

# Minutes of the Meeting of the Fusion Energy Sciences Advisory Committee (FESAC)

February 27 & 28, 2001  
Hilton Hotel, Gaithersburg, MD

## Committee Members Present:

Richard D. Hazeltine (Chair)—University of Texas at Austin  
Charles C. Baker—University of California, San Diego  
Vincent S. Chan—General Atomics  
Jill P. Dahlburg—General Atomics  
Jeffrey P. Freidberg—Massachusetts Institute of Technology  
Joseph A. Johnson, III—Florida A&M University  
John D. Lindl—Lawrence Livermore National Laboratory  
Kathryn McCarthy—Idaho National Engineering and Environmental Laboratory  
William McCurdy—Lawrence Berkeley National Laboratory (afternoon session of February 27)  
George J. Morales—University of California, Los Angeles  
Gerald A. Navratil—Columbia University  
Cynthia K. Phillips—Princeton Plasma Physics Laboratory  
Marshall N. Rosenbluth—General Atomics  
John Sheffield—Oak Ridge National Laboratory

## Committee Member Absent:

William McCurdy—Lawrence Berkeley National Laboratory (morning sessions of February 27 and 28)

## Ex-Officio Members Present:

Allen Boozer (Division of Plasma Physics, American Physical Society)—Columbia University  
Kathryn McCarthy (American Nuclear Society)—Idaho National Engineering and Environmental Laboratory  
Ned R. Sauthoff (Institute of Electrical and Electronics Engineers)—Princeton Plasma Physics Laboratory

## Designated Federal Officer Present:

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

## Others Present:

James W. Van Dam (FESAC Secretary)—University of Texas at Austin  
Names of guests who were present at the meeting are listed in the Appendix at the end of these minutes.

## Tuesday, February 27, 2001

### 1. Call to Order

The chair, Richard Hazeltine, called the meeting to order at 9:02 a.m. on Tuesday, February 27, 2001.

The chair noted that the agenda had been somewhat revised from that posted on the FESAC web page; copies of the revised agenda were distributed. The chair noted that an email reflector has been set up for intra-FESAC communications. The chair requested that FESAC members attempt to minimize the number of paper copies that need to be made on-site at FESAC meetings.

### 2. OFES Perspective

Anne Davies discussed activities of the US Fusion Energy Sciences Program.

She explained that Dr. Jim Decker, acting director of the Office of Science, although originally scheduled to attend this meeting, would be unavailable due to the pressure of budget discussions with the new administration. She said that she expects the Office of Science to have a good budget for this year, although the overall DOE budget will

decrease. The administration will send its Budget Blueprint to Congress tomorrow. A detailed budget will be issued on April 3.

She described the DOE partnership in basic plasma science and engineering with the National Science Foundation. This partnership grew out of the restructuring of the fusion energy program and the initiation of a general plasma science program within the Office of Fusion Energy Science. A five-year memo of understanding was signed with NSF in late 1996. Major announcements of opportunity were made in FY 1997 and FY 2000. In off years, NSF and DOE have jointly reviewed basic plasma science proposals submitted to NSF physics and other divisions. Since 1997, almost 500 proposals have been or are being reviewed under the partnership. OFES funding for the partnership during this time (through FY 2000) has been more than \$16M. OFES has itself funded or jointly funded with NSF more than 50 proposals. Negotiations with NSF to renew this partnership will be carried out this summer, with joint funding of plasma science centers to be a part of these discussions.

