Report of the 2015 Committee of Visitors
Division of Materials Research
National Science Foundation

Meeting Dates
September 16-18, 2015

Submitted on behalf of the Committee by
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to
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I. Summary and Recommendations

The 2015 Committee of Visitors (COV) for the Division of Materials Research (DMR) of the National Science Foundation met at NSF on September 16-18, 2015.

The COV was charged to address and prepare a report on:

- the integrity and efficacy of processes used to solicit, review, recommend, and document proposal actions;
- the quality and significance of the results of the Division's programmatic investments;
- the relationship between award decisions, program goals, and Foundation-wide programs and strategic goals;
- the Division's response to the prior COV report of 2011 as well as annual updates of the response; and
- any other issues that the COV felt to be relevant to the review.

This document is the resulting report.

Section I provides a summary of key observations and recommendations assembled by the COV. These recommendations emerged from discussions of the COV, and largely address themes that were found by the COV to be common to multiple programs within DMR.

Section II details the COV response to the questions posed in Part 4 of the report template.

Section III of the report addresses recommendations for the next COV meeting.

Section IV of the report provides the COVs observations on the individual programs.

Observations and Recommendations

Overall, the members of the COV were impressed greatly by the dedication of the DMR staff, and the quality of the processes used by DMR staff to manage their portfolio of research projects. The COV judged the 12 Programs of DMR to have substantially advanced the strategic goals of NSF over the four year period considered by the COV, including both transforming the frontiers of science and engineering, and stimulating innovation that addresses societal needs. For example, research supported by the Division has led to a range of breakthroughs in basic materials research, including synthesis of ceramic quasicrystals as a new class of materials, key advances in our understanding of topological insulators, insights into atomic-scale flow defects in metallic glasses, room-temperature organic-inorganic hybrid exciton polaritons, and the development of methodologies based on the close coupling of computer simulation and experiment that have led to the discovery of new cobalt alloys for use at high temperatures. These basic materials-related discoveries have subsequently enabled a spectrum of engineering innovations, including water purification technologies, bio-sourced feedstocks for chemicals and materials, x-ray detectors with sensitivities that open up new potential applications in medicine, efficient, energy harvesting solar cells, solid state lighting and optically non-linear quantum devices, novel pigments with high IR reflectivity for "green buildings", prototype soft-solid electrolytes for batteries, "ionic skin" capable of sensing mechanical forces, and metallic alloys for use in extreme environments.

The MRSEC program, in particular, was viewed as an outstanding example of a program that defines and advances frontier topics in basic materials science, and closely couples such basic discovery with innovations that address societal needs. In this respect the COV noted that since

1985, 133 companies in 22 states have been spun out of MRSECs. One MRSEC alone is credited with the creation of >350 jobs. The PREM program was also viewed as an exemplar and model of efforts in the Foundation to broaden the participation of underrepresented groups in STEM fields (more than 46% of graduate students and 49% of faculty participants in PREMs are from under-represented minority groups).

In addition to completing the Program-specific report templates, the COV engaged in a series of conversations during the meeting at NSF from which it arrived at the following key observations and recommendations.

1. The historical impact of DMR-funded research is impressive, but the COV judged that there is an urgent need to benchmark the investment in basic materials research in DMR in a global context. This benchmarking will help guide investment by DMR in the various areas of materials science and engineering, and potentially lead to greater investment. While the COV discussed anecdotal evidence of the declining global leadership of the US in materials research, it was concluded that a new National Academies-level report is needed to assemble the facts and guide investment in basic materials research across the US. This report can play a key role in objective benchmarking of investment in research in DMR. The Academies level report should examine the return on investment occurring in the US and other countries (basic science discoveries, patents, companies…)? It may be part of a broader report on the competitiveness of research in the basic sciences.

2. The core programs in DMR represent important areas of materials research, but the current prioritization of funding in DMR appears to be largely historical, and the relative investment in core programs has changed little over time (although the focus of research within some programs has changed). The COV felt strongly that there needs to be a process at the Division level by which investments are deliberately evaluated and transformed over time. Optimization of the investment must be done at the Division level, not one program at a time. The COV noted that this process may lead to a new program structure that is aligned with evolving materials challenges. The COV noted also that the perspectives assembled through a report of the type in point #1 above would provide key guidance to this process. A precedent for such a process may exist in the Chemistry Division, and it should be examined for the positive and negative outcomes.

3. The COV observed that the program managers and administrative staff of DMR are thoughtful and passionate about their programs. The work load, however, threatens to compromise the ability of the Division to continue its high historical impact and ability to provide continued leadership to NSF. The COV concluded that the workload of the administrative staff (many are managing three programs in DMR; whereas programs in other parts of the Foundation have a single administrative staff member) and program managers (250 proposals/year in DMR whereas 100 proposals/year appears to be more common in other parts of NSF) is unreasonably high. It was also noted that the complexity of the DMR programs is often high, cutting across traditional discipline boundaries and Divisions at NSF. In addition, the COV was concerned that the workload of program managers may be contributing to the high turnover and lack of continuity in flagship programs of the Division. The loss of program managers with a decade or more of experience has the potential to cause long-lasting damage to the Division including the relationship between the Division and materials community. Overall, the COV concluded that the staffing challenge is threatening the ability of the Division to accomplish its mission. The COV recommends that (i) a work-load analysis be used to guide investment of FTEs across the Foundation, (ii) DMR explore other models for conducting reviews, including engagement of the broader community in the review process (precedents exist for such processes, such as the review

process used by NASA), and (iii) the merits of hiring temporary help (contractors) be evaluated.

4. The COV noted that virtual panels have been adopted by DMR over the past 4 years, in part due to fiscal constraints, and that DMR program managers and leadership have been thoughtful in implementing virtual panels to take advantage of their positive attributes relative to in-person panels. For example, the small size of a virtual panel permits program managers to assemble panels that address focused topics. The use of virtual panels also enables participation in the review process of members of the materials community who cannot travel to NSF for panel reviews. However, the impact of virtual panels on the outcomes of the review process has not been systematically evaluated. Given the likely increase in use of virtual panels, the COV judged it timely to evaluate their strengths and weakness as a mechanism for reviewing proposals. This process will help develop best practices that can be broadly disseminated. The COV perceived that in-person panels may offer benefits that are absent in virtual panels - for example, junior members of panels often interact informally with seasoned panelists and program managers during in-person panels. In addition, it was noted that the administrative burden of managing multiple small panels is greater than fewer but larger in-person panels.

5. The COV was impressed by the leadership role that DMR has played within the Foundation in the establishment of the DMREF program as part of the broader Materials Genome Initiative. The success of the program within the Foundation is evidenced by the increasing participation of other Divisions in the program. However, the COV suggests that both DMR and the Foundation examine if the success of DMREF presents an opportunity that can be capitalized on to bring additional funds to NSF as part of the MGI, and to Federally funded research in the US as a whole. With careful presentation of the DMREF program to Congress as part of the Materials Genome Initiative, the potential for increased investment may exist. The Nanotechnology Initiative may provide an example of the potential upside of such an effort.

6. As noted by the previous COV report, DMR's investment in facilities is compelling when the facilities provide unique materials-related capabilities. Given the limited resources available to DMR, the COV felt that the investment in facilities needs to be more carefully examined by DMR, particularly for CHESS. DMR should explicitly justify the investment in CHESS in the context of uniqueness of capabilities for materials research given the other synchrotrons that exist in the US and elsewhere. This was a recommendation of the previous COV and it has not been addressed.

7. With strong justification (lack of funding and complexity of the interactions with foreign funding bodies), DMR leadership has sunset two international programs over the past 4 years (IMI and MWN). International collaborations, however, were judged by the COV as being important because they help prepare the next generation of researchers to operate in the global research community, and because much excellent materials-related research occurs outside of the US (and increasingly so). The COV encourages DMR to explore new mechanisms that enable international interactions without the overhead of the prior programs. The new Israel-US program provides one such example that might be pursued more broadly.

8. DMR program managers are encouraged to articulate the full impact of the accomplishments of the research groups supported by their programs. Specifically, the COV felt that publication in journals with "high impact factors" was overly emphasized as an outcome, whereas high impact research is being published outside of such journals. The COV was concerned that, in some cases, the quality of the research outcomes was articulated by

where the work was published not by the actual research outcome or impact. For audiences such as COVs and the materials science community, the COV recommends that a broader range of metrics and descriptors be used to communicate the impact of the research, including, for example, a more detailed description of the research accomplishment, citations and citation maps of projects, and descriptions of broader societal impacts. In general, the COV recommends that the metrics used to communicate the impact of DMR investment be tuned to the audience.

9. The COV was uniformly impressed by the careful and insightful analysis that is documented in the jackets prepared by the program managers. In general, the COV judged this analysis to provide a strong and convincing rationale for the funding decisions. As such, the analysis has the potential to be highly valuable to applicants in understanding the basis of funding decisions, yet this information is not routinely conveyed to the applicant. Although some program managers communicate elements of this information to the applicant, the practice is not uniform across the Division. The COV recommends that a greater fraction of this analysis be routinely provided to applicants, unless there are compelling reasons for not doing so. Even for proposals that were not discussed at panels, the COV observed that the jackets often contained useful summaries of the deficiencies in the proposals. The COV felt that detailed feedback would also be particularly impactful for borderline decisions, and in cases where extra mentoring would be beneficial (e.g., junior faculty) or additional engagement could have positive effects (e.g., to broaden participation). It is also understood that these processes need to be implemented in a manner that does not lead to an excessive workload increase for program managers. For programs that rely heavily on mail reviews, this practice would be very helpful. In addition, if not already communicated to applicants, all proposals that are not discussed should be accompanied by a clear statement to that effect.

10. The current process for the selection of reviewers for proposals seemed, in general, to be cumbersome and inefficient, and the COV felt that the review process would benefit from a formal database to guide the selection process. The COV also noted lack of uniformity between programs in how reviewers are selected, and the importance of reviewer selection in objective evaluation of the merits of proposals. Some COVs members felt strongly that program managers should receive some independent input on the selection of reviewers.

11. The COV is deeply concerned regarding the sizes of awards. Specifically, over an extended duration (>5 years), the sizes of awards have not kept pace with inflation or the increasing cost of supporting graduate students and, consequently, the buying power of the funds flowing to individual research groups from DMR grants (in single investigator grants as well as MRSEC grants) has eroded to the point that, in some cases, they do not permit full support of even a single graduate student (with supplies etc). It was also commented that the buying power of awards has diminished to the point where most graduate students are partially supported on multiple grants. Many Federal agencies are, in contrast, increasingly expecting research accomplishments be assigned solely to a single Federal program. It was also noted that the scope of work described in typical proposals has not diminished with the decreasing buying power of funds awarded. Finally, it was felt that young investigators and investigators at small institutions are hit particularly hard by small grant sizes (they have few alternative funding sources to supplement partial support of students), and that they are increasingly not viewing DMR as an attractive source of funding. The COV recommends that the buying power of grants awarded by DMR not be allowed to decrease further, and that funding be commensurate with the scope of the work that is described in a proposal.

12. For program managers to maintain their understanding of the key challenges and opportunities in their field, and to maintain contact with researchers in their field, the COVs viewed it as essential that program managers have access to funding and time to attend

technical meetings. The COV is aware that constraints exist for Federal employees attending conferences, but felt that those constraints should not prevent program managers from attending conferences and interacting with their professional community.

Submitted on behalf of the 2015 DMR Committee of Visitors.

Sincerely,

Nicholas L. Abbott
2015 DMR COV Chairperson

Section II: COV Comments on Part 4 Questions

1: Please comment on the appropriateness of the award sizes and durations for the research projects supported by DMR?

The COV is deeply concerned regarding the sizes of awards. Specifically, over an extended duration (>5 years), the sizes of awards have not kept pace with inflation or the increasing cost of supporting graduate students and, consequently, the buying power of funds flowing to individual research groups from DMR grants (e.g., in single investigator grants or within a MRSEC grant) have eroded to the point that, in some cases, they do not permit full support of even a single graduate student (with supplies etc.). It was also commented that the buying power of awards has diminished to the point where most graduate students are partially supported on multiple grants – this comes at a time when some Federal agencies are asking that specific research accomplishments be assigned to a single Federal program. Finally, it was felt that young investigators and investigators at small institutions are hit particularly hard by the decreasing buying power of grants (as they have few alternative funding sources to supplement partial support of students from DMR grants), and that they are increasingly not viewing DMR as an attractive source of funding. The COV also expressed the view that expectations regarding the scope of research proposed in a grant application have remained largely constant as the buying power of each grant has declined. Funding needs to be commensurate with the scope of the work described in the various proposal types. Specific to the MRSEC, the role of seed/superseed projects was viewed by the COV as extremely important to maintaining the cutting-edge position of these centers. It was felt that an increase in the budget of seed programs in MRSECs would help promote further the evolution of the centers and their ability to response to emerging materials research challenges.

In contrast, the overall consensus of the COV was that the duration of the various awards (e.g., 3 years for single investigator awards, 4 years for DMREF, 5 years for PREM and 6 years for MRSEC) generally makes sense given the relative complexity of the projects funded by each mechanism. There was some discussion in the COV regarding the potential merits of increasing the duration of single investigator grants to 4 years – it was felt this had the potential upside of more closely aligning the grant cycle with a graduate student lifecycle. However, these potential upsides were viewed to be outweighed by negatives, such as a decrease in the number of awards and thus a decrease in the size of the community supported by DMR (unless additional funds can be obtained). In the absence of an infusion of additional much-needed funds to DMR, on balance, the COV felt that 3 years is an appropriate grant duration for the majority of single investigator grants in the core programs.

2: Please comment on the level of risk in projects supported in the DMR portfolio.

The COV noted that DMR has in place a number of mechanisms to enable funding of high-risk and potentially transformative research, including the EAGER mechanism and the seed programs of MRSECs. These are excellent and impactful, and DMR is encouraged to continue or expand their use for this purpose.

Within the core programs and regular single/multi-investigator proposals, however, the COV felt that the funded proposals, although representing very strong science, were relatively conservative, which may restrict the potential for large leaps in science or knowledge. It was also acknowledged that there are many forms of risk, and that investment in young investigators via the CAREER mechanism can be viewed as a form of risk taking. That said, the COV encourages program managers to flag proposals that do not do well in the merit review process due to reviewers'

aversion to risk and to carefully evaluate whether or not the potential outcome of the research justifies an investment. Clear justification in these circumstances should be provided in the jackets by the program managers. In some programs, it was evident that the EAGER mechanism had been used to fund proposals that were judged to be too high in risk for a regular grant, but in other programs such actions by program managers were seldom evident. One idea discussed by the COV was for DMR to create a central source of funding that is ear-marked for unusually ambitious proposals that are viewed by reviewers as being too high in risk. The DMR program managers would compete for this funding across the Division. It was also noted that the high turn-over of Program Managers likely leads to less risk-taking as program managers do not have the chance to develop a broad perspective on a field of research or community of investigators. The COV noted that to promote a culture of risk-taking in proposals, it is important that failure of risky projects not impact negatively on Program Managers. The above remarks should also be understood in light of the fact that risk-taking in academic research must be managed in a manner consistent with the education of graduate students.

Finally, it was commented that the community of materials researchers views NSF as an organization that does not tend to fund research that is high in risk, and thus there is a general reluctance in the community to submit such proposals to NSF. To change this perception, the Program Managers are encouraged to communicate broadly their willingness to support high risk research, and to carefully counsel reviewers regarding the desire of the Division to fund high-risk, high-impact research. Overall, a cultural shift is required in the way in which applicants and reviewers view DMR's wish to fund higher risk/higher impact proposals. This statement is true, more broadly, for the entire Foundation.

3: Based on NSF's most recent strategic plan, NSF has three goals:
1) Transform the frontiers of science and engineering. 2) Stimulate innovation and address societal needs. 3) Excel as a Federal Service Agency—to guide the individual and collective efforts involved in achieving the agency's mission.

How well is the division aligned with these goals, specifically in regards to research, education and diversity?

The COV judged DMR to be exemplary in advancing the goals of NSF's strategic plan. Over the past 4 years, research supported by the Division has led to a range of breakthroughs in basic materials research, including synthesis of ceramic quasicrystals as a new class of materials, key advances in our understanding of topological insulators, insights into atomic-scale flow defects in metallic glasses, room-temperature organic-inorganic hybrid exciton polaritons, and the development of methodologies based on the close coupling of computer simulation and experiment that have led to the discovery of new cobalt alloys for use at high temperatures. These basic materials-related discoveries have subsequently enabled a spectrum of engineering innovations, including water purification technologies, bio-sourced feedstocks for chemicals and materials, x-ray detectors with sensitivities that open up new potential applications in medicine, efficient, energy harvesting solar cells, solid state lighting and optically non-linear quantum devices, novel pigments with high IR reflectivity for "green buildings", prototype soft-solid electrolytes for batteries, "ionic skin" capable of sensing mechanical forces, and metallic alloys for use in extreme environments.

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46% of graduate students and 49% of faculty participants in PREMs are from under-represented minority groups). All of these outcomes are aligned with the strategic goals of the Foundation.

It was also evident to the COV that the Program Managers and support staff of DMR are extraordinarily dedicated and committed to fulfilling the mission of the Division in a manner aligned closely with the Foundation. However, at the current critically low levels of staffing, fulfilling this mission in the future, and maintaining the excellence for which the Division is currently known in the materials community, is at risk. The work load of some DMR Program Managers (e.g., 250 proposals/year) appears alarmingly high relative to other parts of NSF (in some cases, at least, 100 proposals per year is closer to the norm). Some administrative staff in DMR are serving 3 different Program Managers, as well as managing many other aspects of the operation of DMR, whereas in other parts of NSF the norm appears to be closer to one Program Manager per administrative staff member. Increasingly, Program Managers in DMR are, out of necessity, performing tasks that would optimally be performed by administrative staff, adding further to their workload. The recent high turn-over in Program Managers is compounding these issues, as new Program Managers require greater levels of administrative help. The concern of the COV is also that the high turn-over reflects the work environment. The loss of Program Managers with 10 years of experience has enormous negative impacts on DMR, including the loss of working relationships with the broad community of materials researchers. The high turnover also impacts the capability of the Program Managers and leadership to evolve DMR programs in a deliberate manner. The COV concluded that there is an urgent need to perform a work-load analysis (if it doesn't already exist), and implement an objective allocation of FTEs across the Foundation to reflect the relative needs of the Divisions. This issue has been raised by previous COVs for DMR, and it has ***not*** been addressed. The COV judges that the absence of immediate action places at risk the ability of DMR to fulfill its mission in a manner consistent with that of the Foundation (specifically, "to excel as a Federal Service Agency").

4: Are any emerging research areas missing from DMR's portfolio? Are there any research areas over emphasized in the portfolio?

