

FUSION ENERGY SCIENCES ADVISORY COMMITTEE

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(CONTINUED)



U.S. DEPARTMENT OF  
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FUSION ENERGY SCIENCES ADVISORY COMMITTEE

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Fusion Energy Sciences Advisory Committee Meeting

June 16, 2014

By Televideo

AGENDA

Time	Topic	Speaker
12:00 p.m.	Welcome, Roll Call, Meeting Agenda and Logistics	Professor Mark Koepke, FESAC Chair West Virginia University
12:15 p.m.	Workforce development report presentation	Professor Hantao Ji, PPPL and Princeton University
1:30 p.m.	Questions and Answers	
2:30 p.m.	Public Comments	
3:00 p.m.	Update on the strategic planning panel activities	Professor Mark Koepke, FESAC Chair West Virginia University
3:30 p.m.	Questions and Answers	
4:00 p.m.	Adjourn	

FUSION ENERGY SCIENCES ADVISORY COMMITTEE

**OFFICE OF SCIENCE**

(CONTINUED)

**ROLL CALL**

**Workforce Development Needs Panel/Voting Members Present:**

Dr. Hantao Ji, **Chair**  
PPPL

Dr. Ed Thomas, **Vice Chair**  
Auburn University

Dr. Amanda Hubbard  
Massachusetts Institute of Technology

Dr. Richard Groebner  
General Atomics

Dr. Ramon Leeper  
Los Alamos National Laboratory

**Workforce Development Needs Panel/Voting Members Absent:**

Dr. Jean Paul Allain  
University of Illinois

Dr. Lee Berry  
ORNL (retired)

**Committee/Voting Members Present:**

Professor Mark Koepke, **Chair**  
West Virginia University

Dr. Steven Zinkle, **Vice Chair**  
Oak Ridge National Laboratory

Dr. Bruce Cohen  
Lawrence Livermore National Lab.

Dr. Arati Dasgupta  
Naval Research Laboratory

Professor John E. Foster  
University of Michigan in Ann Arbor

Dr. Charles M. Greenfield  
General Atomics

Dr. Richard Groebner  
General Atomics

Dr. Jin-Soo Kim  
FAR-TECH, Inc.

Dr. George H. Neilson  
Princeton Plasma Physics Laboratory

Dr. Juergen Rapp  
Oak Ridge National Laboratory

Dr. Don Rej  
Los Alamos National Laboratory

Professor Ellen Zweibel  
University of Wisconsin-Madison

**Committee/Voting Members Absent:**

Professor Amitava Bhattacharjee  
PPPL and Princeton University

Dr. Linda E. Sugiyama  
Massachusetts Institute of Technology

Dr. Chris Hegna  
University of Wisconsin

Dr. Valerie Izzo  
University of California, San Diego

Troy Carter  
University of California, Los Angeles

Professor Robert Rosner  
The University of Chicago

Professor Chris Keane  
Washington State University

Dr. Gert Patello  
Pacific Northwest National Laboratory

**Liaisons/ex officios Present:**

None

## FUSION ENERGY SCIENCES ADVISORY COMMITTEE

### OFFICE OF SCIENCE

(CONTINUED)

#### Liaisons/Ex officios Absent:

Professor Fred Skiff  
American Physical Society  
Division of Plasma Physics  
Professor of Physics  
University of Iowa

Dr. Minami Yoda  
American Nuclear Society  
Fusion Energy Division  
Professor of Engineering  
Georgia Institute of Technology

Dr. John W. Steadman  
Institute of Electrical and Electronics Engineers  
Dean of Engineering  
University of South Alabama

#### Office of Fusion Energy Sciences (FES) Attendees:

Dr. Bolton	Mr. Stevens	Dr. Barish
Dr. Van Dam	Dr. Finnegan	Dr. Podder
Dr. Mandrekas	Dr. Thio	Dr. Eckstrand

#### Other Attendees:

Dr. Bev Hartline, Montana Tech

**Monday, June 16, 2014**

**Dr. Mark Koepke, Chair, was presiding.**

### WELCOME

Dr. Mark Koepke discussed the membership changes, rules of the meeting, and the agenda, and introduced the presentation by Dr. Hantao Ji, PPPL.

