

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

**March 29-30, 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  
Martin J. Greenwald—Massachusetts Institute of Technology  
Joseph A. Johnson, III—Florida A&M University  
Rulon Linford—Retired  
Kathryn McCarthy—Idaho National Engineering and Environmental Laboratory  
George J. Morales—University of California, Los Angeles  
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:**

Jeffrey P. Freidberg—Massachusetts Institute of Technology  
Joseph J. Hoagland—Public Power Institute, Tennessee Valley Authority

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

David Hammer (Division of Plasma Physics, American Physical Society) —Cornell University  
A. René Raffray (American Nuclear Society)—University of California, San Diego  
John Steadman (Institute of Electrical and Electronics Engineers) — College of Engineering, University of South Alabama

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

None

## **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

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

The Chair opened the meeting at 9:00 AM and welcomed Dr. R. Orbach, Director of the Office of Science.

## **2. SC comments (R. Orbach)**

Dr. R. Orbach thanked FESAC for its work. He then summarized the budgetary situation and complimented FESAC and the fusion community on the role they had played in the selection of the first two facilities on the DOE facilities list — ITER and a leadership-class 200 Tflops computer. He described his vision for a new sociology of high-end computing and informed FESAC that he has secured 4.5 M CPU hours at NERSC to support work towards this goal. Dr. Orbach next described the progress of negotiations concerning the site-selection for ITER. He pointed out the unique nature of ITER as the first truly international project.

Dr. Orbach concluded his talk by commenting on the tasks he has charged FESAC with. He stressed the importance of the prioritization activity, commenting that the results of this activity will determine the future of the US fusion program. He instructed FESAC to develop the priorities in such a way that the program can blossom when budgets get better, noting that one must plant when times are tough.

Chair Richard Hazeltine expressed the committee's appreciation for Dr. Orbach's steadfast advocacy and guidance of the fusion program, and thanked him warmly for his support.

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

Dr. Davies began by introducing three new members of the OFES team: Sam Barish (Stellarators), Sharon Long (ITER administrator) and Kathryn Chantry (assistant to Dr. Davies). She then gave a summary of the budget situation. She concluded her talk by commenting on the nature of fusion as a moral imperative in the face of global energy demand and environmental concerns.

Following Dr. Davies' talk Charles Baker expressed his dismay with the decision to eliminate fusion technology funding, and asked Dr. Davies to explain the reasons for this decision. Dr. Davies replied that the budgets were tight and that it was not possible to support a comprehensive research portfolio on available funds. John Sheffield expressed his agreement with Baker and added that maintaining technological know-how was key to our ability to capitalize on the results of ITER and NIFS. René Raffray deplored the imbalance between MFE and IFE and the dissonance between the budget and the stated policy goals. Jerry Navratil asked if the labeling of operations funds as ITER support might put these funds at risk of being redirected to support ITER construction. Dr. Davies assured him of DOE's intention to oppose any such redirection

## **3. Workforce panel report (E. Thomas)**

Edward Thomas described the report of the panel on workforce needs that he chaired. He explained that the panel wanted to avoid advocating the training of scientists that the

program would be unable to employ. The conclusion of his panel's investigations, however, was that a medium-term labor shortage was inevitable and that the shortage would become severe over the long term. His report was followed by a vigorous discussion in which some members pointed out that key conclusions of the report were based on the optimistic scenario described in the 35-year development plan. These members requested that the nature of the assumptions be given more emphasis in the report. Other FESAC members expressed support for the report and offered suggestions for strengthening its recommendations. Chairman Hazeltine summarized the discussion by noting that the concerns of FESAC could be met by making a number of minor changes to the report. Professor Thomas agreed to implement these changes.

#### **4. Report of Committee of Visitors (W. Nevins)**

Bill Nevins described the work performed by the committee of visitors and the methods the committee used. He then explained the recommendations contained in the report. He took special care in justifying the recommendation that OFES should strive to increase the success rate among new applicants, a recommendation that was greeted with an expression of concern by Curt Bolton (OFES). Anne Davies corrected the misconception that peer review is a recent innovation, pointing out that the nature of the recent changes is to carry out peer reviews on a competitive basis. She stated that she does not support warning reviewers about likelihood of partial funding, as suggested by the Committee of Visitors.

Chairman Hazeltine read a cover letter to Dr. Orbach expressing FESAC's unqualified endorsement of the report of the workforce panel. FESAC approved the letter after editing it. Hazeltine then read another cover letter expressing FESAC's unqualified endorsement of the COV report. The committee approved the second letter unanimously.

#### **5. IFE panel report (Rulon Linfoord)**

Rulon Linfoord presented the results of the work of the IFE panel. He summarized the progress achieved in the three approaches to IFE and described the basis for the panel's conclusion that all approaches are currently on track in their respective development paths. He stated that the IFE Panel is of the unanimous opinion that the IFE program is technically excellent and that it contributes in ways that are noteworthy to the ongoing missions of the DOE. He also voiced his panel's concern with the elimination of the fusion technology program. In the discussion following the presentation, Linfoord described the US position with respect to the world program. In response to another question, he stated that a comparison of the merits of the three main approaches to IFE was premature, and that carrying forward a spectrum of approaches increased the chances for success. Jill Dahlburg added that making such a comparison was not part of the panel's charge.

A letter endorsing the IFE report, prepared by Chairman Hazeltine, was discussed and adopted unanimously by FESAC.

## **6. Public comments**

Rob Goldston (Princeton Plasma Physics Laboratory) presented an alternative analysis of the fusion program's workforce needs based on the assumption of a 5% annual growth in budget. His conclusion was that the program could meet the demand for labor by hiring 50% of its own graduates and supplementing this with 30% of outside graduates.