Given the constraints on time, the COV members were hesitant to offer a list of specific research areas that are missing or over-emphasized in DMR's portfolio, largely out of concern that the reporting of an incomplete list of research areas may skew future discussions regarding priorities. The discussions of the COV in response to this question revolved, instead, around the need for additional processes within DMR to identify emerging areas of research for Program Managers as well as areas that have matured and may be over-emphasized. These processes could include greater participation of Program Managers in technical meetings, and the convening of focused workshops aimed at evaluating emerging areas of research. The COV was surprised, for example, that the relative funding levels of the various core programs in DMR has remained constant over an extended duration. While it was recognized that the research supported within the core program areas has evolved, it was felt that an objective analysis of the challenges facing the materials community has the potential to generate even greater impact from the limited resources coming to DMR.

One topic that did arise during the discussion of this question was related to the funding of soft matter physics. While many programs do fund certain aspects of soft matter physics, a number of members of the COV felt that the potential benefits of the creation of a soft matter physics program should be examined by the leadership of DMR.

Listed below are some emerging themes and areas of research that were identified by the COV as ones that deserve or potentially deserve investment by DMR. As emphasized above, however, the list of research topics should not be viewed as an exhaustive list, nor should it be interpreted to suggest that topics not included in the list are not equally or more important. The COV did not have

a substantial discussion of areas of research that it felt were over-represented in DMRs current portfolio.

Cooperative material systems
Extracellular biological materials and function (extremophiles)
Functional surfaces (antibacterials, self-cleaning..)
Hierarchical assembly of structure and properties
Instrumentation – *in situ* and *in operando* technique development
Materials for extreme environments (high P, T, radiation)
Machine learning in computational materials science
Meso-scale science
Many-body localization
Systems far from equilibrium
Solid state platforms for quantum computation
Two-dimensional and three-dimensional semiconductor synthesis
Waste and materials lifecycle

III: Suggestions for Next COV

The COV recommends that the following points be considered when planning the next COV meeting.

1. The inclusion of a greater number of COV members who have had prior experience on the DMR COV (e.g., 20%) will provide continuity and memory between COVs.

2. The effectiveness of the COV can likely be increased by more organization up-front: It is suggested that each group assigned to a program hear the program manager give his/her presentation ahead of time via telecon and that the slides be available to those COV members ahead of time. This information will provide context for the assignment to review jackets. In the simplest model, this implies three telecons for each member (overview and then two programs each), but the payoff will likely be a more efficient and effective in-person meeting.

3. There was a general consensus among COV members that the program manager's oral reports were variable in their effectiveness regarding communication of information required to assess the outcomes of their programs. Greater uniformity in the presentation of outcomes is encouraged. More broadly there was a general concern that the materials presented to the COV were overly skewed towards process, particularly details of merit review. The importance of having the merit review process effectively audited was appreciated by the COV, but there was also a feeling that the COV should evaluate the management of DMR to all relevant metrics. In particular, there should be greater focus on outcomes (impact of the science executed with the money awarded).

4. A better selection of e-jackets is needed to ensure that the e-jackets are representative of the various types of proposals/decisions handled by DMR program managers. The e-jackets provided for some DMR programs were not representative (due to the random selection of small numbers of proposals) and additional e-jackets had to be requested. The random algorithm needs to be applied more narrowly among categories of proposals (research: CAREER, renewal, other new; other, e.g. conference support; ideally, although this may be a software challenge, among the three rating categories: awarded, highly competitive not awarded, other). The bottom line is, the COV needs a more representative set of jackets for effective analysis.

5. A searchable spreadsheet/database containing key data on proposals/review outcome will permit COV members to efficiently extract certain classes of proposals from e-jackets (e.g., gray-zone proposals, proposals submitted by underrepresented groups etc)

6. A shared drive (or equivalent) should be available for circulating documents among COV members.

7. It would be beneficial to conduct committee discussions in a format where COV members face one another around a table as they speak. This will promote a balanced discussion.

Section IV: Program Reports

National Facilities (NAT FAC)

INTEGRITY AND EFFICIENCY OF THE PROGRAM'S PROCESSES AND MANAGEMENT

Briefly discuss and provide comments for *each* relevant aspect of the program's review process and management. Comments should be based on a review of proposal actions (awards, declinations, and withdrawals) that were *completed within the past three fiscal years*. Provide comments for *each* program being reviewed and for those questions that are relevant to the program(s) under review. Quantitative information may be required for some questions. Constructive comments noting areas in need of improvement are encouraged.

I. Questions about the quality and effectiveness of the program's use of merit review process. Please answer the following questions about the effectiveness of the merit review process and provide comments or concerns in the space below the question**.**

QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCESS	YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE
1. Are the review methods (for example, panel, ad hoc, site visits) appropriate? Comments: Review methods for National Facilities involved ad hoc reviews and periodic site visits, both needed to properly evaluate and monitor this scale of facility. This balance between types of review methods seems appropriate. Site visits included a panel of experts. In addition to external review, an extensive process of internal review, involving first the Program Director and Division Director and subsequently the AD review committee, Directors Review Board, then the National Science Board provides extensive oversight and examination of proposals. For the National Facilities, the solicitation and the review process is quite complicated and is not as broadly communicated to the scientific community as a typical NSF program. However, the review process is appropriate for this type of program. The Instrumentation program solicitation and review are more typical and are appropriate. The mail-in reviews are done in isolation, which can be less effective than panel reviews or post-site-visit written reviews because reviews are often conflicting. An important part of effective evaluation is interacting with other reviewers and thus it is suggested that mail-in reviews supplement the panel or site visit process but not replace it. Alternatively, the ad-hoc reviews could benefit from a subsequent web-based consensus meeting.	YES

For the National Facility reviews, some of the mail-in reviews focus on a single experimental beamline or technique by a specialist, so those reviews are very specific and useful. **Data Source: EIS/Type of Review Module**	
2. Are both merit review criteria addressed a) In individual reviews? Individual reviewers all listed technical merit and broader impact but addressed technical merit much more fully (and often more harshly) than the broader impact. b) In panel summaries? Equally addressed technical merit and broader impact. c) In Program Officer review analyses? Equally addressed technical merit and broader impact. Comments: Both review criteria are typically addressed well. Other merit review criteria are important in the National Facilities program and must be addressed separately in all evaluations (individual, panel summary, and review analysis). These include: long-term vision of the facility, role in the national and international context, user science impact, quality of user time, uniqueness of capabilities and services, fairness of the proposal review process, and user demand. For the National Facilities, the annual process of holding site visits requiring extensive reports is rigorous and important for keeping the facilities productive. For the National Facilities, although the two main merit criteria are met, sometimes the above described proposal-specific criteria do not appear to be met. An example is the CHESS national facility. In the review process and program manager assessment, the context of the facility is not placed into the national and international context, nor is its uniqueness addressed, especially in light of the existing and quite similar other synchrotrons across the nation and the world. None of the experimental beamlines are identified as being unique or world class. For the Instrumentation program reviews, the broader impacts receive less attention. **Data Source: Jackets**	YES

3. Do the individual reviewers giving written reviews provide substantive comments to explain their assessment of the proposals? Comments: For the National Facilities, the level of individual review is rigorous and thorough. The number of reviews is also large (sometime more than 20) and diverse, which is important given the broad range of research conducted at the facilities. The individual reviewers make extensive comments and have accurately described the basis of their assessment. **Data Source: Jackets**	YES
4. Do the panel summaries provide the rationale for the panel consensus (or reasons consensus was not reached)? Comments: There are many reviews, which provide many perspectives on which to base a consensus decision. This is very important given the breadth and depth of these programs. The panel summaries (i.e. site-visit reports for National Facilities) are highly effective and incorporate the major issues identified in the individual reviews. Areas with disagreement were identified and described. **Data Source: Jackets**	YES
5. Does the documentation in the jacket provide the rationale for the award/decline decision? [Note: Documentation in the jacket usually includes a context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), program officer review analysis, and staff diary notes.] Comments: For the National Facilities, the decision as to whether to award or decline a proposal does not solely involve the input from the site visit panels and PO assessment - the PO recommendation is only the first step in the decision-making process, which also involves the Division Director, AD Review Board, and higher level evaluations. The reviews focus on how to continuously improve the facility in keeping with the cooperative stewardship model. A large amount of data is collected to warrant the funding decision. While it is an enormous task to compile and distill this information, the COV believes this combination of individual reports, site visit reports, and PO reports is effective. Jacket documentation for the full proposal is complete and thorough. These records, however, can be difficult to find in among the numerous categories and routing funding extensions. The Jacket documentation and tracking could benefit from some cross-referencing. For the National Facilities, where there are many annual report documents, it would be helpful to cross-reference these renewals with the parent proposal. **Data Source: Jackets**	YES

6. Does the documentation to the PI provide the rationale for the award/decline decision? [Note: Documentation to PI usually includes context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), and, if not otherwise provided in the panel summary, an explanation from the program officer (written in the PO Comments field or emailed with a copy in the jacket, or telephoned with a diary note in the jacket) of the basis for a declination.] Comments: There are substantial interactions between the program director and the PIs to communicate feedback from the various types of reviews, ranging from ad hoc reviews to site visit. In particular, the feedback to PIs from site visits reflected the site visit discussion quite closely. However in some cases, it is suggested that the comments in the site review summary be communicated to the PI along with a frank evaluation of specific strengths and weaknesses. **Data Source: Jackets**	YES
7. Additional comments on the quality and effectiveness of the program's use of merit review process: The procedural aspects of the merit review process are effective and generally well-managed. The FastLane and Jackets systems are well-organized and able to document proposals effectively. For the National Facilities, the reviews were of high quality, but the proposal specific metrics were not applied equally. These include long-term vision of the facility, role of the national and international context, user science impact, quality of user time, uniqueness of capabilities and services, fairness of the proposal review process, and user demand. The programmatic goals and the processes for establishing them were not well articulated. The stated goal is to manage a portfolio that already exists and just needs to be maintained. The scientific drivers were not apparent. For the Instrumentation proposals, it was somewhat unclear how Program Directors balance scores among and between reviewers and make funding decisions. This was especially the case for the proposals in the gray area that were neither outstanding nor poor. This could be improved by providing a more detailed Program Director summary that includes the scientific impact, number of users, and leverage with other facilities, instrumentation, and programs of interest to NSF-funded researchers. For future COV meetings, it would also be nice to have a database query of proposal ratings (scores) vs. decisions in order to evaluate this better.	YES

II. Questions concerning the selection of reviewers. Please answer the following questions about the selection of reviewers and provide comments or concerns in the space below the question.

SELECTION OF REVIEWERS	YES , NO, DATA NOT AVAILABLE, or NOT APPLICABLE
1. Did the program make use of reviewers having appropriate expertise and/or qualifications? Comments: The reviewers for National Facilities proposals are extremely well-qualified with diverse expertise required for these broad and far-ranging programs. The reviewers are very experienced in working with and running user facilities. Some of them have experience in management of national facilities supported by other agencies. The diversity of the panels (gender, university/national lab, domestic/international, fundamental/applied) is well balanced. A brief mention was made by a PD regarding the existence of a reviewer database, but it does not appear to be widely used. The COV recommends the development and adoption of a database for reviewers. This has the potential to aid the identification of qualified reviewers (following the example of journals) and also decrease the time invested by Program Officers in finding reviewers. **Data Source: Jackets**	**YES**
2. Did the program recognize and resolve conflicts of interest when appropriate? Comments: There was no evidence of COI for reviewers in the NAF programs. **Data Source: Jackets**	**YES**
Additional comments on reviewer selection: The National Facilities program has assembled a number of very high quality reviewers, evidenced both by their scientific recognition and by their well written reviews. This program deals with fewer but more extensive proposals than many others. By fully engaging the scientific community, a strong pool of willing reviewers has been generated.	

III. Questions concerning the management of the program under review. Please comment on the following:

MANAGEMENT OF THE PROGRAM UNDER REVIEW
1. Management of the program. Comments: For the National Facilities, the NSF manages a portfolio of strong, unique facilities and their Instrumentation program provides cutting edge capabilities. In addition, the portfolio also includes the operation of facilities with aspects that are not unique or highly specialized. The NAF program staffing is small and works very hard to effectively manage this unique portfolio that involves extensive reviews, documentation, and interaction with the scientific community. The management of the program is excellent, particularly in terms of selection of reviewers, execution of the review process as well as the site visit coordination. Importantly, the program directors are also active in interacting with other NSF divisions and funding agencies that participate in the stewardship of these facilities. In general, the program has been managed so that the detailed feedback is obtained from expert reviewers and there is then effective communication between the program director and the PIs to ensure any concerns are addressed. One concern is that the management of this program requires program directors with broad and substantial experience and a history of working in this program. The loss of two experienced program officers is a cause for concern. A second concern is that the portfolio has not changed much over the years and there seems to be little room for growth with a flat budget. Thus, the program directors are maintaining a strong portfolio but not able to fund new facilities that support leading-edge capabilities. Either the budget needs to grow or some hard decisions will be needed to shut down existing facilities to replace them with new facilities.
2. Responsiveness of the program to emerging research and education opportunities. Comments: Responsiveness to emerging research was well described (detector development, new magnetic field capabilities) and is a strong point of the NSF facilities. In addition, the focus on fundamental science, rather than emphasizing research with technological appeal is consistent with the mission of NSF. The site visit reports provide an excellent feedback mechanism - they highlight drivers of change for existing facilities and the evolution of the facilities in response to the drivers. However, the process for determining priority directions at the DMR level could be better articulated to the scientific community. One concern is that the cost of high-end instrumentation and new technologies is growing and the program budget is staying flat. Thus, the National Facilities program is doing a good job to support the existing facilities, but there is no room to grow into new ones. Creative funding mechanisms and partnerships are needed (as evidenced in some programs already). The midscale instrumentation program (MIP) appears to have the potential to be an effective

approach to nurture new emerging areas of research that are enabled by instrumentation. This program is designed to significantly accelerate advances in materials research and engineering through the establishment of nationally unique midscale facilities.. The COV felt that this is a very positive addition to the facilities program, and that it will help enable world class materials capabilities in targeted, emerging areas of research.

The MIP program is complemented by the NSF-wide Major Research Instrumentation (MRI) program, which is critical to technology development within NSF.

NAF also does a good job at supporting schools and workshops to train scientists in the use of these new techniques and facilities. This program is commended for supporting and encouraging underrepresented minority groups in these areas.

The education and diversity enrichment opportunities were very well handled in this program (workshops, schools, opportunities for meaningful hands-on research for undergraduates, participation of minority serving institutions and predominantly undergraduate institutions). The education efforts and opportunities offered by the program through REU and RET programs, workshops as well as summer schools are highly positive. This may serve as an example of best practices to be adopted more broadly by NSF.

3. Program planning and prioritization process (internal and external) that guided the development of the portfolio.

Comments: The program has a detailed process by which new proposals get submitted, reviewed, and evaluated. One weakness is that while the process for soliciting and evaluating proposals was clear, strategic planning and the measurement of program level outcomes were not as well articulated.

4. Responsiveness of program to previous COV comments and recommendations.

Comments: The previous COV comments have been addressed through specific studies/reports, namely the *Materials 2022 Committee Report* and *Closing the Loop* by the MPSAC subcommittees that led to recommendations and initiatives on funding of unique and mid-scale facilities. These kinds of studies should be undertaken at regular intervals to ensure that the investment in facilities is aligned with emerging areas. One response to these two reports was the formation of the new MIP program. The COV felt that this is a very positive development, allowing DMR to respond rapidly to emerging directions.

The National Facilities program, however, does not appear to have been responsive to the previous COV report in addressing the overall uniqueness of one of the facilities (CHESS) – particularly in terms of placing it in context with the other synchrotron facilities. Only in a few specific aspects of the proposal (source and detector technology development) has the uniqueness criteria/national context been addressed.

The previous COV felt the Nat Fac program had too great an emphasis on large instrumentation. In response, the program has made some small changes, such as diverting a small percentage of the budget away from large instrumentation. This fraction is small and does not fully address the COV concern. The program has also initiated workshops on instrumentation needs to establish a strategic vision for the future. While commendable, three years later these workshop recommendations are relatively slow to be implemented.

Ceramics (CER)

INTEGRITY AND EFFICIENCY OF THE PROGRAM'S PROCESSES AND MANAGEMENT

Briefly discuss and provide comments for *each* relevant aspect of the program's review process and management. Comments should be based on a review of proposal actions (awards, declinations, and withdrawals) that were *completed within the past three fiscal years*. Provide comments for *each* program being reviewed and for those questions that are relevant to the program(s) under review. Quantitative information may be required for some questions. Constructive comments noting areas in need of improvement are encouraged.

