

DOE/SC-0098

Fusion Energy Sciences Advisory Committee

Compilation of Reports from the First Round of Committees of Visitors' Reviews of the Fusion Energy Sciences Program

October 2006



U.S. Department of Energy
Office of Science

Preface

In August 2003, the Director of the Office of Science (SC) charged the Fusion Energy Sciences Advisory Committee (FESAC) to provide to the Department every three to four years the Committee's views on the efficiency and quality of the processes used by the Department to deal with the many aspects of procuring contractors and grantees to carry out the tasks needed to meet the goals of the Office of Fusion Energy Sciences (OFES). FESAC was asked to establish a Committee of Visitors (CoV) to assist it in reviewing the elements of the Fusion Energy Sciences program on a rotating basis. For this purpose, OFES asked FESAC to consider the program to be composed of three elements:

- Theory and computations
- Confinement innovation and basic plasma sciences
- Tokamak research, diagnostics development, and enabling technologies

The CoV was specifically asked to access the processes used for

- soliciting proposals from the National Laboratories, universities, and industrial firms,
- obtaining peer reviews of submitted proposals
- recommending which proposals should be selected
- documenting these actions
- establishing appropriate consistency between the selected proposals and the program's stated goals and objectives
- monitoring the ongoing technical work following the award of grants or contracts

In addition, the committee was asked to comment on how the aforementioned processes affect the breadth, quality and balance of the OFES R&D portfolio as well as the national and international perceptions of the elements of that portfolio.

FESAC has recently completed the first round of reviews of the three sets of program elements listed above. This document is a compilation of the three FESAC reports that provide the result of these reviews.

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DOE Response

Executive Summary
of
Compilation of Reports from the First Round of
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of the
Fusion Energy Sciences Program

Introduction

In 2003, Dr. Ray Orbach, Director, Office of Science (SC), charged the Fusion Energy Sciences Advisory Committee (FESAC) to establish a Committee of Visitors (COV) through which FESAC can assess matters pertaining to program management decisions on a regular basis. Similar committees have been established for the other SC offices, while other funding agencies, such as the National Science Foundation (NSF), have long used Committees of Visitors to evaluate the management of their programs. The intent of the charge is to have the COV review program management every three to four years, on a rotating basis, for the following elements of the Fusion Energy Sciences (FES) program:

- 1) Theory and computation
- 2) Confinement innovation and basic plasma science
- 3) Tokamak research and enabling technologies

The FESAC, with the help of its Committees of Visitors, has recently completed the first full round of reviews of these program elements. The report on the review of the theory and computation program was completed in March 2004. The report on the review of the innovative confinement program and general plasma sciences program was completed in March 2005. The report of the review of the enabling technologies, diagnostics and tokamak programs was completed in February 2006. This document is a summary of the findings, conclusions and the responses by the Department of Energy (DOE) to these reports.

COV Findings and DOE Responses

The original charge asked the COV to assess the efficiency and quality of the processes used to: a) solicit, review, recommend and document proposal actions; b) establish the consistency between award decisions and the Office of Fusion Energy Sciences' (OFES) programs and goals; and c) monitor active projects and programs. In addition, the committee was asked to comment on how the award process has affected: a) the breadth, quality and balance of portfolio elements; and b) the national and international standing of the portfolio elements.

The COV focused most of their attention and efforts on the evaluation of the program management processes at the OFES. OFES was commended by the COV for the way it manages

all phases of the peer-review process as well as the post-award monitoring of the funded projects. In addition, the COV agreed with and encouraged the continued exercise of discretion by OFES Program Managers in making final funding decisions, especially when the results of peer-reviews are not clear cut. Most of the concerns expressed by COV members or by members of the fusion research community surveyed by the COV were related to program constraints caused by the need for higher program budgets rather than with specific management practices used by OFES. The need for higher program budgets was not part of the charge to FESAC.

Each review resulted in recommendations from FESAC on how to improve the OFES management processes. OFES has responded directly to FESAC with action plans on how it is going to implement the FESAC recommendations it deemed appropriate and feasible.

Among the recommendations that have already been implemented, or are in the process of being implemented are:

- Improvement of the uniformity and consistency of the information kept in the review folders:

This recommendation was a result of all three reviews, and it has already been implemented to a large extent. The two latter reviews recognized this to be the case. It has contributed to a better organization of the information maintained by OFES.

- Improvements in the peer-review process:

As a result of this recommendation, recent OFES solicitations have been updated to include:

- The addition of outcome-related language (e.g., *must fund*, *should fund*, *fund if funds available*, etc.) to the description of the numerical scores in the evaluation forms and expanding the rating scale from 1-5 to 1-10.
- The addition of a new criterion in our application evaluation form entitled “Performance under existing award” for renewal applications, asking the reviewers to explicitly comment on the past work of the principal investigator (PI).
- A question under the scientific/technical merit review criterion for proposals submitted under theory solicitations on the applicant’s plans to validate theoretical predictions with experimental results, where appropriate.
- A standard format for preparing proposals is now included in the language of new solicitations.

- Implementation of a uniform rebuttal process:

A rebuttal process is now a part of all OFES solicitations with the exception of joint NSF/DOE solicitations that are conducted by NSF using NSF procedures. The results of the rebuttal process may be considered in making funding decisions if additional discriminators are found to be necessary.

- Communication of the proposal rating to the PIs:

For quite some time, sanitized versions of the reviewers' comments have been provided to people submitting proposals. Henceforth, the overall rating given to a proposal by each reviewer (*Excellent, Very Good, Good, Fair, Not recommended*) will be included with the sanitized comments.

Regarding the second part of the charge on how the award process has affected the breadth, quality and balance of the fusion program's portfolio, as well as their national and international standing, the COV spent little time addressing it due to the lack of meaningful metrics to evaluate this issue. However, COV panel members—many of whom are active researchers in plasma physics and fusion—expressed confidence in the quality of the OFES research programs based on recent reviews by outside panels such as the National Research Council's (NRC) review of plasma science and its assessment of the FES Program, as well as on the strong presence and contributions of U.S. scientists in international meetings.

Conclusions

The first round of reviews of the OFES program elements had a positive impact on the management of the program. The implementation of a significant number of recommendations has helped strengthen and improve the procedures for soliciting proposals, peer-reviewing them, and making funding decisions, as well as for monitoring the progress of the active projects in our portfolio.

In addition, the three COV reviews provided a unique opportunity for the members of the FES research community to become familiar with the internal procedures used in dealing with proposals thus increasing their confidence in the peer-review process and reassuring them that proposals are treated fairly and conscientiously by the OFES program managers.



Department of Energy
Office of Science
Washington, DC 20585

August 15, 2003

Office of the Director

Professor Richard D. Hazeltine, Chair
Fusion Energy Sciences Advisory Committee
The University of Texas at Austin
Institute for Fusion Studies
1 University Station, C 1500
Austin, TX 78712-0262

Dear Professor Hazeltine:

This letter provides a charge to establish a Committee of Visitors (COV) through which the Fusion Energy Sciences Advisory Committee can assess matters pertaining to program decisions on a regular basis. It is our desire to have the COVs review program management every three to four years, on a rotating basis, for the following elements of the Fusion Energy Sciences program:

- Theory and computation
- Confinement innovation and basic plasma science
- Tokamak research and enabling technologies

Specifically, the committee is asked to assess, for the National Laboratory, University and private industrial participants, the efficiency and quality of the processes used to:

- Solicit, review, recommend and document proposal actions
- Establish the consistency between award decisions and the Office of Fusion Energy Sciences' programs and goals
- Monitor active projects and programs

The committee is asked to comment on how the award process has affected:

- The breadth, quality and balance of portfolio elements
- The national and international standing of the portfolio elements

The first area that I would like you to address is the theory and computation program. You should work with the Associate Director for the Office of Fusion Energy Sciences to establish the processes and procedures for the first COV.



I believe that the COV will help us maintain a high standard of scientific research. I look forward to your feedback on how the Office of Fusion Energy Sciences is making program decisions, and how that decision process can be improved.

I would like to have a final report from you by late spring of 2004.

Sincerely,

A handwritten signature in black ink that reads "Raymond L. Orbach". The signature is written in a cursive style with a large, prominent initial 'R'.

Raymond L. Orbach
Director

SECTION I

Report of the Committee of Visitors
on its Review of the
Process and Procedures used to Manage the
Theory and Computations Program



INSTITUTE FOR FUSION STUDIES
THE UNIVERSITY OF TEXAS AT AUSTIN

Robert Lee Moore Hall • Austin, Texas 78712-1060 • (512) 471-1322 • fax (512) 471-6715

March 30, 2004

Dr. Ray Orbach
Director, Office of Science
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585

Dear Dr. Orbach:

In response to your letter of August 15, 2003, the Fusion Energy Sciences Advisory Committee (FESAC) established a Committee of Visitors (COV) to review program management by the Office of Fusion Energy Sciences (OFES) of fusion theory and computation. After an extensive meeting with OFES officials in November of 2003, the COV completed its report on January 20, 2004. We now submit the report to you with FESAC's full endorsement.

As recommended in the charge, OFES will be reviewed by three COV's, corresponding to three major components of the program: theory and computation; confinement innovation and basic plasma science; and tokamak research and enabling technologies. Each Committee will conduct periodic reviews at intervals of three or four years.

The Theory and Computation COV, chaired by Dr. William Nevins, had fifteen members, including fusion theorists and computational scientists; fusion scientists who do not specialize in theory or computation, but who use the results of such research; and scientists from neighboring disciplines, such as astrophysics and solar physics.

In its report the COV notes "the success of OFES in its implementation of comparative peer review and...the quality of the reviewers chosen by the OFES Theory Team." The report concludes that "the competitive peer review process has improved both the fairness and accountability of the proposal review process." The COV then provides six recommendations intended to improve the comparative peer review process. FESAC agrees with the COV's conclusions and recommendations.

Being the first COV to meet, Dr. Nevins' Committee had special burdens and responsibilities. FESAC believes that the Committee met these responsibilities with skill and good judgment, setting an example to subsequent COV activity, and we thank all members of the Committee for their hard and valuable work.

Yours truly,

A handwritten signature in black ink, appearing to read "R. D. Hazeltine".

Richard Hazeltine
Chair, Fusion Energy Sciences Advisory Committee

Enclosure

cc: N. A. Davies
FESAC

Executive Summary

A Committee of Visitors (COV) was formed to review the procedures used by the Office of Fusion Energy Sciences to manage its Theory and Computations program. The COV was pleased to conclude that the research portfolio supported by the OFES Theory and Computations Program was of very high quality. The Program supports research programs at universities, research industries, and national laboratories that are well regarded internationally and address questions of high relevance to the DOE. A major change in the management of the Theory and Computations program over the past few years has been the introduction of a system of comparative peer review to guide the OFES Theory Team in selecting proposals for funding. The COV was impressed with the success of OFES in its implementation of comparative peer review and with the quality of the reviewers chosen by the OFES Theory Team. The COV concluded that the competitive peer review process has improved steadily over the three years that it has been in effect and that it has improved both the fairness and accountability of the proposal review process. While the COV commends OFES in its implementation of comparative review, the COV offers the following recommendations in the hope that they will further improve the comparative peer review process:

- The OFES should improve the consistency of peer reviews. We recommend adoption of a “results-oriented” scoring system in their guidelines to referees (see Appendix II), a greater use of review panels, and a standard format for proposals.
- The OFES should further improve the procedures and documentation for proposal handling. We recommend that the “folders” documenting funding decisions contain all the input from all of the reviewers, that OFES document their rationale for funding decisions which are at variance with the recommendation of the peer reviewers, and that OFES provide a Summary Sheet within each folder.
- The OFES should better communicate the procedures used to determine funding levels. We recommend that the OFES communicate a clear and consistent policy on the level at which successful proposals are funded to both PI’s and reviewers and document their rationale for the funding level of successful proposals.
- The OFES should add additional criterion when evaluating large university and laboratory theory groups with multiple investigators. We recommend that larger theory groups include an additional review criterion including clear evidence of collaborative work and the extent to which the group addresses problems requiring a team effort and that the threshold (currently 6 FTE’s) for holding an on-site panel review of theory groups be reduced.
- The OFES should increase opportunities for new investigators (who have not previously received fusion theory and computations grants). We recommend that the OFES track the success rate for proposals by new investigators and that OFES consider ways that increase the success rate for proposals from new investigators.
- The OFES should encourage greater interaction between the theory and experimental programs. We recommend that experimentalists be invited to participate in the peer review process for theory grants and that reviewer evaluation criteria include efforts to validate theoretical models.

1. Introduction

In August of 2003 the Director of the Office of Science requested that the Fusion Energy Sciences Advisory Committee (FESAC) establish a Committee of Visitors review process for programs within the Office of Fusion Energy Sciences. Over the past few years the Office of Science has chartered Committees of Visitors to review elements of the Basic Energy Sciences program, and the reports of these previous committees (see <http://www.sc.doe.gov/bes/besac/reports.html>) were taken as models for the effort reported on here.

2. The Charge

The Charge to the COV was provided in a letter from Ray Orbach (Director of the Office of Science) to Richard Hazeltine (Chairman of FESAC). The charge letter requests that the committee review the management of the Theory and Computations program within the Office of Fusion Energy Sciences and assess the quality of the processes used to:

- Solicit, review, recommend and document proposal actions
- Establish the consistency between award decisions and the Office of Fusion Energy Sciences' programs and goals
- Monitor active projects and programs

The committee was also asked to comment on how the award process has affected:

- The breadth, quality and balance of portfolio elements
- The national and international standing of the portfolio elements

3. Committee Composition

The committee was chosen by Prof. Richard Hazeltine (FESAC Chairman) and Dr. W.M. Nevins (the COV Chairman) in consultation with OFES. They sought broad representation within the overall OFES magnetic fusion community, including members from universities, industry, and National Labs with both theoretical and experimental backgrounds. We also sought members from outside the OFES community with broad experience in plasma physics in an effort to benefit from their experience with peer review as it is practiced by funding agencies other than the DOE Office of Science. We settled on a COV with 15 members, including 8 from universities, two from industry, and 5 from National Laboratories. Ten members of the COV received the bulk of their

research funding from OFES, while of the remaining members four received all of their research funding from agencies other than OFES.

COV Panel Members

Name	Institution
Bill Nevins, Chair	LLNL
Mike Brown	Swathmore
Vincent Chan	GA
Dan D'Ippolito	Lodestar
Todd Ditmire	UT
Dan Dubin	UCSD
Alan Glasser	LANL
Martin Greenwald	MIT
Bill Kruer	LLNL
Mike Mael	Columbia
Martha Redi	PPPL
Bob Rosner	Chicago
Carl Sovinec	U of Wisconsin
Ed Synakowski	PPPL
Richard Wolf	Rice

4. The Process

The COV met with the Dr. Anne Davies, Dr. John Willis, and the OFES Theory Team at the Department of Energy offices in Germantown on Nov. 13-14, 2003. The morning of Nov. 13 was devoted to presentations from the OFES staff. Dr. Davies (Head of the Office of Fusion Energy Sciences) reviewed the charge, and thanked the Committee for participating in this review. Dr. Willis (Director, Research Division) gave an overview of the comparative peer review process used by OFES for awarding grants. Dr. Steve Eckstrand (former Theory Team Leader, Research division) and Dr. Curt Bolton (Theory Team Leader, Research Division) provided summaries of the comparative review process as it was executed from Jan. through July '01 as input to the award of SciDAC grants (the "SciDACReview"), from Jan. through Sept. '02 as input to the award of FY '03 Theory grants (the "FY '03 Theory Review"), and from Jan. through Sept. '03 as input to the award of FY '04 Theory grants (the "FY '04 Theory Review"). Finally, Dr. John Sauter gave a presentation describing how proposals made to the OFES are documented in "folders".

The COV broke up into three subcommittees to review the folders documenting the FY '03 Theory Review, the FY '04 Theory Review, and the SciDAC Review. Breaking into three subcommittees was useful both to help distribute the work involved in reviewing the folders and (through care in designing the sub-committees) to assist

individual members in avoiding conflicts (no committee member reviewed a folder for a proposal led by their institution, or one in which they had had any financial involvement).

Sub-Committee	Group 1	Group 2	Group 3
Chair: [] [] [] []	Todd Ditmire	Richard Wolf	Bob Rosner
	Bill Kruer	Mike Brown	Bill Nevins
	Dan Dubin	Vincent Chan	Carl Solvinec
	Alan Glasser	Martha Redi	Dan D'Ippolito
	Mike Mauel	M. Greenwald	Ed Synakowski
Assignment			
Nov. 13	SciDAC	'03 Theory	'04 Theory
Nov. 14	'04 Theory	SciDAC	'03 Theory

The COV met in closed session both on the (late) afternoon of Nov. 13 and (early) afternoon of Nov. 14 to discuss their findings. The meeting of the COV closed on the afternoon of Nov. 14 with a presentation of our preliminary findings by W.M. Nevins (Chairman of the COV) to the OFES Theory Team.

5. Discussion and Recommendations

During the past few years, OFES has put greater emphasis on the use of comparative peer review for the evaluation and award of theory grants. Our committee strongly endorses this use. In the broadest sense, the COV was extremely impressed with the quality of the review process implemented by the OFES Theory Team. This process has improved significantly over the last 3 years. The COV was particularly impressed with the new proposal review structure, which more closely approximates the NSF style of proposal competitions in which a significant number of new and renewal proposals are competed at the same time. This is a major improvement over previous methods of funding proposals based on consideration of a single proposal at any one time. This new process has led to an improvement in the quality of an already outstanding theory and simulation program.

Since 2001, the solicitation, review, and selection of proposals have followed a well-structured time-line. There is an annual call for proposals (usually in January), which includes broad guidance from the OFES on topics of programmatic interest (see, for example, <http://www.science.doe.gov/grants/Fr03-18.html>). Next, letters of intent (if applicable) and proposals are received. All proposals submitted in response to this call have the same deadline, and are considered together. The OFES Theory Team forwards those proposals judged responsive to the guidance provided with the call for proposals to (generally) three peer reviewers. ORISE assists the OFES Theory Team in tracking the progress of the peer review via PeerNet (a web-based system for accessing proposals and submitting reviews). Reports from reviewers come in (usually electronically through PeerNet) by about June. The Theory Team within the OFES reviews these reports and

makes a group decision on which proposals to recommend for funding. These funding recommendations are based both on the peer reviews and on overall considerations of program balance. Funding recommendations are forwarded to Dr. Willis (Director, Research Division) for final decisions. Dr. Willis may ask for additional reviews in an effort to give grant applicants as fair a hearing as possible. Theory and computations grants generally last for three years. Because there is a new call for proposals every year, unsuccessful applicants can (and often do) present a new proposal the following year.

Theory program funding is \$27M per year — 11% of the OFES budget. About 41% of the theory program funding goes to DoE labs, 41% to universities, 15% to industry, and 3% to non-DoE labs. Grant awards vary from small individual investigator grants with less than \$100k annual funding to larger group and collaborative efforts employing many investigators with more than \$1M annual funding. The entire theory sum is available every 3 years on a rotating basis.

Annual calls for proposals in theory and computations have appeared in each of the past three years. These calls have attracted 3 to 4 times more proposals than the OFES is able to fund. Almost all of these proposals were judged to be responsive to the guidance provided within the call for proposals and forwarded to peer reviewers. The peer reviewers provide both a written commentary on the proposal and a numerical score between 1 (Not Recommended) and 5 (Excellent). The bulk of the proposals sent out for review were well thought out and received scores between 3 (good) and 5 (excellent) from their peer reviewers. While funding of proposals has not been based solely the scores received from the peer reviewers (the OFES Theory Team exercises discretion in order to achieve program balance) almost all of the funded proposals received an average scores of 4 (Very Good) or greater from their peer reviewers.

The comparative peer review process is open to all interested principal investigators and is clearly more competitive than the mission-oriented process it replaced. The COV found that the comparative peer review process has improved steadily over the 3 years during which it has been in effect, and that it improves both the fairness and accountability of the process it replaced.

Quality of Peer Reviewers

The COV was impressed with the quality of the reviewers chosen by the OFES Theory Team. The list included many of the most able scientists within the OFES Theory program and their fields of expertise were generally very well matched to those proposals they were asked to review.

