



U.S. Burning Plasma Organization e-News
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Dear Burning Plasma Aficionado:

This newsletter provides a short update on U.S. Burning Plasma Organization activities. E-News is also available online at <http://burningplasma.org/enews.html>. Comments on articles in the newsletter may be sent to the editor (R. Nazikian mazikian@pppl.gov) or assistant editor (Emily Hooks ehooks@mail.utexas.edu).

Thank you for your interest in Burning Plasma research in the U.S.!

Comments from the Director of the BPO by J. Van Dam

The U.S. Burning Plasma Organization owes a tremendous debt of gratitude to its founding director, Ray Fonck. He worked tirelessly to establish the USBPO, visiting numerous fusion groups around the country and giving presentations at major meetings. He guided the establishment of the Council, the Topical Groups, and the Research Committee. He set up the USBPO web site. He spearheaded the Burning Plasma Workshop in December 2005. He interfaced with the US Department of Energy and the ITER Project Office. As we all know, Ray has now become the new Associate Director of the Office of Fusion Energy Sciences, Office of Science, at the U.S. Department of Energy.

Similarly, we are extremely thankful to Tony Taylor for his outstanding service as the USBPO Deputy Director. His involvement in the establishment of the Topical Groups and the Council, his leadership of the Research Committee, and his all-around wisdom

and zeal for burning plasma research have been highly valued. Tony also has a new responsibility, namely, director of the DIII-D National Fusion Facility.

Finally, we are grateful to Joan Welc-LePain for having served as the USBPO Administrator. Her performance in this position was a model of excellence.

It is an honor for me to succeed Ray Fonck as director, and it is a pleasure to work with these new members of the USBPO leadership team: Chuck Greenfield (Deputy Director), Amanda Hubbard (Council Chair), and Mike Zarnstorff (Council Vice Chair). In addition, the new position of Assistant Director for ITER Liaison has been created, and Nermin Uekan fills that position. The new USBPO administrator is Emily Hooks. Support for the web site will continue to be provided by Jim DeKock. We earnestly solicit the assistance of the U.S. fusion community in continuing and enhancing the role of the USBPO in defining, coordinating, facilitating, and promoting burning plasma research.

One of the first tasks we faced this year was to respond to the needs of the ITER design review activity. ITER has set up eight working groups to review and update its baseline design. One of these, the Design Requirements and Physics Objectives Working Group (whose U.S. members are Rich Hawryluk and Ron Stambaugh), issued a list of 12 urgent science issues. The U.S. ITER Project Office referred this list to the USBPO and asked that technical experts be identified who could help with the analysis of these issues. With the help of institutional program managers and OFES guidance, this has been done. More information about the design review can be found in the next article in this newsletter.

In addition to involvement with the ITER design review issues, the ten USBPO Topical Groups have also been active in ITER issue cards, in ITER physics tasks (with 76 submitted and 14 selected, with work underway), and in burning plasma studies of broader scope. Several of the Topical Groups have held get-togethers, examples being the diagnostics workshop in January and the Verification and Validation Task Group discussion in April (see associated articles in this newsletter).

The leaders and deputy leaders of the Topical Groups constitute the Research Committee, which meets by videoconference every other week. Earlier this year the members of the Research Committee held three cyberspace virtual retreats in order to draft a document with guidelines about Topical Group research activities (see related article).

The Council has also been active. It was responsible for writing the new USBPO Charter and Bylaws; it led the search for candidates for the directorship; and now it is formulating plans and strategy for U.S. participation in ITER burning plasma research, as a follow-up to the Energy Policy Act report prepared by the USBPO last year (see related article).

One of the last things that Ray Fonck accomplished as director was to write—together with Ron Stambaugh (Chair of the ITPA)—a document about the integration of the ITPA and USBPO activities on the national level. One result is that ITPA meetings and activities are now publicized on the USBPO web site.

As had Ray Fonck, I also am serving as chief scientist for the U.S. ITER Project Office. This provides a natural link and contact, especially with Ned Sauthoff, the IPO director. I also inherited a commitment to present a talk at the April APS Meeting (Jacksonville, FL) on the subject of “How to make a big international science project happen: Lessons from ITER.” This talk, as well as talks that were presented at the recent FESAC meeting and the OFES Budget Planning Meeting, are available on the USBPO web site (<http://burningplasma.org/reference.html>).

Status Update on ITER Design Review Process and BPO Contributions – Overview by R. Hawryluk

During the week of April 16, the ITER Working Group on the ITER Design Requirements and Physics Objectives met in Cadarache, France. The working group is concentrating on the so-called “category D” items, which are defined as: “The highest priority (category D) concern directly or indirectly long-lead items (TF coils, vacuum vessel, buildings, construction schedule, safety report etc.)”. Progress was made on several elements of the work plan identified previously. More detailed work plans were developed and efforts are underway to involve additional members of the BPO in addressing the technical issues. The USBPO members made significant contributions in the areas of resistive wall modes (RWM) and resonant magnetic perturbations (RMP) as well as disruption mitigation and pellet-pacing gas-loading requirements. In this note, the contributions of the USBPO members to this ITER Working Group will be highlighted.