I. Questions about the quality and effectiveness of the program's use of merit review process. Please answer the following questions about the effectiveness of the merit review process and provide comments or concerns in the space below the question**.**

QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCESS	YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE
1. Are the review methods (for example, panel, ad hoc, site visits) appropriate? Review methods are appropriate. For the Ceramics Program, most reviews are done via ad hoc mail reviews. The ad hoc mail review approach provides the manager the flexibility and ability to respond to changes in funding and reviewer availability. It is unclear that a consistent reviewer database is available. From interaction with the PD, this stems from lack of funds for investing in software to enable the process. Ad hoc reviews are done without the context provided by a panel, which can be less effective than panel reviews. The use of mainly ad-hoc individual reviews on the proposals has benefits and this could be enhanced by including web-based (virtual panel) summary discussions among reviewers to ensure shared expertise and consensus is incorporated in the recommendation. An important part of effective evaluation is interacting with other reviewers. Thus, it's suggested that mail-in reviews supplement the panel or site visit process but not replace them. The challenge is to normalize reviewer comments and find a rationale for so doing. On occasion, CER has assembled panels to specifically review proposals with disparate ratings. This is a sound approach and can provide the NSF PD additional information to better understand the ratings. In some cases, a supplement to an already funded proposal has been awarded on the basis of "Life Balance Opportunities". The approach adopted by DMR addresses an issue that the program has been specifically designed to cover. Small proposals, for example, extensions with small budgets, were not always externally reviewed. In 2013, a government shutdown curtailed some of the panel reviews. An alternate approach was implemented by DMR that effectively responded to this short-term issue. Special consideration can be given for EPSCoR proposals with disparate	YES

ratings provided that the proposed work is deemed transformative. However, EPSCoR proposals with disparate ratings that are deemed incremental did not fare as well. The identification of high-risk proposals for Eager funding from regular submissions is excellent. Funding for students to attend Conferences/Workshops is applauded. **Data Source: EIS/Type of Review Module**	
3. Are both merit review criteria addressed d) In individual reviews? e) In panel summaries? f) In Program Officer review analyses? Comments: Two principal review criteria (intellectual merit, and broader impacts) have been addressed in all jackets for each of the categories defined above. These two criteria constitute the cornerstone of the NSF proposal review process. Reviewers were directed to address both merit criteria; reviews include comments on both. In several cases, if the reviewer thought the intellectual merit of the proposal was weak, their review of the broad impact was terse. In addressing these criteria, the question usually asked is whether each criterion is merely incremental or transformative. Those proposals that are deemed truly transformative often gain higher rankings by individual reviewers. This assessment is used by the PD to justify awards or declinations in cases where the reviews are mixed. Funding declinations are immediately recommended by the PD when the proposal does not contain the required information, contains superfluous information, or does not adhere to the spirit of the call. The PD applies sound judgment in returning proposals to the PI with no review when the PD assesses it to be too similar to a previous or pending award or if there is no report of findings in the project description that had originated from work performed in a previously funded proposal. Individual reviews, especially ad hoc mail-in reviews tend not put equal weight on the broader impacts. The PD should request and emphasize BI inputs from the reviewers. It is important to note that PD review analyses are more candid and provide a broader rationale for the funding decision/recommendation that the PI does not see or does not get from the drier Panel Summary. **Data Source: Jackets**	YES

3. Do the individual reviewers giving written reviews provide substantive comments to explain their assessment of the proposals? Comments: In most every case, at least one substantive review has been submitted. However, there are instances where all reviews consist of but a few sentences with general comments that are not helpful in assessing the quality of the proposal. In these cases the PD consistently utilized the good practice of requesting and securing an additional reviewer for the proposal. For the ceramics program, the level of individual review is rigorous and thorough when it includes interaction with a panel or virtual review. The quality of ad hoc reviews seemed to vary much more, from excellent reviews to those with very little content or substance. DMR should implement a database of reviewers or an equivalent process. **Data Source: Jackets**	YES
4. Do the panel summaries provide the rationale for the panel consensus (or reasons consensus was not reached)? Comments: Panel summaries capture the essence of reviewer impressions concerning the proposal. A statement to the effect that a consensus was reached by the panel accompanies the panel summary. Clarification regarding how EAGER decisions are made should be clearly documented in the jackets. The very thorough and contextualized PD Review Analysis should be translated to the PI as consensus feedback. **Data Source: Jackets**	YES
5. Does the documentation in the jacket provide the rationale for the award/decline decision? [Note: Documentation in the jacket usually includes a context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), program officer review analysis, and staff diary notes.] DMR PD's provide a most comprehensive evaluation of the reviewer and panel reports. These reports highlight a number of issues that either support funding or declination of a proposal. FastLane and the document jackets are nicely organized to provide documentation of the proposal process. NSF should be commended. That said, improvements to the jacket documentation and tracking can be improved for data querying purposes. Right now it requires a lot of 'drilling down' to find relevant information. Again, the PO Review Analysis puts everything in context beyond reproach and although not public information, a version of this that can be released would be very useful to be sent to the PIs as feedback with documentation; that is, that would become part of the jacket documents for the COV to review. **Data Source: Jackets**	YES

6. Does the documentation to the PI provide the rationale for the award/decline decision? [Note: Documentation to PI usually includes context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), and, if not otherwise provided in the panel summary, an explanation from the program officer (written in the PO Comments field or emailed with a copy in the jacket, or telephoned with a diary note in the jacket) of the basis for a declination.] Comments: The PO effectively integrates reviewer comments and panel summaries into documentation sent to the PI. In many cases of declined awards, guidance is provided to the PI as to how the proposal can be improved. Occasionally, a suggestion is made that the proposal may fare better if submitted to a different program office within the NSF. The PO comments to the PI are both helpful and encouraging. In a GOALI review with 3 participating universities, awards were recommended for two and a declination for the third. The third involved device fabrication. In some cases, reviewer comments are massaged too much and the PI could benefit from a more frank evaluation of their strength and weaknesses. There is not but should be a consistent method of final feedback to the PI to improve the quality of feedback being received by the PI. **Data Source: Jackets**	YES
7. Additional comments on the quality and effectiveness of the program's use of merit review process: Consistency was noted across all review packages with respect to the two review criteria, innovation of the proposed project and prospective outreach activities. The procedural aspects of the merit review process are effective and generally well-managed. The FastLane and Jackets system is well organized and able to document proposal evaluations effectively. It was a little unclear how POs balance scores between reviewers and make funding decisions. This was especially the case for the proposals in the gray area that were neither outstanding nor poor. For future COV meetings, it would be helpful to have a database query of proposal ratings (scores) vs. decisions in order to evaluate this better. The program is managed meticulously and the PO pays close attention to education, diversity, and meeting other metrics. Some proposals were permitted a rebuttal process but this should be made consistent. The method seems to work very well, particularly since most of the reviews are ad hoc and thus there is some consistency in the extent and quality of reviews received. Panel reviews and panel summary statements appeared rushed and not very thorough as a way to provide overall context in the review further supporting the use of ad hoc reviews.	YES

II. Questions concerning the selection of reviewers. Please answer the following questions about the selection of reviewers and provide comments or concerns in the space below the question.

SELECTION OF REVIEWERS	YES , NO, DATA NOT AVAILABLE, or NOT APPLICABLE
1. Did the program make use of reviewers having appropriate expertise and/or qualifications? Comments: PO asks PI's to list three prospective reviewers. They are almost never used. In one instance, one suggested reviewer has no publications in the past 5 years. However in another case, a suggested reviewer was used and only gave the proposal a G rating. It is unclear how are suggested reviewers accepted or rejected. However, it is important to note that in the ceramics program, reviewer selection is done more personally and on a manual basis, which has helped with the success rate of finding good reviewers. On the other hand, the process for choosing reviewers was not very clear. Thus the use of technology to improve upon this process (like journals) is highly recommended as this will make it a more robust process and hopefully less work for the PO. Internal reviews are used if request is supplemental or less than 20% of award. In-house reviews of supplemental grants, less than 20% of original award justified the award. EAGER (Early concept Grants for Exploratory Research) grant proposals are internally reviewed. Internal assessment rigorous and demonstrated excellent science background of PO. **Data Source: Jackets**	YES
2. Did the program recognize and resolve conflicts of interest when appropriate? Comments: One review was not returned to the PI although the reasons for this action were not clear. In panel reviews, COI has been addressed. The PD was present for all panel discussions. This process seems to be taken seriously and well managed. There were even PO comments and communication with the PI at the submission level when this was identified which clearly indicates that attention is being paid to COIs. **Data Source: Jackets**	YES

Additional comments on reviewer selection: Restricted travel budgets/PD time limit the quality and effectiveness of the review process as the program director is less able to go to conferences, tutorials, or visit sites. This limits the program director's abilities to identify a diverse set of the most appropriate reviewers and to understand the emerging directions of science.	

III. Questions concerning the management of the program under review. Please comment on the following:

MANAGEMENT OF THE PROGRAM UNDER REVIEW
1. Management of the program. Comments: The CER program is exceptionally well managed and the proposal review process is deemed to be consistent. Reviewer selection for mail review, panel review, or virtual panel review is a challenging task. Technical diversity among the set of submitted proposals increases this challenge. The PD is most effective in selecting appropriate reviewers for each proposal. NSF proposal review guidelines have been followed. Declination/acceptance rationale is strong and reflects the comments offered by the reviewers. The PD has an exceptionally large workload that often is hindered by an inadequate software infrastructure. To continue this high level of performance, additional resources both in terms of staff and efficient software should be provided. There did not seem to be a strong scientific strategic plan to develop and/or strengthen certain areas of the portfolio besides the continuous updating of the program synopsis. Also the funding to each of the core programs has not changed much over the years. This program has made a number of changes reflecting an active and progressive leadership. These include a trend toward longer (4 year) proposals. An example of excellence includes leveraging with other programs for joint funding, thematic collaboration, and participation in major initiatives thus amplifying the footprint and impact of the program. The program is the go to place for support of basic science in ceramics and it is very clear how the program runs, its goals and synopsis. All this, despite the fact that the program is clearly understaffed and the staff is overcommitted with assigned activities outside of the program. There is lack of funding for investment in data management software to handle proposals and the review process (e.g. managed database of reviewers). Dwell time changes are indicative of this shortage. It is precisely considering these limitations and challenges that the excellent management of the program is the more impressive.
2. Responsiveness of the program to emerging research and education opportunities. Comments: The PD is well versed in ceramic science and has an excellent grasp of where the field is now and where it is going. Successful workshops (Emerging Research Areas in Ceramics, and Challenges in Ceramic Science) have been held to identify emerging research areas in ceramic science to address national needs. Such activities are to be fostered in the future. CER is most responsive to diversity and has been effective in funding female and minority proposals. Interagency interactions have been registered to develop the scope of emerging research opportunities in the field. The PD has published articles and delivered presentations relating to workforce development, scarce materials, education, and nanoscale ceramics. Such activities are most effective for evolving the research portfolio. Of particular note is the increase in funding of CAREER proposals in this program from

$80K to $100-110K per year (for 5 year grants). Further, EAGERs are common in the program leading so successful new research enterprises, and so are supplements for unforeseen circumstances (additional required meetings not originally budgeted). Moreover, equipment supplements are also part of the portfolio. Finally, there is consistent support for workshops that precisely look at emerging trends and research areas and opportunities in the field. All this indicates that responsiveness to emerging topics is a focus of the PD.

3. Program planning and prioritization process (internal and external) that guided the development of the portfolio.

Comments:
The evolution of the CER program portfolio is guided by the activities discussed in item 2 above. Consideration to fund young investigators and minorities is evident. While the process seemed clear, and the metrics for success are carefully tracked, the strategic planning and the measurement of outcomes are not explicitly articulated for ceramics program. It is difficult to identify the planning and prioritization process that defined the strategic vision. Empirically, a 35% increase in submissions reflects an external interest in the areas supported. The process for identifying needs at the DMR level was not explicit. In essence, the portfolio appears to be guided primarily by the general goals of the program and thus it constitutes an umbrella concept that houses fundamental scientific research in ceramics. An actual prioritization and planning of the portfolio in terms of specific areas is not apparent from the information provided but it is clear that support of the emerging topics activities and the reviews chiefly determine what is being funded. This is understandable being a core program (Ceramics).

4. Responsiveness of program to previous COV comments and recommendations.

Comments:
All items in the previous COV report for the CER program have been addressed. The CAREER grant size has been increased to $100 -$110K per year. Both clarity and consistency in the review of BI's have been implemented. The change has been addressed in CER PI workshops. Understaffing continues to be an issue and new approaches to address this issue (training of new PD's) has been implemented. Proposal handling metrics have been reviewed and approaches for improvement has been identified. Diversity continues to be a shining star of the CER program. Additional specific actions include the support of instrumentation supplements, explicit mention of BIs in the CER program synopsis. Unfortunately, the program continues to have a clear understaffing and increase workload that has not been addressed.

Solid State Materials Chemistry (SSMC)

INTEGRITY AND EFFICIENCY OF THE PROGRAM'S PROCESSES AND MANAGEMENT

Briefly discuss and provide comments for *each* relevant aspect of the program's review process and management. Comments should be based on a review of proposal actions (awards, declinations, and withdrawals) that were *completed within the past three fiscal years*. Provide comments for *each* program being reviewed and for those questions that are relevant to the program(s) under review. Quantitative information may be required for some questions. Constructive comments noting areas in need of improvement are encouraged.

I. Questions about the quality and effectiveness of the program's use of merit review process. Please answer the following questions about the effectiveness of the merit review process and provide comments or concerns in the space below the question**.**

QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCESS	YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE
1. Are the review methods (for example, panel, ad hoc, site visits) appropriate? Comments: SSMC conducts reviews using in-person panels at NSF, ad hoc mail reviews, and virtual panels. Since 2011, this program has reviewed > 140 proposals per year. This number has steadily increased, with 177 reviewed in 2014. The PM has done an excellent job managing the large workload with a mix of panel styles that balance number of panelists with expertise of panelists to cover the proposal topics. Overall, the review methods of this program are appropriate, but it was unclear which were the most effective and a more detailed review of what works best in reviewing would be important. Due to the large number of proposals that are reviewed by panels, the lowest rated proposals (< 30%) are triaged to allow more time to discuss the more competitive proposals. This strategy makes sense in terms of maximizing the time of the panelists. However, PIs having proposals placed in this "do not discuss" category will not receive panel summaries and will only see the individual comments from each reviewer. These reviews tend to have fewer comments and suggestions for the PI to apply towards improving their proposal in the future. There is some inconsistency in ad-hoc reviews vs. panels, but on average, these methods work well. SSMC has well established, but also dynamic protocols, with an intimate broad knowledge of their reviewer and investigator base for their program areas. They know how to assess the very different panel cultures that they must deal with for the different focus areas within their programs, and to quantitatively incorporate that social construct into a merit review protocol that is both equitable and relatively constant over time.	YES

Data Source: EIS/Type of Review Module	
4. Are both merit review criteria addressed g) In individual reviews? The individual reviews do an excellent job in addressing the intellectual merit of proposals. For the data sample provided to the COV, the majority of reviews provide very good critique of the proposed science. The quality of reviews pertaining to the broader impacts was much more inconsistent across reviewers. In some cases, education and outreach were considered "boilerplate", not innovative, or leaning too heavily on existing infrastructure. In other cases, leveraging existing infrastructure was considered a positive attribute. Overall, the inconsistencies mean that PIs are receiving mixed messages on what the panel would expect to see in the broader impacts section. The program should take steps to ensure that reviewers are responding to the broader impacts criteria in each review. h) In panel summaries? Panel summaries typically follow a template provided by the PM. This is quite effective in normalizing the output to the PI and ensuring that all aspects of the review receive formal attention. There was some concern that the summaries are more conservative compared to individual reviews, but on average, panel summaries provide an appropriate balance in addressing both merit review criteria, even when the individual reviews are lacking. For proposals that have been triaged into "low priority" status, these do not receive panel summaries because they are not discussed. i) In Program Officer review analyses? The POs provide detailed and informative review analyses that explain very clearly the rationale for funding or declining a particular proposal. **Data Source: Jackets**	Yes

3. Do the individual reviewers giving written reviews provide substantive comments to explain their assessment of the proposals? Comments: On the whole, individual reviewers provide substantive feedback to the PIs of each proposal. The extent of the review often depends on the expertise of the reviewer, i.e., someone only tangentially related to the field of the proposal will provide fewer comments/criticisms. When some individual reviews are weaker, the other reviewers and panel summaries make up for the deficit or program managers must seek out additional ad hoc reviews. Reviewers on average focus more on the intellectual merit of the proposal and do not provide as much critique of broader impacts. **Data Source: Jackets**	Yes
4. Do the panel summaries provide the rationale for the panel consensus (or reasons consensus was not reached)? Comments: The panel summaries provide strong rationale for the consensus reached by the panel except for those cases where diverse scores were entered. Usually the low (poor, fair, good) comments were not fully reflected in the panel summary, although the panel summary did reflect the comments of other written reviews (sometimes word-for-word). There were a few examples in the jackets wherein the panel summary appears to be too positive for a proposal that was rejected. However, the program managers' quality control of summaries is excellent on average, and the PI receives a good reflection of the discussion surrounding their proposal and the reasons it was rejected or accepted. It was noted that proposals triaged into low priority status were not discussed by the panel and did not receive panel summaries. **Data Source: Jackets**	Yes
5. Does the documentation in the jacket provide the rationale for the award/decline decision? [Note: Documentation in the jacket usually includes a context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), program officer review analysis, and staff diary notes.] Comments: The documentation in the jacket was quite thorough and covered all aspects of the review process. In reading the entire jacket, it was clear why the proposal was awarded/declined. In almost all cases, the panel summary and the award/decline decision were closely tied. The PO review analyses are well done and provide deeper context into the award/decline decisions. **Data Source: Jackets**	Yes

6. Does the documentation to the PI provide the rationale for the award/decline decision? [Note: Documentation to PI usually includes context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), and, if not otherwise provided in the panel summary, an explanation from the program officer (written in the PO Comments field or emailed with a copy in the jacket, or telephoned with a diary note in the jacket) of the basis for a declination.] Comments: Overall, the panel summaries and individual reviews provide excellent documentation to the PI for the rationale of the award/decline decision. However, low priority proposals typically do not receive a panel summary because it does not get discussed. In these cases, the individual reviews must be very strong to provide the PI with the proper feedback on their proposals. In other cases, jackets included statements along the lines of "in comparison to the other proposals reviewed by this panel, this proposal is not as competitive", or "the proposed broader impact activities are not as strong". This feedback was deemed to be less helpful in directing the PI on how to improve their future proposals, especially in cases when the proposal was considered "competitive". **Data Source: Jackets**	Yes
7. Additional comments on the quality and effectiveness of the program's use of merit review process: NSF has one of the more unbiased and transparent review processes of any agency. The panel model ensures that new investigators will be seen and that underrepresented groups can be emphasized (assuming equal merit). The slight downside to this model relative to the PI is that the panel membership is potentially different each review period. As a result, there is little institutional memory, and this can make it difficult for PIs to respond to review critiques and improve their proposals based on the panel reviews (e.g., the next panel may have a completely different set of issues/critiques with the proposal). More broadly, the COV also noted that panel reviewers tend to be conservative in their critique of proposed work that could be considered high risk/high reward. Considering the various types of reviews (panel, virtual, ad hoc), there was some concern that the on-site panel review and web-based panel review have different dynamics and may result in different outcomes.	Yes

II. Questions concerning the selection of reviewers. Please answer the following questions about the selection of reviewers and provide comments or concerns in the space below the question.

SELECTION OF REVIEWERS	YES , NO, DATA NOT AVAILABLE, or NOT APPLICABLE
1. Did the program make use of reviewers having appropriate expertise and/or qualifications? Comments: The program does a good job of assembling experts for proposal reviews. The method of mixing ad hoc, in person panels, and virtual panels is effective. The process could be more effective if NSF provided database support for the various programs to track reviewer information. **Data Source: Jackets**	Yes
2. Did the program recognize and resolve conflicts of interest when appropriate? Comments: The program does an excellent job of recognizing and resolving conflicts of interest, even when the panelist might not realize a conflict exists. All NSF programs place proper emphasis on this point, and COIs are usually resolved well in advance of a panel meeting. **Data Source: Jackets**	Yes
Additional comments on reviewer selection: The program managers do an excellent job in handling this task. Selecting reviewers for the large number of proposals submitted every year is a non-trivial assignment. Limited travel budgets/constraints on time prevent program directors from attending conferences and meeting new investigators that would fit their programs.	