Consistency of Peer Reviews

In the comparative peer review systems used by the OFES Theory Team each reviewer will typically review and provide numerical scores (which range from 1 to 5) for about 3 (out of a total of about 40) proposals. Comparisons between proposals — which are critical to making funding decisions — require comparing the scores provided by one reviewer with those provided by others. However, comparing the written text to the numerical score, it appears that different reviewers use different criteria for assigning scores. In addition, different reviewers will often give markedly different scores to the same proposal. The COV found that the “cut-off” point for receiving funding was typically an average (between the reviewers) score of between 4.0 and 4.5. Individual proposals falling in this range often received scores of 3, 4, and 5 (occasionally 5, 5, and 2) from their three reviewers. That is, the variance between scores from individual reviewers often exceeds the difference between the average score for a proposal and the nominal score required to receive funding.

While the COV strongly endorses the use of peer-review, we have several recommendations on how it could be used more effectively.

A Result-Oriented Scoring System. Instead of associating an adjective to each numerical score [1–not recommended, 2–poor, 3–good, 4–very good, 5–excellent] the OFES Theory Team should associate a result to each numerical score [1–Do not fund (a single score of 1 will, very likely, eliminate a proposal’s chances of funding), 2–Barely acceptable (a single score of 2 may eliminate a proposal’s chances of funding), 3–Fund if budget permits (proposals with an average score of 3 should rank in the 3rd through 5th decile of all proposals submitted, and are typically not funded), 4–Deserves funding (proposals with an average score of 4 should rank in the second decile of all proposals submitted, but funding is not assured), 5–Must fund (Proposals with an average score of 5 should rank in the top 10% of all proposals submitted and will generally be funded.)].

Revised “Guidelines to Reviewers”. A suggested revision to the “Guidelines to Reviewers” is attached as Appendix II.

Make Greater Use of Panel Reviews. The COV recommends a two-stage review process. The present system (written reviews by three anonymous peer reviewers) would form the first stage, to be followed by a second stage in which a review panel, formed from a subset of those providing written reviews, would meet together with the goal of providing the OFES Theory Team with an ordered list of proposals (that is a list containing all of the proposals ranked by technical quality). Given present experience (about 40 proposals in total to be scored) and reviewer work-load (about 3 reviews/reviewer) it would require a panel of between 10 and 15 reviewers to insure that each proposal had been reviewed by at least one panel member. Based on previous OFES experience (the SciDAC reviews and Innovative Confinement Concept panel reviews) it should be possible for each member of such a panel to provide the OFES Theory Team with an “ordered list” of the proposals after a meeting which lasted 3 to 4

days. While the ordered lists from each panel member may not be identical, their experience in interacting together should greatly reduce the variance between lists. The direct cost of such a panel (travel for, perhaps, 5 persons — the travel for most of the panel members would be charged to their existing theory grants) would be modest (probably less than \$25k), while the actual cost (including salaries and travel for all panel members) would be somewhat higher (perhaps as much as \$100k). This should reduce the variance among reviewer's scores, and be well worth the additional cost.

A Standard Format for Proposals to enforce some uniformity so that reviewers (and auditors like this COV) could more easily make comparisons. The COV suggests the following:

- a) Executive Summary — one page summarizing all pertinent points below
- b) Abstract — one paragraph summary of the planned work
- c) Background — putting the proposed work into scientific and programmatic context
- d) Description of recent accomplishments — for renewals
- e) Proposed research — including scope, schedules, deliverables
- f) Textual summary of budget (in addition to the formal budget pages)
- g) Management plan — if appropriate (for larger groups)
- h) Description of facilities, resources, and personnel
- i) Other current and pending support

Procedures and Documentation

The COV approves of the procedures used by the OFES Theory Team for soliciting and reviewing proposals. The manner in which each proposal was considered for funding is documented by an individual “folder” containing the proposal, written reviews from each of its peer reviewers and, in the event that it is selected for funding, a record of the size and duration of the grant which was received.

These procedures were followed in almost all of the “folders” reviewed by the COV — demonstrating that the OFES Theory Team has implemented the comparative peer review system in an ordered and disciplined manner. We note that these folders were prepared before they had any reason to anticipate that they would be reviewed by a COV. This involved a substantial effort in retaining and archiving documents relating to each proposal received. We commend the OFES on this effort. However, the COV makes the following recommendations to improve the documentation:

- **Ensure that the “folders” contain all the input from all of the reviewers.** A small number of folders did not contain reviews from (at least) three referees or, very occasionally, did not contain the reviews (and scores) from all of the peer reviewers who had been assigned to review that proposal. This situation often appeared to have been a consequence of difficulty in getting referees to respond in

a timely manner or because some peer reviewers failed to use the web-based PEERNET system to submit their review. The COV believes it important that complete reports from all the reviewers be retained in the folders to properly document each funding decision.

- **Document rationale for funding decisions which are at variance with the recommendation of the peer reviewers.** Some funding decisions seem to be at variance with the contents of the folders. The COV appreciates that this situation results from the Theory Team using other criterion (such as “programmatic balance”) in making its funding recommendations, and recognizes the necessity of the Theory Team very occasionally overriding the peer reviews — in fact, the COV often found themselves in agreement with the actions taken by the Theory Team in this regard. However, we think it important that the Theory Team include a brief memo in the relevant folder documenting the “other considerations” which led to the funding decision and describes the Theory Teams rationale for the decision they reached in those cases where they have chosen to over ride the advice from the peer reviewers.
- **Provide a Summary Sheet within each folder.** In the interest of assisting future COV’s, we recommend that each folder be expanded to include a summary sheet which provides the following information:
 1. The institution applying for the funding
 2. The principal investigator
 3. The title of the proposal
 4. Whether this is a renewal or a proposal for new funding
 5. A list of the peer reviewers and their scores
 6. The disposition (funded, close-out funding, or not funded)
 7. Funding level (both the PI’s request and the OFES funding reward)

The COV appreciates that all of this information is already available somewhere within the folder, but feels that job of future COV’s would be greatly facilitated by collecting it on a single summary sheet for each proposal.

Decisions on the Level of Funding

The COV found that successful proposals — even proposals receiving “excellent” scores from each of the peer reviewers — often (perhaps always?) received substantially less funding than that requested by the PI. Given these large disparities between the PI’s request and the actual funding grant, it becomes important to document the procedures used to determine the recommended funding levels.

- **The Theory Team should have a clear and consistent policy on the level at which successful proposals are funded** which can be communicated to both potential PI’s and to peer reviewers. The PI’s need to understand the Theory

Teams policy on funding successful proposals so that they don't define a scope-of-work that is more ambitious than the OFES Theory Team is willing to consider. The reviewers need to understand the policy so that they can intelligently comment on the proposed budget.

- **Document rationale for funding levels.** A description of the rationale for the particular funding level recommended by the Theory Team should be included in the folder for each successful proposal.

Large University and Laboratory Theory Groups

The COV found that some of the proposals considered (and funded) under the general call for proposals encompassed larger scale efforts involving multiple investigators. These proposals usually included three or more FTEs and had substantially higher annual budgets (few hundred k\$) than the single investigator proposals. These proposals competed against the smaller scale single investigator proposals. The COV felt that some of these large-scale efforts were of a significant enough difference in scale and budget to warrant with the inclusion of additional criterion when considering them for funding. These additional criteria for larger group proposals would be an addition to those criteria used in judging single investigator grants. In particular, these larger group proposals should be rated on the synergy of the group. This will prevent block grant funding of a collection of unrelated single investigator style efforts. With respect to synergy, appropriate review criteria are

- Clear evidence of collaborative work
- The extent to which the group addresses problems requiring a team effort

The OFES Theory Team should also reduce the threshold (currently 6 FTE's) for holding an on-site panel review. Alternatively, they could hold a "reverse" site review, in which representatives of several institutions traveled to a common site to make presentations to a common review panel.

Program Evaluation

The OFES Theory Team evaluates program execution by having team members attend technical conferences and workshops regularly to learn about theory progress and discuss issues with project/program staff; through annual progress reports from PI's who have received theory grants; and through presentations at the annual budget planning meeting. The Theory Team takes this information into account when making funding decisions

The COV believes that the many interactions between the OFES Theory Team and members of the theory community are, in part, responsible for the markedly higher probability that proposals for renewed funding will be successful relative to that for new proposals (particularly new proposals from principal investigators with no previous funding history from the OFES). The COV recognizes that program execution and program continuity are important and we found ourselves in agreement with the individual decisions made by the Theory Team.

However, we were struck by the success rate for proposals for renewed funding (greater than 90%) vs. the success rate for proposals submitted by individuals who had not previously received OFES theory and computations funding (less than 10%). The COV believes it is in the best interest of the fusion energy science program that opportunities be found that encourage and enable funding of quality proposals from new investigators who have not previously received OFES funding. This issue is related to those of demographics and diversity discussed in the next section. The COV recommends

- **That the Theory and Computations team track the success rate for proposals by new investigators** trying to enter the OFES Theory program, and present this information to future COV's.
- **That the OFES seek opportunities to fund new proposals from investigators with no previous funding history from the OFES.** The present success rate for such proposals is about one per cycle. It is the opinion of the COV that the quality of the proposals from prospective new entrants into the OFES Theory community easily justifies a doubling of their success rate.

Demographics and Diversity

The OFES Theory and Computations community is mainly composed of white and Asian males over 50 years of age. The composition of the community reflects the absence of any funding increases over the last two decades in this field and largely reflects the "hiring pool" of 20 years ago. Yet the composition with respect to gender of the plasma physics community is in fact different from the US physics community; for example, the fraction of members of the American Physical Society overall who are female (9%) is twice that of the American Physical Society Division of Plasma Physics (5%). The fraction of US physics PhD's earned by women is now at 13%, up from 6% earned by women 20 years ago. The fraction of women professors of physics at the top 20 universities in the US is 6%; the fraction of women professors of plasma physics in MFE is <1%. Support for young faculty in plasma science is critical for the long-term health of the field and special attention is needed in reviews and decisions on young faculty grant proposals. The equitable distribution of research funding according to merit, without discrimination according to age, gender or race is an important goal for DOE and other government agencies. Clearly, research-funding decisions can critically affect the demographic balance of US science and engineering programs. The annual OFES proposal process is the gateway into the program, so it is important to understand how it

can be used to effectively recruit young physicists in general, and women and minority physicists in particular.

The COV discussed this issue among ourselves and with the OFES management. It is our opinion that the OFES management views enhancing the diversity of the OFES program generally as an important goal, and is working to achieve it. Because of the lack of diversity in our program we encourage OFES in the future to request voluntary information about gender and ethnicity, etc. from principal investigators, just as NSF and other government funding agencies do. In Appendix III we reprint a section from the most recent NSF Grant Proposal Guide, NSF 04, which may be found at <http://www.nsf.gov/pubsys/ods/getpub.cfm?gpg>. This addition to the information requested in submitting a grant proposal to DOE would not be inconsistent with existing government rules and would provide some data on the funding demographics. We applaud the efforts of the OFES management to increase diversity of the scientific community they fund, and wish them additional success in formulating strategies to achieve this end.

Encouraging Greater Connection Between the Theory and Experimental Programs

As currently implemented, there are parallel peer review processes for theory and experimental grants. The COV recognizes that such a division is necessary to the management of the peer review process. However, one undesirable consequence of this division is a tendency for proposals aimed at validating theory against experiment to plummet into the gap between these parallel review processes. A continuing dialogue between the theory and experimental programs of the OFES is greatly to be desired, and both the theory and experimental grant review processes should encourage this dialogue. To this end, the COV recommends:

- **Inclusion of experimentalists in the peer review process** for theory grants.
- **Consideration of proposed efforts to validate of theoretical models as part of the reviewer evaluation criteria** (see Appendix II).

Program Quality

The COV did not solicit input on the program quality. However, as researchers active in the field of plasma physics it is our opinion that the OFES supports a high-quality theory program. This view is supported by a recent review of Plasma Science by the National Academy of Science [see *Plasma Science: From Fundamental Research to Technological Applications*, The National Academies Press (1995), available on-line at <http://www.nap.edu/books/0309052319/html/>].

The plasma theory effort supported by OFES is well regarded internationally. Evidence of this regard can be seen in the preponderance of talks by US theorists at major international meetings. For example, at the 19th Fusion Energy Conference (IAEA-CN-94, 14-19 Oct. 2002, Lyon France. The program of this conference is available on-line at http://www-pub.iaea.org/MTCD/publications/PDF/csp_019c/START.HTM) scientists supported by OFES theory grants were chosen to present four (out of a total of twelve) of the theory talks; while two additional talks include scientists supported by OFES Theory grants as co-authors. This was more than any other national group (European scientists collectively presented 3 theory talks).

Appendix I . The Charge Letter

Professor Richard D. Hazeltine, Chair
Fusion Energy Sciences Advisory Committee
The University of Texas at Austin
Institute for Fusion Studies
1 University Station, C 1500
Austin TX 78712-0262

August 15, 2003

Dear Professor Hazeltine:

This letter provides a charge to establish a Committee of Visitors (COV) through which the Fusion Energy Science Advisory Committee can assess matters pertaining to program decisions on a regular basis. It is our desire to have the COVs review program management every three to four years, on a rotating basis, for the following elements of the Fusion Energy Sciences program:

- Theory and computation
- Confinement innovation and basic plasma science
- Tokamak research and enabling technologies

Specifically, the committee is asked to assess, for both the National Laboratory, University and private industrial participants, the efficiency and quality of the processes used to:

- Solicit, review, recommend and document proposal actions
- Establish the consistency between award decisions and the Office of Fusion Energy Sciences' programs and goals
- Monitor active projects and programs

The committee is asked to comment on how the award process has affected:

- The breadth, quality and balance of portfolio elements
- The national and international standing of the portfolio elements

The first area that I would like you to address is the theory and computation program. You should work with the Associate Director for the Office of Fusion Energy Sciences to establish the processes and procedures for the first COV.

I believe that the COV will help us maintain a high standard of scientific research. I look forward to your feedback on how the Office of Fusion Energy Sciences is making program decisions, and how that decision process can be improved.

I would like to have a final report from you by the summer of 2004.

Orbach

Appendix II. Revised Evaluation Criteria and Scoring

1. Scientific and technical merit of the proposed research.
 - a. Does this application address an important problem in plasma science, plasma technology, fusion energy sciences, or fusion energy technology?
 - b. How does the proposed research compare with other research in its field, both in terms of scientific and/or technical merit and originality?
 - c. What is the likelihood that it will lead to new or fundamental advances in its field?
2. Appropriateness of the proposed method or approach.
 - a. Are the conceptual framework, methods, and analyses adequately developed and likely to lead to scientifically valid conclusions?
 - b. Does the proposed research employ innovative concepts or methods?
 - c. Does the applicant recognize potential problems and consider alternative strategies?
3. Competency of applicant's personnel and adequacy of proposed resources.
 - a. How well qualified are the applicant's personnel to carry out the proposed research? (If appropriate, please comment on the scientific reputation and quality of recent research by the principal investigators and other key personnel.)
 - b. Please comment on the applicant research environment and resources.
 - c. Does the proposed work take advantage of unique facilities and capabilities and/or make good use of the collaborative arrangements?
4. Reasonableness and appropriateness of the proposed budget.

Are the proposed budget and staffing levels adequate to carry out the proposed research? (Note: the OFES Theory Team often funds projects at less than the requested level)
5. Other appropriate factors.

How is the proposed project relevant to the Office of Fusion Energy Science's goals?

Does this proposal include efforts to validate theoretical models against experiment?
6. Other constructive comments for the Principal Investigator.

What are the overall strengths and weaknesses of the proposal?
7. Please rate the proposal based on the following scale (fractional scores are acceptable):
 - 1 – Do not fund (a single score of 1 will, very likely, eliminate a proposal's chances of funding)
 - 2 – Barely acceptable (a single score of 2 may eliminate a proposal's chances of funding. Proposals with an average score of 2 or less should rank in the bottom 50% of all proposals submitted)
 - 3 – Fund if budget permits (proposals with an average score of 3 should rank in the 3rd through 5th decile of all proposals submitted, and are typically not funded)
 - 4 – Deserves funding (proposals with an average score of 4 should rank in the second decile of all proposals submitted, but funding is not assured).
 - 5 – Must fund (Proposals with an average score of 5 should rank in the top 10% of all proposals submitted and will generally be funded.)

Appendix III. NSF Request for Information on Principal Investigators

The following is quoted from the NSF Grant Proposal Guide, Section II.C.1.a, page 13. <http://www.nsf.gov/pubsys/ods/getpub.cfm?gpg> in the hope that it may serve as a model for a similar request for information about the gender, race, ethnicity and disability status of individuals named as PIs/co-PIs on proposals and awards from the Office of Fusion Energy Sciences.

C. PROPOSAL CONTENTS

1. Single-Copy Documents

Certain categories of information that are submitted in conjunction with a proposal are for "NSF Use Only." As such, the information is not provided to reviewers for use in the review of the proposal. With the exception of proposal certifications (which are submitted via the Authorized Organizational Representative function), these documents should be submitted electronically via the Proposal Preparation module in the FastLane system. A summary of each of these categories follows:

a. Information About Principal Investigators/Project Directors and co-Principal Investigators/co-Project Directors

NSF is committed to providing equal opportunities for participation in its programs and promoting the full use of the Nation's research and engineering resources. To aid in meeting these objectives, NSF requests information on the gender, race, ethnicity and disability status of individuals named as PIs/co-PIs on proposals and awards. Except for the required information about current or previous Federal research support and the name(s) of the PI/co-PI, submission of the information is voluntary, and individuals who do not wish to provide the personal information should check the box provided for that purpose.

DOE Response
to the
Review of the
Process and Procedures used to Manage the
Theory and Computations Program



Department of Energy
Office of Science
Washington, DC 20585

May 20, 2004

Professor Richard D. Hazeltine, Chair
Fusion Energy Sciences Advisory Committee
Institute for Fusion Studies, RLM 11.218
University of Texas at Austin
1 University Station, C 1500
Austin, TX 78712-0262

Dear Professor Hazeltine:

Richard

I would like to express my appreciation to FESAC for successfully completing the request made for a committee of visitors (COV) to review the Office of Fusion Energy Science's procedures for reviewing and funding work in the theory and computational program. A special thanks goes to the COV Panel, chaired by Dr. Bill Nevins (LLNL), for a thorough examination of the program and for the excellent report that clearly states the panel's findings and recommendations.

I consider the ongoing COV process to be an important way for me to insure that the Office of Fusion Energy Sciences review and award process is both sensible and fair and results in a balanced portfolio of excellent science. This first effort went very well, from my perspective, and I believe our future reviews will benefit from the COV Panel's recommendations.

I have attached a detailed response to your report.

Sincerely,

Anne Davies

N. Anne Davies
Associate Director
for Fusion Energy Sciences
Office of Science

Enclosure



Response to Recommendations of the first Committee of Visitors review of the Office of Fusion Energy Sciences Theory and Computation Program.

Recommendation: We recommend adoption of a “results-oriented” scoring system in their guidelines to referees, a greater use of review panels, and a standard format for proposals.

OFES Response: OFES plans to change the scoring system in future solicitations and will require that researchers use a standard format in preparing proposals. It is the experience of the theory team that, generally, the written reviews give them clear guidance on the scientific merit of the proposals. So we will continue to use them as the primary way of determining scientific quality. The OFES plans to continue to use review panels to resolve differences between closely rated proposals from related topical areas.

Recommendation: We recommend that the “folders” documenting funding decisions contain all the input from all of the reviewers, that OFES document their rationale for funding decisions which are at variance with the recommendation of the peer reviewers, and that OFES provide a Summary Sheet within each folder.

OFES Response: OFES plans to add further documentation to the folders especially to explain the rationale for the decisions

Recommendation: We recommend that the OFES communicate a clear and consistent policy on the level at which successful proposals are funded to both PI’s and reviewers and document their rationale for the funding level of successful proposals.

OFES Response: OFES will document the rationale for the funding level of funded proposals. Efforts will also be made to provide clearer guidance as to the levels of funding that are potentially available.

Recommendation: We recommend that larger theory groups include an additional review criterion including clear evidence of collaborative work and the extent to which the group addresses problems requiring a team effort and that the threshold (currently 6 FTE’s) for holding an on-site panel review of theory groups be reduced.

OFES Response: We currently have additional criteria that are applied to large theory groups. For practical reasons we will continue to use the threshold of about 6 FTE’s for holding an on-site panel review, but consideration will be given to reducing the threshold number in instances where that appears to be appropriate.

Recommendations: We recommend that the OFES track the success rate for proposals by new investigators and that OFES consider ways that increase the success rate for proposals from new investigators.

