



United States  
Burning Plasma Organization

# ACTIVITIES OF THE U.S. BURNING PLASMA ORGANIZATION

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**Is this a collaboration?** Yes

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Progress Report will be submitted separately

# Progress Report for Activities of the U.S. Burning Plasma Organization

## 1. Executive Summary

The U.S. Burning Plasma Organization (USBPO) is a national organization of scientists involved in researching the properties of magnetically confined burning fusion plasmas. Its main activities are the coordination, facilitation, and promotion of research activities in the U.S. fusion energy sciences program relevant to burning plasma science and, in particular, of preparations for U.S. participation in the international ITER experiment.

Specifically, the USBPO mission is to advance the scientific understanding of burning plasmas and to ensure the greatest benefit from a burning plasma experiment by coordinating relevant U.S. fusion research with broad community participation.

Its stated goals are the following:

- Coordinate and advocate U.S. Burning Plasma research
- Provide a U.S. organizational structure for participation in BP program
- Optimize U.S. ITER participation and address issues beyond ITER
- Educate and advocate BP science to the wider scientific community
- Closely coordinate U.S. activities with U.S. ITER Project Office
- Facilitate strong interactions with international partners

Calendar year 2008 was yet another extremely busy year of USBPO activities. To cite a few examples:

- Strong U.S. scientific involvement in addressing the urgent R&D issues for ITER (including the so-called 13 STAC Issues), with results presented at the IAEA Fusion Energy Conference
- Rotation of ITPA topical group membership and leaders
- Involvement in the development and analysis of the ITER Research Plan and the ITER Work Program documents
- ITER Town Meeting and ITER contributed-oral session at the APS Division of Plasma Physics Meeting
- National Research Council review of the Energy Policy Act Report

The current USBPO membership (i.e., registered members in the ten USBPO topical groups) is 314 persons, consisting of 300 regular members and 14 associate members. The current number of subscribers for *eNews*, the monthly USBPO electronic newsletter, stands at 450.

## 2. Directorate

The USBPO Directorate acts to facilitate the definition, participation, and execution of burning plasma research activities. The USBPO leadership is as follows:

- Director: James W. Van Dam (University of Texas)

- Deputy Director: Charles Greenfield (General Atomics)
- Assistant Director for ITER Liaison: Nermin Uckan (Oak Ridge National Laboratory)
- Administrator: Rita Wilkinson (University of Texas)
- Web site manager: James DeKock (University of Wisconsin)

The Directorate also includes the leaders and deputy leaders of the USBPO Topical Groups, who constitute the Research Committee. Meetings of the Research Committee are held every other week. The Deputy Director serves as the chair of the Research Committee.

The Director, Deputy Director, and Assistant Director for ITER Liaison also meet on a semi-regular basis with the USBPO Council to hold discussions and make decisions concerning policy and directions.

Emily Hooks ably served as the USBPO Administrator (and assistant editor of *eNews*) until February 2009, when she was recruited to another position at The University of Texas at Austin. Rita Wilkinson has replaced her in this position.

### 3. Council

The Council is the advisory body of the USBPO. It provides oversight of USBPO activities and is responsible for long-term strategic planning of burning plasma research. The Council sets the policies and procedures of the USBPO, including the Charter and Bylaws governing USBPO activities.

The leadership of the Council is as follows:

- Chair: Amanda Hubbard (Massachusetts Institute of Technology)
- Vice-Chair: Michael Zarnstorff (Princeton Plasma Physics Laboratory)

The members of the Council are listed in Table 1. As specified in the USBPO Bylaws, the Council has 12 regular members who serve staggered terms of 3 years each. Council members cannot serve consecutive terms. Elections for Council members are to be held annually to replace half of the members whose terms are ending. The remainder of the open Council seats will be filled by appointment. In order to bring the number of its members down to the level indicated in the USBPO Charter, the Council determined not to replace Steve Cowley (UCLA), one of its members, who resigned in 2008 in connection with becoming the next Director of UKAEA Culham Laboratory

In mid-2008 the Council replaced four of its members. Two of the new Council members were elected by the general USBPO membership, viz., Martin Greenwald (MIT) and Ed Synakowski (LLNL). The election—which was the first ever for the Council—was held with the use of a specialized web site at the University of Wisconsin under the supervision of the USBPO web site manager. In accordance with the Charter, the USBPO Director appointed two more new Council members: C. S. Chang (NYU) and Michael Ulrickson (SNL). Partial rotation of Council membership in this manner will occur every year. We thank Steve Allen, Dave Petti, Earl Marmar, and Jerry Navratil, who retired from the Council, for their excellent service.

The entire USBPO Council—including the incoming members for the first time and the outgoing members for the last time—held a meeting by videoconference on July 16, led by Council chair Amanda Hubbard. Items on the agenda included a proposal for several new USBPO topical

group leaders, the revised U.S. membership for the Integrated Tokamak Physics Activity (ITPA) with interface to the USBPO, a report from the Council's strategic planning panel on burning plasma research, and suggestions for USBPO activities at the upcoming 2008 APS Division of Plasma Physics Annual Meeting.

The following Council meetings were held last year:

- Wednesday, March 5, 2008, 1:00-3:00 p.m. EST (via video conference)
- Wednesday, July 16, 2008, 3:30-5:30 p.m. EDT (via video conference)
- Wednesday, October 8, 2008, 1:00-3:00 p.m. EDT (via video conference)
- Tuesday, November 18, 2008, 12:45-2:00 p.m. EST (during the APS-DPP Annual Meeting in Dallas, TX)

Minutes of the Council meetings are posted on the USBPO web site.

