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June 30, 2016

Dr. Cherry Murray
Director, Office of Science
U.S. Department of Energy
1000 Independence Ave., SW
Washington, DC 20585

Dear Dr. Murray,

In a letter from your office dated September 21, 2015, NSAC was asked to assemble a Committee of Visitors (COV) to review the management processes of the Department of Energy Office of Science's Office of Nuclear Physics program. The request stated that the panel should provide an assessment of the processes used to solicit, review, recommend, and document proposal actions and monitor active projects and programs for both DOE laboratory and university programs during the fiscal years 2013 through 2015.

NSAC – then chaired by Dr. Don Geesaman – formed a COV, which was chaired by Prof. Gail Dodge of Old Dominion University. The COV was slated to meet in Germantown for three days in January, 2016, and was requested to prepare its report by the end of March. Unfortunately, the so-called "Snowzilla" winter storm coincided with the COV meeting; the meeting was cancelled and rescheduled for March 1-3, 2016. The subsequent report was presented to NSAC at its June 27th meeting. Following a thorough discussion, the report was approved unanimously. It accompanies this letter.

There are a few high-level conclusions I would like to share with you in this transmittal letter.

- The science program was deemed to be either world-leading or world class in each of four major subareas of nuclear physics. This is consistent with findings from the 2015 Long Range Planning process and the 2013 comprehensive Comparative Research Review exercise. The COV found that "NP has been an effective steward of nuclear physics resources in support of the priorities of the community."
- While the COV offered across-the-board praise to the NP Office for the quality of its work, several recommendations related to filling critical vacancies in the Research Division emerged. Most importantly, "The vacancy in the Research Director position constitutes a significant risk to the quality of the research review process and effectiveness of NP as a whole." We trust that OS will be supportive of every effort to help fill this critical position soon.
- You will notice a significant discussion of PAMS and a recommendation to OS to "redouble efforts" to make it fully functional.
- Finally, while no evidence of bias was found in any funding decisions owing to gender or

ethnicity of PIs, the COV considered how NP might take the next step in promoting diversity and inclusion in their programs. The longer term goal would be to increase the participation of underrepresented groups in physics.

Sincerely,

David W. Hertzog
Professor of Physics
Chair, NSAC

cc: Pat Dehmer, DOE
Tim Hallman, DOE
F. Fleming Crim, NSF
Allena Opper, NSF

Report of the
Committee of Visitors of the Office of Nuclear Physics
(FY 2013, 2014 and 2015)
March 1 – 3, 2016
Germantown, MD

Presented to the
Nuclear Science Advisory Committee

June 27, 2016

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I. Executive Summary

A meeting of the Committee of Visitors (COV) for the Department of Energy (DOE) Office of Nuclear Physics (NP) was convened at DOE headquarters in Germantown, Maryland, March 1 – 3, 2016. The COV was charged to evaluate (a) the efficacy and quality of the processes used to solicit, review, recommend, monitor, and document application, proposal, and award actions; and (b) the quality of the resulting portfolio, including its breadth and depth, and its national and international standing. The review period for this evaluation is FY 2013 – FY2015.

The agenda consisted of presentations by NP staff, breakout sessions in which subcommittees investigated various aspects of NP operations, and meetings with program managers and NP management. A list of the committee members can be found in the Appendix. Extensive briefing materials were made available to the committee before the meeting. The committee was very impressed with the dedication and talent of the NP staff. Everyone was very helpful and forthcoming. Requests for additional information were fulfilled quickly and thoroughly.

The science portfolio managed by NP positions the U.S. among the world leaders in nuclear physics research in subfields as diverse as hot, dense nuclear matter, the quark structure of matter, nuclear structure, nuclear astrophysics, and neutrino science. Investments in discovery science include national laboratories, user facilities, universities, and international research collaborations. The goals of the 2007 NSAC Long Range Plan have been substantially achieved, despite highly constrained budgets. The committee concludes that NP has been an effective steward of nuclear physics resources in support of the priorities of the community.

The committee took a close look at the Comparative Research Review (CRR) processes and outcomes. We concluded that the CRR was well managed; it helped to optimize the research portfolio, free up money for new initiatives, and defend the overall level of funding. One of the values of the review was the opportunity to evaluate lab research alongside university research. An important part of the process was the opportunity for terminated groups to re-compete with new proposals the following year.

The Facilities and Projects Management (FPM) Division manages a very broad program of complex projects as well as accelerator R&D and SBIR/STTR programs. It is notable that the excellent performance of the operating facilities was achieved concurrent with two large, ongoing construction projects. These major construction projects are well-aligned with the NSAC Long Range Plan.

The committee is impressed with the progress over the review period towards further enhancing the availability of priority isotopes. Notable accomplishments include continued production of record levels of isotopes, formal evaluation of commercialization of Ge-68 production, and the initiation of major development efforts such as accelerator facility

upgrades, the Enriched Stable Isotope Pilot Plant (ESIPP) and the Tri-Lab Ac-225 production development effort. The Isotope Program is well organized and well managed.

The FPM Division is now fully staffed. However, the vacancy in the position of Physics Research Division Director is now in its 5th year, with the Associate Director filling this position in an acting capacity. Further, there are three openings for program managers in the Physics Research Division. Although NP has run searches for the Research Division Director and two of the program manager positions, so far they have been unsuccessful. We commend the hard work of all members of the NP staff who have had to pitch in to cover some of the responsibilities of the open positions. As detailed in this report we have found no evidence that the quality of the NP proposal review process has been compromised, but the recent departure of the low energy program manager renders the current situation even more critical. We believe this situation constitutes a significant risk to the future efficient and effective operations of NP.

The Portfolio Analysis and Management System (PAMS) database is online and gradually adding functionality. PAMS is now being used to submit and review proposals, maintain information on reviewers, and document and process funding decisions. The COV has two major interests in PAMS. The workload of the program managers is extremely heavy. Any systematic improvements that allow them to do their jobs more efficiently are highly valued. The initial indications are that the system is helping with proposal reviews and saving time during the processing of new awards for funding. The other extremely important capability is the collection of the optional personal profile information to enable the office and external reviews like the COV to have the data to search for potential biases in operations. It is too soon to determine the effectiveness of PAMS at collecting and tracking demographic data. The COV encourages NP to monitor the response rate, particularly for junior researchers (graduate students and postdoctoral researchers) and take action as necessary to ensure the community populates the PAMS database.

We acknowledge that it no longer makes sense for NP to pursue tracking of demographic information separately from PAMS. We also understand that NP staff pay attention to diversity information in the selection of panel members and in other aspects of their work. NP is in a position to play a pivotal role in promoting diversity and outreach throughout its portfolio. To the extent possible within the Federal system, targeted enhancements to current NP activities should be considered and could have far-reaching effects in the field.

The assessment of the committee is that 9 of the 15 Recommendations from the 2013 COV have been fully addressed. The remaining 6 Recommendations are related to subjects that continue to require the attention of NP (staffing, workforce analysis, and the path forward for defining the post-CRR peer review process) or the Office of Science (PAMS database development and demographic tracking).

The COV makes the following five recommendations to the Office of Nuclear Physics and to the Office of Science.

Recommendations

1. Our highest priority recommendation is that NP fill the Physics Research Division Director position. NP should consider creating a search committee or task force in the community to identify and recruit candidates for the research director position. The search committee might also be helpful in identifying obstacles to filling the position. NP should report on progress at the next NSAC meeting after receiving the report.
2. Filling the program manager positions in the Physics Research Division is of critical importance. NP should develop and implement a recruitment strategy to fill these positions as soon as possible.
3. A mechanism should be developed to provide support to the proposal review process so that new program managers can effectively and efficiently execute funding decisions. Explore options such as convening an expert panel or engaging a short-term detailee or a consultant.
4. The Office of Science should redouble efforts to get a fully functional PAMS system in place and populated.
5. Create a plan for the Office of Nuclear Physics to promote diversity and inclusion throughout its portfolio of programs.

II. Major Findings, Comments, and Recommendations

A. The effectiveness, efficiency, and quality of the processes used to solicit, review, recommend, and document proposal actions

The COV paid particular attention to issues related to the staffing in the Office of Nuclear Physics (NP), the new Portfolio Analysis and Management System (PAMS) database, and the Early Career Awards (ECA), so our findings and comments in these areas are listed first. Additional findings and comments related to university grants, laboratory research, nuclear data, facility operations, and isotopes are in the following sections.

Findings:

NP Staff

The Facilities and Project Management (FPM) Division is now fully staffed with the hiring of five new program managers, including three new positions (industrial concepts, isotope facilities, and isotope initiatives). The isotope organization is still evolving as a result of a visible and continued growth in work scope and mission over the review period, combined with the increased demands on staff to effectively manage a diverse mix of projects.

The vacancy in the research director position is now in its 5th year, with the Associate Director filling that role in an acting capacity. Two searches have been completed to try to fill this position, both unsuccessful.

Three permanent program manager positions in the research division are currently unfilled (heavy ion, fundamental symmetries, and low energy each have acting program managers). The fundamental symmetries portfolio was recently split off from the low energy nuclear physics portfolio; therefore, the recent departure of Cyrus Baktash created two vacancies. The office recently filled the medium-energy program manager position internally. Searches for the fundamental symmetries and heavy ion positions have been unsuccessful.