Arnold Kritz (Lehigh University) concurred with the conclusions of the workforce panel and pointed out that the recent immigration restrictions are having a negative impact on our ability to attract and retain foreign students. He surveyed various programs providing support for young scientists and called for continuing funding of these programs

Miklos Porkolab (MIT) presented data showing that approximately one fifth of MIT students since 1980 have remained in the program. He agreed with the conclusions of the workforce development panel, and stated that the situation was particularly difficult with regard to the competitive hiring of new faculty.

François Waelbroeck expressed his support for the procedural recommendations contained in the report of the Committee of Visitors, but objected to other recommendations promoting particular research quality criteria. He asked that reviewers be allowed to exercise their own judgment as to the relative importance of the various quality criteria.

The meeting was adjourned for the day at 17:00.

## **SECOND DAY**

The meeting reconvened the following day at 9:00. Dr. Davies informed the committee of the success of a DOE suit against the city of San Diego concerning the taxation of DIII-D operations by the city. The city has reimbursed the government, and the collected funds excluding interest are expected to become available to OFES.

### **7. Role of developing countries in international fusion program (J. Sheffield)**

John Sheffield reported on a conference examining the role of developing countries in the fusion effort. He summarized the situation regarding population growth and the threat from greenhouse gases if projected energy demand is met through fossil fuels. A major question is the availability of capital enabling developing countries to meet their energy needs. Sheffield reviewed the energy situation in various key countries such as India, China and S. Korea. He concluded his report with the statements that new energy technologies are needed on a massive scale, and that extensive deployment in transitional and developing countries require global development.

In response to requests for copies of his talk, Sheffield directed FESAC to [www.jiee.org](http://www.jiee.org) (joint institute for energy and environment.)

### **8. Report on the work of the priorities panel (C. Baker)**

Charles Baker next reported on the activities of the priorities panel. He presented the membership of the panel and explained that it had expanded somewhat to address concerns about the inclusion of younger scientists. Another issue faced by the panel was how to deal with the IFE program, which is presently funded from two different sources. The panel decided to limit their recommendations on priorities to the part of the IFE program funded by OFES, but will include all aspects of inertial fusion research when describing technical issues.

Baker next explained that the priorities panel had examined the work of similar panels in other fields and agreed on a work plan. In broad outline, the plan calls for (1) developing overarching themes and scientific questions and developing decision criteria; (2) developing a process for working with the community to define research thrusts and campaigns; (3) developing priorities and interacting with the community. He then described the themes and decision criteria developed by the panel so far. He explained that the decision criteria were divided in two categories representing criteria to be applied to campaigns across all topical questions and criteria to be applied to individual campaigns or activities to help determine priorities within each topical area.

After Baker's talk, the concern was expressed that the two categories of decision criteria might become synonymous with large and small projects, and that the prioritization process would result in the elimination of small-scale investigator-driven research to the benefit of large projects. Baker replied that the panel does not intend to list all projects in a single ordered list, but will instead address relative emphasis. Another member expressed the concern that the questions listed by the panel might not lead to ITER and burning plasmas as the first priorities. Baker replied that the panel did not want to use

ITER as a starting point but that the set of questions selected by the panel was similar to those which led preceding panels to recommend making burning plasmas the top priority.

### **9. Report on status of ITER project (N. Sauthoff)**

Ned Sauthoff described the progress of multi-party discussions aimed at defining the nature of the US contribution to ITER. He pointed out that the success of our ITER participation depends on how well we prepare. Items being discussed include management structure, staffing, procurement systems, procurement allocations, resource management regulations, risk, intellectual property and decommissioning. Sauthoff focused his talk on the procurement allocations. He informed the committee that allocations consistent with the negotiated percentages had been tentatively agreed on and that these included roughly 70% in high-technology contributions (which is a greater fraction than in the whole). The scope of the contributions satisfies export restrictions and is matched to US interests and capabilities. His talk offered many illuminating glimpses into the engineering issues associated with coil construction and diagnostic placement.

In response to questions, Sauthoff explained that the additional cost of dividing some construction projects among different suppliers should be balanced with the need to insure against failure of one of the producers by building redundancy and with the desires of the parties to engage in specific technologies.

### **10. Concluding remarks**

Chairman Hazeltine asked members to consider a suggestion by R. Betti to start future meetings at 9:30 to allow people to travel on the day of the meeting.

The meeting was adjourned at 12:00

## **APPENDIX: Guest List**

Curtis Bolton—DOE/OFES  
Rostom Dagazian—DOE/OFES  
Steve Dean—FPA  
Adil Hassam—UFA/U. Maryland  
Bill Nevins—LNNL  
Rob Goldston—PPPL  
Richard Hawryluk—PPPL  
Dave Baldwin—General Atomics  
Erol Oktay—DOE/OFES  
Albert Opdenaker—DOE/OFES  
John Sauter—DOE/OFES  
John Willis—DOE/OFES  
Miklos Porkolab—MIT  
Grant Logan—Berkeley  
Arnold Kritz—DOE/OFES  
Michael Roberts—DOE/OFES  
Darlene Markerick—DOE  
Francis Thio—DOE/OFES  
Michael Strayer—DOE/OFES  
Steve Eckstrand—DOE/OFES  
Gene Nardella—DOE/OFES  
Sharon Long—DOE/OFES  
Kathryn Chantry—DOE/OFES  
Sam Barish—DOE/OFES  
Wilhelm B. Gauster—Sandia  
Ray Stults—LANL  
Dan Goodin—General Atomics  
Jason Van Wey—MIT  
Buff Miner—DOE/OASCR  
A. Damani—E.C.  
Chris Carter—PPPL  
Stan Milora—ORNL  
Mark Tillack—U.C. San Diego  
Mike Holland—OSTP