III. Questions concerning the management of the program under review. Please comment on the following:

MANAGEMENT OF THE PROGRAM UNDER REVIEW
1. Management of the program. Comments: SSMC is very well managed and has clear goals and objectives. This program often reviews proposals that do not fit in many of the other programs or reviews proposals that would be/are co-funded with other programs. SSMC is understaffed and overworked, but they still manage to handle the workload admirably. Considering the diversity of this program and proposal load, staffing issues should be addressed. A management mandate specified a reduction in the SSMC program mortgage level that required an amount equivalent to about 1 program per year. This has been implemented. The PD successfully sought co-funding and co-proposal review with other programs. In cases where proposed work does not fit within the SSMC portfolio subject, the PD has asked the PI to withdraw the proposal.
2. Responsiveness of the program to emerging research and education opportunities. Comments: The program is responsive to emerging areas, e.g., energy storage and organic materials. SSMC has also supported education opportunities through funding of conferences and workshops, and through funding research in undergraduate institutions. The EAGER component of this program allows for opportunities to pursue emerging research and should be continued.
3. Program planning and prioritization process (internal and external) that guided the development of the portfolio. Comments: The program appears to be prioritizing research areas and adding to their portfolio from emerging areas. Proposals are often accepted for review after being transferred from other programs. Optics and photonics has been identified as an emerging priority area. A national priority in the assembly of materials with multi-scale properties (Å to macro-scale) has emerged over the past few years and should be pursued as an emerging area of national importance. SSCM should consider aligning a segment of the portfolio with this research area.
4. Responsiveness of program to previous COV comments and recommendations. Comments: Program manager was not explicit about this. From the jackets, it is apparent that attempts have been made to normalize the reviewer responses to broader impacts; this was a point of emphasis in previous COV comments.

Materials Research Science and Engineering Centers (MRSEC)

INTEGRITY AND EFFICIENCY OF THE PROGRAM'S PROCESSES AND MANAGEMENT

I. Questions about the quality and effectiveness of the program's use of merit review process. Please answer the following questions about the effectiveness of the merit review process and provide comments or concerns in the space below the question.

QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCESS	YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE
1. Are the review methods (for example, panel, ad hoc, site visits) appropriate? Comments: The COV panel commenting on the MRSEC program expresses its gratitude to NSF PDs, managers, and staff for their outstanding efforts in managing this highly-visible and important program in the face of budget challenges, staff workload, and turnover. Reviews, in general, were helpful in understanding the decisions regarding which proposal should get funded, particularly in cases where the 'letter grades' were narrowly distributed. The MRSEC program adheres to a scrupulous and thorough merit review system, which includes a panel evaluation of pre-proposals, from which full mail proposals are requested, followed by a down-select of invitees for reverse site visit panel review. This approach manages to combine all of the advantages of the mail reviews (the IRGs get written reviews by expert in the specific IRG areas) with the benefits from evaluation by multiple panels as checks-and-balances. Review of the PD analyses and comparison to the reviews themselves showed fidelity and a clear correspondence between quality of proposal and eventual award. However, a paucity of information at the earliest stage – prepropsal evaluation – prompts the COV to suggest that PDs consider justifying the 'decline' decisions explicitly and to transmit this information to the applicant; perhaps this can be done simply by appending the panel summary statement. COV further encourages PDs to continue to provide PIs with an accounting -- as detailed as possible -- of the elements the PD uses to prioritize the RSV recommendations leading to final award decisions. **Data Source: EIS/Type of Review Module**	YES
5. Are both merit review criteria addressed	YES

j) In individual reviews?

k) In panel summaries?

l) In Program Officer review analyses?

Comments:

Individual reviews and panel reviews for MRSECs invariably comment on the technical merit of proposals (although see Question #3 below) and include comments of varying depth on certain aspect of the broader impacts. NSF's emphasis on broader impacts means that centers such as these have left few avenues unexplored. Hence it appears that MRSECs—both existing and proposed—have developed a palette of activities for broader impacts vis-à-vis education and outreach, and the funded MRSECs examined by the COV were doing a superb job in this regard. NSF is correct in leaving broader impact somewhat in the eye of the beholder, allowing for the potential that the MRSEC projects will innovate in this arena.

The COV sees two potential opportunities:

- COV suggests an even greater emphasis in 'broader impacts' be placed on potential impact on society (job creation, spin-off companies, new technologies leading to new industries) both within and beyond the boundaries of the MRSEC itself.

- Outcomes in the science and technology space can pay dividends in the long run and represent part of the MRSEC return on investment. COV suggests that the PD encourage panels to draw from collective experience and to consider more deeply the potential for scientific impact in this broader sense, as well as in the educational arena.

Concern was raised by some members of the COV that panel summaries are too terse and provide little in added value over the individual written reviews to the PI who receives them.

The PD reviews are particularly thorough, detailed, and comprehensive. They include detailed accurate summaries of the comments made at all levels, before the PD goes on to present the justification for the PD's own recommendation.

Data Source: Jackets

3. Do the individual reviewers giving written reviews provide substantive comments to explain their assessment of the proposals? Comments: In most cases the reviews are substantive and thorough, reflecting the scope of the MRSEC proposal itself. However, an uncomfortably large fraction of reviews focus on very high level issues and argue by opinion rather than by providing evidence from the proposal itself. In some cases, this issue is mitigated by the sheer number of reviews. The COV would like to highlight one specific observation: the COV found a number of instances where comments from reviewers are directed more toward the reputation and visibility of the PIs rather than toward the proposed research. While it is certainly valid to take a specific past record into account when evaluating a proposal, we felt in these that the referees went too far in basing their evaluations on reputation. The COV suggests that such evaluations be treated accordingly by the PD with instructions given to panels to weigh the proposed science more heavily than the proposers' reputations. . **Data Source: Jackets**	Generally Yes
4. Do the panel summaries provide the rationale for the panel consensus (or reasons consensus was not reached)? Comments: COV finds that the panel summaries do present evidence substantiating the consensus opinion. As discussed in Question #1 above, in some cases these summaries are a bit terse. **Data Source: Jackets**	YES
5. Does the documentation in the jacket provide the rationale for the award/decline decision? [Note: Documentation in the jacket usually includes a context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), program officer review analysis, and staff diary notes.] Comments: MRSEC packet documentation is generally thorough. This is clearly a task that the program officer takes very seriously as part of managing the portfolio. The summary information provided in the analysis typically reflects the content of the reviews and/or panel summary with the occasional opinion of the program manager woven in appropriately. COV notes a few occasions when the PD analysis adds technical information or additional depth beyond that contained in the reviews and/or panel summary. This is welcome and reflects an active, interested manager engaging with the portfolio. **Data Source: Jackets**	YES

6. Does the documentation to the PI provide the rationale for the award/decline decision? [Note: Documentation to PI usually includes context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), and, if not otherwise provided in the panel summary, an explanation from the program officer (written in the PO Comments field or emailed with a copy in the jacket, or telephoned with a diary note in the jacket) of the basis for a declination.] The PI receives all the reviews given by individual reviewers as well as that from the reverse site visit (note caveat at Question #1 regarding pre-proposal outcomes). Most reviews are detailed. The COV could not assess how well the final analysis provided to the PI adhered to that provided for the NSF record. COV encourages the PD to transmit as much of the 'PD Analysis' as possible, recognizing the need to redact sensitive information. **Data Source: Jackets**	YES
7. Additional comments on the quality and effectiveness of the program's use of merit review process: It is apparent that the MRSEC program officer is conscientiously managing a review process with the objective of funding the strongest, most impactful proposals. This is a daunting task given the budget challenges obviously facing the NSF as well as the larger US science enterprise. The COV is slightly concerned that excessive weight might be placed on scores given by reviews that are not particularly substantive, and it would be helpful if the PD in the analysis or other documentation offered even more insight than that already present evidencing how the various reviews were weighted by the panel or by him/herself in the decision. This is particularly important in cases where large dynamic range is found in the reviews for 'borderline' cases and a disconnect exists in the formalities of the decision-making process.	

II. Questions concerning the selection of reviewers. Please answer the following questions about the selection of reviewers and provide comments or concerns in the space below the question.

SELECTION OF REVIEWERS	YES , NO, DATA NOT AVAILABLE, or NOT APPLICABLE
1. Did the program make use of reviewers having appropriate expertise and/or qualifications? Comments: The quality of the substantive reviews demonstrates that the vast majority of the reviewers have the appropriate expertise and qualifications and were selected well. The COV commends the MRSEC PD for emphasizing diversity of experience, institution, background, etc. in populating the panels. This is a strength of the process. **Data Source: Jackets**	Yes
2. Did the program recognize and resolve conflicts of interest when appropriate? Comments: MRSEC PDs are scrupulous about COI issues and do an effective job of identifying and managing any conflicts. **Data Source: Jackets**	Yes
Additional comments on reviewer selection:	

III. Questions concerning the management of the program under review. Please comment on the following:

MANAGEMENT OF THE PROGRAM UNDER REVIEW

1. Management of the program.

Comments:

The COV was impressed by the scientific breadth and impact of the MRSEC program and the extent to which collaboration has been maximized in its implementation. This observation reflects the PDs skill in assembling, managing, and representing the MRSEC program. The PDs energy and impressively comprehensive understanding of the program were exemplary. The COV recognizes that managing such a high-visibility program can lead to difficult decision-making, and commends the PD for the professional handling of the process.

The COV would also like to commend the PD on the thoroughness of post-award management of the portfolio. Annual reports and site visit reports are highly detailed, thorough, and balanced. They rightfully point out issues that each MRSEC may face in the future (in a possible resubmittal), and identify aspects or areas for improvement (e.g. fraction of co-authored papers among the MRSEC faculty,).

The COV is extremely concerned about the high level of turnover in this flagship program as well as the current situation where a single PD is responsible for a ~$50 M program. We recommend in strongest terms that additional staff be devoted to this important program and emphasis on staff retention be prioritized to recognize the importance of institutional memory and continuity in such a complex milieu.

One COV member was concerned that the information provided to the committee did not speak to the level of financial oversight applied to the individual MRSEC project directors. We rsuggest that in future COV meetings that the MRSEC PD provide an overview as well as detailed explanation of how financial oversight occurs at all levels of the program.

2. Responsiveness of the program to emerging research and education opportunities.

Comments:

The MRSEC program follows a staggered three year cycle of recompetes of six year programs. This is at once an asset and a liability:

- Exceptional, solid science takes time. The extended six-year performance period allows deep and broad exploration of IRG topics and encourages risk-taking on the part of participants not held to a three-year renewal cycle. The scope and sustained funding for MRSECs allow institutions to attract new faculty, and result in high quality publications, patents, and transformative science. These centers have also provided support for other

researchers to access unique facilities that they typically would not have available.

- The three year cycle of MRSEC competitions can render the program as a whole less agile to respond to emerging areas than other DMR programs that issue annual solicitations. This limitation is mitigated in part through SEED projects within each IRG/MRSEC. Indeed, the PD pointed out that in some cases a SEED project resulted in an IRG in a later recompete of the MRSEC. Nonetheless, seeing that areas such as topological matter, 2D materials, far-from equilibrium matter, etc. are developing in the MRSEC portfolio indicates that it remains at the forefront and indeed is shaping the frontier. The COV recognizes that there are other DMR modalities of funding that can and do take up this function, such as DMREF, in between solicitations. But none of these programs has the same mission as MRSEC.

A unique aspect of the MRSEC system is the potential for existing centers to 'reinvent' themselves and recompete on an equal footing with new center candidates. This comes with distinct advantages, among them including:

- It is possible that the structure of the selection process inclines the MRSEC program to limit change and tend toward funding the usual (very successful) suspects.

- Incumbent institutions through their experience and infrastructure become empowered to define the emerging research and educational opportunities through the renewal process.

This also comes with concerns voiced by members of the COV. Specifically, it was noted that many of the MRSECs have been in existence throughout the entire history of the program (6/21 hark back to the early 1960's), and also that the rate for establishment of new MRSECs is quite low compared with the rate of successful recompetes. The 'legacy' centers clearly have an advantage over new proposals, since they have an established infrastructure to achieve MRSEC goals; they have a good idea of what they can realistically achieve in the way of facilities operation, outreach, industrial partnership, etc. Also, they are well-versed with the NSF review process, especially the reverse site visit. We recognize that these concerns are balanced by the fact that these well-established centers are usually doing superb work, both in science and in broader impact.

In response, we encourage DMR to consider exploring ways to level the playing field for new MRSEC proposals while maintaining the highest quality scientific standards and expectations of broader impact. COV recognizes that there have been historical attempts to deal with this imbalance (MIRTs, MRGs, etc.) and that this is an ongoing challenge; DMR is encouraged to continue exploring solutions.

3. Program planning and prioritization process (internal and external) that guided the development of the portfolio.

Comments:

The COV considers that the word 'prioritization' is a bit of misnomer in the context of the MRSEC program. Insufficient information was provided during the presentations or in the e-jackets to evaluate the level to which strategic planning in the MRSEC program office guides the portfolio development. In fact, it appears quite the opposite, that this is very much a 'bottom up' activity, in which the proposers themselves through the proposals steer the course of the portfolio, guided by the successful review process. The COV endorses this approach wholeheartedly. The aspects of high-level planning implemented by the PD in his decisions were not discussed substantively.

COV notes that the MRSEC solicitation states “A center may address any area of research supported by the NSF Division of Materials Research.” We suggest that DMR carefully consider the underlying basis for achieving ‘balance’ across the centers vis-à-vis overlaps with the broader MPS Directorate. We consider it a potential benefit to the scientific community for MRSECs not to be constrained solely by the contents of the DMR portfolio extant at the time of proposal competition.

4. Responsiveness of program to previous COV comments and recommendations.

Comments:

The previous COV embraced the program with minimal input.

Biomaterials (BMAT)

INTEGRITY AND EFFICIENCY OF THE PROGRAM'S PROCESSES AND MANAGEMENT

Briefly discuss and provide comments for *each* relevant aspect of the program's review process and management. Comments should be based on a review of proposal actions (awards, declinations, and withdrawals) that were *completed within the past three fiscal years*. Provide comments for *each* program being reviewed and for those questions that are relevant to the program(s) under review. Quantitative information may be required for some questions. Constructive comments noting areas in need of improvement are encouraged.

I. Questions about the quality and effectiveness of the program's use of merit review process. Please answer the following questions about the effectiveness of the merit review process and provide comments or concerns in the space below the question**.**

QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCESS	YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE
1. Are the review methods (for example, panel, ad hoc, site visits) appropriate? Comments: The methods are very appropriate. Current reviews (as of 2013) are panel reviews that are a mix of on-site Reviewers (often junior PI's) and off-site Reviewers using realtime video links for the full panel meeting. Technology is now reliable, and the Program Manager sees no obvious differences in Reviews submitted before the Panel Meetings. Discussions, including rankings, were described as good. The mix could be good to reduce pressure to reach consensus. Mail in reviews are rarely used, estimated at 1-2% of proposals, which means suitable review panels can be put together to discuss the most meritorious proposals. This is all good, but quantitation that the combination of review methods are working could help. For example, the workload is such that it must be difficult to provide adequate time for panelists reviewing each proposal and program officers documenting the process as well as limited staff to organize it. Heavy workload problem can make it more challenging to identify and foster potentially game changing high risk projects. Consistency in the quality of the initial set of reviews can also be an issue. Many reviewers provide detailed listings of strengths and weaknesses according to NSF review guidelines, while others do not. This can in some instances lead to disparate proposal rating conclusions. Panel review discussions can, and do, in many instances correct and clarify this deficiency. **Data Source: EIS/Type of Review Module**	Yes, mostly

6. Are both merit review criteria addressed m) In individual reviews? n) In panel summaries? o) In Program Officer review analyses? Comments: Most individual reviews indeed focused appropriately on technical merit and look for broader impact in the context of the excellence of the scientific concept or the potential scientific impact. In each case there is a clear description given for the strengths and the weakness for a proposal's merit review criteria. The panel summaries and review analysis often dwell more on the societal broader impacts, which also seems appropriate. However, at least one COV member considered the panel review summary to be a document produced to support the initial set of reviews and hardly an improvement over the original review. The program manager/officer could just as easily perform this task. **Data Source: Jackets**	Yes

3. Do the individual reviewers giving written reviews provide substantive comments to explain their assessment of the proposals? Comments: The reviewer's comments generally do explain their assessments of the proposals in the key areas (Intellectual merit and broader impact). Comments made on broader impact sometimes emphasize the need for the broader impact activities to be related to the scientific component of the proposal, which is good. There are usually 4 reviews, which is a good number for an assessment, especially because one or two reviews seem to provide only NIH-style reviews with just 1-2 strengths and 1-2 weaknesses in sentence form. Most of the reviewers do a good job, providing the PI with specific criticism necessary to improve any future or subsequent proposal submission, or alternatively provide specific reasoning as to what made the proposal worth funding. In some reviews, one brief insight seems to be repeated in various ways throughout. One COV member also thought that some reviews were generic and could be used for any proposal with but a few word changes. Reviewers that only provide minimal feedback should be removed from the review process, and it is not clear whether that occurs. This could be an issue if Program Manager turnover becomes high. Fortunately, BMAT benefits from stability of Program Managers compared to most other DMR Programs! **Data Source: Jackets**	Yes In most cases
4. Do the panel summaries provide the rationale for the panel consensus (or reasons consensus was not reached)? Comments: Panel summaries do suggest all reviews are taken into consideration by the panel. Panel summaries emphasize strengths and weaknesses and also sometimes offer suggestions for project improvement, or areas of concern to help explain the panel's ultimate ranking of the proposal. The proposals that were selected for funding are of very high quality. The documentation seems adequate considering workload limitations. However, summaries do not always explain the rationale even when they capture the consensus. **Data Source: Jackets**	Yes

5. Does the documentation in the jacket provide the rationale for the award/decline decision? [Note: Documentation in the jacket usually includes a context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), program officer review analysis, and staff diary notes.] Comments: Reviewer comments and panel summaries are clearly taken seriously by the program managers as is evident in each review analysis written by the program managers. The panel summaries include a summary of the discussion beyond what might be written in reviews, and the panel indicates how a proposal rates, i.e. highly competitive, competitive or non-competitive. Final numerical rankings by each panel largely dictate the funding decision (>90% of time the COV was told), which is good. However, clearer statistics and 'gray zone' exceptions could have helped the COV better understand this new program that is growing in terms of DMR funds. **Data Source: Jackets**	yes

6. Does the documentation to the PI provide the rationale for the award/decline decision? [Note: Documentation to PI usually includes context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), and, if not otherwise provided in the panel summary, an explanation from the program officer (written in the PO Comments field or emailed with a copy in the jacket, or telephoned with a diary note in the jacket) of the basis for a declination.] Comments: PI's are not only provided the reviews and panel discussion summaries as is needed but are also in some cases told how to address certain areas. However, when PI's do make revisions per the reviews and re-submit, different reviewers of different backgrounds almost certainly express different concerns, which makes it tough for the applicants. Moreover, the rationale for a decision is sometimes direct and to the point based on the initial reviews, but in other situations the results are not as clear, such as when there is a wide disparity of views. Then it is clearly difficult to convey why it was not funded. **Data Source: Jackets**	yes
7. Additional comments on the quality and effectiveness of the program's use of merit review process: Withdrawals seemed to involve harsh judgements of Program Officers and were variably documented. Two first-inspection rejections by Program Officer were because of incomplete data in reference lists or prior support not in Project Description. Such rejections were controversial among the COV. Likewise, EPSCOR declinations lacked explanation. Overall, the merit review process is very well thought out and executed. It arrives at a result that can be accepted because it involves many people at different levels within the proposal review process. It seems to provide some checks and balances to minimize cronyism and professional jealousy. Continued improvement will help achieve the lofty standards of NSF. The program is growing and maturing, and so quantitative metrics of impact of funded awards should be considered in preparation for the next COV and DMR leadership. These could include total students supported, citation numbers for papers, and companies created (including financial value and employee numbers).	

