FUSION POWER ASSOCIATES
EXECUTIVE NEWSLETTER

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ITER SITE DECISION DELAYED
INERTIAL FUSION PROSPECTS BRIGHTEN

ITER Site Decision Delayed

Government officials from the European Union, Russia, Japan, United States, China and Republic of Korea, met December 20 in Washington, DC, with hopes of selecting a site for the International Thermonuclear Experimental Reactor (ITER) project, but the "ministerial level" delegates postponed the decision until February 2004.

Officially the delegates stated that both the European site in France and the Japanese site were "excellent" and that more imformation would be sought before a site was chosen

Unofficial reports from the meeting indicated that the six parties were split down the middle, with Europe, Russia and China favoring the European site, while Japan, the US and Korea favored the Japanese site. One news report indicated that Korea moved to a neutral position during the day-long meeting.

The official communique from the meeting reads as follows:

"The Six Parties have reached a strong consensus on a number of points.

"We have two excellent sites for ITER, so excellent in fact that we need further evalulation before making our decisions based on consensus.

"We have agreed to provide the remaining questions to the candidate host parties by the end of December for their answers by the end of January.

"We will ask the ITER team in conjunction with the ITER Parties to conduct a rapid exploration of the advantages of a broader approach to fusion power. This work will be done on the same schedule.

"With all this information, we plan to hold a follow-up Ministerial meeting to reach consensus as quickly as possible, likely to be in February."

The Official communique and other reports on the meeting are posted at http://fire.pppl.gov

Abraham Endorses Japan as ITER Site

On January 9, the United States, for the first time publicly, backed Japan to host the ITER multi-billion-dollar experimental nuclear fusion reactor instead of France, saying it offered a superior site. The project will either be sited in the French town of Cadarache or the northern Japanese village of Rokkasho-mura.

"I am proud to say today that the United States strongly supports building ITER here in Japan. From a technical standpoint you offer the superior site," US Secretary of Energy Spencer Abraham told a gathering of Japanese business leaders during a visit to Tokyo. "The location of Rokkasho is superbly situated to receive the large materials needed for ITER. Your technical and engineering skills are known and admired in every corner of the world. What is more, the local community clearly welcomes this project and has always gone out of its way to encourage the siting of ITER in Rokkasho," Abraham said.

A spokesman for the US embassy in Tokyo confirmed it was the first time that Washington had gone on record in support of the Japanese bid. "We feel extremely encouraged by his comment," an official from Japan's science and technology ministry commented. "We will continue to work with other countries so that we can build ITER in Rokkasho-mura."

A French source close to ITER said it would have been better for Abraham to have waited for the completion of ongoing technical studies before commenting saying,

"The remarks of the US secretary amount to a questionable way of disrupting the study."

Links to other ITER reports are posted at the Fire web site: http://fire.pppl.gov

Inertial Fusion Ignition Prospects Brighten

Dr. David Crandall, Assistant Deputy Administrator for Research, Development & Simulation, at DOE's National Nuclear Security Administration (NNSA), told Fusion Power Associates annual meeting that fusion ignition "is a major goal for NNSA/Defense Programs and will be a major focus." He said that although "Defense Programs does not have an energy mission, ignition supports the DOE's Office of Fusion Energy Sciences (OFES) mission and OFES use of NNSA's inertial confinement fusion facilities is accepted." He said that "inertial fusion will be achieved, probably in various forms" and that the "precise nature of technology best suited to exploit ignition for energy will depend on what approach works best."

Crandall noted that "ignition appears feasible over a wider range of target and laser conditions and that range may widen further within a few years." "Predicted gains (fusion energy produced/laser energy input) have increased," he said. He said that "direct drive ignition shows promise," and that "recent experiments have shown improved target performance" for both direct and indirect drive. He also noted that "significant progress has been made in producing cryogenic targets for both x-ray and direct drive."

Crandall reported that a refurbishment of the Z facility at Sandia National Laboratories is in progress at a total cost of $57 million over 4-5 years. The facility, to be called ZR, will have somewhat higher current and energy per pulse than the present Z facility. He also noted that plans are underway for at $45-55 million "extended performance" upgrade to the Omega laser at the University of Rochester. Two high-energy petawatt lasers will be added to Omega for advanced backlighting and fast ignition experiments. Crandall said "a worldwide race for high-energy petawatt lasers is in progress."

FPA Annual Meeting Presentations

Presentations at Fusion Power Associates November 19-21, 2003, annual meeting and symposium, Forum on the Future of Fusion, are posted at http://fire.pppl.gov/fpa_annual03.html

The presentations include a perspective on fusion within the U.S. government from Dr. Ray Orbach, director of the DOE Office of Science, and from Dr. Joel Parriott, fusion budget examiner at the White House Office of Management and Budget.

A comprehensive set of presentations on the status of ITER is included, as well as a series of talks on the status of burning plasma and tokamak physics, and also an overview of the innovative concepts program and spherical torus research.

A comprehensive set of presentations is also included on all aspects of inertial fusion, including the present status of the National Ignition Facility (NIF).

