itercanada.com

JAPAN AEC APPROVES ITER STATEMENT

On June 5, the Atomic Energy Commission of Japan approved the final report from a Special Committee of the ITER Project. The AEC of Japan issued the following additional statement (unofficial translation):

"1. Fusion is a promising option for the future energy supply. Fusion requires highly advanced science and technology which calls for long term development efforts. Fusion research and development has been effectively and steadily promoted while

maintaining a balance between energy development and basic/fundamental science research. Fusion research and development in our country has been progressed in an integral way based on the "Third Phase Basic Program of Fusion Research and Development" (hereinafter referred to as the "Basic Program") set up by the Commission in May 1992.

"2. The Commission has successively received the reports from the Fusion Council on promotion of the ITER Project. Furthermore, on 18 May 2001, the Commission accepted a report from the "Special Committee of ITER Project" (hereinafter referred to as the "Special Committee") on its deliberation about the position of our country with regard to the ITER Project. ITER is a Tokamak-type fusion experimental reactor which satisfies the objectives defined in the Basic Program. From the technical review reports provided by the Fusion Council, the Commission understands that ITER can satisfy its technical objectives. In addition, the Special Committee, comprised of intellectuals representing a wide variety of communities, conducted a wide-range of investigations and deliberation about the Japan's strategy on the promotion of the ITER Project, taking into account the social and economic aspects such as energy supply in the future and international contributions. Furthermore, before finalizing the report, the public comments to the draft report were collected from the nation at large.

"3. The Commission has recognized that the results of the reviews and deliberation by the Fusion Council and by the Special Committee are quite appropriate, in view of the energy constraints that mankind is facing and the significance of fusion energy in that context, as well as technical aspects such as feasibility of the ITER Project and social aspects such as a role of our country in the international society, national identity, and ethical and public consciousness of our society. The Commission has reached a conclusion that, in the course of the integral promotion of fusion research and development, it is reasonable to promote the ITER Project with a full respect to the Special Committee's report. At the same time, the Commission has noted that the Special Committee concluded that "it would be of great significance for Japan to host ITER in addition to participating as a key member". With a view to hosting ITER in Japan, it would be urgently necessary to (1) examine candidate sites for internal selection and confirm whether any of them can be the site which satisfies the requirements; (2) strive to recognize the situations of other parties and start international negotiations with the other parties so that the ITER Project can provide the maximum benefits to our country. The Commission would like to make a necessary decision, based on careful examination of the process of and outcomes from this work and investigation of the status and outcomes of deliberation by the persons concerned on the issues identified by the Special Committee for further considerations, such as securing financial and human resources.

"4. The Commission will positively conduct the ITER project along with the Basic Program and promote further the fusion research and development in a balanced and integrated manner. The Commission has recognized that it is important to review, at every milestone, the significance and the progress of fusion research and development, including especially the ITER Project, and to publicize the results of the review. It is also important to make continuous efforts in providing highly transparent information on the project to public, including safety issues, so that fusion research and development be well recognized by the nation. The Commission would like to ask the persons concerned to make further efforts for maintaining and improving the public acceptance of fusion research and development. The Commission itself also would like to actively deal with this task."

For further information, contact: H. Kishimoto (hirosik@naka.jaeri.go.jp)

FUSION BILLS INTRODUCED IN CONGRESS

On June 28, Senator Larry Craig (R-ID) and Senator Dianne Feinstein (D-CA) introduced S. 1130, "The Fusion Energy Sciences Act of 2001" in the Senate. The bill is virtually identical to a bill introduced in the House on May 9th by Congresspersons Zoe Lofgren (D-CA) and George Nethercutt (R-WA).

The House Science Committee is tentatively scheduled to mark up and report out the House bill in July. No action is scheduled yet in the Senate Committee on Energy and Natural Resources.

Senators Craig and Feinstein issued the following press release:

WASHINGTON DC - Senators Larry Craig (R-ID) and Dianne Feinstein (D-CA) introduced today the Fusion Energy Sciences Act of 2001, a bill to strengthen the fusion program at the Department of Energy and speed up planning for the next major step in fusion energy science development.

"It is critical that we focus our efforts on developing and refining promising new sources of environmentally friendly energy, and this bill expands our efforts to develop this promising source. If we can successfully harness the energy released by the joining of atoms, fusion will be close to an ideal energy source, because it emits zero air pollutants and its fuel source, hydrogen, is in nearly unlimited supply," said Senator Craig.

"Fusion is a safe, almost inexhaustible energy source with major environmental advantages. As a co-sponsor of this legislation, I hope to see fusion move quickly from an experiment in the lab to a reality for our homes and businesses," Senator Feinstein said. "While I work on the short-term problems in California, I join my colleague from Idaho on this

bill to develop a key long-term solution to our current energy problems."

Simply put, fusion is the combining -- or fusion -- of two small atoms into a larger atom: when two atomic nuclei fuse, tremendous amounts of energy are released. Fusion is the energy source that powers the sun and the stars, and has promising potential to contribute a strong source of safe, reliable environmentally sound energy to our nation's domestic energy supply.

