

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

**May 15 & 16, 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
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 Members Absent:

None

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:

Names of guests who were present at the meeting are listed in the Appendix at the end of these minutes.

Tuesday, May 15, 2001

1. Call to Order

The chair, Richard Hazeltine, called the meeting to order at 9:00 a.m. on Tuesday, May 15, 2001.

The chair indicated that he would request FESAC to consider reducing the number of its meetings per year and varying the location of the meetings.

Anne Davies noted that Mike Holland, OFES examiner at the Office of Management and Budget, would talk to FESAC at dinner tonight about research and development in the President's FY 2002 budget.

She also reminded FESAC members to be alert to any conflicts of interest or the appearance thereof. Most federal advisory boards have membership from outside the contractors and grantee universities; FESAC had been granted an exception. However, FESAC members are required to recuse themselves from decisions that might directly affect or financially benefit their respective institutions.

2. Office of Science Perspective on the FY 2002 Budget

Dr. James Decker, acting director of the Office of Science, U.S. Department of Energy, discussed the FY 2002

budget request for the Office of Science. His presentation will be posted on the FESAC web page at http://www.foe.er.doe.gov/more_html/FESAC/Presentations.5.01.html.

He described several budget highlights. "Genomes to Life" is a new initiative of the Office of Basic Energy Research, coordinated with the National Science Foundation and the National Institutes of Health. Science education, which mostly consists of summer fellowships for undergraduate research, will increase a bit. Other increases will go for science facilities expansion, instrument upgrades for intense-pulse neutron source, terascale computing facilities, and additional operating time at Fermilab and SLAC. The Spallation Neutron Source (a \$1.6B project) is on target to be completed in June 2006. The Scientific Discovery Through Advanced Computing (SciDAC) program began last year; in response to \$53M in solicitations to universities and laboratories to focus research and development in three areas of advanced computing; 160 pre-proposals were received. The Nanoscale Science program is a multi-agency initiative; it has \$30M in new funds, and FY 2001 solicitations produced 745 pre-proposals from universities and 46 from laboratories.

3. Office of Fusion Energy Sciences FY 2002 Budget Request

Anne Davies presented an update about the fusion energy sciences program. Her talk is posted on the FESAC web page at http://www.ofes.science.doe.gov/More_HTML/FESAC/Presentations5.01/Davies.pdf.

She reported that the FY 2002 OFES budget request to Congress is \$248.5M. This is level with respect to the FY 2001 appropriation. The proposed budget break down is also virtually unchanged. The impact of having no cost-of-living increase could possibly be the loss of a hundred positions.

The decontamination and decommissioning of the TFTR tokamak, expected to be finished in September 2002, is on cost and on schedule.

The scientific research on TSTA is being completed this fiscal year. In FY 2002, the budget for TSTA will be increased to replace the \$1M that Japan has been contributing to the research efforts at TSTA. In FY 2002, funding at TSTA will be used to clean up the tritium in the facility before turning it over to the DOE Office of Environmental Management for decontamination and decommissioning, hopefully in FY 2003.

FY 2002 funding for operation of the three major fusion facilities (DIII-D, C-Mod, and NSTX) would permit the facilities to operate at about 50% of the maximum time possible for full, single shift operation. This, a 10% reduction of operating time compared to FY 2001, would be a direct result of level funding with no cost-of-living increase for FY 2002.

She described the recent solicitation and review of fusion energy science proposals for the SciDAC advanced computing program. There were 20 pre-proposals, followed by 13 actual proposals. The proposals were collaborative, with an average of four institutions per proposal. The evaluation process involved several mail reviews of each proposal and then a panel review. The panel's final ratings of the proposals, along with OFES programmatic considerations, led to the OFES decisions about the awarding of SciDAC funds. Three proposals were fully funded: Magnetic Reconnection Code, Terascale Atomic Physics, and Computation of Wave-Plasma Interactions. Also, two pilot projects were continued from last year: Extended MHD Modeling, and Plasma Microturbulence. Total funding for FY 2002 will be \$3M. Several FESAC members asked questions about the openness of the review process and the determination of programmatic relevance.

