

**Report  
to  
Basic Energy Sciences Advisory Committee**

**Committee of Visitors  
For  
Basic Energy Sciences Scientific User Facilities Division**

**April 6-8, 2010**

# I. Introduction and Overall Conclusions

During the past decade a Committee of Visitors (COV) process was established for all divisions within the DOE Office of Science. Within Basic Energy Sciences BESAC appoints the COV, provides the charge, and receives the report every three years.

The 2010 COV for the Scientific User Facilities Division (SUFD) met in Germantown on April 6-8, 2010 to assess the three-year period 2007-2009. Membership of the COV is listed in Appendix A. The agenda is included as Appendix B.

The charge to the COV was:

- i. For SUFD and Accelerator and Detector program, assess the efficacy and quality of the processes used to:
  1. Solicit, review, recommend and document proposal actions
  2. Monitor and review active projects, proposals, and facilities
- ii. Within boundaries defined by DOE missions and available funding, comment on how the award process has affected:
  1. Breadth and depth of portfolio elements
  2. The national and international standing of the portfolio elements
- b. Provide input for evaluation of progress toward the long-term goals specified in the Government Performance and Results Act (GPRA), and comments on observed strengths or deficiencies and suggestions for improvement.

This report is organized as follows:

Section II contains findings and recommendations that are related to the entire portfolio of the Division. This is followed in Section III by the individual reports of the six teams that examined the major components of the portfolio

1. Lightsources
2. Neutron sources
3. Nanocenters
4. Electron Microscopy Centers
5. Program in Accelerator and Detector R&D
6. Construction Projects

The overall conclusions of the Committee are:

- **The efficacy of the processes to review, recommend and document proposal actions are excellent**
- **The efficacy of the processes to monitor and review active projects, programs and facilities are also excellent**
- **Within the scope of DOE missions and available funding, the award processes continues to strongly enhance the breadth and depth of portfolio elements as well as their national and international standing**
- **The response from SUFD to the previous COV report is excellent**

**Summary of the SUFD performance on the Government Performance and Results Act (GPRA) Long-Term Measures**

	new materials	chemical reactivity	energy research	new instruments
Lightsources	Excellent	Excellent	Excellent	Excellent
Neutron sources	Excellent	N/A	Excellent	Excellent
Nanocenters	Excellent	Excellent	Excellent	Excellent
Electron Microscopy	Excellent	N/A	Excellent	Excellent
Accelerator & Detector	N/A	N/A	N/A	N/A
Construction	N/A	N/A	N/A	N/A

## II. SUFD-Wide Findings and Recommendations

### A. Implementation of previous COV recommendations

#### FINDINGS:

- Implementation of the recommendations has led to improved process and documentation
- The COV is delighted to see increased SUFD staff, a major recommendation of the previous report
- Recommendation on theory retrofit for existing facilities has not been acted upon in the face of budgetary constraints.

#### RECOMMENDATIONS:

- **As the budget allows, continue to explore ways to establish theory programs at existing facilities where they do not exist. In the view of the COV, this is a highly cost-effective way to make the facilities even more productive.**

### B. Assessment of COV process effectiveness.

#### FINDINGS:

- Complete sets of files were made available to the COV.
- Documentation was thorough and well organized.
- Staff was fully available and cooperative in answering questions
- For the second time in a row, the timing of the COV coincided with an incomplete cycle of Nanocenter reviews.
- Dealing with paper files was seen as less efficient than if searchable electronic files would have been available
- The Germantown Headquarters venue was inconvenient due in part to the need for security screening and in part to the wide distribution of the teams throughout the building

#### RECOMMENDATIONS:

- **COV timing: Avoid repeated coincidence with the cycle of nanocenter reviews**
- **At the first breakout session of the COV subpanels, schedule a brief update by the cognizant SUFD program manager for the facility type being assessed**
- **Consider making the documentation available in the future in electronic form**

- **Consider holding the COV meeting off-site**

### **C. Facility review process description and effectiveness.**

#### **FINDINGS:**

- The 3-year reviews of the facilities are well organized and well executed.
- The review teams are carefully selected for subject matter competence and lack of conflict of interest
- Facility response to the recommendations based on the reviews and SUFD guidance is uneven in timing and completeness
- Instructions to reviewers include assessment targets that are not communicated to the facilities
- There is some non-uniformity among facilities as to what is considered a high-impact journal, or what is considered a more standard publication
- There is some non-uniformity among facility types regarding the reporting of off-site (mail-in or ship-to) users
- Some of the reviews are overly long and detailed.

#### **RECOMMENDATIONS:**

- **As part of future 3 year reviews, ask the facilities how previous recommendations have been implemented**
- **Provide the facilities with the questions directed to reviewers**
- **Further diversify the types of organizations the reviewers are drawn from, including industry representatives.**
- **Establish a uniform definition of publications and high impact publications.**
- **Establish a uniform definition of off-site users**
- **Ask reviewers to summarize major findings and recommendations at the beginning of their report**

### **D. General Issues**

#### **FINDINGS:**

- The quality of the scientists at the facilities is the critical asset that ensures excellence and success. The COV compliments the SUFD for recognizing the importance of supporting staff research and the selection of high-quality scientists.
- Different types of facilities serve different scientific communities. They are all needed and important.

- Given the dependence of the BES Facilities on the tools provided there and the people who devise, construct and operate them, the COV commends BES on its recognition of this through its inception of a Program of Detector and Accelerator R&D.
- Productivity depends strongly on experimental apparatus, sample environment and software. These areas deserve added emphasis
- Many of the facilities produce an annual list of publications and currently available equipment using a common template.
- There is a change occurring in the culture of users: fewer users are now well trained in the operation of beamlines , endstation equipment, and data acquisition.
- The travel budget for the Division is too small for sufficiently frequent visits by the SUFD Program Managers to visit the facilities, or to assess comparable institutions abroad.
- There is an acute shortage of office space for SUFD staff

#### **RECOMMENDATIONS:**

- **Request an annual listing of publications and currently available equipment from all facilities**
- **Place added emphasis on maintaining state-of-the-art experimental apparatus, sample environment and software at all facilities to maximize scientific productivity**
- **Foster a pipeline of instrumentation, accelerator, detector experts**
- **Encourage more outreach to train present and future users in the use of the facilities**
- **Increase the SUFD Program Managers' travel- budget so as to be commensurate with the mission of the BES SUFD.**
- **Provide additional office space for the SUFD.**

### III. Reports on the components of the portfolio

#### **1. Synchrotron Light Sources**

##### *i. List/description of Sources reviewed:*

The COV subcommittee on X-ray Synchrotron Facilities studied the reviews and review processes for the four DOE synchrotron sources: Advanced Light Source (ALS), Stanford Synchrotron Radiation Laboratory (SSRL), National Synchrotron Light Source (NSLS) and the Advanced Photon Source (APS). The reviews took place in late 2007 and early 2008.