With the differences of opinion about the causes of our current energy problems and what the solutions are, Craig and Feinstein say there is general consensus that energy forms a vital link to our economic prosperity and continued investment in new technology is crucial. This bill assures that as short term energy needs are sorted out, a strong focus remains on long term investment in fusion energy, which has the potential to help secure our energy future.

Representatives Zoe Lofgren (D-CA) and Mike Simpson (R-ID) are cosponsors of the companion legislation (HR1781) in the House of Representatives.

HAZELTINE TESTIFIES TO CONGRESS

Prof. Richard D. Hazeltine, Professor of Physics, University of Texas at Austin and Chair of the USDOE's Fusion Energy Sciences Advisory Committee (FESAC) testified May 17 to the House Committee on Science.

Hazeltine said "The mission of the Fusion Energy Sciences program is to Advance plasma science, fusion science and fusion technology -- the knowledge base needed for an economically and environmentally attractive fusion energy source." He said, "The mission of the Fusion Energy Sciences program is to "Advance plasma science, fusion science and fusion technology-the knowledge base needed for an economically and environmentally attractive fusion energy source." He said, "Fusion researchers view their product as part of the mix of improved energy sources that will begin to dominate the global economy during the 21st century." He noted, "fusion offers a safe, long-term energy option with important environmental advantages."

Hazeltine said, "Fusion scientists need to understand plasma behavior, because any gas that is heated sufficiently to fuse is necessarily in the plasma state. Plasma physics is famous for its demanding complexity -- this is the primary fusion challenge. However, because plasma is so pervasive in the universe, understanding its rich and varied dynamics would be an enormous boon to several areas of science and technology. Thus the fusion quest is linked to numerous deep questions about the natural world."

Hazeltine testified, "Fusion progress over the past decade has been enormous, and exemplified by the production of megawatts of fusion power at laboratories in Oxford in the United Kingdom, and at the Princeton Plasma Physics Laboratory in New Jersey. These advances (along with others that missed the headlines) have brought fusion research to a watershed: its central challenge is no longer to demonstrate that fusion reactors are feasible, but rather to show that they can be practical. The present focus of fusion research is to establish the scientific and technological reality of a fusion power source with operational features (including competitive cost and size) that would attract commercial investment."

Hazeltine said, "A class of experiments that is certain to advance scientific understanding, while bringing fusion closer to the power grid, comprises the so-called "burning plasma" experiments, in which fusion reactions are sustained at a relatively high level and for long periods of time. A burning plasma experiment can be said to create a star in the laboratory, allowing analysis of its behavior. Because of the scientific progress described previously, a burning plasma experiment is within our reach, and it could be constructed at lower cost and higher confidence than would have been possible a decade or so ago. The European community, Russia and Japan are expected to begin joint work on such experiments very soon, and they would welcome our participation. However, an effective US role in an international burning plasma experiment would require us to enter negotiations with the other participants very soon. It is another exciting opportunity that is threatened by limited program resources."

Hazeltine noted, "The fusion program has been examined in recent years by several independent agencies, including the President's Committee of Advisors on Science and Technology (PCAST), the Secretary of Energy's Advisory Board (SEAB) and the National Research Council (NRC), the research arm of the National Academy of Science. Although each panel had a somewhat different scope and purview, all came to similar conclusions about the value of fusion research. Thus SEAB remarks that "In light of the promise of fusion and the risks arising from increasing worldwide energy demand and from eventually declining fossil energy supply, it is our view that we should pursue fusion energy aggressively." PCAST describes fusion as "an attractive and possibly essential new energy source for this country and world" while the NRC states that "the quality of the science funded by the US fusion research program in pursuit of a practical fusion power source (the fusion energy goal) is easily on a par with other leading areas of contemporary physical science." Thus there is every reason for fusion scientists to feel very good about the importance and quality of their work."

For a copy of his complete testimony, contact Richard Hazeltine (rdh@physics.utexas.edu).

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FPA 2001 AWARDS: GOLDSTON, PARKER, BANGERTER, FRIEMAN, SNEAD

YEAR 2001 AWARDS

Fusion Power Associates Board of Directors has announced the recipients of its 2001 Awards. FPA Awards are given annually for Leadership, Distinguished Career and for Excellence in Fusion Engineering. Special Awards are also occasionally presented. For a list of previous award recipients, go to the FPA home page (//fusionpower.org) and click on Awards.

LEADERSHIP awards have been presented annually since 1980 to individuals who have shown outstanding leadership qualities in accelerating the development of fusion. This year's recipients are **Robert J. Goldston** and **Ronald R. Parker**.

Rob Goldston, an outstanding fusion research scientist, has been Director of the Princeton University Plasma Physics Laboratory since 1997. In selecting him for this award, the FPA Board recognizes not only his outstanding leadership of the laboratory but most especially his influence on the course and content of the national fusion program and his effectiveness in communicating the value of fusion research to the U.S. Congress and the Executive Branch. His award states, "You have provided forceful and effective guidance to a wide spectrum of fusion scientific topics and have helped put fusion back on the U. S. national political agenda."