### ***ITER Planning Subcommittee***

A subcommittee of the Council was set up in late 2007 to carry out long-range planning related to burning plasma scientific research. This group was led by Earl Marmor and included both Council members as well as other experts from the fusion community: Steve Allen, Michael Bell, Steve Knowlton, Farroukh Najmabadi, Hutch Neilson, Martin Peng, Phil Snyder, Ted Strait, George Tynan, and Nermin Uckan. (Cary Forest and Dennis Whyte were also members until they were asked to serve on the NRC panel to review U.S. involvement in ITER.) The subcommittee's report about updating plans for U.S. participation in ITER is almost finished.

### ***Executive Committee***

The USBPO Executive Committee consists of the Council Chair and Vice-Chair, along with the Director, the Deputy Director, the Assistant Director for ITER Liaison, and the OFES ITER Science Manager. The Executive Committee holds meetings by teleconference usually every other week at 12:00 noon ET for approximately one hour. A list of action items is circulated after each meeting. The following meetings were held during the past year:

- Friday, April 4, 2008
- Friday, April 25, 2008
- Friday, June 6, 2008
- Friday, June 13, 2008
- Friday, June 27, 2008
- Friday, July 11, 2008
- Friday, August 8, 2008
- Friday, August 22, 2008
- Wednesday, September 24, 2008
- Friday, October 31, 2008
- Friday, November 14, 2008
- Friday, December 5, 2008
- Thursday, January 15, 2009
- Friday, January 30, 2009
- Friday, February 27, 2009

## 4. USBPO Topical Groups

The Topical Groups represent the resources and expertise of the USBPO. They exist to address the science issues of burning plasmas and provide a venue for community-based burning plasma research. The Topical Groups stimulate, support, organize, define, and execute burning plasma-related research tasks in the U.S. fusion program.

The USBPO has so far established ten Topical Groups focused on distinct sub-areas of burning plasma science. These Topical Groups are the basic organizational structure by which scientists in the U.S. fusion community are involved in USBPO burning plasma research activities. Each Topical Group has a leader and deputy leader(s). The leadership of each Topical Group identifies and promotes research activities for the members of that group. The Topical Groups and their respective leaders and deputy leaders are listed in Table 2. The Director provides guidance for the rotation and selection of new Topical Group leaders, in accordance with the USBPO Charter and Bylaws.

Approximately half of the Topical Group leaders were rotated during 2008. At its March 5, 2008, meeting, the USBPO Council approved Steve Allen (LANL) as the new leader for the Diagnostics topical group, replacing Rejean Boivin, who had served as its leader since the beginning of the USBPO in early 2006 when the topical groups were first formed. Steve had already been serving as co-deputy leader of this group with Jim Terry (MIT), who will continue as the deputy leader. Bill Heidbrink (UCI) stepped down as deputy leader for the Energetic Particles topical group when he became the secretary-treasurer of the APS Division of Plasma Physics. Subsequently the Council approved Don Spong (ORNL) as the new deputy leader for this topical group. The Council also approved the following appointments: Chris Hegna to move up from deputy leader for MHD Macro-stability to leader, and Ted Strait to replace him as the new deputy leader; Edward Doyle to move up from deputy leader for Transport to leader, and John Rice to replace him as the new deputy leader; Chuck Kessel to move up from deputy leader for Integrated Scenarios to leader, and Tim Luce to replace him as the new deputy leader. We thank the retiring Topical Group leaders for their excellent service.

The leaders and deputy leaders of the Topical Groups constitute the Research Committee, which is chaired by the USBPO Deputy Director. The Research Committee held meetings every other week on the following dates, via the ESnet videoconference connection, at 12:00 noon ET for approximately one hour:

- Thursday, January 10, 2008
- Thursday, January 31, 2008
- Wednesday, February 13, 2008
- Wednesday, February 27, 2008
- Wednesday, March 19, 2008
- Wednesday, April 2, 2008
- Wednesday, April 16, 2008
- Wednesday, May 14, 2008
- Wednesday, May 28, 2008
- Wednesday, June 11, 2008
- Wednesday, June 25, 2008
- Wednesday, July 9, 2008
- Wednesday, August 6, 2008

- Wednesday, August 20, 2008
- Wednesday, September 10, 2008
- Wednesday, October 8, 2008
- Wednesday, October 29, 2008
- Wednesday, November 12, 2008
- Tuesday, November 25, 2008
- Tuesday, December 9, 2008
- Tuesday, January 6, 2009
- Tuesday, January 27, 2009

## 5. Task Groups

The USBPO Confinement and Transport Topical Group created a task group on verification and validation. This task group was formed to address the need for active verification and validation of transport models and numerical modeling activities within the U.S. fusion program, a topic of increasing importance for theory and simulations of burning plasmas. The task group came up with several original contributions to the subject of verification and validation, which were published in the following peer-reviewed paper:

*Validation in fusion research: Towards guidelines and best practices*

Phys. Plasmas **15**, 062503 (2008); DOI:10.1063/1.2928909 (published 6 June 2008)

Authors: P. W. Terry, M. Greenwald J.-N. Leboeuf, G. R. McKee, D. R. Mikkelsen, W. M. Nevins, D. E. Newman, D. P. Stotler, Task Group on Verification and Validation, U.S. Burning Plasma Organization, and U.S. Transport Task Force

The Fusion Engineering Science Topical Group set up a task group on the physics and technology issues associated with Test Blanket Modules for ITER. Some of these issues are the effect of TBM-generated ripple on start-up, alpha particle losses, and the H-mode threshold and also the impact of ferromagnetic field correction inserts.