She announced a competitive review of the advanced diagnostics development program. The entire diagnostics program will be competed for FY 2002. Proposals for developing new measurement capabilities will be sought. Letters of intent will be due on June 28, 2001, and proposals on August 1. New submissions are encouraged, even though the budget will be flat.

She reported about recent fusion policy developments in Europe and Japan. The Commission of the European Communities issued a report in November 2000, in which it stated that supporting research into reactors of the future, notably nuclear fusion, is a priority. In April 2001, the Japan Atomic Energy Commission approved a draft report from a special committee on the ITER project, in which it was stated that hosting ITER, as well as taking a main role in the project, would be of great significance for Japan.

There was a general discussion about the policy of the new presidential administration concerning energy issues.

4. Response to NRC Report

The chair noted that, in accordance with the discussion at the February 2001 FESAC meeting, he had drafted a letter responding to the recommendations in the report of the Fusion Science Assessment Committee of the National Research Council. This draft letter had been circulated to FESAC members via email, and modifications incorporated in subsequent versions.

The chair asked each FESAC member to comment on the latest version of this letter. Most of the discussion focused on the NRC recommendation of new fusion frontier science centers. Anne Davies noted that the University Fusion Association is currently soliciting white papers about such centers, as input to OFES for making the case for funding in FY 2003.

FESAC agreed that the chair would make the small changes that had been proposed and then send the final letter to Dr. Decker, acting director of the DOE Office of Science.

5. Scheduling of FESAC Meetings

The chair noted that recently FESAC has been meeting four or five times each year; other Office of Science advisory committees usually meet only twice a year. It was reported that several FESAC members had suggested meeting twice a year. This schedule would probably require longer meetings, and a third meeting might occasionally be needed. The suggestion that FESAC return to the practice of moving around the locations of the meetings, for the sake of visibility and site visits, was also reported. After some discussion, FESAC agreed to meet twice a year, at a variety of sites, except when circumstances would require more meetings.

6. Recess and Reconvene

The chair recessed the meeting at 11:55 a.m. for lunch. He reconvened the meeting at 1:02 p.m.

7. Report from FESAC Proof-of-Principle Sub-Panel

Jeffrey Freidberg, chair of the FESAC Proof-of-Principle Sub-Panel, introduced the report of the sub-panel. His report is posted at http://www.ofes.science.doe.gov/More_HTML/FESAC/Presentations5.01/Freidberg.pdf. The other members of this sub-panel were Tom Jarboe, Joseph Johnson III, Jerry Navratil, David Newman, Tony Peebles, Don Steiner, Tony Taylor, and Harold Weitzner. In March this sub-panel conducted a proof-of-principle review of the National Compact Stellarator Experiment (NCSX), which was held simultaneously with the NCSX physics validation review by another panel. The two review panels had some overlap in membership.

He summarized the charge of the Proof-of-Principle Sub-Panel. At its meeting in Knoxville in August 1999, the sub-panel had concluded that the reversed-field pinch was ready for proof-of-principle status, but that the magnetized target fusion (MTF) concept and the NCSX were not. Although the sub-panel had felt that NCSX was an interesting idea with much potential, there was the technical issue that the possibility had not been demonstrated of being able to evolve the equilibrium stably from a cold initial state to a high-beta final state, with the self-consistent bootstrap current taken into account. The sub-panel at that time had recommended that the NCSX team carry out a more detailed design and demonstrate that the evolutionary path is robust with respect to small perturbations, after which the sub-panel would re-evaluate whether NCSX is ready for proof-of-principle status.

The Proof-of-Principle Sub-Panel answered its charge in the narrow sense of determining only whether the new NCSX design is sufficiently robust to warrant proof-of-principle status; the sub-panel did not raise any additional scientific questions or review other parts of the U.S. stellarator program. The conclusion of the sub-panel was that the NCSX team has made substantial progress in validating the robustness of quasi-axisymmetric equilibria, and that the NCSX design is ready for proof-of-principle status as the lead element in a stellarator proof-of-principle program. The sub-panel also noted in its report that NCSX would be a fairly costly element in the national fusion program, and it recommended that FESAC and OFES address larger programmatic issues to see how, when, and whether to proceed with construction. Specifically, the sub-panel recommended that FESAC clarify and update the Knoxville recommendations, create a detailed spending profile to show how NCSX can be built and operated, and make sure that other programmatic needs are kept in balance if NCSX is built.