Ron Parker, former director of the MIT Plasma Fusion Center and former leader of the ITER co-center in Garching, Germany, is recognized for his many scientific contributions to fusion research, his dedication to the production of high performance fusion conditions in the laboratory and his leadership and vision to the cause of developing practical fusion power. His award states, "You have provided inspiration and technical guidance to the tokamak fusion program and leadership to those seeking to expedite the development of a practical fusion power system."

DISTINGUISHED CAREER awards have been presented annually since 1987 to those individuals, at or beyond retirement age, who have made distinguished lifelong career contributions to fusion development. This year's recipients are **Roger O. Bangerter** and **Edward A. Frieman**.

Roger Bangerter recently retired as leader of the heavy ion fusion (HIF) group at the Lawrence Berkeley National Laboratory and Director of the HIF Virtual National Laboratory. The Board recognizes his many scientific contributions and the leadership and vision he has provided to the development of the heavy ion approach to inertial confinement fusion throughout his career.

Edward A. Frieman was a pioneer fusion researcher at the Princeton Plasma Physics Laboratory and for many years its Deputy Director. Later he became a vice president of Science Applications International Corporation, Director of the Scripps Institute of Oceanography of the University of California at San Diego and a member of the President's Council of Scientific Advisors (PCAST). The Board recognizes his many scientific contributions to the early development of fusion and his later contributions as an advisor on national fusion policy.

EXCELLENCE IN FUSION ENGINEERING awards, in memory of MIT Professor David J. Rose, have been given annually since 1987 to individuals relatively early in their careers, who have shown both outstanding technical accomplishment and potential to become exceptionally influential leaders in the fusion field. This year's recipient is **Lance L. Snead**.

Lance Snead is a research scientist in the Metals and Ceramics Division of Oak Ridge National Laboratory. In selecting him, the FPA Board "recognizes the seminal contributions you have made to the development of silicon carbide composites for fusion applications and your emerging leadership in the area of materials research for inertial confinement fusion."

Special Awards are given periodically to recognize special contributions not readily covered in other awards. This year the FPA Board recognizes, with a Special Award, **Mark Haynes**, Vice President, Washington Operations, General Atomics, for his dedicated and effective efforts in the area of fusion education among teachers, Congress and congressional staff.

ADVANCE IN Z MACHINE AT SANDIA

In its first try as a Sandia National Laboratories diagnostic tool, the third-biggest laser on earth, Z-Beamlet, confirmed that Sandia's Z machine — the most powerful laboratory producer of X-rays in the world — spherically compressed a simulated fusion pellet during a firing, or "shot," of the giant accelerator.

"The beam compressed the pellet by a factor of 2," says project leader John Porter, "and demonstrated an encouraging uniformity. Our results show we're moving in the right direction."

Uniform 3-D compression is an essential step in creating controlled nuclear fusion. It means that almost none of the X-ray energy delivered to the pellet squirted uselessly away. Weapons simulation work (the alternative to nuclear testing) conducted on supercomputers by Sandia for the US Department of Energy is expected to benefit from data from fusion pellets, as should, further down the pike, energy production.

Until now, Z researchers had to be content with electronic images of smoother and smoother Z pinches - the tool of compression. The pinch — a vertical magnetic cylinder — with increasing smoothness impels ions of tungsten toward its vertical axis at a considerable fraction of the speed of light. But knowing that the tool is good and getting better isn't definite information about the pellet upon which the tool is operating. Only direct data is entirely convincing.

Z-Beamlet images the pellet in a kind of giant dental X-ray, says Porter. In a burst of energy only a fraction of a billionth of a second long, it takes a snapshot by creating a shadow on a piece of X-ray film placed behind the BB-sized pellet inside the central chamber of the firing Z machine. The shadow, like the picture taken of a tooth, accurately depicts what is going on in the "mouth" of Z.

Lawrence Livermore National Laboratory originally built the Beamlet laser to serve as the scientific prototype of the National Ignition Facility. The California lab decided to remove the laser to make room for those of the NIF.

The entire project to reassemble the recycled Livermore laser cost $12.875 million, took 3 years to complete, and required the talent and dedication of scores of individuals from Lawrence Livermore and Sandia, says Porter. "Now we're more optimistic than ever," he says. "Instead of seeing the outside of Z science - the instabilities in the compressing magnetic field - we can now see the inside, the pellet at the center of the million-degree furnace - the interior of the sun, if you will - and we can accurately describe what's happening there."

ITER STATUS

The International Atomic Energy Commission (IAEA) marked the official "completion of the Engineering Design Activity (EDA)" of the International Thermonuclear Experimental Reactor (ITER) in a ceremony July 17 in Vienna, Austria. The EDA began in 1992 as a four party (Europe, Japan, Russia, United States) collaboration to design the world's first net power-producing fusion energy test facility. The United States withdrew from the collaboration in 1998. The IAEA noted, in a July 10 press release, that the current ITER design "will be capable of generating 500 MW of fusion power for hundreds of seconds," and "could lead to the construction of a demonstration fusion power plant that generates large amounts of electricity." The remaining parties plan to make site and construction decisions during the coming year and have expressed hope that the U. S. would rejoin the project.