She described the Scientific Discovery through Advanced Computing (SciDAC) program. This program has survived in the new budget. OFES wants to establish topical centers in three of the following areas: turbulence and transport, macroscopic equilibrium and stability, magnetic reconnection, electromagnetic wave/particle interactions, boundary layer effects in plasmas, and electromagnetic fields and beam dynamics in particle accelerators. A Fusion Energy Sciences Notice was published on January 3. The application proposals will be evaluated against standard OFES criteria. In addition, scientific and technical merit will include four other criteria. Appropriateness of proposed method or approach will also consider collaboration among members of the center; communication with other advanced computation efforts; verifying and validating the models developed; and quality and clarity of the proposed work schedule and deliverables. The ultimate product of a topical center is to be a single sophisticated code or (if dictated by the complexity of the physical system being modeled) a fully integrated set of codes. In response to a question whether the SciDAC evaluation criteria are too narrow, she noted that these criteria had been developed by the SciDAC program in the Office of Science, with input from the Office of Advanced Scientific Computing Research. There had been a general recognition that integrated teams are needed.

She described progress toward an effective International Tokamak Physics Activity (ITPA). Europe, Japan, and the US held discussions in Japan a month ago (Russia was not represented) and came up with a workable system. The objective is cooperation in the development of the physics basis for burning tokamak plasmas—including data bases, modeling, analysis, and workshops. Access to all relevant data bases, including that of ITER, will be provided for all participants. It reflects a common desire on the part of the US, Japan, Europe, and Russia to work together on a broader basis than that of ITER and of the International Preparatory Meetings of the last two years. The arrangement will use existing mechanisms: viz., legal formalities based on bilateral agreements; the Coordinating Committee (whose US members are E. Oktay, N. Sauthoff, and R. Stambaugh); and the seven ITPA topical science groups. The arrangement has been endorsed by IAEA International Fusion Research Council and the IEA Fusion Power Coordinating Committee.

She gave an update about the International Tokamak Experimental Reactor (ITER) project. The ITER parties (Japan, Europe, and Russia) are completing a design for a device called ITER-FEAT that has reduced cost and technical objectives. Its cost is about half of that for the former ITER-EDA device. The parties are now in an Exploration phase, preparing ideas on the ITER Legal Entity and readying site offers. The parties are meeting in Canada this week. The parties want the US to rejoin. She noted that Japan's situation has been complicated due to the merging of JAERI into the Ministry of Education, with a new structural organization. She also noted that Jim Decker has been invited to talk to the German Bundestag this year about why the US left ITER and what it would take for the US to get back in. She cited the high-energy physics example of US involvement in the Large Hadron Collider at CERN, which could be a model for US involvement in ITER.

She reported concerning the Compact Stellarator Program. The 1999 FESAC Priorities and Balance Review had concluded that the compact stellarator was not ready at that time for Proof of Principle designation because of technical concern about the robustness of the National Compact Stellarator Experiment (NCSX) design. She described the current status of the compact stellarator activities. A Physics Validation Review of NCSX is scheduled for March 26-28. The FESAC sub-panel that had considered compact stellarators in 1999 will participate in this review and then report back to FESAC about the robustness issue. A Project Validation Review for NCSX will be scheduled for late spring, if the physics peer review is successful and the robustness issue is resolved. A review of the Quasi-Omnigenous Stellarator (QOS), being proposed as a Concept Exploration device, is scheduled for April 24. The Compact Toroidal Hybrid stellarator experiment at Auburn University was approved last summer and is now under construction. In response to a question whether OFES will want FESAC to endorse NCSX before

deciding whether to proceed, she said that this would be helpful input.

She reminded FESAC that, at its preceding meeting, Rick Borchelt (DOE Office of Science) had given a talk about effective communication of science. She noted that he is organizing a major conference, "Communicating the Future," to be held on September 23-25, 2001, and stated that she would like people from major fusion groups to attend and participate in order to learn new techniques for communicating science. The conference web site is [www.nist.gov/bestpractices](http://www.nist.gov/bestpractices).

She gave an update about the Integrated Program Planning Activity. Its report was issued in December and is ready to be sent to congressional committees. A brochure was also published, and copies are available upon request.

Finally she noted that the annual OFES Budget Planning Meeting would be held March 13-15 in Gaithersburg, MD. The morning session of the first day will focus on science in the technology area.

