

Response to the Report of the 2016 Committee of Visitors for the NSF Major Research Instrumentation Program

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The 2016 MRI Committee of Visitors (COV) met September 22/23, 2017 at the National Science Foundation to review the MRI program for the period FY 2010 – FY 2015. This review was undertaken to provide NSF with an independent evaluation that:

- Assessed the quality, integrity and transparency of program operations and program-level technical and managerial matters pertaining to proposal decisions; and
- Commented on how the results generated by awardees have contributed to NSF's mission, the attainment of NSF's strategic goals, and MRI program objectives.

The report prepared by the COV, and presented to OIA on December 11, 2016, reflects a valuable evaluation of the program. Dr. Theodore Goodson served as Chair of the COV and led its detailed analysis of 320 of the MRI program actions, including 83 awards and 237 declinations, taken during the period of review. Each COV member was first assigned 20 MRI proposals that were aligned as best as possible with the individual member's core disciplinary expertise. Each member was then assigned to review 3 proposals from the American Recovery and Reinvestment Act (ARRA) MRI competition and 1 proposal from the MRI Gulf of Mexico Oil Spill RAPID Dear Colleague Letter (DCL) notice.

The process by which jackets were selected used stratified random sampling to select ~5% of the total number of MRI actions undertaken during the evaluation period. Strata were defined for jacket characteristics of interest to assure representation of those characteristics in the sample. The strata were combinations of: Minority Serving Institution status of proposing institution, gender of the PI (female, male, or unknown), and institution type (PhD, non-PhD, or non-degree granting). Conflicts of Interest were examined and replacement jackets were randomly selected if needed. The Chair of the COV agreed to the sampling approach.

The 2016 MRI COV Report provided findings and recommendations which are summarized below, along with the OIA responses. While some COV findings and recommendations warrant further discussions and actions by NSF, OIA is in general pleased with the outcomes of the COV deliberations, especially the conclusions that overall "the MRI program as a critical part of maintaining a healthy and excellent science and engineering infrastructure in the US, facilitating capacity-building to build research capabilities across diverse institutions" and that "the MRI merit review process is generally a well-documented procedure that works extremely well". The MRI program will provide additional information regarding actions in response to COV recommendations in annual updates.

This Response is structured to note 1) positive feedback from the COV, followed by 2) issues and opportunities highlighted under the following general categories:

- MRI Management
- Conflict-of-Interest (COI) Management
- Merit Review and Funding Allocation Process
- Proposal and Merit Review Documentation
- PI Feedback
- Broadening Participation / Gender Parity
- MRI Program Value

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OIA Responses to COV Findings and Recommendations

Positive Feedback

MRI Management

The COV noted that “NSF MRI program's review of the scientific merit of proposals submitted was found to be excellent and to be a major strength of the MRI program and that the breadth of the NSF-MRI program to fund instrumentation for all fields is excellent”.

- ***As the coordinating office for MRI, the Office of Integrative Activities (OIA) appreciates the 2016 COV's finding that the review of the scientific merit of proposals was “excellent”.***

Within the Report, the COV noted that as managed, “the MRI program has the potential to be responsive to emerging and evolving technologies”. Since MRI does not focus on targeted priorities “this provides flexibility in what is being requested and therefore allows those with the most knowledge in specific areas – the researchers – to request funds for what they believe they need”. Additionally, the COV noted that “the use of expert review panels serves to further direct funding to new areas”.

- ***The MRI Program appreciates the view of the COV that MRI has the flexibility to respond to emerging research area. NSF will continue to strive to retain this important aspect of the Program.***

Conflict-of-Interest (COI) Management

The COV also noted that “program officers should be commended on their extensive work in ensuring that the potential conflicts have been avoided”, especially “given the fact that the proposals are often very specific with few specialists focusing on these areas”.

- ***OIA wishes to thank the Foundation-wide MRI Program Officers for their hard work avoiding COIs and thanks the COV for “commending their extensive work”. The MRI Program, like NSF as a whole, takes seriously the avoidance of COIs and values the external acknowledgment and appreciation of these efforts.***

MRI Merit Review and Funding Allocation Process

The COV emphasized that “overall, the NSF review process is admirable and provides excellent constructive detail to proposers and program officers”. The COV also noted that “The MRI merit review process is generally a well-documented procedure that works extremely well”. The COV noted that “Proposals submitted to the MRI program are evaluated in an ad hoc and/or panel review process according to the needs of each specific disciplinary division” and that “This approach is suitable and supports broad participation of disciplines within the program”. On

this topic the COV further explored the “complex dynamics” of how the allocation of MRI resources supports the goals of the Program while retaining flexibility for Divisions/Directorates to support research communities, and commented that the process was “clearly explained to the committee”. The COV recommended that the Program keep track of funding allocations by Division-level to monitor the distributions across research fields.

- ***The MRI Program values the COV’s affirmation of the “bottom-up” flexibility provided to NSF Divisions/Directorates based on the cultures of their communities.***
- ***The MRI Program will continue to track MRI allocations to NSF Directorates and Divisions.*** The Foundation-wide MRI Working Group will annually assess the distributions to establish allocation process adjustments if needed.