There was a very interesting and productive discussion regarding RWM and RMP coils, in large part due to participation by scientists from both the EU, who attended the meeting, and the U.S. Despite the time zone difference, we had good participation by scientists from Columbia University (S. Sabbagh), DIII-D (T. Evans and M. Schaffer), and PPPL (J. Menard) by teleconference. The tentative conclusions are:

- ELM control is a critical issue for ITER. A successful approach that will work in a burning plasma remains to be established. Need options for ELM control including pellet pacing and RMP.
- Several approaches have been identified to provide the perturbation required to control ELMs. Engineering issues have been identified but not resolved. We had productive discussions with the IO engineering team about this; however, they are concerned about the impact of implementing RMP and RWM coils.
- RWM stabilization offers the potential of much higher $\beta_N \sim 3.9$, for one proposed coil configuration. This is beneficial for long pulse high fluence operation.
- Provisions should be made for early application of ELM control and later for RWM stabilization.

At the end of the meeting a work plan was developed, which includes the following elements:

- Report on physics assessment of RMP and RWM coils in July. Seek IO support for engineering studies of design options in July.

- Analysis of engineering implications. (September)

This is an aggressive schedule but would enable the RMP and RWM coils to be incorporated into the project baseline, if approved by the IO.

The other area in which the USBPO contributed was in addressing the impact of increased gas loads due to pellet pacing and disruption mitigation on pumping systems affecting building size. This discussion was more narrowly focused but here we also benefited by teleconferences with participants in EU, IO, and U.S. (D. Rasmussen, ORNL). The tentative conclusions are:

- Need to be able to use low field side pellets for pellet pacing.
- Massive gas injection requirements have been identified by John Wesley (GA).

The near-term effort will focus on:

- Developing requirements for pellet pacing based on analysis of ASDEX-U and DIII-D data and pellet simulations for ITER. (September.)
- Requirements of massive gas injection for disruption mitigation. (July)
- Analysis of vacuum system gas loads for pellet pacing and massive gas injection. (September)

The major concerns are that the use of pellet pacing will result in a gas load beyond the capability of the pumps and that massive gas injection will result in the beamline cryopanels regenerating, affecting operations and the number of shots per day.

Report on BPO Diagnostic Workshop by R. Boivin

US-BPO Topical Meeting on Diagnostics

February 6-8, 2007

General Atomics, San Diego, California

The Burning Plasma Organization Topical Group on Diagnostics held its first meeting on Feb. 6-8, 2007 at General Atomics. The meeting was organized in close collaboration with the US ITER Project Office (US-IPO) and the ITER International Office (ITER-IO).

The goals of the meeting were to:

- 1) Promote dissemination of information on ITER diagnostics, ITER-IO and US-IPO plans
- 2) Identify and initiate tasks for the US-BPO diagnostic topical group
- 3) Review technical studies funded by the US-IPO for the US procured diagnostic systems and to provide input in the current design

Approximately 50 people attended the meeting, with an additional 10-15 attending remotely through a video and audio link. Alan Costley from the ITER-IO presented the latest in ITER diagnostic plans. Of particular importance was the ongoing design review process, which is being addressed through the issue card system. David Johnson from the US-IPO presented the latest plans and technical aspects of the procurement and design of

the U.S. diagnostic packages. These include the port plug assemblies and the associated diagnostics. Jim Terry and Alan Costley reviewed those ITER Issue Cards having relevance to the BPO Diagnostics Topical Group.

Initial plans for the BPO topical group on diagnostics were presented. In conjunction with the entire BPO organization, potential ITER physics tasks for the U.S. to perform were generated, evaluated, and submitted to the ITER organization. A larger list of tasks was submitted as ITER issue cards. Finally, the process of generating and executing tasks through the BPO system was elaborated. At the workshop the first major task for the Diagnostics Topical Group was chosen. It is to perform a review the ITER measurement requirements related to the U.S.-credited systems, and to assist in assessing the expected performance of these systems. These assessments will be best performed within the four “diagnostics” working groups formed last summer (Microwave Systems, IR/FIR systems, Active Spectroscopy, Imaging Systems).