At the ceremony, Dr. M. Yoshikawa, Chairman of the ITER Management Advisory Committee, spoke on the role of fusion energy in the future; Academician E. P. Velikhov, Chairman of the ITER Council, spoke on the history of the ITER project, and ITER Director Dr. R. Aymar spoke about ITER objectives and parameters.

Delegations from Canada, the European Union, Japan and the Russian Federation held their second meeting in Vienna July 16–19 to further joint discussions aimed at implementing construction of the Iter project. This meeting follows a successful first meeting in Moscow in June.

At the 3 day Vienna meeting, significant progress was made by the Negotiators, including:

* Development of an overall indicative work program with milestones, that sets out the plan to conclude negotiations for an international agreement by the end of 2002 to implement Iter.

* On the invitation of the Director General of the IAEA, establishment of the framework for the support of negotiations and preparation for Iter implementation by an international team of scientists and engineers working out of offices in Naka, Japan and Garching, Germany, in close cooperation with national home teams.

* The formation of a standing sub-group of experts to support the negotiations process.

The participants agreed to meet again in Toronto in October to further their discussions.

Another step along the road to possible construction of the International Thermonuclear Experimental Reactor (ITER) was successfully taken in July when the prototype toroidal field test magnet was operated at a world record current of 80,000 amperes, corresponding to a maximum magnetic field of nearly 8T. Project Manager Ettore Salpietro said, "The behavior of the superconductor and the joint resistances are as expected as well as the temperature increase in the structures during fast ramp and safety discharge."

The ITER toroidal field model coil project started in 1995 and the contracts for the supply of superconductor and coil were placed with European companies early in 1996. The engineering design was completed in 1997. New design principles and manufacturing methods had to be used for the construction of the coil, which took about 4 years. The coil and

its support structure, having a total weight of about 60 tons, were completed in industry by the end of 2000. The assembly and installation into the TOSKA facility a the Forschungszentrum Karlsruhe (Germany) started in January 2001 and was completed in June. The coil reached the transition temperature to the superconducting state on July 6 and the testing phase began on July 16. The coil reached a new world record current for a superconducting coil of 57 kA on July 19 and extended this record to 80 kA on July 24.

Salpietro said, "The successful testing of the coil confirms the feasibility of the ITER magnet system." "A test program will continue to explore the operational limits of the coil and validate the design codes. Both are needed to optimize the ITER operating parameter's space and cost," he said.

For further information, contact Ettore Salpietro (salpiee@ipp.mpg.de).

UFA ISSUES STATEMENT ON BURNING PLASMAS

The Executive Committee of the University Fusion Association has issued the following statement entitled "UFA Technical Policy on Burning Plasma:"

A burning plasma (BP) experiment would greatly strengthen the US fusion energy sciences program. The TFTR and JET experiments have produced reactor like plasmas and attained near breakeven conditions ($Q \sim 1$). The alpha particle beta and energetic particle heating effects in these experiments were reactor-like, allowing the first exploration of BP physics. These $Q \sim 1$ results using a tokamak magnetic configuration give high confidence in the feasibility of a $Q>5$ experiment. Production of a strongly self-heated fusion plasma will allow the study of a number of new phenomena. The non-linear coupling between fusion alpha production, alpha-heating-sustained pressure profiles, pressure-driven current, MHD stability, turbulent transport, and boundary plasma behavior, as well as fusion ignition transient phenomena will be studied and controlled. The additional studies of Alfven wave dynamics, the effect of energetic particles on collisionless reconnection and proton and alpha particle heating will also impact space and astrophysical plasma physics.

While fusion research is ready for a BP experiment more knowledge of plasma physics is required for building a cost effective reactor. Innovations to improve the economics of the tokamak or a more cost effective configuration are needed for a practical reactor. A BP experiment will open up new scientific frontiers of study and take us a critical step closer to realizing the goal of fusion power. Further, clearly demonstrating that a BP can be achieved in a tokamak configuration will be directly applicable to a large number of related magnetic configurations. In addition, achievement of a BP will stimulate the creative engineering and technical development needed to make fusion energy practical. Finally, operating in high-Q regimes allows new discoveries, leading to significant advances towards practical fusion energy. The UFA supports the exploration of potential BP experiments and advocates that this important next step be pursued by the U S fusion energy sciences program.

The main focus of the US fusion energy sciences program is to develop the science and technical base needed for practical fusion energy by exploration across a broad spectrum of magnetic configurations. Each innovative confinement concept being investigated offers advantages that would improve the economics and/or reliability of a fusion power system. Also pursued in the present program are basic plasma science, plasma theory, computational plasma physics, system studies, and technology research that are essential to develop new understanding that leads progress toward practical fusion and towards other applications of plasmas. This base program is needed to advance essential science and technology, to develop a more cost effective concept, and to capitalize on advances made with a burning plasma experiment. Thus, a BP experiment must be funded with a significant augmentation of the fusion budget. The relatively flat funding in the US fusion energy sciences program for the past several years following a major budget cut in 1996, has left the base program badly underfunded. Therefore, the UFA supports a balanced program for a faster realization of fusion power, requiring an increased base program as well as a BP experiment.

For further information, contact Tom Jarboe (jarboe@aa.washington,edu), UFA President.