II. Questions concerning the selection of reviewers. Please answer the following questions about the selection of reviewers and provide comments or concerns in the space below the question.

SELECTION OF REVIEWERS	YES , NO, DATA NOT AVAILABLE, or NOT APPLICABLE
1. Did the program make use of reviewers having appropriate expertise and/or qualifications? Comments: The two BMAT program managers do an excellent job in selecting reviewers with expertise in various areas of the proposal then bringing them together for panel discussions to address the proposals, leading to insightful discussions and well-founded outcomes. It seems a good mix of faculty from Chemistry, sometimes Physics (recently), and Engineering (Chemical, Biological, Mechanical, and Materials) with balance depending on proposals. Some reviewers are from top tier universities. This is quite a challenge for this program given the interdisciplinary nature of the field as well as the need for collaborations between investigators from very different disciplines. In recent years the program has ensured that panels review all proposals with both on-site and virtual panelists. Some proposals also use comments given by ad hoc mail-in reviewers. This diversity of reviewer contributions should help keep the reviewer pool large, eliminating the difficulties of travel for some, but a quantitative evaluation of how the mixed panels work together should be considered. **Data Source: Jackets**	Yes

2. Did the program recognize and resolve conflicts of interest when appropriate? Comments: Within the process, apparent COI's are identified and resolved. Based on the information provided by the program officers in the prepared presentation and in response to specific questions from panel members, there is constant vigilance in asking reviewers to recognize and report COIs. There is also a thorough process to determine the conflicts of interest of PIs, and the program follows the guidelines very closely. **Data Source: Jackets**	Yes

III. Questions concerning the management of the program under review. Please comment on the following:

MANAGEMENT OF THE PROGRAM UNDER REVIEW
1. Management of the program. Comments: The BMAT program managers have clearly been very responsive to applicants in terms of timely communication of the outcome of a submission as well as responding to inquiries that arise. They have been effective in identifying a broad pool of qualified reviewers across the range of designated topics required for evaluating the interdisciplinary nature of proposal received by the program. All decisions for new proposals are made using external reviewers who are experts in the field. Panelists review comments made by individual reviewers that consequently lead to important and detailed discussions, either virtually or on site or a combination. The recommendations made by the panel are taken by the program managers and play the major role in influencing the decision to fund or not fund a proposal. Nonetheless, there are some proposals that are declined that are worthy of funding based on the reviews and panel summaries. The BMAT program management is strong and stable, and it adheres to a mandate in the NSF strategic plan. The program is welcoming of new and novel ideas that are both high-risk and high-reward. The existence of the BMAT program is the latest important evidence of the openness of the NSF Division of Materials Research to create and grow funding in new areas of investigation (with ~15% increase from 2011 to 2014). A National Academies report had indicated that it is important to focus on these materials and DMR has responded. Ultimately, the two current program managers have many years of experience in either BMAT or other related NSF bio programs and have done an outstanding job identifying and supporting important transformative science.
2. Responsiveness of the program to emerging research and education opportunities. Comments: The BMAT program is newly-developing and has embraced emerging research areas as suggested in proposals and reviewed by the community as well as suggestions given in the 2012 Biomaterials Workshops in which scientists and engineers in the field converged on a short list of common themes after extensive discussions. Nonetheless, there are many challenges associated with understanding biological and bioinspired soft materials and how they might be used as part of complex material systems. For example, one very interesting area that might be explored is the structure and function of extremophiles because they might provide clues as to how amazing function and specificity of biological materials might be generated outside living organisms. However, it is difficult to assess the ease of integrating such a novel research topic into the current themes or ‘bins’ in BMAT. Such examples should be described to the next COV.

3. Program planning and prioritization process (internal and external) that guided the development of the portfolio.

Comments:

The program prioritizes novel material designs and developments as well as discovery of new materials-related phenomena. The fundamental research areas focus on topics related to (1) biological materials, (2) biomimetic, bioinspired, and bioenabled materials, (3) synthetic materials intended for applications in contact with biological systems, and (4) the processes through which nature produces biological materials. In terms of its portfolio, the BMAT program seems to be driven by the scientific community and the proposals it receives, rather than by top-down prioritization. This is important because it allows NSF to fund great research, which simply doesn't fall under the umbrella of more focused programs such as those at other agencies. The program managers do say that they avoid investing too heavily in a single area, which is reasonable. However, how priorities are executed specifically was not clear, although the stability of the program officer is likely to help provide continuity.

4. Responsiveness of program to previous COV comments and recommendations.

Comments: The previous COV had no comments to respond to because the BMAT program is new. Thus, there were no recommendations for change.

Metals and Metallic Nanostructures (MMN)

INTEGRITY AND EFFICIENCY OF THE PROGRAM'S PROCESSES AND MANAGEMENT

Briefly discuss and provide comments for *each* relevant aspect of the program's review process and management. Comments should be based on a review of proposal actions (awards, declinations, and withdrawals) that were *completed within the past three fiscal years*. Provide comments for *each* program being reviewed and for those questions that are relevant to the program(s) under review. Quantitative information may be required for some questions. Constructive comments noting areas in need of improvement are encouraged.

I. Questions about the quality and effectiveness of the program's use of merit review process. Please answer the following questions about the effectiveness of the merit review process and provide comments or concerns in the space below the question**.**

QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCESS	YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE
1. Are the review methods (for example, panel, ad hoc, site visits) appropriate? Comments: The review process is well defined, generally consistent, and strictly administered. The spread in ratings is usually not extreme. The process correctly identifies the strong and weak proposals. The opportunity for improvement resides in more clearly delineating selection/rejection criterion for those projects between the strong and weak ones. However, one problem is consistency in the quality of the initial set of reviews. Many reviewers provide detailed listings of strengths and weaknesses according to NSF review guidelines, while others do not. This can in some instances lead to widely disparate proposal rating conclusions. Panel review discussions can, and do, in many instances correct and clarify this deficiency. Reports back to the PI's are adequate. **Data Source: EIS/Type of Review Module**	Yes, mostly.
7. Are both merit review criteria addressed p) In individual reviews? q) In panel summaries? r) In Program Officer review analyses?	Yes .

Comments: The panel review summaries, while useful, are documents produced to support the review process and discussion. They do not universally include details of that discussion as they occurred, which influenced the final proposal decision. However, since they don't deviate much, if at all, from the initial set of reviews, they are hardly an improvement over the original reviews and aside from some "clarifying" reasons for selecting or declining a proposal for award serve little useful purpose. The PM analyses were uneven, probably reflecting the different individuals holding the office during the period of consideration. In general, the analyses capture the essential elements, with the more extensive reports offering a deeper view into the decision process and the underlying review evidence. While one does not need a verbose report, some of them are less than ½ page, which is inadequate. It is on the 'borderline' proposals that a clearer explanation of the PD decision process is most important. **Data Source: Jackets**	

3. Do the individual reviewers giving written reviews provide substantive comments to explain their assessment of the proposals? Comments: The majority of reviews are comprehensive enough that excellent proposals can be differentiated from poor proposals. In the case of fair to good proposals, i.e., those in the middle, the language in the initial reviews and the PM decision letter is often insufficient to clearly convey opportunities for improvement or effectively explain basis of judgment. There are many reviews in the sample set of proposals provided to COV that probably could be used for *any* proposal with but a few word changes. They are not useful in terms of defining "why" a proposal was not funded. In particular, an uncomfortably large fraction of reviews focus on very high level issues and argue by opinion or 'cut-and-paste' from the proposal itself rather than by providing contrary evidence or analysis. This is alarming particularly in the case of strong positive or negative reviews. What these poorly written reviews do is to put the onus on the review panel to do the original reviewer's review. The extent to which NSF can encourage reviewers by explicit instruction to provide substantive, defensible comments would be of value. Metrics on reviewer performance should be gathered. In addition to those that do not respond to requests or respond negatively, reviewers that only provide minimal feedback should be removed from the NSF review process. This will require NSF to implement a reviewer assessment program where a reviewer's review should be assessed in terms of NSF criteria, and if found wanting in adhering to NSF review guidelines, they should not be asked to review another proposal.	Mostly Yes

Data Source: Jackets	
4. Do the panel summaries provide the rationale for the panel consensus (or reasons consensus was not reached)? Comments: This is very subjective and cannot be directly answered without being part of the panel. It is impossible to judge aspects of the "discussion" that led to specific recommendations by the panel in the panel review summary. In general, panel summaries provide appropriate rationale but in certain cases, they do not. In these latter cases (which are rare), it would be useful if the panel summaries were written in more depth with specific criticism, particularly when the reviews being provided to the panel offer insufficient review reasoning for the decision. From the documents provided, the panel summaries provide appropriate rationale for concurrence even when there are dissenting opinions in the individual reviews. **Data Source: Jackets**	Yes
5. Does the documentation in the jacket provide the rationale for the award/decline decision? [Note: Documentation in the jacket usually includes a context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), program officer review analysis, and staff diary notes.] Comments: The documentation in the jacket is consistent with the decision reached and is almost always well organized and utilized in the decision making process. Documentation is quite thorough, and the PM review is detailed and cogent. The summary information provided in the analysis is <u>almost</u> always reflective of the reviews and/or panel summary with some opinion of the PM woven in appropriately. In most cases the decision was clearly in line with the input from the review process. There were a few cases where the PM analysis is a bit terse. One does not want to mandate a format or required length of such analyses, but they should be provided with sufficient detail for a PI to understand the thought process by which a final decision was reached. In some cases this is missing. This is particularly important to what might call 'borderline cases' where proposal reviews span a wide dynamic range. **Data Source: Jackets**	Yes

6. Does the documentation to the PI provide the rationale for the award/decline decision? [Note: Documentation to PI usually includes context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), and, if not otherwise provided in the panel summary, an explanation from the program officer (written in the PO Comments field or emailed with a copy in the jacket, or telephoned with a diary note in the jacket) of the basis for a declination.] Comments: The documentation in the jacket is consistent with the decision reached. Sometimes the rationale is direct and to the point and based on the initial reviews plus some discussion from the panel. This is the easy situation. In other situations the results are not as clear. In cases where there is a wide disparity of views, i.e., middle grouping of proposals, attempts to convey what was wrong with the proposal in technical (correctable) terms were not well enunciated. On the other hand, the PM decision letter almost always included a good summary of the decision analysis. **Data Source: Jackets**	Yes
7. Additional comments on the quality and effectiveness of the program's use of merit review process: Overall the merit review process is very well thought out and executed. It arrives at a result that can be accepted exactly because it involves many people at different levels within the proposal review process. Ideally it should provide checks and balances to minimize cronyism and professional jealousy in the process. However, only if the quality of "all" reviews continues to improve will it attain the lofty management goal for a superior merit review system NSF hopes for. Incorporating more quantitative metrics on all aspects of MMN proposal submission and the proposal process (success/failure, submission numbers for each topical area, etc.), which could be shared with future COV and the NSF research community would enhance the merit review process, while aiding the PI in constructing better proposals. Transparency at each stage of the merit review process will enhance program effectiveness. The current MNM program manager is doing a professional job of implementing an effective merit review process, as established by the thoroughness of the review analysis documents that were provided. Within the current NSF guidelines for merit review this is an effective program.	

II. Questions concerning the selection of reviewers. Please answer the following questions about the selection of reviewers and provide comments or concerns in the space below the question.

SELECTION OF REVIEWERS	YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE
1. Did the program make use of reviewers having appropriate expertise and/or qualifications? Comments: The individuals seemed qualified to review the proposed research. They appear to have been appropriately selected (although it is not exactly clear how this occurred over the four-year span). However, there does not appear to be a consistent methodology within MMN and DMR for selecting reviewers. It seems to be PM specific. Consistency across DMR would be especially useful if was also transparent. **Data Source: Jackets**	Yes
2. Did the program recognize and resolve conflicts of interest when appropriate? Comments: The apparent COI's were identified and resolved with substantial investment of effort on behalf of the program managers. **Data Source: Jackets**	Yes
Additional comments on reviewer selection: Reviewers who are non-responsive or submit substandard reviews should not be asked to participate in future NSF review activities or other NSF events.	

III. Questions concerning the management of the program under review. Please comment on the following:

MANAGEMENT OF THE PROGRAM UNDER REVIEW
1. Management of the program. Comments: Management of the program adheres to the existing NSF strategic plan. However, there has been almost constant change within the PM leadership over the time frame (2011-2014) being evaluated. There have been four MMN Program Directors. This is not a good prescription for effective program leadership or management. And while rotation of PM's is part of the NSF culture, it seems as if this program has had a rather significant record of turnover, and this is a situation that is sub-optimal for the program in the long-term. It directly and adversely impacts efficiency through the loss of institutional memory, the need to relearn processes, the loss of long-standing relationships between PI's and PM's, etc. The program has made a strategic decision to move toward almost exclusively panel reviews (virtual and face-to-face), which is generally a positive move. It would be useful to have some kind of evaluation of how effective the virtual panel approach is compared to past mail in reviews. The program has decided to increase the number of new proposals funded over the past couple of years at a cost of 20% decrease (on average) of award size and award length. It is possible that this is acceptable if more low cost projects can be funded (e.g., theoretical/computational), but a *de minimis* funding level may be fast approaching beyond which inflationary pressures may endanger MMN project portfolio. Although the number of CAREER applications and applications from under represented researchers are small, there has been an effort on the part of the PM to ensure that they are represented well in awards.
2. Responsiveness of the program to emerging research and education opportunities. Comments: The program seems to be behind the curve in identifying new areas of research, including new materials, innovative interrogation tools, and novel experimental techniques. Addressing emerging research more proactively, naturally addresses the education opportunities. It actually enhances them. This is a program that has roots in traditional disciplines of synthesis and processing, defects, phase behavior, microstructure, etc. MMN program has moved recently to topics such as high-entropy alloys, but even this is not 'new.' Perhaps the frontier here rests in the application of 'big data,' machine-learning and large-scale simulations as well as novel experimental probes, especially microscopies or other tomographic approaches, to explore meso-scale effects. Aspects of

computational materials science need to be funded or co-funded in MMN where experimental exploration is part of the research proposal.

There have been some changes in the percentages of awards given to the various topical areas in response to changing research priorities (e.g., an increase in research in mechanical behavior at the nano-scale).

The data provided for broader impacts was good, particularly as it pertains to the participation of women in the MMN field.

3. Program planning and prioritization process (internal and external) that guided the development of the portfolio.

Comments:

No data are provided that would allow external evaluation of this process. As such it is not clear how priorities were selected. While a listing of priorities exist as provided in the MMN program planning presentation, and proposals have been and are selected based on this listing, how this occurs is not clearly defined or transparent, and obviously depends on the incumbent PM. It is clear that while much thought has gone into what needs to be done within the MMN program to balance the portfolio between the competing research priorities, very little forward thinking on future planning and prioritization is apparent to the COV.

The NSF workshop – Emerging Science and National Priorities in Metals and Metallic Nanostructures was well done. The results, however, validated a list of priorities that have been around for 10-20 years. Some effort in defining existing (and possibly emerging) knowledge gaps, and tracking progress in closing these gaps, would be useful in accessing this aspect of the portfolio.

4. Responsiveness of program to previous COV comments and recommendations.

Comments:

Where comments were received program staff addressed them as needed and decisively. This aspect is taken very seriously be the program staff and program officers.

Designing Materials to Revolutionize and Engineer our Future (DMREF)

INTEGRITY AND EFFICIENCY OF THE PROGRAM'S PROCESSES AND MANAGEMENT

Briefly discuss and provide comments for *each* relevant aspect of the program's review process and management. Comments should be based on a review of proposal actions (awards, declinations, and withdrawals) that were *completed within the past three fiscal years*. Provide comments for *each* program being reviewed and for those questions that are relevant to the program(s) under review. Quantitative information may be required for some questions. Constructive comments noting areas in need of improvement are encouraged.

I. Questions about the quality and effectiveness of the program's use of merit review process. Please answer the following questions about the effectiveness of the merit review process and provide comments or concerns in the space below the question**.**

QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCESS	YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE
1. Are the review methods (for example, panel, ad hoc, site visits) appropriate? Comments: With a large number of submissions and diverse areas of materials encompassed by the program, this program was reviewed by a set of panels established according to the focus materials type in the proposal. This is a relatively new program, but given the size of the response and the diversity of contents in the proposals, the use of focused panels appears an appropriate approach to reviewing. Discussions with the current Program Officer indicates that the process continues to be refined, likely important for efficiency and effectiveness. The multi-panel process helps to bring to the review process the diversity of perspectives that are represented by the program. Given the breadth of proposals, there are significant challenges. For example, this resulted in some individual reviews early in the panel review process being performed by people that were not subject-matter experts. As a consequence some individual proposals were unfairly rated too low to be further competitive. Due to the broad scope of each proposal (theory, synthesis and characterization, prototypically), the use of just three reviewers in the initial phase was judged by the COV to be insufficient to both cover the technical breadth and assure a balanced input. An increase in the number reviews appears needed to address this issue. **Data Source: EIS/Type of Review Module**	

8. Are both merit review criteria addressed

   s) In individual reviews?

   t) In panel summaries?

   u) In Program Officer review analyses?

Comments:

Broader impacts were nearly always addressed (very few exceptions). In a number of cases, this seemed more like a “box-checking” enterprise - the broader impacts were addressed in a single sentence. There do not appear to be uniform standards on what constitutes E, VG G, …. in terms of broader impacts. A limited number of reviewers provided much deeper commentary on the broader impacts.

The panel summaries appear to be better balanced, roughly in the right proportion.

The Program Officer review analyses are very even handed in applying the criteria and in balancing the comments from the individual reviewers and the panel recommendations. Overall, final outcomes seem to be clearly correlated.

One example from 2013 did show a real disconnect between what seemed to be strong criticism of the proposal and then a final set of paragraphs justifying a positive funding decision. Given well-known issues with panel process management, it would have been helpful to have more information on how program officers handle this proposal. It would also be helpful to have more information on how program officers made decisions at the boundary between funded and not-funded.