The Boundary Topical Group initiated the creation of a task group to study patterns of impurity and radiation toroidal asymmetries associated with disruptions. The focus is on the radiation distribution during massive gas injection, used for mitigation of disruptions. An urgent need was to estimate how many toroidal injection ports would be needed during massive gas injection in order to avoid beryllium wall melting.

The Integrated Scenarios Topical Group initiated the creation of a Heating Mix Task Group. The purpose of this task group is to analyze the mix of heating and current drive methods for ITER, including lower hybrid current drive, which is not in the baseline operation.

## 6. Coordination with U.S. ITER Project Office

The USBPO Director concurrently serves as the Chief Scientist for the U.S. ITER Project Office. This facilitates close interaction and coordination of activities between the U.S. ITER Project Office (USIPO) and the USBPO.

Working with the USIPO on coordinating the involvement of U.S. scientists in addressing the STAC Issues for the ITER design consumed much of the energy of the USBPO during 2008.

## ***STAC Issues for ITER design***

The Science and Technology Advisory Committee (STAC) of the ITER Council, at its second meeting, identified several high-priority technical issues still to be considered for the ITER design. The ITER Organization quickly organized 13 international topical groups to address these key issues. During CY 2008, a number of U.S. scientists were vitally involved in these topical groups as group leaders and members. Along with the Directorate, the USBPO Topical Groups participated in identifying U.S. experts who could address these so-called STAC Issues. Helping to coordinate and carry out this research was a major focus for the USBPO during 2008. The results from the STAC Issue topical groups were considered at a special STAC meeting held April 7-9, 2008. The STAC also held a regular meeting a month later (May 19-21) to review the proposed cost and schedule impacts of the changes that will be a part of the Overall Project Cost and Overall Project Schedule documents.

## ***ITER Science and Technology Advisory Committee (STAC)***

The USBPO Director serves as a U.S. member of the Science and Technology Advisory Committee (STAC) of the ITER Council. The other U.S. members of the STAC are Rob Goldston (PPPL), Tony Taylor (GA), Stan Milora (ORNL), and Erol Oktay (OFES).

Last year (2008), STAC meetings were held April 7-9, May 19-22, and October 20-22, in Cadarache, France.

In order to prepare the U.S. members of the STAC for these meetings, the USBPO organized several tele/video-conference briefings:

- March 27, 2008—The U.S. ITER Project Office and the USBPO organized a marathon videoconference briefing session, which lasted for most of the day. A number of U.S. scientists, who are actively involved in the international effort through the 13 STAC Issues Working Groups to address key issues with the ITER baseline design, presented summary-form updates about this work to the U.S. STAC members.
- October 7, 2008—The USBPO organized a marathon five-hour videoconference briefing, with about 20 U.S. technical experts providing background information and updates.

One of the items on the agenda for the STAC-5 Meeting (October 20-22) was a discussion of Work Plans proposed by the ITER Organization. These work plan documents are intended to describe how the ITER Research Plan could be implemented, in particular, the urgent R&D that is needed during the next 2-3 years. An international teleconference of scientific representatives from the seven ITER Members (in which the USBPO Director participated) was held on October 1 in order to review these documents with ITER scientific officers prior to the STAC-5 Meeting.

For the convenience of the U.S. STAC members, the USBPO had set up a limited-access STAC web page on the USBPO website. The USBPO has continued to use this web page for posting materials and background documents.

## ***USIPO Technical Advisory Committee meeting***

The USIPO Technical Advisory Committee (TAC), chaired by Dr. Charles Baker, held its annual meeting in Oak Ridge on August 13-14. The USBPO Director attended and presented a talk on “Most Urgent ITER Physics Needs & the ITER Research Plan.” The TAC, during its debriefing at the end of the meeting, commended the U.S. fusion community for its strong and valuable

response to addressing ITER urgent R&D needs. The TAC also had some suggestions for how to further enhance the U.S. involvement in the continued development of the ITER Research Plan by involving broadened community input.

### ***Special Expert Groups for ITER***

The USBPO was involved in arranging for U.S. participation in three special working groups of experts that the ITER Organization recently set up—one group to work on extending the ITER Research Plan document, another to coordinate the development of integrated modeling capabilities for ITER, and the third to guide the Test Blanket Module program on ITER.

#### ***ITER Research Plan Working Group***

Version 1 of the Research Plan was presented to the Science and Technology Advisory Committee at its STAC-4 Meeting in May 2008. Following up on recommendations from the STAC, the ITER Organization is now undertaking a second phase for further development of the plan in time for its presentation at the STAC-6 Meeting in May 2009. Particular goals for the next phase of development are to incorporate the following items:

- Operations planning constraints based on RAMI (reliability, availability, maintainability, and inspectability) analysis
- TBM program
- Heating and current drive commissioning program
- Physics Work Program for 2009-2011
- Options for accelerating the arrival of the research program at DT operation
- Plasma scenarios for experimental operation
- Upgrade options and how they might fit into the research time schedule

Dr. David Campbell of the ITER Fusion and Science Technology Department is leading this effort. On December 18, 2008, he organized a conference call of chief scientists from the ITER Members in order to discuss the anticipated Phase 2 activities; the USBPO Director participated in this call.