### **3. High-Average-Power Laser Program**

Ralph Schneider (National Nuclear Security Administration, Office of Defense Programs) described the multi-laboratory effort to develop a rep-rate laser facility for Inertial Fusion Energy application and Defense Programs needs. This facility is based on the direct-drive approach and builds upon recent Defense Programs advances in lasers and target design. The ELECTRA laser has been built at the Naval Research Laboratory for the purpose of developing technologies for a low cost, durable, and efficient rep-rate krypton-fluoride laser. The high-average-power laser program had a \$10M budget last year. It has a 10-year plan, with research and development followed by the design and construction of an Integrated Research Experiment that would be ready for test operation in FY 2011. In FY 2001, Defense Programs is spending \$20M on laser optics and \$5M on laser-specific facilities.

Anne Davies noted that OFES partially funds some Inertial Fusion Energy work—specifically, heavy ion fusion.

### **4. Science in the National Ignition Facility**

John Lindl gave an informal update about the status of the National Ignition Facility (NIF). Recently there have been three reviews of NIF. A Mission Review of NIF was held January 30-February 2. This review was mostly concerned with the role of NIF in the stockpile stewardship program, although some talks described science issues that can be addressed with NIF. This review went well, and there was agreement to recommend proceeding with the full NIF facility. Also, a NIF Project Review was held, primarily concerning milestones. In addition, the University of California Science and Technology Panel reviewed NIF. He noted that last year NIF faced several technical challenges; however, pilot runs have been successful, and half of the laser glass is now in hand.

### **5. Fusion Materials Science Program**

Steve Zinkle, the new leader of the fusion materials program at Oak Ridge National Laboratory and also the lead person for fusion materials research in the Virtual Laboratory for Technology, presented an overview of the overall fusion materials sciences program. The fusion materials science annual budget is \$6.5-7.0M, which is 0.1% of the total US work on materials science. (DOE Basic Energy Sciences funds \$300M/yr in materials science research.)

He described the response to the 1998 FESAC review of this program. University funding has tripled during the past three years, and the number of institutions has doubled. The materials science program is being restructured from a technology and development program to a science program. It now has more emphasis on theory and modeling and on fundamental understanding. Experiments now guide and validate theory and modeling. Also, the fusion materials science program interacts with the broader materials community.

He described recent materials science highlights. Fusion materials scientists are contributing to the resolution of several grand challenges in the general field of materials sciences. New modeling efforts being supported are multi-scale modeling of radiation effects, deformation and fracture, phonon scattering, and helium effects.

A \$1M theory and modeling effort (15% of the program's budget) is now underway. However, he noted that the FY 2002 straw-man budget would not allow both international commitments and also theory and modeling to be maintained at current levels.

In response to a question about how the US materials science program would be rated in relation to other world materials science programs, he said that the US is either the undisputed leader or among the leaders, despite having a budget that is only 1/2 to 1/3 of the budgets of other such world programs. Over the last 15 years at the annual

meetings of the International Materials Fusion Conference, US scientists have received a dominant share of the invited talks.

In response to a question about international collaborations, he noted that such collaborations—e.g., on ferritic steels, vanadium alloys, and silicon composites—are carried out through the IAEA. Japan is providing state-of-the-art silicon fibers, which the US knows how to turn into composites. There are formal bilateral collaborations with the Japan Atomic Energy Research Institute and with universities in Japan. Previously there were collaborations with Russia, but no longer.

## 6. Recess and Reconvene

The chair recessed the meeting at 12:05 p.m. for lunch. He reconvened the meeting at 1:33 p.m.

## 7. Report from Workshop on Burning Plasma Science

Jerry Navratil, chair of the organizing committee, described the Workshop on Burning Plasma Science, sponsored by the University Fusion Association, which was held December 11-13, 2000, at the University of Texas at Austin. The workshop focused on identifying the unique science issues that could be addressed with a burning plasma experiment. This workshop was intended to be one of the primary sources of community input to the assessment of burning plasma science by FESAC.

