

# **Minutes of the Meeting of the Fusion Energy Sciences Advisory Committee**

July 16-17, 2007  
Marriott Hotel, Gaithersburg, MD

## **Members present:**

Dr. Jill Dahlburg, Naval Research Laboratory  
Prof. Jeffrey Freidberg, Massachusetts Institute of Technology  
Dr. Martin Greenwald, Massachusetts Institute of Technology  
Prof. Richard Hazeltine, University of Texas-Austin  
Prof. Joseph Johnson, Florida A & M University  
Dr. Kathryn McCarthy, Idaho National Laboratory  
Prof. Gerald Navratil, Columbia University  
Prof. Stewart Prager (chair), University of Wisconsin-Madison  
Dr. John Sheffield, University of Tennessee  
Prof. Edward Thomas, Auburn University  
Dr. Michael Zarnstorff, Princeton Plasma Physics Laboratory

## **Members absent:**

Dr. Charles Baker, Sandia National Laboratories  
Prof. Riccardo Betti, University of Rochester  
Dr. Richard Callis, General Atomics  
Dr. Rulon Linford, Lawrence Livermore National Laboratory

## **Ex-officio members present:**

Dr. Vincent Chan (APS-DPP), General Atomics  
Dr. Roger Stoller (ANS), Oak Ridge National Laboratory  
Dr. John Steadman (IEEE), University of South Alabama

## **Ex-officio members absent:**

None

## **Designated Federal Officer present:**

Albert Opdenaker III, Executive Assistant for Fusion Energy Sciences, US Department of Energy

## **FESAC Executive Secretary:**

Dr. John Sarff, University of Wisconsin-Madison

Other persons attending the meeting are listed in the appendix.

## **1. Meeting Agenda and Logistics.**

The meeting was called to order at 9:00 am.

## **2. Office of Fusion Energy Sciences Perspective.**

Dr. Raymond Fonck, Associate Director, provided an update of the Fusion Energy Sciences Program. He began by noting a number of exciting scientific accomplishments throughout the program. He appealed to the community to keep OFES informed with research highlights that express how scientific understanding has improved (not just numbers). Dr. Fonck described the budget, which is on track to fund ITER and provide an increase for domestic activities. He commented on the difference in the House and Senate versions of the FY 2008 Appropriations Bill. The House bill would terminate funding for High Energy Density Laboratory Plasma (HEDLP) research, and redirect the requested funding to increasing operations at the three major fusion research facilities, for the theory program, the materials program and research in alternate confinement concepts. The Senate bill praises the HEDLP program and suggests no changes to the request by DOE. Dr. Fonck reported that the proposals in response to solicitations for the theory, SciDAC, and diagnostics programs are under review. He noted that it has been difficult to find reviewers, and therefore the process will likely be somewhat delayed. The Junior Faculty Award solicitation has been published. Dr. Fonck also described the status of ITER. The US ITER Project Office (USIPO) is now fully staffed, and the management team is focused on critical decisions CD1 to CD4. He described the high priority task to complete the design of ITER by the end of the year. A number of members of the US fusion community are officially engaged in the design review, and the US Burning Plasma Organization (BPO) is coordinating design activities. Dr. Fonck reported on the recent meeting of the ITER Interim Council. All parties have ratified the ITER agreement except Russia and China. In the establishment of ITER Domestic Agencies (DA), the US is far ahead of the other parties in putting into place and organizing its DA. Dr. Fonck reported that the team for the National Compact Stellarator Experiment (NCSX) under construction at PPPL cannot complete construction within the established \$92.4M TEC baseline as well as the scheduled July 2009 completion date. A Lehman review of the NCSX project will be conducted in August, and a scientific review of the stellarator program is anticipated. In regard to planning for OFES's future program, Dr. Fonck stated that OFES is not ready to issue another major FESAC charge (other than the current charge discussed under item 5 below). However, he emphasized the need for exciting proposals that will position the US as world leaders in fusion science, while at the same time stewarding basic plasma science. He commented on the aging workforce, emphasizing the need to engage younger people in the program. He described the OFES having a "gridlock funding profile" in which all programs are critical or sub-critical. He discussed a number of resources needed to reinforce activities and initiate new directions. He described a multi-tiered approach to planning that is under consideration, including internal OFES planning, identifying challenges, use of workshops to develop approaches, and working with the community to refine the process. Dr. Fonck also discussed recent workshops on the ITER Test Blanket Module Program (TBM), on Inertial Fusion Energy (IFE), and on the Fusion Simulation Project (FSP) (see related items below). In regard to the TBM workshop, Dr. Fonck noted that it was very useful for informing a negotiating position that maintains an option for the US to join the TBM effort, even though the assessment from the workshop was that the US is not ready to be a leader in the TBM program. Lastly, Dr. Fonck described the personnel situation at OFES, noting a number of retirements are expected. He emphasized the opportunity for younger people to be involved in OFES. Also, Dr.