### PRESENTATION OF THE REPORT ON WORKFORCE DEVELOPMENT NEEDS

**Dr. Hantao Ji, Chair, Subcommittee on Workforce Development, assisted by Dr. Ed Thomas, Vice Chair**

Dr. Ji's commentary followed closely his written slides. Details and questions were mostly postponed until after the presentation. Key points: Unlike Discovery Plasma Science, diagnostics and emerging disciplines in fusion engineering sciences, including fusion materials science, are poorly represented in curricula even though they are in high demand. Summer school seminars and internships, in collaborations with national labs, and increased support for developing and delivering needed curriculum topics, would help address workforce development needs.

#### Findings to identify disciplines not well represented in academic curricula:

- F1.** Curricula in MFE core disciplines are reasonably represented in academia.
- F2.** The university HEDLP/IFE research groups are small in number but stable in size.
- F3.** Discovery Plasma Science is stable and healthy at a large number of universities. Curricula in Discovery Plasma Science are strong.
- F4.** All emerging disciplines in fusion engineering sciences are poorly represented in curricula.

**OFFICE OF SCIENCE**

(CONTINUED)

**Findings to identify disciplines in high demand:**

**F5.** The demand in workforce in the core disciplines is strong and is well matched by the strong curricula, with the exception of diagnostics for MFE, which is least represented in curricula.

**F6.** Fusion engineering sciences are in high demand, as a whole, and are poorly represented in curricula.

**Finding to identify disciplines for which the DOE labs may play a role in workforce needs:**

**F7.** There is general recognition that national labs can play a role in workforce development for the emerging disciplines, especially in fusion engineering sciences.

**Finding for grad student/postdoc programs that address discipline-specific workforce needs:**

**F8.** It is critical to support faculty who develop and deliver curricula of sufficient depth and breadth and who provide research training needed for workforce development.

**Recommendations for Curriculum development and classroom education:**

- 1.** Establish summer schools for grad students and postdocs in fusion engineering sciences.
- 2.** Establish a consortium among national labs and academic institutions to enhance grad student training and develop curricula for advanced diagnostics and fusion engineering sciences.

**Recommendations for Workforce development needs in research training:**

- 3.** Encourage grad students/postdocs to pursue fusion engineering sciences.
- 4a.** Enhance the participation of universities in large FES projects – particularly in the areas of advanced diagnostic and materials development.
- 4b.** Establish a program at national labs to support grad students and postdocs in advanced diagnostics and in targeted emerging engineering science areas, including nuclear materials

**OFFICE OF SCIENCE**

(CONTINUED)

**COMMITTEE DISCUSSION**

Q = Question

A = Answer

S = Statement

S: Hutch Neilson: I owe the panel congratulations, and I'm impressed with methodology, responsiveness, and quantification of the data. I **suggest** we modify 4a, to add "...and international collaborations," with the intention of getting universities involved in large projects. International provides larger projects and creates stronger connections.

A discussion ensued about Hutch's **suggestion**. Members believed that including international collaboration in this effort was charge-appropriate, kept the statement U.S.-centric, and reflected that broadening the opportunities for the US universities, to gain experience, is growing and proving extremely valuable.

S: Mark Koepke: I'm going to restate the **motion**, and see if there is more discussion. The **motion** is to change 4a to increase academic institutions' participation in FES international collaborations, particularly in diagnostics. We will take the vote:

Charles: yes    Rich: yes    Hutch: yes    Juergen: yes

Steve: yes    Arati: yes    Bruce: yes    Mark: yes                      **(8 yes, 0 no)**

Q: Charles Greenfield: I don't agree with the metrics being used in 4a and 4b. Diagnostics is universities' lead role in DIII-D and NSTX, so I wonder if we are ignoring classroom work on diagnostics, because research on diagnostics seems to be reflected here.