Breakout sessions were held in five topical areas: (1) Energetic alpha particle physics; (2) Self-heating, transport, and confinement at reactor scale; (3) Macro-stability in a self-heated burning plasma; (4) Boundary science; and (5) Relation of burning plasma science to other fields. Many of the talks presented at the workshop are posted on the workshop web site at [w3fusion.ph.utexas.edu/bpsworkshop](http://w3fusion.ph.utexas.edu/bpsworkshop).

The objective of the workshop was to address the following five questions: (1) What are the compelling scientific issues that could be addressed by a burning plasma experimental facility? (2) Identify those burning plasma scientific issues that are inaccessible for study in existing or near-term non-burning plasma experiments. (3) What is the present physics basis and confidence level in achieving burning plasma conditions? In particular, how have recent developments in theory and experiment affected our confidence in achieving burning plasma conditions? (4) How comprehensively can these burning plasma science issues be addressed establishing a firm basis for extrapolation in scale and magnetic configuration? (5) Are there compelling scientific issues outside of fusion energy that can be addressed by a burning plasma experimental facility?

Navratil distributed copies of the draft version of the report that had been prepared by the workshop leaders, in which the range of views expressed and the degree of consensus reached at the workshop are summarized. He discussed the content of the draft summary report.

- Concerning questions #1 and #2: He stated that a decision by the community to move ahead on a next-step burning plasma will be possible only with a clear articulation of the unique fusion science contributions that such an experiment would make possible. An outstanding challenge is to identify more clearly the new phenomena that can be expected in the strong coupling regime of a burning plasma.
- Concerning question #3: He reported the opinion expressed by one of the invited speakers at the workshop that there are no show-stoppers to achieving generic burning plasma conditions.
- Concerning question #4: He noted that an invited speaker at the workshop had made the point that nearly all theory, modeling tools, diagnostic advances, experimental techniques, and experimental discoveries made using the tokamak have found application in research on other fusion configurations. However, details of the strongly nonlinearly coupled physics in a burning plasma will likely be configuration-specific.
- Concerning question #5: He said that several physics issues, inaccessible for study in existing non-burning experiments, could be examined in a burning plasma experiment. Examples are alpha physics in the solar wind, collisionless reconnection in magnetospheric and solar plasmas, plasma effects on nuclear cross-sections in astrophysics, and thermonuclear deflagration flame phenomena for supernovae dynamics.

Several FESAC members debated whether the physics of a burning plasma experiment would be relevant to other scientific fields.

Navratil reported that a follow-on workshop, entitled “Workshop on Burning Plasma Technology,” also sponsored by the University Fusion Association, will be held May 1-3, 2001, at General Atomics. The chair of the organizing committee is Ron Parker. The workshop web site is [fusion.gat.com/bps2/](http://fusion.gat.com/bps2/).

## **8. Status of Activities on the Burning Plasma Physics Charge**

Jeff Freidberg, chair of the FESAC sub-panel that had been established to address the burning plasma physics charge, reported concerning the status of this sub-panel's activities.

He described the procedure and the schedule that the sub-panel is following. It will finish its report by July 2001. The report will follow the following outline: (1) Introduction: Simple description of a tokamak; (2) Science issues in a burning plasma; (3) Technology issues in a burning plasma; (4) Existing experiments versus a new experiment; (5) Reaching consensus; and (6) Recommendations. So far, the report is written through the second item. He discussed a representative list of some difficult questions that might be included in the write-up for the fifth item.

In response to a question about political issues, he said the sub-panel would mostly not address them. In response to another question, he said that the issue of whether to wait for non-tokamak concepts to mature would be addressed by listing the arguments pro and con. To another question, he responded that the sub-panel would address whether the Next-Step Options program is designed to focus on burning plasma questions.