Fonck and Prof. Prager are on the search committee for the position formally held by Jim Decker. Dr. Fonck noted that OFES would greatly appreciate receiving suggestions on individuals that would be suited for these DOE employment opportunities.

*FESAC discussion:* Several questions were asked in regard to the role of basic plasma science and fusion technology, prompted by the NRC Plasma 2010 report and Test Blanket Module (TBM) Workshop. Dr. Fonck noted that OFES has programmatic goals, different from curiosity-driven science. He agrees that the TBM workshop reveals that fusion technology research has suffered. However, for both of these cases, he emphasized that it will be necessary to work with the community and government agencies to identify, plan, and structure the exciting science research that needs to be done. Dr. Fonck was also asked if it was possible for OFES to work with other federal agencies to help relieve the funding “gridlock”. Dr. Fonck noted the recent joint NNSA-DOE effort in the High Energy Density Laboratory Plasma (HEDLP) program as such an example. He also noted the materials expertise stewarded by Basic Energy Sciences, but that it up to the fusion community to drive the scientific issues and engage these other communities. Asked if reports from the recent workshops which Dr. Fonck referred to in his presentation would be made public, Dr. Fonck replied that he expected this to be the case. Asked if changes in personnel at the Office of Management and Budget (OMB) might cause changes in attitudes toward the fusion energy sciences, Dr. Fonck replied that this question is best put to Mike Holland, and that he is looking forward to working with Mr. Holland and others at OMB.

### **3. Report on the Fusion Simulation Project workshop.**

Prof. Arnold Kritz, Lehigh University, presented a summary of the workshop on the Fusion Simulation Project (FSP). The workshop was organized in four panels of 11-13 members. About 70-80 persons attended the workshop, roughly half the panel members and the other half DOE staff and others. The minutes from the workshop are available on request. Prof. Kritz described the FSP mission or vision, goals, and anticipated benefits that were refined in the course of the workshop. Beyond the vision articulated in the 2002 report, the panels sought to move forward with near and far term goals. As illustration, Prof. Kritz described the FSP approach to five critical issues: disruption effects and mitigation, pedestal formation and transient heat loads on the divertor, tritium migration and impurity transport, performance optimization and scenario modeling, and plasma feedback control, noting the recurring theme of the integrated nature of fusion science. Prof. Kritz described the FSP management and integration challenges (multi-institution, multi-code, etc.) He also described the FSP goals established for 5, 10, and 15 year time frames. The FSP was described as a framework to organize research, and OFES would issue calls for proposals to do the science. Prof. Kritz noted that the management strategy would be based on established principles, and he outlined some of the management issues would need to be addressed. In regard to connections to the rest of the program, Prof. Kritz noted that the base theory program is needed to support FSP efforts, and that improved diagnostics are required in the experimental program for validation efforts.