OFES Response: In the future we will track the success rate for new investigators. The OFES maintains a very successful young investigator program that encourages the placement and support of young new faculty at Universities and Colleges. We expect to continue supporting the Junior Faculty Development Program.

Recommendation: We recommend that experimentalists be invited to participate in the peer review process for theory grants and that reviewer evaluation criteria include efforts to validate theoretical models.

OFES Response: OFES has consistently used experimentalists on the onsite reviews we have conducted of the large theory groups. We will also attempt to include experimentalists for panel reviews of the theory program when we use them. In future solicitations we will add a question for the reviewers to comment on whether the results of the proposed research will be appropriately validated against experimental results.

SECTION II

Report of the Committee of Visitors

on its Review of the

Innovative Confinement, General Plasma
Physics, and Inertial Confinement Programs



INSTITUTE FOR FUSION STUDIES
THE UNIVERSITY OF TEXAS AT AUSTIN

Robert Lee Moore Hall • Austin, Texas 78712-0262 • (512)471-1322 • FAX (512)471-6715

April 11, 2005

Dr. Ray Orbach
Director, Office of Science
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585

Dear Dr. Orbach:

In response to your letter of August 15, 2003, the Fusion Energy Sciences Advisory Committee (FESAC) has established two Committees of Visitors (COVs) to review program management by the Office of Fusion Energy Sciences (OFES) of fusion research. As recommended in the charge, OFES will be reviewed by three COV's, corresponding to three major components of the program: theory and computation; confinement innovation and basic plasma science; and tokamak research and enabling technologies. Each Committee will conduct periodic reviews at intervals of three or four years.

The report of the second COV, concerned with innovative confinement concepts, inertial confinement fusion and general plasma physics, was presented to FESAC on April 7, 2005. After reviewing this report, prepared by a Committee of fourteen scientists led by Professor Jeff Freidberg, FESAC submits it to you with its full endorsement.

While suggesting ways in which Office management might be improved, the report is positive about OFES procedures and policies; it notes that "the OFES staff does a very good job managing the way it solicits, reviews, awards and monitors proposals..." and that "the community can feel confident in the knowledge that their proposals will be reviewed fairly and conscientiously by OFES."

We thank Professor Freidberg and his Committee for their conscientious, perceptive and very constructive work.

Yours truly,

A handwritten signature in black ink, appearing to read "R. Hazeltine".

Richard Hazeltine
Chair, Fusion Energy Sciences Advisory Committee

Enclosure

cc: ✓ N. A. Davies
FESAC

Executive Summary

This report summarizes the findings and recommendations of the second Committee of Visitors (COV) whose charge was to review the Office of Fusion Energy Science (OFES) management of the Innovative Confinement, General Plasma Physics, and Inertial Confinement programs.

Overall, the OFES staff does a very good job managing the way it solicits, reviews, awards, and monitors proposals included in the programs examined by the present COV. The staff is serious, conscientious, and dedicated in its efforts to generate a high quality research program by means of the peer review process. For a very large majority of the proposals submitted, it is the opinion of the COV that OFES makes sound decisions regarding which proposals should and should not be funded. For decisions on the borderline, where there can be legitimate differences of opinions, OFES has thought about the issues carefully and can provide a detailed rationale for its decision.

A survey sent to the fusion community revealed that, in general, the community has positive feelings about the review process. This is an important conclusion and the COV commends OFES on its management of the peer review process to obtain this positive result. The main concerns expressed by the fusion community relate to severe budget constraints, and the corresponding lack of growth for the programs under consideration.

The COV would also like to let members of the fusion community know that OFES is doing a good job reviewing their proposals. Based on our experience, the community can feel confident in the knowledge that their proposals will be reviewed fairly and conscientiously by OFES.

Based on our findings the COV has developed a set of recommendations to help OFES improve the management of the ICC and GPP programs. Most of these recommendations are highly sympathetic with those made by the first COV. Moreover, these improvements can be implemented without significantly increasing the review burden on OFES or on the research community; we consider it important not to add to the already significant workload of proposal and review activities. The recommendations are given as follows.

- **A rebuttal procedure**

OFES should develop a uniform, clearly stated, rebuttal procedure for proposal writers.

At present there is no uniform rebuttal process in OFES. Rebuttals are occasionally allowed, but are not automatically requested. Also, the request for rebuttals is not uniform from RFP to RFP. The COV, in accordance with the fusion community, recommends that OFES clarifies and formulates a uniform rebuttal process.

- **Improving the review procedure**

OFES should implement several relatively simple ideas in the peer review process to improve the accuracy of the final funding decisions

The review process already works quite well. The COV has several additional recommendations to make that would, in our opinion, further improve the process, most likely in an incremental manner. First, the directions to reviewers should include descriptive correlations between numerical score and suggested funding decisions (e.g. a score of “5” should signify “must fund” rather than “excellent”).

Second, reviewers should be allowed to offer more accurate scores using decimal values to improve resolution. Even allowing scores of half integers (i.e. for instance 3.5) would be an improvement.

Third, on a related point reviewers should be discouraged from using a low score of 1 for a proposal which is technically competent but not responsive to the solicitation guidelines. Instead the rating sheet could include a specific request for the reviewer’s opinion on responsiveness to solicitation guidelines, separate from the 1-5 rating, which would be reserved for judging technical merit.

Fourth, OFES should press very hard on reviewers who complete the informational portion of their reviews but for one reason or another do not enter a final numerical score.

- **Uniform review folders**

OFES should improve the uniformity and consistency of the information contained in the review folders

The COV urges OFES to continue to improve the uniformity and consistency of the review folders for each proposal. Of particular importance is a clear, concise summary sheet containing among other things the funding decision, the funding level if funded, the reviewers’ scores, a justification for those proposals funded, and an explanation describing why other proposals were not funded.

Finally, OFES could probably improve its “big picture” of the review process by creating simple overview data sheets as presented in Appendix D. Such data would help OFES to compare the quality and the amount of OFES discretion required for each RFP. It would also allow comparisons between one RFP and another.

Committee of Visitors

Final Report March 2005

I Introduction

This report summarizes the findings and recommendations of the second Committee of Visitors (COV) whose charge was to review the manner in which the Office of Fusion Energy Science (OFES) manages certain programs under its charter. The specific programs reviewed by this COV involve confinement innovation and basic plasma sciences. The first COV completed its work last year and was concerned with the Theory and Computation Program. The present Committee would like to acknowledge the substantial help we received from the first COV and its chairman, Dr. Bill Nevins.

The report is organized as follows. The first few sections set the background for the report by describing the charge to the Committee, the actual program elements reviewed, the composition of the Committee, and the process used to arrive at our conclusions. The last two sections contain the main results of our deliberations, comprised of our Findings and Recommendations.

II The Background and Charge to the Committee

The request to establish a series of committees (COVs) was made by Dr. Ray Orbach, Director of the Office of Science, in August 2003. He transmitted his request to Dr. Richard Hazeltine, Chairman of the Fusion Energy Sciences Advisory Committee (FESAC). Professor Hazeltine has already established two COVs and will complete Dr. Orbach's request next year with the establishment of a third COV panel. Thus when a COV completes its report, it forwards it to FESAC which must then approve it and, finally, submit it to Dr. Orbach.

The charge to the Committee is given in Appendix A. Basically, the Committee is asked to review the way that OFES manages its program elements with respect to:

- The complete review processes involved in selecting proposals for awards
- The manner in which progress is monitored
- The connection between proposal awards and the overall program goals

The Committee is also asked to comment on the following:

- The breadth, quality, and portfolio balance
- The national and international standing of the portfolio elements

Although interesting and important, it was *not* in the charge to the COV to assess the present role of the confinement innovation and the basic plasma science programs within

the context of the overall balance in the fusion program. This lies in the domain of the ongoing “Priorities Panel” chaired by Dr. Charles Baker.

III The Specific Program Elements Reviewed

There are many elements in the overall fusion program. The present panel was charged with reviewing program elements concerned with Innovative Confinement Concepts (ICC), General Plasma Physics (GPP), and Inertial Fusion Energy (IFE). The specific program elements reviewed are as follows.

- NSF/DOE joint program
- General plasma physics program at the national laboratories
- Fusion Science Centers
- Atomic physics
- Junior faculty program
- Innovative confinement concepts
- Inertial fusion energy/high energy density physics

These elements represent annual funding of more than \$49M. The largest elements are ICC research (\$26M), IFE/HEDP research (\$13.8), and GPP research (\$7.1M). This year, the Fusion Science Centers were added as a new element to the program with annual funding of \$2.3M.

Overall the Committee examined the review process for approximately 100 proposals. The Committee did not review the National Spherical Torus Experiment (NSTX) or the National Compact Stellarator Experiment (NCSX), which although being innovative confinement concepts, are grouped together with the large tokamak facilities as “large experiments.” Most of the proposals reviewed by the COV panel were submitted in response to formal solicitations of the DOE Office of Science. They included:

- Notice 03-19, “Research in Innovative Approaches to Fusion Energy Science,” <http://www.science.doe.gov/grants/Fr03-19.html>, Published March 4, 2003.
- Notice DE-FG01-03ER03-26, “Fusion Science Centers,” <http://www.science.doe.gov/grants/Fr03-26.html>, Published August 15, 2003.
- Notice DE-FG01-04ER04-18, “Research in Innovative Approaches to Fusion Energy Science,” <http://www.science.doe.gov/grants/FAPN04-18.html>, Published April 20, 2004.

In addition the Committee examined, in-part, proposals submitted to NSF as part of the NSF/DOE Partnership in Basic Plasma Science and Engineering: NSF 02-184, “Partnership in Basic Plasma Science and Engineering,” <http://www.nsf.gov/pubs/2002/nsf02184/nsf02184.htm>, Published October 1, 2002.

IV The Committee

The Committee was comprised of 14 members from universities, laboratories, and industry. All were relatively senior, having had considerable experience writing and reviewing technical proposals. Some members had research interests that were directly involved in the programs being reviewed. Some were members of the fusion community, primarily involved with tokamaks, while others were not directly in the fusion community but had related interests in plasma physics or nuclear science. We believe that the Committee had a good overall balance. The members, affiliations, and primary research interests are summarized in the table below.

Name	Institution	Expertise
Jeff Freidberg (Chair)	MIT	Tokamaks/ICC
Don Batchelor	ORNL	Tokamaks
Jeff Coderre	MIT	Non-fusion
Fred Driscoll	UCSD	Basic Plasma Physics
Gail Glendinning	LLNL	IFE/HEDP
Chuck Greenfield	General Atomics	Tokamaks
Dave Hammer	Cornell	Basic Plasma Physics
Mike Mauel	Columbia	ICC/Tokamaks
Ed Ott	U. of Maryland	Non-fusion
John Sarff	U. of Wisconsin	ICC/Basic Plasma Physics
Ed Thomas	Auburn U.	Basic Plasma Physics
Francois Waelbroeck	U. Texas, Austin	ICC/IFE/Tokamaks
Harold Weitzner	NYU	ICC/Tokamaks
Dan Winske	LANL	Non-fusion

V The Process

The process by which the COV arrived at its findings and recommendations involved several steps.

First, we had several discussions with the first COV to learn from their experiences. One member of the Committee also served on the first COV that reviewed the processes and procedures used to manage the Theory and Computations Program.

Second, after several conference telephone calls the Committee agreed upon a fairly detailed questionnaire concerning the way in which OFES manages the programs under consideration. This questionnaire was sent to OFES. Many of the questions were answered with written responses. Others were deemed slightly sensitive and OFES wanted to answer these in person during the site visit, which they did, in a cooperative and forthcoming manner. Based on the discussions the panel then wrote responses to these questions. A copy of the questionnaire and answers is included in Appendix B.

Third, after an additional conference call the Committee agreed upon a set of questions that were sent in the form of a simple multiple choice survey to relatively senior members of the fusion community directly involved in the programs being reviewed. The survey was sent to 61 scientists and we received 39 responses. A copy of the survey, including a summary of the results, is given in Appendix C. Interestingly, members of the community were quite willing to express their views with written comments in numbers far exceeding our expectations, thus being too lengthy to include in the report. The Committee considered these comments seriously, although not directly, in reaching our conclusions. A copy of the survey, including the written comments, was sent to OFES before the site visit.

The fourth step in the process involved a two-day site visit to OFES headquarters in Germantown. During this visit, the COV heard presentations by OFES (1/2 day), examined the proposals covered by our review (1/2 day), met in executive session to develop our findings and conclusions (2/3 day), and closed with a preliminary presentation of our report to OFES (1/3 day).

Through the usual series of emails and a conference telephone call we converged to this final report.

VI Findings

A. Overall Summary

Overall, the OFES staff does a very good job managing the way it solicits, reviews, awards, and monitors proposals included in the programs examined by the present COV. The staff is serious, conscientious, and dedicated in its efforts to generate a high quality research program by means of the peer review process. For a very large majority of the proposals submitted, it is the opinion of the COV that OFES makes sound decisions regarding which proposals should and should not be funded. For decisions on the borderline, where there can be legitimate differences of opinions, OFES has thought about the issues carefully and can provide a detailed rationale for its decisions. Often this rationale is explained in writing and included as part of the proposal folder. We urge OFES to do this for all proposals primarily to institute a history and sense of continuity for each project under consideration, which is particularly important as assignments in OFES change and personnel come and leave.

The survey revealed that in general the community has positive feelings about the review process. This is indeed a non-trivial result. Our interpretation of the main overall concern expressed by the fusion community is ultimately related to the flatness of the budget, and the corresponding lack of growth for the programs under consideration. There is a frustration in that it takes a considerable expenditure of time and effort for community members to continually prepare and submit new proposals, which are then prioritized through a time consuming peer review process, only to have high quality proposals unfunded because of budget limitations. Even so, it is important for OFES to maintain the peer review process. This is particularly so because in the near future with

the (hopeful) agreement to proceed with ITER there may be large changes in the program in terms of funding and research directions. When this occurs, the peer review process should be very helpful and play a major role in deciding which projects should and should not be funded.

Lastly, the COV would like to let members of the fusion community know that OFES is doing a good job reviewing their proposals. The community should have confidence that the peer review process, when properly carried through, is the best approach so far in selecting which proposals to fund. Some members of the community, like some members of the COV, tend to be somewhat suspicious of the way OFES reviews their proposals, although this feeling is largely generated by a lack of knowledge of the process. The COV, once it learned first hand how OFES actually carries out the review process, was favorably impressed. Based on our experience, the community can feel confident in the knowledge that their proposals will be reviewed fairly and conscientiously by OFES, even though the budget limitations may limit the total number of awards made in any given program.

B. Solicitation of proposals

New request for proposals (RFP's) are officially announced on the public Federal website "Grants.gov" (<http://grants.gov/>) and also listed on the DOE Office of Science website (<http://www.science.doe.gov/grants/>). The survey indicates that fusion researchers virtually always know about a new (RFP's) in time to complete and submit proposals. We also note that non-government websites post links to the official proposal solicitations. These include Fusion Power Associates, <http://fusionpower.org/>, the University Fusion Association, <http://depts.washington.edu/ufoa/home.html>, and the "Fire" website, <http://fire.pppl.gov/>, at PPPL. These other online notifications help to keep the community informed. In addition, we appreciate (1) the verbal presentations by OFES staff at "town hall" meetings at the APS Division of Plasma Physics Annual Meeting and (2) the email announcements of DOE proposal opportunities that are sent by the APS-DPP to its membership. Verbal communications between OFES staff and appropriate members of the community are especially effective ways to announce RFPs. The COV encourages OFES to consistently use all of these forms of communication to insure the widest possible awareness of program solicitations.

In general OFES is able to complete the entire process from the issuance of the RFP to the final notification of awards on a reasonable time scale, on the order of 6 to 8 months. This is quite satisfactory.

C. Reviewing of proposals

The review process requires several steps. (1) choosing reviewers, (2) choosing the method of review (i.e. mail vs. site visit), (3) analyzing and deciding which proposals to fund based on the reviewer input, and (4) documenting the review result for each submitted proposal for the purposes of continuity, future use, and internal (OFES) and external (COV) analysis. In addition, the COV reached several conclusions regarding the

overall effectiveness of the current peer review process. Our findings regarding these points are as follows.

The COV panel was favorably impressed by the quality of the scientists chosen to review proposals. These scientists are invariably senior members of the community with considerable experience in the technical area being reviewed. OFES chooses from a large number of reviewers and appears to have a good knowledge of which scientists routinely provide careful, detailed, well thought out reviews on a timely scale and which scientists do not. This knowledge is mainly in the heads of OFES staff through years of personal contact and experience. There is no organized computerized list of reviewers and OFES may want to consider establishing such a list in view of retirements and career changes. However, since the system is currently working, one should be careful expending too much time and energy fixing a process that is not broken.

Most of the proposals that we examined were for relatively small amounts of funding (i.e. single investigator proposals) and as such were reviewed by mail. The few larger ones involved site visits. In terms of efficiency this makes good sense. However, the site visit proposal writers have the advantage of directly addressing, face-to-face, any questions or problems raised by the review panel. They essentially have a built-in, real time, rebuttal procedure. The mail review proposal writers correctly note that this gives the larger projects an advantage since they (the mail review proposal writers) often do not have a chance to rebut any negative referee comment. In fact, a large majority of the responders from the community survey were very unclear about whether or not a unified rebuttal procedure exists and, if one did exist, did it have any impact on funding decisions. Addressing the question of rebuttals is one of the main recommendations of the COV and is discussed in the recommendations section.

Typically each proposal is reviewed by at least three scientists who score on the basis of 1 to 5, with 5 being the highest. A recommendation made by the first COV, and which we heartily endorse, is to put more appropriate word correlations with each grade to help each reviewer's ranking be better calibrated against the other reviewers. For instance, rather than stating that 5 = excellent and 1 = poor, a better system might be:

- 5 = must fund
- 4 = deserves funding
- 3 = OK to fund if resources available
- 2 = marginally acceptable, fund only for a crucial programmatic need
- 1 = not acceptable, do not fund under any circumstances

An important issue that was identified and partially quantified by the COV concerns the variation in the reviewers' scores as compared to the average scores of all proposals within a given RFP. Specifically, it was found that the average value of the standard deviation of the reviewers' scores on a given proposal was of the same order as the standard deviation of the average scores of all proposals. Some examples are given in Appendix D. The implication is that the numerical scores resulting from the peer review

process provide a reasonably good guideline as to which proposals should or should not be funded but are not a razor sharp, precision tool, upon which to base decisions.

OFES has recognized this problem and has adopted an internal team review process to help arrive at proper funding decisions. When the external reviews are collected, a group of typically four OFES members form a team to collectively review the results. This team attempts to sort out biases, eliminate inappropriate or occasionally misinformed reviews, and take into account programmatic needs. The team approach appears to work quite well. Four team members discussing the results lead to better decisions than would arise solely from a single OFES staff member who invariably would not have complete expertise in all areas under consideration (i.e. theory, computation, or experiment, with application to transport, heating, or confinement). The conclusion is that OFES carefully considers the reviewers rankings of the proposals but sometimes uses discretion in arriving at its final decisions; that is, awards are not based on a purely numerical ranking of the reviewers. However, based on the admittedly limited data in Appendix D, it would appear that this discretion is only used very occasionally. This is slightly worrisome in view of the fact that the deviation in the scores of the reviewers is comparable to the deviation in the average scores of the proposals.

Constrained by flat budget limitations, many funding decisions go to existing projects up for renewal because of the excellence of the research and the substantial investments that have already been made in terms of experimental hardware. Even so, there is turnover and balance in the program and new and sometimes quite innovative research is being supported. Also there is thought put into balancing university research versus projects at the national labs. This is crucial since, as stated, the numerical score from the external reviewers is not a precision tool. The COV has several recommendations on relatively simple ways to improve this process without imposing significant new burdens on the community or OFES staff. These are discussed in the recommendations section.

On a related issue, the Committee was very pleased to learn of the procedure followed by OFES when the terminations of large ICC research programs were recommended. Naturally, in an active and innovative research program like fusion, existing research programs must prepare renewal proposals that compete with new ideas and programs proposed by other research groups. This competition is the appropriate way to insure continued high quality of research and to provide review of research progress. The proposals that we examined included several proposals to renew ICC research programs. We noted that in the cases where reviews of existing programs would lead to project termination, OFES always allowed the PIs the opportunity to prepare rebuttals. The Committee strongly endorses this practice. Additionally, the Committee was also pleased to learn that closeout funds were provided to allow the completion of on going graduate dissertation work.