Overviews are also presented of both the Office of Fusion Energy Sciences programs and the inertial confinement fusion program of the National Nuclear Security Administration.

A summary of the symposium will be published in the Journal of Fusion Energy at a later date.

House Senate Conferees Agree on FY04 Fusion Funding

House and Senate Conferees have resolved differences in their separate appropriations bills to provide FY04 funding to fusion and other Department of Energy Programs.

The agreement provides $264.1 M, to DOE's Office of Fusion Energy Sciences, an increase of $6.8 M over the Presidents request. It directs this money be provided to non-ITER-related activities to domestic fusion programs that had been largely eliminated in the fusion technology areas in the President's budget. It also provides $517.3 M to DOE's National Nuclear Security Administration's inertial confinement fusion program, an increase of $50.5 M over the President's request.

The agreement provides $25 M to continue the high average power laser program. For several years DOE has consistently refused to request funds for this program and Congress has consistently added the funds for this excellent program. The agreement also provides $4 M to "initiate assessments and initial development and testing of Z-pinch inertial fusion energy. These two programs are to be funded within the DOE's National Nuclear Security Administration's inertial confinement fusion program.

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SPHERICAL TORUS SETS NEW RECORDS
DOE PROPOSES INCREASED ITER FUNDING AND TERMINATION OF FUSION TECHNOLOGY EFFORTS

NSTX Sets New Records

The National Spherical Torus Experiment (NSTX) at the Princeton Plasma Physics Laboratory has been out of operation for the past year making repairs to a magnet that failed. It recently came back on line and, in its first full week of operations, set records for both toroidal and normalized beta. Beta is the ratio of plasma pressure to magnetic field pressure and is an important measure of fusion power density and efficiency. Using strong neutral beam heating, the NSTX team achieved toroidal betas of up to 37% and normalized betas of up to 7.

Machine performance was aided by boronization and conditioning of the neutral beam systems. High toroidal beta values were achieved with the plasma current being ramped to 1.3 MA. The high normalized beta was obtained through current ramp down experiments in which beta-poloidal reached 1.5. Global confinement times were calculated to be approximately twice the conventional L-mode scaling value for both L- and H-mode plasmas.

The neutral beam systems were able to support these experiments with all three sources operating at 90 keV for a total neutral power of over 6 MW.

Information on NSTX is posted at
http://www.pppl.gov/projects/pages/nstx.html

FY 2005 Fusion Budget Request

President Bush sent his Fiscal Year 2005 Budget Request to Congress on February 2, 2004. For the Department of Energy's Office of Fusion Energy Sciences, the President requests $264.1 million, the same amount Congress appropriated for FY 2004. The President, however, proposes to distribute those funds somewhat differently, primarily by re-directing some additional resources in support of the international ITER tokamak project. All long-range fusion technology programs (a total of $3.1 million in FY 2004) would be terminated. Direct ITER funding would be increased from $3 million in FY 2004 to $7 million in FY 2005 and an additional $31 million of ongoing tokamak research would be refocused in support of ITER.

Of the $264 million, $13.9 million would be devoted to inertial fusion energy, with the balance focused on magnetic fusion energy science. $18.1 million would be spent on innovative alternate concepts research other than than the Spherical Torus (NSTX), Compact Stellarator (NCSX) and Reversed Field Pinch (MST).

In unveiling the DOE budget, Energy Secretary Abraham said that within the $264 million fusion budget request, "DOE's contribution to the International Thermonuclear Experimental Reactor (ITER) project in FY 2005 is $38 million, $30 million more than last year, and is consistent with the Administration's renewed commitment to contribute to this $5 billion cost-shared project that may ultimately lead to a fusion power plant that delivers electric power to the grid.

Details of the fusion budget request are posted at http://fire.pppl.gov

In addition to the civilian fusion effort in the U.S. Department of Energy (DOE) Office of Fusion Energy Sciences, the DOE also funds an effort in Inertial Confinement Fusion (ICF) in its National Nuclear Security Administration (NNSA).

In his FY 2005 budget, recently submitted to Congress, the President requests $492 million, compared to $514.3

million appropriated by Congress in FY 2004. As in previous years, the DOE NNSA failed to request continuation of efforts important for civilian energy applications of ICF. Those programs , added by Congress, were funded at a level of $28.78 million in FY 2004. Of the $492 M requested, $130 million is for continuation of construction of the National Ignition Facility (NIF).

Orbach Testifies to Congress

Dr. Raymond L. Orbach, Director of the US Department of Energy Office of Science, testified to the Committee on Science, U.S. House of Representatives, on February 11, 2004.

Orbach said that the Office of Science FY 2005 budget request is $3.432 billion, a $68,451,000 decrease over the FY 2004 appropriation levels. When $140,762,000 for FY 2004 Congressionally-directed projects is set aside, there is an increase of $72,311,000 in FY 2005. When compared to the FY 2004 comparable President's Request, the FY 2005 request increases $104,885,000 or 3.2 percent. This request allows us to increase support for high priority scientific research, increase operations at our key scientific user facilities, keep existing construction projects on schedule, and support new initiatives. This request, coming at a time of tight overall Federal budgets, is also a demonstration of the Administration's support for basic research and the role that fundamental science plays in keeping our Nation strong and secure.