##### *ii. Response to April 2007 COV subcommittee recommendations.*

The previous COV subcommittee made no specific recommendations, but commented on the need to include the number of remote users as a metric. The previous subcommittee also strongly supported strategic planning for future light sources.

Planning for future light sources appears to be appropriate. A major workshop on future light sources was held in 2009 and additional workshops on accelerator technology and compact light sources will take place in 2010.

No documentation for remote users was found in the four reviews.

##### *iii. Facility review process description*

The subcommittee was favorably impressed by the detail and scope of the facility reviews. The synchrotron light sources are large facilities, which provide unique capabilities and science. The overall quality of the science and operations performance of the four facilities is inspiring. The review process appears to be well organized and the documentation is also well-organized, complete and often redundant. This included the review summary requested by a previous COV. The attachment of summary reviews, BES recommendations and separate review documents from each of the reviewers is good practice and provides a complete sense of the range of reviewer responses to the presentations-including sometimes conflicting recommendations.

One area where better documentation would be useful is in the immediate and long-term response to the BES review recommendations. *A formal short-term reply is needed for the review process.* This was present in several reviews but was in the form of a terse PowerPoint in other reviews. In addition, we recommend as good practice that *one of the elements of the three-year review be a formal presentation on how the facilities responded to the previous review recommendations.* We do note that

a description of the response to the previous 3 year review was present in at least one of the facility responses.

*iv. Issues/comments*

The non-optimal travel budget of the SUFD results in limited face-to-face contact between the facility staff and SUFD management. New ways should be explored to improve the situation. For example, a contractor style meeting could provide important opportunities for both cross-fertilization between the light sources and an additional contact with SUFD management.

The "impact" of the synchrotron light sources is an important issue and one where no single metric is adequate. As an attempt to address this issue the Neutron facilities subpanel has identified a process that has been successfully used by the NIST Center for Neutron Research for many years. This makes use of the concept of "research participant". This is discussed further in the Neutron sources subpanel report.

*v. Findings*

*Review panel makeup:*

There is a preponderance of national laboratory participants in the DOE reviews, which does not reflect the user and instrument communities of the synchrotron light sources. For example, a table of the reviewers is presented in Table 1 below. This raises the question of how the reviewers are selected and what panel makeup will best serve the important national investment represented by the X-ray Synchrotron Facilities.

Table 1. Home institution of reviewers for 2007-2009 X-ray Facility Reviews

Facility	National Laboratory	Industry	Joint National Lab/University	University	Foreign
ALS	7	0	1	1	1
APS	12	0	0	3	2
SSRL	4	0	0	3	
NSLS	6	0	1	2	

*High impact journal metric*

The facilities are asked to supply the number of high impact publications as defined as those in four journals: Science, Nature, Physical Review Letters, and Cell. However, various definitions of "high impact" papers were adopted by the four light sources. This makes it difficult to judge the relative and absolute performance of the

facilities. In addition, the journals recommended are Bio and Physics centric. The NSLS approach which counts as “high-impact” all publications in journals with an impact factor greater than 6 is a reasonable model.

#### *Relationship to local laboratory plans*

One of the review topics described in the cover letter to facility directors is “how the laboratory plans may affect the facility under review”. However, this does not appear in the specific information requested from the facility and is hard to find in the documentation. In some cases the issue was covered in the overview presentations- for example a review of the new NSLSII facility. In addition, an even more important question might be, “how does the facility help meet the mission of the DOE”.

#### *End stations / experimental facilities*

The letter sent to reviewers focuses on the operational aspects of the light source with no specific mention of the end stations/experimental equipment/software available at each beamline.

### **vi. Recommendations**

- **A more balanced representation of the user and instrument communities on the review panels is recommended.**
- **The metric for “high impact” publications should be based on a field-dependent impact factor of the journal rather than specific journal names. The metric should be uniform among all facilities.**
- **A documented official letter of response should be provided to "closeout" the review (within a fixed period of receipt by facility director of guidance letter from SUFD).**
- **The facility review should begin with a summary of how the facility addressed the recommendations from the prior review.**
- **The previous COV discussed splitting the facility reviews into science and operations reviews because on the larger facilities the scope of the review was too large. We do not concur with this suggestion. We noted that all reviewers are given the same charge. Possibly subdividing the responsibilities of the reviewers could better meet the need to have an integrated review but at a manageable level.**

- **Supplement the single metric of “user” with those of “research participant” as successfully used by the NIST Center for Neutron Research (co-proposers and co-authors of publications).**
- **Specifically request that the quality of the end stations/experimental facilities available to the users be part of the review process. Now that in many light sources the beamlines are facility owned and operated this responsibility falls under the purview of the light source and should be included in the review.**

***vii. Government Performance and Results Act (GPRA) Performance Measures for BES evaluation***

*Demonstrate progress in designing, modeling, fabricating, characterizing, analyzing, assembling and using a variety of new materials and structures, including metals, alloys, ceramics, polymers, biomaterials and more- particularly at the nanoscale- for energy-related applications.*

Rating: Excellent

Light sources provide a unique resource for characterizing materials at the atomic and nanoscale. X-rays by their very nature are sensitive to local structure, elemental composition, chemistry and electronic and magnetic structure. The DOE light sources are pushing the frontier in all these areas and have provided a major impact in the areas stated above.

*Demonstrate progress in understanding, modeling, and controlling chemical reactivity and energy transfer processes in the gas phase, in solutions, at interfaces, and on surfaces for energy-related applications, employing lessons from inorganic, organic, self-assembling, and biological systems.*

Rating: Excellent

The penetrating power and surface sensitive of X-ray and related techniques are uniquely suited for studies of liquid/solid, gas/liquid and other interfaces. The DOE light sources are at the forefront, enabling unprecedented science of these important systems.