The last topic of interest involves documenting the review process for each proposal and, on a larger scale, for the RFP as a whole. OFES is making considerable progress in this area but OFES still has a way to go. Consider first the documentation for separate

proposals. It is essential that the folder for each proposal be uniform in structure. Also, a standard summary sheet serving as the cover page would be very helpful to OFES and future COV in order to quickly assess the status of the proposal and the reason why the proposal was funded or not. In this connection, a short paragraph explaining the justification for funding or the reason for not funding should be included on the summary page. In terms of documenting the results for the RFP as a whole, there was little information available. The COV found summary sheets prepared specifically for the site visit by Darlene Markovitch, Francis Thio, and Michael Crisp very helpful. Some samples are included in Appendix D. It was disappointing that such data for all the programs under consideration was not available for the Committee prior to the site visit, although it was requested in the original questionnaire to OFES. The reason is that this information is not readily or easily available to OFES in spite of its obvious usefulness for internal self-assessment. This is not due to a lack of interest on the part of OFES but much more to the lack of availability of an efficient DOE information system for processing and manipulating the data. We understand that DOE-wide efforts are underway to correct this situation but this does not help the present situation for OFES or other divisions. Until this situation is improved, many organizations in DOE will be lacking an important tool for internally assessing their overall performance on the review process.

Overall, the COV believes the current peer review process can be characterized as follows. Peer review has increased the fairness of the review process, both in perception and reality. Peer review has increased the quality of the proposals as well as the quality of the reviews. There is, however, no obvious metric that shows whether or not the actual quality of the research has increased. Stated differently, the quality of the research was already very high even before the peer review system was introduced and continuing improvements were made. Peer review requires a considerable effort on the part of the community and OFES in terms of writing and reviewing proposals. There was also strong feeling in the community that too many “new initiatives,” while desirable in the abstract, are not very desirable in the present environment. They require substantial amounts of additional efforts in the writing and reviewing of proposals, but in a flat budget are often funded by extracting funds from given programs to free up funds for the new initiative. Thus researchers feel they are doing a lot more work re-competing for funds that were already awarded. Even though some of these new initiatives are externally imposed unfunded mandates, OFES should be very cautious before they are implemented because of the flat budget situation.

D. Fusion Science Center Solicitation

For the first time, OFES issued a solicitation for Fusion Science Centers. This initiative was recently recommended by the NRC Fusion Science Assessment Committee (available at <http://www.nap.edu/books/0309073456/html/>). This initiative included a pre-proposal step, and included presentations of second-round proposals to a panel of fusion science experts. Overall the COV was very pleased with the review procedures and the fairness of the proposal process. However, the Committee notes that the scientists asked to review the Fusion Science Center proposals were all “fusion insiders.”

Since a central motivation for the fusion science centers is to increase the visibility and interaction with related areas of science, mathematics, and physics, OFES should seek to include scientists from outside the fusion program in future review processes. (A broad range of expertise is typical of the reviewers evaluating proposals for the NSF/DOE Partnership in Plasma Science.)

E. Funding level of proposals

The committee considered the question of the ratio between the amount of funding awarded and the amount requested. This ratio varied between the two years we examined, the average being close to 100% in 2003 and declining to 86% in 2004. In discussions, the OFES staff indicated that they tried to provide the requested funds whenever reasonable, and to stay as close to the requested amount as possible otherwise. The reasons for funding at reduced levels are varied but chief among them is the desire to preserve OFES investment into experimental equipment during funding fluctuations. OFES staff is keenly aware of the dangers of consistently under-funding budget requests and how this will likely lead to PIs routinely asking for the maximum plausible funding on any proposal. The COV commends OFES for their awareness of this potential problem and supports their vigilance in preventing it from occurring.

F. Monitoring of proposals

Most members of the community felt that OFES does a satisfactory job monitoring the progress of research on funded proposals. Some of the smaller projects felt, however, that there was almost no contact. On the other hand, OFES has stated in their questionnaire that large projects are required to report on a weekly basis. Clearly there is a sliding scale for the level of monitoring required dependent upon the size of the project. This makes good sense, but OFES may want to have some fine-tuning internal discussions to make sure the monitoring process is uniform and that at the extremes there is not too little or not too much reporting required by the principal investigators carrying out the research.

G. National and international recognition

The COV panel did not spend much time discussing the national and international perception of the quality of the ICC and BPP programs, primarily because there are no simple but meaningful metrics available for OFES to evaluate this issue. However, in all recent reviews of the US fusion and plasma science programs conducted by panels with broad membership, the whole of the program (including ICC and BPP research) is favorably regarded with respect to all areas of science research (2001 NRC Fusion Science Assessment Committee, <http://www.nap.edu/books/0309073456/html/>). Our Committee strongly endorses this view. We further note that the community survey we conducted suggests US scientists also believe that the ICC and GPP programs are highly respected and competitive, but at the same time they believe that the international community appears to be less interested in these areas of research because their programs have more of an explicit "energy mission" (dominated by tokamak research).

Nevertheless, significant ICC research occurs many places in the world, with especially large programs in Europe and Japan.

VII Recommendations

Based on these findings the COV has developed a set of recommendations to help OFES improve the management of the ICC and GPP programs. Most of these recommendations are highly sympathetic with those made by the first COV. Moreover, these improvements can be implemented without significantly increasing the review burden on OFES or on the research community; we consider it important not to add to the already significant workload of proposal and review activities. The recommendations are given as follows.

A. A rebuttal procedure

OFES should develop a uniform, clearly stated, rebuttal procedure for proposal writers.

At present there is no uniform rebuttal process in OFES. Rebuttals are occasionally allowed, but are not automatically requested. Also, the request for rebuttals is not uniform from RFP to RFP. The COV, in accordance with the fusion community, recommends that OFES clarifies and formulates a uniform rebuttal process.

When rebuttals are allowed they are communicated from the proposal writers directly to OFES program managers, typically via email. A return deadline is established and made clear to the proposal writers. This correspondence is collected and saved, but it typically does not later get included in the proposal folder. The OFES recognizes that clerical procedures regarding rebuttals could be improved, but also notes that there is usually little time between when rebuttals are received and when funding decisions must be made, so the effort is focused more on decision making.

At a minimum a rebuttal is read and reviewed by the OFES program manager responsible for the proposal, although in many (perhaps most) cases it is read and assessed by several members of the OFES review team. This is especially true for those proposals, which score near the cutoff between being funded and not funded, and for renewal proposals. Occasionally OFES will discuss a rebuttal with the proposal reviewers to receive additional input, but this is not standardized. In cases where a large discrepancy in several reviewers' scores is received, an additional person is sometimes asked to review the proposal in an effort to resolve the discrepancy.

The OFES agrees that the rebuttal procedure could be improved, but there are significant difficulties to overcome. A uniform process requires lengthening the overall time for the proposal review by several weeks. Some reviewers are slow to return their reviews, and to allow a second round following rebuttal introduces the risk that the time schedule will exceed mandated limits. In some cases, the rebuttal actually exceeded the length of the original proposal, rendering it unhelpful. The new PEERNET (online) review system

was not designed explicitly to handle rebuttals, and any particular programming solution implemented by the OFES would be expensive.

Despite the difficulties, the members of the OFES staff have been discussing possible solutions and described an example that encouraged the COV that a more uniform and effective process could be devised. Clearly, once an improved process is devised, it should be carefully elucidated in all RFP's.

B. Improving the review procedure

OFES should implement several relatively simple ideas in the peer review process to improve the accuracy of the final funding decisions

The review process already works quite well. The COV has several additional recommendations to make that would, in our opinion, further improve the process, most likely in an incremental manner. First, the directions to reviewers should include descriptive correlations between numerical score and suggested funding decisions as described in Finding C.

Second, reviewers should be allowed to offer more accurate scores using decimal values. The current procedure of requiring integer scores between 1-5 appears to be a low-resolution instrument in terms of measuring excellence. Even allowing scores of half integers (i.e. for instance 3.5) would be an improvement. The half-integer system is sometimes, but not uniformly, used at present. If implemented, the decimal option should be clearly stated in the RFP.

Third, on a related point reviewers should be discouraged from using a low score of 1 for a proposal which is technically competent but not responsive to the solicitation guidelines. The discrepancy in multiple reviewers' scoring was sometimes large for this reason. Instead, for example, the rating sheet could include a specific request for the reviewer's opinion on responsiveness to solicitation guidelines, separate from the 1-5 rating, which would be reserved for judging technical merit.

Fourth, OFES should press very hard on reviewers who complete the informational portion of their reviews but for one reason or another do not enter a final numerical score. This would save OFES from having to enter its own educated guesses whenever there is a missing numerical score.

C. Uniform review folders

OFES should improve the uniformity and consistency of the information contained in the review folders

The uniformity and consistency of the review folders for each proposal is under steady improvement by OFES. The COV panel commends OFES for recognizing the importance of this activity and urges them to continue these efforts.

Of particular importance is a clear, concise summary sheet containing, among other things, the funding decision, the funding level if funded, the reviewers' scores, a justification for those proposals funded, and an explanation describing why other proposals were not funded.

Also, each folder should contain all the comments of the reviewers, the rebuttals if any, and the OFES or reviewer responses to the rebuttals.

Finally, OFES could probably improve its "big picture" of the review process by creating simple overview data sheets as presented in Appendix D. This would require some additional work, but would not be too much of a hardship if the data were collected at the time of the final decision making for each RFP. Such data would help OFES to compare the quality and the amount of OFES discretion required for each RFP. It would also allow comparisons between one RFP and another.

VIII. Conclusion

Based upon the survey responses and our own appraisals of the large number of proposals submitted from our solicitations, it is the opinion of the Committee that the OFES supports a high-quality research program in innovative confinement concepts, general and basic plasma physics, and IFE/high energy density physics. Indeed, all proposals submitted in the most recent ICC solicitation were rated good or better by peer review. A comment often repeated, and one that we share, is the frustration of limited funds during a time of great excitement and numerous innovative research proposals that must remain unfunded.

Appendix A
The Charge Letter from Dr. Ray Orbach

August 15, 2003

Professor Richard D. Hazeltine, Chair
Fusion Energy Sciences Advisory Committee
The University of Texas at Austin
Institute for Fusion Studies
1 University Station, C 1500
Austin TX 78712-0262

Dear Professor Hazeltine:

This letter provides a charge to establish a Committee of Visitors (COV) through which the Fusion Energy Science Advisory Committee can assess matters pertaining to program decisions on a regular basis. It is our desire to have the COVs review program management every three to four years, on a rotating basis, for the following elements of the Fusion Energy Sciences program:

- Theory and computation
- Confinement innovation and basic plasma science
- Tokamak research and enabling technologies

Specifically, the committee is asked to assess, for both the National Laboratory, University and private industrial participants, the efficiency and quality of the processes used to:

- Solicit, review, recommend and document proposal actions
- Establish the consistency between award decisions and the Office of Fusion Energy Sciences' programs and goals
- Monitor active projects and programs

The committee is asked to comment on how the award process has affected:

- The breadth, quality and balance of portfolio elements
- The national and international standing of the portfolio elements

The first area that I would like you to address is the theory and computation program. You should work with the Associate Director for the Office of Fusion Energy Sciences to establish the processes and procedures for the first COV.

I believe that the COV will help us maintain a high standard of scientific research. I look forward to your feedback on how the Office of Fusion Energy Sciences is making program decisions, and how that decision process can be improved.

I would like to have a final report from you by late spring of 2004.

Sincerely,

Raymond L. Orbach
Director

Appendix B

Questionnaire for OFES

Appendix B contains the questionnaire sent by the COV to OFES. The goal was to obtain as much information as possible before the site visit so that once there we could focus on the more crucial issues.

Note that there are three types of fonts used in the questionnaire.

1. **Boldface, Times New Roman information represents the original questionnaire sent to OFES.**
2. The written answers submitted by OFES are presented in the normal Helvetia font.
3. *The italic Times New Roman font is used for comments and answers provided by the COV based on our discussions with OFES at he site visit.*

Questions for the Office of Fusion Energy Sciences

INTRODUCTION

Below is reasonably detailed set of questions that the COV Panel would like OFES to answer to help us carry out our charge. Note that there are three types of questions as described below.

- The goal of the “informational” questions is to obtain high level descriptive information that we can incorporate into our report to help readers understand the Basic Plasma Physics and Innovative Confinement Concepts Programs under review. The answers to these questions will not be subject to review by the Panel since they lie outside the charge to the Panel. They are mainly for informational purposes for the Panel and readers of the report. Please send us this information by October 29, 2004
- The answers to the “assessment” questions will be reviewed by the Panel in accordance with our charge. These are detailed questions that will help the Panel understand how OFES manages the Programs under consideration covering the full process: solicitation, review, award funding, and project monitoring. Please send us this information by October 29, 2004
- The goal of the “data analysis” questions is to provide the Panel with certain data regarding the results of the review process. This will allow us to carry out some preliminary data analysis to identify whether or not there are any weaknesses in the review process. This information should help us focus on the most important issues during our site visit to OFES. Please send us this information by October 15, 2004

In the questions below “ICC” is assumed to include the combined experimental efforts in the Innovative Confinement Concept program, the Madison Symmetric Torus program, and Inertial Fusion program. The abbreviation “BPP” includes the basic plasma physics experimental projects carried out under the joint OFES/NSF program and Junior Faculty program. No theory projects are considered as they have already been reviewed by the first COV Panel.

INFORMATIONAL QUESTIONS

A. Description of the (Innovative Confinement Concepts) ICC and General Plasma Physics (GPP) programs

1. What is the role of the ICC program within the overall fusion program? What projects are included in the ICC program? In particular, please comment on OFES’s view of the relative priorities of the various missions within the ICC program such as:

- a. **Carry out high quality basic plasma research**
- b. **Carry out applied plasma research contributing to both tokamak and alternate concepts.**
- c. **Educate and train new students and post-docs to enter the program**
- d. **Provide alternatives to the mainline tokamak**
- e. **Address specific programmatic needs within the overall program**
- f. **Other missions (please be specific)**

The ICC Program

In this year's COV review, "ICC" refers to magnetic confinement programs included in two of the OFES Budget elements labeled as "Experimental Plasma Research (Tokamaks) and Experimental Plasma Research (Alternatives)." These two budget elements contain most of the concepts referred to as Innovative Confinement Concepts by the fusion community. (These two program elements have been consolidated into one program element in FY04 with the label "Experimental Plasma Research" with no qualifier). At present the projects funded within the Experimental Plasma Research elements include concept exploration experiments in tokamaks, stellarators, spherical torus, spheromaks, field reversed configurations, magnetized target fusion, levitated dipole, mirrors with centrifugal confinement, velocity-shear stabilized z-pinch, inertial electrostatic confinement, plasma acceleration for helicity injection, refueling, rotation, and profile modification to alter, improve or sustain the confinement characteristics of magnetized plasmas.

These Experimental Plasma Research (EPR) program elements are part of the broader OFES program in Configuration Optimization, which has a 10-Year Performance Measure of advancing the science of magnetic confinement and improving the scientific basis for future burning plasma experiments through research on a broad range of innovative confinement configurations. The configuration optimization program seeks to resolve key scientific issues and determine the confinement characteristics of a range of attractive fusion approaches with reduced-cost paths towards practical fusion energy systems in the long term. With respect to the mission options listed in the question, OFES views the order of priorities as:

1. Provide alternatives to the mainline tokamak.
2. Carry out applied plasma research contributing to both tokamak and alternate concepts.
3. Educate and train new students and post-docs to enter the fusion program.

Basic plasma research comes under the purview of the General Plasma Science program and is outside the scope of the ICC program. Within the

budget allocated to it, the EPR program does not address any other programmatic needs within the overall program.

2. **What is the role of the GPP program within the overall fusion program? What projects are included in the GPP program? In particular, please comment on the views of OFES of the relative priorities of the various missions within the GPP program such as:**
- a. **Carry out high quality basic plasma research**
 - b. **Educate and train new students and post-docs to enter the program**
 - c. **Attract new faculty members and new universities into the program**
 - d. **Address specific programmatic needs within the overall program**
 - e. **Other missions (please be specific)**

The General Plasma Physics program can be divided into five elements: (1) the NSF/DOE Partnership in Basic Plasma Science and Engineering, (2) the General Plasma Physics program supported at the DOE Laboratories, (3) the Plasma Physics Junior Faculty Development Program, (4) the Fusion Science Centers program, and (5) the Atomic Physics program. Element (1) was a response to the recommendations of a 1995 National Research Council (NRC) report, entitled "Plasma Science". Element (2) was initiated to complement the program of element (1). Element (3) was a response to the recommendations of a 1996 Fusion Energy Advisory Committee report, entitled "A Restructured Fusion Energy Sciences Program". Element (4), the Fusion Science Centers program, is a new, Fiscal Year 2004 initiative which was a response to recommendations of a 2001 NRC report. Element (5) was initiated in 1975 to meet the needs of the Fusion Energy Sciences program.

The NSF/DOE Partnership in Basic Plasma Science and Engineering:

This program is managed in cooperation with the National Science Foundation (NSF) under a five year Memorandum of Understanding with the Department of Energy which was originally signed in 1996 and renewed in 2002. It is restricted to academic and non-profit institutions and funds basic plasma science research that is not directly related to fusion. The program details can be found on the NSF web site:

<http://www.nsf.gov/pubsys/ods/getpub.cfm?nsf99159>. In addition to direct support for single PI/small group plasma science and engineering, the NSF, DOE and UCLA have jointly funded, under a separate MOU, the operation of the Large Aperture Plasma Device (LAPD) at UCLA, which serves as a user facility for a broad group of plasma researchers. The DOE part of the FY04 budget for the entire NSF/DOE Partnership was over \$4 million (including \$780 thousand for the LAPD), with a comparable contribution from the NSF.

General Plasma Physics program supported at the DOE Laboratories:

The program to fund General Plasma Physics at the DOE labs was last completed in 2000. The FY04 budget is a little over \$ 2.5 million. Also included in this category is the funding of the DOE laboratory part of the NSF Center for Magnetic Self-Organization (CMSO) in Laboratory and Astrophysical Plasmas at the University of Wisconsin-Madison. The DOE part of this NSF Physics Frontier Center is about half a million dollars.

Plasma Physics Junior Faculty Development program: The Plasma Physics Junior Faculty Development Program was started in FY 1997. A principal goal of this program is to identify exceptionally talented plasma faculty members early in their careers and to assist and facilitate the development of their research programs. Proposals for research in any areas of plasma physics research, including fusion science, fall within the intent of this program. However, the emphasis in the program is on the general plasma physics elements of the research as opposed to applications of plasma physics. The most recent Announcement for this program can be found at: <http://www.science.doe.gov/grants/FAPN04-29.html>. Information on past awards can be found at: <http://www.ofes.fusion.doe.gov/News/JrFacAward.pdf>. This program has attracted both new principal investigators and new institutions. It also has the potential to address fusion programmatic needs in so far as research relevant to fusion science is allowed under this program. The program funding is ~\$1.3M/year, with ~\$450k of that amount available for new awards.

Fusion Science Centers (FSC) program: This program is a response to some of the recommendations of the 2001 NRC report entitled "An Assessment of the Department of Energy's Office of Fusion Energy Sciences Program." Applications were solicited by an August 2003 Federal Register Notice (<http://www.science.doe.gov/grants/Fr03-26.html>) and awards were announced in May of 2004 following a two-phased competition. The FY04 budget for the two FSC was over \$2 million.

The Atomic Physics program: The experimental parts of the atomic physics program are carried out at the National Institute of Standards and Technology (NIST) and the Oak Ridge National Laboratory (ORNL). This effort is complemented by an Atomic Theory program, which was included in last year's COV. The ORNL Controlled Fusion Atomic Data Center (CFADC) reviews and disseminates the atomic data that is derived mostly by theory and bench marked by the experimental program. The FY04 budget for the experimental atomic physics program and the CFADC was a little over one million dollars.

- 3. This is an ICC question. In the mid-90's the fusion community developed a progression path for new concepts that involved different phases, with**

substantial funding increases as each new phase is reached: (1) Concept exploration, (2) Proof of principle, (3) Performance extension, (4) Burning plasma. Please provide information as to which concepts have been terminated, which new projects have been started, and what is the average duration of an ICC project. Is this information in accordance with the guidelines? In view of the fact that fusion budgets have not increased at the hoped for rate, does this system still make sense and if so is it still being implemented? If not, what, if anything has replaced it?