DOE MAKES ADVANCED COMPUTING AWARDS

The US Department of Energy announced its first awards under the new Scientific Discovery through Advanced Computing (SciDAC) program. Fifty-one projects will receive $57 million this fiscal year "to advance fundamental research in several areas related to the department's missions, including: climate modeling, fusion energy sciences, chemical sciences, nuclear astrophysics, high energy physics and high performance computing.

Fusion received approval for 6 projects totaling $4.8 million.

The fusion projects will go to:

1. U. Iowa, U. Chicago, U. Texas at Austin, for magnetic reconnection; A. Bhattacharjee, PI, $750,000.

2. Auburn U., Rollins College, ORNL, for atomic physics for the edge region in plasmas, M. Pindzola, PI, $300,000.

3. ORNL, PPPL, MIT, Lodestar Corp., CompX Corp., for wave-plasma interactions in multi-dimensional systems, D. Batchelor, PI, $1 million.

4. PPPL, SAIC, U. Wisconsin, NYU, U. Colorado, MIT, Utah State U., General Atomics, LANL, U. Texas at Austin, for Center for MHD Modeling, S. Jardin, PI, $500,000.

5. LLNL, General Atomics, PPPL, U. Maryland, U. Colorado, UCLA, for the Plasma Microturbulence Project, W. Nevins, PI, $450,000.

In addition, in the category "National Collaborations & Networking," the following fusion-related award was made:

6. General Atomics, MIT, Princeton University, U. of Utah, PPPL, ANL, LANL, for A National Collaboratory to Advance the Science of High Temperature Plasma Physics for Magnetic Fusion, D. Schissel, PI, $1.8 million.

For more information, visit http://www.sc.doe.gov

ROSEN, ATZENI WIN TELLER AWARD

Lawrence Livermore National Laboratory (LLNL) laser and plasma physicist Dr. Mordy Rosen is one of two recipients of the prestigious Edward Teller Medal for 2001. The award was announced by the American Nuclear Society. Rosen was named along with Professor Stefano Atzeni of the University of Rome "La Sapienza" and the Italian National Institute for the Physics of Matter. The Edward Teller Medal recognizes pioneering research and leadership in inertial fusion sciences and applications.

"This is a fabulous feeling," said Rosen. "I feel humble knowing the company of people I am in. These winners were pioneers in this field and I am honored to be a part of them."

Rosen is recognized internationally for major contributions to the development of laboratory soft X-ray lasers, and to the design and analysis of complex high energy density and ICF target physics experiments, elucidating electron and radiation transport, and the properties of hot dense matter. These experiments were carried out on a long line of high power lasers at LLNL and, along with the subsequent work of many others, formed the foundation for the national science-based stockpile stewardship effort and contributed to DOE approval of the National Ignition Facility.

The Teller Medal was created in honor of LLNL Director Emeritus Edward Teller, who is recognized worldwide as a pioneer in inertial fusion sciences. The award has been granted to 18 scientists from nine countries in previous years.

The awards will be presented at a conference Sept. 12 in Kyoto, Japan. The conference, organized by Osaka University, the University of California and Ecole Polytechnique, will bring together about 400 scientists and engineers from all parts of the world to compare notes on the latest research in inertial fusion.

Rosen's fellow recipient, Stefano Atzeni, who did much of the research for his Teller award while he was at the Frascati laboratories of ENEA (Italian National Agency for New Technologies, Energy and the Environment), is being honored because of his leading contributions to understanding and teaching the high energy density physics related to Inertial Confinement Fusion.

KOTSCHENREUTHER PROMOTED

The University of Texas has recently promoted Dr. Michael Kotschenreuther to the rank of Senior Research Scientist in the Institute for Fusion Studies.

He received his Ph.D. from Princeton University in 1982 and has worked at the IFS since that time. He has made important discoveries that have affected the course of fusion research. Examples include his insights on magnetic island healing, curvature effects on island evolution, and convective instability of drift waves. He is perhaps best known for two innovations. First, his development of the "delta-f" algorithm for numerical computation of kinetic effects, which can drastically reduce the noise level (and indirectly the computation time) in kinetic simulations, is now used throughout the world. Second, his development, in collaboration with physicists at Princeton Plasma Physics Laboratory, of new computational methods in nonlinear plasma transport theory has led to huge advances in the ability of transport codes to simulate fusion experiments. His present research interest is finding novel, cost-effective paths to fusion power.

IN MEMORIAM

Charles Maisonnier died on July 27, 2001 in Brussels, at the age of 69.

The memorial service will be held on September 19 at 11 AM at the Saint-Anne Church, 8, Saint-Alliance Square, Brussels, Belgium.

Charles played an important role in fusion research, both in Europe and worldwide.

He was prominent in plasma focus research. He was a program leader at Frascati until late 1970s. He has served as a leader of the European Fusion Program for more than 15 years until he retired in the mid 1990s. He was a strong and efficient supporter of the ITER program.

Fusion researchers worldwide mourn his passing.