Report on TTF Discussion of Transport Task Group on Theory Validation by P. Terry

The Verification and Validation (V & V) Task Group was formed in December 2006 by the Confinement and Transport Topical Group. The task group was formed to address the prescient need for active verification and validation of transport models and numerical modeling activities within the U.S. fusion program. The task group presented its initial findings to the US-European Transport Task Force in San Diego on April 18. The task group’s presentation set out definitions of key concepts and procedures, highlighted issues encountered in nascent validation efforts based on comparison of mathematical models with experimental results, and proposed procedures and practices which could be developed to deal with these issues quantitatively. An important example of such procedures is the development of validation metrics, which set quantitative bounds on systematic errors and uncertainties in both model and experiment, and quantitatively rate primacy hierarchies and sensitivities involved in comparisons. The presentation was followed by an hour-long discussion in which the meeting participants offered comments, observations, and suggestions. Validation metrics have not yet been created in fusion applications, and some of the discussion centered on the difficulty of doing so.

-- Organizational Status Updates --

Research Committee Guidelines

The leaders and deputy leaders of the Topical Groups constitute the Research Committee of the BPO. Earlier this year the members of the Research Committee held three cyberspace virtual retreats in order to draft operational guidelines for research activities undertaken by the BPO. The meetings considered the process for research task formation, RC review and approval, task prioritization and the reporting of progress in research activities. A subcommittee made up of members of the RC (R. Nazikian, T. Taylor, N. Uckan, R. Nygren and D. Whyte) integrated the consensus views into a guidelines document that can be viewed at <http://burningplasma.org/groups.html>.

Changes in Research Committee Membership

Before becoming USBPO Deputy Director, Chuck Greenfield had been serving as the leader of the Integrated Scenarios Topical Group. To fill this vacancy, Chuck Kessel (previously the deputy leader) will move up to become leader, and Tim Luce will become the new deputy leader. Both of them are very qualified persons, and we appreciate their service, as well as that of those who are providing leadership for the other Topical Groups.

Recent BPO Council Activities

The USBPO Council is the advisory body of the USBPO. Its responsibilities include long-term strategic planning of burning plasma research, and setting the policies and procedures of the USBPO. The Council has been active in both of these areas in recent months.

USBPO Charter & Bylaws completed and approved

A subcommittee of the Council, led by George Tynan and including Council members Amanda Hubbard, Martin Peng, Craig Petty and John Sarff, worked for several months to draft a Charter and Bylaws for the USBPO, with input from the entire Council, US DOE and the Directorate. The Charter, which sets out the roles of the various components of the organization, was approved in December. The Bylaws, which cover such matters as selection and tenure of the positions on the Directorate, Research Committee and Council, were finalized and approved by the Council in April. The full text of both documents can be seen online at <http://burningplasma.org/charter.html>.

New Council Subcommittee on Planning for US ITER Participation

A new Council Subcommittee has recently been formed to examine and detail U.S. plans for ITER participation. This group will be led by Earl Marmar, and includes both Council members and other experts from the fusion community: Steve Allen, Michael Bell, Cary Forest, Steve Knowlton, Farroukh Najmabadi, Hutch Neilson, Martin Peng, Phil Synder, Ted Strait, George Tynan, Nermin Uckan and Dennis Whyte.

This Subcommittee will follow up on the report of a 2006 USBPO panel led by Ray Fonck which prepared an initial plan in response to the requirements of the 2005 Energy Policy Act. It was recommended in that report that the initial planning exercises be continued and expanded by the USBPO, taking into account the evolving plans of the international ITER organization. More details on the plans of the new Subcommittee will be made available in coming weeks as it begins its work.

-- USBPO Related Meetings --

May 7-10

ITPA SOL/Divertor Group
Garching, Germany

May 7-10

ITPA Pedestal Group
Garching, Germany

May 9-11

ITPA meeting on Steady State Operation
Daejeon, Republic of Korea

May 14-17

5th IAEA TCM on Steady-State MFE Devices
Daejeon, Republic of Korea

May 21-24

ITPA meeting on MHD physics and control
General Atomics, La Jolla

<http://fusion.gat.com/conferences/mhd07>

Jun 4-8

6th IAEA TM on Ctrl, DAQ & RP
Inuyama, Japan

<http://tm2007.nifs.ac.jp/>

Jun 6-8

4th IAEA TM on ECRH Physics & Technology for ITER
Vienna, Austria

<http://www-naweb.iaea.org/naweb/physics/meetings/4ECRH.htm>

Jun 20-22, 2007

2nd IAEA TM "First Generation of Fusion Power Plants - Design and Technology"
IAEA, Vienna, Austria

<http://www-naweb.iaea.org/naweb/physics/meetings/TM32812.html>

Jul 2-6, 2007

34th European Conference on Plasma Physics
Warsaw, Poland

<http://www.eps2007.ifpilm.waw.pl/>

For more 2007 Fusion Research-related events, visit the USBPO Upcoming Events page online at <http://burningplasma.org/events.html>.