A FESAC member recommended that the sub-panel address the questions of whether critical burning plasma-related issues could be studied in existing facilities; whether there is technical readiness for a burning plasma experiment; and whether advanced tokamak capabilities should be incorporated.

## **9. Status of Activities on the Theory Program Review Charge**

The chair recused himself during the discussion of the FESAC charge concerning a review of the fusion science theory program. Charles Baker assumed the chair at 3:32 p.m.

John Sheffield, chair of the FESAC sub-panel that had been established to address the theory program review charge, reported concerning the status of this sub-panel's activities to date. One meeting was held January 31-February 1 at the University of California, Los Angeles, and another meeting will be held March 29-30 at Princeton Plasma Physics Laboratory. Sheffield summarized some of the input that had been received. His preliminary summary will be posted on the FESAC web page. He reported that the presentations and written input at the first meeting had not indicated any great unhappiness with the management and balance of activities for the theory and computing program. Nevertheless, some points of concern had been raised: (1) Inconsistency in evaluating programs from different types of institutions. (2) Inadequate descriptions of categories. (3) Inadequate systematic support for computational work, e.g., for innovative confinement experiments. (4) Inadequate funding for theory and computing to meet the expectations of the program--which could equally well be said of all other parts of the program, too. (5) Insufficient analysis of how program goals are set in the theory and computing program. Feeling that there is insufficient analysis of the details of goals for deliberate decision making on priorities. (6) Need for better understanding of what is happening in code development, maintenance, and availability. (7) Trend toward fragmented support for components of the program. (8) Need for the field to attract young people.

FESAC members commented concerning fusion participation in new government advanced computing initiatives, promotion of theory and computing research opportunities, and the new OFES theory review procedures.

Hazeltine resumed the chair at 4:20 p.m.

## **10. Recess**

The chair recessed the meeting at 4:22 p.m. for the evening.

## **Wednesday, February 28, 2001**

## **11. Reconvene**

The chair reconvened the meeting at 9:00 a.m. on Wednesday, February 28.

## **12. NSF Physics Frontier Centers**

Joe Dehmer, Directorate for Mathematical and Physical Sciences, National Science Foundation (NSF), described the NSF Science Frontiers Centers.

He initiated the Physics Frontiers Centers a couple years ago, with the objective of enabling universities to make transformational advances in physics. Centers are selected by means of open, direct competition across sub-fields.

Awards are for five years, ranging from \$0.5M/yr to \$4M/yr. There are 12 such centers now, and the goal is to have 25, with an average of five new centers each year. Existing centers may re-compete at the end of their grant. Last year there were 50 proposals, among which four were selected. A center may have its personnel either co-located or distributed.

This year 50 pre-proposals were received, from a broad distribution of universities (16 of the top 20), colleges, HBCU, and minority-serving institutions, with topics ranging over cosmology, astrophysics, particle physics, nuclear physics, gravitational physics, atomic-molecular-optical physics, biophysics computational physics, accelerators, turbulence, nanoscience, and geophysics. New funding in the amount of \$20M has been received, although half of it is dedicated to nanoscience.

He described the review procedures. He noted that the NSF reviewing process does take into account outreach and equal opportunity.

He noted that NSF Frontier Centers ask for 15% non-federal matching funds. This level seems comfortable, although it is not critical. Its purpose is to make the host institution a partner.

He said that he had read the NRC Fusion Science Assessment Report and is aware of the concern about the dwindling number of university plasma faculty members. He thinks opportunities in plasma science are undervalued, although this is not the only field with this problem. Concerning the NRC recommendation of new interdisciplinary plasma physics centers, he commented that it would energize the field. Whether NSF could be a joint partner with DOE for these centers will take some thought. He acknowledged that DOE, with its infrastructure responsibilities and large number of scientists supported on soft money, is in a different situation than that of NSF and therefore different rules would be needed for its centers.