8. Report about NCSX Physics Validation Review

Gerald Navratil, chair of the NCSX Physics Validation Review Panel, described the report of this panel. His report is available at http://www.ofes.science.doe.gov/More_HTML/FESAC/Presentations5.01/NavratilReport.pdf. The other members of the panel were David Anderson, Jeffrey Freidberg, Alan Glasser, Jeff Harris, Tom Jarboe, Joseph Johnson, David Newman, Shoichi Okamura, Tony Peebles, Stuart Pitcher, Peter Politzer, Donald Steiner, and

Harold Weitzner. Navratil noted that most of the members of the FESAC Proof-of-Principle Sub-Panel had also been members of the Physics Validation Review Panel.

The Physics Validation Review Panel had been charged to investigate the scientific and/or technical merit of the proposed research; the appropriateness of the proposed method, management, and budget; and the relevance to the FESAC ten-year goal of determining the attractiveness of a compact stellarator. The review was held March 26-28, 2001, at the Princeton Plasma Physics Laboratory.

The panel's report contains a number of general findings and recommendations, followed by more technical recommendations. The panel concluded, among other things, that the physics requirements and capabilities of the pre-conceptual NCSX design represent an appropriate approach to developing a proof-of-principle experiment for establishing the attractiveness of the compact stellarator concept. The panel also noted that the choice of a quasi-axisymmetric configuration for the design would be complementary to domestic and international research in stellarators. In reference to the FESAC ten-year goal, the panel recommended that OFES and FESAC address overall programmatic issues—including program balance within available fusion budgets, needs of current program elements, and opportunities for other new starts and collaborations—in determining whether and on what time scale to proceed with construction of NCSX.

After completing the summary of the panel's report, Navratil presented some discussion comments on NCSX programmatic issues: viz., the effect of NCSX on program balance and the effect of NCSX on taking steps to proceed with a burning plasma experiment. His comments are posted on the OFES web page at http://www.ofes.science.doe.gov/More_HTML/FESAC/Presentations5.01/NavratilDiscussion.pdf.

FESAC members discussed the proof-of-principle report, the physics validation report, and the programmatic issues.

9. Public Comments on Compact Stellarators

David Baldwin (General Atomics):

He said that, without intending to be critical of NCSX, he thinks it is appropriate to consider the rate for starting the project in different budget scenarios and to discuss the programmatic issues that have been raised. He commented that he was disappointed with what the panel report said about the central question of flux surfaces, since the results so far look promising. He also stated that it is the responsibility of each experimental project to identify theory support.

Rob Goldston (Princeton Plasma Physics Laboratory):

He described the current projects in each of the elements of the U.S. stellarator program: proof-of-principle experiment, theory, concept exploration experiments, international collaboration, and reactor studies. He mentioned a number of possible ideas for strengthening the U.S. stellarator program: e.g., reinvigorating the role of a national stellarator coordinating committee, having a stellarator theory planning workshop, holding a summer institute, changing the scope of the NCSX program advisory committee within PPPL and broadening its membership.

He said that compact stellarators would test many aspects of fusion science—macroscopic stability, micro-turbulence and transport, wave-particle interactions, and plasma-boundary interactions. The quasi-axisymmetric configuration has very low effective magnetic field ripple.

He noted that the proof-of-principle and physics validation reviews show that the NCSX design has a sound basis. This experiment is an important national laboratory goal because it will allow more people to be brought in. The NCSX construction cost—\$55M in 1999 dollars and \$65 in spent dollars—will be moderate. It would involve an increase of \$10M each year during FY 2003-2006. The proposal would be to use \$10M of the TFTR roll-off funds, with the other half being used to fix problems in the community. The annual operating budget would be \$22M. Operation in parallel with NSTX would reduce these costs, since the manpower would be shared and since the federal government is already paying the overhead costs. PPPL will lose 100 employees after TFTR decontamination and decommissioning, which will bring it back to 1999 levels.

Finally, he said that NCSX would both benefit from and also give benefit to a tokamak burning plasma experiment, in that it would help reduce the burden of proof for approval of a burning plasma experiment.