*FESAC discussion:* Several members of FESAC commented that, in particular, the Executive Summary of the Workshop Report did not clarify the opportunity and goals for the FSP. It was observed that three of the five example issues are “disasters” which may not adequately convey the scientific challenge and scope of vision for the project. Also, there is no reference to two previous FESAC reports related to FSP. Concern was also expressed that it might be hard for

“outsiders” to understand what the FSP is doing, what exactly is included in the codes, how an interested researcher might get involved, and how the FSP connects to the broader community. The multi-faceted integration of these issues is not adequately described in the Executive Summary or the report. Other members questioned the readiness and lofty goals of the FSP concept, citing the not fully mature current state of knowledge and appearance to create a “user friendly” environment prematurely. Others argued that the community is ready to begin integration tasks, but not complete it. In this regard, the FSP has no logic without a strong base program. A question was asked on the possible advantage of making the FSP international. Prof. Kritz replied that there are many problems. For example, Europe tends to be sensitive to intellectual property issues, required negotiated agreements. Japan appears most interested in pursuing a similar project on its own. There is cooperation in certain technical areas, but it has been hard to circumvent these issues. It was observed that verification and validation (V&V) is a critical need, but that the budget emphasizes computer science and theory: where is V&V, and experimental support for V&V in particular? Prof. Kritz replied that there is a clear investment in ITER, and that collaborations with other experiments are ongoing.

#### **4. Preliminary report from the FESAC Panel on the Fusion Simulation Project charge.**

Dr. William Tang, PPPL, presented a status report of the FESAC sub-panel he chairs that has been established to address the charge on the Fusion Simulation Project. He summarized the five charge questions and the panel makeup. Two panel members are assigned to lead the drafting of responses to the five charge questions. The panel’s report is to be delivered to FESAC by Oct. 19. Dr. Tang described the opportunity in FSP for US leadership and the panel’s initial impressions of the FSP initiative. There is good cooperation between DOE, OASCR, and SciDAC. In particular, interest by OASCR was evident in the workshop participation. Dr. Tang stated the targeted budget is \$20-25M per year, with significant resources from OASCR expected. He emphasized these must be new funds, not a redistribution of existing funds. Dr. Tang commented on the roadmap laid out in the FSP workshop report (particularly the 5, 10, and 15 year goals), but he emphasized this will need to be a “living” process, partly because of the incomplete status of the present knowledge base.

*FESAC discussion:* It was noted that five years have passed since the previous FESAC report on the FSP. If the same name is used, it must be made clear how this proposed project aligns with past recommendations, especially funding. Dr. Tang agreed, and added that expectations should be realistic. This project will take dedicated resources and re-alignment of some experimental resources to support verification and validation.

#### **5. Status report from the FESAC Panel on the scientific and technological issues leading to DEMO.**

Dr. Martin Greenwald (MIT), chair of the FESAC sub-panel established to answer the charge on strategic planning, presented a status report of the panel’s work, particularly the panel’s interpretation of the charge and the approach to answer the charge. Dr. Greenwald noted that the panel is not creating a new development plan or roadmap. Also, the discussion does not encompass the whole of the fusion program, and therefore the panel’s output will imply nothing about the importance of elements of the program that are not included in this process by its construction. Dr. Greenwald described the challenge to define what is meant by “DEMO”, noting that programs around the world do not have a consistent view on DEMO. The panel is adopting

the view that DEMO is a prototype, electricity producing fusion reactor, hence a broad view of technical issues is being adopted to cover multiple possibilities. Dr. Greenwald described five tasks that have been identified for the panel to complete its work: identify the issues, prioritize the issues, inventory available means, identify critical gaps and paths, and identify opportunities. The panel will draw on many available reports, plans, and concurrent activities. Dr. Greenwald described the process for community input. An online bulletin board has been established for communicating and receiving input to and from the community. The principal request to the community by the panel is white papers that address the charge. He noted that it is technically difficult to contact the community and suggested that FESAC might take on the task of making this process easier. Individuals will have the opportunity to address the panel at two meetings, one of which is complete, the other to be held in early August. A first draft of the report is scheduled to be complete by early September, and a final draft delivered to FESAC by October 1. Dr. Greenwald then described the set of issues that the panel is in process of defining; he emphasized that there is no unique way to define the issues. The issues are grouped under three broad themes in terms of building the knowledge base for next steps. Dr. Greenwald noted the challenge in prioritization given that all of the issues are important and must be solved. Risk of delay is unavoidable if the issues cannot be dealt with simultaneously. A systematic process based on a set of criteria is being developed by the panel to achieve consensus on priority. The gap analysis will begin at the sub-issue level, using metrics and measures of extrapolation as much as possible. The gaps will inherit their prioritization from the issue level.

