

**Minutes for the
Basic Energy Sciences Advisory Committee Meeting
December 11, 2000,
Metro Center Marriott Hotel, Washington, D.C.**

BESAC members present:

Collin L. Broholm	Jack E. Crow
Mostafa A. El-Sayed	Laura H. Greene
Anthony M. Johnson	Cherry Murray
Geraldine L. Richmond, Chair	Zhi-Xun Shen, Vice Chair
Sunil Sinha	Kathleen C. Taylor
Edel Wasserman	

BESAC members absent:

David D. Awschalom	D. Wayne Goodman
Boris W. Batterman	Patricia M. Dove
James A. Dumesic	Robert B. Horsch
Walter Kohn	Marsha I. Lester
Anne M. Mayes	C. William McCurdy, Jr.
C. Bradley Moore	Richard E. Smalley
Joachim Stohr	Samuel I. Stupp
David E. Tirrell	

Also participating:

Meigan Aronson, Department of Physics, University of Michigan
Kent Blaisie, Department of Chemistry, University of Pennsylvania
Bruce Brown, Director, IPNS, Argonne National Laboratory
Patricia Dehmer, Director, Office of Basic Energy Sciences, DOE
Zach Fisk, Department of Physics, Florida State University
Beverly Hartline, Acting Dep. Assoc. Lab. Dir. for Strategic and Supporting Research at LANL
Frederick O'Hara, BESAC Recording Secretary
Toby Perring, ISIS, Rutherford Appleton Laboratory
Ward Plummer, Distinguished Scientist, ORNL and Distinguished Professor of Physics, The University of Tennessee
Andrew Taylor, Deputy Chief Executive Director, ISIS, Rutherford Appleton laboratory
Iran L. Thomas, Associate Director, Office of Basic Energy Sciences; Director, Office of Basic Energy Sciences, Division of Materials Science
John Tranquada, Head, Neutron Scattering Section, Department of Physics, Brookhaven National Laboratory

Approximately 30 others were in attendance as observers.

Monday, December 11, 2000

Chairwoman **Geraldine Richmond** called the meeting to order at 8:52 a.m. She thanked the members for their attendance on short notice, had them introduce themselves, and reviewed the agenda of the meeting. She introduced **Patricia Dehmer** to speak about news from the Office of Basic Energy Sciences (BES) and to give an outline of the procedures that would be followed during the meeting.

Dehmer started by reviewing the Office's activities related to neutron sources, largely in terms of the studies conducted and reports issued by BESAC and its subcommittees over the years. In *Neutron Sources for America's Future* (January 1993), which is available on the Web at www.sc.doe.gov/production/bes/BESAC/Neutron%20source%20America%20Future.pdf, Walter Kohn included the importance of neutrons to science and technology. This report set the stage for BES's subsequent activities in neutron science. Later, BESAC published *Neutron Sources and Applications* (January 1994), which is available upon request from BES. When it became apparent that the Advanced Neutron Source would not be built, BES and BESAC evaluated the possibility of upgrading reactors and accelerators while the next generation of neutron sources was developed. Each national laboratory was asked for proposals on upgrading its neutron sources. A proposal was received from LANSCE and one from IPNS, the two U.S. spallation sources; however, neither met the criteria set forth by BESAC for an interim facility to meet the nation's needs while the SNS was being constructed. Those criteria required an affordable (<\$100M) upgrade to produce a short-pulse spallation source in the class of ISIS. Upon review of the situation, it was recommended in the *Report of BESAC on Neutron Source Facility Upgrades and the Technical Specifications for the Spallation Neutron Source* (January 1996) that other paths be explored. That publication is available on the Web at www.sc.doe.gov/production/bes/BESAC/neutron%20source%20rpt.pdf. Subsequently, BES and DP jointly entered into an upgrade of LANSCE. After the permanent shutdown of the High Flux Beam Reactor, a subcommittee of BESAC headed by Martin Blume of the American Physical Society surveyed the field again and published its findings in the *Report of the BESAC Subpanel on Neutron Scattering* (February 2000), which is available on the Web at www.sc.doe.gov/production/bes/BEBESAC.

At this point, BESAC is considering the report of another subcommittee, which was charged to review the Intense Pulsed Neutron Source (IPNS) at Argonne National Laboratory (ANL) and the Manuel Lujan, Jr., Neutron Scattering Center (MLNSC). That subcommittee was charged to look at the science and facilities at each site, considering the full range of activities that occur there (e.g., isotope production). The forest fire surrounding LANL and the safety stand down that occurred at the LANSCE complex delayed the progress of this study of the IPNS and the Lujan Center, the report of which is now in draft form (November 2000).

Because a quorum was not present at this meeting of BESAC, Dehmer stressed that it was important that the minutes reflect the comments of the Subpanel, the discussions of the Committee, the comments by the public, plus any written statements submitted. The notes from this meeting will be circulated to the Committee members, and a vote will then be taken on the acceptance of the IPNS/MLNSC report.

She noted that the *Federal Register* contained a Notice of Open Meeting that was published Nov. 27, 2000. It said, "Public Participation: The meeting is open to the public. If you would like to file a written statement with the Committee, you may do so either before or after the meeting.

If you would like to make oral statements regarding any of the items on the agenda, you should contact Sharon Long at 301-903-6594 (fax) or sharon.long@science.doe.gov (e-mail). You must make your request for an oral statement at least 5 business days prior to the meeting. Reasonable provision will be made to include the scheduled oral statements on the agenda. The Chairperson of the Committee will conduct the meeting to facilitate the orderly conduct of business. Public comment will follow the 10-minute rule.”

To ensure the accuracy of oral comments, she requested that members of the public making oral statements submit a written statement no later than 15 minutes after the official close of the meeting. These written statements will be included in their entirety in the minutes of the meeting. It is expected that the meeting minutes will be available by early January 2001 on the BESAC website at www.sc.doe.gov/production/bes/BESAC/Meetings3.html. If and when it is approved by the full BESAC, the final report will be made available through the BESAC website at www.sc.doe.gov/production/bes/BESAC/charges.html.

In addition, she also noted that, at the prior BESAC meeting, \$30 million in funding for nanoscience and technology was announced. Subsequently, a notice inviting research-grant applications was published in the *Federal Register*. A copy of that invitation was distributed to the attendees.

Richmond recapitulated the procedure to be followed during the course of the meeting and declared a break at 9:14 a.m. The meeting was called back to order at 9:42 a.m. to hear **Ward Plummer** begin the summary and discussion of the Subpanel’s review of the IPNS and LANSCE/MLNSC facilities. He noted that, in September 1999, the Chair of BESAC, Geri Richmond, was charged by Martha Krebs, Director of the DOE Office of Science, to convene a subpanel to review the IPNS at ANL and the MLNSC at Los Alamos national Laboratory (LANL). He quoted from the charge letter:

“The first activity is a review of the IPNS and MLNSC. As you know, BES has begun the construction of the Spallation Neutron Source (SNS) at Oak Ridge National Laboratory and is upgrading the MLNSC jointly with the Office of Defense Programs. When commissioned in 2005, the SNS will be the world’s premier spallation source for neutron scattering research. However, during the interim and even past the time of the SNS commissioning, IPNS and MLNSC will be critical components of this country’s capabilities in neutron scattering. Therefore, I would like BESAC to review the science and the user programs at IPNS and MLNSC. The group that you assemble for this task should, of course, contain experts in the sciences enabled by neutron scattering, but it should also contain members who will be able to address the effectiveness of the user program; user support; proposal review mechanisms; availability, dependability, and reliability; and the vision for the future of each facility. By analogy with the Birgeneau study of the synchrotron radiation light sources, the review should consider the full range of activities at IPNS and MLNSC regardless of whether they are supported by the BES program. I would like to have this report by July 2000. With the completion of this study and that already under way for the electron beam microcharacterization centers, BESAC will have reviewed all of the major BES facilities. These reviews represent an outstanding effort that is recognized throughout the scientific community. I want to thank and congratulate you for the thorough and professional way in which BESAC has conducted these reviews.”

Because of the circumstances at LANL (the safety stand down, the forest fire, etc.), the review was delayed until the fall of 2000. He listed the Subpanel members and introduced those who were present:

- Chair, Ward Plummer, Distinguished Professor, The University of Tennessee (present)
- Meigan Aronson, Department of Physics, University of Michigan (present)
- Kent Blaisie, Department of Chemistry, University of Pennsylvania (present)
- Collin Broholm, Department of Physics and Astronomy, Johns Hopkins University (present)
- Jack Crow, Director, National High Magnetic Field Laboratory, Florida State University (present)
- Charles Duke, Vice President and Senior Research Fellow, Xerox Research and Technology
- Zach Fisk, Department of Physics, Florida State University (present)
- Stephen Lovesey, Head, Condensed Matter Theory Division, Rutherford Appleton Laboratory
- Toby Perring, ISIS, Rutherford Appleton Laboratory (present)
- Andrew Taylor, Deputy Chief Executive Director, ISIS, Rutherford Appleton Laboratory (present)
- John Tranquada, Head, Neutron Scattering Section, Department of Physics, Brookhaven National Laboratory (present)

The activities of the Subpanel included a kickoff meeting (Oct. 12–13, 2000, in Gaithersburg, Md.); the issuance of a request for information from directors of the facilities (Oct. 25, 2000); site visits to the LANL/LANSCE/Lujan Center (Nov. 14–15, 2000) and the ANL/IPNS (Nov. 16–17, 2000); the preparation of the Subpanel's report (Nov. 18–Dec. 8, 2000); and the presentation to BESAC (Dec. 11, 2000).

In setting the terms of the national agenda, all national studies have pointed out the usefulness of neutrons for research and technology. They also agree that the United States should be brought into a leadership position in the use of neutrons for science, medicine, and national defense. The flagship of this endeavor will be the \$1.41 billion SNS, which will be commissioned in the summer of 2006 and reach full power in 2008.

Currently, the neutron-scattering user base in the United States is ~1000; if the United States is to be competitive with Europe or Japan, it will need to have 4000 to 5000 users by the time the SNS is fully operational.

Under the charge, the Subpanel undertook to review the science and the user programs at IPNS and MLNSC, keeping in mind that the SNS, the world's premier spallation neutron source is coming along. Until the SNS is online, however, and even past that time, IPNS and MLNSC will be critical components of this country's capabilities in neutron scattering. For each facility, the review addressed the effectiveness of the user program; user support; proposal-review mechanisms; availability, dependability, and reliability; and the vision for the future (until 2008).

The benchmark chosen for comparison is ISIS, which is the world's best pulsed neutron source. Trying to do an international benchmark in these fields is difficult, as others before the Subpanel had found out. The National Academy of Sciences' Committee on Science, Engineering, and Public Policy said in its *Experiments in International Benchmarking of U.S. Research Fields*, "the key to the nation's leadership is the flexibility of the materials science and engineering research enterprise, its innovation system, and its intellectual diversity. But the ability of the United States to capitalize on its leadership opportunities could be curtailed because of shifting federal and industry priorities, a potential reduction in access to foreign talent, and

deteriorating facilities of natural materials characterization. Of particular concern is the lack of adequate funding to modernize major research facilities in the United States when facilities here are much older than in other countries.” In another quote, that Committee noted that “state-of-the-art facilities attract the world’s leading scientists, so excellent facilities often make for award-winning research.”

One observer, Thom Mason, Director of the Experimental Facilities Division at the SNS, made the general observation about the IPNS and MLNSC: “The most important things these facilities can do is to run reliably, build a user base, and do good science, training scientists to utilize the unique instrumentation associated with a pulsed spallation source.”

Plummer then turned the floor over to **Jack Crow** to review the methods used in the assessment. He noted that it was important to look at the operational reliability, the caliber of the staff, and the stewardship of the facility. In such a facility, scientific output is a product of proton beam power, target effectiveness, moderator optimization, number and type of instruments, quality of instruments, reliability, facility support, and users. If any of these factors is zero, output drops to zero, also.

Each of the facilities was rated on the basis of its source, reliability, instrumentation, support facilities, support staff, users, cost-effectiveness (in terms of both operation and science), stewardship management, and impact. For each of these measures, each center was rated as being outstanding, competitive, in need of improvement to be competitive, or unacceptable.

A host of earlier reports plus the new report from the National Research Council were made available to the Subpanel.

After the October kickoff meeting, representatives from the pulsed sources were asked for information about each of the facilities: source, instruments, reliability, facilities support, staff, users, scientific impact, costs, performance milestones, and plans for the future. Site visits were made to the LANSCE/Lujan Center, Nov. 14-15, 2000, and to the IPNS, Nov. 16-17, 2000, at which time presentations were made to the Subpanel by site personnel. The Subpanel also solicited input from experts.

The detailed information requested from the centers was:

- The Source:

- A brief description of the existing facility
 - Performance of the source: five-year trends of the availability, reliability, user schedules, and operational data

- Instruments:

- A brief description of each instrument, the research community served by each instrument, layout of the facility, and ranking of each instrument and beamline

- The reliability of each instrument

- The availability of beam time to different groups for each spectrometer [e.g., external users, instrument scientists, director’s discretion and other internal usage (including calibration and commissioning)]

- The user demand in terms of days requested and delivered on each instrument by scientific field, (i.e., physics, chemistry, biology, engineering, and other)

- The new investments, upgrades, and maintenance that took place in regard to the instruments during the past five years

- Support facilities:

Availability and planned facilities (sample preparation, computer analysis, etc.)

- Staff:
 - Size of the staff and their assignments, giving a breakdown of the staff according to areas (i.e., accelerator, scientists, technicians, and computing)
 - Assessment of quality of the staff
- Users:
 - An assessment of the quality of the user research program: For the past five years, list the 20 top publications sorted according to research area, citation index, and impact; list awards given to users and staff
 - Summary of the source and level of outside support for users
 - Distribution of users according to fields
 - User proposal-review process and allocation of user time: users per year, experiments per year, and proposals per year
 - Measure of user satisfaction
 - How is your facility increasing the neutron user base in the United States?
- Impact:
 - List the 20 most important papers during the past five years
 - List all publications in past five years
- Cost:
 - Operational, maintenance, upgrades and investment costs for the facility
 - Cost per paper
 - Cost per delivered beam day
- DOE milestones and performance assessment:
 - Outside review reports
- The Future:
 - What is the role for the facility for the next few years, what upgrades have been approved, and what plans are there for new instrumentation?

A table analyzing the user communities of major neutron sources was shown. The percentages of graduate students and postdocs in those communities were focused on:

	HFIR	MLNSC	IPNS	NIST ^a	ISIS
Graduate students	19%	30%	22%	28%	60%
Postdocs	12%	11%	20%	10%	

^aNational Institute of Standards and Technology

These numbers need to be increased for the MLNSC and the IPNS and the number of the U.S. user community needs to be increased, also.

A graph was displayed that showed the awards made by the National Science Foundation (NSF) (all directorates) and DOE/SC/OBES to university-based neutron scattering programs. DOE's awards were generally less than half of the total, and all of these numbers were still relatively small. Another graph showed the expenditures for university-based neutron scattering programs in. Here, DOE's awards were significantly less than those of the NSF. Again, though the amounts in question are small (a total of \$6 to 7 million).

Bar graphs of the annual budgets of the neutron scattering groups at ANL and Brookhaven National Laboratory (BNL) showed a disturbing decrease from FY 1989 to FY 2001, and data for

ORNL are similar. The science programs at the laboratories produce many of the users. What these graphs show is a steady erosion of support with time.

To bring to light some of the staffing issues and to show what is needed to support these facilities, a final table showed the levels of staffing in support of science and user programs at four neutron sources.

	ISIS	ILL	MLNSC	IPNS
Number of instruments	17	25	7	14
Number of scientists or research assistants per instrument	2.2	2.0	2.2	1.4
Number of technicians per instrument	1.0	1.0	0.5	1.0
Number of engineers and support staff per instrument	0.6	2.0	1.2	0.25
Total staff per instrument	3.8	5.0	3.9	2.7

The floor was turned over to **Andrew Taylor** to present the facility evaluations. He noted that the international benchmark, ISIS, is a source of 160 kW that operates 168 days per year with a 91% reliability. That works out to 687 mA-hr delivered. Its user community numbers more than 1200. They perform more than 600 experiments per year and produce more than 400 publications per year at an overall cost of \$80,000 per paper.

The Subpanel used a grading scale of Outstanding (++), Competitive (+), Needs Improvement to be Competitive (-), and Unacceptable (- -). This scale was applied to each of nine categories.

Source

The LANSCE source was rated +. At 80 kW and producing 100 μ A at 20 Hz, it is definitely competitive. It represents a major investment and capability. It produces excellent work in many areas ranging from isotope production to proton radiography and fundamental science.

The IPNS source was rated -. At 7 kW and producing 14 μ A at 20 Hz (actually better than that because a U²³⁵ target and solid methane are used to make it act as a 15-kW thermal/epithermal- and 50-kW cold-neutron source), it needs improvement to become competitive. It is an old facility.

Reliability

The LANSCE/MLNSC reliability was rated -. It is not running six to eight days a month and needs improvement. Its 550 hours per month of availability compares with ISIS's availability of 687 hours per month. The Subpanel did, however, note that the facility's managers were looking at ways to improve operations. They are taking a systematic approach, but they are working with aging systems that need investment to improve reliability. If no investments are made for improvements, the trend in reliability will go downward.

The IPNS reliability was rated ++. With a 95% availability during a recent week, its availability is outstanding for now, but that rate cannot be sustained with the current equipment.

Instrumentation

The Lujan instrumentation was rated -. It has a suite of 6 to 7 instruments, which are good in parts. Three of those instruments are in the user program, and two are world-class, which is important because one cannot do world-class research on less-than-world-class instruments. The Neutron Powder Diffractometer (NPD) is certainly a world-class instrument that attracts world-class researchers. Two of the instruments at MLNSC (MAPS and PHAROS) are illustrative of the problems there. ISIS has a machine similar to PHAROS that is making a major impact. At MLNSC, the ability is there, but something has gone wrong, and the equipment is not drawing the user community.

The IPNS Instrumentation was rated -. The facility has a well-balanced suite of instruments that are useful research tools despite severe under-investment. Indeed, five of them are producing world-class science, such as the publication “Magnetic Structures in the CMR Manganites: The Pseudo-2d System $\text{La}_{2-2x}\text{Sr}_{1+2x}\text{Mn}_2\text{O}_7$ ” by C. D. Ling, J. E. Millburn, J. F. Mitchell, D. N. Argyriou, J. Linton, and H. N. Bordallo [*Phys. Rev. B*62, (Dec. 1, 2000)]. The operation of the IPNS instrumentation is highly cost-effective; for example, the Quasielastic Neutron Spectrometer (QENS) was upgraded by a factor of 10 for \$700,000. It has much potential and serves as a testbed for the SNS.

Support Facilities

The Lujan support facilities were rated -. They are ranked well by user community, but the Subpanel thought that the users were not critical enough. The facilities need improvement.

The IPNS support facilities were rated -. The facilities benefit from the Materials Science Division (MSD) infrastructure but exhibit significant under-investment. Those facilities provided users coming in from the outside need improvement.

Support Staff

The Lujan support staff was rated +. They are dedicated and committed. However, the accelerator is understaffed. They have 3.9 staff per instrument, which is about the same as at ISIS; however ISIS has more instruments, so it provides more services with about the same number of staff.

The IPNS Support Staff support staff was rated +. They are dedicated and committed. The accelerator is seriously understaffed, although a program is in place to move this forward. Its 2.7 staff members per instrument is significantly less than the ratio at ISIS and is very stretched.

User Community

The Lujan user community was rated +. It has significant potential, and the Subpanel was very impressed with the young researchers, who are enthusiastic despite setbacks. The Spectrometer Development Team (SDT) concept has been successful in involving the University of California (UC) campuses.

The IPNS user community was rated +. The internal program in MSD is of absolutely outstanding quality. There is a strong commitment at all levels in the organization to the concept of a user facility. They know how to run a user facility. They also came to the Subpanel with an enhancement plan on how to develop the user base.

Richmond asked if shutdowns (like that experienced at the MLNSC) were more serious for younger researchers (in their pre-promotion years). She asked if the Subpanel had gotten any

sense that their careers had been damaged by the shutdowns. A. Taylor answered that a lot of them will be all right because the instruments they are using will produce world-class research.

Cost Effectiveness

For LANSCE/MLNSC, the cost-effectiveness of operations funded by BES is in need of improvement and was rated -. But if one looks at the whole LANSCE program, the overall cost-effectiveness of operations is unacceptable (- -). The cost-effectiveness of the science funded by BES was rated +, but the overall science cost-effectiveness was rated -.

For IPNS, the cost-effectiveness of operations (at 7 to 8 k\$ per instrument day) was rated outstanding (++) . In terms of science output, the cost-effectiveness was rated +, taking the strength of the source, the instrumentation, etc. into account.

The comparative numbers for these measures are

	LANSCE	IPNS	ISIS
Average cost per facility day in 1999 (in thousands of dollars)	910	81	222
Average cost per instrument day in 1999 (in thousands of dollars)	182	6.8	12

Stewardship/Management

The LANSCE stewardship and management was rated - - because the performance is far below the potential and the operation of the MLNSC is grossly inadequate. The Subpanel saw no correlation between articulated priorities at all levels and funding flow. Richmond asked for examples. A. Taylor continued that there was a lack of focus over a prolonged period of time that was still ongoing. The management is not looking at how to add to the facility and how to improve reliability during the next 5 years. An isotope-production facility is proposed, but it weakens the management focus. Proton radiography has detracted from the neutron-scattering capabilities. All the words were there, but the actions were not. The rhetoric was excellent, but there was no correlation with actions over a sustained period. Multiple sponsors lead to no single champion. There was no clearly identifiable action plan at the highest levels in LANL and in DOE, which the Subpanel found appalling. The differences are in operating time and in the quality of spectrometers. Putting in more money will not solve the problem. The commitment has to be enhanced from the MLNSC floor to the upper reaches of DOE.

The IPNS stewardship was rated +. They are a well-integrated team that is internationally acclaimed. They have a real commitment to running a user facility and are enthusiastically embracing the SNS. Overall, this facility is truly outstanding, but it is let down by the lack of support and commitment from DOE.

Impact

The impact of the LANSCE/MLNSC was rated -. It produces a modest impact compared with its resources; it is overshadowed by the IPNS. However, there is a broad range of competencies on the mesa in terms of the GENIE (GENetic Imagery Exploitation) detector developed at Lawrence Livermore National Laboratory (LLNL) and in proton radiography. The MLNSC has great potential for both internal and external programs, but at the moment it needs improvement.

The impact of the IPNS was rated +. The facility has a reservoir of expertise and a track record of seminal developments that is second to none (in targets, moderators, software, etc.). The international standing of the staff in both IPNS and MSD is high. Their outreach to build a community is particularly praiseworthy, but the impact is moderated by the low source strength and the lack of investments in instrumentation. An order of magnitude improvement in the source strength needs to be achieved.

In summary, LANSCE/MLNSC has the potential to be a world-ranking user facility. There is a latent user community both internally and in the UC campuses that could use a world-class machine. The staff on the MLNSC floor and in the SDTs show promise, and there is evidence of commitment at all levels, but the lack of integration renders this ineffective. The IPNS is an outstanding value. Its impressively well-integrated team keeps an outmoded source operational at the highest levels of efficiency. The facility could be sustained and enhanced with modest investments. Indeed, the Subpanel was presented with a plan that identified cost-effective upgrades. There is a window of opportunity to pass on IPNS's expertise to a new generation of researchers. It is committed to success at all levels and has a new director.

Summarizing the scores gives the following tally:

	LANSCE/MLNSC	IPNS
Source	+	-
Reliability	-	++
Instrumentation	-	-
Support facilities	-	-
Support staff	+	+
User community	+	+
Cost-effectiveness		
Operations	--	++
Science	-	+
Stewardship/management	--	+
Impact	-	+

There is a gradient (trend) on these numbers that is quite frightening. That gradient will take reliability down, the staff will leave, and the impact will go down.

The findings of the Subpanel are:

- It is imperative that every spallation source in the United States is utilized to its full potential to ensure that a sufficiently large and well-trained user community exists when SNS is fully operational in ~2008.
- It is essential to substantially increase the size of the neutron user community to fully exploit the SNS; this will not occur in a timely fashion without an active program.
- The IPNS is an extremely reliable source with a talented and experienced staff. However, the facilities (the source and some instruments) are in need of improvements to make them more competitive and to maintain reliability.
- The LANSCE/MLNSC has a competitive source, and the facility could be world-class. However, the governance is dysfunctional, and the management scheme is not compatible with effective stewardship and the operation of a national user facility.

El-Sayed asked if the United States is losing some of its best people as they leave here and go to ISIS. A. Taylor responded that what ISIS is doing is taking the cream of the U.S. neutron scatterers. ISIS opened up its doors to university faculty; it does not just serve the facility staff. The staff at the U.S. facilities are there to serve primarily the internal researchers. El-Sayed asked if the market for these people is better in Europe than in the United States in this field of endeavor. A. Taylor said that there was a renaissance in Europe's universities during the past decades, and it is easier for researchers to get involved at the European centers.

The floor was returned to **Ward Plummer** to present the recommendations of the Subpanel. He referred to the numbers presented by Crow. What is important is that 60% of the ISIS users that are graduate students or postdocs, which was much greater than the numbers at U.S. facilities. Wasserman asked how those students broke down into full-time expert users in neutron scattering, those for whom neutron scattering was a major instrument for research, occasional users, and casual users. A. Taylor responded about 25% were full-time expert users, about 25% used neutron scattering as a major instrument for research, about 25% were occasional users, and about 25% would come in to run a single (but critical) experiment. Johnson asked if the pharmaceutical industry represented a major part of the user community. A. Taylor said that the 1% of users who buy proprietary time are engaged largely in surfactants and polymers. Their proposals are peer reviewed, though. Some industrial users, however, come through universities, and the facility management cannot tell who the industrial sponsors might be. Plummer stated that the universities must be the source of an increased user base, not the industrial researchers.

Plummer showed a table containing the ratings that the Subpanel had assigned to the two facilities for the different attributes considered. He asked a rhetorical question: What needs to be done to move these scores from the negative into the positive columns?

The recommendations for the IPNS were given first: Immediately enhance activities at the IPNS facility.

- Invest to maintain the excellent reliability.
- Invest to enhance the IPNS source and instrumentation.
- Expand operation of the user program to 30 weeks per year.
- Strengthen scientific programs at ANL that develop the user base and scientific agenda for the SNS.
- Explore the possibility of developing and operating first-class instruments at IPNS that can later be moved to SNS.

The estimated cost for these improvements is an additional \$9 million per year.

The recommendations for the LANSCE/MLNSC were then given: Restructure the LANSCE/MLNSC to deliver an internationally competitive user facility.

1. A single Steward for this facility must be appointed, incorporating all the different DOE offices and UC. The Steward is charged with single-point budget, policy, and priority responsibility. In the opinion of the Subpanel, UC is likely the best choice.
2. This Steward shall deliver an adequately funded actionable implementation plan for FY 2002, sustainable over the period 2002 to 2008, to generate a fully functional user facility, competitive with international benchmarks (e.g., ISIS).
3. The plan must specify a ramp-up schedule for LANSCE/Lujan to fully functional status by FY 2003 in time to impact the SNS ramp-up in 2006.
4. A fully functional neutron facility should have increased the LANSCE/MLNSC user base to about 1000 by 2006.

At the present time, money is not the problem at this facility. Given the quality of the instruments at this center, surely this facility has a life after the SNS.

An equally important recommendation was that the university base for neutron scattering be expanded at the LANSCE/MLNSC by

1. initiating a well-funded facility-based user program that pays travel and living expenses (seen to be the best way to grow young scientists),
2. establishing joint university–neutron scattering facility partnerships,
3. developing a national agenda for enhancement of neutron scattering research in the United States, and
4. strengthening the national laboratory neutron scattering groups.

It is important to keep this user base from continuing to deteriorate. What the Subpanel would like is a three- to four-fold increase in the academic user base by the time SNS is functional. The second item in the above list could be done immediately by the laboratory's directors; currently, only one such partnership exists (at ANL).

In summary, Plummer noted that neutrons are an important probe of matter of all sorts and that the Subpanel's recommendations would be even more important should something happen to derail the SNS.

El-Sayed said that other agencies' [e.g., the Department of Defense (DoD) and NSF] putting money into the initiative would also improve the situation. Plummer replied that this is a DOE panel with no advisory power for other agencies, but that the NSF and others could improve support significantly through a number of vehicles.

Greene said that what was not clear was what the Subpanel wanted to do with the management structure at LANSCE. What changes would have to be implemented? How do we salvage these great facilities? Plummer responded that it has to be salvaged and pointed out that there is a suggested management structure in the Subpanel's report. He noted that someone in DOE has to be the point person. Greene asked how many are involved in running LANSCE? A. Taylor said that the line management of LANSCE is different from that at MLNSC. The situation is complicated by multiple sources of DOE funding. Instead of a line, you could almost draw circles. Thomas noted that LANL is a DOE weapons laboratory. It uses a matrix-management system. The programmatic line obtains the funding, and another line executes things. Allocation of funding is performed by those that secure the funding. SC is a relatively small funder of LANSCE, predominantly for the MLNSC. Of the two separate appropriations for LANSCE (national security and science), the Office of Defense Programs (DP) is the major driver. Greene asked how BES is going to get into this matrix and get the management structure changed. Thomas responded that this facility was originally established to perform nuclear physics, and neutron scattering was added as a parasitic use. The nuclear-physics work was finished, and the facility was shut down. The laboratory director declared that it was a facility that was essential for national interests, and SC funding was restored when the linac was reactivated. The SC funds were used for instrumentation.

Richmond noted that LANL's management needs to bring forward a plan; it is not the Subpanel's responsibility to revamp the management. If a management revamping is not carried out, however, shutdown is a possibility. Richmond said that she would like to see this plan presented at the BESAC February meeting. Wasserman asked what would have to be in that plan and who would have to approve it? Thomas said that that action could go several ways: DP could shut down the linac and that would be the end of the Lujan Center because SC would not be able

to come up with the money to operate the linac. The first step is that the Laboratory has to come forward with a proposal. Wasserman noted the number of the agencies involved in managing LANSCE and asked whether consulting with all those agencies would make meeting even an April deadline infeasible, let alone a February deadline. Plummer responded that what the Subpanel was asking was that the laboratory management prepare a plan by April 2001 and have that plan subsequently approved by the sponsors. He went on to say that everyone in the LANL management believes that the Center is important to the Laboratory, but they do not have any idea how to run a user facility. They do not understand what they have to do. They get confusing signals from their different sponsors. It is a DOE problem; BES and DP have to talk to each other. Thomas interjected that first DOE has to understand what the Laboratory wants to do.

Plummer noted that the Subpanel thought that the present report would be presented at the February meeting; that is why the Subpanel recommended the April date for LANL to respond.

Murray asked what the DOE goal for LANSCE is. Is improving the weapons program the real goal? Plummer said that the Subpanel did not know, but 40% of the postdocs that come into LANSCE stay in the DP activities. The facility is a major source of trained personnel for DP, and it is a source of important materials-science research for them, as well. Crow added that a critical portion of the DP material-science research is done at the MLNSC. Murray stated that BESAC should hear from someone in DP in February. Plummer said that is BESAC's job, not the Subpanel's.

K. Taylor asked if the DP use of the facility is represented in the user numbers. Plummer said that, yes, they were listed as users. Thomas went on to say that the users group includes all the users, including those from DP. K. Taylor observed that then the instrumentation there would not be used and the user community would go away.

Greene asked again if BESAC was going to hear from someone at LANL on how they are going to revamp their operations. Dehmer said that the Subpanel and the Committee will have to think and talk about this. (The Subpanel's charter will be posted on the BESAC web site.)

A lunch break was declared at 11:35 a.m. Richmond asked the members to consider during lunch what issues have not been brought up. Public comment would be held after lunch. It is important that the Committee get enough information from the Subpanel members present to hold a vote on the issue once the minutes are available.

The session was reconvened at 1:15 p.m. Richmond said a discussion would be held among the BESAC members and then public comment. The report will be posted on the Web, the minutes will be sent to Committee members, and a vote will be taken early in January.

Wasserman stated that the rationale for an increased number of users (from 1000 to 4000) to bring about parity with Europe and Japan by itself is not a particularly strong justification. The case could be strengthened by focusing on the technical opportunities for new science, and that could be phrased in terms of DOE's mission. Also, the focus on the university community is too narrow. Industry would make up more users if there were an effective, personnel interface with "inexpert" outsiders, thus making the experience more inviting and beneficial to them. In addition, the term "dysfunctional" and other negative characterizations are, perhaps, too strong. Instead of looking at the past, the report might say that other opportunities now exist but would require new management structures.

El-Sayed noted that such a report should invite a response from those at the institutions. He went on to voice a strong opinion that any funding provided should not come from the core research. Shen concurred and said that, in increasing the number of users, we must not dilute the

amount of support available. The core expertise must not be diluted. As much as possible should be done to increase the output at ANL. It is less clear what can be done at LANL.

Richmond said that ANL and the IPNS should be congratulated for good operation and management and should not be overshadowed by the experience at LANSCE. She opened the floor to public comment.

The first speaker began, "I am **Beverly Hartline**, Acting Deputy Associate Lab Director for Strategic and Supporting Research at Los Alamos. First, I want to thank and commend Ward Plummer and the panel he led for doing a thorough and thoughtful job that responded well to the charge from the DOE Office of Science. Second, I will reiterate the statements of LANL's Senior Executive Team that LANSCE and Lujan are important to the Laboratory, serving its national security and science missions. Due to the presence at LANL today of the Secretary's Commission on Science and Security, led by John Hamre, no members could be here at this BESAC meeting.

"The Laboratory acknowledges both the outstanding potential of LANSCE/Lujan and the important issues the panel brought forth. We understand that the burden is on us to demonstrate that we can produce neutrons reliably at the Lujan Center for scientific and national security users, and we are prepared to do that. The plan recommended by the panel is an obvious first step, and elements of this planning are already under way.

"As a public institution, Los Alamos has an obligation to the taxpayer, to the scientific community, and to our programmatic sponsors to meet their high expectations and capitalize on the unique capabilities available at LANSCE and the Lujan Center. We agree that LANSCE is, and it is important for it to remain, a valuable resource to the scientific community.

"We cannot change the past. We can learn from the past and change the future. We look forward to seeing the panel's final report as soon as it is available. We would appreciate the opportunity to view the report in draft, if possible."

A second speaker came forward and stated, "I am **Bruce Brown**, director of IPNS at Argonne. I also want to thank the Subpanel for doing a very thorough review. I am, naturally, gratified to hear the many nice words from the Subpanel on IPNS operation and scientific impact. I would like to emphasize the importance of acting on the Subpanel's recommendation of additional funds for IPNS operation, accelerator maintenance, instrument upgrades, and enhancement in the MSD and IPNS science programs. We can start all of these immediately and the maximum impact requires additional funding, starting this fiscal year. I would also like to emphasize the importance of increasing university support. Our enhancements are designed to leverage activities at the universities in order to broaden and enlarge the user community.

"One final note. We've run very successful neutron and X-ray schools at Argonne for the past two summers, as a start toward broadening the community, and intend to again if funds are provided."

There being no further public comment, Richmond asked Dehmer to explain what path the Committee might follow. Dehmer thanked the Subpanel members for their hard work, their attendance at the meeting, and the information they provided. They did a good job. Congratulations were offered to ANL. There is also good news at the MLNSC in terms of its excellent new instrumentation and associated personnel. The path that might be followed is:

1. Approval of the report in as expedient a manner as possible.
2. Mildred Dresselhaus will be asked to brief the National Nuclear Security Administration (NNSA) and DP at DOE Headquarters (not at LANL) about the situation at LANL.

3. This report will be taken to Office of Science and Technology Policy (OSTP), where there have been preliminary talks on how DOE and NSF can support neutron science.
4. A detailed report will be required of the IPNS, and a formal response will be required of LANL at the February BESAC meeting.
5. When the report is finalized, what it means for DOE's investment strategy in FY 2001 will be considered.

Richmond then asked to go around the table to get people's response to the recommendations as they were presented in the Subpanel's report (as amended by the movement of the date of a required plan from April to February and by the request that funding not come out of the core funding). She also noted that Committee members who were not able to attend the meeting would be given the opportunity to submit written comments on the report; those written comments are included here at the end of the minutes.