The COV heard some detail about these searches and was told that there has not been much interest in the community to fill these positions. In some cases promising candidates have been identified but have ultimately chosen not to come to DOE after a period of negotiation. DOE search procedures and the timing of the fiscal year limit the frequency with which these searches can be done.

Because of the staffing shortage in the Physics Research Division, some program managers have had to manage several programs. At present, some acting program managers are in positions outside their main areas of expertise.

Some program managers commented that they appreciated efforts to support their professional development, especially opportunities to serve on committees outside NP.

PAMS

PAMS is designed to be an integrated electronic system to handle many aspects of the Office of Science workflow. PAMS is online and gradually adding functionality. PAMS is now being used to submit and review proposals, maintain information on reviewers, and document and process funding decisions. Investigators of both declined and awarded proposals are given access to redacted mail-in reviews and panel comments via PAMS.

Most recently PAMS is able to receive annual progress reports and maintain a public abstracts website. The progress reports are submitted using the federal-wide, standard Research Performance Progress Report (RPPR), but Principal Investigators (PIs) can attach a pdf document with additional information.

During the annual report process PIs are asked to provide email addresses for all participants on their grants. These participants are invited to update or establish a PAMS profile, which includes questions about race, ethnicity, gender, disability, and citizenship. For these demographic questions "Do not wish to provide" is an accepted response. We were told that about 16,000 external users have logged into PAMS during the past year, and about 25% of them have answered the gender question.

PAMS does have the ability to accept program manager notes, and uploaded documents or other information from the program managers. Using PAMS, a proposal can be declined by checking a box, without any explanation. A declination memo is no longer required, although there is an option to enter additional information in PAMS.

When reviewing proposals in a group, such as the ECA or responses to a particular funding opportunity announcement (FOA), PAMS does allow reviewers to enter a numerical score (1 – 6 for ECA) in addition to comments. When reviewing individual proposals that are not part of a cohort, such as the regular university research proposals, it is not possible to ask for a numerical rating in PAMS. The PAMS interface is standardized across the Office of Science.

ECA

The steady-state goal for NP is to support five new university grants and three new lab grants each year. Due to the full-funding mandate, the numbers have been somewhat lower in recent years.

Each year a different program manager has taken the lead in handling ECA proposals, which means that these proposals may be processed differently in different years. Mail reviews are collected and include a numerical score. Based on these reviews, an initial cut is made on the proposals considered for further review. Then a panel is formed to consider the mail-in reviews and rank the proposals across sub-fields relative to each other. Sometimes, as in 2015, a panel of outside experts is convened to rank the candidates, based on the mail reviews and their own judgment. At other times, the panel that evaluates mail reviews is composed solely of the program managers. How the ECAs are managed can depend on external factors, such as the

timing of information from the Office of Science regarding funding.

For the 2015 ECA awards each file (jacket) contained the proposal, the mail reviews, and the selection statement from the program manager, which includes some justification for making the award and the panel ranking of that proposal. Neither panelist comments nor a ranked list of all proposals were included, but these items were available to the COV upon request. We were told that the panelist comments are in the electronic record but the ranked list of all proposals is not. For ECA declinations there was only the proposal, an email to the PI stating that it was declined, and one other brief document.

Of the new investigators that were not funded through the ECA program, some were later funded through regular grants. As an example, in the heavy-ion program, three new investigators were funded through money freed up by the Comparative Research Review.

Since ECA funding is for 5 years, and the ECA program only started in 2010, there were limited data on what happened to funded PIs after the ECA grant expired. Of the eight investigators in this category, three were funded as part of a lab group, four were given further DOE funding, and one was not supported in the subsequent year.

It was brought to the committee's attention that even though the PI standing and proposal quality of isotope production, accelerator R&D and instrumentation technology related ECA proposals are competitive, they are often more application-oriented and can have a hard time competing against those addressing more fundamental nuclear physics topics.

University Grants

The previous COV was concerned with the statements of the program managers that mail reviews were not discriminating enough to help program managers make meaningful decisions. As discussed above, it is not possible to add a numerical score to the mail reviews for proposals that are not evaluated together as part of a cohort. NP reported that they are considering evaluating all proposals for new funding together each year as a "campaign," as happened with the recent competitive review.

The committee found incomplete documentation in the jackets. This may be related to the transition to PAMS, since some information is now electronic and not duplicated in the files. Additional information was available upon request.

During 2015, an FOA for topical collaborations in nuclear theory was issued. Thirteen proposals were received with a total funding request of $32 M. There was a two-stage review, namely a technical mail review, followed by an external panel review. Three proposals were recommended for funding, at a level of 22% of the total initial funding request. The science scope of the awarded proposals is well aligned with the priorities of the 2015 Long Range Plan, and the collaborations will initiate activities in FY2016.

Laboratory Research

Laboratory research programs are traditionally evaluated via quadrennial reviews in each of the subfields. Quadrennial reviews were suspended for 2013 and 2014 in view of the Comparative and Competitive Research Review (CRR) processes. The quadrennial review schedule was resumed in 2015 with a review of laboratory groups working in Heavy-Ion Physics, and will be continued in 2016 with a review of the national lab Nuclear Theory groups. Following the experience gained in the CRR 2013 process, group leaders were asked for the 2015 Heavy-Ion Physics quadrennial review to provide specific information on the past and proposed research performed by each group member, yielding a highly detailed picture of group activities. Precise instructions for proposal preparation, together with clear explanations of the evaluation criteria and of how the results of the review will be used in future funding decisions, were communicated to the PIs in the cover letter.

Nuclear Data

NP conducted a review of the US Nuclear Data Program, which was the first review in nearly 20 years. The NP Office has begun to implement many of the recommendations of the review, including a mission statement and the establishment of an advisory committee whose goal is to guide the Nuclear Data Program into the future.

Facility Operations

The Office of Nuclear Physics operated three national user facilities at National Laboratories during this assessment period: RHIC (BNL), CEBAF (TJNAF), and ATLAS (ANL). Disposition activities took place at HRIBF (ORNL) and WNSL (Yale).

Facility Operations accounts for 51% of the NP FY2015 budget.

FRIB is under construction at MSU and civil construction is about 50% complete. Project completion is expected around FY21-22. FRIB is within budget and about 10 weeks ahead of schedule at this point. The 12 GeV upgrade at TJNAF is another major construction project within NP. TJNAF is beginning to restart with first physics experiments expected in FY17.

NP has been able to fund two major construction projects while continuing to operate the existing facilities. Some budget reductions in overall research funds and facility operating funds have been necessary, but no major cuts to existing programs were required.

The American Recovery and Reinvestment Act (ARRA) funding provided ~$150M of (mostly) new money for NP operations from 2009-2015. All ARRA projects were required to be completed by end of FY2015. $65M of ARRA funds went to fast-tracking the Jefferson Lab 12 GeV upgrade project, which then was removed in the subsequent years from the previously planned funding stream. The committee was informed that the remainder went to a large array of Accelerator Improvement Projects (AIP) and fundamental research projects that would not have been able to receive timely funding within the 'normal' NP budgets. These projects included major upgrades of ATLAS and RHIC as well as funds for a wide variety of development and research projects, both in the FPM Division and in the Physics Research Division. We were

told that these funds were extremely valuable in allowing NP to address the significant needs of both the user labs and individual research projects at a time of very constrained budgets.

The Small Business Innovation Research and Small Business Technology Transfer (SBIR/STTR) programs were recently reauthorized, and additional funds were directed into these programs. The total funding transferred from the NP appropriation to the SBIR/STTR program was $14.8M in FY15, which represented the mandated 3.3% of non-capital NP funding. In FY16 the mandated percentage rises to 3.45% and then levels out at 3.65% starting in FY17. In the last year 270 letters of intent were filed. Once a proposal is approved there is a mandated maximum of 90 days until the funding must begin for successful projects. Awards are decided based on good reviews, commercialization potential and NP priorities. There must be 2 reviews, at a minimum, for each proposal. NP prefers to get 4 reviews for each proposal, if possible. A new person has been added to the permanent staff for handling the SBIR/STTR program and to serve as an industry liaison. The accelerator R&D portfolio is now handled separately by another program manager, who also helps with the SBIR and STTR program as the Portfolio Manager.

Isotopes

The Isotope R&D program includes funding support for core research at DOE's Laboratories specifically stewarded by the DOE Isotope Program and for competitive funding opportunities open to Laboratories and Universities. The process for solicitations and awards made by the Isotope Program is based on standard NP practice and procedures. There have been two FOA's relevant to isotope production research in the time-frame of this review period. Both were entitled "Research, development and training in isotope production." A separate FOA focused on facilities enhancement and isotope production aimed at expanding availability of priority isotopes.

The committee found that the variety of research areas associated with isotope production covered by the R&D portfolio is very broad, and includes disciplines ranging from nuclear physics to nuclear and radiochemistry.

The committee was informed by the program manager that the funding level for the portfolio is low, and that two years of appropriation must be consolidated to fund a meaningful number of grants. FOA's are therefore posted biennially. Projects are usually funded for two years with clear deliverables, and no renewals are accommodated. The committee notes that the 2015 report of the NSAC Isotopes (NSAC-I) subcommittee recommended a significant increase in funding for isotopes research and development.