A discussion ensued about how curriculum and research go hand in hand and how the survey questions were formulated and answered in terms of curriculum needs. Chuck emphasized that diagnostics are a large strength of the university program at national labs and we need to further integrate with other universities.

Q: Hutch Neilson: Both Chuck's and the panel report don't have a conflict. I read this recommendation as following from the highlighted gaps, which the panel highlighted as strong as it highlighted the university programs. There is a greater demand, even though the program is already strong. I don't see a conflict.

Q: Amanda Hubbard: The detailed text says multiple universities play key roles in diagnostics, but should expand for mutual collaboration in materials science.

S: Charles Greenfield: I'm happy with the answer. Periodic diagnostic competitions by FES are extremely competitive; only 50% win the competition. I want to see new diagnostics coming up on new machines. This is limited by funding.

Mark Koepke invited further questions. Steve Zinkle asked about error bars on the statistics in terms of indications of factors of two in some places and factors much less than a factor of two elsewhere in the numbers. Hantao was uncomfortable quantifying error bars on the statistics in terms of the tenths place, e.g., +/- 0.2, of the numbers quoted. Steve was satisfied with his

FUSION ENERGY SCIENCES ADVISORY COMMITTEE

**OFFICE OF SCIENCE**

(CONTINUED)

answer.

Q: Steve Zinkle: I have a question and recommendation regarding 4a, 4b. I'm wondering if the panel is attempting any kind of benchmarking with SC programs, such as HEP, NP, and BES, and if there is any discussion in the panel on increasing academic facilities, and looking at other SC programs that were benchmarked.

Q: Hantao Ji: The simple answer is "no" due to time and energy constraints. But, at the beginning, in April, we discussed other successful examples, such as NNSA, for this issue. Ray Leeper, looked at that program and gave a summary to the panel, but didn't investigate the question further. A radiological chemistry summer school was another successful program for WD-needs in the future. Do you suggest implementing those kinds of recommendations for further insight?

Q: Steve Zinkle: I'm satisfied due to the time urgency. It needs to be added, but no formal effort is required.

S: Lee Berry: I think there is a difference between some classes of experiments, such as plasma experiments. The fusion experiments are generally not user facilities, so common approaches may not work. Look at the nature of the facility, such as whether it is a user facility or not, and interpret this in terms of what the accelerator physics panel recommends.

A: Mark Koepke: For interpreting 4a 4b, refer to how the Office of Workforce Development of Teachers and Scientists (WDTS) addresses these workforce development needs. WDTS activities may be appropriate for FES or may provide good examples of something analogous.

Q: John Foster: Higher resolved categorization is needed for discovery science. Michigan was missing from the Survey, and they have a large program. Why were they not included? Discovery Plasma Science, space plasmas, and low temperature plasmas are all strong programs at Michigan.

A: Hantao Ji: In page 7, under theory, plasma science was the only category, e.g., Discovery Plasma Science.

Q: John Foster: In chart 22, showing ratios of university demand vs. curricula, Discovery, on pages 24-25, may be flipped like that because there is so much included in that category. There may be a large low temperature plasma program, but much smaller programs in other categories. Can we break Discovery into more subcategories?

Q: Mark Koepke: Would your comment change the conclusions of the report?

A: John Foster: No, it wouldn't change the conclusions of the report. My concern is that it gives the impression that there is not as much going on compared to what is actually occurring. There is a lot going on.

Q: Mark Koepke: We have to be cognizant that there will be some detail left out. As long as the conclusions are not changed, at the level of the charge response, we have to tolerate this.

Q: Ed Thomas: When the national lab reports came in, they self-reported a lower demand on the

FUSION ENERGY SCIENCES ADVISORY COMMITTEE

**OFFICE OF SCIENCE**

(CONTINUED)

Discovery science side. There is a lot lumped in as John said. Two key points: the areas identified were in previous FESAC reports, and need to be consistent. The lower scores were from the labs' self reporting, which refers back to Steve's question on the error bars. The same effect is due to lab reporting. Don't interpret that as a lack of interest, if it's artificially lower.