Vladimir Alikaev passed away recently after a long illness, according to an announcement from the Nuclear Fusion Institute of Russian Research Center "Kurchatov Institute." The noted Russian scientist, the chief of a Department of High-Frequency Methods of Plasma Heating of Institute of Nuclear Fusion, came to the Kurchatov Institute in 1955 as a graduate of the Physical Department of the Moscow State University and worked in the Center until the last day of his life. From the very beginning his scientific interests were problems of interaction of high-frequency fields with plasma. Among the first, he estimated opportunities and prospects of microwave applications for heating plasma to thermonuclear temperatures and devoted all his life to the decision of this problem. He took active participation in works of Institute of Applied Physics of the Russian Academy of Science on creation of powerful long pulse microwave generators — gyrotrons, provided the basis for practical applications in plasmas. For these works in 1981 he was awarded with a rank of the State Prize laureate. Today gyrotrons are used practically on all tokamaks in the world.

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ENERGY SECRETARY ABRAHAM CALLS FUSION A "PRIORITY"

ABRAHAM SETS DOE PRIORITIES

U.S. Energy Secretary Spencer Abraham, in an address to DOE senior staff on October 24 titled "Mission and Priorities of the Department," told the group there were "two priorities that deserve special mention. The first involves the unique technological contribution we can make to our energy and national security by finding new sources of energy. Whether it is fusion or a hydrogen economy, or ideas that we have not yet explored, I believe we need to leapfrog the status quo and prepare for a future that, under any scenario, requires a revolution in how we find, produce and deliver energy." Abraham said, "It is not simply because many of our resources are depletable. It is not simply because we are increasingly dependent on energy from areas of the world that are periodically unstable. It is not simply because questions surrounding climate-change force us to confront policies that focus on a carbon-free society. All of these are factors. But the important point is that success in this mission could well be one of the greatest contributions to our energy and national security for generations to come. I intend, therefore, that this Department take a leadership role in exploring how we can identify and use potentially abundant new sources of energy with dramatic environmental benefits."

The second "priority" he discussed was to focus on "the threat of weapons of mass destruction posed either by small groups of terrorists or by nation states." Abraham asked his top aides to conduct a "strategic missions review with a report to me by the end of next January." Included in the review was "to identify what changes are necessary to increase our ability to use every resource at our disposal to support the following missions:

- Identifying New Sources of Energy for the Future,
- Protecting Our Critical Energy Infrastructure,
- Implementing the President's Energy Plan,
- Implementing the President's Climate Change Initiative,
- Ensuring the Reliability of Our Stockpile,
- Addressing Proliferation of Nuclear Weapons and Technology,
- Enhancing Homeland Defense Against New Terrorist Threats, and
- Implementing Environmental Cleanup Faster and Cheaper.

The Secretary said, "Our overarching mission is national security." Abraham said, "Quite obviously, the Defense side of the building fits well within that mission. But so should our other programs. I think it is time for all of us to understand that our energy and science programs should be judged by whether they advance this Nation's energy — and hence national — security. And I think it is time for us to understand that cleanup of our sites is an imperative to ensure that safety legacies of the cold war are addressed and resolved, and done so in a manner that does not impede future national security missions."

With respect to "the science programs and, in particular, the National Laboratories, Abraham said he "will expect us to implement a major change in how we do business. That change means that our science programs and National Laboratory work should directly relate to and support the missions I have outlined above. Programs and projects that fall outside those missions will not receive my support for funding without a clarity of mission and compelling circumstances."

The full text of Abraham's remarks can be found at http://fusionpower.org/ then click on Fusion Program Notes, then click on FPN01-68.

U.S. REJOINS INTERNATIONAL EFFORT

Since the end of U.S. participation in the International Thermonuclear Experimental Reactor Engineering Design Activities (ITER-EDA) extension in 1998, the U.S. tokamak research community has been limited in its ability to engage in the activities of international topical physics groups since they were under the auspices of

ITER. Since 1999, the U.S. participated in "Preparatory Meetings" that focused on the scientific topics but did not include ITER-specific work. Now, after more than 2 years of discussion and joint planning through several international arrangements, the U.S. is once again a full participant in the newly-named International Tokamak Physics Activity (ITPA), which will foster cooperative research aimed at the advancement of understanding of the physics of burning plasmas.

DOE fusion chief, Dr. N. Anne Davies, said, "I consider ITPA to be an important opportunity for the U.S. researchers to achieve U.S. program goals more effectively via joint research with the world fusion program on tokamak burning plasma physics, and I urge (U.S. fusion researchers) to participate fully in this activity."

The ITPA aims at cooperation in advancement of the physics basis for burning tokamak plasma physics by cooperation between four participants: Japan (JA), European Union (EU), Russian Federation (RF), and the U.S. It evolved from the ITER Physics Expert Groups and the subsequent International Preparatory Meetings through discussions among the representatives from the U.S., EU, JA, RF over the past 2 years at various locations. At its meeting at Sorrento in Italy on October 3, 2000, the IAEA International Fusion Research Council (IFRC) developed and approved a position paper supporting the formation of ITPA. The IFRC reaffirmed its support of ITPA at its meeting in Vienna on June 18, 2001 and the process was started to implement ITPA as of July 1, 2001. The International Energy Agency (IEA) Fusion Physics Coordinating Committee also expressed its support of ITPA at its January 2001 meeting.