10. Discussion of FESAC Response to NCSX Reviews

The chair led a discussion of how FESAC should respond to the proof-of-principle review and the physics validation review of the proposed NCSX experimental facility.

The chair proposed that the FESAC write a cover letter and send it, along with the report of the proof-of-principle sub-panel, to the Office of Science. The cover letter would be based on one of the viewgraphs from Navratil's presentation about the physics validation review, endorsing the proof-of-principle status for NCSX but also including the recommendation that the larger programmatic issues related to its construction be addressed.

During the discussion that ensued, it was eventually agreed that the cover letter would begin with positive comments about compact stellarators, possibly taken from the FESAC Knoxville report or the NCSX physics validation report. The letter would then have a paragraph stating FESAC's endorsement of the compact stellarator as a proof-of-principle program. Then there would be a paragraph about the consideration by OFES of larger programmatic issues in relation to the proposed construction of NCSX.

Anne Davies agreed to make a presentation at the next FESAC meeting about the OFES plan for proceeding with NCSX construction, in which she would show how it would affect program balance under various budget scenarios and describe a cohesive stellarator program. FESAC would then have opportunity to comment on her presentation.

11. General Public Comments

Spencer Pitcher (Massachusetts Institute of Technology):

He read an open letter to FESAC, dated May 11, 2001, signed by several hundred persons from the burning plasma scientific community, including senior scientists, scientists from all the fusion national laboratories, and some scientists from industry. The letter stated that rank-in-file scientists are deeply frustrated that a burning plasma experiment is still only being talked about. The program was technically ago (even though not politically or financially) ready for this step ten years ago. Also, two years have already passed since the Snowmass meeting. The signers of the letter feel that it is time for the fusion community to be specific about a burning plasma experiment. There are several potential projects on which the U.S. could collaborate. Unanimity of opinion may be unlikely, but there should be a step in the direction of a burning plasma experiment. The letter proposed that a process should be started for selecting a particular project. A panel or subcommittee could decide which banner to stand behind. The community is looking for leadership and wants to rally behind the one or two projects that would be decided on. There are no technical reasons for delay. There have been no developments in the past three years that could change this, and none are likely in the next three. The climate now is good to propose such an initiative. There should be a sense of urgency.

Rich Hawryluk (Princeton Plasma Physics Laboratory):

The second UFA workshop on burning plasma science last week and Spencer Pitcher's letter raised the idea of holding a burning plasma Snowmass meeting. When it should be held and who should provide leadership for running such a meeting are issues that need to be addressed. We need to move ahead if it is to be held in 2002. We need to decide on topics and how to discuss them, how to identify what the opportunities are, and how to strengthen proposals. He suggested that FESAC discuss these questions over dinner tonight.

Dale Meade (Princeton Plasma Physics Laboratory):

The most important question is "when." What determines the pace of the program? In the past we said international projects determine the pace. In the last couple of months, the situation is changing. A fusion bill was introduced in the congressional Science Subcommittee that can be a good guideline for discussion on fusion. The bill can be found on Rep. Lofgren's website. It has 22 sponsors. On Thursday this week, Vice-President Cheney will present a national energy plan. Fusion should be part of the energy solution. The Lofgren bill calls for money by 2003, for DOE to prepare a plan for a burning plasma experiment, to be submitted to Congress by 2004, and for the U.S. to participate in the international project. I think that we may need to move quicker than 2004. There is interest on the Hill for fusion.

Stan Milora (Oak Ridge National Laboratory):

He said that he had looked at ITER in detail when he was at the IAEA meeting in October. The amount of work in that project is extensive. He has written a summary of this and can make a copy available to anyone who is interested.

12. Recess

The chair recessed the meeting at 6:02 p.m. for the evening.

Wednesday, May 16, 2001

13. Reconvene

The chair reconvened the meeting at 8:35 a.m. on Wednesday, May 16.

14. Report from the Theory Review Sub-Panel

The chair recused himself during the discussion of the review of the fusion science theory program. Charles Baker assumed the chair at 8:36 a.m.