*FESAC discussion:* It was observed that a DEMO fusion facility must demonstrate high availability, and so it was recommended that this be explicit under the “harnessing fusion power” theme. Dr. Greenwald noted the sub-panel debated this point specifically (calling it out separately versus as an integration issue). He assured FESAC that the importance of high availability is not being overlooked. A question was asked on how the international “available means” referred to in the charge (i.e., programs and facilities) will be weighed in priority. Dr. Greenwald noted this is an explicit criterion in the prioritization process the sub-panel is using, but that relative weighting of all criteria has not been settled. It was noted that with prioritized lists, it is typical to interpret the top few as most important and ignore the rest. Dr. Greenwald replied that the issues will most likely be ranked in tiers, and that it will be important to recognize that all of the issues are essential and cannot fall off the list. Supposing the report is endorsed by FESAC, the question was raised does the best proposal in the follow on process referred to in the charge address the highest priority issues? Dr. Greenwald responded that he anticipates this is how OFES will use the report. It was noted the the sub-panel is instructed to assume ITER is successful. Dr. Prager commented that the panel may need to decide what it means for ITER to be successful in the context of this charge. Dr. Fonck added that the charge is explicit in assuming ITER succeeds, but that there is a long term process for dealing with ambiguities. Dr. Greenwald replied that the gaps will be synthesized into missions in so far as possible. Whether or not this implies work on ITER or follow-ons to ITER remains to be seen. The question was asked if the sub-panel was going to identify the degree to which existing facilities will be able to address the issues. Dr. Greenwald replied that, ideally yes, but that is it no obviously straightforward to do so. Dr. Prager summarized the discussion, noting the sub-panel has created an excellent foundation that is logical and workable. He expressed concern that there is only one more scheduled face-to-face meeting of the sub-panel, partly to hear from the community. A suggestion for additional meetings was offered. Dr. Greenwald agreed the

schedule is difficult, and he is hopeful that conference calls will be more effective after the scheduled face-to-face meetings.

#### **6. Report on the High Energy Density Laboratory Plasmas workshop.**

Dr. Francis Thio (OFES) presented a status report on the High Energy Density Laboratory Plasma (HEDLP) program. Public release of an inter-agency report on HEDLP is imminent. Dr. Thio reported on two workshops, the Inertial Fusion Energy (IFE) Strategic Planning Workshop held at Sam Ramon, CA, and a HEDLP Workshop held at ANL. The IFE workshop was driven by a sense of urgency for National Ignition Facility (NIF) experiments. The workshop, chaired by Dr. Edmund Synakowski (LLNL), had 115 participants. The proceedings will be published in the Journal of Fusion Energy. All elements of IFE research and development were discussed, including the High Average Power Laser (HAPL) program, the Heavy Ion Beam program, and the Z-pinch program. A conclusion from the workshop was that DOE should plan for a transition from a laboratory ignition feasibility experiment to a program that addresses the science required for the energy application of inertial fusion. Dr. Thio reported that the HEDLP workshop was chartered by the Undersecretary of Science, and that it was chaired by Dr. Bob Rosner (ANL) and Dr. John Browne (LANL). Dr. Thio described three principle themes that emerged from the workshop: (1) enable fusion energy by HEDLP, (2) create, probe, and control new states of matter in HEDLP, and (3) ultrafast dynamics-catching reactions in the act. Dr. Thio announced that several of the Innovative Confinement Concept (ICC) projects that explore the science of HEDLP have been moved from the ICC program to the HEDLP program. Dr. Thio also described future plans in HEDLP, including a solicitation for new proposals in FY2008 competing for new money in FY2009.