The legal basis for the U.S. participation in ITPA is provided through U.S. bilateral agreements with JA, RF, and EU.

The official international membership of ITPA includes a maximum of five scientists from each party for each of the seven Topical Physics Groups. However, the U.S. participation in the activities of these groups is open and broad participation is welcomed. U.S. participants have, as a major part of their scope, the integration of the ITPA topical group activities into the U.S. community, as well as assisting DOE Office of Fusion Energy Sciences in selecting the U.S. participants for the official Topical Group meetings. An ITPA Web Page will be established at IPP Garching.

Dr. Davies said, "As the U.S. fusion community works toward the achievement of the objectives of the 2002 Snowmass Summer Study, I see the ITPA as a significant source of information on the key scientific issues that relate to the physics basis for designing such an experiment and on the scientific benefits of research on a burning tokamak plasma. The ITPA will provide access to the ITER physics basis and will foster involvement of the international fusion community in the determination of criteria for assessing the benefits of research on the range of approaches to study of burning plasmas."

Davies said, "In the past, there has been some confusion and concern about the designation of past ITER Physics work and future ITPA work as "voluntary". This confusion is unfortunate, since it is perceived as reducing the significance and recognition of the work, almost to the extent of placing it outside the official work scopes for the U.S. fusion program. This perception is incorrect. The ITPA activities are fully consonant with and are part of the official U.S. fusion program work, and the U.S. participants are supported to engage in the ITPA activities as part of their pursuit of the U.S. program goals. The term 'voluntary' means only there is no binding agreement on how much each party is obligated to contribute to this effort. The work of the U.S. scientists on ITPA is a part of their work funded by the OFES, guided by their program managers at laboratories and OFES. The relevance of the ITPA work to the U.S. program goals, its close coupling to the U.S. activities as described above, and its productivity and excitement will determine the level of effort that the U.S. scientists contribute to this effort. I expect that the U.S. scientists will participate in the ITPA as a part of their program to enhance understanding of burning plasmas, through joint work on highly integrated experiments, theory, and modeling and sharing databases and their analysis. I am looking forward to a successful ITPA and your participation in international activity which offers the U.S. and opportunity to advance U.S. fusion goals more effectively through joint research."

CONGRESS AGREES ON FUSION BUDGET

On the evening of October 30, House and Senate "conferees" ironed out differences in their respective versions of the FY2002 U.S. Department of Energy appropriations bills, which includes funding for fusion research. The combined bill is expected to be passed by both houses of Congress in the near future and signed into law by President Bush

The bill provides $248,495,000 for the Office of Fusion Energy Sciences, as requested by the President, and level with FY2001. Fusion researchers had been hoping for a $30 million add-on in conference, which did not materialize. However, the conferees did provide an increase of $39.5 million over the President's request for inertial confinement fusion as part of DOE's Defense Programs budget. This amount includes $24.5 million for the development of high-average-power lasers, slightly less than the $25 million appropriated last year. Funds for this program were not requested by the President.

Funds in the amount of $3 million were added for a new program for "conceptual and preliminary engineering design" for the development of petawatt lasers. Petawatt lasers are an essential component for "fast ignition," of inertial fusion targets, which could improve the prospects for affordable inertial fusion power plants.

The relevant conference report language is provided as follows: "Fusion energy sciences.--The conference agreement includes $248,495,000, as proposed by both the House and Senate, for fusion energy sciences."

"For inertial confinement fusion, the conference agreement provides $506,443,000, an increase of $39,500,000 over the budget request, and includes several program funding adjustments. The conference agreement includes $10,000,000 for the Naval Research Laboratory, the same as the budget request. Funding of $24,500,000 has been provided to further development of high average power lasers.

"The conference agreement includes $35,450,000 for the Laboratory for Laser Energetics at the University of Rochester, an increase of $2,000,000 over the budget request, to be used for development of critical short-pulse laser technologies that should be extensible to producing very high power laser capability on the National Ignition Facility as well as existing large fusion research lasers like Omega.

"The conference agreement provides an additional $7,000,000 for enhanced National Ignition Facility (NIF) diagnostics and cryogenic target activities, and $245,000,000, the same as the budget request, for continued construction of the NIF.

"The conferees understand the Department is preparing a National Petawatt Strategic Plan and support completion of this initiative, including within the strategic planning the research and development of supporting technologies necessary to ensure U.S. leadership in ultra-short-pulse laser technology. Funding of $3,000,000 is provided for conceptual and preliminary engineering design studies for a petawatt-class laser at the Sandia National Laboratory's Z machine, and $1,000,000 is provided to initiate development of critical short-pulse laser technologies like damage-resistant gratings.

"The conferees strongly support university participation in this program and have provided $9,886,000 for university grants/other ICF support, an increase of $4,500,000 over the budget request. This includes $2,500,000 to complete the installation and initiate operation of a petawatt laser or high power, short-pulse laser at the University of Nevada-Reno. The conferees believe that early access to an operating petawatt-class laser will provide opportunities for exploring technology options to incorporate in the next generation of petawatt lasers."