John Sheffield, chair of the FESAC Theory Review Sub-Panel, presented the report of the sub-panel. The other members of the sub-panel were Thomas Antonsen, Lee Berry, Michael Brown, Jill Dahlburg, Ronald Davidson, Martin Greenwald, Chris Hegna, William McCurdy, David Newman, Claudio Pellegrini, Cynthia Phillips, Douglass Post, Marshall Rosenbluth, Thomas Simonen, and James Van Dam.

Sheffield reviewed the charge from the Office of Science (dated November 2000), according to which FESAC was requested to review the overall content, plans, structure, and governance of the fusion energy sciences theory and computational program. The charge had eight questions, which the sub-panel answered in its report. The sub-panel held two meetings, first at UCLA on January 31 and February 1, 2001, and then at PPPL on March 29 and 30, 2001. Institutions had been invited to attend these meetings and make public presentations to the sub-panel. At the FESAC meeting in February, he had presented a summary of the first of these two meetings.

He reviewed the executive summary of the sub-panel's report. The executive summary lists a number of findings and recommendations in response to each of the eight questions of the charge. He reported that the sub-panel had concluded that the overall balance of the theory and computational program is not bad. The sub-panel did find that theory and computing support for innovative concept experiments is inadequate, and recommended that programs (including theory and computing support) be funded rather than just projects. Another recommendation is that integrated research across topical areas should be encouraged. The sub-panel thought that the new OFES peer review process is good, although it could be improved somewhat. Inter-disciplinary research and inter-institutional sabbaticals should be encouraged. A concern was that the efforts of individual scientists are often highly fragmented. Numerical modeling should not be treated as a third discipline, but remain integrated with theory and experiment. There are not enough computational experts in the fusion program. Code duplication should be minimized for mature physics and algorithms. The fusion program needs both multi-user code development and small-scale research codes. Legacy codes are not being explicitly supported.

Concerning management and governance, the sub-panel found that the program is sub-critical with respect to levels of computing. The peer review procedures should be posted on the OFES web page. Community governance should be encouraged, and a standing committee set up as an advocate for theory and computing. There is a need to attract and retain young scientists. The DOE graduate student and post-doctoral fellowships should be made more attractive and flexible.

Sheffield noted a few items that the sub-panel had discussed but not put in the report. One is setting up a web-based proposal system similar to the NSF FastLane system. Another is encouraging rotation of scientists from the field to work at OFES on temporary assignments. He also noted the sub-panel's feeling that international collaborations are valuable for theory and computing.

FESAC members asked clarifying questions and commented on the report.

15. Public Comment on the Theory Review Sub-Panel Report

Rob Goldston (Princeton Plasma Physics Laboratory):

Clearly projects should pay for the application of theory. However this must be balanced against other technical needs. Theory should be planned for. Another kind of theory is the development of new tools, which is more topically oriented. Project-specific theory is concept-specific. We need to find scientific opportunities within the IPPA goals. Laboratories do have responsibility to develop teams to develop tools. PPPL has a university support program; it would be reasonable to open that program for theorists to help with operations.

Steve Dean (Fusion Power Associates):

He commended the Theory Review Sub-panel saying it had one of the clearest set of recommendations he had ever heard from a panel and contained many specific recommendations that could be acted upon. He contrasted that to the NRC report, saying that he thought most of its recommendations were fuzzy, except for the recommendation to start new Centers. While he has no problem with starting new Centers if there were a lot more money, he said he does not agree that any new Center should be started in the present financial climate since we already have many Centers, all of which are grossly under-funded. He also commented on program balance, saying that, as chair of the Magnetic Confinement subgroup at Knoxville, he believed that his group had favored more effort on technology as being a higher priority than more theory or a new stellarator. He also commented that he thinks the designation of NSTX and NCSX as "alternate concepts," when they are really tokamaks or tokamak-like, gives a misleading picture of the balance of the program between tokamaks and alternates, as presented in Anne Davies's viewgraphs. He stated that the "real alternates" are not being supported at a level commensurate with the program rhetoric about broadening the US fusion program.