Apart from the four standard NP policy factors considered in proposal reviews, the Isotope Program R&D FOA's require the consideration of two additional program policy factors: 1) Potential for impact on availability of a priority isotope and 2) Potential for impact on the workforce in isotope production S&T.

Comments:

NP Staff

The FPM Division is well managed with clear and frequently used lines of communication among the program managers and director. It is notable that the successful staffing of the Division was achieved while bringing on-board a new isotopes program, which required significant attention in order to address many previously neglected features of that program.

The FPM Division Director is to be commended for adding a second person to the staff to separately handle the SBIR/STTR program. This action clearly shows that management is closely monitoring activities within the programs and plans for meeting the requirements of program growth.

The COV is concerned that the lack of a permanent Director of the Physics Research Division is negatively affecting the functioning of the research division. The Research Director (RD) has an important role to play in training and supervising program managers, ensuring consistency and quality in policies and procedures, advocating for the division and the science, and filling the program manager vacancies. The vacancy in the research director position constitutes a *significant* risk to the quality of the research review process and effectiveness of NP as a whole.

The COV has serious concerns that the three program manager vacancies in the Physics Research Division are detrimental to the long-term health and functioning of the research division. This situation has become critical in light of the departure of the low-energy program manager and the planned return of Jim Sowinski to the facilities division in summer 2016.

The shortage of staff, and the attendant assumption of extra responsibilities, appears to limit the time program managers can devote to their program responsibilities, and has the potential to reduce the effectiveness of NP in responding to funding requests from the community. The committee notes that most program managers in the research division have a very heavy workload. For example, the program manager in theory has to handle approximately 80 university grants in addition to the lab research.

The committee is impressed by the incredibly hard work and dedication of the Associate Director, the FPM Division Director, and the program managers in NP in taking on extra responsibilities related to all the vacancies. A lot of time and attention has been spent on unsuccessful searches and we see no indication that the searches have failed due to some lack of effort in NP. We also note that, in spite of the personnel shortage, we have not identified situations in which the quality of the review process has been compromised nor have we found evidence of poor outcomes. Still, the COV believes this is an unsustainable situation.

A program manager with experience and knowledge of the community is vital for selecting referees and making meaningful funding decisions on proposals, which further instills confidence in NP by the community. We have seen examples of program managers doing an

excellent job in an area outside their primary expertise, but it takes time for a program manager to come up to speed in a new field.

Given that many of the current program managers in NP first came to DOE as IPAs or detailees, it would make sense to strongly pursue researchers both at national labs and universities who may be interested in a two- to four-year positions at DOE to fill program manager positions. NP can also consider shorter-term assignments of members of the community to assist with referee selection, proposal reviews and other research division activities. Such assignments may also help promote an understanding within the community of the responsibilities of program managers and the functioning of NP.

Attention to the professional development of the project managers strengthens morale and improves performance and productivity.

PAMS

The COV has two major interests in PAMS. The workload of the program managers is extremely heavy and any systematic improvements that allow them to do their jobs more efficiently are highly valued. The initial indications are that the system is helping with proposal reviews, though it was stated that responses can be slow at times, which needs to be continuously addressed. PAMS also seems to be saving time during the processing of new awards for funding.

The other extremely important capability is the collection of the optional personal profile information to enable the office and external reviews like the COV to have the data to search for potential biases in operations. It is too soon to determine the effectiveness of PAMS at collecting and tracking demographic data. The COV encourages NP to monitor the response rate, particularly for junior researchers (graduate students and postdoctoral researchers) and take action as necessary to ensure the community populates the PAMS database.

NP should consider developing guidelines for program managers about what documentation is appropriate to include in PAMS, both for awards and declinations. In particular, it would be helpful if there is some statement included for a declination that reflects the judgment of the program manager. The COV would like to have enough information in the electronic file to enable us to independently assess the process of making funding decisions (once the COV has access to PAMS).

Some functions of an electronic database system have been recommendations of the past three COVs. The COV is disappointed by the pace of implementation.

ECA

The continued monitoring of the ECA program as a tool for integrating talented new investigators into the research portfolio would be beneficial. This involves tracking not only

award recipients, but also the further career paths of PIs whose ECA proposals were declined. It may be important to evaluate this independently for lab and university awards.

The possibility that ECA proposals in the isotopes area, which are more applied, have a hard time competing with nuclear physics proposals must be monitored by NP going forward and addressed, if necessary, to ensure a level playing field for PIs in science areas related to isotope production.

University Grants

Since the COV did not have access to PAMS, our ability to fully investigate some grant actions was limited by the necessity of requesting additional information and the time available. It is very important that the next COV have access to PAMS.

For all proposals to which the COV had full access to all materials pertinent to the application and funding decision, the decisions made were assessed by members of the COV to be valid and fair.

The COV appreciates the discriminating power of evaluating proposals head-to-head and viewed positively the idea of treating new proposals as a cohort once per year.

The Physics Research Division Director has to sign off on each award, and would ideally provide constructive feedback to the review process. An active Research Director is essential to make sure that review, approval, and monitoring of grants is done effectively and consistently across the various programs in the Research Division.

Laboratory Research

The review processes for laboratory groups are reasonable and provide the DOE program managers with sufficient input to establish priorities and make funding decisions. NP is commended for having considerably improved their record of providing the results of these reviews in a timely fashion.

The Committee found that these reviews provided a good assessment of the laboratory research programs. It was important that the comparative review provided an evaluation of relative merits of laboratory and university research. Unlike the case of university proposals, the results of these reviews do not commit to specific funding decisions, but give rather general guidance of what one might expect for future funding.

The process used for the 2015 quadrennial review of Heavy-Ion Physics performed by laboratory groups was fair, effective, and efficient. It optimized the DOE decision-making process by improving instructions to and communications with the PIs, including a very timely return of the final results of the review. Improvements in the review process were informed by a DOE-internal analysis of the CRR in 2013, which resulted in a very detailed and transparent set of instructions and process explanations to the PIs in preparation for the review. The COV feels

that the 2015 Heavy-Ion Physics review can serve as a template for other future quadrennial reviews.

Nuclear Data

The COV applauds the recent review of the US Nuclear Data Program and the establishment of an advisory committee to guide the program in the future. However it is surprising that the program had not been reviewed for 20 years. While considerably smaller than the isotope program, it shares with that program the burden that much of its mission is related to the work of other federal organizations and industry. Communications with this diverse customer base must be a priority.

Facility Operations

The overall assessment of this subcommittee is that the ARRA funds were well used and advanced NP priorities without requiring damaging cuts to other programs.

Three different Accelerator R&D projects, two competitive and one ARRA project, were randomly selected for an in depth review with input from program managers M. Farkhondeh and M. Shinn. The review process is well defined for accelerator R&D projects and includes the use of a panel of experts. No issues of note surfaced in our review of these projects.

Over the past six or seven years a number of changes have taken place in how facility budgets are planned and new programs proposed. This has resulted in a significant change in the use of the Field Work Proposals (FWP) in NP. They no longer appear to have value as planning documents since they are not received from the labs until after decisions have been made for the following year plus one budget, but apparently still have value as funding documents. Guidance on how FWPs are now used and their relationship to the information provided in the Budget Briefing process would be very helpful at this point.

Isotopes

The Isotope program subcommittee reviewed a representative sample of solicitations, proposals, review records, comments, and related award or denial feedback. Based upon the evidence found in the files presented, the committee concluded that proposals are generally of a high quality and well written, and that reviews were adequate. Review comments were reasonable, and appropriate feedback to the PI's of both funded and declined proposals had been provided in a timely manner.

It was brought to the committee's attention that, due to the diverse nature of research areas addressed by each FOA and due to the relatively small target community, it is very difficult to find a sufficient number of non-conflicted, technically competent and willing reviewers. Finding appropriate reviewers in the case of proposals addressing classified topics in the area of safeguards and security is even more challenging.

Recommendations:

1. Our highest priority recommendation is that NP fill the Physics Research Division Director position. NP should consider creating a search committee or task force in the community to identify and recruit candidates for the research director position. The search committee might also be helpful in identifying obstacles to filling the position. NP should report on progress at the next NSAC meeting after receiving the report.
2. Filling the program manager positions in the Physics Research Division is of critical importance. NP should develop and implement a recruitment strategy to fill these positions as soon as possible.
3. A mechanism should be developed to provide support to the proposal review process so that new program managers can effectively and efficiently execute funding decisions. Explore options such as convening an expert panel or engaging a short-term detailee or a consultant.
4. The Office of Science should redouble efforts to get a fully functional PAMS system in place and populated.

B. The monitoring of active projects and programs

The COV paid particular attention to issues related to the Comparative/Competitive Review and Diversity, so our findings and comments in these areas are listed first. Additional findings and comments related to university grants, laboratory research, facility operations, projects, and isotopes are in the following sections.

Findings:

Comparative/Competitive Review

In May-June of 2013, NP conducted a comparative review of about 200 groups funded as part of the research portfolio. A similar exercise was last conducted in 1994.

The evaluation was based on activities during the previous three-year period. Groups were graded on six criteria, including scientific productivity, leadership, impact on the field, and training of future investigators. About two months before the review, a briefing package was requested from all groups summarizing activities during the past three-year period and a template was provided.