U. MARYLAND HEAVY ION FUSION EFFORT

The use of heavy ion beams to drive inertial fusion targets was first suggested in the mid-1970s. The high electrical efficiency of high-current ion accelerators makes them attractive as drivers for inertial fusion power plants. Research has since been in progress in several countries, including the US, Germany and Russia. The lead lab in the US is the Heavy Ion Fusion (HIF) Virtual National Laboratory under the direction of B. Grant Logan at the Lawrence Berkeley National Laboratory (LBNL).

Results of HIF R&D are reported in biannual Heavy Ion Fusion symposia and elsewhere. The last (13th) symposium was held under the auspices of Fusion Power Associates in March 2000 in San Diego, CA, and the next symposium is scheduled for May 2002 in Moscow.

Existing accelerator technology for use in high-energy or heavy-ion physics is highly developed. However, the application to heavy-ion inertial fusion requires considerable new R&D to produce the short, high-power beams that must be delivered to the fusion targets. Heavy ion beams with unprecedented currents of tens of kA, accelerated to several GeV, must hit the mm-size targets in short pulses of about 10 ns. These beams are essentially nonrelativistic, dominated by space-charge forces and must have very low emittance and energy spread. Simulation of the beams with special computer codes, verified by comparison with experiments, is a necessity for the staged development of a full-scale HIF driver. Heavy-ion induction linac experiments at the ampere level are being pursued at LBNL.

At the University of Maryland, two "table-top," low-cost experiments are being conducted with electrons to study major beam physics issues relevant to HIF drivers and to serve as testbeds for validating theory and computer simulation codes. Even though the electron energy is kept low (10 keV initially, 50 keV in the future), the beam is sufficiently intense to simulate the physics of nonrelativistic ion beams with several kA of current.

One of the two experiments, dealing with the longitudinal resistive-wall instability, which might adversely affect the beam quality in HIF drivers, has already produced significant results. It confirmed the predictions of linear theory, but also revealed nonlinear effects that are so far unexplained. Current research is aimed at understanding the evolution of energy spread using a new energy analyzer with highly improved resolution.

The second and major project, now under construction, is the 3.5-m diameter University of Maryland Electron Ring (UMER) for investigating the physics of space-charge dominated beams over a relatively long distance in the presence of dispersion by the bending magnets. The use of low-energy electrons keeps the size and cost relatively small and allows the use of innovative printed-circuit quadrupoles and dipoles. Progress, reported in seven papers at the recent Particle Accelerator Conference, includes excellent agreement of injector beam measurements with envelope calculations; descriptions of the beam diagnostics, controls and alignment system; electron gun simulations; and initial energy analyzer measurements. Initial measurements of the 4x normalized emittance using the "pepper-pot" method yield a respectable value of 15 mm-mrad. The computer simulation code, WARP, originally developed at LLNL/LBNL, accurately reproduced experimental results, in particular the unexpected observation of radial space-charge waves, which gives confidence into the code's predictive capability. The ring will be fitted with induction gaps to provide longitudinal control of the beam bunches and, ultimately, acceleration. The ring will thus in effect be a recirculating induction accelerator, capable of acceleration from 10 keV to 50 keV (v/c=0.4) in 100 turns. Beam experiments are being conducted as construction proceeds. A wealth of new phenomena will be studied, including longitudinal-transverse coupling, resistive-wall instability, halo formation, resonance traversal, evolution of energy spread, and emittance growth due to several possible causes.

The electron beam physics laboratory at UMD is under the direction of Patrick O'Shea and Martin Reiser. It is funded jointly through the Office of Fusion Energy Science and the Office of High Energy and Nuclear Physics at DOE. Detailed information is available in the web site: http://www.ireap.umd.edu/umer For further information, contact Patrick O'Shea (pshea@eng.umd.edu).

J. FUSION ENERGY NAMES EDITORS

The Journal of Fusion Energy (Kluwer Academic/Plenum Press) has named a new editorial board and is seeking papers. Subscription information and instructions for submitting papers can be found on the journal's web site: http://www.wkap.nl/journalhome.htm/0164-0313

Papers are solicited on all scientific and technological aspects of fusion and plasma research, including plasma propulsion and other plasma applications. Opinion and survey articles are also welcomed. A copyright form, which may be downloaded from the web site, must be submitted with all papers. There are no page charges. Papers may submitted to any of the following:

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FPA NAMES DIRECTORS, OFFICERS

The representatives of Fusion Power Associates member institutions have elected the following Directors to 3-year terms commencing Nov 1:

Jeffrey Freidberg (MIT, Dept. of Nuclear Engineering)
Robert Goldston (Princeton Plasma Physics Laboratory)
Gerald Kulcinski (U. Wisconsin, Fusion Technology Inst.)
Stanley Milora (ORNL, Fusion Energy Division)
Stephen Payne (LLNL, Laser S&T Program)

They will join the following current members of the Board:
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In addition, the Board has elected the following officers to 2-year terms commencing November 1:
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John Lindl, Vice Chairman of the Board
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Ruth A. Watkins, Secretary/Treasurer and VP, Administration and Finance

The Board encourages all fusion institutions and fusion researchers, worldwide, to become members or affiliates of Fusion Power Associates. Information on FPA membership and activities can be found at the FPA web site: http://fusionpower.org