*Develop new concepts and improve existing methods for major energy research needs indentified in the 2003 Basic Energy Sciences Advisory Committee workshop report, Basic Research Needs to Assure a Secure Energy Future.*

Rating: Excellent

High-brilliance light sources provide unique capabilities for understanding materials at the atomic scale and in extreme environments. As such DOE facilities are a key tool toward meeting major energy research needs

*Demonstrate progress in conceiving, designing, fabricating, and using new instruments to characterize and ultimately control materials.*

Rating: Excellent

DOE light source facilities have been extremely successful at designing and fielding new characterization instruments that are essential to ultimately understand and control materials over the critical length, energy and time scales. Such instruments include the new nanoprobe at the APS, PEEM at the ALS, high pressure instruments at the NSLS and APS, nanoimaging at the APS, ALS and SSRL and other unique instruments.

#### Annual Measures

With regards to operation time, spatial resolution and temporal resolution, the Government Performance Measures for Basic Energy Sciences light source facilities have been met.

## **2. Neutron Sources**

The review period has seen both the ramping up of power at the new Spallation Neutron Source, with growing numbers of completed instruments, and the closure of the Intense Pulsed Neutron Source, which resulted in a substantial decline in the number of operational instruments at DOE/BES facilities. Meanwhile, the Lujan Center and the High Flux Isotope Reactor have each steadily increased the numbers of users served. During this time of flux, effective stewardship of the neutron facilities is of considerable importance.

### i. List/description of Sources reviewed

Reviews of operations at the Lujan Neutron Scattering Center, LANL, and at the High Flux Isotope Reactor and the Spallation Neutron Source (SNS), ORNL, were performed in FY09. An initial review of operations at the SNS occurred in early FY07. In FY08, there was a review of the decommissioning plan for the Intense Pulsed Neutron Source (IPNS), ANL.

### ii. Response to prior review recommendation(s)

The subcommittee is pleased with the responses to the previous review. In particular, the inclusion of a brief summary of reviewer comments, along with the guidance letter following a facility review, has been implemented quite effectively. The summaries in the folders provide a balanced representation of the reviewers' comments.

### iii. Facility review process description

The review process is working well. The selection of reviewers by BES and the breadth of the review team seem quite appropriate (with the possible exception of under representation of industrial researchers.) The preliminary review material, prepared by the facilities, is distributed to reviewers 2 weeks in advance of the review. There is reasonable parallelism between the instructions to the reviewers and the information requested from the facilities. During the reviews, closed breakout sessions involving reviewers and non-management facility staff have proven quite valuable in providing candid perspectives on staff issues and morale.

### iv. Findings

The metrics used to compare the performance of facilities provide incentives that affect facility management and policies. The present metrics do not take into account “mail-in sample” users. (Note that such users must get access to beam time through a proposal, but need not be physically present for their sample to be measured.) This is an area that is expected to grow in coming years, and can provide a valuable way to optimize facility performance and impact while minimizing unnecessary travel costs. It would be unfortunate if the lack of an appropriate metric were to provide an inadvertent disincentive to such programs.

With the substantial costs associated with new facilities and new instruments, there are high expectations for rapid results following completion of construction projects. There is evidence, however, that the plans for new instruments frequently do not address all aspects necessary to reach scientific productivity (as measured by publishing results in scientific journals). For example, to obtain significant new results from an instrument, one needs more than a high-flux neutron beam and an operating detector. One also requires adequate software to handle (and visualize) the large data output that is increasingly common with modern detector systems, and one may also need suitable simulation software. Furthermore, special sample environments can be of crucial importance. In order to meet stakeholder expectations, work on all critical components needs to be pursued in parallel, rather than serially.

#### v. Comments and issues

The closure of the IPNS in FY08 resulted in a net decrease by 6 (14%) of operational neutron scattering instruments in the US from 2007 to 2009. These numbers include instruments at the NIST Center for Neutron Research, supported by the Department of Commerce. The number of instruments available is a relevant metric, as it constrains the number of users that might be served. The subcommittee notes that the number of operational instruments in the US is well behind that in Europe. While this number is gradually increasing, largely through the SNS, the beam-time over-subscription rate in the US is at least a factor of 2 for virtually all instruments. Thus, there is a robust demand for an increasing supply of neutron instruments.

As part of facility reviews, the reviewers should have a baseline for evaluation of facility progress in key areas. A mechanism for accomplishing this would be to provide to the reviewers a copy of the executive summaries (program manager letter plus synopsis of

review committee comments) from the previous review along with a document from the facility outlining the steps taken to respond to the recommendation. The BES review committee would then have a baseline against which to evaluate progress in the key areas identified in the previous review.

There are inherent weaknesses in relying on any single metric to assess facility impact, and obtaining a meaningful perspective on impact requires looking at a constellation of indicators. When visiting the BES website or seeing a presentation on the BES user facilities, the one metric that is most frequently presented is number of users. Taken on its own, this number can be misleading as a measure of impact or facility use. One way to address this would be to consider a new indicator to supplement the “user” metric.

One specific indicator that is worth considering is *research participant*, which has been used by the NIST Center for Neutron Research for many years. *Research participants* include (a) users who physically come to the facility [present user definition], (b) active collaborators, including co-proposers of approved experiments and also co-authors of publications resulting from work performed at the facility (counting these individuals only once per year). This metric is a useful supplement to the “user number” (but not a replacement) because it is composed of both leading and lagging indicators of facility use and impact. This metric captures demand (proposers) as well output (co-authors). As such, it is one appropriate metric for looking at both new and mature facilities.

#### **vi. Recommendations**

- **In instrument planning in reviews, and in defining completion of an instrument project, give more attention to the full set of requirements for scientific productivity, especially including software and sample environments.**
- **Consider introducing a supplementary metric, intended to reflect facility impact that would include not only on-site facility users, but also collaborators on successful proposals and coauthors on resulting publications, counting any name no more than once per year.**
- **Consider providing to BES review teams copies of the previous review executive summary and the synopsis of review committee comments to use as a baseline for evaluating progress since the last review.**

- **Research highlights should emphasize those experiments which can not be done by any other techniques, and explain why these experiments are important.**

vii. GPRA evaluation

Progress in characterizing new materials and structures for energy-related applications---Excellent

Progress regarding chemical reactivity and energy transfer processes---  
N/A

New concepts and improved methods for energy-related applications---  
Excellent

Progress in conceiving, designing, fabricating, and using new instruments to characterize materials---Excellent

### **3. Nanocenters**

#### *Response to prior review recommendation*

There was not a formal response to the prior COV recommendations; however, it is clear that our previous discussion has led to a number of changes in the review process and NSRC operation, which are in line with our suggestions. These are briefly discussed here.