Orbach said the Fusion Energy Sciences (FES) program "advances the theoretical and experimental understanding of plasma and fusion science, including a close collaboration with international partners in identifying and exploring plasma and fusion physics issues through specialized facilities. This includes:

1) exploring basic issues in plasma science;
2) developing the scientific basis and computational tools to predict the behavior of magnetically confined plasmas;
3) using the advances in tokamak research to enable the initiation of the burning plasma physics phase of the Fusion Energy Sciences program;
4) exploring innovative confinement options that offer the potential of more attractive fusion energy sources in the long term; 5
5) focusing on the scientific issues of non-neutral plasma physics and High Energy Density Physics;
6) developing the cutting edge technologies that enable fusion facilities to achieve their scientific goals; and
7) advancing the science base for innovative materials to establish the economic feasibility and environmental quality of fusion energy."

Orbach said that when the President announced that the U.S. would join in the International Thermonuclear Experimental Reactor (ITER) project he noted that "the results of ITER will advance the effort to produce clean, safe, renewable, and commercially available fusion energy by the middle of this century." He said "To this end, the Department continues its commitment to the future of Fusion Energy Science research with a request of $264.1 million, slightly above the FY 2004 level. Within that amount, DOE's funding in preparation for ITER in FY 2005 is $38 million, $30 million more than last year. Of this $38 million, $7 million is for engineers who support the International Team and for the qualification of vendors for superconducting cable. The other $31 million is for experiments on our tokamak facilities and for component R&D in our laboratories and universities that is closely related to our ongoing program but which is focused on ITER's specific needs."

Orbach noted that fabrication of the National Compact Stellarator Experiment (NCSX) will continue with a target of FY 2008 for the initial operation of "this innovative new confinement system that is the product of advances in physics understanding and computer modeling." In addition, work will be initiated on the Fusion Simulation Project to provide an integrated simulation and modeling capability for magnetic fusion energy confinement systems over a 15-year development period. He said, "The Inertial Fusion Energy research program will be redirected toward high energy density physics research based on recommendations of the recently established Interagency Task Force on High Energy Density Physics."

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U. S. TO TERMINATE FUSION TECHNOLOGY EFFORTS PANEL ENDORSES BALANCED INERTIAL FUSION EFFORT

USDOE Plans Termination of All Fusion Technology Efforts

According to the U.S. Department of Energy's FY 2005 budget submission to Congress, and a subsequent clarifying letter from DOE Office of Science director Raymond Orbach, the Department plans to terminate all its efforts on Fusion Technology by September 30 of this year. These efforts were funded at a level of $11.1 million in FY 2003. In a related action, the DOE also plans to reduce its efforts on Advanced Design and Analysis of fusion energy systems from $6 million in FY 2003 to $2.6 million in FY 2005. The DOE had proposed last year to terminate the Fusion Technology effort in FY 2004 but a Congressional add-on and a strongly-worded letter to Orbach from his Fusion Energy Sciences Advisory Committee (FESAC), resulted in a partial reprieve. DOE has since announced that it used the Congressional add-on to plan for "orderly close-out" of the Fusion Technology programs in FY 2004.

In its letter to Orbach last year, FESAC said, "...devastating cuts in certain program elements are alarming; this note expresses our most serious concerns," and commented, "Thus, FESAC is puzzled by the elimination in the FY 2004 budget of funding for fusion technology." The FESAC said, "Similarly, inertial fusion energy (IFE) is an important element of a balanced US fusion program: it provides the principal alternative to magnetic fusion and takes advantage of NNSA investments in the National Ignition Facility. The FY 2004 budget, however, eliminates (fusion) chamber technology for both MFE (magnetic fusion energy) and IFE. With respect to the Advanced Design and Analysis program, the FESAC said, "The study of future energy systems is a central component of fusion research. Its evolving conceptualization of an eventual fusion power plant has helped us visualize our target, while allowing us to identify key scientific challenges." "In summary," the 2003 FESAC letter said, "FESAC finds the Presidential request for fusion research funding in FY 2004 to be not only meager but also harmfully distorted. It terminates components of the program that are truly essential." The recent FY 2005 budget request is similar to the FY 2004 with regard to the funding distributions criticized by FESAC in 2003.

In a recent letter to Livermore scientist John Lindl, DOE Office of Science director Ray Orbach defended the planned termination of the Fusion Technology effort, saying, "The issue really is the degree to which our Fusion Energy Sciences program should become an energy development program. The Administration position on this issue is that now is not the right time for us to invest energy related R&D for fusion, either for MFE or for IFE." Orbach said, "For MFE, funding for energy relevant technology R&D will wait for the results of ITER. Similarly, for IFE, we will wait for the achievement of ignition and gain before investing in the technology required for energy applications." "Until we are confident that we understand the science of fusion, we would be taking an unacceptable risk to commit the sums required to develop the technology needed to apply that science," Orbach said.