Panels (with about 10 members) were formed in each subfield with a largely international composition, and each research group was invited to make a presentation to the panel in their area.

Each panel member scored each group on a 10-point scale on the 6 different criteria. Panel members were instructed that the figure of merit should be the relative physics productivity per level of funding.

Panels were instructed that, at most, 20% of groups should be rated as "High competitive," while at least 10% of groups should be rated "Low competitive." The mean composite score was between 5.6-6.0 in each panel, but with a broad dispersion.

For 20-25% of grants, support was terminated as a result of the comparative review; this corresponded, however, to only $8.9M out of the total $162M research funding (5.5%).

Grants that were terminated as a result of the 2013 comparative review were able to reapply the following year and were subjected to a competitive review in 2014 that also included all new proposals. The competitive review involved both mail and panel reviews (but no in-person presentations). The criteria applied to the 2014 competitive review were different than the 2013 comparative review, and focused on the scientific merits and potential impact of the proposed program. A total of 35 new proposals were subsequently funded. Of these 35 new proposals, 16 were resubmissions from previously low-performing proposals, amounting to $2.6M/yr. A total of 19 proposals from new investigators and initiatives were funded, which was aided by funding made available from the terminated programs.

Diversity

Since the 2013 COV review, NP has relied almost entirely on the development of the PAMS system to pursue diversity tracking statistics. Due to the slow pace of implementation of PAMS functionality in this area, almost no data exist.

The PAMS system is now coming into operation and, we were told, will accept personal information allowing demographic tracking to study workforce diversity in Nuclear Physics, as well as demonstrate equality of opportunity in grant awards and other related decision making in the NP programs.

NP has used the Workforce Survey to track the number of permanent staff, temporary staff, graduate students, and Ph.D.s awarded, but this survey includes diversity information only for Ph.D.s awarded. Outside of the Workforce Survey, NP also tracks the gender of the PI for grants.

There is currently no mechanism within the NP processes to encourage or value work in support of diversity or outreach in individual proposals.

The FPM Division Director stated that there is strong awareness of diversity issues at the level of program managers in the various portfolios. In addition, it was stated that there are no known technical barriers for further use of the Workforce Survey, but there may be administrative barriers due to the Paperwork Reduction Act and the PAMS development effort.

University Grants

Program managers stated that Continuation Progress Reports (CPRs) are used to evaluate progress towards milestones outlined in the initial award and to verify that activities are within

the scope of the work initially proposed. Some program managers reported that the continuation progress reports were useful to them, but that the reports could be more concise.

Time and budgetary constraints prohibit program managers from making site visits to most university-based grant recipients.

Laboratory Research

The laboratory research programs are monitored via annual CPRs, field work proposals, facility reviews, and discussions with the laboratory PIs during the annual budget briefings. DOE program managers read the CPRs carefully but, due to workload, do not usually report back to the PIs on the CPR unless problems need to be addressed. While not a primary focus, some research progress is often highlighted at the annual laboratory budget briefings. Some large research projects are subject to more rigorous project management.

Facility Operations

In FY 2013, SC changed its approach to performance measures upon direction from the Office of Management and Budget (OMB); the new matrices are now more directly linked to scientific productivity, and NP utilizes NSAC-approved measures to gauge scientific productivity. The COV notes that NSAC has not been asked to update these measures since 2008. NP still monitors percent utilization, which is the ratio of weeks financially supported relative to optimum weeks of running. NP will continue to strive to highlight the scientific and technical achievements of the facilities in the budget narrative.

NP continued to monitor operational metrics from the operating facilities, such as operating hours, downtime hours, availability and reliability, and other facility specific performance measures.

Projects

One of the goals of NP is to build and operate forefront facilities that can lead to significant discoveries and/or advancements. The FPM Division is responsible for and works toward this goal through the fabrication of scientific instrumentation and facilities, capital investments, and construction projects. To monitor and assess instrumentation and project performance, the FPM Division performed 37 project reviews, participated in 11 Office of Project Assessment reviews, completed 1 Facility Operations Review, and conducted oversight through project reporting (monthly, quarterly, PARS, etc.) and site visits. During the COV review period, the funding for construction increased from $40 million to over $100 million. Funding for Major Items of Equipment (MIE) projects continued to decline with no new starts until 4th quarter of FY2015.

Currently, two major construction projects are being supported: 12 GeV CEBAF Upgrade at TJNAF, and the Facility for Rare Isotope Beams at Michigan State University. During this COV period (FY2013 – FY2015), the 12 GeV CEBAF Upgrade completed a project rebaseline due to a directed funding change in FY2012 and high-risk items, then achieved CD-4A approval five months ahead of schedule for completion of accelerator scope. During this COV period, the

FRIB project received approval of CD-2/3A (start of civil construction) and CD-3B (start of accelerator/experimental systems construction).

NP managed and tracked 33 additional projects during this COV period with Total Project Costs (TPCs) below $50M. This is more than double the number (14 projects) being managed in this category at the time of the 2013 COV. These projects fall into several categories: MIEs, AIP, Capital Equipment (CE), Information Technology, and Other:

- MIE: Two were completed in this period (LBNL CUORE and BNL STAR HFT), and two were initiated (LBNL GRETA and ORNL SIPF).
- AIP: Five projects were completed (JLab 11 GeV, ANL's ARRA and EBIS, BNL's ARRA and Elens2), and four remain active (BNL's 56MHz, BLIP, LEReC, and LANL IPF Beam Transport Upgrade).
- CE: Four projects (<$2M) were completed (BNL's PHENIX MPC-EX, STAR MTD, STAR Forward GEM, and Texas A&M Cyclotron Upgrade), and five remain active (ANL AGFA, TJNAF SBS and RICH, ORNL Nab, and LBNL GRETINA).
- Information Technology: LQCD-ext and LQCD-ARRA were completed, and LQCD-ext-II remains active.
- Other: One project was completed, and seven remain active ranging from under $2M to $21M.

The oversight is consistent with DOE O 413.3B project management principles but tailored in extent and format as appropriate to each particular project. Tailoring is implemented based on several criteria, including cost, schedule, and/or technical risk, as well as issues related to partnerships with domestic and foreign collaborators.

Following the National Laboratory Directors Council recommendations for operational improvement, the threshold for MIE TPCs was raised from $2M to $5M. The FPM Director indicated that the current approach to risk-based tailoring of project management oversight is appropriate to the suite of projects currently in progress, and anticipates maintaining this approach with the new MIE thresholds.

Isotopes

The Isotope Program is a highly visible program, which maintains extensive infrastructure for production and distribution of radioactive and stable isotopes that are in short supply, including by-products, surplus materials and related isotope services. Research projects and production programs supported and managed by the Isotope Program are wide ranging in scope. R&D topics include development of robust and efficient targets for radioisotope production in reactors and accelerators, development of chemical and physical methods for recovery and purification of needed radioisotopes, development of state of the art methods in remote handling, automation and robotics to safely handle irradiated targets, and development of technologies for mass-separation of isotopes for production of enriched stable isotopes. A number of capability enhancement initiatives also resulted in several new facility and facility upgrade projects managed by the program.

The committee found that the isotope program has made progress towards expanding the availability of priority isotopes and addressing recommendations. (See Meeting Isotope Needs and Capturing Opportunities for the Future: the 2015 Long Range Plan for the DOE-NP Isotope Program. NSAC Isotope Subcommittee Report, July 2015.) Accomplishments include:

- Production of record levels of isotopes by the DOE Isotope Program.
- Initiation of a Cf-252 equipment modernization project
- Initiation of accelerator upgrade projects to increase isotope production and R&D capabilities at BNL, BLIP, LANL, and INL/PNNL.
- Worked with DOE General Counsel on commercialization of Ge-68 production
- Developed a novel 100 mA Non-Ambipolar Electron Driven Ion Source (NEDIS) at ORNL.
- Developing Enriched Stable Isotope Pilot Plant (ESIPP) at ORNL.
- Achieved CD-0 Approval: Expansion to a Stable Isotope Production Facility (SIPF).
- Conducted helium-3 auctions in 2013 and 2014
- Completed major americium-241 glovebox construction
- Initiated a 3.25-year effort to scale up production of Ac-225 by proton irradiation of thorium (LANL/BNL/ORNL) to produce sufficient qualities and quantity for clinical trials.
- Demonstrated the ability to recover valuable isotopes produced during operation of FRIB.
- Worked to assure continuation of Nuclear Chemistry Summer Schools program in FY15 and FY16

Comments:

Comparative/Competitive Review

The 2013 comparative review provided a snapshot of the relative strengths of all research groups within each subfield and documented the competitiveness of the overall research portfolio in an international context. This comparative ranking helped to optimize the research portfolio, to free up funding for compelling new initiatives, and to defend the overall level of funding for the research portfolio. More new initiatives could be supported as a result of the process. Some groups previously terminated in the comparative review regrouped and reapplied with a more competitive research program; about 30% of the new funding awarded competitively in 2015 went to such groups. The international nature of the panels helped to fairly gauge the impact of programs in the global context. Unfortunately, the mandate to fully fund awards of less than $1M negated some of the positive impact of the comparative review, by absorbing about 1/3 of the funding made available from the terminated programs.