- Coordination among the NSRCs has resulted in some commonality of forms. This should continue and the NSRCs should work on a generalized access modality for the Centers. This latter point was also discussed in the last COV meeting.
- The integration of the NSRCs with the core-research programs of the DOE and of the host laboratory continues to be an important issue. Important progress has been made in understanding this issue and a clear policy has been formulated and is being documented in each review.
- The prior report included the following quote “No NSRC made a convincing case that the internal shuffling of national lab scientists is a mechanism by which the excellence of the NSRC would be guaranteed. Achieving excellence means hiring the best people.” The committee is impressed that the quality of the newly hired scientists is excellent and that the selection of the correct percentage of time for dedicated scientists to be involved in extramural science efforts has been thought through carefully.

#### *Facility review process description*

The documentation in the formal program jackets is clear and well laid out. The reviewers wrote detailed, constructive and frank reviews that were summarized very well by the program officer.

The choice of panelists on the review panels, including scientific background and organization representation, was well matched to the BES mission and to the user population.

To increase the value and clarity of the individual reviews, DOE should make a request to the facility reviewers that in their written review they should address a specific set of criteria that would be structured in a convenient outline form, including an open-ended opportunity to provide comment; the reviewers should be asked to structure their review around this outline.

## *Findings*

- Users: Definition

The evolution of the definition of user has been thought through clearly for NSRCs. As a result the new definition of an “off-site” user has been chosen. This is a sensible policy, which the COV endorses.

- Impact and Metrics

It is important to have at hand a full-success story from research to application, which highlights the value of NSRCs to the nation. In addition and more generally, it is necessary to properly articulate the practical impact of the Nanocenters, as well as their value to society.

There is an important need to establish realistic useful metrics and not be overly reliant, for example, on flashy items such as the covers of Nature and Science. Thus it is important to have a standard set of broader measures of first-rate scientific accomplishments. These include solid lasting publications, patents, economic development achievements, awards, invited talks at major meetings, international collaborations, and leadership in national and international professional organizations. The COV is pleased that many of these metrics are currently being examined.

## *Comments and issues*

A key recommendation is to continue the BES efforts in expanding the outreach and involvement of industry in the centers. It is recognized that involvement is small at present and thus even a small increase will be helpful. This increase can be helped by the following steps:

- Develop a transparent cost structure for proprietary proposals and a more flexible legal agreement for these proposals.
- Carry out workshops to increase industrial awareness and participation.
- Encourage involvement of additional industrial scientists as proposal reviewers.

The COV requests that a list of capital requests and “awards” made to each NSRC be included in the documentation.

The career path for young scientists in the NSRCs needs to be well laid out and delineated. This is apparently not uniformly planned at present. In addition, in some cases the presence of an operations director would assist in the management of technician and administrative personnel.

The COV recommends that the original mission of NSRCs be maintained despite the current strong interest in energy missions. For example, nanomaterials and synthesis are important for the myriad needs of DOE.

Finally the COV recommend that the Nanocenters develop a clear total cost recovery process for proprietary users and strive to include industrial users in proposal evaluations

### **Recommendations**

- **DOE should use a specific set of guidelines, including a section for general comments, for the panelists in order to structure their individual written reviews.**
- **Metrics should be substantive such as solid, archival publications, patents, economic development (e.g., start ups, licenses, technological success), the scientific successes of users, honors and awards, invitations to major meetings, and leadership in national and international professional organizations.**
- **Include a list of capital requests and “awards” made to each NRSC in the program jacket.**
- **Clearly delineate the career path for the young scientific staff.**
- **The original mission of NSRCs should be maintained since these provide a crucial ingredient to carry out the mission of the DOE.**
- **Continue to strengthen the engagement of industry in the NSRCs.**
- **Develop a clear total cost recovery process for proprietary users.**
- **Include industrial users in proposal evaluation**

### *GPRA evaluation*

- 1) New materials and structures for energy-related applications - Excellent
- 2) Chemical reactivity and energy process for energy-related applications - Excellent
- 3) Development of new energy concepts - Excellent
- 4) Development of new instruments – Excellent

## **4. Electron Microscopy Centers**

General comments:

Although it is a personal burden on reviewers, there is value of having reviewers on multiple (more than one) review panel and repeating in time. This provides a broader perspective of how a facility is evolving and responding to challenges and also how they compare with one another. BES is doing a good job at this aspect of review panel composition.

There are finer descriptions in the charge letter to the reviewers than that sent to the facility. Although the detailed comments are wholly in line with the general guidance, efficiency might be gained if the reviewed facility knew of these priority sub-topics.

The goals of all facilities are common and in general well understood. However there is significant diversity among the approaches taken and each is at a different stage of evolution to the SUFD model. As each of the host laboratories has other major SUFD supported facilities, there seem to be opportunities to gain knowledge and expertise from those sister operations. This is likely happening at each facility and to differing extent. There may be benefit for BES to encourage or even facilitate such interactions to share best practices.

There also may be opportunities for the facilities to learn from one another. There are similar “barriers” to be overcome to fully equip each new facility and it might be valuable to have management discussions among the three electron microbeam characterization facilities to share experiences. The NSRCs benefit from similar interactions.

During this review period the three centers adapted to the philosophy of SUFD that involves a strong culture of service to users rather than individual research projects. In most cases the metric of the centers is user based. The process is an ongoing one and should be carefully followed in the next few years. During this period all three facilities received new equipment based on aberration corrected microscopy. The TEAM project was accomplished and now the challenge is to put those machines on line as user facilities. That will assure that the benefits of the TEAM project reach a broader base of users.

Theoretical capabilities have become weaker in all centers. This was pointed out in the previous review report, and yet not addressed. In particular the interpretation of Electron Micrographs is still not straightforward. The very wide spread idea that HAADF-STEM images can be directly interpreted is not supported by recent theoretical calculations that indicate that the intensity of atomic columns in an image is more complex than previously thought. Traditionally the e-beam centers were on the frontline of the theoretical development in this area. Unfortunately the theoretical work at NCEM is now zero. In order to advance at the same level as the

hardware, the software must be continuously developed. The same is true for analysis and interpretation of spectroscopic data.

#### FINDINGS:

- The documentation provided for the reviews by the microscopy facilities was not consistent with that requested.
- User time is not always distributed in an equitable way. In some cases the internal users receive a very large fraction of the time, in an other case a single user group accounted for 40% of the use.
- The facilities have worked very hard in improving the hardware and that is a very positive fact. The TEAM project is now achieved and important results should follow
- Theoretical analysis and image interpretation capabilities at the Centers has been reduced to almost zero

#### RECOMMENDATIONS:

- **Time on the instruments should be distributed in a more equitable and transparent way.**
- **The response of the facilities to the request for information in advance of the reviews needs to be more in line with the request**
- **The facilities should broaden their user base**
- **The instrumentation and mission of the centers should be high-end microscopy. Although some users are demanding more routine equipment this should be avoided. The nanocenters can fill the gap of equipment for routine examination.**
- **An effort should be made to develop theoretical capabilities.**
- **It is important to make the charge of the reviewers consistent with the information requested to the facility director.**
- **The three centers need to establish their own identities. Rather than acquiring the same hardware and capabilities a unique capability should be developed in each one.**

#### GPRA ratings:

- 1) New materials and structures for energy-related applications - Excellent
- 2) Chemical reactivity and energy process for energy-related applications – N/A
- 3) Development of new energy concepts – N/A
- 4) Development of new instruments – Excellent

## **5. Accelerator and Detector Research**

The Program for Detector and Accelerator R&D was reviewed and discussed with the Program Manager and Director to get their vision of how best to form the Program and priorities.

The previous COV made several recommendations regarding the Program, then nascent. Owing to delay in establishment of a full time Program Manager and budget constraints, their recommendations could not be acted upon. We have repeated their recommendations in the material below.

The review process in this Program follows the usual method for R&D proposals. Currently, “unsolicited” proposals form the input to the system. If the formal requirements are satisfied, the proposals are sent to expert reviewers, including foreign experts, for their comments along with a template for the subjects for reviewer comment. The reviewers’ opinions plus the budget realities and the priorities of the Program are then employed in formulating a decision to fund or decline. The procedures for Grants (universities) and FWP’s (DOE Labs) are somewhat different

### **FINDINGS:**

- We are pleased to find that since the inception of the Program with a full time Manager, the reviews, recommendations and documentation have become steadily more orderly and transparent. In addition there is a conscious effort to make the standards for acceptance more rigorous and the reporting of progress on an annual basis routine.
- A strategic vision for the program is being formed with important input from workshops designed to cover areas important for BES

such as the light source workshop held in fall of 2009, the results of which will be published in NIM. Other workshops concerning detectors and beamline optics and other topics in the accelerator and detector field are expected to follow.

- The Early Career Grants for young scientists are an excellent idea and a significant asset for BES.
- The program is supporting five each accelerator and detector R&D projects.
- A serious situation in the neutron detector area has developed owing to the shortage of  $^3\text{He}$
- Use of SBIR grants to promote work relevant to accelerator and detector technology has expanded a great deal, 31 awards were made in 2009, 19 in 2008 and 17 in 2007 with a total funding of 17.7M\$

#### Comments and Issues regarding Scientific Facilities:

The scientific efficiency of a facility depends on the quality of its tools and the expertise of the workforce that devises, constructs and operates them. Thus attention to tool and workforce development needs to be commensurate with the investment in these facilities to remain competitive on the world stage. Currently BES operates a capital suite of several billion dollars and spends three quarters of a billion dollars annually for its operation. The goal for the equilibrium-size of the new Program needs to properly take this into account, while noting the potential synergies and overlaps with R&D supported by other parts of DOE and other agencies.

#### **RECOMMENDATIONS (no priority order):**

- 1. The procedures for treating R&D proposals from universities and DOE labs should be made as similar as possible. A proposal template would facilitate achievement of this goal.**
- 2. Continuing the process of making review, funding and reporting requirements more rigorous and even-handed between universities and labs is encouraged**
- 3. The use of the SBIR resource has been pursued assiduously. It is recommended that when the “final” reports from the 2009 SBIR awards are available that a thorough review of the net result be made to determine the net value to the Program**
- 4. As the portfolio strategy develops, the use of solicitations to enhance areas of particular focus for the Program should be carefully examined. Possible examples include a) the current need for alternatives to  $^3\text{He}$  based neutron detectors, b) hard x-ray imaging detectors, or c) determination of the rf-superheating field of  $\text{MgB}_2$ . It is important that a significant portion of the supported work be the result of unsolicited proposals to avoid over-constraint of the Program**
- 5. Given that many of the accelerator and detector advances today are being made in Europe, the Program can derive great benefit by seeing the European accelerator and detector scene on the ground in the leading European laboratories. This experience will not only reveal what the competition is doing, but also provide contacts for reviewers of the frontier work that the DOE Program aspires to support**
- 6. While reviewer comments are summarized and transmitted to the PI's in the case of declined proposals,**

**this summary is not supplied for accepted proposals. Doing the same for accepted proposals could provide useful information and ideas to the PI's of accepted proposals**

- 7. For renewal applications it would be most helpful to proposal reviewers if the last annual report of the original proposal is included in the review package so progress achieved can be evaluated**
- 8. As the portfolio strategy develops the balance between detector and accelerator R&D support as well as the balance among short, medium and long term R&D must be dealt with. The interface between work supported as part of facility development connected with operations and the R&D supported by this Program will also need serious consideration.**

#### **GPRA Metrics**

**As this program is in its teething stage, application of GPRA metrics is not appropriate**

## **6. Construction Projects and MIEs**

### **Purpose and scope of the 2010 COV review.**

The Construction projects and MIE subpanel identified the key relevant processes in this area as: (a) DOE O 413.3A; (b) the SC-OPA led peer reviews of projects; and (c) the SC Management System.

The subpanel reviewed and assessed the application of the methods prescribed above as robust and successful in delivering projects on schedule, within budget and meeting the baseline technical performance parameters.

A total of 10 projects were reviewed, five construction projects and five Major items of Equipment, as summarized in Table 1.

### **Construction Project & MIE review process description.**

The subpanel discussed the elements of the charge with the SUFD staff and reviewed records and detailed reports on the projects identified within the scope of the COV. It was noted that there were many elements in the COV charge and associated documents that the COV was asked to comment on and provide suggestions for improvement where applicable. The Construction projects subpanel believes that improvements are possible in organizing and summarizing the information needed by the subpanel to meet the requirements of the COV charge and has made a recommendation to improve the efficacy of subsequent COV reviews.

### **Metrics and User definitions.**

Metrics utilized to evaluate the Construction projects and MIE component for the COV include standard cost and schedule indexes (Table 2.) for the projects that are in progress, and final costs and schedules versus approved baselines for completed projects. For the period of the COV, Table 2 shows that SUFD met and often exceeded BES annual goals of within 10% for cost/schedule performance

## **FINDINGS**

- SUFD manages approximately \$150-200M annually of active project work and projects have met baseline delivery objectives.
- The SUFD implemented the principles and practices of DOE O 413.3A to monitor and control projects through a Critical Decision milestones approach.

- SUFD also employs a comprehensive peer review methodology to periodically evaluate and make corrections where needed in project technical, budget, schedule and management performance.
- SUFD has implemented over the past 3 years the Office of Science Management System (SCMS), a web-based management tool that provides a comprehensive description of the Office of Science responsibilities, associated authorities and management approaches designed to deliver the SC mission.
- SUFD, within BES, utilizes a dynamic strategic plan for long-range facility planning and funding of advanced planning tasks, in conjunction with a broad series of user and scientific community workshops to define science needs.
- BES, including SUFD, focuses on a set of key factors to manage project success, including a strong reliance on qualified and experienced line managers in both government and M&O contractor roles, an integrated project team, risk management, active program involvement with committed management from executing laboratories, adequate budget and schedule contingencies and a stable funding profile when projects are baselined.
- While successful in executing projects now, the trend in workforce demographics and eventual dilution of experience could jeopardize continued success.

### **Comments and issues.**

- BES and SUFD have robust processes in place that have proved effective in the 2007-2009 period in successfully delivering projects and MIEs on time, within budget and meeting performance requirements. Complementing these processes has been a lean but highly experienced cadre of staff in BES and, in SUFD in particular, that has undergone in the same timeframe major changes in personnel.
- As in many areas of government and industry, general workforce demographics indicate the need for SUFD to analyze and address the potential vulnerabilities associated with the current key success records in projects, including succession planning and mentoring, intern programs for young employees, early implementation of lessons learned in planning, and building effective staff succession plans for critical roles among others. Such initiatives apply in government, in the M&O contractors who execute BES projects and in key industrial technologies. For the Construction Team in SUFD that is responsible for Construction and Major Item of

Equipment (MIE) projects, the present and immediately planned staff is believed to be adequate. However, the depth of staff in the Construction Team, in key BES Management positions, persons available to become or serve as Federal Project Directors, and in the key related Office of Project Assessment is considered tenuous for the purpose of maintaining effective project management into the future. This includes the lack of an adequate pool to draw from for succession planning and management. Some explicit effort to address work force development seems to be warranted.

- The volume of records needed to effectively complete the COV charge in the Construction Projects and MIE component is quite large and took much effort by the subpanel to get to the information relevant to the COV charge. Improved presentation of summary performance information for the next COV (2010-2012) could improve the efficacy of the next COV assessment, including:
  - Provide a list of the scope of projects reviewed from the prior COV as well as the current COV and include all CD status/phases for the current COV
  - Provide trace-back to proposals generated by earlier BESAC reports, including identification of the BESAC reports that originate the proposals leading to CD-0.
  - List project proposals generated by BESAC activity developed in the current COV
  - List proposals not acted on in the relevant COV scope
  - Annual costs for in-scope projects for each year of the COV
- The subpanel was not able to find evidence of a formal process that addresses all aspects of advance planning of projects in the initiation phase. Some aspects of this approach, including validation of early cost planning figures and funding of project initiation activities, are not documented.
- While the management processes for projects are well defined during construction, some facility reviews examined during this COV indicate that in some cases there have existed differing expectations among stakeholders with the ramp up of scientific output. SUFD should consider earlier involvement with project implementing contractors and stakeholders in planning the post-construction transition to operations phase to ensure uniform expectations and consistent plans are developed for the facility's level/pace of scientific output.

**RECOMMENDATIONS:**

- **Examine Work Force Development options and implement one or more as appropriate to maintain successful CMIE delivery.**
- **Improve efficacy of future COVs in the Construction project and MIE component through consolidated presentation of the most COV-charge-relevant information.**
- **SUFD be prepared at the next COV to present in detail planning and funding actions in support of project initialization phase (pre CD-0 thru CD-1/2.)**
- **SUFD should define a post-construction transition process that results in definitive plans with projects and managing contractors for realizing uniform expectations by all stakeholders for scientific output following CD-4.**

**Table 2. CMIE Summary for COV 2010**

			Performance Metrics			
Project	TPC	Most Recent CD	% Complete	Cum CPI	Cum SPI	As Of
LCLS	\$ 420.0M	CD-3	98.6%	1.00	1.00	Feb-10
NSLS-II	\$ 912.0M	CD-3	26.2%	1.04	0.99	Feb-10
USB	\$ 35.1M	CD-3	65.6%	1.00	0.93	Jan-10
PULSE	\$ 11.2M	CD-3	67.0%	0.99	0.97	Jan-10
STS	\$ 800.0 - \$1,500.0M	CD-0	N/A	N/A	N/A	N/A *
SING	\$ 68.5M	Tailored	88.1%	0.98	0.99	Feb-10
SING-II	\$ 60.0M	Tailored	24.2%	1.09	1.03	Feb-10
LUSI	\$ 60.0M	CD-3	42.0%	1.06	0.92	Feb-10
PUP	\$ 89.6 - \$96.1M	CD-1	N/A	N/A	N/A	N/A *
TEAM	\$ 27.1M	CD-4b	100.0%	0.97	1.00	Sep-09

\* Project is not baselined, no statistics are required.

# Appendix A

**DOE/BES  
Scientific User Facilities Division  
Committee of Visitors (COV) Review Panel  
Germantown, MD  
April 6-8, 2010**

## **Committee Members**

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**OTHER ATTENDEES:**

J. Hemminger, BESAC Chairperson (1<sup>st</sup> day only)  
J. Kirz, ALS **(Chairman of COV) (retired)**  
H. Kung, DOE  
L. Horton, DOE (1<sup>st</sup> day only)  
E. Rohlfig, DOE (1<sup>st</sup> day only)  
P. Montano, DOE  
A. Carim, DOE  
T. Brown, DOE  
R. Klaffky, DOE  
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# Appendix B

**COMMITTEE OF VISITORS  
Scientific User Facilities Division  
DOE/Germantown Complex  
April 6-8, 2010**

**AGENDA**

<b>Tuesday, April 6<sup>th</sup>, 2010</b>		
7:30 am – 8:00 am	Personal Transportation to Complex	Fairfield Inn & Suites by Marriott Germantown, Maryland
8:00 am – 8:30 am	Security Entrance, Committee to Assemble in A-410 Conference Room (Continental Breakfast Available)	COV members and BES staff
8:30 am – 8:45 am	Executive Session, Committee Assignments (Janos Kirz)	COV members
8:45 am – 9:00 am	BESAC and COV Process (John C. Hemminger)	COV members and BES staff
9:00 am – 9:30 am	Welcome and Introduction to BES and the COV process (Harriet Kung)	COV members and BES staff
9:30 am – 10:15 am	Overview of the Scientific User Facilities Division and the peer review process (Pedro A. Montano)	COV members and BES staff
10:15 am – 10:30 am	Executive Session (Conference Room, A-410)	COV members
10:30 am – 10:45 am	Break	
10:45 am – 11:15 am	Q&A with staff of the Scientific User Facilities Division	COV members and BES staff
11:15 am – 12:30 noon	Executive Session – Review files and jackets <i>(Neutron Committee – Conf. Room, G-426)</i> <i>(Nanocenters Committee – Conf. Room, E-401)</i> <i>(Light Sources Committee – Conf. Room, A-410)</i> <i>(Microscopy Committee – Conf. Room, G-207)</i> <i>(Accelerator &amp; Detector Research – Conf. Room J-108)</i> <i>(Construction Projects – Conf. Room, E-114)</i>	COV members (BES staff on call)
12:30 pm – 1:30 pm	Lunch (Conference Room, A-410)	
	Executive Session – Review files and jackets <i>(Neutron Committee – Conf. Room, G-426)</i> <i>(Nanocenters Committee – Conf. Room, E-401)</i> <i>(Light Sources Committee – Conf. Room, A-410)</i> <i>(Microscopy Committee – Conf. Room, G-207)</i>	

1:30 pm – 4:30 pm	<i>(Accelerator &amp; Detector Research – Conf. Room J-108)</i> <i>(Construction Projects – Conf. Room, E-114)</i>	COV members (BES staff on call)
4:30 pm – 5:00 pm	Questions and Answers with BES staff (Conference Room, A-410)	COV and BES Staff
5:00 pm	Adjourn for the day	
	Dinner (On your own)	

<b>Wednesday, April 7<sup>th</sup>, 2010</b>		
7:30 am – 8:00 am	Personal transportation to Complex	Fairfield Inn & Suites by Marriott Germantown, Maryland
8:00 am – 8:30 am	Security Entrance, Committee to Assemble in A-410 Conference Room (Continental Breakfast Available)	COV members and BES staff
8:30 am – 9:30 am	Full Committee Executive Session – (Continental Breakfast available)	COV members
9:30 am – 10:30 pm	Executive Session – Review files and jackets <i>(Neutron Committee – Conf. Room, G-426)</i> <i>(Nanocenters Committee – Conf. Room, E-401)</i> <i>(Light Sources Committee – Conf. Room, A-410)</i> <i>(Microscopy Committee – Conf. Room, G-207)</i> <i>(Accelerator &amp; Detector Research – Conf. Room J-108)</i> <i>(Construction Projects – Conf. Room, E-114)</i>	COV members (BES staff on call)
10:30 am – 10:45 am	Break	
10:45 am – 12:30 pm	Executive Session – Review files and jackets <i>(Neutron Committee – Conf. Room, G-426)</i> <i>(Nanocenters Committee – Conf. Room, E-401)</i> <i>(Light Sources Committee – Conf. Room, A-410)</i> <i>(Microscopy Committee – Conf. Room, G-207)</i> <i>(Accelerator &amp; Detector Research – Conf. Room J-108)</i> <i>(Construction Projects – Conf. Room, E-114)</i>	COV members (BES staff on call)
12:30 pm – 1:30 pm	Lunch (Conference Room, A-410)	
1:30 pm – 4:30 pm	Begin Draft report and recommendations - Executive Session – Review files and jackets <i>(Neutron Committee – Conf. Room, G-426)</i> <i>(Nanocenters Committee – Conf. Room, E-401)</i> <i>(Light Sources Committee – Conf. Room, A-410)</i> <i>(Microscopy Committee – Conf. Room, G-207)</i> <i>(Accelerator &amp; Detector Research – Conf. Room J-108)</i> <i>(Construction Projects – Conf. Room, E-114)</i>	COV members (BES staff on call)
4:30 pm – 5:00 pm	Executive Session (Conference Room, A-410)	COV members
5:00 pm	Adjourn for the Day	
	Dinner (on your own)	

<b>Thursday, April 8<sup>th</sup>, 2010</b>		
7:30 am – 8:00 am	Personal Transportation to Complex	Fairfield Inn & Suites by Marriott Germantown, Maryland
8:00 am – 8:30 am	Security Entrance, Committee to Assemble in A-410 Conference Room (Continental Breakfast Available)	COV members and BES staff
8:30 am – 9:00 am	Questions & Answers for COV Members and BES Staff	COV members and BES staff
9:00 am – 10:30 am	Complete Draft report and recommendations Executive Session – Review files and jackets <i>(Neutron Committee – Conf. Room, G-426)</i> <i>(Nanocenters Committee – Conf. Room, E-401)</i> <i>(Light Sources Committee – Conf. Room, A-410)</i> <i>(Microscopy Committee – Conf. Room, G-207)</i> <i>(Accelerator &amp; Detector Research – Conf. Room J-108)</i> <i>(Construction Projects – Conf. Room, E-114)</i>	COV members (BES staff on call)
10:30 am – 10:45 am	Break	
10:45 am – 12:30 pm	Full Committee Executive Session: Review and revise report (Conference Room, A-410)	COV members
12:30 pm – 1:30 pm	Lunch (Conference Room, A-410)	
1:30 pm – 2:30 pm	Closeout	COV members and BES staff
2:30 pm	ADJOURN (Except Team Leads)	
2:30 am – 3:30 pm	Team Leads complete written draft report	