Critics of the Orbach letter point out that, even at the FY 2003 level of $11 million, the programs at issue were only about 5% of the fusion budget, that the science of fusion was judged sufficiently understood to justify the construction of NIF (a $4 billion expenditure) and the proposed construction of ITER (an estimated $5 billion expenditure), and that various review panels have judged the probability of NIF and ITER achieving their performance objectives to be high. Critics say that it is one thing to differ on the amount to be spent preparing for the longer term and quite another to have a policy to spend nothing.

The complete text of the Orbach letter to John Lindl and Lindl's original email to Orbach are available from Fusion Power Associates.

FESAC Panel Urges Balanced Inertial Fusion Energy Effort

A panel of the Department of Energy's Fusion Energy Sciences Advisory Committee (FESAC), charged with reviewing its Inertial Fusion Energy (IFE) program, has urged the Department to carry out "a coordinated program with some level of research on all the key components (targets, drivers and chambers), always keeping the end product and its explicit requirements in mind." The wording is intended to call attention to the fact the DOE recently announced termination of all its efforts on targets and chambers for IFE as part of its plan to end all work on Fusion Technology.

The panel noted that there are three main approaches to IFE, based on heavy ion accelerators, lasers, and z-pinches. They said, "The recent progress related to these approaches is substantial and the quality of science and engineering research is excellent." They said, "All approaches are currently on track for developing the science and technology to properly evaluate their potential for IFE. However, the planned termination of technology programs in support of the heavy ion approach is not consistent with their importance to heavy ion IFE, and the Panel is concerned about the impact of this action."

The Panel said that "each of the approaches to IFE may benefit if the technique of Fast Ignition proves effective. However, since fast ignition is at an early stage of development it would be premature for any of the IFE approaches to rely on the success of fast ignition to achieve an attractive fusion energy system."

"In sum," the Panel said, "the IFE Panel is of the unanimous opinion that the IFE program is technically excellent and that it contributes in ways that are noteworthy to the ongoing missions of the DOE. Moreover, the Panel agrees with the IFE community that the most efficient way to achieve the ultimate goal of fusion energy is to carry out a coordinated program with some level of research on all of the key components (targets, drivers, and chambers), always keeping the end product and its explicit requirements in mind."

The Panel also noted that "the scientific and technical challenges posed by IFE, along with their many connections to high energy density physics, have attracted many outstanding researchers from academia as well as federal laboratories. Success will depend on sustaining the commitment and involvement of such people in a broad spectrum of scientific disciplines."

The Panel was chaired by Rulon Linford (University of California), with Vice Chairs Jill Dahlburg (US Naval Research Laboratory) and Riccardo Betti (University of Rochester).

The full FESAC endorsed the Panel report at it meeting March 29, and transmitted it to DOE Office of Science Director Ray Orbach, stating, "The Fusion Energy Sciences Advisory Committee (FESAC) has reviewed the enclosed report, "A Review of the Inertial Fusion Energy Program," and submits it to you with our full endorsement." The FESAC is chaired by Richard Hazeltine (University of Texas).

Copies of the Executive Summary are available from Fusion Power Associates: fpa@fusionpwrassoc.org.

Components Arriving for New German Stellarator

The first major components have been delivered for the new, billion-dollar-class stellarator, Wendelstein 7-X, being constructed in Greifswald, Germany. The components include a magnet coil, the first plasma vessel segment, vessel ports and a microwave transmitter for plasma heating. Stellarators are magnetic fusion configurations similar to tokamak configurations but having no plasma current. A much smaller ($86 million) "compact stellarator" is under construction in the U.S. at the Princeton Plasma Physics Laboratory. A billion-dollar-class stellarator,LHD, is already in operation in Japan.

Wendelstein 7-X is scheduled for completion in 2010.

The Wendelstein 7-X will be heated in continuous mode by ten microwave gyrotrons, each having one megawatt of power at a frequency of 140 gigahertz. Such gyrotrons previously have been limited to pulses of a few seconds and powers of a few hundred kilowatts. The improved tubes are being developed by the French company, Thales Electron Devices, and by the U.S. company Communication and Power Industries (CPI).

Further information is posted at http://www.ipp.mpg.de

Information on the Japanese LHD stellarator is posted at http://www.lhd.nifs.ac.jp

Information on the U.S. compact stellarator, NCSX, is posted at http://www.pppl.gov/projects/pages/ncsx.html

A newsletter describing international stellarator research results is available at http://www.ornl.gov/fed/stelnews/

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ITER SITE STILL NOT CHOSEN
HOUSE RECOMMENDS HIGHER FUSION FUNDING

ITER SITE STILL IN DOUBT

The good ship ITER remains at sea without a port in sight. A site was to have been chosen in December 2003 but the six ITER participants (European Union [EU], Japan, China, Russia, Republic of Korea and the United States) remain split down the middle, with the EU, China and Russia supporting a site in France and the other three supporting a site in Japan.