The comparative review process was extremely well managed. Information and guidance provided to PI's on the process was clear and thorough. Program managers and staff are commended on their efforts to conduct an efficient and well-organized review. The one-month lead-time given to prepare briefing packages was reported to be difficult by some investigators as it fell near the end of the spring semester.

The considerable effort and expense associated with a program-wide comparative review prohibit this type of review from occurring frequently. Reviewing submissions for new

proposals each year competitively, as was done in the CRR 2014, will help ensure that the best new proposals are funded, though this likely increases the work required by program managers. Adding a quantitative component to the review criteria for renewals may facilitate the comparison of the relative strengths and weaknesses of renewal applications and contribute to the goal of maintaining an accurate snapshot of the relative strengths of research groups within each subfield.

It is very important that NP effectively communicate any changes in the yearly review process or proposal due dates to the scientific community. Some confusion in the community or inequities in how new proposals are considered could result if practices were to differ between programs or between new proposals and renewals.

Diversity

Considerable committee time and effort were dedicated to the topic of diversity in the field of nuclear physics and assessing it within the context of the breadth, depth and quality of the program. It is the view of the committee that diversity and inclusion are essential components of achieving and maintaining a high-quality program.

Discussions with program managers indicated that there is a general awareness of diversity issues within NP. At the Director level, the high value placed on diversity and inclusion is demonstrated by the attention paid during hiring and staffing of review panels and committees. These efforts would benefit from continuing discussions within NP to evaluate diversity statistics and to increase awareness of implicit bias.

The statistics that will eventually be available from the PAMS system will be important in determining whether bias exists in the process of reviewing and awarding grant funds in all programs administered by NP. It is important that the program managers be able to access diversity statistics in PAMS.

While the statistics are small, we reviewed available grant and ECA proposal actions for any evidence of bias in evaluations and found none.

NP is in a position to play a pivotal role in promoting diversity and outreach throughout its portfolio. To the extent possible within the Federal system, targeted enhancements to current NP activities should be considered and could have far-reaching effects in the field.

University Grants

While NP provides written guidance for preparation of CPRs, content and length of CPRs vary dramatically among PIs. Feedback from program managers to individual PIs regarding the formulation of CPRs may enhance the efficiency of both CPR preparation and review.

In discussions with program managers it was acknowledged that in the past there were visits to university-based grant recipients from time-to-time and that such visits were a valuable

component of grant monitoring. NP should consider making such visits again in the future once program manager positions are filled and the workload returns to normal.

Laboratory Research

The Laboratory projects and programs are well monitored by numerous reviews and visits. The appropriate program managers are well informed on their status and future plans.

Facility Operations

The NP user facilities met or exceeded all operating expectations. RHIC significantly improved performance within flat or inflation adjusted budgets. This is a major positive accomplishment in a constrained budget environment. There is ample evidence that NP facility management processes contributed or positively influenced this important outcome. These include effective processes to set performance expectations, monitor facility performance, provide feedback to the laboratory operators and hold laboratories accountable when required.

It is notable that the excellent performance of the operating facilities was achieved concurrent with two large, ongoing construction projects.

As FRIB migrates to an operating facility, there will be four national user facilities to manage as well as monitoring the operations at a few 'centers of excellence.' A discussion of the planning for the future management of those facilities was held with FPM Division management. It is clear that the FPM Division is well aware of its future challenges and will address them as they become relevant.

Projects

The FPM Division manages a very broad program of complex projects as well as accelerator R&D and SBIR programs. Thanks to the talented and dedicated staff, this heavy load is successfully managed and is well-integrated and communicated with partner entities (e.g. SC program offices, non-DOE funding agencies, universities).

The documentation we were shown is quite broad and varied, ranging from capital equipment projects under one million dollars to a major construction project. The major construction project documentation was extensive and complete.

The two examples of smaller projects both appeared to be exceptions to the tailored management process described by the Office. With the recent change in the MIE threshold, the Office should consider further modifying the level of oversight and tracking applied to activities costing less than the MIE threshold. This would potentially help allow the NP staff to deal with their heavy workload more efficiently.

Isotopes

The committee is impressed with the progress over the review period towards further enhancing the availability of priority isotopes, especially in light of the heavy workload on all staff. The Isotope Program is well organized and well managed.

Regular S&T reviews of the production facilities, ad-hoc audits, annual cost reviews, and related processes such as market assessment and demand forecasts, are effective in monitoring projects and improving the supply of isotopes. These efforts play a key role in the program's ability to sustain the delivery of record supplies of critical isotopes and to continue the establishment of new supply chains in important areas.

The R&D program's intensified and multipronged approach to workforce development should be commended for its positive impact on workforce training in an area where the nation currently produces such a limited number of Ph.D. graduates per year. The 2015 NSAC-I Report states that over the previous five years, research funding from the Isotope Program has supported the training of 45 nuclear and radiochemistry Ph.D. students and 33 post-doctoral fellows, and 120 undergraduate students in isotope-related activities. Given the program's continued focus on workforce development, the upward trend in these numbers is expected to continue.

Recommendations:

5. Create a plan for the Office of Nuclear Physics to promote diversity and inclusion throughout its portfolio of programs.

C. Within the boundaries defined by DOE missions and available funding, how the award process has affected the breadth and depth of the Nuclear Physics portfolio elements.

The COV has addressed issues related to the awarding and monitoring of grants in Sections A and B. A few additional remarks are included in this section.

Findings:

The NP university and laboratory research portfolio includes efforts in Heavy Ions, Low-Energy physics, Medium-Energy Physics, Fundamental Symmetries, Theory, Accelerator Science, and Isotopes. In deciding which proposals to fund, program managers have input from the Long Range Plan, expert reviews, and panels (in some cases). The breadth and depth of the resulting portfolio is strongly affected by the interests of the community and by the interests and merit of the PIs. New awards are often funded as part of the ECA program.

The isotope program has received input from a separate planning process, namely reports released by the NSAC Isotopes (NSAC-I) subcommittee, which released two reports in 2009. During the present COV review period, NSAC was again asked in April 2014 to re-establish NSAC-I and requested that it develop an updated Long Range Strategic Plan for the Isotope Program and articulate the progress since the 2009 NSAC-I reports. The report released in July 2015 identifies significant improvements made since the 2009 Long Range Plan, and notes that the DOE Isotope Program successfully addressed all previous NSAC recommendations. The mission of the Isotope Program is threefold:

- Produce and distribute radioactive and stable isotopes that are in short supply
- Maintain the infrastructure required to produce and supply isotope products and related services.
- Conduct R&D on new and improved isotope production and processing techniques.

Comments:

NP clearly takes the Long Range Planning process seriously, and has worked hard to implement the 2007 plan. NP has been an excellent steward of the nuclear physics program, despite challenges posed by vacant positions.

The science quality of the university and laboratory programs is very high, and the breadth of the programs covers a wide range of topics that reflect the priorities of the NP Long Range Plan. The award process maximizes the effectiveness and impact of constrained research funding by supporting the best science.

The completed and active projects are well aligned with the scientific priorities recommended in the 2007 NSAC Long Range Plan, and cover a broad scope of nuclear physics carried out at National User Facilities, other Laboratory facilities, and universities. It will be a continuing challenge to address the priorities set forth in the recent 2015 Long Range Plan.

Investments in MIEs were extremely curtailed during this period. However, two new MIE starts in the 4th quarter of FY2015 are consistent with the 2015 NSAC LRP recommendation to increase investments in small-scale and mid-scale projects.

The isotope R&D program, is now well-established and helps to ensure a robust supply of enriched stable isotopes and radioactive isotopes needed for research and application in a variety of important areas including medicine, physics, chemistry, life sciences, agriculture, environment and national security. The supported work in radioisotope production is wide ranging in scope including development of targets for radioisotope production in reactors and accelerators, of recovery and purification methods for radioisotopes, of remote handling methods, including automation and robotics, and of technologies for mass-separation of isotopes for enriched stable isotope production.

The management of the isotopes program follows an effective strategic approach for meeting isotope demands by shaping the focus areas of the FOA's to ensure they align with fluctuating isotope needs through input from various sources. Regular input is also actively sought from a variety of isotope user communities, including program managers, federal agencies and users in the commercial sector. These efforts are encouraged. The ability of the Isotope Program to respond to changing demands not only benefits the science community at large but it also supports the needs of the nuclear physics portfolios within NP. Continuation of these outreach efforts is encouraged to help keep the R&D areas aligned with the nation's isotope needs.

Recommendations: **none**

D. The national and international standing of the portfolio elements

Findings:

NP oversees a diverse portfolio of programs that range from very competitive in an international context to world-leading. While a detailed assessment of the impact of the NP program is beyond the scope of this report, a comprehensive Comparative Research Review (CRR) of DOE-supported programs was carried out in 2013. It found that "the scope of the U.S. nuclear physics program is much broader than in any other country" and that "U.S. nuclear scientists are at the forefront of research worldwide and often define the decisive scientific milestones. This leadership of U.S. nuclear science, as well as the breadth of its research program, has been visible during the entire review process."