The question about which projects have been terminated involves information about unsuccessful applicants, which should only be discussed at the review. Other questions in this group deal with broader program strategy and may be somewhat outside the scope of this review, perhaps falling within the purview of the FESAC priorities panel. It would be best to discuss these questions at the review.

Answers to these questions were provided in part by the overview given by Francis Thio, who is now senior adviser to the ICC Team that is being led by Ken Hill. The committee was provided with copies of his presentation and was allowed to look at the documents that summarized the funding decisions in the ICC program for FY05 and FY05. The ICC program has been managed by five individuals in the past nine years and proposals are only kept for a few years, so the committee only had access to the details of the program for the last two years. For each of these years the ICC team evaluated the proposals based on mail-in reviews and overall program balance and goals, and wrote a document that summarized the proposals, the evaluations, and the funding decisions. In each year in response to the solicitation, a number of new and renewal proposals were received for a relatively small available funding to explore new concepts. In spite of small budgets, the overall philosophy of funding a number of small-scale experiments persists. And in this program there is a strong tendency to renew experimental projects that have been ongoing for only a few years for another three year cycle, recognizing the time it takes to build new experiments, get them operating and obtain data. There is some turnover in the program (two large scale experiments were terminated in the last two years) and good new ideas are being recognized and supported. Closeout funds are provided for projects that have been terminated to keep students funded to complete their work.

- 4. This is a related ICC question. Given that success in demonstrating the physics performance of an ICC may depend upon its funding level, how does OFES resolve the tradeoff between funding more ICC's at a lower average level versus a fewer number at a higher average level?**

This is clearly a complicated issue. The issues are different depending on whether it is a question of terminating a program to provide more funding to the remaining ICC programs or whether it is a question of starting one new

ICC program versus two new ICC programs. Again, it would be best to have a dialogue on this issue at the review.

The issue of the tradeoff between funding more ICC exploratory experiments at a lower average cost versus a smaller number at a higher average cost could also been seen in the funding documents. In each of the last two years one new large project (> \$1M) was approved along with a number of smaller (< \$400K) projects. These decisions are made collectively by the ICC Team, and the results of the last two years may be due more to the quality of the proposals and the amount of funding available, than to a specific underlying strategy.

- 5. In view of the government requirement that laboratories not compete directly with universities for certain type grants how does OFES insure fairness when evaluating ICC and BPP proposals from both type organizations? This is important because members of each community want to feel confident that this requirement does not give the other community an unintended advantage.**

In the fusion program we have significant involvement of industry as well as laboratories and universities. The answer to this question is different for each of the programs. For example the NSF/DOE partnership is open only to universities and non-profit institutions. In other cases, industries and universities may compete. Again, we will provide information pertinent to this question in our presentations to the COV and will be prepared to discuss this question at the review.

From the Community Survey it appears that much of the community (42%) believes there is fairness with respect to proposals submitted by universities, laboratories, and industries. However, a sizeable fraction (36%) believes that laboratories have an unfair advantage, presumably because they are not allowed by law to directly compete with universities and industries.

- 6. How are the tasks and responsibilities divided between OFES and NSF with regard to the joint Basic Plasma Science program?**

The NSF/DOE Partnership is formally governed by a Memorandum of Understanding (MOU) between the Department of Energy and the NSF that was first signed in 1996 and later renewed in 2002. More than 500 basic plasma science and engineering grant applications were received during the first 5 years of this program and more than 100 grants were funded with a 5 year total funding of over \$27 million. In practice, all the NSF/DOE Partnership in Basic Plasma Science and Engineering grant applications come into the NSF FastLane system, the staff members from the NSF and OFES meet to choose reviewers and later a live panel is convened to evaluate the applications on the basis of mail reviews and the panel's own review. After a ranking of applications has been made by this panel, NSF and DOE staff members meet to decide on grant awards based upon the

panel's ranking, available funding and programmatic issues. Some of the grants are funded as DOE grants and some are funded as NSF grants. For some of the NSF grants, DOE money is passed through to the NSF.

B. Funding for the ICC and BPP programs

- 1. For the year 2004, how many total projects are funded in the ICC program and in the BPP program? How many new or extension proposals were submitted and how many were funded? What is the overall level of funding for the ICC and BPP programs as compared to the total OFES budget? What is the breakdown between laboratories, universities, and industry? The aim of these questions is to give the ultimate reader of our report an overview of the programs so here, please only give totals, not details. Also, please provide this information for 2003 and 2002 so we can see if there are any trends.**

We do not have any detailed information on the grant applications that are submitted to the NSF/DOE Partnership in Basic Plasma Science and Engineering, since these are submitted through NSF. All of the other data is available, although most of it must be compiled manually. John Sauter will work with the program managers to gather the requested data. For the next several weeks he will be fully occupied preparing the PRs that must be issued early in the fiscal year and supporting the NSTX review. It is unlikely that we can provide all of this data before mid-December.

- 2. How is the total budget for the ICC and BPP programs decided? For example how do the following issues enter in the overall budget process?**
 - a. High level internal OFES discussions on the relative importance of basic science and alternate concepts vs. programmatic goals leading to the identification several overall themes**
 - b. Following the guidelines of a high-level fusion review panel. (If this is important, which panel and why that panel and not others.)**
 - c. Do tokamaks and ITER get funded first and then ICC and BPP get to share what is left over**
 - d. The ICC and BPP are fixed fractions of the total budget**
 - e. An individual, case by case examination**
 - f. Mandates by Congress, OMB, OSTP, or the Office of Science**
 - g. Other (please be specific)**

The total budget for the ICC and BPP programs is determined annually as part of the OFES budget formulation process. This process is complex and best discussed at the review.

The strategy more or less seems to be determined by analytic continuation from one year to the next under the assumption that there was proper balance between the programs at some distant time in the past. There are incremental changes from

year to year but large changes only arise when mandated by some outside force (e.g. Congress, OMB, a high level review panel).

QUESTIONS TO BE ASSESSED

A. Solicitation of proposals

- 1. What is the process used to solicit new proposals? Also, are solicitations always passive (notices in various official documents) or are they sometimes active (contact with specially qualified groups to attack certain critical problems)?**

In the ICC (EPR) program, full-length proposals for three-to-five-year awards are accepted for consideration only through the annual ICC solicitation that is announced as a public Notice through Grants.gov (previously through the Federal Register), which is a Federal wide public announcement system for solicitations by Federal Agencies. The same Notice is also published at the DOE Office of Science website. Renewal proposals are considered competitively together with the new proposals for awards. PI's whose projects are up for prospective renewals in a given year are sent reminders of the need to submit renewal proposals to the competitive solicitation after the Notice is released publicly. Before the announcement of the solicitation, OFES program managers, in their role to coordinate research and foster interests in the various parts of the program, often interact with the scientific community, for example at scientific meetings or by other means, to inform and discuss the needs of the program with members of the community, collectively and/or individually, and how these needs can be best met. These specific programmatic needs, once formalized, are made known publicly, for example, in the open solicitation, or other channels. No new proposals are considered and funded outside this process in the EPR program.

Occasionally, an on-going project is granted permission to submit a proposal for a limited renewal up to a maximum of eighteen months for one or more of the following reasons: (a) For reasons acceptable to OFES program management, the project requires additional time to complete the construction of the experimental system, and/or to acquire additional data so that the project can be given a more incisive scientific review; (b) to bring the project performance period more in sync with the competitive solicitation cycle; (c) to allow the PI to avoid having to submit more than one renewal proposal to the same solicitation.

- 2. How much time is typically allowed for scientists to submit proposals?**

The average amount of time between the posting of a grant notice and the due date is about two months. For proposals which require establishing

collaborative arrangements, such as for the fusion science centers, several more weeks are typically allowed. A representative selection of announcements is included in the cover e-mail, and you can see the range of times allowed in these recent announcements.

- 3. Some IFE related questions: Who and how is it decided which IFE projects will be funded by OFES as opposed to the DOE Defense Program (NNSA)? How is this information communicated to scientists? How does OFES deal with grant applications that it feels are misdirected? Where does OFES publish the IFE solicitations? Does OFES coordinate IFE solicitations with the DOE Defense Program?**

This is again a complex issue and should be discussed at the review.

We did not have time to discuss this at the site visit.

B. Review of proposals

- 1. How do you select reviewers for the proposals? How many per proposal? What are the criteria for determining whether a proposal will be reviewed by a visiting Panel or solely through the mail? Are the guidelines and criteria for review carefully presented? Please give several examples of typical guidelines. Are there explicit instructions to reviewers to address each of the criteria?**

We select reviewers based on their technical competency to review a proposal, their past performance in providing incisive, timely reviews, and the absence of any known conflicts of interest. Normally, there are three reviewers per proposal, but we select more reviewers for multi-task or larger group proposals.

The answers to the other questions here are different for each of the programs and can sometimes vary from year to year depending on external circumstances. We will be prepared to discuss the procedures used for all of the reviews done during the past three years in each of the areas that you are assessing.

- 2. How long do you usually allow for the review process?**

The official due date for renewal proposals is 6 months before the end of the project period. We must send renewal PRs to the field office 45 days before the start of the new project period. This means that we must make our funding decisions at least 60 days before the end of a project period, so that we have time to prepare the selection statements and PRs. This leaves a maximum of 4 months to select reviewers, send the proposals to the reviewers, give them time to complete the reviews, provide time for rebuttals, if necessary, assess the reviews, and make the funding decisions.

Often, we set a due date of 5 months before the renewal date to give scientists time to complete more research before having to submit a renewal application. This reduces the total time available for all aspects of the review process to a maximum of 3 months.

3. Do you believe the review process has become fairer in recent years? If so, how do you quantify this conclusion?

This is a subjective question, and one that seems to be part of the COV charge.

The committee feels that the peer review process instituted in recent years has made the review process fairer; and that it also enables the program goal of connecting with a broader range of academic pursuits.

4. Do you believe the review process has improved the quality of proposals submitted for review? If so, how do you quantify this conclusion?

This is also a subjective question, and we have, at best, some anecdotal evidence. It would be best to discuss this at the onsite review.

The quality of proposals received in the ICC and NSF/DOE BPP programs is very high. With the cessation of the 1.5M\$/yr ONR funding for basic plasmas, the "proposal pressure" in the NSF/DOE program has been exceedingly high; indeed, the distressingly low funding rate of 20% in the first 5 years is only now being partially ameliorated by program growth. **Do you believe the review process has improved the quality of research being carried out in the ICC and BPP programs? If so, how do you quantify this conclusion?**

It seems to us that the only way to answer this question would be to have conducted an external technical review of the program several years ago and compare the results with another one conducted today. Even if this had been done, it would be difficult to separate the effect of the proposal process from other positive effects on the ICC program, such as the excellent workshops that the ICC community holds on a nearly annual basis. We would certainly be very interested in discussing this issue at the review and hearing the opinions of the COV members on this question.

Quantitatively assessing the quality of science is a difficult issue. There are various metrics that one could consider such as:

- *number of publications from an individual investigator or a project*
- *the citation index of the publications*
- *the impact factor of the journals in which the investigators publish*
- *the number of invited talks at international meetings*
- *the number of major awards received by OFES-funded investigators.*

The OFES staff does not currently attempt to compile these data. Nor is it clear that the effort would produce meaningful results for the extra effort required. These data would be unlikely to produce a fine enough “resolution” to allow meaningful comparisons of year-to-year results or multi-year trends towards improved quality. The COV felt that it was not worth the effort on the part of the OFES staff to compile these data. The best way to ensure a high-quality program is to focus on the peer-review process and ensure that the best proposals are consistently ranked at the top of the grouping and that the limited funds available are always directed towards the highest-ranked proposals, whether they are renewals or new applications.

Two pieces of information can be cited as evidence of a high-quality OFES program, (though not to document an improvement over time).

1) The junior faculty award recipients show that a high percentage go on to receive tenure. This is a very important observation and the OFES should publicize it appropriately.

*2) In the Community Survey data:
50% of respondents felt that there was either a large or some improvement in the actual quality of research carried out over the last three years.*

- 6. Have you made any estimates of the increased amount of time that researchers spend on writing and reviewing proposals under the recently initiated peer review system? The point of this and the previous three questions is to obtain some quantitative information that will demonstrate whether or not there is improvement in the cost/benefit ratio due to the peer review system.**

This answer to this question is no; we have no way of knowing how much time investigators spend preparing proposals.

It is hard to justify the time and effort required to write an NSF/DOE proposal with an anticipated success rate of 20% for good to excellent proposals. Such proposal pressure strongly mandates funding shifts, as have occurred to some extent. Also, new initiatives without new funding can divert effort from research to proposal generation.

- 7. If a proposal is turned down for funding do the proposers have an opportunity to respond to the reviewers comments? If so, under what circumstances, and how is this done in a consistent manner?**

The issue of rebuttals varies among the various elements of the BPP and ICC programs. It would be best to discuss this issue at the review.

At present there is no uniform rebuttal process in the Office of Science. The COV, in accordance with the fusion community, recommends that OFES establish such a process. At present, rebuttals are occasionally allowed, but are not automatically requested. Also, the request for rebuttals is not uniform from RFP to RFP.

When rebuttals are allowed they are communicated from the proposal writers directly to OFES program managers, typically via email. A return deadline is established and made clear to the proposal writers. This correspondence is collected and saved, but it typically does not later get included in the proposal folder. The Office recognizes that clerical procedures regarding rebuttals could be improved, but also notes that there is usually little time between when rebuttals are received and when funding decisions must be made, so the effort is focused more on decision making.

At a minimum a rebuttal is read and reviewed by the OFES program manager responsible for the proposal, although in many (perhaps most) cases it is read and assessed by several members of the OFES review team. This is especially true for those proposals which score near the cutoff between being funded and not funded. Occasionally OFES will discuss a rebuttal with the proposal reviewers to receive additional input, but this is not standardized. In cases where a large discrepancy in several reviewers' scores is received, an additional person is sometimes asked to review the proposal in an effort to resolve the discrepancy.

The Office agrees that the rebuttal procedure could be improved, but there are significant difficulties to overcome. A uniform process requires lengthening the overall time for the proposal review by several weeks. Some reviewers are slow to return their reviews, and to permit a second round following rebuttal introduces the risk that the time schedule will exceed mandated limits. In some cases, the rebuttal actually exceeded the length of the original proposal, rendering it unhelpful. The new PEERNET (online) review system was not designed explicitly to handle rebuttals, and any particular programming solution implemented by the Office would be expensive.

Despite the difficulties, the OFES staff have been discussing possible solutions and described an example which encouraged the COV that a more uniform and effective process could be devised. Clearly, once an improved process is devised, it should be carefully elucidated in all RFP's.

- 8. There is a perception among some researchers in the community that the number of “new initiatives” has increased over the last few years. Is this so? If so please explain the motivation for these initiatives in view of the fact that the overall budgets have been fairly flat during recent years. That is, conservation of funds, implies that any new initiative will likely cause a decrease somewhere else in the budget? Is the extra work writing and reviewing more proposals plus the accompanying decreases in morale and**

stability caused by the implied reductions in the ongoing base funding worth the scientific or other gains from new initiatives? A related question: In certain cases new initiatives have been justified by the promise of new non-OFES funding. In these cases, has the additional funding actually materialized?

We are aware of four initiatives in the areas that the COV is addressing: the initial ICC program itself, the junior faculty program, the NSF/DOE partnership, and the basic fusion science centers. All of these were recommended by FESAC and/or NAS panels and all except the fusion science centers have been in existence for about five years. If we have missed one, please let us know.

Furthermore, these initiatives have in many cases, simply provided programmatic focal points for the many activities that are conducted by OFES.

The strength of these initiatives and their associated proposal cycles is that they allow for continual evaluation of the scientific progress and capabilities of OFES activities. This helps to ensure the overall quality of the program remains high and the program remains balanced among its different activities. The challenge is that under constrained budgets, highly rated new projects submitted under these initiatives are sometimes not funded in favor of maintaining equally highly rated established projects. This has been, and will continue to be, a source of some tension within the program.

- 9. Recognizing that there will always be imperfections with the peer review system, OFES will still have to use some discretion in deciding precisely which proposals to fund. In funding a lower score proposal against one with a higher score, what issues does OFES consider in making this decision?**

In general we use the factors that are specified in the Office of Science Grant Application Guide:

“For renewal applications, the Office of Science also shall consider the recipient's performance under the existing award.”

“Also, the Office of Science shall consider, as part of the evaluation, other available advice or information as well as program policy factors such as ensuring an appropriate balance among the program areas.”

In this case, other advice or information would be FESAC or NAS reports. Occasionally we use other criteria, which are listed in the Notices.

- 10. With the recent system of more extensive peer review, does OFES feel it has too little, too much, or just about the right amount of discretion in making the final funding decisions?**

In general, we feel that we have the right amount of discretion in making final funding decisions. Our most serious constraint is funding. The new process has resulted in more proposals and more difficult funding decisions. For example, to fund a new, innovative proposal, we would have to terminate an ongoing project that has received very good to excellent reviews. Every year we turn down some very good grant applications that deserve of funding, and this is tough for all of us.

11. Which of the recommendations of the Theory and Computation COV Panel been implemented in the ICC and BPP programs?

We are in the process of implementing them and will discuss how this is being done in each program element at the review.

Many of the recommendations made by the first COV are in the process of being implemented but there is still more to do before completion.

C. Funding of proposals

1. In virtually all cases months are involved between the time proposals are first solicited and the time awards are made. Is OFES usually able to allocate the amount of funds anticipated at the time of solicitation to the winning proposals when the awards are finally made? If not, what might prevent you from doing so?

In general, the amount of funding awarded is nearly the same as the amount of funding anticipated. Announcements are normally based on the President's Budget Request, whereas awards are based on the Congressional Appropriation. Slight variations (usually reductions of a few percent) are possible when Congress specifies funding for certain budget elements or includes a general reduction in the Appropriation Bill. The only significant change in the past few years occurred in the SciDAC program, where OFES made a programmatic decision to initiate Fusion Simulation Project pilot efforts (in partnership with the Office of Advanced Scientific Computing) rather than continue SciDAC funding at a constant level.

2. When proposals are funded do they usually receive the requested budget? If not, why not?

This is generally decided on a case by case basis. It would be best to discuss this at the review, when we can talk about specific reviews and proposals.

The committee considered the question of the ratio between the amount of funding awarded and the amount requested. This ratio varied between the two years we examined, the average being close to 100% in 2003 and declining to 86% in 2004. In discussions, the OFES staff indicated that they tried to provide the requested funds whenever reasonable, and to stay as close to the requested amount as possible otherwise. The reasons for funding at reduced levels are varied but chief among them is the desire to preserve OFES investment into experimental equipment during funding fluctuations. OFES staff is keenly aware of the danger of an inflation of the ratio of awarded to requested funds that might result from systematic under-funding. They are cautious to avoid such inflation.

- 3. To help the Panel answer the question in the Charge Letter concerning the international view of the ICC and BPP programs please provide us with the following budget information. What fraction of their total fusion funding does the European Community and Japan devote to projects that the US would consider to be part of the ICC or BPP programs? Clearly, for fairness the LHD and W7-X stellarators, as well as the MAST spherical torus should not be included as part of the international ICC program. To keep things relatively simple, provide this information solely for MFE, as even sorting out the US IFE program is quite complicated.**

We no longer track this type of information.

D. Monitoring of proposals

- 1. What procedures does OFES have in place to monitor the research progress made in funded proposals?**

Routine written progress reports are provided anywhere from weekly for large programs, like NSTX, to annually for the small grants. There are also quarterly televideo conferences for the NSTX program, and conference calls and one-on-one telephone calls on an as needed basis for all the programs.

- 2. Are final reports required for each proposal, and if so, who reviews them?**

Yes, final reports are required for all grants, cooperative agreements, and contracts. They're reviewed by the OFES program manager.

- 3. Does OFES monitor the number of students and post-docs supported by ICC and BPP projects, and if so, how many of each are supported?**

We will provide this data along with the other detailed information by mid-December

We did not receive this data and did not have much time to discuss the issue at the site visit. However, base on our discussions we determined OFES is very serious

about student and post-doc support and will make a very strong effort to make sure that no one is left in a financial bind because of funding changes.