Asked why NSF support for plasma and fusion physics is low, he replied that this is largely historical, due to the emphasis on fusion energy development and the large support from DOE. He indicated his desire to increase support for plasma science, but said that his top two priorities this year are astrophysics and the physics frontiers centers.

He noted that nuclear and high-energy physics are initiating long-range planning activities, with the NSF as a co-sponsor. He recommended that fusion energy sciences also have a positive vision of intellectual opportunities, driven by compelling science questions, with connectivity to other science fields, stressing educational and other broad impacts, placed in an international context, established with community input and endorsement, and promoted coherently.

### **13. Further Response to NRC Report**

The chair reminded FESAC that in its earlier letter to Dr. Mildred Dresselhaus, in which it gave a preliminary response to the NRC Fusion Science Assessment Report, it had promised to provide a more detailed subsequent response. He proposed that FESAC send a short letter to Dr. Jim Decker, acting head of the DOE Office of Science, with direct responses to each of the NRC recommendations. The FESAC responses will constitute advice to DOE about whether to implement the respective recommendations or how to interpret them. The chair reported that the opinions of the FESAC members, collected individually via e-mail prior to this meeting, indicate fairly good agreement with most, but not all, of the NRC recommendations.

FESAC members discussed various NRC recommendations. The chair asked Charles Baker to lead a small subcommittee that will write a first draft for the FESAC response concerning the creation of new multidisciplinary centers (NRC recommendation #7). Jill Dahlburg and Kathryn McCarthy volunteered to be on this subcommittee. The chair asked Jill Dahlburg, John Lindl, John Sheffield, and Kathryn McCarthy to contribute written comments regarding breadth, including its use as a metric and the emphasis on non-fusion science (NRC recommendation #3). He asked John Lindl to collect these comments and draft a paragraph. The chair asked Jerry Navratil to draft several sentences regarding scientific understanding as a program goal and metric (NRC recommendation #1).

The chair said that, after receiving the input about these three recommendations, he would write a draft of the proposed letter and circulate it via the email reflector for further comments from FESAC members. This letter will be discussed at the next FESAC meeting and then sent to the head of the Office of Science.

### **14. Public Comments**

The chair introduced persons who had expressed a desire to make public comments.

**Bob Bushnell (Wayne State University, retired):**

He proposed that it is time to ask the president to fund a crash program for fusion energy by 2020. He referred to recent CIA projections that indicate water will be a crisis by 2015. Cheap energy could solve many problems. Fusion energy could be used for desalinizing water, to make the desert bloom. Cheap energy will solve both the world's energy problem and water problem. There should be a bipartisan effort, like the space program, to develop an unlimited source of power for the world. It would be expensive, but currently there is a budget surplus. Energy and potable water would help to raise the level of wealth in poor countries, and fusion could make it happen.

**Rob Goldston (Princeton Plasma Physics Laboratory) and David Baldwin (General Atomics):**

Together they commented that advanced-tokamak physics, if shown with confidence to work, should be exploited in order to reduce the cost of a burning plasma reactor. It is good to have a design like FIRE on the table, which can study advanced-tokamak physics. A near-term opportunity to do this might come along (e.g., if ITER were to collapse). On the other hand, the Knoxville plan calls for assessing advanced-tokamak physics by 2004. The US program should be asking what needs to be known in order to reduce reactor cost. The Next Step Options program should consider whether such opportunities exist. The Knoxville strategy does not demand that a burning plasma facility depend on advanced-tokamak physics, but we should be able to ask if it is a viable option. This information would nicely fit with the strategy. So far, the FESAC Burning Plasma Physics sub-panel does not reflect this thinking, nor is the Next Step Options program considering how advanced-tokamak physics could fit into the burning plasma strategy. It would provide a different way of how to look at the design and execution of fusion as a science program.