The participants have reportedly agreed on how to share the construction costs and to a large degree on how to distribute the component construction tasks. Decisions on key personnel and organizational logistics await the site decision.

Officials at the vice-ministerial level from the European Union (EU), Japan, China, Korea, Russia and the United States, failed to reach an agreement on where to site the $10 billion International Thermonuclear Experimental Reactor (ITER) at a June 18 meeting in Vienna.

According to news reports, Japan offered to increase its contribution to the construction cost of ITER from 48% to 50% and also to pay half of an estimated $800 million cost for an auxiliary fusion facility to be built in Europe. The European Union representative reportedly matched the offer.

These reports have not been officially confirmed by either the EU or the Japanese government, but one news account states that the additional funds from Japan would be offered in part to help pay the cost of providing a remote ITER research center in France and in part as a reserve in case any of the participants backs out of the project. One news account states that during recent talks between EU and Japanese officials, "the EU suggested that the plant could be built in Japan if Japan was willing to increase its contribution to help cover the construction cost of ITER-related facilities to be built in France."

At the conclusion of the June 18 meeting the parties issued the following official statement:

"Common Message from 3rd Preparatory Meeting for ITER Decision Making (IAEA Vienna, 18 June 2004) Delegations from China, European Union, Japan, the Republic of Korea, the Russian Federation, and the United States met at the IAEA headquarters in Vienna on 18 June 2004 to advance the ITER negotiations. The two potential Host Parties, European Union and Japan, presented their positions, taking account of recent bilateral discussions on a broader approach to realising fusion energy. The parties noted that the contents of these offers were essentially symmetrical and showed a readiness of each of the potential Host Parties to contribute significantly to the realisation of elements of the Broader Approach other than ITER in addition to their contributions to ITER itself. All Parties stressed the urgency of reaching a rapid resolution of the siting issue so as to move forward to implementation of ITER in a framework of international collaboration."

In September 2002, the USDOE's Fusion Energy Sciences Advisory Committee reiterated a position it had taken a year before that if the ITER project "does not move forward" by July 2004, then the U.S. should put forth the less ambitious FIRE project "as a U.S.-based burning plasma experiment with strong encouragement of international participation." However, the USDOE has indicated it plans to terminate its FIRE activities shortly and has already begun to redirect millions of dollars of its current fusion research effort in support of ITER on the assumption that ITER is going to proceed.

ITER news is posted at http://fire.pppl.gov

House Committee Urges Increased Fusion Funds

The Appropriations Committee of the U. S. House of Representatives has "marked up" the FY2005 appropriations bill. The bill provides $276 million to the DOE Office of Fusion Energy Sciences, $12 million more than requested by the President. The report states:

"The Committee recommendation for fusion energy sciences is $276,110,000, an increase of $12,000,000 over the budget request. The additional $12,000,000 is to be used to increase the utilization of existing large and small experiments; further work in inertial fusion technology; take advantage of opportunities in High Energy Density Physics, including research on fast ignition, and large-scale scientific computing; and provide for cost-effective construction and development of the National Compact Stellarator Experiment. The Committee notes the delay in site selection for the International Thermonuclear Experimental Reactor (ITER) and expects the Department to reduce its planned expenditures on ITER in fiscal year 2005 in consideration of this delay."

The Committee also added funds to the President's request for Inertial Confinement Fusion in DOE's National Nuclear Security Administration's budget and issued the following report.

"Inertial Confinement Fusion Ignition and High Yield Campaign.--The Committee recommends $545,034,000 for the inertial confinement fusion program, an increase of $53,000,000 over the budget request of $492,034,000. The Committee is greatly concerned by the Department's fiscal year 2005 budget justification as it related to the program goals for the National Ignition Facility (NIF). In the budget justification, the NNSA seemed to waiver in its commitment to NIF by delaying the proposed date for achieving ignition from 2010 to 2014. The Committee views ignition as the sole benchmark for success in this program and is very concerned the four-year slip in the ignition milestone buried in the NNSA's budget justification documents represents a change in the Department's commitment to ignition in favor of less challenging goals for the NIF. The Committee's priority is on completion of the project in 2008 and achieving the functional requirement of first ignition in 2010. The Committee directs that no funds be expended, directly or indirectly, for additional capabilities for NIF that are not specified in the current baseline until the NIF project is completed in 2008 and ignition attempted in 2010. Any diversions represent significant risk to a project that has already experienced well-publicized cost and schedule problems. The Committee's appropriation for the ICF campaign will be controlled at the major technical effort (MTE) subprogram level noted in the Committee Report tables. Neither the Department nor the national laboratory will divert funds from within the control levels as appropriated without first submitting a formal reprogramming request to the Appropriations and Armed Services Committees.

"The Committee directs the NNSA to develop a management process that is consistent with DOE Order 413.3 and manages the ignition, diagnostic, cryogenic and experimental subprograms as projects incorporating a work breakdown structure to track scope, cost, schedule, and key milestones within a management control system. The Committee directs the NNSA to report quarterly on the milestone cost and schedule variance within the respective experimental programs from the NIF 2000 rebaselined program.