- 4. Is OFES making the most out of current information technology? For example, how did the introduction of Industry Interactive Procurement System (IIPS) affect grant management and record-keeping? How is the soon-to-be-introduced grants.gov system expected to affect grant management and record-keeping? Do you expect the use of electronic submission systems to facilitate the collection and analysis of data that could assist in program management? Has there been any discussion within OFES of using information gathered in this way to provide program metrics to Office of Science? One specific test of the OFES use of information technology is the time required to provide the data requested in the “Data analysis request” below. Is this information readily available in Excel spreadsheets or is it going to require many hours of leafing through stacks of paper and compiling the data manually? OFES should comment on this point.**

Basically, the IT systems that we have are still fairly primitive and are not very user friendly. There are various IT initiatives both within the Department of Energy and government wide. We have some information on the DOE initiatives but little or no information on the government wide initiatives. We would be happy to demonstrate the systems that exist when you are here for the review.

We agree with the OFES assessment. The systems under which they operate are indeed primitive. This makes it difficult for OFES to easily obtain certain data that would help them carry out internal self assessments evaluating the way the peer review process is working. On a less important note, it made it difficult for OFES to provide some of the data that the COV requested.

DATA ANALYSIS REQUESTS

- 1. To help the Panel carry out its tasks, please provide us with the following data from the 120 or so proposals under consideration for the past three years. Give each of these proposals an identifying number, the year submitted, the separate ratings of each of the three reviewers, and specify whether or not the proposal was funded. To protect confidentiality over e-mail do not list the title of the proposal, the PI on the proposal, any of the reviewers, or any budget information. We will obtain this information during our site visit when we can examine the folders in more detail. The Panel will carry out various analyses based on this data.**

We will provide this data by mid-December

We did not receive this data until just before the site visit. The reason is again associated with the primitive level of the systems under which OFES must operate. Thus the data by and large had to be assembled manually

- 2. Please separately provide the panel with the name and e-mail address of each of the PI's of the proposals under consideration. We plan to send out a survey to these scientists to obtain some community input to the review.**

This issue has been resolved in a telephone conversation. However, critical limitation is that we cannot provide names of unsuccessful applicants.

The Panel has independently developed its own list of scientists to whom we will send the survey. This resolved the confidentiality requirements faced by OFES

Appendix C

Survey for the Fusion Community

Appendix C contains a survey sent by the COV to (about 60) senior members of the fusion community carrying our research in the programs under review. The goal was to learn how members of the community feel about the OFES administration of their programs.

The survey is presented along with the numerical results which have been tabulated for convenience. Note that some questions required just a single answer to a multiple choice question and here, the numerical results represent the average % of responses for each choice. Other questions asked for a prioritization of items and the corresponding results represent the average value of the responses. Numbers in parenthesis indicate the number of respondents who made entries for the option under consideration.

Lastly, it should be noted that there were a surprisingly large number of written comments returned with the surveys, too numerous to reproduce here. COV committee members read these comments which helped us understand the community's view of the review process.

Survey Questions for the Fusion Community

The Survey below contains two types of questions. The first type contains objective questions related to the actual proposal review process. The answers are semi-quantifiable based on your own experiences and address issues directly raised in the Charge Letter to the Committee. The second type contains more subjective questions related to the overall operation of the Innovative Confinement Concept and Basic Plasma Physics programs. These questions ask for your opinions on certain issues. The goal here is to provide some feedback to OFES on how the community views these programs and to point out possible areas of concern.

In the all the questions below “ICC” is assumed to include the combined experimental efforts in the Innovative Confinement Concept program, the Madison Symmetric Torus program, and Inertial Fusion program. It does not include NSTX or NCSX. The abbreviation “BPP” includes the basic plasma physics experimental projects carried out under the joint OFES/NSF program, the Junior Faculty program, and the new Science Center programs. No theory projects are considered as their management was already reviewed by the first COV Panel.

OBJECTIVE QUESTIONS

1. Solicitation of new proposals

How well do you think OFES does in letting you know about solicitations for new proposals and initiatives? Please answer this question based on OFES actions rather than hearing about it from your colleagues. Choose one.

- | | | |
|----|--|-------|
| a. | I always know about new solicitations..... | 13.5% |
| b. | I know about new solicitations most of the time..... | 54.1% |
| c. | I know about new solicitations some of the time..... | 27.0% |
| d. | I rarely know about new solicitations..... | 2.7% |
| e. | I never know about new solicitations..... | 2.7% |

2. Time to prepare new proposals

Once you hear about a new solicitation how much time is allowed for you to prepare your proposal? Choose one.

- | | | |
|----|------------------------------------|-------|
| a. | More than enough time..... | 16.7% |
| b. | Just about enough time..... | 63.9% |
| c. | Not quite enough time..... | 13.9% |
| d. | Much less time than necessary..... | 5.6% |

3. The proposal reviewers

What do think about the quality of the reviewers of your proposals? Prioritize as many choices as appropriate. A “1” represents the most likely occurrence based on your own experiences.

- | | | | |
|----|---|------|------|
| a. | Very high quality, thoughtful reviews..... | (9) | 2.33 |
| b. | Good quality reviews with some useful comments..... | (26) | 1.50 |
| c. | Reviewers are on average satisfactory, only a few useful comments..... | (14) | 1.29 |
| d. | Some reviewers are below average, didn't understand the the proposal..... | (13) | 2.15 |
| e. | Some reviewers are poor, made incorrect comments..... | (7) | 2.14 |

4. The time for review

After submitting a proposal for review, how long do you have to wait to learn about the outcome? Prioritize as many choices as appropriate. A “1” represents the most likely occurrence based on your own experiences.

- | | | | |
|----|---|------|------|
| a. | Learn the results very expeditiously..... | (3) | 3.67 |
| b. | Learn the results on a relatively short time scale..... | (7) | 1.86 |
| c. | Learn the results on a satisfactory time scale..... | (18) | 1.5 |
| d. | Takes somewhat too long to learn the results..... | (19) | 1.26 |
| e. | Takes much too long to learn the results..... | (5) | 1.4 |

5. The fairness of the review process

Do you believe that the overall review process has become fairer over the last three years with respect to your opportunities, and the opportunities of your colleagues to compete for new research grants? Choose one.

- | | | |
|----|--|-------|
| a. | The review process is much fairer (equal opportunities)..... | 3.1% |
| b. | The review process is somewhat fairer..... | 43.8% |
| c. | The review process is about the same..... | 43.8% |
| d. | The review process is less fair..... | 6.3% |
| e. | The review process is much poorer (special “deals”)..... | 3.1% |

6. Quality of the proposals I

Do you believe the quality of the proposals that you have written over the last three years has improved? Choose one.

- | | | |
|----|-------------------------------------|-------|
| a. | Large improvement in quality..... | 20.6% |
| b. | Some improvement in quality..... | 47.1% |
| c. | Quality about the same..... | 32.4% |
| d. | Quality has somewhat decreased..... | 0 |
| e. | Quality is much poorer..... | 0 |

7. Quality of the proposals II

Do you believe the quality of the proposals that you have reviewed over the last three years has improved? Choose one.

- | | | |
|----|-------------------------------------|-------|
| a. | Large improvement in quality..... | 3.2% |
| b. | Some improvement in quality..... | 35.5% |
| c. | Quality about the same..... | 45.2% |
| d. | Quality has somewhat decreased..... | 16.1% |
| e. | Quality is much poorer..... | 0 |

8. Quality of the research

Do you believe the actual quality of the research carried out in the ICC and BPP programs has improved in the last three years? Choose one.

- | | | |
|----|-------------------------------------|-------|
| a. | Large improvement in quality..... | 8.8% |
| b. | Some improvement in quality..... | 41.2% |
| c. | Quality about the same..... | 35.3% |
| d. | Quality has somewhat decreased..... | 14.7% |
| e. | Quality is much poorer..... | 0 |

9. The amount of time writing and reviewing proposals

During the last three years has the time you have spent writing and reviewing proposals increased? Choose one.

- | | | |
|----|---|-------|
| a. | Time spent has greatly increased..... | 27.8% |
| b. | Time spent has increased slightly..... | 41.7% |
| c. | Time spent is about the same..... | 19.4% |
| d. | Time spent has decreased slightly..... | 8.3% |
| e. | Time spent has decreased substantially..... | 2.8% |

10. OFES discretion

Even with the recent system of more extensive peer review, OFES still has to use some discretion in deciding which proposals to fund. How do you think OFES utilizes this discretion? Choose one.

- | | | |
|----|---|-------|
| a. | OFES uses too much discretion in making funding decisions... | 17.2% |
| b. | OFES uses its discretion judiciously..... | 63.8% |
| c. | OFES relies too heavily on the numerical grades from the reviewers. They should use more discretion in making final decisions.... | 19.0% |

11. International standing

How do you feel international fusion community feels about the USA ICC and BPP programs? Choose one.

- a. Very high quality, wish they had a similar program of their own... 25.8%
- b. A good program, comparable to their own..... 16.1%
- c. They do not care very much. They are focused on an energy mission, rather than a basic plasma science mission..... 58.1%

12. Monitoring of proposals

How well does OFES monitor the progress made on your proposals? Choose one.

- a. Much too much reporting required..... 5.6%
- b. A reasonable amount of reporting required to substantiate progress. 77.8%
- c. Rarely have contact with OFES to discuss progress..... 16.7%

13. Rebuttal to the reviewer's comments

Do you believe that OFES has a well-established, uniform process for PI's to offer a rebuttal to a reviewer's criticism that might lead to a change in the funding decision? Choose one.

- a. OFES has a well-established uniform procedure for rebuttals..... 17.7%
- b. OFES allows rebuttals only in special cases..... 55.9%
- c. OFES never allows rebuttals in the review process..... 26.5%

SUBJECTIVE QUESTIONS

1. Your view of the ICC program

How would you prioritize the various missions within the ICC program? Assume "1" is the highest priority and higher numbers correspond to decreasing priorities. Prioritize as many missions as you feel are appropriate.

- a. Carry out high quality basic plasma research..... (34) 1.97
- b. Carry out applied plasma research contributing to both tokamak and alternate concepts..... (33) 2.33
- c. Educate and train new students and post-docs to enter the program (35) 2.46
- d. Provide alternatives to the mainline tokamak (35) 2.20
- e. Address specific programmatic needs within the overall program..... (23) 3.87
- f. Other missions (please be specific).....

2. Your view of the BPP program

How would you prioritize the various missions within the BPP program? Assume “1” is the highest priority and higher numbers correspond to decreasing priorities. Prioritize as many missions as you feel are appropriate.

- a. Carry out high quality basic plasma research..... (36) 1.44
- b. Educate and train new students and post-docs to enter the program..... (34) 1.88
- c. Attract new faculty members and new universities into the program..... (30) 2.67
- d. Address specific programmatic needs within the overall program..... (22) 3.36
- e. Other missions (please be specific).....

3. Fairness with respect to universities, laboratories, and industry

The government requires that laboratories not compete directly with universities or industry for certain type grants. In your opinion how well does OFES do in insuring fairness when evaluating ICC and BPP proposals from the three types organizations? Choose one and underline either “favorable” or “unfavorable” as appropriate.

- a. Laboratories get preferential treatment (favorable or unfavorable)..... 36.1% F
5.6% U
- b. Universities get preferential treatment (favorable or unfavorable)..... 11.1% F
2.8% U
- c. Industry gets preferential treatment (favorable or unfavorable)..... 2.8% U
- d. All are treated fairly with respect to one another..... 41.7%

4. Funding for the ICC and BPP programs

This question focuses on how OFES decides on the total budget for the ICC and BPP programs. Specifically, how in your opinion does OFES prioritize the following issues that enter in the overall budget process? A “1” is the highest priority. Prioritize as many choices as you feel is appropriate.

- a. High level internal OFES discussions on the relative importance of basic science and alternate concepts vs programmatic goals leading to the identification several overall themes (23) 2.22
- b. Following the guidelines of a high level fusion review panel..... (20) 2.6
- c. Tokamaks and ITER get funded first and then ICC and BPP get to share what is left over..... (26) 1.46

d.	The ICC and BPP are fixed fractions of the total budget.....	(15)	2.33
e.	An individual, case by case examination.....	(12)	3.75
f.	Mandates by Congress, OMB, OSTP, or the Office of Science.....	(15)	2.2
g.	Other (please be specific).....	(3)	2.33

5. The number of new initiatives

In recent years there is a perception among some researchers that there are too many new initiatives in the fusion program in the face of a fixed overall budget. Thus, the claim is made that more time must be spent writing and reviewing new proposals in order to re-compete for funds that have been withdrawn from existing programs in order to fund the new initiatives. In your opinion is this a valid concern? Choose one.

a.	Too many new initiatives, too much extra work.....	47.4%
b.	Has not made much difference to me.....	42.1%
c.	Let's have more new initiatives even at fixed overall budget...	10.5%

6. The need for a rebuttal procedure

Do you think OFES needs to have a well-defined, uniform procedure that always allows for PI's to offer a rebuttal to a reviewer's criticisms? On the one hand this would improve the quality of the review process. On the other hand this could add substantial time to the overall review process. Choose one.

a.	OFES should have a well-defined uniform process that covers all proposals.....	77.1%
b.	OFES should allow rebuttals only in special cases at their discretion.....	22.9%
c.	OFES should not allow rebuttals. It adds too much time to the review process.....	0

Appendix D

Data from the review process

Appendix D contains a concise summary of the data from the review process for several of the programs under consideration by the COV. The specific programs involved are (1) the Junior Faculty Program for 2002, 2003, and 2004 and (2) the Innovative Confinement Concepts Program for 2004.

The data is essentially self-explanatory. The one point to note is that an “X” in the column labeled “Discretion” indicates that the corresponding proposal was not funded even though it had a higher referee score than other proposals that were funded. In other words, OFES used their “discretion” in making this decision.

**Junior
Faculty
Program**

Year	Identifier	Rating 1	Rating 2	Rating 3	Rating 4	Rating 5	Average	Std. Dev.	Funded Y or N	Discretion
2004	92937	4	4	4			4.00	0.00	Y	
	92950	5	3	3.3			3.77	1.08	Y	
	92935	3	4	4			3.67	0.58	Y	
	92938	4	3	3			3.33	0.58	N	
	92940	4	4	1			3.00	1.73	N	
2003	89503	3	5	4	5	5	4.40	0.89	Y	
	89502	4	5	4	4.5		4.38	0.48	Y	
	89506	5	4	3.5			4.17	0.76	Y	
	89458	5	3	4.5			4.17	1.04	N	X
	89500	5	3	3	2.5		3.38	1.11	N	
	89479	2	3	2			2.33	0.58	N	
	89488	4	1	1	3		2.25	1.50	N	
2002	85915	5	5	4	4		4.50	0.58	Y	
	85980	4	4	5	5		4.50	0.58	Y	
	86039	4	4	4.5			4.17	0.29	Y	
	85916	4	5	5			4.67	0.58	N	X
	86037	4	5	2			3.67	1.53	N	
	85903	2.5	4	4			3.50	0.87	N	
	86031	3	3.5				3.25	0.35	N	
	86041	3	1	5			3.00	2.00	N	
	86000	3	2				2.50	0.71	N	
	86023	1	1	1	4		1.75	1.50	N	
3 year average							3.56			
3 year STD							0.82			
Average 3 year STD								0.88		

2004 ICC program

ID	Lab?	Referee #					Avg	Std	Funding/ Request	Type	Discretion
		1	2	3	4	5					
95305	Non-lab	5.0	5.0	5.0	5.0		5.00	0.00	100%	new	
95281	Non-lab	4.5	5.0	5.0			4.83	0.29	100%	new	
95283	Non-lab	4.5	5.0	5.0			4.83	0.29	95%	new	
95284	Non-lab	4.5	5.0	5.0			4.83	0.29	94%	new	
95268	Lab	4.5	5.0	4.5			4.67	0.29	53%	renewal	
95304	Non-lab	5.0	4.5	4.5			4.67	0.29	100%	renewal	
95300	Non-lab	4.0	5.0	4.5			4.50	0.50	74%	renewal	
95301	Non-lab	5.0	4.0	4.5	5.0	4.0	4.50	0.50	77%	renewal	
95292	Non-lab	4.0	5.0	4.0			4.33	0.58	96%	renewal	
95293	Non-lab	4.0	4.0	4.5			4.17	0.29	87%	renewal	

Total

Average Funding Amount

84%

95299	Non-lab	4.0	4.0	3.5	3.5	2.0	3.40	0.82	6%	close-out	
95266	Lab	4.3	5.0				4.65	0.49	0%	new	X
95291	Non-lab	4.0	4.0				4.00	0.00	0%	new	
95297	Non-lab	4.0	4.0				4.00	0.00	0%	new	
95271	Lab	4.0	3.5	4.0			3.83	0.29	0%	new	
95296	Non-lab	3.0	4.0	4.5			3.83	0.76	0%	new	
95302	Non-lab	4.0	3.0	4.0			3.67	0.58	0%	new	
95236	Non-lab	4.0	3.0	3.5			3.50	0.50	0%	new	
95294	Non-lab	4.0	3.0	3.5			3.50	0.50	0%	new	
95303	Non-lab	3.0	4.0				3.50	0.71	0%	new	
95270	Lab	4.0	3.0	3.0			3.33	0.58	0%	new	
95273	Lab	4.0	3.0	3.0			3.33	0.58	0%	new	
95267	Lab	5.0	1.5	3.0			3.17	1.76	0%	new	
95289	Non-lab	4.0	2.0	3.5			3.17	1.04	0%	new	
95272	Lab	3.0	3.0	3.0			3.00	0.00	0%	new	

Average Value

4.00

Standard Deviation

0.63

Average STD

0.49

DOE Response
to the
Review of the
Innovative Confinement, General Plasma
Physics, and Inertial Confinement Programs



Department of Energy

Washington, DC 20585

April 26, 2005

Professor Richard D. Hazeltine, Chair
Fusion Energy Sciences Advisory Committee
The University of Texas at Austin
Institute for Fusion Studies
1 University Station, C 1500
Austin, TX 78712-0262

Dear Professor ~~Hazeltine~~ *Richard*:

I would like to express my appreciation to FESAC for the committee of visitors (COV) review of the Office of Fusion Energy Sciences' programs in the areas of Innovative Confinement Concepts, General Plasma Physics, and HEDP/Inertial Fusion Energy. A special thanks goes to the COV Panel, chaired by Dr. Jeffrey Freidberg from MIT, for a thorough examination of the program and for the excellent report that clearly states the panel's findings and recommendations.

I consider the ongoing COV process to be highly valuable, because it 1) helps me identify needed improvements to ensure that our review/award process is as fair as possible and results in a balanced portfolio of excellent science and 2) informs the fusion community of the quality of the Office of Fusion Energy Sciences' peer review/award process.

The second COV review went well, from my perspective, and I believe our future reviews will benefit from the COV Panel's recommendations.

I have attached a detailed response to your report.

Sincerely,

A handwritten signature in black ink, appearing to read "Anne", is written over the word "Sincerely,".

N. Anne Davies
Associate Director
For Fusion Energy Sciences
Office of Sciences

Enclosure



Office of Fusion Energy Sciences

Response to the Final Report of the Second OFES Committee of Visitors

On January 26-27, 2005, a Committee of Visitors (COV) reviewed the Office of Fusion Energy Science's programs in the areas of Innovative Confinement Concepts, General Plasma Physics, and HEDP/Inertial Fusion Energy. The review was conducted in response to a charge from Dr. Raymond L. Orbach, Director of the Office of Science, to the Fusion Energy Sciences Advisory Committee (FESAC) chaired by Dr. Richard Hazeltine of the University of Texas. The COV was chaired by Dr. Jeffrey Freidberg from MIT, a member of FESAC. The COV consisted of 14 members from universities, laboratories, and industry. Some were members of the fusion community and received funding from OFES or NNSA, while others were not members of the fusion community but had related interests in plasma physics or nuclear science.

This document provides the Office of Fusion Energy Sciences (OFES) response to the final report of this Second Committee of Visitors, which was presented to the Fusion Energy Sciences Advisory Committee on April 7, 2005. This document is organized into two sections: the first provides the OFES comments on all of the major findings of the panel, and the second provides the OFES response to each of the recommendations of the panel along with actions implemented, pending, or planned by OFES management to address those recommendations that require action. In some cases, a finding has a corresponding recommendation and, thus, the OFES comments are provided in the recommendation section.

Findings

In this section, the text of each of the COV's findings is provided in italics and the OFES comments follow. The page numbers refer to the page in the electronic PDF file of the report posted on the OFES web site where each of the quoted COV findings is located.