*FESAC discussion:* The status of the funding for HEDLP in the House's budget was raised, given that it was explicitly removed from the Administration's proposed budget. Dr. Fonck replied that he expects the funding will be restored in the House-Senate conference. A concern was expressed on the parallel funding by DOE, NNSA, and joint DOE-NNSA for three possible inertial fusion energy (IFE) development paths. Dr. Thio replied that the stewardship for IFE is a clear issue. Dr. Fonck added that there are some focusing points, such as the National Ignition Facility (NIF) schedule. He added that OFES is working to understand how to engage the necessary discussion. A question was raised on the apparent lack of direct-drive capability for NIF, and the implications for the direct-drive fusion development path. Dr. Thio noted the workshop did not cover this issue in detail and invited Dr. Grant Logan to comment. Dr. Logan explained that the OMEGA upgrade is developing a plan for direct-drive on NIF, but that NNSA needs to make decisions on going ahead and on modest cost changes to front-end hardware, perhaps by later this year.

#### **7. Presentation of the plasma sciences decadal study by NRC.**

Prof. Steve Cowley (UCLA), and Dr. John Peoples presented an overview of the recently released Plasma 2010 decadal study undertaken by the National Academies. Dr. Tim Meyer (NAS) presented an introduction that put the Plasma 2010 study in perspective with other similar studies. Dr. Meyer described the NAS systematic survey of branches of physics done every decade or so. The NAS plans to issue a joint volume that includes the 2010 decadal studies for elementary particle physics, atomic, molecular and optical physics, condensed matter physics, and plasma physics. Prof. Cowley summarized the process used to conduct the study, which was

initiated in 2005. He noted the committee was composed of scientists examining plasma science (not a policy committee). The committee was organized in five groups that focused on the different areas of plasma research. Prof. Cowley described the study's key recommendation that DOE OFES should reorient its research programs to incorporate magnetic and inertial fusion energy sciences, basic plasma science, non-mission-driven high-energy density plasma science, and low-temperature plasma science and engineering. In these areas there are two recurring themes, new regimes and predictive capability. Prof. Cowley discussed six processes that illustrate the intellectual unity of these areas of plasma science, motivating the recommendation for the reorientation of DOE OFES programs. He also described four areas which demonstrate the importance of plasma research: (1) economic security, (2) energy and environmental security, (3) national security, and (4) scientific discovery. Dr. Peoples commented that it was personally rewarding and interesting for him to be a member of the panel. He described the panel's deliberation of options for recommendations, deciding on one principal recommendation that DOE OFES reorient its research programs. He elaborated on the meaning of "reorient," which is intended to mean re-focus rather than to move funding from A to B. He emphasized that the reorientation should be viewed as an evolutionary process rather than a revolutionary process. To illustrate this point, Dr. Peoples noted that it is possible to know everything there is to know about nuclear weapons, so NNSA support for plasma science is uncertain. And if ITER is successful, then fusion energy development might be moved from DOE OFES. In these cases, the question becomes who will steward plasma science? The Plasma 2010 study recommends this should principally be the job of DOE OFES.