**Dale Meade (Princeton Plasma Physics Laboratory):**

Fusion needs to get attention. Herman Grunder has said that if fusion could develop a compelling program plan, the funding would follow. Burning plasma is part of our vision for the future. The NRC recommendation #5 is to develop support for a burning plasma experiment and decide the near-term route to it. The Next Step Options program and the recent burning plasma science and technology workshops are ways to obtain full input. The Next Step Options program advisory committee is in fact discussing the balance between generic burning plasma physics and advanced-tokamak physics. The FIRE project is addressing this and will present something by the burning plasma technology workshop in early May. Europe will have decisions by as early as six months from now.

He proposed holding a Snowmass meeting in 2002 on burning plasmas. The issue is how much can we count on new physics being developed for use in a burning plasma experiment. In 1991, the BPX-Advanced Tokamak was proposed, in order to reduce cost and size. The physics needs to be credible. Ignitor has been before us for the past 15 years; we didn't proceed with it, due to uncertainties concerning its physics and engineering.

**Arnold Kritz (DOE/OFES, on leave from Lehigh University):**

He commented concerning the relative efficiency of institutional development of codes versus community development. He said that institutional development has been inefficient. The reasons are development of overlapping codes; dependence on homegrown tools of limited use; and institutions sometimes not taking ownership of codes. He said that multi-institutional/community development is more efficient. The reasons are that having multiple users leads to community support, usage, and maintenance and also reduces parochialism. He noted that other fields of science have become successful at developing community codes, simply by bringing in young people who were trained in modern code-building techniques (e.g., object-oriented methods).

**15. Date of Next Meeting**

The next FESAC meeting was scheduled for Tuesday and Wednesday, May 15 and 16, 2001, and will be held in Gaithersburg, MD.

**16. Adjourn**

The chair adjourned the meeting at 12:23 p.m.

Minutes submitted by:  
James W. Van Dam, FESAC Secretary

Approved by:  
Richard D. Hazeltine, FESAC Chair

**APPENDIX: Guest List**

<b>Name</b>	<b>February 27</b>	<b>February 28</b>
Toshiro Asakawa—JAERI (Washington office)	X	
Jeffrey Auchmoody—DOE/SC	X	
David Baldwin—GA	X	X
Sam Berk—DOE/OFES	X	
Curt Bolton—DOE/OFES	X	
Bob Bushnell—WSU (Detroit)	X	X
Mike Crisp—DOE/OFES (DOE/SC-55)	X	
Rostom Dagazian—DOE/OFES	X	
Steve Dean—FPA	X	X
Joe Dehmer—NSF/Physics Directorate		X
Steve Eckstrand—DOE/OFES	X	
Moto Eto—JAERI (Washington office)	X	X
Rob Goldston—PPPL	X	X
Adil Hassam—U. Maryland	X	X
Richard Hawryluk—PPPL	X	X
Mark Haynes—GA	X	
Clarence Hickey—DOE/SC-83	X	
Milt Johnson—DOE/SC	X	
Arnold Kritz—Lehigh U.	X	X
Darlene Markevich—DOE/OFES	X	
Warren Martin—DOE/OFES	X	X
Ron McKnight—DOE/OFES	X	X
Dale Meade—PPPL	X	X
Stan Milora—ORNL	X	
Erol Oktay—DOE/OFES	X	X
Albert Opdenaker—DOE/OFES	X	X
Miklos Porkolab—MIT	X	X
Jeff Quintenz—SNL	X	
Barrett Ripin	X	
Michael Roberts—DOE/OFES	X	X
Walter Sadowski—DOE/OFES (DOE/SC-55)	X	X
John Sauter—DOE/OFES	X	
Ralph Schneider—DOE/NNSA	X	
Kurt Schoenberg—LANL		X
Ray Schwartz—DOE/SC-83		X
Richard Siemen—LANL	X	
Ron Stambaugh—GA	X	X
Michael Watkins—ERDA-JET	X	
John Willis—DOE/OFES	X	X
Steve Zinkle—ORNL	X	X