Miklos Porkolab (Massachusetts Institute of Technology):

He commented on educational aspects. MIT is healthy. The number (and quality) of students is staying at a healthy level. The majority of them come from the US. There are limited openings for theory students because funding at MIT is limited and not growing. However, the number of slots for students overall is constant (about 50 Ph.D. students at MIT in Plasma Science and Engineering.) As older scientists are retiring there is a certain amount of loss of knowledge and wisdom in the program. There is no lack of jobs for graduates. Europe is campaigning to hire some of our young people (and is succeeding to some extent). Industry competes and wins graduates with higher salaries. We have to counter with exciting opportunities. Moving ahead with a burning plasma experiment would attract new students into the program. The breadth of the program attracts new students. At MIT we are successful in reaching students in grades K-12, up to 30,000 last year.

Stan Milora (Oak Ridge National Laboratory):

It is essential to integrate theory with experiment and modeling. FESAC has exaggerated the theory problem.

David Baldwin (General Atomics):

He urged the sub-panel to go back and pick out some strong points to emphasize, and not to round them off. He thought that the Theory Coordinating Committee would grow into more than it has. The culture of the community is to not want to be organized. The format of meeting for dinner does not predispose the Theory Coordinating Committee to action. People who submit proposals believe that it is helpful to involve more organizations, whereas a smaller number would have better communication. There could be a guideline concerning the number of organizations, which would specify the minimum number—e.g., two—FTE's at a given organization.

14. Response to the Report from the Theory Review Sub-Panel

FESAC agreed with the recommendation of the chair *pro tem* that the sub-panel be instructed to reconsider points that had been raised during the discussion of its report and submit a revised report at the next FESAC meeting.

Sheffield asked that FESAC members send written comments to the sub-panel.

Hazeltine resumed the chair.

15. Status of Activities of the Burning Plasma Physics Sub-Panel

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

He reported that the sub-panel had met three times. The sub-panel also held public sessions at two conferences, with good attendance. The writing of the sub-panel's report is now about 85% completed. The sub-panel plans to meet at the end of May at Columbia University to discuss its first round of recommendations. The report should be finished in June, with word-smithing until the next FESAC meeting. The strategy in the report will be to limit the number of findings and recommendations, in order to emphasize them. In preview, the report covers 14 topics and has four recommendations regarding the timing for a burning plasma project, the funding strategy, the plan for the project, and the Next Step Option program. The sub-panel has addressed most of the questions in the charge.

He responded to questions from FESAC members.

16. Date of Next Meeting

The chair proposed that the next FESAC meeting be scheduled for Tuesday and Wednesday, September 5 and 6, 2001, and be held at Princeton Plasma Physics Laboratory.

17. Adjourn

The chair adjourned the meeting at 11:53 a.m.

Minutes prepared by Michelle Priestley,
Albert Opdenaker, and James Van Dam

Approved by:
Richard D. Hazeltine, FESAC Chair

APPENDIX: Guest List

| Name | May 15 | May 16 |
|--------------------------------------|---------------|---------------|
| Jeffrey Auchmoody—DOE/SC | X | |
| David Baldwin—GA | X | X |
| Curt Bolton—DOE/OFES | X | X |
| Mike Crisp—DOE/OFES (DOE/SC-55) | X | X |
| Rostom Dagazian—DOE/OFES | X | |
| Steve Dean—FPA | X | X |
| Chuck Finfgeld—DOE | X | |
| T.V. George—DOE/OFES | X | X |
| Rob Goldston—PPPL | X | X |
| Richard Hawryluk—PPPL | X | X |
| Mark Haynes—GA | X | |
| Grant Logan—LLNL | X | |
| Darlene Markevich—DOE/OFES | X | |
| Ron McKnight—DOE/OFES | X | |
| Dale Meade—PPPL | X | X |
| Stan Milora—ORNL | X | X |
| Gene Nardella—DOE | X | X |
| Hutch Nielson—PPPL | X | |
| Erol Oktay—DOE/OFES | X | X |
| Albert Opdenaker—DOE/OFES | X | X |
| Spencer Pitcher—MIT/PSFC | X | |
| Miklos Porkolab—MIT | X | X |
| Don Priester—DOE | X | X |
| Walter Sadowski—DOE/OFES (DOE/SC-55) | X | X |
| John Sauter—DOE/OFES | X | X |
| Richard Siemen—LANL | X | X |
| Stan Staten—DOE | X | |
| John Willis—DOE/OFES | X | X |
| Michael Zarnstorff—PPPL | X | X |