Q: John Foster: The charge requested that the results be put in the report, with the assessment of the jobs. How do you put in that into perspective?

A discussion of the connection between jobs and workforce development ensued. John made a **motion** (not seconded) that a statement should be added, for context, to explicitly link the findings and recommendations of the report to jobs. Hantao pointed out that workforce development means jobs.

S: Hutch Neilson: I see what John is saying, but to go beyond what is written and tabulated would get us into speculation. The survey asked to look 10 years out; it was a complicated calculation in these fields and in these disciplines. To get more specific is an additional task. I don't think this is necessary, and would require more work.

S: Hutch Neilson: I don't want an additional report to addresses this.

A: Mark Koepke: I am aligned with you, when you read in the 2nd paragraph in the charge, "significantly greater training to address gaps in SC mission needs". The purpose is to fill the gaps with employed people.

S: John Foster: It was a good report, but it's too much work and speculation to go beyond what is there. I just want to bring it up.

Q: Mark Koepke: What would be your vote on your own **motion**?

S: John Foster: Yes

Q: Jin-Soo Kim: From the very beginning of the employment question, in plasma physics and engineering, many graduates go to industry and they make a lot of progress in R&D in industry. Is this part of the discussion?

A: Mark Koepke: It's not part of the discussion. You're commenting about jobs. This is another comment.

S: Jin-Soo Kim: There are other types of industries where our graduates go, but they are not included in the whole program. I just bring it up.

A: Mark Koepke: We decided to not make any further articulation on the issue of jobs. Do you want to bring it back, and include private industry?

S: Hutch Neilson: That is a different point, that DOE SC is not the only customer for graduates in plasma and other fields.

S: Jin-Soo Kim: There is a large impact in industry, and it's never brought up.

FUSION ENERGY SCIENCES ADVISORY COMMITTEE

**OFFICE OF SCIENCE**

(CONTINUED)

A: Mark Koepke: I'm fully aware of that, but that is a totally different topic of labs and corporations in the report. We are not addressing jobs. If something is missing in the report, please suggest wording and where it should be in the report.

S: Hutch Neilson: This is another effort, bringing up additional jobs.

S: Hantao Ji: We do have a bullet in the final comment, as we want diversity, which is needed for the health of the field. So it is out of scope, but related. This is beneficial not just for FES employment, but we want to have that input, for the panel.

Q: Mark Koepke: Do others have comments for the subcommittee?

S: Juergen Rapp: No comment, I'm fine with the report and recommendations.

Q: Arati Dasgupta: Regarding IFE: There is a small but stable program at the labs. Are we happy or should we recommend growth? Should it stay small?

A: Hantao Ji: That is key finding #2; it is small but important to maintain and expand in this discipline (see pg. 20).

Q: Arati Dasgupta: One more question: the summary said that we need growth in certain areas, but not at the expense of other areas. For the panel, with a set budget, how is that possible?

A: Hantao Ji: You need a creative, effective way to cover all the areas, and keep them healthy and strong.

A: Bruce Cohen: I want to comment, to echo that this is an impressive report by the panel that is very deep, comprehensive, and has specific recommendations. It's easy to slip outside the charge, to give FES recommendations on program expansion, but that is not part of the charge.

Q: Mark Koepke: What about workforce development for teachers in science programs that are important to SC? The charge says workforce development for teachers and scientists for graduate students, faculty, etc... Did you evaluate those in terms of pertinence in gaps and implementing them or not?

A: Hantao Ji: We did. One comment was that we are not very effective in filling FES needs. Part of the observation of the committee is that we know that FES-related graduate and postdoc fellowship applicants are not faring well in science-wide competition in the graduate and postdoc fellowship programs. Ed Thomas can say more.

A: Ed Thomas: We did look into that. FES and also folks from WDTs provided us information about the status of the postdoc program. We got specific numbers of the level of 7-8 recipients per year, when the program was operated by FES compared to the level of 2-3 recipients per year, when the FES programs for junior faculty and postdocs were incorporated Office of Science wide. We saw a decline. We chose to make a neutral stand due to going outside the charge. The panel felt we needed to make a comment, but it's on the edge of the charge.