A. Overall Summary

Page 4: Overall, the OFES staff does a very good job managing the way it solicits, reviews, awards, and monitors proposals included in the programs examined by the present COV. The staff is serious, conscientious, and dedicated in its efforts to generate a high quality research program by means of the peer review process.

OFES appreciates the Committee's recognition of our efforts to improve our processes for soliciting and reviewing research applications and proposals. Since the publication of the January 1996 Fusion Energy Advisory Committee report entitled "A Restructured Fusion Energy Science Program," OFES has endeavored to follow its major recommendation that "a peer review process should be used as the primary mechanism for evaluating proposals, for assessing progress and quality of work, and for initiating and

terminating facilities, projects, research programs, and groups.” In 1996 there was only one grant Notice published by OFES other than the general notice published each year. In FY 2005, OFES will publish 7 Notices in addition to the general notice. Since 1996, OFES has more than doubled the number of person hours per year that are devoted to preparing grant and lab notices, selecting reviewers, planning reviews, analyzing proposals and reviewers’ comments, preparing funding recommendations for OFES management, and documenting the results of reviews.

Page 4: For decisions on the borderline, where there can be legitimate differences of opinions, OFES has thought about the issues carefully and can provide a detailed rationale for its decisions. Often this rationale is explained in writing and included as part of the proposal folder. We urge OFES to do this for all proposals primarily to institute a history and sense of continuity for each project under consideration, which is particularly important as assignments in OFES change and personnel come and leave.

OFES concurs with this finding, and, in the future, OFES program managers will prepare a summary of how they handle each solicitation, including an explanation of the review process and the rationale for their funding recommendations. Since OFES uses a comparative review process, some program managers prefer to prepare a summary explanation/rationale statement for all of the grant applications or proposals received in response to a solicitation, rather than a separate explanation about each grant application or proposal.

Page 4: There is a frustration in that it takes a considerable expenditure of time and effort for community members to continually prepare and submit new proposals, which are then prioritized through a time consuming peer review process, only to have high quality proposals unfunded because of budget limitations.

OFES shares this frustration. In nearly every review during the past four years, it has been necessary to turn down very good proposals that would have been valuable to the program had we been able to fund them.

Page 5: The community should have confidence that the peer review process, when properly carried through, is the best approach so far in selecting which proposals to fund. Some members of the community, like some members of the COV, tend to be somewhat suspicious of the way OFES reviews their proposals, although this feeling is largely generated by a lack of knowledge of the process. The COV, once it learned first hand how OFES actually carries out the review process, was favorably impressed.

OFES believes that this validation of the OFES review process is one very valuable outcome of the COV process. For obvious reasons of confidentiality, OFES program managers are able to provide few details about our peer review process in open forums. Thus, it is very valuable to have an independent committee review the details of our peer review process and provide its assessment of our solicitation and review processes.

B. Solicitation of Proposals

Page 5: New request for proposals (RFP's) are officially announced on the public Federal website "Grants.gov" (<http://grants.gov/>) and also listed on the DOE Office of Science website (<http://www.science.doe.gov/grants/>) ... We also note that non-government websites post links to the official proposal solicitations. These include Fusion Power Associates, <http://fusionpower.org/>, the University Fusion Association, <http://depts.washington.edu/ufa/home.html>, and the "Fire" website, <http://fire.pppl.gov/>, at PPPL ... The COV encourages OFES to consistently use all of these forms of communication to insure the widest possible awareness of program solicitations.

OFES will continue to use a variety of ways to provide information about our lab and grant notices in a fair and open manner.

C. Reviewing of Proposals

Page 6: The COV panel was favorably impressed by the quality of the scientists chosen to review proposals.

OFES program managers spend considerable time selecting peer reviewers, since they know that good reviewers are critical to a sound review process. OFES program managers try to attend a variety of major scientific meetings to remain cognizant of the current research interests and expertise of potential reviewers, but limitations in the OFES travel budget do not permit attendance at many of the meetings that non-fusion plasma physicists attend.

Page 6: There is no organized computerized list of reviewers and OFES may want to consider establishing such a list in view of retirements and career changes. However, since the system is currently working, one should be careful expending too much time and energy fixing a process that is not broken.

The Office of Science uses an information management system to process grant applications (IMSC). In addition to contact information, the IMSC database is capable of storing information on the keywords relating to the expertise of our reviewers. OFES program managers have chosen not to use this function, as it would take a great deal of work to keep this information up to date. Fortunately, the management of the Office of Science has recently obtained access to a wide variety of electronic journals, which provide up-to-date information on the current research of nearly all potential reviewers. At latest count, Office of Science program managers have access to 1487 on-line journals, including most of the major plasma physics journals.

Page 6: In fact, a large majority of the responders from the community survey were very unclear about whether or not a unified rebuttal procedure exists and, if one did exist, did it have any impact on funding decisions.

This finding directly relates to a recommendation below and is addressed in the recommendations section.

Page 6: A recommendation made by the first COV, and which we heartily endorse, is to put more appropriate word correlations with each grade to help each reviewer's ranking be better calibrated against the other reviewers. For instance, rather than stating that 5 = excellent and 1 = poor, a better system might be:

5 = must fund

4 = deserves funding

3 = OK to fund if resources available

2 = marginally acceptable, fund only for a crucial programmatic need

1 = not acceptable, do not fund under any circumstances

In the future, all peer review evaluation forms will include such descriptions.

Page 6: An important issue that was identified and partially quantified by the COV concerns the variation in the reviewers' scores as compared to the average scores of all proposals within a given RFP... The implication is that the numerical scores resulting from the peer review process provide a reasonably good guideline as to which proposals should or should not be funded but are not a razor sharp, precision tool, upon which to base decisions.

OFES program managers have long recognized that the variation in scores is an issue and have never set a strict numerical cutoff for funding recommendations. See the following comment for a more complete description of how OFES program managers develop funding recommendations.

Page 7: The conclusion is that OFES carefully considers the reviewers rankings of the proposals but sometimes uses discretion in arriving at its final decisions; that is, awards are not based on a purely numerical ranking of the reviewers. However, based on the admittedly limited data in Appendix D, it would appear that this discretion is only used very occasionally. This is slightly worrisome in view of the fact that the deviation in the scores of the reviewers is comparable to the deviation in the average scores of the proposals.

OFES program managers actually use their discretion to a greater extent than is apparent. In most of our reviews, approximately 25% of the applications are uniformly highly rated, approximately 25% are uniformly rated significantly lower than average, and the remaining proposals are rated near the average and/or have widely varying scores. The program managers analyze this last group of proposals and their reviews very carefully, and, in developing their funding recommendations, they use their discretion in several ways. In cases with widely varying scores, they may conclude that the narrative review does not match the numerical score, in which case they give greater weight to the narrative review. In other cases, they might decide to obtain an additional peer review. For proposals that are closely ranked around what would be a strict numerical cutoff, they independently evaluate the proposals before deciding which ones to recommend for

funding. Thus, program managers often use considerable discretion in making funding recommendations, although it is only apparent when they decide to recommend a proposal with a slightly lower rating over one with a slightly higher rating.

Page 7: Constrained by flat budget limitations, many funding decisions go to existing projects up for renewal because of the excellence of the research and the substantial investments that have already been made in terms of experimental hardware.

OFES does consider the level of past investment in making funding decisions. Among equally ranked proposals, OFES would normally fund continued research on an existing facility over research requiring the construction of a new facility.

Page 7: We noted that in the cases where reviews of existing programs would lead to project termination, OFES always allowed the PIs the opportunity to prepare rebuttals. The Committee strongly endorses this practice. Additionally, the Committee was also pleased to learn that closeout funds were provided to allow the completion of on going graduate dissertation work.

OFES views training of students as a crucial and integral part of our program. Therefore, OFES policy is to provide funding to allow graduate students to complete their dissertations whenever possible.

Page 8: It is essential that the folder for each proposal be uniform in structure. Also, a standard summary sheet serving as the cover page would be very helpful to OFES and future COV in order to quickly assess the status of the proposal and the reason why the proposal was funded or not. In this connection, a short paragraph explaining the justification for funding or the reason for not funding should be included on the summary page.

OFES will provide a more uniform structure for the information in the folders. The Office of Science has recently developed an automated system for preparing selection statements. This system will provide more uniform information on those proposals that were funded. Since OFES uses a comparative review process, some OFES program managers prefer to provide an overall summary for each review process rather than a separate explanation about each grant application or proposal, since this is often the best way to communicate the funding recommendations to the Division Director for a funding decision. In such cases separate explanations would be redundant.

Page 8: It was disappointing that such data for all the programs under consideration was not available for the Committee prior to the site visit, although it was requested in the original questionnaire to OFES. The reason is that this information is not readily or easily available to OFES in spite of its obvious usefulness for internal self-assessment. This is not due to a lack of interest on the part of OFES but much more to the lack of availability of an efficient DOE information system for processing and manipulating the data. We understand that DOE-wide efforts are underway to correct this situation but this does not help the present situation for OFES or other divisions. Until this situation

is improved, many organizations in DOE will be lacking an important tool for internally assessing their overall performance on the review process.

The information technology systems that the Office of Science uses to receive proposals, conduct reviews, document the review process, develop budgets, and monitor progress are not integrated or fully developed. There are several initiatives in progress to improve these shortcomings, but their completion will depend on the availability of funding over the next several years.

Page 8: Overall, the COV believes the current peer review process can be characterized as follows. Peer review has increased the fairness of the review process, both in perception and reality. Peer review has increased the quality of the proposals as well as the quality of the reviews. There is, however, no obvious metric that shows whether or not the actual quality of the research has increased.

The changes in the peer review process are fairly recent, whereas it would likely take several years before any improvement in the quality of research was apparent. One result of gaining experience in writing high quality proposals is that several PIs from the fusion program have successfully competed for funding from NSF programs.

Page 8: There was also strong feeling in the community that too many “new initiatives,” while desirable in the abstract, are not very desirable in the present environment. They require substantial amounts of additional efforts in the writing and reviewing of proposals, but in a flat budget are often funded by extracting funds from given programs to free up funds for the new initiative. Thus researchers feel they are doing a lot more work re-competing for funds that were already awarded.

Suggesting that funds are already awarded implies entitlement. In fact, new initiatives are generally developed during the budget formulation process. In a competitive funding environment, scientific research programs like the fusion program must justify their funding on an annual basis, and sometimes new initiatives within a flat budget are an important part of this justification.

D. Fusion Science Center Solicitation

Page 8: Overall the COV was very pleased with the review procedures and the fairness of the proposal process. However, the Committee notes that the scientists asked to review the Fusion Science Center proposals were all “fusion insiders.” Since a central motivation for the fusion science centers is to increase the visibility and interaction with related areas of science, mathematics, and physics, OFES should seek to include scientists from outside the fusion program in future review processes.

Some of the scientists involved in this review do not receive funding from OFES, although they do receive funding from DOE/NNSA. Nevertheless, OFES concurs with the point that it would be good to include more reviewers from outside the fusion program on our review panels, and OFES program managers will try to include more

outsiders for reviewing programs like the fusion science centers. Travel budget restrictions make it difficult for fusion program managers to attend many general scientific meetings, but the greater availability of electronic journals should make it possible to identify potential reviewers from related areas of science.

E. Funding Level of Proposals

Page 9: The reasons for funding at reduced levels are varied but chief among them is the desire to preserve OFES investment into experimental equipment during funding fluctuations. OFES staff is keenly aware of the dangers of consistently under-funding budget requests and how this will likely lead to PIs routinely asking for the maximum plausible funding on any proposal.

OFES tries to find the proper balance between the number of programs funded and the amount of funding for each program. In times of flat or decreasing budgets, this is a very difficult problem.

F. Monitoring of Proposals

Page 9: Most members of the community felt that OFES does a satisfactory job monitoring the progress of research on funded proposals. Some of the smaller projects felt, however, that there was almost no contact. On the other hand, OFES has stated in their questionnaire that large projects are required to report on a weekly basis. Clearly there is a sliding scale for the level of monitoring required dependent upon the size of the project. This makes good sense, but OFES may want to have some fine-tuning internal discussions to make sure the monitoring process is uniform and that at the extremes there is not too little or not too much reporting required by the principal investigators carrying out the research.

While program managers do not have the time or travel funds to visit small research programs, they do try to make contact with their PIs at general scientific meetings. Most program managers attend one or more meetings such as the American Physical Society Division of Plasma Physics Meeting, the Sherwood Theory Meeting, the High Temperature Plasma Diagnostic Meeting, or the Transport Task Force Meeting each year. In addition, program managers maintain telephone contact with their PIs, and the PIs are encouraged to communicate with their program managers as needed. Finally, program managers receive annual reports on all of the research projects that they manage.

Recommendations

In this section, the committee's recommendations are numbered and printed in bold type. These recommendations include multiple comments, and the text of these comments is included in italics. The OFES response and actions follow in plain type.

1. OFES should develop a uniform, clearly stated, rebuttal procedure for proposal writers.

The OFES recognizes that clerical procedures regarding rebuttals could be improved, but also notes that there is usually little time between when rebuttals are received and when funding decisions must be made, so the effort is focused more on decision making.

Also, many OFES programs are arranged to review a fraction of the research projects each year. This arrangement means that at the same time the program managers are conducting peer reviews of new and renewal proposals, they are also examining progress reports and preparing continuation PRs for the remainder of the research projects in the program.

The new PEERNET (online) review system was not designed explicitly to handle rebuttals, and any particular programming solution implemented by the OFES would be expensive.

Following the committee visit in January, OFES program managers began discussions with the project managers at the Oak Ridge Institute for Science and Education (ORISE) on how to implement a rebuttal system. Although developing a fully integrated peer review and rebuttal system would be fairly expensive, we discovered that with modest manual intervention and modest additional cost, the existing PeerNet system could be used to manage a rebuttal process.

OFES Action: Starting with the review of theory proposals currently in progress, OFES will implement the following rebuttal process:

1. The initial peer review will proceed as it does now, with 3 or more reviewers depending on the scope of the proposal.
2. Next an ORISE project manager would consolidate all the comments of all of the individual reviewers into a single file, and this file will be made available to the PI through PeerNet to enter a rebuttal into PeerNet.
3. Finally, each reviewer will be given access to the single file containing the comments of all peer reviewers and the file contains the PI's rebuttal to all of the peer reviews so that he/she may enter final comments and a final summary rating. Peer reviewers will be urged to enter additional comments and a final summary evaluation, but if they do not, their original comments and summary evaluation will be considered final.
4. OFES program managers will use the final comments and summary evaluation in the ranking tables.
5. All of this information will be saved in the proposal folder and will be available to future Committees of Visitors.

OFES program managers feel that this process will provide some of the benefits of a review panel. When responding to the rebuttals, the reviewers would see the original comments of all of the other reviewers and would see the PI's rebuttal to their own comments as well as those of the other reviewers. In their final review, they would be

able to comment on the validity of the other reviewer's comments as well as the on the validity of the rebuttals.

OFES will use this system, which would add up to 4 weeks to the review process, whenever possible. On those occasions when time does not permit a rebuttal, such as when the Congressional appropriation comes well after the beginning of the fiscal year, the fact that rebuttals can not be accommodated would be included in the Notice that is published on grants.gov.

2. OFES should implement several relatively simple ideas in the peer review process to improve the accuracy of the final funding decisions.

First, the directions to reviewers should include descriptive correlations between numerical score and suggested funding decisions as described in Finding C.

OFES program managers are adding outcome related language (e.g. must fund, should fund, fund if funds available ...) to the description of the numerical scores on evaluation forms.

Second, reviewers should be allowed to offer more accurate scores using decimal values.

Rather than using decimals, OFES will expand the rating scale from 1-5 to 1-10. This change has the same effect as allowing half integer scores.

Third, on a related point reviewers should be discouraged from using a low score of 1 for a proposal which is technically competent but not responsive to the solicitation guidelines.

We will make it clear that, when we send a proposal out for technical review, one or more OFES program managers have already evaluated the proposal for responsiveness to the solicitation and judged it to be responsive enough to justify a peer review. Additionally, we will be more aggressive in rejecting non-responsive proposals without peer review, so that we do not waste the time of the peer reviewers.

Fourth, OFES should press very hard on reviewers who complete the informational portion of their reviews but for one reason or another do not enter a final numerical score.

OFES will emphasize the importance of the summary evaluation in our review process. OFES will also consider adding a comment section so that reviewers can explain the rationale behind their summary score.

3. OFES should improve the uniformity and consistency of the information contained in the review folders.

Of particular importance is a clear, concise summary sheet containing, among other things, the funding decision, the funding level if funded, the reviewers' scores, a justification for those proposals funded, and an explanation describing why other proposals were not funded.

OFES plans to continue to improve the documentation of peer reviews. In particular, a discussion of the recommended funding amounts versus the requested amounts will be included. However, since OFES uses a comparative review process to review proposals submitted in response to specific Notices, some program managers find it more useful to document their funding recommendations in an overall statement explaining which proposals they are recommending for funding, which they are not recommending, and why, since they think that this is the best way to communicate their funding recommendations to OFES management.

Action: OFES will develop a summary statement format, and a summary statement will be included in each folder in the future.

Also, each folder should contain all the comments of the reviewers, the rebuttals if any, and the OFES or reviewer responses to the rebuttals.

As described above, the new rebuttal process will allow for collection of all of this information in PeerNet, making it possible to print it out and include it in the folders.

Action: These rebuttal data will be included in each folder in the future.

Finally, OFES could probably improve its "big picture" of the review process by creating simple overview data sheets as presented in Appendix D.

Creation of such tables would currently have to be created mostly by hand, since our IT systems cannot produce such reports automatically. OFES program managers have analyzed a few reviews in the past and obtained a similar result: that the average standard deviation in the reviewers' scores is about 0.5. The ability to provide such data sheets would be a useful requirement to include in the specification for planned Office of Science and/or DOE systems.

Action: OFES will recommend that that such a capability be included in the specification of future IT systems designed to handle peer reviews.

SECTION III

Report of the Committee of Visitors
on its Review of the
Tokamak Research, Diagnostics and
Enabling R&D Programs



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May 26, 2006

Dr. Ray Orbach
Director, Office of Science
U.S. Department of Energy
1000 Independence Avenue, S.W.
Washington, D.C. 20585

Dear Dr. Orbach,

With this letter, the Fusion Energy Sciences Advisory Committee is conveying the report of the Committee of Visitors (COV) that reviewed program management in the Office of Fusion Energy Sciences (OFES) of tokamak research and enabling technologies. This report is the third COV formed in response to your letter of August 15, 2003. The first COV reviewed the OFES program in theory and computation; the second COV reviewed the program in confinement innovation and basic plasma science. Hence, the current report completes the first cycle of our response to your letter.

The report of the third COV, concerned with tokamaks and enabling technologies, was presented to FESAC on February 28, 2006. After reviewing this report, prepared by a committee of eight scientists led by Dr. Kathryn McCarthy, FESAC submits it to you with its endorsement.

The COV concludes that “OFES supports a high-quality research program in Tokamak Research and Enabling Technologies.” The COV agrees with the recommendations of earlier COVs. We are pleased to note the observation of the COV that “DOE program managers have already implemented many of the recommendations of earlier COVs.” In addition, the COV report includes several useful recommendations regarding the execution of proposal reviews.

We thank Dr. McCarthy and her committee for their very useful work.

Sincerely,

Stewart C. Prager
Chair, Fusion Sciences Energy Advisory Committee

Enclosure

Cc: Dr. J. Decker
FESAC

Committee of Visitors

Tokamak Research and Enabling Technologies

Final Report
May 2006

I Introduction

This report summarizes the findings and recommendations of the third Committee of Visitors (COV) whose charge was to review the manner in which the Office of Fusion Energy Science (OFES) manages certain programs under its charter. The specific programs reviewed by this COV involve Tokamak Research and Enabling Technologies. The first COV completed its work two years ago (Theory and Computation), and the second COV last year (Confinement Innovation and Basic Plasma Sciences). The present committee used the previous two years' reports as models for their task, and this COV would like to acknowledge the efforts of those committees and their chairmen (Dr. Bill Nevins, and Prof. Jeff Freiberg).

This report is organized as follows. The second section sets the background for the report by describing the charge to the Committee, the third section discusses the actual program elements reviewed, the fourth section describes the composition of the Committee, and the fifth describes the process used to arrive at the conclusions. The sixth section provides the COV observations and recommendations, and section seven has the committees overall conclusion.