Data Source: Jackets

3. Do the individual reviewers giving written reviews provide substantive comments to explain their assessment of the proposals? Comments: For the most part, yes. Where proposals were not considered for panel discussion, individual reviews did a good job of capturing weaknesses. In a few cases, very highly rated proposals had less thorough flushing out of strengths and weaknesses by the individual reviews and summaries, but the program directors made considerable effort to address and explain outcomes in their recommendations – addressing either details of the discussion, or in at least one case, the overwhelming enthusiasm of all the people who considered it. Relative to other programs that were reviewed, the DMREF proposals had a more variable review quality. One noteworthy factor was identified by the Program Officer in discussion: a significant number of reviewers were not fully informed regarding the particular requirements of the DMREF program, especially the importance of 'closing the loop' between theory/modeling and experiment. This is expected to go well beyond conventional collaboration, to establish predictive modeling towards the goals of the MGI. The science quality of the reviews was more heterogeneous – some were really excellent – some low enough in quality that they would be easily refuted were the comments made in the context of a journal review. The broader impact reviews were highly variable. Many reviewers use only a single line to address this. There do not appear to be consistent standards on what constitutes, excellent, good, poor, etc. Individual committee members expressed concern that even in the 2014 round, the review process seems to have resulted in awards or declines that were not based on the judgements of well-informed expert reviewers. **Data Source: Jackets**	
4. Do the panel summaries provide the rationale for the panel consensus (or reasons consensus was not reached)? Comments: Most of the panel summaries seemed descriptive, but without the panel rankings, it is hard to comment further. In some cases (evidently lower ranked proposals), they were quite terse. In some cases, it is not clear, on the basis of this summary alone, where the proposal fell in the distribution. The only statement provided gives the panel rating (highly competitive, competitive, or not competitive). It is not clear how many of the middle-ranked proposals are near borders with either the top or bottom category. **Data Source: Jackets**	

5. Does the documentation in the jacket provide the rationale for the award/decline decision? [Note: Documentation in the jacket usually includes a context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), program officer review analysis, and staff diary notes.] Comments: We note that in each of 2012, 2013 and 2014, a different Program Officer was responsible. There were some differences from year to year that resulted. Overall, and in particular in 2014, the program officer review analysis was very informative in providing the reasoning behind the decisions. In some cases, the reviewers gave a proposal a high rating but had particular reservations that the panel and subsequently the program officer highlighted. When one or more reservations resulted in funding being declined, this was made clear in the review analysis. There were cases where the reviewers had reservations but were not deemed serious enough to decline funding. Maintaining consistency still presents major challenges. As an illustration, examples where the ratings for proposals that were funded seemed to vary significantly. Another factor, that is in part a general issue across DMR, is that the reasoning for the decision where it involves competition between two comparably reviewed proposals is not easy to discern from the record. One member felt that the program officer was providing more a rationalization of the comments of the reviewers, as opposed to using the comments for advice in making decisions. **Data Source: Jackets**	

6. Does the documentation to the PI provide the rationale for the award/decline decision? [Note: Documentation to PI usually includes context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), and, if not otherwise provided in the panel summary, an explanation from the program officer (written in the PO Comments field or emailed with a copy in the jacket, or telephoned with a diary note in the jacket) of the basis for a declination.] Comments: We found no record of additional information in the jackets reviewed for extra communication with the PI. We were therefore not able to document a meaningful answer We note that the Program Officer should be responsible for documenting these interactions. **Data Source: Jackets**	
7. Additional comments on the quality and effectiveness of the program's use of merit review process: Overall, we think the current Program Officer for DMREF is thoughtfully managing a complex review task. The review analyses are thoughtful and well balanced. The current multi-panel process is cumbersome, but not an unreasonable choice. It does present an extra layer of complexity in arriving at final decisions, not the least being calibration between panels. There is an important part of the funding decision that is not open to us for assessment: how the Program Officers make the final decisions among highly rated / high merit proposals. The documentation and presentations at the COV make clear the principles involved and the application to individual proposals. This is a particularly important issue for DMREF due to the cross-NSF nature of the program and the number of other program managers that may be involved. Based on the documentation available to us, the judgment exercised by the Program Officer in this process is only subject to internal NSF oversight (DD concurrence). The COV felt that DMR program management should identify best practices for documenting the decision rational that captures essential aspects in the special circumstances of the DMREF program.	

II. Questions concerning the selection of reviewers. Please answer the following questions about the selection of reviewers and provide comments or concerns in the space below the question.

SELECTION OF REVIEWERS	YES , NO, DATA NOT AVAILABLE, or NOT APPLICABLE
1. Did the program make use of reviewers having appropriate expertise and/or qualifications? Comments: It is clearly much more challenging to secure the right balance of reviews for this program than for a typical DMR program. In some cases, the breadth of teams is not necessarily reflected in the written reviews performed. This raises concerns as to whether the important step of getting written reviews was always based on a balanced distribution of expertise among the three reviewers chosen. Some of the reviews were cogent and well constructed. Others were surprisingly short and/or ill-informed. In many cases, the latter were associated with reviewers that weren't really subject matter experts. Lack of familiarity with the topics seemed, in the limited sampling conducted, to result in lower scores. The net effect was observed to be more variability in the quality of reviews in this program in comparison to core programs. It seems to be much more challenging to secure the right balance of reviews for this program than for a typical DMR program. In some cases, breadth of teams was not necessarily reflected in the reviews performed. **Data Source: Jackets**	
2. Did the program recognize and resolve conflicts of interest when appropriate? Comments: Conflicts were handled clearly. **Data Source: Jackets**	
Additional comments on reviewer selection: Since panels must be assembled to cover a broad swath of technical expertise, there are clearly cases where soliciting written reviews from the key subject matter experts would be useful.	

III. Questions concerning the management of the program under review. Please comment on the following:

MANAGEMENT OF THE PROGRAM UNDER REVIEW
1. Management of the program. Comments: Background information based on the Program Officer presentation and follow-up discussion: A key point is that the DMREF program has scope well beyond DMR and requires coordination with about 10 different program officers. It is a new program that has ramped up over a period of three years under the oversight of a different Program Officer each year. It is one of the few new materials theory (plus synthesis and characterization) initiatives and has, as such, drawn large numbers of proposals, further complicating the management aspects. As the NSF contribution to the MGI, there are additional expectations imposed on the proposals, particularly the essential need to demonstrate and take advantage of a clear closure of the loop between theory, synthesis and characterization to achieve target materials properties. The DMR aspect of the program has been managed to emphasize fundamental science and materials discovery, within this picture of integrated research. The decision to use multiple panels for review was likely the only logical approach available. Issues in the peer review process that have emerged are documented in prior sections. Given the size of the program and the interest, the community might be better served if a two tier approach to review was initiated with preproposals and a smaller number of full proposals upon invitation-only out of that pool. The staff burden might be similar, but the review burden and the time spent on failed proposals by the community would certainly be reduced. Worthy of consideration in this same line: It would be valuable in this and other DMR programs, for the program manager to estimate the amount of time that the community spends responding to the call. Relatively simple calculations could then be used to estimate the dollar value of this time compared to the total dollar value of the program. Some DoD funding agencies aim for <10% of the total dollar value on the program to be spent in responding to the call. Where does NSF fall on this metric? Certainly key groups in the core MGI community are supported and the new awards cover a broad swath of materials areas. It is less visible the extent to which the funded programs robustly meet the additional criteria discussed above, but this is one of the stated guiding principles for selection and rightly so. So far, the full range of materials science is not well represented, but the new program officer should be allowed time to even-out the distribution of the science areas that should be integrated into the program. Also, with the focus on collaboration and ‘closing the loop’ with theory and modeling and informatics, the program may have funded some programs that are otherwise not particularly novel. The program has had three managers in as many years. This is not ideal, especially for a new initiative as complex as DMREF. It is clear that the current management has a commitment to improving the organization and efficiency of the program. For example, the practice of ‘zero mortgage’ is commendable and continuing this is encouraged. The intention to build stronger

connections to DMS and CISE are also excellent. We hope that a new era of stable program management will hold in the future.

For consideration in the relationship to the rest of the DMR program, some committee members have raised concerns regarding the unique benefits of DMREF as a stand-alone program, versus a managed cross-cut that drives shifts in core portfolios. There seems to be a lot of overlap with existing core programs (CMMT, CMP and elements of the materials class programs – POL, CER and MMN) with the potential to create either redundancies or gaps. However, it is early in the program and it is recognized that the full scope and context of the MGI objectives may well justify the present approach.

2. Responsiveness of the program to emerging research and education opportunities.

Comments: This is an emerging area in its own right.

3. Program planning and prioritization process (internal and external) that guided the development of the portfolio.

Comments: There is clear evolution of management of the program in its short life and the changes implemented so far have improved the program and those described as being implemented for 2015/16 should further benefit the program, making the review more streamlined and internal NSF management across directorates more clear. In other words, the program management has been responsive to lessons learned in its short life and the current Program Officer has, in particular, learned a lot in his short tenure in this position and done a commendable job with such a complex project. He clearly thinks carefully about what he is doing and its impact on the stakeholders. DMR is to be commended for its leadership role in this NSF wide program.

The program is working hard to bring together the funded parties in this program through a series of workshops. We encourage this engagement, particularly to identify for new areas of investment, although we do not have high priority recommendations for specific communities at this time.

Balancing the portfolio with respect to materials classes is a challenge. These communities are not all in the same place with respect to fundamental understanding, models, theories and computational tool sets. There should be some outcomes/feedback for the core programs (especially CMMT) in terms of areas of need for additional investment or portfolio redistribution.

A considerable amount of planning and coordination between different Directorates appears to have gone into developing the portfolio of the DMREF program, which represents NSF's response to the Materials Genome Project. Joint meetings have been arranged with other federal agencies as of early 2015.

As it is presently organized, a great deal of the decision-making involves concurrence among a large number of NSF directorates and program officers. The details of this process are not particularly visible to the COV, although we have been informed of basic processes and principles. As the program continues to evolve, the responsibilities and accountabilities for program outcomes need to be clearly described and documentation of practices agreed upon and implemented.

4. Responsiveness of program to previous COV comments and recommendations. N/A

Condensed Matter and Materials Theory (CMMT)

INTEGRITY AND EFFICIENCY OF THE PROGRAM'S PROCESSES AND MANAGEMENT

Briefly discuss and provide comments for *each* relevant aspect of the program's review process and management. Comments should be based on a review of proposal actions (awards, declinations, and withdrawals) that were *completed within the past three fiscal years*. Provide comments for *each* program being reviewed and for those questions that are relevant to the program(s) under review. Quantitative information may be required for some questions. Constructive comments noting areas in need of improvement are encouraged.

I. Questions about the quality and effectiveness of the program's use of merit review process. Please answer the following questions about the effectiveness of the merit review process and provide comments or concerns in the space below the question**.**

QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCESS	YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE
1. Are the review methods (for example, panel, ad hoc, site visits) appropriate? Comments: Reviews were judged to be conservative; thus, the mail in review method is entirely appropriate for the CMMT program for areas that are very active. One concern – funding of excellent researchers in areas not seen as "hot" – depends on the prescience of Program Managers. It is therefore important that CMMT Program Managers have the wide experience they have currently, supplemented by complementary expertise of rotators. **Data Source: EIS/Type of Review Module**	YES
9. Are both merit review criteria addressed v) In individual reviews? w) In panel summaries? x) In Program Officer review analyses? Comments: The vast majority of reviews addressed both broader impacts and the scientific content of the proposal, though broader impact results evaluation was less detailed. Panel summaries were rarely used, so this was less	 YES, mostly NA YES

critical to this program. The Program Officer's review analyses were very even handed in applying the criteria and in balancing the comments from the individual reviewers. There was some amount of variability in how substantive individual reviews were. Some reviewers do not take Broader Impacts seriously; perhaps this issue needs to be emphasized to reviewers. The Program Officer review analyses are well done and provide a good rationale for the decisions that were examined. **Data Source: Jackets**	

3. Do the individual reviewers giving written reviews provide substantive comments to explain their assessment of the proposals? Comments: The majority of the reviews solicited were from well-qualified subject matter experts. In most cases, the reviews were substantive and detailed; in about one-fifth of the reviews the grades were not well substantiated by the report. In cases where revised proposals were submitted, the feedback obtained from reviewers on previous versions seemed to be very useful in improving the package. In a limited number of cases, the reviews were directed more at the proposer than the science addressed in the proposal. When this happened, the program manager did an excellent job of addressing this in the summary. The reviews on broader impact were generally shorter and more qualitative than the reviews of the scientific content. That said, this community seemed to provide a more substantive review of broader impacts than was the case for some other programs (particularly in more recent years). It appears that more emphasis could be given to whether the question proposed is worthy of public support, rather than merely reviewing the PI's agenda. **Data Source: Jackets**	YES, mostly
4. Do the panel summaries provide the rationale for the panel consensus (or reasons consensus was not reached)? Comments: This program uses mail reviews almost exclusively. **Data Source: Jackets**	NOT APPLICABLE

5. Does the documentation in the jacket provide the rationale for the award/decline decision? [Note: Documentation in the jacket usually includes a context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), program officer review analysis, and staff diary notes.] Comments: The jacket documentation was systematic and comprehensive; the review analysis was found to be cogent and well balanced in almost all of the examples reviewed. The panel was able to ascertain the fairness of the funding decisions after additional jackets were made available upon request, beyond the random sampling provided (which had an inadequate sampling of proposals in several key areas). The program officer is to be particularly complimented for diplomatic and fair summaries in the case where eminent scientists submitted vague proposals. **Data Source: Jackets**	YES

6. Does the documentation to the PI provide the rationale for the award/decline decision? [Note: Documentation to PI usually includes context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), and, if not otherwise provided in the panel summary, an explanation from the program officer (written in the PO Comments field or emailed with a copy in the jacket, or telephoned with a diary note in the jacket) of the basis for a declination.] Comments: CMMT sends custom email notifications with comments to investigators. As a result, it is hard for this panel to see what information was provided. In some cases, where there is a record of the communication between the Program Officer and the PI, the quality of explanation offered is to be commended. These notes represent additional effort and are easy to understand and oriented towards helping the PI improve in the future. **Data Source: Jackets**	YES
7. Additional comments on the quality and effectiveness of the program's use of merit review process: Overall, the quality of work done by the Program Officers in CMMT is impressive. The review analyses are thoughtful and well balanced. The E/V/G/F/P classifications are not homogeneous across reviewers, and it is not clear how this variability affects award decisions. There is an important part of the funding decision that is not open to us for assessment: How do the Program Officers make the final decisions among	

highly rated / high merit proposals? The documentation and presentations at the COV make clear the principles involved and the application to individual proposals. However, the judgment exercised by the Program Officer in this process is only subject to internal NSF oversight (DD concurrence). The COV questionnaire focused more on the review and award process, and there was no explicit request for the COV to review the progress once a grant is awarded; this issue deserves further thought.	

II. Questions concerning the selection of reviewers. Please answer the following questions about the selection of reviewers and provide comments or concerns in the space below the question.

SELECTION OF REVIEWERS	YES , NO, DATA NOT AVAILABLE, or NOT APPLICABLE
1. Did the program make use of reviewers having appropriate expertise and/or qualifications? Comments: Generally, this was done appropriately. The mail review process allowed the program officer to solicit opinions from subject matter experts. However, based on the random sample jackets originally provided, the quality of some of the reviewers was somewhat underwhelming. (Multiple COV members felt this about their own area of expertise). More emphasis needs to be placed on excellence of the reviewers. The solicited jackets seemed to have reviewers whose quality was more in line with expectations of the COV members. **Data Source: Jackets**	YES
2. Did the program recognize and resolve conflicts of interest when appropriate? Comments: No COI issues were detected. **Data Source: Jackets**	YES
Additional comments on reviewer selection: An impression (based on the random sample provided) was left that top tier scientists in some areas may not be engaging in the review process. Use of foreign reviewers was commendable, but they may need to be provided material to be properly informed about the US classification system and usage of words. Foreign reviewers seem to be predominantly from western Europe, relatively few from Asia; this should be evaluated. Timely response from reviewers appears to be an issue in this program; this (and factors such as overload of proposals for a single Project Manager, and the extreme budget pressures) appears to lengthen the decision process beyond that of other programs. This needs to be addressed promptly.	

III. Questions concerning the management of the program under review. Please comment on the following:

MANAGEMENT OF THE PROGRAM UNDER REVIEW
1. Management of the program. Comments: The management is being done well, especially as the low success rate suggests that there are an ever-growing number of proposals, despite the flat funding. However, the presentation was not effective in conveying the effectiveness of the management. The investment in KITP, ACP, Boulder Summer School, (as well as newer initiatives) is found to very appropriate for CMMT. Given the increasing footprint of CMMT in the theoretical physics community, it would behoove DMR to continue their support at the level necessary for these institutes/centers to be stable. The program manager(s) have opted to keep the funding rate higher by reducing the length of the award. This has the advantage of providing support for a larger fraction of the community, at the expense of shortening the award lifetime. This process leads to award lifetime being significantly mismatched to the lifetime of a typical graduate student. Whereas is some departments funding shortfalls can be addressed by assigning TA's (say for a service course), this is certainly not possible in all departments. It is worrisome to see the very long dwell-times on the proposals. In 2012 and 2013, approximately 30% of proposals had no decision after 6 months. In 2014, processing times improved, so that only ~15% did not have decisions after 6 months. However, in ~5% of the cases in 2014, no decision was made after 12 months. This process should be tightened up so that responses are supplied to the proposer in a timely fashion. This requires alleviating the extremely large workload for the Program Manager, and systematically developing a pool of reviewers who can respond in a timely manner.
2. Responsiveness of the program to emerging research and education opportunities. Comments: This has been handled very well so far. CMMT appears to be coupling well to both the Materials Genome Initiative and the Cyberinfrastructure Framework for the 21st Century. The CMMT program has been evolving appropriately to shifting topics within its purview – encouraging new areas of research, while continuing to support core areas. One concern is that CMMT has had several very fundamental advances in the past decade; as a result, the field is attracting young talent of ever-increasing quality away from other fields of physics that have traditionally attracted top talent. It is not clear that with the current funding levels we will be able to take full advantage of this gain without a strong pro-active response by CMMT in NSF, and commensurate widening of what falls within the purview of CMMT. This is a matter of serious concern.

3. Program planning and prioritization process (internal and external) that guided the development of the portfolio.

Comments: This has always been contentious issue in the field; a properly balanced portfolio, based on scientific excellence, not on applications, is important for a basic program within DMR like CMMT. The current portfolio seems reasonably balanced, though the exact mechanism to keep it balanced is not very transparent and relies heavily on having a seasoned expert as Program Manager.

4. Responsiveness of program to previous COV comments and recommendations.

Comments: This seems to be done appropriately. However, one of the recommendations of the previous COV, namely diversity of reviewers (institutional, geographic, etc.) could have affected their overall quality. If so, extra care should be taken to ensure that quality is not compromised.

While there was concern at the lack of progress in numbers of women and especially minorities in CMMT over the past half decade, it is hoped that the improving situation in CAREER awards augurs well for the future. The program manager's report shows that success rate is higher for women and underrepresented minorities. Some of the panel members were concerned about the declining percentage of awards in soft condensed matter; this may reflect the shifting of the interests of theorists to areas in biophysics. The Program Manager said that overall success rate in the subfield is higher than average; it is the number of submitted proposals that is substantially less.

Polymers (POL)

INTEGRITY AND EFFICIENCY OF THE PROGRAM'S PROCESSES AND MANAGEMENT

Briefly discuss and provide comments for *each* relevant aspect of the program's review process and management. Comments should be based on a review of proposal actions (awards, declinations, and withdrawals) that were *completed within the past three fiscal years*. Provide comments for *each* program being reviewed and for those questions that are relevant to the program(s) under review. Quantitative information may be required for some questions. Constructive comments noting areas in need of improvement are encouraged.

I. Questions about the quality and effectiveness of the program's use of merit review process. Please answer the following questions about the effectiveness of the merit review process and provide comments or concerns in the space below the question**.**

QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCESS	YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE
1. Are the review methods (for example, panel, ad hoc, site visits) appropriate? Comments: The PM provided a compelling rationale for using predominantly mail review. Handling single investigator grants by mail in review enables the PM to tap highly qualified experts around the world. Career Proposals are, appropriately, assessed by panel review. Reviewer selection, level of detail in assessing input and rationalizing outcomes was clearly visible in the e-Jacket documentation of the methods used. Group 3 notes that successful use of this approach places significant burden on the program manager to provide thorough, comprehensive analysis. The POL program manager consistently devotes the effort to make excellent use of mail review. **Data Source: EIS/Type of Review Module**	Yes
10. Are both merit review criteria addressed y) In individual reviews? z) In panel summaries? aa) In Program Officer review analyses? Comments: All Group 3 members who examined POL eJackets noted that every review and	Yes

summary they read addressed all of the merit review criteria. While Broader Impacts were commented on in every case examined, reviewers are not generally consistent in the weight they gave Broader Impacts in their overall evaluation. (some reviewers do not take Broader Impacts seriously.) In all eJackets examined, the PM's assessments of each of the proposals had captured the tenor of the reviews and had thoughtfully integrated specific quotations from the referees when appropriate. **Data Source: Jackets**	

3. Do the individual reviewers giving written reviews provide substantive comments to explain their assessment of the proposals? Comments: For the most part, the reviewer's comments in eJackets provided substantive information to justify the ranking of the proposals. Reviews tended to be lengthier for those proposals that had some very good parts but some detracting aspects. The PM gave careful attention to and made an appropriate assessment of these comments in his Review Analysis. Where proposals were not considered for panel discussion, individual reviews did a good job of capturing weaknesses. In a few cases, very highly rated proposals had less thorough comments on strengths and weaknesses. This was observed in the individual reviews and summaries, but the PM made considerable effort to address and explain outcomes in their recommendations – addressing either details of the discussion, or in at least one case, the overwhelming enthusiasm of all the people who considered it. There were some instances where the comments were quite positive, but the ranking of the proposal (G, V) did not reflect the remarks made in the review. It was noted, in the eJackets examined, that the PM had detected these inconsistencies and thoughtfully addressed them in his assessment of the proposals. **Data Source: Jackets**	
4. Do the panel summaries provide the rationale for the panel consensus (or reasons consensus was not reached)? Comments: In POL, few proposals are reviewed by panels. Where panels were used, the summaries sometimes differ from the written reviews, but no glaring deviations were found. The PM's review analyses do an excellent job of weighing the individual reviews and panel summary, and arriving at a recommendation that is consistent with them. The PM does a nice job of relying very heavily on excerpts and observations from the reviewers to inform the recommendations. (in	Yes

general, the members of Group 3 would appreciate greater clarity regarding the number of proposals ranked near borders with either the top or bottom bins.) **Data Source: Jackets**	
5. Does the documentation in the jacket provide the rationale for the award/decline decision? *[Note: Documentation in the jacket usually includes a context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), program officer review analysis, and staff diary notes.]* Comments: All Group 3 members who examined POL jackets were impressed by the thorough, thoughtful assessments that the PM wrote for each proposal (both awarded and declined). The detail that he includes in his assessments and the care and thoughtfulness that he exercises in this aspect of the review process is exemplary. **Data Source: Jackets**	Yes

6. Does the documentation to the PI provide the rationale for the award/decline decision? *[Note: Documentation to PI usually includes context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), and, if not otherwise provided in the panel summary, an explanation from the program officer (written in the PO Comments field or emailed with a copy in the jacket, or telephoned with a diary note in the jacket) of the basis for a declination.]* Comments: Ample information is provided, as well as emphasis on open opportunities to engage with the PM to clarify feedback. The PM documents the phone conversations with and e-mails to the PIs (declined and awarded) that convey the rationale for the award/decline decision. The PM goes out of his way to provide documentation, and is remarkably responsive to proposers' requests for feedback and input. **Data Source: Jackets**	Yes
7. Additional comments on the quality and effectiveness of the program's use of merit review process: The PM adds 10% new reviewers each year; he recruits them when he attends national meetings (e.g., ACS, APS…). He regards this as part of mentoring young researchers who are entering the field. Lovinger engages experts from around the world in mail reviews; he notes that	Yes

this enables him to tap appropriate experts, well matched to the proposal. The merit review process was used very effectively to arrive at award/decline decisions. It was clear that the PM used the information contained in the reviews to make informed decisions that shape the POL program. The PM stays abreast of the field and, when he feels a proposal that did not review well deserves seed funding, he makes judicious use of EAGER to augment the peer-review program and introduce some additional risk into the portfolio. POL's PM invests considerable effort and expert judgment to ensure thorough consideration and appropriate prioritization of the proposals submitted to the Polymers program.	

II. Questions concerning the selection of reviewers. Please answer the following questions about the selection of reviewers and provide comments or concerns in the space below the question.

SELECTION OF REVIEWERS	YES , NO, DATA NOT AVAILABLE, or NOT APPLICABLE
1. Did the program make use of reviewers having appropriate expertise and/or qualifications? Comments: The members of Group 3 who examined POL jackets observed that reviewers had suitable expertise for the proposals they were asked to review. In cases where the selection of the referees looked curious, the PM had provided information in the jacket that addressed the selection of the specific reviewers. One member of Group 3 was surprised that many of the reviewers were unknown to them. (Perhaps this relates to the vigorous efforts of the PM to recognize up-and-coming experts when he attends conferences and recruiting them to be reviewers.) The Polymers program does an excellent job of providing a range of perspectives in reviewer selection. Reviewers have the appropriate range of expertise and represent a diverse set of institutions, geography, gender and ethnicity. **Data Source: Jackets**	**Yes**
2. Did the program recognize and resolve conflicts of interest when appropriate? Comments: To the best of our knowledge, this was done appropriately; however, we are not sure there was enough information in the jackets to address the question. **Data Source: Jackets**	**Yes**
Additional comments on reviewer selection: The broad use of foreign reviewers is impressive and well managed. As a caveat, though, usage of words may not be the same for non-native English speakers. The selection of international reviewers seems skewed to Western Europe and Israel (rather few from Asia).	

III. Questions concerning the management of the program under review. Please comment on the following:

MANAGEMENT OF THE PROGRAM UNDER REVIEW
1. Management of the program. Comments: The PM has a thorough and comprehensive view of the portfolio. His overview of the program was exceptional in its organization, balance of data vis a vis anecdotal evidence and reflection of the many facets of program analysis. The PM is clearly dedicated to the advancement and integration of polymer science in the broader spectrum of DMR and MPS. The PMs commitment to supporting Polymer-related research throughout NSF is a testament to his commitment to serve the Foundation broadly. The POL portfolio encompasses a broad range of investigators, from seasoned scientists to new faculty just beginning their careers. Review of the research portfolio shows a healthy mix of CAREER, GOALI, and EAGER awards, as well as a balance of collaborative and single investigator awards. The POL portfolio covers the entire area of polymer research and it is evident that the PM has been able to use POL funds to foster polymer research in other MPS programs (perhaps contributing to the creation of BMAT in DMR and Macromolecules in CHE). The PMs firm grasp of portfolio management reflects his deep roots in the polymer community, which are nurtured by heavy investment of time on his part communicating with individuals and attending conferences. The PM's rapid rate of processing and responding with award/decline decisions (fastest in the DMR) is particularly remarkable as it appears that the program is understaffed with 1.2 technical managers and 1 support staff person. (The loss of Dr. Khoury from the program has increased the burden on the PM.) The PM's exceptional ability to communicate with PIs in a timely manner (verbally and by e-mail) concerning the proposals is quite important for the individual PIs. He understands the system at NSF and how to optimally deploy POL resources. He has been a very efficient and effective manager of this program. In support of the decision "to pay down mortgages" in DMR, the PM has "paid off" almost 20% of his mortgage over just three years.
2. Responsiveness of the program to emerging research and education opportunities. Comments: POL has awarded 4 EAGER and 3 INSPIRE proposals over the past 4 years that have led to results that are now being highlighted by NSF. These ideas are truly emergent and the PMs investments in these proposals have paid off. Supporting these "risky" ideas is an absolute must for the field to grow and develop. The PM has also supported novel education ideas, e.g., the education of deaf children that recently received presidential recognition. The evidence clearly shows that the PM has been attentive and responsive to emerging opportunities, both in research and education.

The use of a “decadal” style workshop is an excellent method of enabling the community suggest new topics for the program. DMR is a leader in this aspect of the community as well.

3. Program planning and prioritization process (internal and external) that guided the development of the portfolio.

Comments:

The PM has kept abreast of the developments in polymer science and materials science globally by his attendance at national meetings that have substantial international participation. These activities enable him to maintain a knowledge base of researchers in the community that is essential in obtaining an appropriate set of reviewers for each proposal and for setting timely priorities. We note that the PM has earned the respect of the community through his obvious commitment to excellence and his transparent communication style, both gathering and disseminating information.

One member of Group 3 suggests that polymer science related to intrinsically disordered proteins and nucleic acids be considered for inclusion in the POL portfolio.

4. Responsiveness of program to previous COV comments and recommendations.

Comments:

The one recommendation of the 2011 COV focused on inclusion of women and minorities. From the data that were provided, the polymer program is now well above the numbers for DMR, MPS and NSF as a whole. It is clear that the PM took the previous report very seriously, and was responsive to the primary concern. The data showing success rates of proposals submitted to the program from URG’s was compelling and commendable.

Partnerships for Research and Education in Materials (PREM)

INTEGRITY AND EFFICIENCY OF THE PROGRAM'S PROCESSES AND MANAGEMENT

Briefly discuss and provide comments for *each* relevant aspect of the program's review process and management. Comments should be based on a review of proposal actions (awards, declinations, and withdrawals) that were *completed within the past three fiscal years*. Provide comments for *each* program being reviewed and for those questions that are relevant to the program(s) under review. Quantitative information may be required for some questions. Constructive comments noting areas in need of improvement are encouraged.

I. Questions about the quality and effectiveness of the program's use of merit review process. Please answer the following questions about the effectiveness of the merit review process and provide comments or concerns in the space below the question.

QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCESS	YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE
1. Are the review methods (for example, panel, ad hoc, site visits) appropriate? Comments: Yes, but not uniformly. In general, the review methods for PREM are appropriate. Although, the nature of the PREM program is different in scope from a standard proposal; therefore, it may warrant a different structure for proposal analysis, i.e., a preliminary competition to reduce the number of highly competitive research partnerships and then have a more detailed analysis of the pipeline development plans. Data Source: EIS/Type of Review Module	Yes
11. Are both merit review criteria addressed bb) In individual reviews? cc) In panel summaries? dd) In Program Officer review analyses? Comments: Yes, but not uniformly. NSF has an effective review process by including intellectual merit and broader impact. Individual review, for the most part, addressed both criteria, with slightly more weight being given to the criterion of broad impact. For the PREM program NSF might consider giving each criterion a separate evaluation based on "poor to excellent" to make the role of each in the evaluation process	Yes, but not uniformly

more apparent to the panel and program manager when ranking the proposal. Panel summaries tend to include more substantive comments and address all review criteria. Review Analyses addressed all criteria and were detail oriented. Data Source: Jackets	

3. Do the individual reviewers giving written reviews provide substantive comments to explain their assessment of the proposals? Comments: Yes, but not uniformly There was variation in the level of the feedback from the reviewers ranging from restating what the proposal entailed to substantive comments about the project. For the most part, the broader impacts sections were discussed in detail. Perhaps NSF might consider expanding from the current “strengths and weaknesses” approach and require the reviewer to answer specific questions or follow a specific structure, for each of the two criteria. Data Source: Jackets	YES, but not uniformly
4. Do the panel summaries provide the rationale for the panel consensus (or reasons consensus was not reached)? Comments: Yes, but not uniformly The panel summaries were detailed in that they conveyed the strengths and weaknesses of the proposal and the overall consensus of the panel regarding the recommendation for funding. There are some cases where information in the PO review analysis includes discussion points which do not appear in the panel summary which could be useful for the PREM and Partnering institutions. For clarity, NSF could add a “rationale for the panel consensus” section to the panel summary. Data Source: Jackets	Yes, but not uniformly

5. Does the documentation in the jacket provide the rationale for the award/decline decision? [Note: Documentation in the jacket usually includes a context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), program officer review analysis, and staff diary notes.] Comments: Yes. PO review analyses were excellent. They clearly outlined the Intellectual Merit, Broader Impacts, panel funding decision and the overarching reason the proposal was/was not funded. Data Source: Jackets	Yes

6. Does the documentation to the PI provide the rationale for the award/decline decision? [Note: Documentation to PI usually includes context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), and, if not otherwise provided in the panel summary, an explanation from the program officer (written in the PO Comments field or emailed with a copy in the jacket, or telephoned with a diary note in the jacket) of the basis for a declination.] Comments: Yes The PI is provided constructive feedback on the proposal through the individual reviews and the panel summary; however, information arising in the panel discussion which may play a role in some marginal decisions is not extractable from the documents sent to the PI. NSF should consider divulging some of the comments made by the PO in the review analysis to the PI. Data Source: Jackets	Yes
7. Additional comments on the quality and effectiveness of the program's use of merit review process: The merit review process is being administered well for the PREM Program. However, the size and diversity of the efforts suggests that perhaps an approach which is closer to the MRSEC approach might be useful.	

II. Questions concerning the selection of reviewers. Please answer the following questions about the selection of reviewers and provide comments or concerns in the space below the question.

SELECTION OF REVIEWERS	YES , NO, DATA NOT AVAILABLE, or NOT APPLICABLE
1. Did the program make use of reviewers having appropriate expertise and/or qualifications? Comments: Yes The adhoc and panel reviewers of the PREMs appear to be well versed in undergraduate education and creation of pipeline. Reviewer forms contained up to 16 reviewers names; however, there were no details in the ejackets outlining the criteria used for reviewer selection. Data Source: Jackets	Yes
2. Did the program recognize and resolve conflicts of interest when appropriate? Comments: Yes. COIs were clearly identified in the Reviewer forms. In general, POs stated that obvious conflict were resolved through the standard process of COI form completion before the review process; however, it was difficult to resolve personal conflicts, and they relied on the reviewers to identify these conflict during the review process or at the panel meeting. Data Source: Jackets	Yes
Additional comments on reviewer selection: The process for reviewer selection should be more transparent.	

III. Questions concerning the management of the program under review. Please comment on the following:

MANAGEMENT OF THE PROGRAM UNDER REVIEW
1. Management of the program. Comments: This program was managed well and may be a direct reflection of the dedication and energy of the POs during this period. There is real involvement of the program officers in the program where site visits were documented thoroughly and care was taken to ensure that both institutions benefited from the partnership. Program management mentioned that they will be tracking the overall effectiveness of the PREM program on producing URM in STEM which is critical for determining program effectiveness. The program management is also carefully considering its criteria for partner institutions to be minority-majority institutions versus just HSIs, ASNIs, etc. This should be clarified before the next submission cycle.
2. Responsiveness of the program to emerging research and education opportunities. Comments: PREM provides unique opportunities for UG from MSIs to pursue research and create a pipeline at all levels of education. The program tends to support work which is perceived as being in the forefront of knowledge generation in research. A number of novel education and outreach approaches are seen among the funded projects and are developed each year; these explore new directions in STEM education.
3. Program planning and prioritization process (internal and external) that guided the development of the portfolio. Comments: A significant priority of this program is the effective marriage between the PREM and partner institution to ensure the both entities benefit from the collaboration, i.e.., make sure there is no over-constraint of the PREM institutions research directions. Some priority will need to be placed on budget constraints which may limit the number of PREMs that can be funded in light of the increasing number of MRSECs, STC, etc., which can compete for the awards. One best practice of the program is that partner institutions collaborate with multiple MSI institutions when appropriate and encourage collaboration between these institutions.
4. Responsiveness of program to previous COV comments and recommendations. Comments: The previous COV recommended additional funding for the PREM program so that award size could be increased. The program management has been able to fund additional programs.

Condensed Matter Physics (CMP)

INTEGRITY AND EFFICIENCY OF THE PROGRAM'S PROCESSES AND MANAGEMENT

Briefly discuss and provide comments for *each* relevant aspect of the program's review process and management. Comments should be based on a review of proposal actions (awards, declinations, and withdrawals) that were *completed within the past three fiscal years*. Provide comments for *each* program being reviewed and for those questions that are relevant to the program(s) under review. Quantitative information may be required for some questions. Constructive comments noting areas in need of improvement are encouraged.

I. Questions about the quality and effectiveness of the program's use of merit review process. Please answer the following questions about the effectiveness of the merit review process and provide comments or concerns in the space below the question**.**

QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCESS	YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE
1. Are the review methods (for example, panel, ad hoc, site visits) appropriate? Comments: Review methods for proposals were appropriate, consisting mostly of panel reviews with some mail-in reviews. The COV would like to see CMP continue to rely primarily on panel reviews and continue to experiment with virtual panels in order to better understand if they can help make future review processes more efficient. **Data Source: EIS/Type of Review Module**	YES
12. Are both merit review criteria addressed ee) In individual reviews? ff) In panel summaries? gg) In Program Officer review analyses? Comments: Individual reviews, for the most part, addressed both criteria, though generally relatively less attention was given to broader impact. Some reviewers did not address broader impact at all. We recommend continued efforts to encourage reviewers to provide meaningful assessment of broader impacts. NSF might also consider giving each criterion a separate	YES

evaluation on the “poor to excellent” scale to make the role of each more apparent in the evaluation process. Panel summaries tended to include somewhat more substantive comments on broader impact and overall did a good job of assessing the intellectual merit of proposals. PO analyses were quite good overall at addressing both merit criteria. Many provided separate analysis while some mostly repeated mail-in/panel comments. **Data Source: Jackets**	

3. Do the individual reviewers giving written reviews provide substantive comments to explain their assessment of the proposals? Comments: For the most part, reviews were substantive, but some reviews were weak in describing the justification for a rating. Perhaps NSF might consider expanding from the current “strengths and weaknesses” approach to give reviewers more detailed guidelines and suggest a more specific structure for assessment of the two criteria. **Data Source: Jackets**	YES
4. Do the panel summaries provide the rationale for the panel consensus (or reasons consensus was not reached)? Comments: Overall, panel summaries did a very good job of providing a rationale for a decision and in general were more informative in this regard than individual reviews. In marginal declines, a more detailed rationale for the decision would be helpful. Perhaps NSF might consider adding a section to the panel summary called “rationale for panel consensus” in addition to the current “strengths and weaknesses” format. **Data Source: Jackets**	

5. Does the documentation in the jacket provide the rationale for the award/decline decision? [Note: Documentation in the jacket usually includes a context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), program officer review analysis, and staff diary notes.] Comments: PO review analyses were generally excellent and provided clear justification for why proposals were or were not funded. **Data Source: Jackets**	YES

6. Does the documentation to the PI provide the rationale for the award/decline decision? [Note: Documentation to PI usually includes context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), and, if not otherwise provided in the panel summary, an explanation from the program officer (written in the PO Comments field or emailed with a copy in the jacket, or telephoned with a diary note in the jacket) of the basis for a declination.] Comments: CMP does a good job overall of supplying information to the PI through several vehicles (individual reviews, panel summaries and PO comments). The process could be further improved by providing PIs with the PO review analyses, which we felt were very informative. **Data Source: Jackets**	YES
7. Additional comments on the quality and effectiveness of the program's use of merit review process: Merit review is the bedrock of a strong program and CMP is effective in using it. A challenge, however, is that a strong merit review process places a considerable burden on the PO time as well as on the reviewers themselves. The COV encourages NSF/DMR to continue to explore refinements of the process that are more time efficient while maintaining a robust review of the proposals. We support the "triage" practice in which any proposal with an average review ranking below some threshold (e.g., "good or less") is not discussed by the panel in order to allow more time to assess competitive proposals. In these cases, PIs would still receive the individual reviews and hopefully also receive additional feedback from POs in the form of PO comments or the PO review analysis.	

II. Questions concerning the selection of reviewers. Please answer the following questions about the selection of reviewers and provide comments or concerns in the space below the question.

SELECTION OF REVIEWERS	YES , NO, DATA NOT AVAILABLE, or NOT APPLICABLE
1. Did the program make use of reviewers having appropriate expertise and/or qualifications? Comments: In general, panelist and ad-hoc reviewers were experts with appropriate backgrounds, but there were a few exceptions. Perhaps NSF might consider using more foreign reviewers for mail-in review to both relieve some of the 'burden' on US reviewers and also add a stronger global element to the review process. Some members of the COV raised concerns about CMP's broad scope (covering hard and soft matter as well as turbulence), which makes it unreasonable to expect a PO to be so broadly knowledgeable to be able to uniformly select 'expert' reviewers in all cases. This is exacerbated by turn over in POs but could be minimized in part if POs could utilize a well-structured database of referees. **Data Source: Jackets**	YES
2. Did the program recognize and resolve conflicts of interest when appropriate? Comments: NSF excels in this area. **Data Source: Jackets**	YES
Additional comments on reviewer selection:	

III. Questions concerning the management of the program under review. Please comment on the following:

MANAGEMENT OF THE PROGRAM UNDER REVIEW
1. Management of the program. Comments: Management is highly competent, committed to providing value added to DMR and the US materials community. The CMP program is well managed with an impressive and broad portfolio that includes the fundamental science in CMP of the highest quality as well as transformative interdisciplinary efforts that connect with other programs. To be a program manager while the budget is constant, the number of proposals is going up, travel limitations are in place, the level of staffing is insufficient, and still manage effectively takes some serious talent which fortunately has been present. Suggestions for further improvement: • Give program managers the opportunity to out-source some administrative work to allow a more efficient review process. • Consider more assessment of funding investment and review practices. Efforts should be made to quantify the success of funding investments with multiple metrics including more than just numbers of high impact publications. • Collect more data on virtual vs. in-person panels and assess its effectiveness and possibility of increasing use. • Provide more continuity in management and stability to CMP. The management of CMP changed more frequently than may be effective for purposes of continuity and best guidance of the portfolio.
2. Responsiveness of the program to emerging research and education opportunities. Comments: The CMP program has done a good job evolving its research portfolio in response to emerging research opportunities. On the whole, this program has responded quickly and effectively to new research areas, things topological being a prime recent example. More generally, the program has clearly supported leading edge questions and has been helped by the decision to support significant conference/workshop activities which are important avenues for this community to develop clarity on effective directions. The efforts focused on career development of young scientists from the graduate student stage to the early faculty stage is also particularly responsive and notable.
3. Program planning and prioritization process (internal and external) that guided the development of the portfolio.

Comments:

The program managers meet at the end of the year and establish plans and prioritization for the next year based on proposal submissions and feedback at workshops/conferences. From available information, the actual method used to set priorities is not clear. It would seem that the program mangers look for balance in the awards but are largely driven by selecting the most highly rated proposals.

Suggestions:

- An issue that should be considered is the development of a process and/or metrics that clearly point out the success that DMR has had and the benefit of that success to the country.
- Basic research, which is the bedrock of DMR, often doesn't pay-off in new technologies/spin-offs until years to decades after initial funding. The program managers might consider developing some documentation of those pay-offs.

4. Responsiveness of program to previous COV comments and recommendations.

Comments:

The CMP program has responded to the previous COV reports well insofar as budget allows.

Suggestions:

- While the emphasis on both merit criteria is clear in both panel summaries and review analyses, the one area which could be improved is to require more uniformity of the response to broader impacts in the reviews.
- Communication with the PIs, especially in borderline cases, could be enhanced more.

Electronic and Photonic Materials (EPM)

INTEGRITY AND EFFICIENCY OF THE PROGRAM'S PROCESSES AND MANAGEMENT

Briefly discuss and provide comments for *each* relevant aspect of the program's review process and management. Comments should be based on a review of proposal actions (awards, declinations, and withdrawals) that were *completed within the past three fiscal years*. Provide comments for *each* program being reviewed and for those questions that are relevant to the program(s) under review. Quantitative information may be required for some questions. Constructive comments noting areas in need of improvement are encouraged.

I. Questions about the quality and effectiveness of the program's use of merit review process. Please answer the following questions about the effectiveness of the merit review process and provide comments or concerns in the space below the question**.**

QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCESS	YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE
1. Are the review methods (for example, panel, ad hoc, site visits) appropriate? Comments: The review methods were overwhelmingly via in person panel with only a few ad hoc review-based decisions from the Program Officer and a few virtual meetings. The direct decisions were all entirely appropriate but both forms of panel review are considered to be a better approach. In essentially all cases, the panel discussions were appropriate and the conclusions supported. In many cases (for declinations) the panels invested more time and energy than was necessary to reach a fairly obvious conclusion. Using more virtual panels would introduce some advantages to the review process but should be explored and assessed carefully to ensure an overall advantage. **Data Source: EIS/Type of Review Module**	Yes
13. Are both merit review criteria addressed hh) In individual reviews? ii) In panel summaries? jj) In Program Officer review analyses? Comments: Both merit review criteria were addressed in all individual reviews, panel summaries, and Program Officer review analyses. Of course, the individual reviews often varied widely on the level of detail and at times seemed to have lower standards for broader impact. Program Officer review	Yes

analyses were more even and contained appropriate thought and detail. While most analyses seemed to copy straight from panel reviews and summaries, they also include additional summaries and analysis of the review process, as well the rationale for funding decisions. **Data Source: Jackets**	

3. Do the individual reviewers giving written reviews provide substantive comments to explain their assessment of the proposals? Comments: The individual written reviews tend to be a roughly bi-modal distribution of either very thorough or very terse comments along with the assessment. In some cases there were contradictions in their statements. For example, stating that a proposal is well written and interesting then giving a "poor or fair" rating. It is unclear if the PO requests additional information from reviewers. It might be useful to provide more detailed guidelines to reviewers. **Data Source: Jackets**	Yes
4. Do the panel summaries provide the rationale for the panel consensus (or reasons consensus was not reached)? Comments: The panel summaries tend to be a little more detailed when there are differences among the written reviews but do not always provide the rationale for the consensus decision when the written reviews are not in agreement. When the written reviews are more consistent, those reviews provide more of the panel consensus content. Some summaries suggest that consensus was either difficult or impossible to reach. Panel summaries are often more thorough in giving the PI feedback on the intellectual merit aspects of the proposal. **Data Source: Jackets**	Yes
5. Does the documentation in the jacket provide the rationale for the award/decline decision? [Note: Documentation in the jacket usually includes a context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), program officer review analysis, and staff diary notes.] Comments: The documentation is very clear on the rationale for the award/decline decisions in essentially all of the cases. Virtually all proposals are placed in the correct context and the overall discussions by the panel are well captured. It might be helpful to the PIs if this, or some synopsis of this, additional documentation were made available to them, especially for those who came very close to being funded. **Data Source: Jackets**	Yes

6. Does the documentation to the PI provide the rationale for the award/decline decision? [Note: Documentation to PI usually includes context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), and, if not otherwise provided in the panel summary, an explanation from the program officer (written in the PO Comments field or emailed with a copy in the jacket, or telephoned with a diary note in the jacket) of the basis for a declination.] Comments: The documentation provided to the PI does clearly provide the rationale for the decision. The PO comments are valuable for the PI because these provide the true rationale for the decision for why proposals that could be funded were rejected. The PO comments also provide guidance for whether resubmission should be considered, especially for borderline cases. More useful feedback could be provided on broader impact weaknesses/strengths. **Data Source: Jackets**	Yes
7. Additional comments on the quality and effectiveness of the program's use of merit review process: In many cases, certainly for the lowest rated proposals, more time and effort than necessary is clearly expended by the panel and Program Officer. The "triage" process, in which proposals that have low ratings from individual reviewers do not get significant discussion by the panel as a whole, is viewed as effective. The PO comments also provide guidance for whether resubmission should be considered. This would relieve some of the time constraints on the POs while encouraging potentially good proposals for resubmission.	

II. Questions concerning the selection of reviewers. Please answer the following questions about the selection of reviewers and provide comments or concerns in the space below the question.

SELECTION OF REVIEWERS	YES , NO, DATA NOT AVAILABLE, or NOT APPLICABLE
1. Did the program make use of reviewers having appropriate expertise and/or qualifications? Comments: Most of the reviewers appear to have expertise in the topics of the panels. Panel makeup seems diverse in expertise and experience, giving assurance that the proper reviewers are used. The program identified numerous reviewers and panelists for each proposal but the method for choosing reviewers was not clear. **Data Source: Jackets**	Yes but some data not available
2. Did the program recognize and resolve conflicts of interest when appropriate? Comments: We saw no evidence of conflicts of interest that needed to be addressed. NSF is generally very good at recognizing, resolving, and making panelists/reviewers aware of COIs. The Program Officer stated that obvious conflicts were resolved before proposals were sent for review or the start of panel; however, they found it difficult to resolve personal conflicts and relied on the reviewers to self-identify these conflicts. **Data Source: Jackets**	Data not available
Additional comments on reviewer selection: While younger faculty need the experience they can be unduly harsh. Thus a good mixture of new and senior faculty along with members from national laboratories is encouraged. The process for selecting the reviewers could be more transparent.	

III. Questions concerning the management of the program under review. Please comment on the following:

MANAGEMENT OF THE PROGRAM UNDER REVIEW
1. Management of the program. Comments: The EPM management seems to be remarkably thorough and scrupulously fair. If there is any criticism, it is that too much effort has been spent on some of the poorer proposals. The Principal Investigators may appreciate that but it comes at the expense of lower efficiency. The EPM Program Officer appears to understand the challenges and is proactively managing the program. It seems that most Program Officers and staff are overworked. Based on the Program Officer's presentation, the management has kept a constant success rate over the past ten years despite the cut in funding to the division. This has meant that award amount has remained flat over this time period. Supplementary awards were eliminated because of the amount of work required and the low impact value. This is also partially due to the lack of personnel available to the program. The program officer should be applauded for managing to keep a flat success rate without compromise to the quality of research.
2. Responsiveness of the program to emerging research and education opportunities. Comments: EPM aims to fund cutting-edge materials research for electronics and photonics. A broad range of research topics are covered under this program, which allows funding of emerging research. This has allowed the program to support research in areas of greater importance to the research community such as integration of dissimilar materials and the study of surfaces and interfaces. Renaming the program in 2007 was in alignment with the community it serves. Examination of the portfolio suggests that EPM has largely met this objective. EPM is very responsive to new research topics and emerging areas of research and education. There was no mention of emerging education opportunities by the EPM PO, and no immediately available information in the jackets. It is not possible to assess responsiveness on this part. Responsiveness to emerging research opportunities could be better assessed from the presentations, as well as the topics of proposals being funded. Overall it seems that while EPM is making efforts to keep up with emergent fields, budgetary constraints are limiting these efforts to almost token levels. It might be interesting to occasionally engage the community in some panel discussions, with no direct funding implications, on future areas of high risk, high reward research. This information could be used to guide portfolios.
3. Program planning and prioritization process (internal and external) that guided the development of the portfolio. Comments: The program planning and prioritization processes largely reflect the ad hoc development of written and panel reviews in response to unsolicited proposals. Emerging electronic

and photonic materials are the main priority areas. The Program Officer has worked to develop links with other agencies (i.e. AFOSR for 2D materials) to enrich the portfolio while sharing the funding load. The Program Officer has prioritized the importance of not decreasing the funding rate for the program. There is some support for continuing REU and Conferences support, at least for under-represented groups. Some thought might be given to means for assessing the return on investment, which cannot be truly measured until 5 years out.

4. Responsiveness of program to previous COV comments and recommendations.

Comments: The responses to the previous COV report on EPM (which were fairly mild) were appropriate. On the whole the entire Division has responded effectively to the previous COV.
It was, however, noted that some questions regarding the value of CHESS were not fully addressed. Prior COV comments asked for more feedback to PIs. EPM has tried to address this with more detailed feedback, especially with quality panel summaries. This could be further expanded. The previous COV recommended more emphasis on broader impacts; however, there is not a lot of evidence that this was carried out since many of the individual reviews and the panel summaries only briefly discussed the broader impact of the proposal.

Appendix A: 2015 DMR COV Meeting Agenda

Division of Materials Research

Mathematical and Physical Sciences Directorate

2015 Committee of Visitors

Room 555-II, National Science Foundation

Wednesday, September 16

7:30 AM Continental Breakfast

8:00 AM Welcome & Introduce COV Chair

Linda Sapochak, Acting Division Director, DMR

Nick Abbott, Chair, DMR COV

8:10 AM Charge to the Committee of Visitors

F. Fleming Crim, Assistant Director, Mathematical and Physical Sciences

8:20 AM Overview of COI Policies

Kelsey Cook, Program Director, Chemistry Division, Mathematical and Physical Sciences

8:35 AM Overview of Division

Linda Sapochak, Acting Division Director, DMR

9:50 AM COV Chair explains agenda and tasks

10:05 AM Coffee break

10:20 AM Program Review

COV assembles into 4 breakout groups in breakout rooms

Introduction to Programs by Program Directors

12:30 PM Working Lunch – Review jackets and ask questions

1:30 PM COV reviews jackets

3:30 PM Coffee break

3:45 PM Finish reading and taking notes on sections 1 – 3

4:30 PM Chair meets with committee to discuss progress

5:30 PM Reception (cash bar) Dan and Brads- in the Hilton

6:30 PM Dinner on your own

NOTE

Each core program will receive 20 minutes for presentation + 10 minutes Q&A

MRSEC, PREM and Facilities will have 30 minutes to present + 20 minutes for Q&A

Thursday, September 17

8:00 AM Continental Breakfast

8:30 AM COV returns to breakout groups to prepare the program reports on Sections 1 – 3
Combine individual templates into 1 report for each program

10:00 AM Coffee Break

10:15 AM Discussion of program reports (Room 555, COV only, NSF staff available)

11:15 COV returns to breakout groups to prepare group reports

12:00 PM Working Lunch – discuss progress and introduce part 4 questions (Abbott)

1:00 PM Complete preparation of group reports

2:00 PM Split into breakouts to work on part 4 questions

3:00PM Coffee Break

3:15PM Reconvene to consolidate answers for part 4 questions
Complete first draft of report – refine responses to questions 1-4

4:15PM Dinner on your own

6:00 PM

Friday , September 18

8:00 AM Continental Breakfast

8:30 AM Meet altogether to go over draft, assign tasks, decide what to ask DMR Management

9:30 AM Q & A w/COV Chair, Co-Chair and DMR Management

10:00 AM Coffee Break

10:15 AM Finalize report and prepare final recommendation/findings presentation

12:00 PM Working lunch, preparation for briefing the AD

1:00 PM Meeting with F. Fleming Crim, AD-MPS

2:00 PM Close

Appendix B: 2015 COV Membership

Group	Last Name	First Name	Affiliation
Chair	Abbott	Nicholas	Univ of Wisconsin
Advisor	DePablo	Juan	University of Chicago
	Idzerda	Yves	Montana State Univ
	Miller	Lisa	Brookhaven
	Raghavan	Seetha	Univ of Central Florida
	Baddorf	Art	Oak Ridge nat Lab
	Exarhos	Greg	PNNL
	Nino	Juan C	Univ of Florida
	Stucky	Galen	UC Santa Barbara
	Walton	Krista	GaTech
	Migone	Aldo	Southern Illinois
	Mitchell	John	Argonne
	Thiel	Patricia	Iowa State
	Bedell	Kevin	Boston College
	O'Bare	Sherine	Western Mich Univ
	Roylance	Margaret	DoD Natick Lab
	Discher	Dennis	U. Penn
	Cassada	William	Alcoa Inc. (retired-former director of research)
	Hawk	Jeffrey	National Energy Technology Lab (Albany)
	Bhatt	Ravindra	Princeton
	Trolier McKinstry	Susan	Penn State
	Pianetta	Piero	SLAC National Accelerator Lab
	Kornfield	Julie	Caltech
	Hybertsen	Mark	Brookhaven
	Pincus	Phil	UC Santa Barbara
	Beers	Kathryn	NIST
	Russell	Thomas	Univ Mass-Amherst
	Stokes	Donna	Univ of Houston
	Chhowalla	Manish	Rutgers
	Morris	Jeffrey	City College
	Thompson	Joe, D.	Los Alamos
	Coleman	James	U Texas Dallas
	Salamo	Greg	Univ of Arkansas
	Deutsch	Miriam	University of Oregon
	Girvan	Michelle	University of Maryland