*FESAC discussion:* It was noted that the report recommends an expanded role for OFES in funding plasma science, but without new resources. Dr. Peoples replied that ultimately yes, this is the report's recommendation, but the point is to reorient the stewardship so that plasma sciences would be able to gain more resources in the future. Prof. Cowley added that the report did not specify exactly how this should be done. He noted the recent reorientation of HEDLP research as a move the NRC panel strongly agreed with. He also noted that the only area where substantially new resources are required is low temperature plasma sciences, also observing a commonality with the edge of tokamak plasmas (implying a natural scientific connection to fusion sciences). An explanation of the use of phrase plasma science is "risky" was requested. Dr. Peoples replied this does not refer to the science, rather that changing anything in government programs is risky, and that there is also risk in doing nothing. Several questions were raised in regard to the implications for the role of the National Science Foundation (NSF), possibly leaving the NSF less responsibility for stewarding plasma sciences. Dr. Peoples and Prof. Cowley responded that the report commends the partnership between NSF and DOE, and recommends this continue. They also report that they have presented the study and its recommendations to these other agencies. They emphasize that the report does not intend to harm any existing partnerships, rather recognize the strengths of each agency, and find a way to make them work together. Asked why plasma astrophysics was not included in the reorientation, Prof. Cowley argued it would be a disaster to take plasma science out of NASA. He agreed it might be useful to have an interagency working group. A concern for the possible danger of small programs competing against large programs might be an issue under the study's recommendations. Dr. Peoples and Prof. Cowley noted the panel discussed this at length. The situation for areas like low temperature plasma science is so dire, however, that a change is viewed essential.

## **8. Public comments (2).**

Dr. Stephen O. Dean, Fusion Power Associates, commented on the charge for strategic planning (see item 5 above). He observed that over the past 6-7 years, OFES has gradually shifted way from a program with a balanced effort in science, technology, and multiple approaches to fusion. He argues that if the recommendations of the Plasma 2010 decadal study were implemented, then it would be one more step removing OFES from the responsibility of developing fusion power. He argued that a fusion energy development office might have to be established elsewhere in the DOE if the current trend in OFES continues. He referred to public comments made at the last FESAC meeting by Prof. Thomas Jarboe and himself expressing reservation that the charge on strategic planning would preempt discussion of non-tokamak approaches to fusion. He stated he was pleased with the Greenwald sub-panel's interpretation of the scope of the charge, but he is still concerned that the planning process will not wait for results from follow-on charges. He urged FESAC to encourage DOE issue subsequent charges soon. He expressed his belief that there will be multiple successful approaches to fusion power, and that we should proceed keeping in mind the first solution may not be the best or most practical.

*FESAC discussion:* Dr. Fonck noted that the current charge is specifically intended to be constrained, and that OFES is working on a next charge(s). It is not yet clear if this would be one grand charge, or multiple, more directed charges.

Dr. Karen Pao, NNSA, addressed FESAC on her interest in verification and validation (V&V). She is responsible for writing a national strategy for V&V (within NNSA?) and was interested in the Fusion Simulation Project's goals for V&V. She sensed reluctance in FESAC's discussion of the FSP workshop report (see item 3 above) and offered encouragement and noted parallels with the nuclear weapons program. She noted that V&V is best when there is still control over the codes, when they are modular and easier to debug and easier to define verification experiments. In regard to predictive capability, she encouraged considering how to define the approach since ab initio calculations will not be done in the near future. She noted that when greater computing power becomes available, this will allow more detailed physics, replacing ad hoc models with more fundamental models. She observed that mesoscale modeling is within reach.

*FESAC discussion:* It was noted that the purpose of SCIDAC is ab initio science. An advantage for the fusion program is ongoing experiments which make validation efforts more straightforward. Asked what fraction of the ASCII program is dedicated to V&V, Dr. Pao answered 10%.

First day, adjourned, 5:30 pm  
Second day, called to order, 9:00 am

## **9. DOE Perspective.**

Dr. Raymond Orbach, Under Secretary for Science, reported on the status of ITER and other recent events. Regarding ITER, all parties except Russia and China have completed their respective ITER agreement ratification processes. Russia and China are anticipated to complete their processes by the end of August. France has stated that the construction schedule will be



impacted if the official ITER organization is not established by October. Dr. Orbach noted that the US delegation has significantly influenced the process toward creating an effective international organization with good management principles. He noted that the organizational steps now underway will be critical to the project's success. He stressed the importance of the Management Advisory Committee (MAC), which will assist the ITER Council and Management Team to ensure sound project management, although there are differences in opinion among the partners as to the function of the MAC. Dr. Orbach also commented on the design review activities. The parties have agreed to participate in the finalization of the design (not counted as ITER credit), which needs to be completed by the end of the year. Dr. Orbach described the status of the budget, which includes an increase of \$109M for ITER in both the House and Senate versions. He also discussed the differences in the two versions, particularly in regard to the High Energy Density Laboratory Plasma (HEDLP) program. He stated it is not clear why the House bill zeroed out HEDLP funding, hoping that it is just a misunderstanding that will be resolved in the conference process. In reflecting on the future, Dr. Orbach noted that the planning for new facilities takes years, and that now is the time to think about the "roll-off" of ITER construction funds. He stressed that it is up to the fusion community to produce scientifically strong proposals. How to get from where we (the fusion community) are to where we want to go is the essence of his charge to FESAC (see 5 above).

*FESAC discussion:* Dr. Orbach was thanked for his strong support of fusion research and ITER. He was asked whether the gaps referred to in the charge on strategic planning (see item 5 above) were structural or research in nature. Dr. Orbach replied that there are two different kinds of gaps. One is scientific: where research needs to go relative to the present knowledge base. The second is a facilities gap: the existing fusion research facilities are old and there are opportunities for new facilities represented in the ITER roll-off. He noted that other (non-fusion) programs have a continual renewal of facilities. He noted that new facilities are anticipated in the 10 year planning from 2003, although the specifics are more vague further out in time. Dr. Orbach was asked how the ITER partners are reacting to the U.S. push for strong project management. He replied that at the recent interim ITER Council Meeting, India was very helpful in also forcing these points. He noted that although some countries have gotten used to cost overruns, the Office of Science will not have cost overruns. The OS's track record in completing major construction projects on time and on budget has allowed relative freedom in proposing new facilities. Dr. Orbach was asked about addressing engineering sciences in the charge on strategic planning. He was reluctant to comment, stating he does not see a difference between basic and applied research, leaving it to the fusion community to provide advice on important science for which the U.S. can be leaders. Dr. Orbach was also asked about funding for workforce development. He replied that Congress zeroed out educational support in the DOE budget, but he is hopeful that a standing budget with \$5M/year increases will be restored. He encouraged FESAC to work with Mr. Bill Valdez to be included in educational support discussions.

## **10. Report on ITER Project.**

Mr. Jeffrey Hoy, US ITER Program Manager, presented a status report on ITER and the US ITER Project. Mr. Hoy took over Warren Marton's position nine months ago. He summarized the first meeting of the Interim ITER Council, key facts about ITER, and the construction phase cost sharing. The U.S. is responsible for 1/11 of the project construction. A central reserve of

10% has been established, made possible by India joining the project. Dr. Hoy also described the management structure and personnel for the ITER Organization, as well as the top-down integrated project schedule. A near term critical path is licensing. A preliminary safety report is expected to be submitted this year. A major activity currently underway is a bottoms-up schedule assessment. Mr. Hoy noted that the lack of domestic agencies analogous to the US ITER Project Office is hampering this activity. It is hoped this schedule will be completed by the end of the year. It is also hoped that the bottoms-up planning will agree with the established top-down schedule. Presently the bottoms-up schedule has two more years required for ITER construction. Mr. Hoy also described the ITER design review currently underway to establish a new baseline capability. The de-scoping of ITER capability during 1998-2001 was performed quickly in some areas, leading to inconsistencies and technical issues that will be addressed by the design review. Mr. Hoy also announced that the Broader Approach agreement between Europe and Japan has been signed. Ingredients in the Broader Approach include upgrade of JT-60, the establishment of an international research center and remote participation capability, and the design of IFMIF. Mr. Hoy also reviewed ITER progress on the domestic front. He reviewed the U.S. in-kind contributions, the organization of the U.S. ITER Project Office (USIPO), and the USIPO activities. Mr. Hoy discussed the ITER construction budget, which has been fixed (an unusual occurrence for large construction projects prior to the CD-2 phase). He emphasized that the ITER design must be completed soon so that the U.S. in-kind contributions can be completed on time.

*FESAC discussion:* Several questions were asked about the ITER design review. It was noted that the design review will last six months, so a question was asked if the implied delay is already such that the construction cannot fit within the established funding profile. Mr. Hoy answered that the design must be complete by next Spring before there is a need to look at the profile differently. Asked if ITER commissioning is still expected to occur in 2014, Mr. Hoy answered that until the domestic agencies are established by all of the parties, it will be difficult to assess the level of commitment to the schedule. He answered that the parties are aware that the construction schedule is a major issue in the U.S. Asked if re-design of aspects of ITER was a concern given the established cost cap, Mr. Hoy agreed this is a source of worry but that the ITER Organization has not yet dealt with this issue (too early). Asked who is responsible for licensing, Mr. Hoy answered that the Deputy Director General for Safety is responsible for working with French regulators on licensing. A comment was made that it is surprising that there appears to be no one in the ITER Organization hierarchy has a French affiliation. Mr. Hoy answered that an assistant to one of the Deputy Directors General is French and is familiar with the system. Also, an entity has been created to deal with this issue. A question was asked if the project had sufficient design engineers. Mr. Hoy answered that the ITER Organization is lean in many areas. Dr. Holtcamp is attempting to use consultants and service contracts to help alleviate this shortage during the ongoing process to fill open positions.

#### **11. USBPO Update and ITER Design Review Activities.**

Dr. James Van Dam, Director of the U.S. Burning Plasma Organization (USBPO), presented an update on USBPO and ITER design review activities. He noted that although USBPO has broader scope than ITER, during the last few months, high priority ITER issues have been the principal USBPO focus. A USBPO workshop on diagnostics was held in Feb. at San Diego, which stimulated a white paper to address a gap in developing diagnostics for burning plasmas.

Presently there is some support from the USIPO, but the OFES diagnostics program only supports existing facilities, not new facilities. The white paper describes an initiative that would operate within the existing program. Dr. Van Dam reported that a USBPO Council sub-committee, chaired by Dr. Earl Marmor (MIT), has been formed to establish a long-range strategy for burning plasma research. This planning builds on the EPACT report submitted to Congress. Dr. Van Dam described USBPO activities planned in conjunction with the APS-DPP meeting in Orlando. A special evening session with featured speaker Dr. G. Janeshitz will be held. Also, Dr. Van Dam will present a tutorial talk on “The Scientific Challenge of Burning Plasmas.” Dr. Van Dam described the USBPO coordination of U.S. participation in the ITER design review. He outlined the timeline and Issue Card process. The design review is being conducted by 8 working groups whose membership includes U.S. personnel. A meeting is occurring during the week of this FESAC meeting to consider the first group of design changes. Dr. Van Dam described activities of Working Group 1 to illustrate the process.

Meeting adjourned at 11:45 am

**Appendix: public attendees.**

Raymond Orbach, DOE  
 Grant Logan, LBNL (HIFS-VNL)  
 Miklos Porkolab, MIT  
 Thomas Jarboe, University of Washington  
 Tony Taylor, General Atomics  
 Rich Hawryluk, PPPL  
 Dale Meade, Fusion Innovation Research Energy  
 George Tynan, UCSD  
 Dan Lehman, DOE/SC  
 Stan Milora, ORNL  
 Stephen Dean, FPA  
 Bill Tang, PPPL  
 Arnold Kritz, Lehigh University  
 James W. Van Dam, IFS-Texas  
 John Willis, self  
 Mark Haynes, General Atomics  
 Mohamed Abdou, UCLA  
 John Peoples, Fermilab  
 Steve Cowley, UCLA  
 Mike Holland, OMB  
 Karen Pao, NNSA  
 Kate Beers, OSTP-EOP  
 Stephen Knowlton, Auburn Univ. (UFA)  
 Kin Chao, DOE/SC  
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