The five U.S. participants in the ITER Research Plan Working Group have taken on responsibilities to work in the following areas:

- Definition of scenarios (Mickey Wade)
- Burning plasma physics program (Steve Wolfe)
- Upgrade options (Ed Synakowski)
- Acceleration of the deuterium-tritium program (Michael Bell)
- Integration of the Test Blanket Module program (Stan Milora)

Note that Bell, Synakowski, and Wade were the original three U.S. representatives on this working group, which produced Version 1 of the ITER Research Plan last year. Two more U.S. representatives (Milora and Wolfe) were added for the second phase of development.

#### ***ITER Integrated Modeling Expert Group***

During the 2008 Annual Meeting of the U.S. Transport Task Force (March 5-28, Boulder, CO), the USBPO sponsored a special town meeting, held in the evening of the second day, at which the needs of the ITER project with regard to integrated modeling work were described. First, Chuck Greenfield, USBPO Deputy Director, talked about “Working with ITER: Where do we go from here?” Next, Wayne Houlberg, a senior scientist in the Fusion Science and Technology

Department of ITER, spoke about “Coordination of the ITER research program between the ITER IO and the ITER parties.” Specifically, Houlberg discussed the implementation of ITER physics activities through the ITPA organization (for longer-term research) and by means of official task agreements (for short-term research deliverables). He also described a new program for visiting researchers to ITER and a postdoctoral program. Finally he announced the establishment of an Integrated Modeling Advisory Group, to include representatives from each of the ITER Parties, who would be asked to give advice to ITER about infrastructure, network, standards, and applications and also to coordinate development and application tasks among the Parties. Both of these talks are posted on the USBPO web site.

The function of this new Integrated Modeling Expert Group (IMEG) for ITER will be to coordinate between ITER and the seven ITER Members in developing a comprehensive suite of integrated modeling capabilities and the concomitant infrastructure. This effort is intended to complement the voluntary R&D being performed through the ITPA on model validation. Specifically, this expert group will work on establishing:

- Core modeling requirements that cover a spectrum of applications
- Documentation, verification, and validation standards for core elements
- Installation and acceptance testing procedures for core elements
- Regression testing procedures for core elements
- ITER hardware (e.g., grid and HPC) and software needs
- Guidelines for the remote access environment

The ITER Integrated Modeling Expert Group has scheduled its annual meeting for June 22-26, 2009, in Cadarache, the week prior to the European Physical Society’s Plasma Physics Meeting. Wayne Houlberg (formerly at ORNL, now at the ITER Organization) is the leader for this expert group. The two U.S. participants in the Integrated Modeling Expert Group are Don Batchelor and Lang Lao.

### ***ITER Test Blanket Module Program Committee***

At the third meeting of the ITER Council held in Cadarache, France, November 19 and 20, 2008, the Council gave formal approval for a Test Blanket Module (TBM) program to be included in the framework of the ITER Agreement. Originally, this had not officially been part of the ITER Agreement. The TBMs will be used to test ideas for breeding tritium in order to ensure fuel self-sufficiency for future fusion reactors. The Council established a TBM Program Committee to oversee this activity. (Note that the U.S. has not yet committed to participate in TBM design and fabrication for ITER.)

The U.S. representatives on the TBM Program Committee are Jeff Hoy, Mike Hechler, Mohamed Abdou, and Rob Goldston. The TBM Program Committee held its first meeting March 25-26 in Aix-en-Provence. Because this first meeting concentrated on intellectual property issues, a lawyer from the U.S. Department of Energy participated.

### ***Physics Task Agreements for ITER***

Occasionally the ITER Organization has issued calls for proposals on physics task agreements. On behalf of the U.S. ITER Project Office, the USBPO circulates these announcements to the U.S. fusion community and solicits proposals. The work solicitations are set up as task agreements between the ITER Organization and the U.S. ITER Project Office.

Recent solicitations for task agreements were the following:

1. Task on the study of control of plasma current, position, and shape
2. Task on self-consistent simulations of plasma scenarios
3. Task on the study of plasma start-up
4. Task on the study of error fields using the Ideal Perturbed Equilibrium Code
5. Preparation of design database with the updated disruption code DINA
6. Task on magnetic reconstruction of the plasma boundary
7. Task on error field measurements in ITER without plasma
8. Task on simulations of toroidal field ripple and TBM effects on energetic particle losses in ITER
9. Task on analysis of Resistive Wall Mode control by in-vessel (RMP) coils

## **7. Specific USBPO Activities**

### ***NRC Review Panel***

On July 29, 2008, the National Research Council of the U.S. National Academies of Science released a pre-publication version of the final report of its Committee to Review the U.S. ITER Science Participation Planning Process (CRISPPP). This special committee had been charged with evaluating the Energy Policy Act (EPA) Report, which was written by the USBPO in 2006. The report of the CRISPPP panel is entitled “A Review of the DOE Plan for U.S. Fusion Community Participation in the ITER Program.” The pre-publication version and the executive summary can be downloaded at <http://www.nap.edu/catalog/12449.html>. The final publication version became available in early 2009 and is available for purchase from the National Academies of Science bookstore.