The DOE program in low-energy nuclear physics comprises nuclear structure and nuclear astrophysics. The CRR found that this program is "very competitive world-wide, and in some areas world-leading." It benefits from a broad suite of laboratory-based and university-based facilities as well as a close relationship between experiment and theory. The capabilities of FRIB will restore the U.S. position to world leadership in this area.

The growing nuclear physics program in Fundamental Symmetries (FS) has led to the creation of a separate FS portfolio in NP. A search is currently underway to identify a subject-matter expert program manager. This diverse program utilizes a broad range of experimental techniques, which involves underground laboratories, radioactive sources, and beams of neutrons and muons provided by facilities outside of the NP portfolio. The CRR found that "The DOE Fundamental Symmetries program is world-class research that has the potential for additional discoveries of far reaching consequence."

Recent Long Range Plan priorities strongly support a ton-scale neutrinoless double beta-decay ($0\nu\beta\beta$) campaign and a best-in-class neutron electric dipole moment (nEDM) search. The DOE is working with the NSF on a joint management plan for R&D required for a ton-scale $0\nu\beta\beta$, with the release of a FOA expected in 2016.

As pointed out in the CRR report, there is growing international emphasis on medium-energy physics, with new facilities either online or planned. The medium-energy program is concentrated at the Continuous Electron Beam Accelerator at Jefferson Lab, but also encompasses the RHIC Spin Program, smaller FNAL experiments, and some US participation in international efforts. The capabilities provided by domestic facilities allow the community to perform "world-class forefront research." In particular, the DOE program has made significant contributions to our understanding of the quark, gluon and spin structure of nucleons and nuclei. The nearly complete upgrade to Jefferson Lab has the US program well-positioned to continue a world-leadership role in medium-energy physics.

The DOE program is world leading in the field of hot/dense QCD matter through the study of ultra-relativistic heavy-ion collisions. The research program is focused at the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory (BNL) in the U.S. and the Large Hadron Collider (LHC) at the CERN Laboratory in Europe, with many U.S. groups contributing to both

programs. The unparalleled flexibility of the RHIC facility enables a research program of unique breadth and depth that continues to ensure a position of global leadership for the U.S. nuclear physics community in the area of heavy-ion physics.

As documented in the report of the CRR, the nuclear theory portfolio has very broad scope, excellent quality, and is well aligned with the experimental efforts and programs at current and future US facilities. The Topical Collaborations in Nuclear Theory, with a first round from 2010 to 2015 and a second round approved for funding in 2016, have contributed additional strength to the program, as detailed in the 2015 Long Range Plan. The SciDAC initiative has been critical for achieving impressive progress, enabled by recent advances in high-performance computing. The continued efforts by the NP office to leverage SciDAC funding with ASCR and NNSA should be commended.

The three operating user facilities in the NP portfolio are operating at very high levels of performance, especially RHIC and ATLAS. At this point, both RHIC and ATLAS lead the world in many measures regarding the type and availability of beams. Upgrades being considered and recently implemented paint a bright future for both of these facilities as world-leading in their respective areas of research. Jefferson Lab has been in a construction mode for the 12 GeV upgrade and consequently has not operated very much during the period of this review. But when it returns to operation, the doubling of the beam energy will make it a world leader in studying chromodynamic effects in nuclei and other fundamental aspects of nuclei. Historically the performance of JLAB in terms of operating hours and reliability has been excellent. The performance of these three major user facilities and their world-class capabilities are critical for providing the tools necessary to conduct forefront research in nuclear physics.

As highlighted by the 2015 NSAC-I report, the Isotope Program is a relatively small federal program with a federal appropriation of ~$20M and isotope sales of approximately two times the appropriation. Yet the program is highly visible and has far-reaching impact. It enables and is immersed in billion dollar enterprises including medical diagnosis and treatment, research, national security, and critical industries. These applications touch the lives of almost every citizen. The program has a multifaceted approach to improving isotope availability. This has resulted in as many as 13 sites that are now engaged in production and distribution either directly for or in collaboration with the DOE program. Some of the isotope production sites managed by the program play a lead role in global supply of important isotopes, some of which have wide-reaching global impact.

Comments:

NP should be congratulated for its continuing support and stewardship of nuclear physics research. We note that the decisions made by NP have been informed by the Long-Range Planning process, and the result is that the program is closely aligned with the priorities of the research community, another indication of the careful stewardship of the program by the nuclear physics office.

The 2013 COV noted that constrained budgets have created a tension between the need to invest in the construction of new, world-leading facilities and in major items of equipment. While that tension still exists, we also point to the impact of construction on the research

budget, which constrains both existing programs as well as those proposed by young investigators just entering the field. We recognize that facility construction is essential for the continued vitality of the field, but the COV encourages NP to continue their efforts to increase research funding.

The Isotope Program continues to play an important role in providing both national and international leadership in the areas of isotope production and isotope research and development. The program's focused efforts towards reestablishing stable isotope production at ORNL will significantly reduce the United States' dependency on foreign sources. Expanded availability of critical isotopes plays a key role in maintaining the United States' leadership in a broad range of areas including medical treatments, basic research, and engineering/industrial applications of isotopes. It also further strengthens our national security in key areas of detection and analysis of threats. The US position is further strengthened by the expansion of the program's university collaborations, engaging the Nation's network of university production capabilities to a much greater extent, and thereby expanding the availability of research isotopes without limiting accelerator capacity for additional R&D at its National Laboratory sites.

Recommendations: **none**

E. Progress made towards addressing action items from the previous COV review

Findings:

A total of 15 Recommendations were included in the 2013 COV Report categorized as Major (5), Process-specific (7), Portfolio for the Future (2), and COV-specific (1).

The 2013 COV report was presented to NSAC on March 15, 2013. The NP response to the COV report was posted on the COV website on May 7, 2013 and updated on October 4, 2013. An updated NP response to the 2013 recommendations was also provided in briefing material to this COV. These 2013 recommendations are presented below (•) along with findings of the present COV on the progress towards addressing these recommendations.

- Major #1: The COV recommended in 2007 and stressed again in 2010 that it was imperative to develop and implement a database to track relevant proposal and grant information. We reiterate the critical need for the rapid implementation of such a database.

The 2007, 2010, and 2013 COVs all identified the rapid implementation of a database to track proposal and grant information as a critical need. The Portfolio Analysis and Management System (PAMS) was developed by the Office of Science and was used to receive grants.gov proposals in 2011. Since then the scope of the system has been gradually increasing. Examples of reports that can be generated using the PAMS database were provided, but significant limitations exist. See section A for a more detailed discussion of PAMS.

• Major #2: We recommend that NP track the participation of under-represented groups and make the information available. The COV urges that the necessary authorization be obtained, consistent with Federal requirements, to track diversity and demographic information.

Response to this recommendation was tied exclusively to the PAMS database, in particular to the slow rate for developing functionality and its limitations in data collection. NP has used the Workforce Survey to track the number of permanent staff, temporary staff, graduate students, and Ph.D.s awarded, but this survey includes diversity information only for Ph.D.s awarded. NP also tracks diversity information for proposal PIs in an informal way. NP did not seek authorization to expand the Workforce Survey to track diversity and demographic information.

• Major #3: We recommend that, after the PAMS system is in operation, its effectiveness to address the relevant issues raised in this report (such as tracking demographics of the workforce, proposal and grant applications, workload of Project Managers, and impact on NP operations) be evaluated. We request that NP report to NSAC yearly on this evaluation.

It was reported that PAMS has simplified some work processes and administrative workloads. However, it is not yet operational for tracking demographics, and full functionality is estimated to be several years away. NP updates to NSAC on this recommendation were not provided. See section A for a more detailed discussion.

• Major #4: The COV recommends an increased focus on timely delivery of reports, and development of a set of written guidelines for Laboratory Review Reports to streamline the process.

In October 2015, NP issued written guidelines for all NP review reports stating that final reports are to be available within 3 months. It was reported that this guideline has been met during this COV period with a few exceptions. The committee found that, excluding the comparative and competitive reviews, NP conducted 56 reviews over all categories in FY13-15. Of these, approximately 10 had completed reports outside of a four-month window and only one (Moller) was significantly delayed.

• Major #5: The COV recommends the development of a set of guidelines defining roles, responsibilities, authorities and accountability for both the research and facilities Program Managers. Such guidelines across the NP portfolio would help to consolidate best practices throughout.

The roles and responsibilities within the DOE Isotope Program have been regularly updated. The roles and responsibilities of Facilities and Project Management Division staff were developed and distributed in December 2015. The roles and responsibilities of Physics Research Division staff were recently developed and presented at this COV meeting.

• Process-specific #1: The NP should work with the community to enhance the peer review process for university grants such that, while continuing to be fair, it is even more discriminating in the evaluation process. The NP could consider the implementation of a quantitative component into the grant evaluation process.

This recommendation was addressed through the 2013 Comparative Review and 2014 Competitive Review processes. The path forward for enhancing the peer review process beyond these broad review events is under development.

• Process-specific #2: We recommend that NP advocate for a change in the administration of the ECA program to give greater control to the individual programs over the size and number of ECA awards. The NP should provide direct feedback to the Early Career Award applicants regarding the relative competitiveness of their proposals, relevance to the priorities of the NP program, and potential alternative routes for funding for the declined proposals.

Greater control to the individual programs over the size and number of ECA awards is in place. Follow-up with PIs of declined awards is through reading review text in PAMS and conversation with the Program Managers if requested.