"The Committee notes that the Defense Science Board (DSB) has been asked to review the NIF Activation and Early Use Plan. The Committee expects the NNSA to submit a copy of the NIF Activation and Early Use Plan to the Committee by September 30, 2004, and a copy of the DSB report when it is completed. The Committee expects the NNSA to insist on a review body that represents the best independent external review capability, free of professional or personal relationships that may lead to the appearance of partiality in the content of the report. The Committee recommendation provides $130,000,000 for construction of the National Ignition Facility (NIF), the same as the budget request.

"The Committee recommendation includes $25,000,000 to continue development of high average power lasers and supporting science and technology within the Inertial Fusion Technology line. The Committee recommendation includes thebudget request of $11,049,000 for the Naval Research Laboratory, and $73,469,000 for the University of Rochester, an increase of $28,000,000 over the budget request. The additional funding has been provided for the University of Rochester's Laboratory for Laser Energetics within the High-Energy Petawatt Laser Development MTE to accelerate the OMEGA Extended Performance capability, a four beam super-high-intensity, high-energy laser facility for support of the nation's stockpile stewardship program. The Committee notes that, other than the few operational beams of NIF, the OMEGA facility is the only large laser implosion facility available for NNSA weapons work and will continue to be a primary laser facility for NNSA Stockpile Stewardship activities. The Committee notes that the University of Rochester is providing over $20 million for the building to house the OMEGA extended performance."

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LDX EXPERIMENTS COMMENCE
ROCHESTER IMPLODES CRYO TARGETS
FPA 2004 AWARDS ANNOUNCED

Bush and Kerry on Fusion

Nature and Science magazines posed questions on science, environment and energy policy to Presidential candidates George Bush and John Kerry. Their responses are posted at http://fire.pppl.gov

With respect to fusion and ITER the questions and responses to Science were as follows:

Science: By siding with Japan, the United States has contributed to the current stalemate over where to build the International Thermonuclear Experimental Reactor (ITER). Would you shift support to Europe as a way to move this project forward? At what point would you withdraw U.S. support for this project?

Kerry: My energy plan will tap America's initiative and ingenuity to strengthen our national security, grow our economy an protect our environment. With regard to ITER, John Edwards and I support a strategically balanced United States fusion programme that includes participation in ITER to supplement a strong domestic fusion science and technology portfolio. As president, my first priority internationally on this and other energy issues will be to engage other nations to find areas of cooperation and common ground.

Bush: I remain committed to building the ITER project, and based on recommendations from the Department of Energy, I believe Japan is the best location for ITER. My administration will continue to collaborate with all ITER participants, including our European partners, in realizing the promise of fusion energy through ITER. This project is one of the four "transformational technology" pillars of my climate change strategy, which focuses on building the emissions-free technologies of the future. From an inexhaustible and entirely clean fuel source, a fusion plant could generate huge amounts of electricity to power megacities and to produce hydrogen.

LDX Begins Plasma Experiments

On Friday August 13, the first plasma physics experiments were conducted using the Levitated Dipole Experiment (LDX). LDX was built at MIT's Plasma Science and Fusion Center as a joint research project of Columbia University and MIT. This major milestone for the project signifies the completion of the fabrication of the experimental device and the initiation of scientific studies.

The Levitated Dipole Experiment (LDX) is a first-of-its-kind experiment incorporating three superconducting magnets and exploring the physics of high-temperature plasma confined by magnetic fields that resemble those surrounding magnetized planets, like Earth and Jupiter. The goal of the experiment is to study the properties of the confined plasma and to determine whether larger dipole magnets could someday be used to create a source of fusion power.

In the experiment, a large superconducting charging coil was used to inductively energize a compact, high-current superconducting ring to more than 750,000 amperes. After disconnecting all cyrogenic and diagnostic services from the superconducting ring, it was twice lifted to the center of a large 16-foot diameter ultra-high vacuum chamber where it maintained a strong dipole magnetic field for over four hours of scientific experiments.

Four dozen deuterium plasma discharges, each lasting from 5 to 10 seconds in duration, were formed with 10 second pulses of multi-frequency microwave heating up to 6.2 kW. Each plasma contained a large fraction of energetic and relativistic electrons that created a

significant pressure that caused outward expansion of the magnetic field.

Many measurements were recorded including multi-cord x-ray spectroscopy that measures the energetic electron temperature profile, arrays of magnetic flux loops and sensors that measure the pressure-driven diamagnetic currents, visible video photography that measures the evolution of the plasma structure, microwave interferometry that measures plasma density, and electrostatic probes inserted to measure the parameters of the edge plasma. Detailed analysis of the measurements are just underway.

The experiments were conducted by a team of five graduate students, two undergraduate students, and several technicians, superconducting magnet engineers, and plasma scientists, and include Alex Boxer, Jennifer Ellsworth, Darren Garnier, Alex Hansen, Ishtak Karim, Jay Kesner, Rick Lations, Scott Mahar, Mike Mauel, Phil Michael, Joseph Minervini, Eugenio Oritz, Austin Roach, Don Strahan, Alex Zhukovsky, and Michelle Zimmermann.

Additional details, photographs, and video are available at the LDX homepage at http://www.psfc.mit.edu/ldx/ .

Rochester Tests Targets

Beginning in April 2004 and continuing through the present, scientists at the University of Rochester Laboratory for Laser Energetics (LLE) have performed implosion experiments on deuterium-filled cryogenic targets using the OMEGA laser. They have successfully produced targets with cryo layer smoothness close to 2 micron rms and produced record neutron yields for deuterium-filled targets in close agreement with the predictions of 1-D multidimensional hydrodynamic codes.

Further information on the programs at LLE can be found at http://www.lle.rochester.edu/ or by contacting Wolf Seka (seka@lle.rochester.edu) or John Soures (jsou@lle.rochester.edu).

FPA Announces 2004 Awards

Fusion Power Associates Board of Directors announces the recipients of its 2004 Awards. Previous recipients are posted at http://fusionpower.org and click on Awards. The awards will be presented at the FPA 2004 annual meeting and symposium, December 13 in Gaithersburg, MD.

LEADERSHIP AWARDS

FPA 2004 Leadership Awards will be presented to **Raymond Fonck** (University of Wisconsin) and to **Farrokh Najmabadi** (University of California, San Diego).

In selecting Dr. Fonck, the Board recognizes his many scientific contributions to the study of plasmas in both tokamak and alternate confinement concepts and especially notes the important leadership role he played in securing priority for the study of burning plasmas both within the fusion community and through his role as co-chair of the National Academies' Burning Plasma Assessment Committee.

In selecting Dr. Najmabadi, the Board recognizes his many contributions to a variety of fusion concepts and especially commends him for his recognition of the importance of the inter-related physics/technology systems aspects of these concepts. The Board also notes the important role he has played as leader of the national fusion power plant studies, which have provided perspective and guidance for the near-term fusion research effort.

DISTINGUISHED CAREER AWARD

The FPA 2004 Distinguished Career Award will be presented to Prof. **Bruno Coppi** (MIT). In selecting Prof. Coppi, the Board recognizes his seminal contributions to plasma and fusion science over many decades. The Board notes that the world fusion effort is especially in his debt for his early and continuing recognition of the importance of high magnetic field in the design and operation of tokamak fusion devices and for his tireless efforts to urge the construction of a fusion ignition experiment.

FUSION ENGINEERING AWARD

The FPA 2004 Excellence in Fusion Engineering Award, established in memory of MIT Professor of Nuclear Engineering David J. Rose, will be presented to **Camille Bibeau** (Lawrence Livermore National Laboratory). In selecting Dr. Bibeau, the FPA Board recognizes her many technical contributions to the design, construction and operation of laser systems, as evidenced by her exemplary publications record and her role as Project Leader of the Mercury diode-pumped solid state laser program at LLNL. The Board especially recognizes her outstanding communications skills in providing clear and understandable presentations on highly complex topics to a variety of audiences.

FUSION POWER ASSOCIATES
EXECUTIVE NEWSLETTER

2 Professional Drive, Suite 249, Gaithersburg, Maryland 20879 • 301-258-0545 • Fax: 301-975-9869 • E-mail: fpa@compuserve.com

http://fusionpower.org

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OMEGA LASER SETS RECORD FOR NUMBER OF SHOTS
NIF IGNITION PROSPECTS ENHANCED
ITER SITE STILL NOT SETTLED

OMEGA Laser Sets Record

During Fiscal Year 2004, a total of 1558 target shots were taken on the OMEGA laser facility at the University of Rochester Laboratory for Laser Energetics. This is a record high number of target shots for OMEGA in any year and the highest number of target shots ever taken in a single year by a comparable-sized inertial confinement fusion facility.

Over 50% of the shots were conducted for external users, including the Lawrence Livermore National Laboratory, the Los Alamos Scientific Laboratory, the Sandia National Laboratories, the Naval Research Laboratory, and other users. The 60-beam OMEGA laser facility has produced over 10,000 target shots during a decade of operations beginning in FY 1995.

For further information contact:
seka@lle.rochester.edu or
jsou@lle.rochester.edu

NIF Ignition Prospects Enhanced

A new point design has been adopted for ignition target capsules for the National Ignition Facility (NIF) at the Lawrence Livermore National Laboratory (LLNL). Computer simulations show significantly greater resistance to hydrodynamic instabilities in the new designs, allowing almost an order of magnitude relaxation on specifications for surface roughness over previous designs. Furthermore, the enhanced hydrodynamic stability opens the possibility of in-situ filling of the capsule with the DT fusion fuel using a small tube, a significant simplification in the capsule filling and fielding process. Details of the advance are posted at
http://www.llnl.gov/nif/icf/icfpubs/highlights/04_may_jun.pdf

ITER Update

As the year 2004 draws near to a close, high level meetings between officials of the European Union (EU) and Japan remain at an impasse on a formula for breaking the deadlock over ITER siting. The other ITER Parties (China, Russia, Republic of Korea and the U. S) have been pressuring the EU and Japan to negotiate an agreement on the site on a bilateral basis and to bring that agreement back to the ministers of the six Parties.