On October 6, 2008, a briefing about the report was held at DOE Germantown for Dr. Pat Dehmer, Deputy Director of the Office of Science. The presenter was Mike Zarnstorff, a member of the CRISPPP committee. In addition to OFES program managers, others in attendance were Don Shapero and David Lang, both from the National Research Council, and the USBPO Director. Overall, the report endorsed the ITER international project and commended the U.S. plan for coordination of research activities. In terms of recommendations, the report called for addressing gaps in the planning for a DEMO power plant, maintaining a vigorous and balanced U.S. fusion program, and restoring federal funding for the U.S. share of the construction of ITER.

### ***IAEA Fusion Energy Conference***

The 22nd IAEA Fusion Energy Conference was held October 13-18, 2008, in Geneva, Switzerland. During the conference, there was a special session devoted to commemorating the birth of the modern fusion era of open international collaboration, which occurred at the 2nd Conference on the Peaceful Uses of Atomic Energy (“Atoms for Peace”), held exactly 50 years ago in Geneva. ITER, the international flagship of burning plasma research, was represented with a dedicated session of invited talks and posters. Two of the nine invited ITER talks were given by U.S. scientists: Rich Hawryluk (USBPO Council member) described the overall status of the ITER design review and STAC issues work activities, and Chuck Kessel (USBPO topical group leader for integrated scenarios) described ITER scenario modeling results. In the ITER poster session, U.S. scientists presented five out of the 40 posters from the ITER Organization

and its seven international Partners, as well as three of the 11 posters from the ITPA about results for ITER.

During the conference, USBPO leaders, along with U.S. institutional program managers, were also busy participating in DOE-scheduled bilateral meetings with ITER partners Europe, Japan, Korea, and China. In addition, the USBPO had an informal discussion with its EFDA counterparts, and there was a luncheon get-together to talk about arrangements for the ITPA/IEA Joint Experiments Planning Meeting (subsequently hosted by MIT, December 11-13, 2008).

### ***APS Division of Plasma Physics Meeting***

The 2008 APS Division of Plasma Physics Annual Meeting, held November 17-21 in Dallas, TX, marked its 50th anniversary. During this meeting, the USBPO sponsored two activities:

- A special “Town Meeting on ITER” was held Tuesday evening, 7:30-9:30 p.m. The speakers for this evening session were Dr. David Campbell (ITER Organization), who reviewed the scientific status of ITER; Dr. Charlie Baker, a U.S. member of the ITER Council’s Management Advisory Committee and also chair of the Technical Advisory Committee for the U.S. ITER Project Office, who commented on the programmatic, management, and organizational aspects of ITER; and the USBPO Director, who described aspects of the U.S. involvement in addressing ITER R&D issues. Amanda Hubbard, chair of the USBPO Council, chaired this Town Meeting. These three talks were posted on the USBPO web site.
- A contributed oral session entitled “Research in Support of ITER,” was held Tuesday morning, 9:45 a.m.–12:33 p.m. The session consisted of 14 ten-minute talks, including several from international groups. Chuck Greenfield, USBPO Deputy Director, chaired this session. Credit for initiating this session goes to Mickey Wade (GA), who solicited interest and received positive responses from leaders of a number of the major U.S. and international fusion experimental facilities.

### ***Research Needs Workshop (ReNeW)***

The USBPO is hosting the web site for the Research Needs Workshop (ReNeW), to be held June 2009, in Bethesda, MD. The DOE Office of Fusion Energy Sciences has sponsored this workshop as a community-wide planning exercise to develop a list of research requirements and priority thrusts. ReNeW is organized into five Theme areas, each having four to seven panels, with about half a dozen participants on each panel. The structure of the ReNeW activities can be seen at its web page (<http://burningplasma.org/renew.html>). The Theme areas held theme workshops in March. Officially, this is not a USBPO activity; however, many of the USBPO topical group leaders and members of the USBPO Council and Executive Committee are actively involved in the ReNeW Theme areas and panels. The USBPO Director is serving as the chair for Theme I “Achieving and Understanding the Burning Plasma State.” Amanda Hubbard (USBPO Council chair) and Chuck Greenfield (USBPO Deputy Director) are the chair and vice-chair for Theme II “Creating Predictable High-Performance Steady-State Plasmas.” Mike Zarnstorff (USBPO Council vice-chair) is the vice-chair for Theme V “Optimizing the Magnetic Configuration.”

### **Internet Seminar on Lower Hybrid Current Drive for ITER**

On February 23, 2009, the USBPO hosted—via the internet—a special seminar about some developments related to a possible lower hybrid current drive system for ITER. Dr. Alain Becoulet and Dr. Tuong Hoang, both affiliated with CEA Cadarache, were the speakers. They are leaders of a new European task group called “LH4IT,” sponsored by the European Fusion Development Agency (EFDA) in coordination with the European Domestic Agency “Fusion for Energy.” The function of this task group is to look at issues such as physics design, research and development, costing, work sharing, and schedule, in order to provide information to ITER for decision-making. The seminar on February 23 described the status of this activity and proposals for collaborations. The talk was posted on the USBPO web site.

### **Fusion Facilities Coordinating Committee**

The USBPO Director attended both meetings of the FFCC in 2008—March 10 (Gaithersburg, MD) and November — to discuss the activities of the ITPA and the USBPO and the high-priority R&D needs of ITER in relation to the research programs of US experimental facilities. The USBPO plans to maintain regular communication with U.S. institutional program leaders.

### **OFES FY 2011 Program Milestone**

The USBPO participated in discussions about the topic and content for the proposed FY 2011 Joule Milestone, which will jointly involve experiments on the three major U.S. facilities and also theory and simulation contributions. It was determined to focus the milestone on experimental tests of theoretical models for pedestal physics, especially the height. The three major fusion facilities will allow tests under a wide range of plasma conditions, including high diamagnetic frequency (C-Mod), high beta (DIII-D), and low aspect ratio (NSTX). The understanding to be gained from these studies will improve the basis for projecting pedestal pressure height to ITER.

## **8. International Tokamak Physics Activities**

### **ITPA Structure**

In accordance with the revised ITPA Charter approved by the international ITER Members, the ITPA came under the auspices of the ITER Organization. In the process, the seven ITPA topical groups were re-organized during 2008, as shown in the following table:

<b>Former ITPA Topical Groups</b>	<b>New ITPA Topical Groups</b>
Diagnostics	Diagnostics
Pedestal and Edge	Pedestal
Divertor and SOL	Divertor and SOL
MHD	MHD Stability
Confinement Database and Modeling	Energetic Particles
Transport Physics	Transport and Confinement
Steady State Operation	Integrated Operation Scenarios

## **ITPA Membership**

Because many of the leaders and deputy leaders of the ITPA topical groups had served in these positions for a number of years, the ITPA Coordinating Committee rotated the leadership in 2008. The USBPO Research Committee, at its April 16 meeting, proposed a number of candidates from the US. Subsequently the members of the USBPO Executive Committee held a discussion with U.S. members of the ITPA Coordinating Committee, which led to a list of U.S. nominees for the leader and deputy leader slots. Erol Oktay, who is one of the U.S. members of the Coordinating Committee, also serves as the official U.S. Contact Person. He and the respective Contact Persons from the other six ITER partners negotiated the selection of the new leadership for the ITPA Topical Groups, as follows:

<b>New ITPA Topical Groups</b>	<b>New Leader</b>	<b>New Deputy Leader</b>
Diagnostics	Rejean Boivin (US)	Hyeon Park (KO)
Pedestal	Howard Wilson (EU)	Naoyuki Oyama (JA)
Divertor and SOL	Bruce Lipschultz (US)	Emanuelle Tsitrone (EU)
MHD Stability	Abhijit Sen (IN)	Edward Strait (US)
Energetic Particles	Sibylle Guenter (EU)	Koji Shinohara (JA)
Transport and Confinement	Stan Kaye (US)	Shaojie Wang (CN)
Integrated Operation Scenarios	Shunsuke Ide (JA)	Adrianus Sips (EU)

A new feature is that each ITPA topical group now has a co-deputy leader who is an ITER Organization staff scientist. The new leadership participated in the annual meeting of the ITPA Coordinating Committee (June 30-July 1, 2008).

According to the ITPA Charter, each of the ITER Members is allowed to identify up to seven scientists to be members of each of the seven topical groups. The USBPO circulated a call for suggestions of names of interested persons to serve as U.S. members in these groups (including self-nominations). The selection process, completed in July, took into account expertise, interest, institutional balance, etc. Following extensive discussions that involved the Office of Fusion Energy Sciences, the USBPO, the ITPA leadership, and U.S. program leaders, the complete list of new U.S. members for the various topical groups was determined, as follows:

<b>Topical Group</b>	<b>U.S. Members</b>
Transport and Confinement (TC)	Stan Kaye (U.S. Coordinator) [1] George McKee (U.S. Deputy Coordinator) Andris Dimits Ed Doyle Dave Mikkelson Craig Petty John Rice
Divertor and SOL	Bruce Lipschultz (U.S. Coordinator) [1] Tony Leonard (U.S. Deputy Coordinator) Russ Doerner Mathias Groth Charles Skinner Peter Stangeby Dennis Whyte
MHD Stability	Ted Strait (U.S. Coordinator) [2] Bob Granetz (U.S. Deputy Coordinator)

	Valerie Izzo Steve Jardin Steve Sabbagh Francois Waelbroeck John Wesley
Pedestal	Phil Snyder (U.S. Coordinator) Rajesh Maingi (U.S. Deputy Coordinator) C. S. Chang Max Fenstermacher Jerry Hughes Alexei Pankin Tom Rognlien
Energetic Particles	Raffi Nazikian (U.S. Coordinator) Boris Breizman (U.S. Deputy Coordinator) Johan Carlsson Eric Fredrickson Bill Heidbrink Don Spong Steve Wukitch
Diagnostics	Rejean Boivin (U.S. Coordinator) [1] Jim Terry (U.S. Deputy Coordinator) Steve Allen David Brower Don Hillis Dave Johnson Brent Stratton
Integrated Operation Scenarios	Chuck Kessel (U.S. Coordinator) Tim Luce (U.S. Deputy Coordinator) Paul Bonoli David Gates Amanda Hubbard Masanori Murakami Ron Prater

Four of the U.S. members also function as either the international leader [1] or the deputy leader [2] of various topical groups, as indicated.

### ***ITPA Topical Group Meetings***

The U.S. members of ITPA members listed in the preceding table are expected to attend their respective topical group meetings, contribute to joint projects, and interface with the U.S. fusion community. They represent the international extension of the USBPO, since the ITPA and the USBPO have been integrated on the national level. USBPO scientists other than the official topical group members often also attend these meetings.

The U.S. members of the ITPA and the USBPO topical groups have been working together to prepare for the twice-yearly ITPA topical groups meetings. Such preparations include developing the meeting proposals and agendas, as well as making recommendations for U.S. participants at these meetings. An important topic of discussion at all of these topical group meetings is currently an evaluation of the ITER High Priority Research Tasks.

The USBPO has continued working on ways to more broadly keep the U.S. scientific community informed of and involved with ITPA activities. ITPA meetings and activities are now publicized on the USBPO web site.

### ***ITPA Coordinating Committee Meeting***

The 10th meeting of the Coordinating Committee for the International Tokamak Physics Activity (ITPA) was held June 30-July 1, 2008, in Aix-en-Provence, France. Each of the seven ITER Partners contributes four members of the Coordinating Committee. The U.S. members are Erol Oktay, Ned Sauthoff, Ron Stambaugh (who also serves as the chair of the Coordinating Committee), and the USBPO Director. The attendance at this year's meeting was especially high, since both the outgoing and the incoming chairs and deputy chairs of the seven topical groups had been invited to participate, along with the co-deputy chairs from the ITER Organization. Leaders for each of the topical groups presented reports about their research activities. Also, representatives from each of the ITER Partners gave status reports about their respective national fusion science programs. From ITER, David Campbell presented two talks, one on "ITER Current Design Status and ITER Research Plan" and the other on "ITER Physics Research Needs and ITPA Contributions." In addition, he discussed a list of "High Priority Research Tasks 2008-2009." All of these presentations have been posted on the ITPA web site (<http://itpa.ipp.mpg.de/>, click on Topical Groups, click on Coordinating Committee, click on 10th Meeting, click on Contributions). Note that the revised ITPA Charter is also posted on this web site.

### ***IEA/ITPA Joint Experiments/Activities Meeting***

The International Tokamak Physics Activities (ITPA) organization held its 7th Annual Joint Experiments Planning Meeting, under the auspices of the various IEA Implementing Agreements, at the Massachusetts Institute of Technology, December 11-13, 2008. U.S. and international program leaders and ITPA members participated. The main objective of this meeting was to review progress in joint experiments carried out during 2008 and then to present, discuss, and approve proposals for joint experiments in 2009. Each of the ITPA topical groups proposed plans for cross-machine experiments. Representing the USBPO at this meeting were Amanda Hubbard (Council chair) and several members of the Research Committee. Scientific leaders from the ITER Organization also provided input concerning the relevance and value of the proposed experiments for addressing urgent ITER R&D needs.

## **8. Communication and Outreach Activities**

The USBPO makes a variety of electronic communication tools available to its members in order to facilitate participation in USBPO research and leadership activities. These tools include the following:

- Support for teleconferences, facilitated by USBPO administration
- Web-based file sharing
- Bulletin board support for Topical Group and Task Group research work and file exchange
- E-mail list servers for easy group communications
- Supported scalable video-conferencing for small and large group discussions
- Monthly electronic newsletter to the fusion community

Internet and communications technology support is carried out at the University of Wisconsin. An IT expert at Wisconsin, Mr. James DeKock, who originally helped build the USBPO web site, has continued to manage it. A small separate grant supports Mr. DeKock's part-time service to the USBPO through the University of Wisconsin (via Prof. Chris Hegna, PI).

### **eNews**

The USBPO newsletter, called *eNews*, is published monthly in electronic format. It is posted on the USBPO web site and also distributed widely via email. Included in the newsletter are the following sections:

- Director's Corner (column and commentary by the USBPO Director)
- Announcements
- Feature articles
- Reports
- Calendar of upcoming fusion events

The USBPO *eNews* was published in every month during 2008, and in January, February, and March so far during 2009. Dr. Raffi Nazikian serves as the editor, with assistance from the USBPO Administrator. Issues of *eNews* are archived at <http://burningplasma.org/enews.html>.

### **Website**

The former USBPO Administrator, Emily Hooks, initiated a process to come up with a new logo for the USBPO, working closely with a professional graphics designer. After several rounds of ideas and iteration, with helpful input at each step from the Executive Committee members, a new logo was designed. The new logo conveys both physics and aesthetics. A re-design for the masthead banner was also completed. Both the new logo and new banner are now being used in presentations and on the USBPO web site.



*New USBPO logo*

### **Other representational activities**

Here are some other activities:

- The International Union of Pure and Applied Physics was established in 1922 in order to foster international collaborations in physics. At the 2008 annual meeting of the U.S. Liaison Committee for the IUPAP, The USBPO Director gave an invited status report about the ITER project and U.S. participation therein. The talk is posted on the USBPO web site.
- At the November 6-7, 2008, meeting of the Fusion Energy Sciences Advisory Committee in Gaithersburg, MD, during 6-7 November, the USBPO was involved with several of the items on the agenda: (1) a presentation given by Rejean Boivin about the USBPO Diagnostics White Paper, which contains recommendations for pursuing yet-uncredited diagnostic development needs for ITER; (2) a "tutorial" talk about plasma-materials interactions by Dennis Whyte, leader of the USBPO topical group on boundary physics; (3) a briefing about the recent NRC review of the DOE plan for U.S. participation in ITER (the so-called CRISPPP Report, cf. last month's *eNews*); and (4) a talk about recent USBPO activities entitled "U.S. Community Support during Preparations for ITER" by

USBPO Deputy Director Chuck Greenfield, accompanying a related talk by Ned Sauthoff (USIPO) about the status of the ITER Project. These talks are posted on the USBPO web site.

- Chuck Greenfield, the USBPO Deputy Director, presented a talk about USBPO activities at the Fusion Power Association Annual Meeting (Lawrence Livermore National Laboratory, December 3-4, 2008).

## 9. Summary of Presentations

During the past twelve months, the following presentations and papers were either given on behalf of or sponsored by the USBPO and are available at <http://burningplasma.org/reference/>.

- *ITER Design Review Physics Issues*: R. J. Hawryluk [presented at the USDOE/OFES Budget Planning Meeting, Gaithersburg, MD, March 11, 2008]
- *Activities of the U.S. Burning Plasma Organization*: J. W. Van Dam [presented at the USDOE/OFES Budget Planning Meeting, Gaithersburg, MD, March 11, 2008]
- *Coordination of the ITER Research Program between the ITER IO and the ITER Parties*: W. A. Houlberg [presented at the Town Meeting on ITER, 21st U.S. Transport Task Force Workshop, Boulder, CO, March 26, 2008]
- *Working with ITER: Where Do We Go From Here?* C. M. Greenfield [presented at the Town Meeting on ITER, 21st U.S. Transport Task Force Workshop, Boulder, CO, March 26, 2008]
- *ITER: An Unprecedented Example of U.S. Involvement in a Big-Science International Physics Collaboration*: J. W. Van Dam [presented to the U.S. Liaison Committee of the International Union of Pure and Applied Physics at the National Academy of Sciences, Washington, DC, June 2, 2008]
- *Most Urgent ITER Physics Needs and the ITER Research Plan*: J. W. Van Dam [presented to the U.S. ITER Technical Advisory Committee, Oak Ridge, TN, August 13-14, 2008]
- *Progress Towards Burning Plasmas*: J. W. Van Dam [presented at the International Congress on Plasma Physics, Fukuoka, Japan, September 8-12, 2008]
- *U.S. Community Support during Preparations for ITER*: C. M. Greenfield [presented to the Fusion Energy Sciences Advisory Committee, Gaithersburg, MD, November 6-7, 2008]
- *Towards a Long-Range, Dedicated, Integrated U.S. Diagnostic Development Program: A U.S. Initiative*: Rejean Boivin [presented to the Fusion Energy Sciences Advisory Committee, Gaithersburg, MD, November 6-7, 2008]
- *The Challenge of Plasma-Surface Interactions for ITER and Beyond*: Dennis Whyte [presented to the Fusion Energy Sciences Advisory Committee, Gaithersburg, MD, November 6-7, 2008]
- *Scientific Status of ITER*: D. J. Campbell [presented at the APS-DPP Town Hall Meeting on ITER, Dallas, TX, November 18, 2008]
- *Programmatic Status of ITER*: Charles Baker [presented at the APS-DPP Town Hall Meeting on ITER, Dallas, TX, November 18, 2008]
- *How the U.S. Fusion Energy Science Community is Actively Contributing to ITER*: J. W. Van Dam [presented at the APS-DPP Town Hall Meeting on ITER, Dallas, TX, November 18, 2008]

- *The U.S. Burning Plasma Program*: C. M. Greenfield [presented at the Fusion Power Associates Annual Meeting and Symposium, Livermore, CA, December 3, 2008]
- *Progress Towards Burning Plasmas*: J. W. Van Dam [presented at Department of Physics, Yokohama National University, Yokohama, Japan, December 22, 2008]
- *A Lower Hybrid Current Drive System for ITER*: G. T. Hoang and A. Becoulet [presented as a USBPO national internet seminar, Austin, TX, February 23, 2009]

**Table 1: USBPO Council Members**

<b>Member</b>	<b>Institution</b>
Amanda Hubbard—Chair	MIT
Michael Zarnstorff—Vice Chair	PPPL
C. S. Chang	NYU
Martin Greenwald	MIT
Richard Hawryluk	PPPL
William Nevins	LLNL
Martin Peng	ORNL
John Sarff	University of Wisconsin
Ed Synakowski	LLNL
Tony Taylor	General Atomics
George Tynan	UCSD
Mike Ulrickson	SNL
<b>Ex Officio</b>	<b>Title</b>
Stanley Milora	Chief Technologist, U.S. ITER Project Office
James Van Dam	USBPO Director; Chief Scientist, U.S. ITER Project Office
<b>OFES Program Managers</b>	<b>Title</b>
Erol Oktay	ITER Science Manager
Gene Nardella	ITER Technology Manager

**Table 2: USBPO Topical Groups and Leadership**

<b>Topical Group</b>	<b>Leader</b>	<b>Deputy Leader</b>
MHD Macroscopic Plasma Physics	Chris Hegna (UW)	Ted Strait (GA)
Confinement and Transport	Ed Doyle (UCLA)	John Rice (MIT)
Boundary	Dennis Whyte (MIT)	Tom Rognlien (LLNL)
Plasma-Wave Interactions	Cynthia Phillips (PPPL)	Stuve Wukitch (MIT)
Energetic Particles	Raffi Nazikian (PPPL)	William Heidbrink (UCI)
Integrated Scenarios	Chuck Kessel (PPPL)	Tim Luce (GA)
Fusion Engineering Science	Nermin Uckan (ORNL)	Richard Nygren (SNL)
Modeling and Simulation	Don Batchelor (ORNL)	Jon Kinsey (GA)
Operations and Control	Dave Humphreys (GA)	Dave Gates (PPPL)
Diagnostics	Steve Allen (LLNL)	Jim Terry (MIT)