• Process-specific #3: It is essential that the NP complete the filling of the Research Division Director and Medium Energy Program Manager positions.

The Medium Energy Program Manager position has been filled internally. The Research Division Director position remains unfilled; two searches for this position were unsuccessful.

• Process-specific #4: The COV recommends that NP define the process and timeframes for the major reviews including the 2013 Comparative Review and communicate this to the field as soon as possible. It is important to provide the guidance to the PIs of the groups and to the panel as soon as possible.

As presented by NP, this recommendation has been addressed, and all information necessary for the PIs and panel members to carry out and participate in the review was communicated.

• Process-specific #5: The NP should perform further analysis of the workforce data and develop plans as needed to mitigate the impact of potentially constrained budgets on the workforce.

NP has an ongoing effort to assess resource needs including analysis of workforce impacts and mitigation methods for essential research and operations staff.

• Process-specific #6: We recommend continued engagement with the User Facilities to establish facility performance metrics that more directly measure the scientific productivity of those facilities.

In FY 2013, SC changed its approach to performance measures upon direction from OMB; the new metrics are now more directly linked to scientific productivity. SC will need to continue to quote percent utilization, which is reported in the annual Congressional budget. Through NP representation on the Office of Science Facilities Group, starting in FY 2016 this parameter in the Congressional budget includes an explanation that percent utilization is not a direct indication of scientific or facility productivity.

- Process-specific #7: The COV recommends that the coordination and the information exchange of accelerator R&D activities between SC offices be strengthened.

NP established an Accelerator R&D Joint Oversight Group (JOG) with BES and HEP which meets several times a year. NP will continue to focus on its short and mid-term accelerator R&D, as HEP is the steward for generic (long-term) R&D.

- Portfolio for the Future #1: We recommend a systematic assessment of computational needs across all theoretical and experimental subfields, especially for the smaller-scale projects in the Medium and Low Energy programs to see if further coordinated efforts within NP are needed.

Some assessment has been done in the areas of experimental fundamental symmetries and nuclear theory. Further activities are underway to coordinate future NP computational needs into the exascale era, such as a joint ASCR-NP workshop planned for June 2016.

- Portfolio for the Future #2: The COV endorses the creation of a distinct neutrino, neutron, and fundamental symmetries portfolio within the office.

A Fundamental Symmetries program within NP has been created and is currently managed in an Acting capacity by a Program Manager for a different NP program. Efforts to fill the Program Manager position with permanent personnel were not successful. The position was re-advertised in December 2015.

- COV-specific #1: The COV recommends that the NP prepare a written response to the COV recommendations within 30 days of receiving them from NSAC as per guidance from the Office of Science. This response should contain a plan of action to address the recommendations in this report. A report card detailing the progress on the COV recommendations should be sent to NSAC at the time of charging the next COV committee. We note that such a report card was not presented to NSAC in 2012 at the receipt of the current charge.

The 2013 COV report was presented to NSAC on March 15, 2013. The NP response to the COV Report was dated May 7, 2013, with an update on October 4, 2013. Regarding the Recommendations made in the 2013 COV Report, an updated response was provided in the briefing materials to this COV.

Comments:

It is disappointing that the 'critical need' for a database to track proposal and grant information, identified in the 2007, 2010, and 2013 COVs, has progressed so slowly. Much functionality is still under development. Given the slow pace of database (PAMS) development, alternative methods were used to a limited extent for tracking diversity and demographic information. It is unclear whether NP can affect the rate of progress in PAMS development, but the COV reaffirms this as a critical need that the Office of Science must address.

Since the 2013 COV, the position of Physics Research Division Director remains unfilled and presents a significant risk to the successful operation of the Office of Nuclear Physics.

The annual Workforce Survey is extremely valuable. The COV encourages NP to continue to analyze the workforce data to inform NP's plans for the future regarding balance of investments in the program.

The committee commends NP's efforts to clarify the performance measures in the Congressional budget language. We encourage NP to continue working with the User Facilities to tie performance metrics to scientific productivity, as needed.

The criteria used to evaluate laboratory grant applications have been clearly communicated in the recent heavy ion quadrennial review. This review can serve as a template for future quadrennial reviews. The time for the production of reports has been reduced considerably; the COV commends NP for this great improvement.

The COV commends NP for establishing an Accelerator R&D Joint Oversight Group (JOG) with BES and HEP. This serves as a valuable forum for communication and coordination of program-specific short and mid-term R&D, as well as generic long-term R&D.

Continued monitoring of computational needs across all subfields is important, and is an issue identified in the NSAC Long Range Plan.

The assessment of the committee is that 9 of the 15 Recommendations from the 2013 COV have been fully addressed. The remaining 6 Recommendations are related to subjects that continue to require the attention of NP (staffing, workforce analysis, evaluation of PAMS, and the path forward for defining the post-Competitive Review peer review process) or SC (PAMS database development and demographic tracking). Some of these items are repeated in the Comments and Recommendations in this COV Report.

Recommendations: **none**

F. Suggestions regarding the COV process

Findings:

The COV committee membership was finalized in early November 2015 and the COV meeting was originally scheduled for the last week in January 2016. A snowstorm forced the postponement of the COV to early March, 2016. Three members from the 2013 COV, including the chair, were part of the 2016 committee.

Extensive briefing materials were available online to the COV several weeks before the meeting.

The COV was able to inspect all the information in any file (jacket) as long as no conflict of interest (COI) existed between the person looking at the file and the members of the relevant group. Because of the transition to PAMS, the documentation in some of the jackets did not contain all relevant information to understand the rationale behind each funding decision. Such information was available upon request but time constraints limited the number of jackets for which that information could be obtained and studied.

Comments:

NP staff were very welcoming and helpful to the COV during our visit. They responded quickly and candidly to requests for information. Most subcommittees met with one or more program managers during the three-day visit in addition to the plenary sessions.

Since there is so much material to review, it would be beneficial to have one or more phone meetings of the COV prior to the COV visit. This was done in 2013. Many basic questions about how the office functions can be asked and answered in advance, leaving the on-site meeting to focus on inspection of jackets and more in-depth discussions with NP staff on particular issues.

The COV should consider requesting input from the community in advance, as was done in 2013, which may suggest issues for the committee to investigate.

It is very important that the next COV have access to all records in PAMS so that a full evaluation of both awards and declinations can be done.

Meetings with individual program managers were very helpful and informative for all subcommittees. In the future, it is important to maximize the time available for such discussions.

It would be helpful if all presentations are available as part of the on-line briefing book a few days before the meeting.

The Isotope Program covers a very diverse set of activities. Beyond grant awards, it also oversees and engages in routine production operations, establishment of new capabilities and

upgrade initiatives at various sites as well as extensive interaction with the various user communities, to name a few. It would be appropriate to consider adding new COV charge elements or additional language to existing charge elements that will direct future COV's to also evaluate the impact of these activities and their associated processes on the communities served by NP.

Section C of the COV report template states, "Within the boundaries defined by DOE missions and available funding, how the award process has affected the breadth and depth of the Nuclear Physics portfolio elements." The COV suggests that this section be eliminated, as most relevant information would naturally fit in sections A, B, or D.

Recommendations: **none**

G. Appendices

- Charge Letter to NSAC Chair
- Charge Letter to COV Chair
- COV Review Agenda
- List of COV Members
- Report Template for the 2016 COV

1. Charge Letter to NSAC Chair

Department of Energy
Washington, DC 20585

September 21, 2015

Dr. Donald Geesaman
Chair
DOE/NSF Nuclear Science Advisory Committee
Argonne National Laboratory
9700 South Cass Avenue
Argonne, Illinois 60439

Dear Dr. Geesaman:

This letter requests that the Nuclear Science Advisory Committee (NSAC) assemble a Committee of Visitors (COV) to review the management processes of the Department of Energy (DOE) Office of Science's Office of Nuclear Physics (NP). The panel should provide an assessment of the processes used to solicit, review, recommend, and document proposal actions and monitor active projects and programs for both the DOE laboratory and university programs.

The panel should assess the operations of the Office's programs during the fiscal years 2013, 2014, and 2015. The panel may examine any files from this period for all actions administered by the program for the period under review, including funding at national laboratories, universities, and other activities handled by the NP subprograms. The panel should consider and provide evaluation of the following major elements:

(a) the efficacy and quality of the processes used to solicit, review, recommend, monitor, and document application, proposal, and award actions; and
(b) the quality of the resulting portfolio, including its breadth and depth, and its national and international standing.

In addition to these findings, comments on observed strengths or deficiencies in any component or sub-component of the Office's portfolio and suggestions for improvement would be very valuable. The panel should also comment upon what progress has been made towards addressing action items from the previous COV review. You should work with the Associate Director of Science for Nuclear Physics to establish the processes and procedures so as to enable the first COV meeting to take place before the end of February 2016. The results of this assessment should be documented in a report with findings, comments, and recommendations clearly articulated; the report should be submitted to NSAC by the end of March 2016.

We appreciate the Committee's willingness to take on these important activities, and we look forward to your final report concerning these important tasks.