II The Background and Charge to the Committee

The request to establish a series of Committee of Visitors (COVs) was made by Dr. Ray Orbach, Director of the Office of Science, in August 2003. He transmitted his request to Prof. Richard Hazeltine, Chairman of the Fusion Energy Sciences Advisory Committee (FESAC). This COV is the third of three COVs requested by Dr. Orbach, thus this report fulfills Dr. Orbach's original charge.

The charge to the committee is given in Appendix A. Basically the Committee was asked to review the way that OFES manages its program elements with respect to:

- The complete review process involved in selecting proposals for awards
- The manner in which progress is monitored
- The connection between proposal awards and the overall program goals

The Committee is also asked to comment on the following:

- The breadth, quality, and portfolio balance
- The national and international standing of the portfolio elements

III Program Elements Reviewed by this COV

The present COV was charged with reviewing program elements associated with Tokamak research and Enabling Technologies. The specific program elements that fall in these categories are:

- Enabling Research & Development
 - Plasma Technologies
 - Advanced Design
 - Materials Research
 - ITER Support
- Alcator C-Mod
- Diagnostics
- DIII-D
- NSTX
- MST

These elements represent annual funding of about \$148M. The funding for each element is \$55M for DIII-D, and \$34M for NSTX, \$27M for Enabling Technologies, \$22M for C-MOD, \$6.3M for MST, and \$3.7M for Diagnostics.

NCSX was not reviewed by this COV, nor previous ones. It is the most recently funded large project. Reviewing it would be useful from that perspective as well as understanding the process of monitoring construction projects as the fusion program enters the ITER construction phase.

IV The Committee

The Committee membership was chosen by Dr. Richard Hazeltine and Dr. Kathryn McCarthy (who served as Chair). The committee was made up of eight members (including the Chair) from universities, laboratories, and industry. The original committee membership was nine members, however one member was unable to participate on the dates selected, and it was not possible to find an alternate. All members have had considerable experience writing and reviewing technical proposals. Some members had research interests that were directly involved in parts of the programs being reviewed. Overall, the Committee was well-balanced.

Name	Institution
Dr. Kathryn McCarthy (Chair)	Idaho National Laboratory
Dr. Bruce Lipschultz	Massachusetts Institute of Technology
Dr. David Rasmussen	Oak Ridge National Laboratory
Dr. Jeff Candy	General Atomics
Dr. Boris Breizman	University of Texas
Dr. David Brower	University of California, Los Angeles
Dr. David Gates	Princeton Plasma Physics Laboratory
Dr. Andrew Ware	University of Montana

V The Process

The process by which the COV arrived at its findings included a series of conference calls between the COV Chair and OFES staff, review of written summaries of the processes used by OFES to review and select proposals, review of the results of earlier COVs, and a two-day meeting at OFES headquarters on February 13-14, 2006 (see agenda in Appendix B).

The presentations given by OFES staff provided the committee with an overview of the processes used by the OFES staff, and gave the COV an opportunity to ask questions.

After the presentations by OFES staff, the COV split into three groups to review proposal traffic. The groups were formed such that there were no conflict of interest problems. One group reviewed Enabling Technology and MST, a second group reviewed Diagnostics and C-MOD, and the third group reviewed NSTX and DIII-D. The proposals, reviewer comments, rebuttals and other documentation are kept in individual proposal "Folders" maintained by the OFES program managers. These Folders were provided to the groups and were the primary basis of their review. The process used to review each of the program elements is described below.

Enabling Technology

The group received a large number of proposal Folders. A random sample of these was taken and examined for content, and later, organization and completeness. Each of the three COV members in this group then discussed the notable features of their subset of Folders with the other two members of this group.

MST

There was a comparatively small amount of MST proposal data, so no subsampling was needed. Each of the members of this group read through the information provided.

DIII-D

The group briefly examined the 5-year program plan for the DIII-D project focusing on the reports of the reviewers. A sampling of the proposals from the DIII-D collaborators was also examined.

NSTX

The group examined the 5-year program plan, focusing on the reports of the reviewers. For the university and industry collaborators, the group members read the summary of the review and decision process from the program manager and examined a sampling of the proposals, both for the physics collaborators and the hardware collaborators. The committee focused on the highest rated proposals that did not get funding, to check for decision consistency and justification.

Diagnostics

The group reviewed the summary information in the folders, and focused on the proposals that were not continued in the last review round, as well as a new proposal that had been submitted but hadn't been funded. A sampling of successful proposals and the associated reviews were also reviewed. Reviews were read, and proposals were skimmed. Questions were addressed to the OFES program manager.

Alcator C-MOD

The group read all reviews and skimmed the proposal. Questions were addressed to the OFES program manager.

On the second day, each group provided their observations to the entire COV. Report findings and observations were agreed upon, and were reported to OFES staff. A draft report was subsequently prepared and approved through a series of e-mails.

VI Findings

General Observations

This COV agreed with the recommendations of earlier COVs, and in this report, rather than repeating those recommendations, the Committee tried to focus on new observations and recommendations.

The DOE program managers were very helpful in providing the requested information and answering questions. The proposal folders were all well organized and were generally complete (this was a result of an earlier COV recommendations). This provided significant assistance to this COV. Overall, there was much evidence that the DOE program managers have already implemented many of the recommendations of earlier COVs. Overall, it is clear that DOE is working to improve the programs and processes.

The COV observed that different review/solicitation/recommendation for funding processes are used in different parts of these programs. For example, DIII-D and C-MOD do not have formal competitive review for university and industry collaborators, while the NSTX and Diagnostics programs do. Enabling Technologies uses a mix of competitive and non-competitive review. In some cases the quality of the process relies on the expertise of the DOE program managers rather than on the process itself. The mix

of competitive and non-competitive review exists primarily for historical reasons. Discussions with DOE program managers indicated that within DOE there is not an agreed set of metrics for deciding what type of review process to implement, but overall, the trend is towards competitive processes as recommended by earlier FESAC panels.

There is a general announcement (solicitation) every year, but it appears to be used only to accommodate proposals that should have been submitted to other calls, but for various reasons were not (for example, they may have missed a deadline). Discussions with OFES staff indicated that they don't feel there is adequate budget to warrant funding proposals submitted to the general call.

As the groups reviewed the reviews and proposals, they found that not all folders included documentation on why decisions were made. Later discussions with OFES program managers indicated that this is being done now as recommended by earlier COVs, but wasn't done for earlier reviews. An additional observation was that reviewers' suggestions for improving proposals are not tracked.

The COV agreed that the quality of the reviews, proposals, and documentation was generally excellent for the larger and competitively reviewed proposals. The COV observed that the quality of the grant proposals and reviews was more varied for smaller, noncompetitive proposals.

Committee Response to Questions in Charge

There were a series of specific questions that the charge asked each COV to consider. The questions and the COV response are shown below.

Consistency between award decisions and the Office of Fusion Energy Science's programs and goals

- Based on the sample examined by the panel, proposals that were funded were focused on OFES programs and goals
- Proposals that are funded are generally strong in both technical merit and programmatic relevance

Monitoring of active programs and projects

- The oversight of the major fusion experiments (DIII-D, C-MOD, NSTX, MST) is comprehensive and appropriate (progress reports from collaborators were not always included in the folders, however the COV understands that this was remedied in later review processes)
- In other parts of the program, the level of oversight is not always clearly documented in the folders (the COV understands that this was remedied in later review processes)

How has the award process affected the breadth, quality, and balance of portfolio items?

- The panel felt it had no basis to judge whether a different award process would result in a better portfolio
- Although different award processes are used in the programs, the overall impression is that the breadth, quality, and balance of portfolio items is good

COV Recommendations

A first recommendation is that **the content of the folders should be complete and consistent across the programs**. This is similar to earlier COV recommendations, but this COV felt it was important enough to repeat. It is clear that DOE is working in this direction, and folders documenting more recent actions are generally more complete than those documenting earlier actions.

There were several instances where the COV felt that **statistics would have been helpful in the evaluation process, as well as to DOE programs managers**. For example, the fraction of projects that are renewed, funding awarded versus funding requested, the correlation between ratings and funding, the duration of contracts that do not undergo competitive review, and demographics for awards. This should not be considered an exhaustive list, but rather examples of statistics that would be useful.

The COV recommends that **the review sheet used for program renewals should explicitly include a review of progress**. The reviewer should have a copy of the original proposal as well as the associated progress report.

Some form of the proposal score should be communicated to the PI in addition to reviewer comments. It may be better to communicate the quartile in which the proposal fell rather than the raw score to compensate for variability in scoring and OFES management actions.

The reviewer pool size should be increased. This is important both to spread the work around amongst a larger number of reviewers, and to increase the overall quality of the reviews. The COV recognizes that recruiting reviewers is very difficult as potential reviewers are very busy. The COV recommends using more international reviewers, and using reviewers outside fusion (*but only where appropriate*).

During our discussions with OFES staff, the COV learned that Junior faculty awards are eligible only to those working in basic plasma science. Although the Junior Faculty Award program was not within the responsibility of this COV, the COV agreed that **the Junior Faculty Award program should be eligible to those outside of basic plasma science**.

The recommendation above was part of a larger discussion as to whether there are enough opportunities being made available to new/junior researchers, and whether there

is enough flexibility in the fusion program to be able to quickly incorporate discoveries and support new ideas. The COV observed that NSTX competitively reviews university and industry proposals every three years, potentially providing an opportunity for new researchers. DIII-D doesn't have a formal re-compete process, but newcomers have an opportunity to get in through DIII-D management. While DOE does request new proposals via a general announcement (solicitation) every year, as mentioned earlier, this has never been used as a means to fund new/junior researchers. The COV discussed what (if anything) should be done formally in a flat-budget environment to bring in new researchers. This COV did not come to a conclusion on this topic, and felt that a focus on this issue in the future is needed.

Finally, there were two issues that the COV agreed warranted attention. The first is providing opportunities to young/new PIs. The COV recommends that DOE consider ways to provide new opportunities in various funding environments (flat, increasing, decreasing). The second is the balance between competitive versus noncompetitive processes, especially for the collaborations on the large machines. The process is not uniform across the various parts of the fusion program. The COV recommends that DOE look into this issue, and determine whether it warrants further attention.

VII Conclusions

Based on this COV's review of the proposal folders and discussions with OFES staff, it is the opinion of this COV that the OFES supports a high-quality research program in Tokamak Research and Enabling Technologies. The OFES staff is working diligently to improve processes, and thus the quality of the overall program.

Appendix A – Charge Letter



Department of Energy
Office of Science
Washington, DC 20585

August 15, 2003

Office of the Director

Professor Richard D. Hazeltine, Chair
Fusion Energy Sciences Advisory Committee
The University of Texas at Austin
Institute for Fusion Studies
1 University Station, C 1500
Austin, TX 78712-0262

Dear Professor Hazeltine:

This letter provides a charge to establish a Committee of Visitors (COV) through which the Fusion Energy Sciences Advisory Committee can assess matters pertaining to program decisions on a regular basis. It is our desire to have the COVs review program management every three to four years, on a rotating basis, for the following elements of the Fusion Energy Sciences program:

- Theory and computation
- Confinement innovation and basic plasma science
- Tokamak research and enabling technologies

Specifically, the committee is asked to assess, for the National Laboratory, University and private industrial participants, the efficiency and quality of the processes used to:

- Solicit, review, recommend and document proposal actions
- Establish the consistency between award decisions and the Office of Fusion Energy Sciences' programs and goals
- Monitor active projects and programs

The committee is asked to comment on how the award process has affected:

- The breadth, quality and balance of portfolio elements
- The national and international standing of the portfolio elements

The first area that I would like you to address is the theory and computation program. You should work with the Associate Director for the Office of Fusion Energy Sciences to establish the processes and procedures for the first COV.



I believe that the COV will help us maintain a high standard of scientific research. I look forward to your feedback on how the Office of Fusion Energy Sciences is making program decisions, and how that decision process can be improved.

I would like to have a final report from you by late spring of 2004.

Sincerely,

A handwritten signature in black ink that reads "Raymond L. Orbach". The signature is written in a cursive style with a large, prominent initial 'R'.

Raymond L. Orbach
Director

Appendix B – Agenda for February 13-14, 2006

Agenda COV 2006

Feb 13, 2006 G207

9-9:15	Panel Discussion	COV
9:15-9:30	Welcome	Davies
9:30-9:50	Diagnostics	Markevich
9:50-10:10	NSTX	Eckstrand
10:10-10:30	D3D	Oktay
10:30-10:45	Break	
10:45-11	CMOD	Rosenberg/Dagazian
11-11:10	MST	Rosenberg
11:10-11:30	Technology	Nardella
11:30-12:30	Lunch	DOE Cafeteria (or other)
12:30-4:30	Reading Reviews (G207)	COV Panel
12:30-4:30	Reading Reviews (G258)	COV Panel
12:30-4:30	Reading Reviews (Res. Dir Office)	COV Panel
12:30-4:30	Reading Reviews (BER Conf Room)	COV Panel
4:30-5	COV Discussion	COV Panel
5	Issues for DOE	COV Panel and DOE

Feb 14, 2006 A 410

9:00	DOE Response (if needed)	COV and DOE
9:30-12	Report Creation	COV
12-1	Lunch	DOE Cafeteria (or other)
1-3	Report Creation (cont)	COV
3-4	Review Results Presented to DOE	COV and DOE
4-5	Report Creation Finished	COV

DOE Response
to the
Review of the
Tokamak Research, Diagnostics and
Enabling R&D Programs



Department of Energy
Washington, DC 20585

June 12, 2006

Professor Stewart C. Prager, Chair
Fusion Energy Sciences Advisory Committee
Department of Physics
University of Wisconsin
1150 University Avenue
Madison, Wisconsin 53706

Dear Professor Prager:

I would like to express my appreciation to FESAC for successfully completing the request made for the third and final committee of visitors (COV) to review the Office of Fusion Energy Science's procedures for reviewing and funding work in the tokamak research and enabling technologies programs. A special thanks goes to the COV Panel, chaired by Dr. Kathryn McCarthy (INL), for a thorough examination of the program and for the excellent report that clearly states the panel's findings and recommendations.

I consider the COV process to be an important way for us to ensure that the Office of Fusion Energy Sciences review and award process is both sensible and fair and results in a balanced portfolio of excellent science and technology. This third effort, just like the previous two, went very well and I believe any future reviews will benefit from this as well as the other two COV Panel's recommendations.

I have enclosed a detailed response to your report.

Sincerely,

A handwritten signature in black ink, appearing to read "James F. Decker", is written over the typed name.

James F. Decker
Acting Associate Director
for Fusion Energy Sciences
Office of Science

Enclosure



Response to Recommendations of the third Committee of Visitors review of the Office of Fusion Energy Sciences Tokamak Research and Enabling Technologies

This document provides the Office of Fusion Energy Sciences (OFES) response to recommendations of the Third Committee of Visitors (COV). On February 13-14, 2006, a COV reviewed the OFES programs in the areas of Enabling Technologies Research and Development, Alcator C-Mod, Diagnostics, DIII-D, NSTX, and MST. The review was conducted in response to a charge from Dr. Raymond L. Orbach, Director of the Office of Science, to the Fusion Energy Sciences Advisory Committee (FESAC) chaired by Prof. Richard Hazeltine of the University of Texas. The COV was chaired by Dr. Kathryn McCarthy (Idaho National Laboratory), a member of FESAC.

Overall Summary of COV

Based on this COV's review of the proposal folders and discussions with OFES staff, it is the opinion of this COV that the OFES supports a high-quality research program in Tokamak Research and Enabling Technologies. The OFES staff is working diligently to improve processes, and thus the quality of the overall program.

COV Recommendations and OFES Response

COV #1: A first recommendation is that **the content of the folders should be complete and consistent across the programs**. This is similar to earlier COV recommendations, but this COV felt it was important enough to repeat. It is clear that DOE is working in this direction, and folders documenting more recent actions are generally more complete than those documenting earlier actions.

OFES Response: The office accepts this recommendation. With the new electronic submission of proposals to the office, and for awards sent electronically, a CD of the proposal will be placed in the OFES file. Copies of the reviews along with documentation on the award will be included as paper copies until the full electronic award process is in place. Afterwards, a CD with all documentation relating to the award in PDF format will be retained. This will be the standard format for all future reviews.

COV #2: There were several instances where the COV felt that **statistics would have been helpful in the evaluation process, as well as to DOE program managers**. For example, the fraction of projects that are renewed, funding awarded versus funding requested, the correlation between ratings and funding, the duration of contracts that do not undergo competitive review, and demographics for awards. This should not be considered an exhaustive list, but rather examples of statistics that would be useful.

OFES Response: Because of the large number of solicitations and reviews that the office conducts, we have an internal solicitation tracking system that we use to keep everyone up to date on the solicitations and reviews. We have recently increased the information

that we track to include statistical information on the reviews. We will increase this further. The system is easy to modify and we will be able to add additional information if needed.

COV #3: The COV recommends that **the review sheet used for program renewals should explicitly include a review of progress**. The reviewer should have a copy of the original proposal as well as the associated progress report.

OFES Response: The office accepts this recommendation. This has already been implemented in the theory solicitations, and we will change the standard review sheet to include an explicit review of previous work. This recommendation will be implemented in two ways. First, the format for all proposals, as recommended by a previous COV, will include a section dealing with previous work. The current theory solicitation states:

Recent Accomplishments - this subsection is mandatory for renewal applications and should summarize the proposed work and the actual progress made during the previous funding period, as well as how the results of this work were communicated

Second, the review sheet will have an additional section as part of the review asking the reviewer to explicitly comment on the past work. As an example, the current theory solicitation asks the reviewers to include a section on:

4. Performance under existing award (for renewal applications);

- Assess the progress the applicants made toward the research goals during the most recent performance period and the impact of the research on the fusion program.
- Have the applicants disseminated the results of their research through publications in peer-reviewed journals, meeting and conference presentations, workshops, or other appropriate means?
- If appropriate, have the applicants attempted to validate their theoretical predictions against experimental results?

COV #4: **Some form of the proposal score should be communicated to the PI in addition to reviewer comments**. It may be better to communicate the quartile in which the proposal fell rather than the raw score to compensate for variability in scoring and OFES management actions.

OFES Response: We agree with this, and in the future we will communicate the score or some measure of how well the proposal has done in the technical reviews to the PI. We have not had a uniform policy on this in the past, leaving it up to the individual program managers to decide if the scores should be provided. One reason is that the reviewer's score is only one part of the basis for the funding decision.

COV #5: **The reviewer pool size should be increased.** This is important both to spread the work around amongst a larger number of reviewers, and to increase the overall quality of the reviews. The COV recognizes that recruiting reviewers is very difficult as potential reviewers are very busy. The COV recommends using more international reviewers, and using reviewers outside fusion (*but only where appropriate*).

OFES Response: Increasing the reviewer pool is a high priority for the program managers. OFES will investigate the possibility of developing a reviewer database that allows us to track the number of proposals that a reviewer evaluates, their institutional affiliations, technical specialty, and other information that will make selecting reviewers more efficient and effective. The plan would be to eventually include all fusion program scientists in this database, so that the pool of US reviewers is as large as possible. OFES expects all researchers with fusion funding to review proposals for this office, and these reviewers will be the first pool contacted by OFES program managers. OFES also plans to look for plasma scientists that are funded by other areas of the government and include as many of those in the database as is feasible. Furthermore, we are starting to use the full range of web-enabled search tools to look for reviewers.

COV #6: During our discussions with OFES staff, the COV learned that Junior Faculty awards are eligible only to those working in basic plasma science. Although the Junior Faculty Award program was not within the responsibility of this COV, the COV agreed that **the Junior Faculty Award program should be eligible to those outside of basic plasma science.**

OFES Response: We agree that the Junior Faculty Award program should be expanded to include other programmatic areas. We should however reformulate the criteria and the basis for the expanded program. OFES feels that this change should wait for the appointment of the new Associate Director for Fusion Energy Sciences.

COV #7: Finally, there were two issues that the COV agreed warranted attention. The first is providing opportunities to young/new PIs. The COV recommends that DOE consider ways to provide new opportunities in various funding environments (flat, increasing, decreasing). The second is the balance between competitive versus noncompetitive processes, especially for the collaborations on the large machines. The process is not uniform across the various parts of the fusion program. The COV recommends that DOE look into this issue, and determine whether it warrants further attention.

OFES Response: OFES will look into these two issues.