Sinha: This course of action is exactly what is needed for the future of neutron scattering in the United States. I am in favor of accepting this report.

Crow: I support the report with some additions (e.g., an introduction and a list of the science drivers of the facilities). Although I am concerned about the length of the report (which is currently approaching 70 or 80 pages), we have to include the connection between the number of users and the science drivers. Certainly, the SNS is justified by the science that can be done with it; it is not just that we want parity with Europe. This justification can be done in part by referring to the extensive documentation extending back to the 1970s that clearly expresses the promise of neutron science. Quite often the justifications offered for facilities are not reflected in the successes; we need to open the doors to these new uses and applications. Unexpected breakthroughs and uses will happen again in the SNS. I would underscore the role OSTP could play in developing neutron sources to stimulate science broadly. Both of these facilities are absolutely needed, and both will be needed as fallback positions if something happens to the SNS.

Broholm: I strongly endorse the report. For a number of reasons, the U.S. neutron-user community has not grown at a rate comparable to the growth in Europe and Japan during the past several decades. This is particularly true for pulsed-neutron users because the success of the ISIS facility has not been matched in the United States. The SNS promises a renaissance for neutron scattering in the United States that will produce a broad range of scientific and technological progress. However, to make proper use of the SNS, especially in the important formative years, we must move aggressively to integrate pulsed neutrons in our R&D infrastructure now. The Subpanel report makes recommendations that, I believe, can achieve this objective if enacted on a timely basis.

Johnson: I would like to commend the panel. I have learned a lot from this report. I think it is important to stress the coupling between these facilities and the SNS. Having resources up and running at full capacity is a further justification for the SNS. It is, therefore, critical that these facilities meet or exceed the recommendations of the Subpanel.

Shen: I think that this is a very good report and I believe that the Subpanel has done an outstanding job. I think the Subpanel's report should be accepted. In emphasizing the desire to significantly increase the total number of users, it should be stressed that this should not come as a dilution of support for good users. I encourage BES to provide more support for IPNS to fully realize the potential of the facility. LANSCE is also crucial for the neutron community. A new strategy is necessary to bring this facility to its full potential.

Richmond: I also want to thank the Subpanel for its hard work, and I reiterate how supportive I am of the whole venture leading toward the SNS. I want to make sure that the neutron-science community grows in a healthy manner and that excellence is a top priority in the science coming out of these facilities. So I also support the recommendations.

Murray: I also appreciate all the hard work that the Subpanel put into the report, and I appreciate the candor of the report. I would have liked to have seen more emphasis placed on the quality of science produced at each of these facilities, not just the number of papers, however. I also support the recommendations.

Greene: First, thank you! Your report was very clearly written and presented. It became obvious that the IPNS, with strong financial supplements, will benefit in all the criteria (benchmarks) you used; most becoming “++ = outstanding.” A facilities upgrade is clearly crucial, but of utmost importance is an increase in personnel. Permanent staff must be increased so more post-docs and visiting professors can be trained (perhaps to be SNS staff and users later). The university staff must be increased to meet this growth goal of approximately 4000 users by 2002. However, the recommendations for Lujan are less clear. The LANL management structure, a complicated BES + Defense DOE/LANL “matrix management “ structure makes this very difficult. We need to hear from DOE/BES + Defense/LANL in February to see if Lujan is salvageable. I recommend that, for the February BESAC meeting, some Lujan management with BES and Defense DOE management present a management/stewardship plan that will work. If they can, we need to see implementation by the April BESAC meeting. If not, we should consider the possibility of cutting it completely.

El-Sayed: I also congratulate the Subpanel for its investigation and finds. I support the report and suggest that DOE put money in material science and that NSF fund medical research to support these facilities.

K. Taylor: The report has a quantitative approach to it. It brings home deficiencies. Looking forward, however, does not have metrics, but it is just as important. You cannot be so quantitative looking forward. I hope this report also tries to capture the forward-looking comments and ideas. People today can go anywhere they want to conduct their research, and where they do the science influences the community in which they do the science. There *is* a global competition in science, and we need to build the facilities that enable that science.

Wasserman: The opportunity here is large. The costs needed to upgrade these facilities are small in comparison to the value that would be received.

Richmond noted that the support for the Subpanel’s report seemed to be unanimous and said that the Committee should expect reports from IPNS, LANSCE, and Pat Dehmer on this topic at the next BESAC meeting.

Richmond asked if there were any additional comments from the Committee members or the public. Not hearing any, she adjourned the meeting at 1:53 p.m.

After the meeting, the following written comments were received by the Committee from Colin Broholm:

“In response to the comments of Ed Wasserman concerning criticism of LANSCE management I would like to emphasize that it is the system not any individual that is criticized in the report. The subpanel met dedicated and competent leaders at LANSCE. However structural problems in the LANSCE/LANL/DOE system have prevented these leaders from achieving their objectives. This is why the report emphasizes that the overall stewardship problems must be solved before progress can occur.

“I also agree with Dr. Wasserman that growth in the neutron scattering community certainly cannot be a goal in and of itself. We invest in neutron scattering to achieve scientific and technological progress. The report provides best estimates for how many scientists are needed to harvest the benefits of the technique for the US at the present time.”

Respectfully submitted
Frederick M. O’Hara, Jr.
Recording Secretary