The European Commission has reportedly recommended that the EU take the initiative to proceed with ITER construction in France if a 6-Party agreement cannot be reached by the end of the year. At a meeting of the European Council of Ministers November 25, the Council agreed with the Commission's recommendation but urged the Commission to continue to negotiate with Japan in hopes of reaching a 6-Party consensus on the site.

The various ITER news stories are posted at http://fire.pppl.gov

House-Senate Conferees Agree on FY2005 Funding

House and Senate Conferees agreed on fusion funding for FY2005, which began on October 1, 2004. The House and Senate are expected to pass the bill and send it to the President.

For the Office of Fusion Energy Sciences (OFES), the conferees agreed to provide $276,110,000 which is $12 million over the President's request. The said "The additional $12 million is to be used to increase utilization of existing large and small experiments; further work in inertial fusion technology; take advantage of opportunities in High Energy Density Physics, including work on fast ignition, and large scale scientific computing; and provide for cost-effective construction

and development of the National Compact Stellarator Experiment." They also said, "The conference notes the delay in site selection for the International Thermonuclear Experimental Reactor (ITER) and directs the Department to reduce its planned expenditures on ITER in fiscal year 2005 in consideration of this delay."

For inertial confinement fusion (ICF) in the DOE's National Nuclear Security Administration's account, the conferees agreed to provide $541,034,000. Within the total, they said, "An additional $46 million is provided to support expanded research on non-NIF ICF research including petawatt and high-energy petawatt laser development." They also said, "The conference recommendation includes an additional $6 million for university grants and other support. Of this amount, $3 million is provided for continued development of the petawatt laser at the University of Texas at Austin; $1 million is provided for an optical parametric chirped pulse amplifier upgrade and associated operations of the short pulse laser at the University of Nevada, Reno; $1 million is provided to the University of Nevada, Reno to continue its collaboration with Sandia National Laboratories on highly diagnosed studies of exploding wire arrays and implosion dynamics; and $1 million is provided for research using the Z-Beamlet laser at Sandia National Laboratories under the Z-Petawatt Consortium...."

They also said, "The conferees also include $25 million to continue development of high average power lasers and supporting science and technology, the budget request for the Naval Research Laboratory, and $73,469,000 for the University of Rochester, an increase of $28 million over the budget request." They also said, "The conference recommendation includes $9 million to initiate double-shift operations and assessments and initial development and testing of Z-pinch inertial fusion energy. The conference recommendation includes $1 million to the University of Nevada - Reno for magnetized plasma/laser interaction studies at the Nevada Terawatt Facility, using the Zebra pulse power machine and the Leopard short pulse laser system.

The complete text of the fusion sections of the conference report at posted at http://fire.pppl.gov

Nat Fisch Wins Lawrence Award

Nathaniel Fisch, a Princeton University professor and a scientist at the Princeton Plasma Physics Laboratory (PPPL), is among seven winners of the U. S. Department of Energy's 2004 E.O. Lawrence Award. Each winner receives a gold medal, a citation, and $50,000. The award is given in categories for outstanding contributions in the field of atomic energy, broadly defined.

Fisch is receiving the award in the nuclear technology category for his discovery of ways to use plasma waves to produce electric current. These wave-induced currents can enable tokamak fusion reactors to operate continuously, which is necessary for an economical and practical fusion reactor, the Department said.

The Lawrence Award was established in 1959 to honor the memory of the late Dr. Ernest Orlando Lawrence, who invented the cyclotron (a particle accelerator) and after whom two major Energy Department laboratories in Berkeley and Livermore, Calif., are named. The Secretary of Energy makes the final selection of honorees each year.

In Memoriam: R. S. Pease

R. S. "Bas" Pease, a pioneer scientist of the world fusion program and long time leader of the British fusion effort, died October 17 in England. He was one of the leaders of the world fusion research effort during the 1950s and illuminated many aspects of the pinch effect, especially the limitations on ohmic heating and current in pinch discharges. He retired from his position as Director of the Culham fusion laboratory in 1987. He was the recipient of Fusion Power Associates Distinguished Career Award in 1989.

The world fusion effort has lost one of its legends. Bas was a colorful, "larger than life" figure on the world fusion scene during his decades long career. After his retirement, he was active in the Pugwash Trust, working with a group of eminent scientists encouraging international collaboration for world peace.

In Memoriam: Herman Postma

Herman Postma, former director of the Fusion Energy Division at Oak Ridge National Laboratory (ORNL), died unexpectedly during a trip to Hawaii. He joined the laboratory in 1959 and made many contributions to the science and technology of heating and confinement of fusion plasmas in magnetic mirror and other configurations.

In 1974, at the age of 40, he was named director of ORNL, a post he held until his retirement in 1988. A native of Wilmington, North Carolina, he attended Duke and Harvard universities and did three summer terms at ORNL beginning in 1954.