Sincerely,

Patricia M. Dehmer
Acting Director, Office of Science

cc: F. Fleming Crim, NSF
Allena Opper, NSF

Printed with soy ink on recycled paper

2. Charge Letter to COV Chair

Donald F. Geesaman 1-630-252-4059 phone
Distinguished Argonne Fellow 1-630-252-3903 fax
geesaman@anl.gov

Physics Division
Argonne National Laboratory
9700 South Cass Avenue, Bldg. 203
Argonne, IL 60439-4845

November 23, 2015

Prof. Gail Dodge
Department of Physics
Old Dominion University
Norfolk, VA 23529

Dear Gail,

As you know Dr. Patricia Dehmer, the Acting Director of the Office of Science at the Department of Energy (DOE), has charged the Nuclear Science Advisory Committee (NSAC) to establish a Committee of Visitors (COV) to review the management processes of the DOE Office of Science's Office of Nuclear Physics. The committee should provide an assessment of the processes used to solicit, review, recommend, and document proposal actions and monitor active projects and programs for both the DOE laboratory and university programs.

I am writing to formally ask you to serve as the Chair of the NSAC subcommittee to consider this charge and report back to NSAC. The work of this COV is of great importance for the future of nuclear science. Previous COV reports were issued in 2004, 2007, 2010, and 2013. Such COV serve a valuable purpose in assessing the management of key areas of the country's research portfolio.

The charge, of which you have a copy, asks that the report be submitted to NSAC by the end of March, 2016. It is expected that the site visit will take place January 26-28, 2016. I anticipate scheduling an NSAC meeting on March 23, 2016 and I would like to ask you to make a presentation on the findings of the COV. The report will need to be sent to me for distribution to NSAC in sufficient time before the NSAC meeting to ensure that the NSAC membership has time to read and reflect on it, preferably two weeks in advance of the meeting.

I realize this task places an extra burden on you. I and our whole community very much appreciate your willingness to take on this task. I therefore want to take the opportunity to express to you and to the sub-committee in advance my thanks for what you are doing. I will be available to help you in any way I can and I will serve on the COV in an ex officio capacity.

Sincerely yours,

Donald F. Geesaman
Chair, Nuclear Science Advisory Committee

3. COV Review Agenda

Committee of Visitors for Office of Nuclear Physics
DOE Headquarters, Germantown, MD
March 1-3, 2016

Tuesday, March 1

8:00 am	**Meet in DOE Lobby**	
8:15 am	Executive Session **(E-301)** COV charge, etc..., procedures	
8:50 am	Welcome	Tim Hallman
9:00 am	Office of Nuclear Physics Overview (30+15)	Tim Hallman
9:45 am	Physics Research Division Overview (30+15)	Tim Hallman
10:30 am	**Break**	
10:45 am	Facilities & Project Management Division Overview (30+15)	Jehanne Gillo
11:30 pm	Isotope Program Overview (30+15 min)	Jehanne Gillo
12:15 pm	**Working Lunch (E-301)**	
1:30 pm	Q&A with Office on morning discussions	
2:30 pm	Budget Process (20+10)	Joanne Wolfe
3:00 pm	Status of PAMS (15+10)	Linda Blevins
3:25 pm	**Break then Closed Session**	
4:15 pm	Discussion with Hallman and Division Director	
4:45 pm	Committee Breakouts (Program Managers available for discussion with breakout groups as requested)	

Grants 1	Grants 2	Lab Res.	Facility Ops	Projects	Isotopes
(G-403)	**(G-412)**	**(F-441)**	**(E-301)**	**(E-301)**	**(J-108)**

6:00 pm	Executive Session **(E-301)** – Committee generates list of additional information desired for presentation on Tuesday or Wednesday.	
7:00 pm	**Adjourn**	
7:30 pm	**Dinner**	

Wednesday, March 2

7:45 am **Meet in DOE Lobby**

8:00 am Report on Homework **(E-301)**

9:00 am Executive Session

10:30 am **Breaks (E-301) & (NP Hallway – near G-417)**

10:45 am Committee Breakouts (Program Managers available for discussion with breakout groups as requested)

Grants 1	Grants 2	Lab Res.	Facility Ops	Projects	Isotopes
(G-403)	(G-412)	(F-441)	(E-301)	(E-301)	(G-207)

12:00 pm **Working Lunch (G-207)**

1:15 pm Continue Committee Breakouts (Program Managers available for discussion with breakout groups as requested)

Grants 1	Grants 2	Lab Res.	Facility Ops	Projects	Isotopes
(G-403)	(G-412)	(F-441)	(H-209)	(J-108)	(G-207)

2:30 pm **Break (NP Hallway – near G-417)**

2:40 pm Executive Session **(G-207)** Discuss initial findings

4:30 pm Committee work or Meet with program managers, assign homework

6:30 pm **Adjourn**

7:30 pm **Dinner**

Thursday, March 3

8:00 am **Meet in DOE Lobby**

8:30 am Report on Homework **(A-410)**

9:30 am Executive Session - Preparation of Report

12:00 pm **Working Lunch**

1:00 pm Preparation of Report

3:00 pm Meet with Jehanne Gillo

3:30 pm **Closeout**

4:00 pm **Adjourn**

4. List of COV Members

Office of Nuclear Physics
Committee of Visitors
2016 Panel Members

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5. Report Template for the 2016 COV

REPORT TEMPLATE FOR THE FY 2016 NP COMMITTEE OF VISITORS

March 2016

2015 Charge to the Nuclear Science Advisory Committee:

"This letter requests that the Nuclear Science Advisory Committee (NSAC) assemble a Committee of Visitors (COV) to review the management processes of the Department of Energy (DOE) Office of Science's Office of Nuclear Physics program. The panel should provide an assessment of the processes used to solicit, review, recommend, and document proposal actions and monitor active projects and programs for both the DOE laboratory and university programs.

The panel should assess the operations of the Office's programs during the fiscal years 2013, 2014, and 2015. The panel may examine any files from this period for all actions administered by the program for the period under review, including funding at national laboratories, universities, and other activities handled by the program. The panel should consider and provide evaluation of the following major elements:

(a) the efficacy and quality of the processes used to solicit, review, recommend, monitor, and document application, proposal, and award actions; and
(b) the quality of the resulting portfolio, including its breadth and depth, and its national and international standing.

In addition to these findings, comments on observed strengths or deficiencies in any component or sub-component of the Office's portfolio and suggestions for improvement would be very valuable. The panel should also comment upon what progress has been made towards addressing action items from the previous COV review. You should work with the Associate Director of Science for Nuclear Physics to establish the processes and procedures so as to enable the first COV meeting to take place before the end of March 2016. The results of this assessment should be documented in a report with findings, comments, and recommendations clearly articulated; the report should be submitted to NSAC by the end of April 2016."

Based on the COV's study of proposal actions completed within the past three fiscal years, please provide concise findings, comments and recommendations on the following aspects of the programs' processes and management related to:

A. The effectiveness, efficiency and quality of the processes used to solicit, review, recommend, and document proposal actions.

Consider for example:

- Consistency with priorities and criteria stated in the program's solicitations, announcements, and guidelines
- Appropriateness of project initiation and selection and adequacy of project definition
- Appropriateness of review mechanism (panels, ad hoc reviews, site visits)
- Adequate number of reviewers for balanced review; use of reviewers having appropriate expertise/qualifications; use of a sufficiently broad pool of reviewers; avoidance of conflicts of interest
- Efficiency/time to decision
- Completeness of documentation making recommendations

Findings:

Comments:

Recommendations:

B. The monitoring of active projects and programs.

Consider for example:

- Grant progress reports
- Appropriateness and effectiveness of review mechanisms:
    - Annual Science and Technology reviews of National User Facilities
    - Program Reviews
    - Project Reviews
    - Other review mechanisms
- Program Manager briefings
- Contractors meetings
- Site Visits
- Interactions at topical, national and other meetings
- Effectiveness of monitoring project/program execution
- Completeness and quality of documentation

Findings:

Comments:

Recommendations:

C. Within the boundaries defined by DOE missions and available funding, how the award process has affected the breadth and depth of the Nuclear Physics portfolio elements.

Taking into account DOE and NP missions, the available funding, and information presented about the portfolio of funded science, comment on how the award process has affected the breadth and depth portfolio elements.
Consider for example:

- The overall quality of science
- The appropriateness of award scope, size, and duration
- The evolution of the portfolio with respect to new investigators and science opportunities
- The balance of projects with respect to innovation, risk and interdisciplinary research
- Long term goals of the NP office (tracked by OMB)

Findings:

Comments:

Recommendations:

D. The national and international standing of the portfolio elements.

Taking into account DOE and NP missions, the available funding, and information presented about the portfolio of funded science, comment on how the award process has affected the national and international standing of the portfolio elements:
Consider for example:

- The uniqueness, significance, and scientific impact of the portfolio;
- The stature of the portfolio principal investigators in their fields;
- The leadership position of the portfolio in the nation and the world.

Findings:

Comments:

Recommendations:

E. Progress made towards addressing action items from the previous COV review

Findings:

Comments:

Recommendations:

F. Suggestions regarding the COV process

This section is to be based on the COV's impression of the overall process used for this review and comment on which processes best enabled the committee to address its charge and suggestions on processes that could be implemented to improve future such reviews.

Findings:

Comments:

Recommendations: