

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

**July, 2004  
Marriott Hotel, Gaithersburg, Maryland**

## **Committee Members Present:**

Richard D. Hazeltine (Chair)—University of Texas at Austin  
Charles C. Baker (Vice Chair)—University of California, San Diego  
Ricardo Betti—Rochester University  
Jill P. Dahlburg—Naval Research Laboratory  
Jeffrey P. Freidberg—Massachusetts Institute of Technology  
Martin J. Greenwald—Massachusetts Institute of Technology  
Joseph A. Johnson, III—Florida A&M University  
Rulon Linford—Retired  
Gerald A. Navratil—Columbia University  
Cynthia K. Phillips—Princeton Plasma Physics Laboratory  
Ned R. Sauthoff—Princeton Plasma Physics Laboratory  
John Sheffield—Joint Institute for Energy and Environment  
Ronald D. Stambaugh—General Atomics  
Edward Thomas Jr. —Auburn University

## **Committee Members Absent:**

Joseph J. Hoagland—Public Power Institute, Tennessee Valley Authority  
Kathryn McCarthy—Idaho National Engineering and Environmental Laboratory  
George J. Morales—University of California, Los Angeles

## **Ex-Officio Members Present:**

David Hammer (Division of Plasma Physics, American Physical Society) —Cornell University  
John Steadman (Institute of Electrical and Electronics Engineers) — College of Engineering, University of South Alabama

## **Ex-Officio Members Absent:**

A. René Raffray (American Nuclear Society)—University of California, San Diego

## **Designated Federal Officer Present:**

N. Anne Davies (Associate Director, Office of Fusion Energy Sciences)—U.S. Department of Energy

## **Others Present:**

François L. Waelbroeck (FESAC Executive Secretary)—University of Texas at Austin  
Michael Holland (invited speaker)—OSTP

## **1. Call to Order and Opening Remarks**

The Chair opened the meeting at 9:00 AM and thanked FESAC members for their attendance.

## **2. OFES comments (Ann Davies)**

Dr. Davies summarized the status of the FY 2005 OFES budget and described the allocation of the tax refund received from the city of San Diego. She then described the process followed to select the US ITER project office. She also briefed the committee on the status of various items in the SC portfolio including SCiDAC, the Fusion Simulation project, theory, ICC, NSTX, and the Fusion Science Centers. She introduced Kenneth Hill who has recently joined OFES and will assume oversight of a portion of the ICC projects, as well as take over leadership of the ICC team. His work will enable Francis Thio to focus more of his time on High Energy Density Physics.

Dr. Davies ended her presentation by presenting the ten-year goals for fusion energy science and a road map of objectives and performance targets. She described three proposed annual measures describing program performance with respect to science, operations, and construction. She explained how progress would be evaluated for each of these measures.

Following Dr. Davies' talk Richard Hazeltine asked what would happen if the milestones for the science measure were not met, and expressed the concern that the existence of the measures would impede progress by encouraging managers to favor conservative research plans over the inherent risks of innovation. Dr. Davies replied that the Office of Science (SC) appreciated the nature of scientific research. She explained that OMB and the administration demanded the measures for operation and construction, and that Office of Science added the science measure because they wanted to be judged on this as well. Charles Baker asked if milestones could be renegotiated in face of circumstances beyond the control of the participants. Dr. Davies answered that they could not. She added that OMB wanted the measures to be auditable, and intended them to affect management practices.

## **3. Overview of the Priorities Panel activities (C. Baker)**

Charlie Baker presented the interim report of the panel on program priorities that he chairs and summarized the progress made by the panel. He summarized two guidelines drawn from studying similar prioritization exercises in other areas of science. These guidelines are to focus on scientific questions as the source of topical research programs, and to treat facilities as a means to address these questions. Following these guidelines, the panel organized its work by defining three overarching themes (inspired by the three program goals of the 1996 restructuring) and 15 topical questions that were grouped according to six themes. The panel charged working groups organized according to the topical questions to identify a small number of research thrusts for each question. The priorities panel intends to organize these research thrusts into approximately ten campaigns. Baker explained that the panel considered all aspects of inertial fusion research when considering research challenges but intended to consider only topics currently funded by OFES when considering future priorities. He also explained that until

now the panel has been relatively unaffected by uncertainty regarding the ITER negotiations, but that he expected this uncertainty to impact the future work on priorities.

In the discussion following Baker's presentation several FESAC members expressed dissatisfaction with the prose of the interim report in general and with the executive summary in particular. Some members suggested adding figures to make the report more readable.

Dr. Davies expressed concern with the third overarching theme of making fusion power practical. She explained that outside reviewers of our program believe that we do not have enough information at present to address fruitfully the question of how to make fusion power commercially practical. John Steadman agreed and pointed out that outside readers might interpret the word "practical" more broadly than intended.

With regard to Inertial Fusion research, Ned Sauthoff suggested that the panel should broaden its scope beyond SC funded research to include all research not funded by NNSA. This would allow it to recommend presently unfunded activities if necessary.

The committee next heard a series of reports from representatives of the topical groups on macroscopic plasma behavior (G. Navratil), Multi-scale transport behavior (P. Terry), waves and energetic particles (Earl Marmor), high energy density implosion physics (R. Betti), boundary physics (S. Allen), and fusion engineering science (M. Abdou). Committee members offered several suggestions to each of the speakers.

Chairman Hazeltine opened the concluding discussion of the interim report on priorities by asking committee members to forward their suggestions to the chairs of the topical groups. He then presented the following summary of the committee's suggestions:

1. Improve readability, convey excitement. Prose tends to be committee-like, too general or vague (even at highest levels). *Make forest visible, not just trees. Add Figures.*
2. Include mention of accomplishments and competence
3. Increase emphasis on diagnostic infrastructure, personnel needs (skilled people?)
4. Open window to wholly new ideas with historical examples.
5. Consider modifying the order of topics (T1-T6) and the arrangement of topics (T10-T12).

General recommendations included striving to display an effective process; to present a strong transparent structure; and to display visible science quality.

Following Hazeltine's summary FESAC members added further recommendations. Phillips suggested moving process issues out of the executive summary. Hazeltine polled the committee to gauge support for suggestion 3 (concerning diagnostic infrastructure) in the above list, and found that 8 members supported this suggestion.

Several committee members expressed anxiety regarding the question of the future of ITER. Some suggested delaying the report until after the conclusion of the ITER site

negotiations. Greenwald reminded the committee that Dr. Looney (OSTP) had advised the committee to take the time necessary to do the job right. Other members suggested that the panel should address the possibility of failure of the ITER negotiations in their recommendations. Dr. Davies took note of the concerns expressed by the committee but firmly rejected the above suggestions, stating that SC planning was based on the assumption that ITER would be built. She asked the panel to adopt this assumption and to proceed with their work without delay.

#### **4. Public Comment**

Rob Goldston (Princeton Plasma Physics Laboratory) presented a series of specific suggestions regarding the priorities report. In particular, he suggested replacing the wording of the third overarching goal by “explore innovations in confinement and technology.” He advocated making the discussion of the six themes more exciting through stronger connection to widely recognized deep and broad science issues, and making these themes the basis for the campaigns. He argued that the science themes were natural nucleation points for the community.

Adil Hassam (University Fusion Association and University of Maryland) approved of the choice of topical questions but expressed concern at what he perceived to be a competition between process and content in the interim report. In particular, he recommended separating the description of the priorities process from the executive summary.

Dale Meade (PPPL) reminded FESAC of its earlier recommendations regarding the strategy for pursuing a burning plasma experiment. Meade quoted the FESAC statement that “if ITER does not move forward FIRE should be advanced as a US based burning plasma experiment with strong encouragement of international participation.” He stated that the original design assumptions for FIRE have been validated by the intervening results, and informed the committee of the successful completion of the physics validation review. Meade concluded by asking that the FESAC Burning Plasma Strategy Panel be charged to expeditiously reassess the U.S. Burning Plasma Strategy *if the ITER decision process remains deadlocked past July 2004.*

Miklos Porkolab (MIT) endorsed the comments of previous speakers and expressed his concern with the problems caused by the delay in funding for the SCIDAC program.

Kim Stein (AREVA) presented a description of his company’s capabilities and achievements and conveyed its interest in ITER.

## **SECOND DAY**

The meeting reconvened the following day at 9:00.

### **5. Status of ITER Project (N. Sauthoff)**

Sauthoff gave an overview of progress in ITER design work. He described a vigorous international program that is making good progress in solving the remaining design issues and preparing for an efficient start of construction. He informed FESAC, however, that the international team was perceived to be subcritical in size and that the US should consider providing staff in several areas, which he listed. He concluded by describing the organization of the US project office.

### **6. Report on the meeting of the Plasma Science Advanced Computing Institute (PSACI) Advisory Committee (W. Tang)**

Tang told the committee that the SCiDAC program is producing new scientific insights and conceptual breakthroughs, and that the computer science and applied math partners have delivered new capabilities. He illustrated the progress achieved with several attractive and colorful graphics. He then presented a series of recommendations aimed at optimizing the use of start-up resources for the Fusion Simulation Project (FSP).

In the discussion following Tang's presentation Baker expressed concern that the \$2M startup funds for the FSP should be used for more than planning. Tang responded that he expects a significant portion of those funds to go to edge modeling, which can be seen as a prototype for other integration problems. Greenwald expressed his disappointment that the recommendations of the Committee of Visitors had not been taken into account by the SCiDAC reviewers. John Willis responded by saying that the reviewers were aware of the recommendations but had apparently chosen to give greater weight to other criteria, such as supercomputing relevance and interaction with applied math and computer science communities.

### **7. Discussion of program intermediate milestones**

In the discussion of the program plan committee members expressed concern that the roadmap gave the appearance of being driven by facilities rather than scientific objectives. Concern was also expressed over the need for intermediate milestones in the preparations for burning plasma. Sauthoff suggested basing intermediate goals on planned activities aimed at understanding burning plasma scenarios.

### **8. Concluding remarks**

Dr. Davies reminded FESAC that R. Hazeltine plans to step down as chairman of FESAC after this meeting. She thanked Hazeltine for his work and dedication.

The meeting was adjourned at 12:00

## **APPENDIX: Guest List**

Mohamed Abdou—UCLA  
Steve Alan—General Atomics  
Dave Baldwin—General Atomics  
Sam Barish—DOE/OFES  
Ben Cross—Westinghouse  
Steve Dean—FPA  
Steve Eckstrand—DOE/OFES  
Kazuo Fujiki—JAERI  
T. V. George—DOE/OFES  
Rob Goldston—PPPL  
Richard Hawryluk—PPPL  
Angela Hardin—Inside Energy  
Adil Hassam—UFA/U. Maryland  
Mike Holland—OSTP  
Kenneth Hill—DOE/OFES  
Arnold Kritz—DOE/OFES  
Sharon Long—DOE/OFES  
Ron McKight—self  
Earl Marmar—MIT  
Dale Meade—PPPL  
Gene Nardella—DOE/OFES  
Erol Oktay—DOE/OFES  
Albert Opdenaker—DOE/OFES  
Miklos Porkolab—MIT  
Michael Roberts—DOE/OFES  
Michael Saltzman—DOE  
John Sauter—DOE/OFES  
Kim Stein—Framatome ANP  
Michael Strayer—DOE/OFES  
Bill Tang—PPPL  
Francis Thio—DOE/OFES  
Mike Ulrickson—SNL  
James Van Dam—Univ. Texas  
Tom Vanek—DOE/OFES  
Jason Van Wey—MIT  
John Willis—DOE/OFES