**Report of the Committee of Visitors of the  
Scientific User Facilities Division  
to the  
Basic Energy Sciences Advisory Committee  
*Review of FY 2007, 2008, and 2009***

***April 6-8, 2010***

***Janos Kirz  
Chair of the COV***

***August 6, 2010***

# 2010 Committee of Visitors

## Scientific User Facilities Division

### Panel Membership

<i>Light Sources</i>	<i>Neutron Sources</i>	<i>Nanocenters</i>
Simon Bare, UOP	John Tranquada, Brookhaven	Richard Osgood, Columbia
Michael Bedzyk, Northwestern	Brent Fultz, Caltech	Ivan Schuller, UCSD
Gene Ice, Oak Ridge	Jim Rhyne, Los Alamos	Miriam Rafailovich, Stony Brook
Z-X Shen, Stanford	Robert Dimeo, NIST	Celia Merzbacher, SRC

<i>Electron Microscopy Centers</i>	<i>Accelerators and Detectors</i>	<i>Construction Projects</i>
Miguel Yacaman, UTSA	Maury Tigner, Cornell	Carl Strawbridge, (retired)
Bob Hwang, Sandia	Patricia Fernandez, Argonne	Dixon Bogert, (retired)
Phillip Russell, Appalachian SU	William Barletta, MIT	Ed Temple, (Fermilab/Argonne)

# Overall conclusions

- **The efficacy of the processes to review, recommend and document proposal actions are excellent**
- **The efficacy of the processes to monitor and review active projects, programs and facilities are also excellent**
- **Within the scope of DOE missions and available funding, the award processes continues to strongly enhance the breadth and depth of portfolio elements as well as their national and international standing**
- **The response from SUFD to the previous COV report is excellent**

# A. Implementation of previous COV recommendations

## **FINDINGS:**

- Implementation of the recommendations has led to improved process and documentation
- The COV is delighted to see increased SUFD staff, a major recommendation of the previous report
- Recommendation on theory retrofit for existing facilities has not been acted upon in the face of budgetary constraints.

## **RECOMMENDATIONS:**

- As the budget allows, continue to explore ways to establish theory programs at existing facilities where they do not exist. In the view of the COV, this is a highly cost-effective way to make the facilities even more productive.

## B. Assessment of COV process effectiveness.

### FINDINGS:

- Complete sets of files were made available to the COV.
- Documentation was thorough and well organized.
- Staff was fully available and cooperative in answering questions
- For the second time in a row, the timing of the COV coincided with an incomplete cycle of Nanocenter reviews.
- Dealing with paper files was seen as less efficient than if searchable electronic files would have been available

### RECOMMENDATIONS:

- COV timing: Avoid repeated coincidence with the cycle of nanocenter reviews
- At the first breakout session of the COV subpanels, schedule a brief update by the cognizant SUFD program manager for the facility type being assessed
- Consider making the documentation available in the future in electronic form

# Facility review process description and effectiveness.

## **FINDINGS:**

- The 3-year reviews of the facilities are well organized and well executed.
- The review teams are carefully selected for subject matter competence and lack of conflict of interest
- Facility response to the recommendations based on the reviews and SUFD guidance is uneven in timing and completeness
- Instructions to reviewers include assessment targets that are not communicated to the facilities
- There is some non-uniformity among facilities as to what is considered a high-impact journal, or what is considered a more standard publication
- There is some non-uniformity among facility types regarding the reporting of off-site (mail-in or ship-to) users
- Some of the reviews are overly long and detailed.

# Facility review process description and effectiveness.

## **RECOMMENDATIONS:**

- As part of future 3 year reviews, ask the facilities how previous recommendations have been implemented
- Provide the facilities with the questions directed to reviewers
- Further diversify the types of organizations the reviewers are drawn from, including industry representatives.
- Establish a uniform definition of publications and high impact publications.
- Establish a uniform definition of off-site users
- Ask reviewers to summarize major findings and recommendations at the beginning of their report

# D. General Issues

## FINDINGS:

- The quality of the scientists at the facilities is the critical asset that ensures excellence and success. The COV commends the SUFD for recognizing the importance of supporting staff research and the selection of high-quality scientists.
- Different types of facilities serve different scientific communities. They are all needed and important.
- Given the dependence of the BES Facilities on the tools provided there and the people who devise, construct and operate them, the COV commends BES on its recognition of this through its inception of a Program of Detector and Accelerator R&D.
- Productivity depends strongly on experimental apparatus, sample environment and software. These areas deserve added emphasis
- Many of the facilities produce an annual list of publications and currently available equipment using a common template.
- There is a change occurring in the culture of users: fewer users are now well trained in the operation of beamlines , endstation equipment, and data acquisition.
- The travel budget for the Division is too small for sufficiently frequent visits by the SUFD Program Managers to visit the facilities, or to assess comparable institutions abroad.
- There is an acute shortage of office space for SUFD staff

# D. General Issues

## **RECOMMENDATIONS:**

- Request an annual listing of publications and currently available equipment from all facilities
- Place added emphasis on maintaining state-of-the-art experimental apparatus, sample environment and software at all facilities to maximize scientific productivity
- Foster a pipeline of instrumentation, accelerator, detector experts
- Encourage more outreach to train present and future users in the use of the facilities
- Increase the SUFD Program Managers' travel- budget so as to be commensurate with the mission of the BES SUFD.
- Provide additional office space for the SUFD.

# OMB Program Assessment Rating Tool

- **Tool to evaluate progress towards the long-term (2015) goals of BES specified by OMB.**

	new materials	chemical reactivity	energy research	new instruments
Lightsources	Excellent	Excellent	Excellent	Excellent
Neutron sources	Excellent	N/A	Excellent	Excellent
Nanocenters	Excellent	Excellent	Excellent	Excellent
Electron Microscopy	Excellent	N/A	Excellent	Excellent
Accelerator & Detector	N/A	N/A	N/A	N/A
Construction	N/A	N/A	N/A	N/A

# Thanks....

- **To Pedro Montano, and**
- **To the program managers, division staff, and associated personnel for assembling review materials and being available for questions and all organizational aspects of the COV review.**
- **Special thanks to Linda Cerrone.**