Q: Mark Koepke: About the 4a findings, did the university support that finding explicitly? Did the



FUSION ENERGY SCIENCES ADVISORY COMMITTEE

**OFFICE OF SCIENCE**

(CONTINUED)

university respondents support moving toward the lab collaborations? The 4a recommendation is actually not in the survey, so you couldn't address this, right?

A: Ed Thomas: If you look at the response of the universities, they thought the labs could help and these emerged. The labs and universities were asked to identify where the labs could contribute. This area is included.

S: Richard Groebner: There are no specific issues, but I agree with the other subcommittee members. In the past, there were data on the labs and corporations. It's not clear whether corporations are in the charge, which gave high response in the charge. They are not absent. The comment about jobs talked about the pipeline from instructors, at universities, to labs, to corporate hiring.

A: Hantao Ji: Rich spent a lot of time reading industry comments not just for fusion jobs, but plasma research in general, which serves the nation. For example, one corporation discussed jobs.

A **motion** to approve the report was made and seconded. There was a short discussion whether subcommittee members were permitted to vote as committee members on the report approval. The outcome was subcommittee membership did not make a committee member ineligible to vote.

Jim Van Dam pointed out numerous small inconsistencies in the labeling and language used throughout the report that introduced unnecessary confusion and inaccuracy. Mark asked Jim to list these types of corrections and send the list to Mark.

Mark Koepke: We need to have a vote by 2:30pm. In the discussion of the **motion**, we can have the discussion. Anyone want to make another point?

Q: Amanda Hubbard: Did everyone see the executive summary report? We did not see it.

Hantao had sent Sam Barish of FES the executive summary at 8:00am without sending it to the rest of the subcommittee or committee. Sam sent it to everyone, so the committee could review it before voting. Before the committee received the executive summary, a vote was taken on the report as presented, followed by a vote on the executive summary.

A: Hutch Neilson: I **move** that we vote on the report, as presented.

Bruce **seconded** the motion.

S: Mark Koepke: We will take a vote, to approve the report only, without the executive summary.

Bruce yes	John yes	Charles yes	Rich yes
Jin-Soo yes	Hutch yes	Juergen yes	Steve yes
Ellen abstain	Arati yes	Mark yes	<b>(10 yes, 1 abstain)</b>

S: Mark Koepke: The report is **approved** by the committee.

S: Charles Greenfield: I **recommend** (move) a vote on the executive summary with the same

## FUSION ENERGY SCIENCES ADVISORY COMMITTEE

### OFFICE OF SCIENCE

(CONTINUED)

changes to section 4a.

Jin-Soo Kim **seconded** the motion.

S: Hutch Neilson: I feel it's a good representation.

The motion was **approved** unanimously to permit the same changes to the executive summary as in section 4a.

S: Mark Koepke: Motion passes.

### PUBLIC COMMENT

There were no public comments at this meeting.

### OTHER BUSINESS

Mark Koepke updated the committee on the strategic planning panel activities using slides. Mark's commentary followed closely his written slides.

### DISCUSSION

S: Hutch Neilson: I'm not sure how you will digest the comments. I have concerns about how to answer the charge that won't be controversial or contentious. FESAC is being passed through most of this exercise. I'm very concerned about getting buy-in on a controversial report.

A: Mark Koepke: Hopefully it will be a week early. In the 15-24<sup>th</sup> September range, for review and preparation of questions and also a discussion period for in person discussion. The panel takes seriously the fact that the final FESAC recommendation is part of the process. This is in the mind of the panel members. The panel is busy digesting the submitted material and prior reports and studies. Concerns are not going to go away. Some in the community and on FESAC will be happy and some will be sad about the process and FESAC can approve it, approve parts of it, or reject it. The panel is focusing on responding to the charge. Keep your concerns coming, so that we make sure the panel tries to address them.

Q: Bruce Cohen: If FESAC is required to put up or shut up in the meeting and the conclusion in voting is to approve or not approve, then it will be a fait accompli and it will be difficult to push it through the meeting.

A: Mark Koepke: Good point. That's nearly impossible to do in the approval meeting. The panel will not invite interaction with FESAC before the approval meeting. This panel has been appointed, for this purpose, and we are taking it very seriously. We are not to seek or include FESAC influence. That means that we will have a report that will have been processed a certain way to respond to the charge, but there is a risk that FESAC approval will not be unanimous.

FUSION ENERGY SCIENCES ADVISORY COMMITTEE

**OFFICE OF SCIENCE**

(CONTINUED)

S: Sam Barish: FESAC has three choices: approve, reject, or modify then approve. Modification has been done at other FESAC meetings. You will have the opportunity, in another meeting, or come up with another report, and approve it at another meeting, if necessary.

A: Mark Koepke: I can tell you right now, from the response letter from Pat Dehmer, that we are not going to be able to go past the October 1 deadline. Voting would have to be in that week of the 22<sup>nd</sup> to 23<sup>rd</sup> of September. It's inappropriate for a televideo format for the FESAC strategic plan charge discussion. I'm optimistic about approval, although there will be pain, intent, and strategy along the way. The regular FESAC process will take place for the discussion. Don't plan on a contingency of another report or meeting. The items of disagreement will need to be worked in real time. We might be able to extend the meeting time.

S: Bruce Cohen: The FESAC meeting approving the Rosner panel report had discussion, but not answering the charge was deemed unacceptable.

S: Mark Koepke: If FESAC votes on the panel report, it jeopardizes the message from the panel if it is not unanimous. The objective of having community consensus may not be fulfilled.

S: Ellen Zweibel: I have a presence in the astronomy community, where there is a much longer, much higher level of input. They have attempted to get input from whole community, which has led to support. I'm in a difficult position as a FESAC member. There is usually some iterative process for fine-tuning or major tweaks to the report.

A: Mark Koepke: Many may have the same perspective. Read the charge on the BPO web site, for the philosophy on the web site. I have provided some statements. The 2007 Greenwald report had tremendous support as a roadmap. ReNeW had incredible input on grand challenges in the field. The work of this panel is not supposed to compete with those extended efforts. Priorities and budget will be the focus of the report. We take 2007 Greenwald in the context of ReNeW and then prioritize. Ellen, I'm addressing the time and involvement of the community through prior reports and the public meetings in this planning exercise.

S: Charles Greenfield: The first two reports you mentioned, Greenwald and ReNeW, were not to be priorities, but the full scope. The Rosner report was the first time to prioritize, which ended up controversial. The full FESAC is made with people with strong opinions. It's difficult for the full FESAC to exercise oversight, which is a big risk.

A: Mark Koepke: First, the 2007 Greenwald report did have prioritization and priorities, in it. It had an algorithm. Second, another big risk is that the report will not be deemed useful to SC; the metric is the conflict of interest. There will be controversies, due to institutional identities. There will be problems and discussions. All the points you made Chuck, were included in the members selection and the report. Even the best road forward is filled with risks.

S: Hutch Neilson: You are doing your best, but you are not addressing the concerns about the panel, as if it is independent from FESAC. The panel is not independent. We, FESAC, are going to

FUSION ENERGY SCIENCES ADVISORY COMMITTEE

**OFFICE OF SCIENCE**

(CONTINUED)

only have a week. Please open this up so we can get it done on schedule; if not on schedule, get the bloodshed out ahead of time.

A: Mark Koepke: 10 out of 19 Panel members are FESAC members.

**CONCLUDING REMARKS**

Are there any other questions on this topic or on other business?

Thank you for your efforts.

The meeting is adjourned.

**ADJOURNMENT**

**The Fusion Energy Sciences Advisory Committee Meeting was adjourned for the day at 4:00 p.m.**

**These meeting minutes were created by Mr. Edward Stevens, FES.**

**The meeting minutes were reviewed by the FESAC chair.**

Certified as correct by:



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16 November 2014

Dr. Mark Koepke, Chair

Date