The COV specifically noted that the reviewers selected by the MRI Program Officers “possessed a remarkable depth and competence in sometimes extremely specific, very narrow topic areas”. The Report further elaborated by noting that “This reflects well on the selection process” and that the Program “has gone to extreme lengths to ensure the participation of the best domain experts”.

- ***OIA wishes to thank the Foundation-wide MRI Program Officers for their hard work and thanks the COV for recognizing and commending Program Officers for “finding excellent review(ers)” and “enthusiastically urging them to continue this great practice”.***

In general, the COV concluded that representation of women and underrepresented minority (URM) reviewers for MRI proposals was a strength for the Program. The COV Report “commends the efforts of the NSF in working towards diverse staffing of review panels”. Interestingly the COV discussions, and the Report itself, also note that “URM reviewers were overrepresented relative to the number of URM proposal submissions”. A recommendation of the Report is to “encourage sensitivity towards possible over-prescription of reviewers from underrepresented groups, not by decreasing diversity on review panels, but by continuing to work towards increasing submissions from these groups...”.

- ***The MRI Program appreciates the recognition of efforts to promote diversity in the MRI reviewer pool, and continues to work toward greater submissions of proposals by women and underrepresented minorities. Upcoming solicitations will note that the program values a diverse portfolio of PIs, including women and underrepresented groups.***

Proposal and Merit Review Documentation

The COV was “generally impressed” with the documentation provided in the proposal jackets. The COV was “impressed with the detail and depth of the technical content of the individual reviews”, and felt that they “demonstrated a high-quality standard for both regular and large-scale proposals and give valuable feedback to the PIs about the strengths and weaknesses of their proposals”.

- ***The MRI Program values the feedback on the quality of the reviews as the Program continues to strive for improvements in the quality of individual/panel reviews. MRI reviewers will be given enhanced guidance on the importance of providing valuable feedback to the PIs.***

Broadening Participation / Gender Parity

The COV determined that the program funds women at a similar rate as men based on the number of proposals submitted by PIs of each gender. However, the COV noted that “the proportion of submissions from women to the MRI program is smaller than the NSF-wide average”.

- ***The MRI Program welcomes the observation that the funding rate for women PIs in the MRI Program is similar (in fact it is higher) to that of men, supporting the Program’s efforts to mitigate/remove unconscious bias in the review process. The MRI Program will continue to seek an award portfolio that strives for balance spanning gender, race and ethnicity. (Issues relating to gender parity for proposals submitted to MRI by institutions will be addressed in a section below). However, upcoming solicitations will note that the program values a diverse portfolio of PIs, including women and underrepresented groups.***

MRI Program Value / Opportunities

Within the COV Report is the following:

“The COV views the MRI program as a critical part of maintaining a healthy and excellent science and engineering infrastructure in the US, facilitating capacity-building to build research capabilities across diverse institutions. This is more critical than ever in the 21st century, in view of increasing competition from abroad. The MRI program is unique because it is responsive to the research vision of a diverse and excellent cadre of STEM scientists in the US, as well as their institutions, who are part of the internal selection process of the proposals submitted to NSF. This distinguishes the NSF MRI program from most other agency infrastructure investments, which often fund shorter-term investments in narrower targeted areas of research. As such, the MRI program is critical for US competitiveness in science and engineering research, allowing teams of faculty to sustain internationally competitive research programs”.

- ***The MRI Program feels that among the most significant findings of the Report is the preceding paragraph.***

The COV also concluded that “The MRI program continues to have a transformational impact on the nation's scientific enterprise”.

The COV also commented: “The COV believes the current planning and prioritization of the MRI program are well suited to achieving the critical goals in sustaining an internationally

competitive research program by allocating funds based on MRI proposals, thus staying at the leading edge of science and engineering innovation in the US”.

- ***The overall COV views that “the MRI program continues to have a transformational impact on the nation's scientific enterprise” and the “...planning and prioritization of the MRI program are well suited...(for) staying at the leading edge of science and engineering innovation...” are especially well-received by the MRI Program.***

Issues and Opportunities

Although largely positive, the COV did note some issues and opportunities for the MRI Program to consider.

MRI Merit Review and Funding Allocation Process

As stated in the solicitations, MRI is a program that supports instrumentation for research and research training. The COV found that the reviewers, in general, “appear to place greater weight on intellectual merit and typically provide excellent and extremely thoughtful reviews of the research. The same careful review of the broader impacts was more mixed”. There was concern that primarily undergraduate institutions (PUIs) may be disadvantaged in the review process without the appropriate guidance to reviewers regarding how to weigh research and training. Similarly, while the COV generally felt that the content of individual reviews in terms of the research was appropriate, there was less overall agreement about the panel summaries, which were thought to sometimes be deficient in reconciling divergent reviewer opinions.

- ***The MRI Program notes that written guidance in the form of an introductory letter from OIA and panel slides specific to MRI is provided to reviewers/panels before the review. These documents contain comments about special circumstances and needs of primarily undergraduate and minority serving institutions. The MRI Program acknowledges that more can and will be done to better clarify the role of MRI in supporting research and research training in the context of the mission of the submitting institution. This will be done through added language in the solicitation, including information describing the proposal review process, as well as information provided to reviewers.***

Proposal and Merit Review Documentation

As with prior COVs, the 2016 COV commented that “the variability in methodology presents additional work for the COV to understand and assess the suitability of the MRI review process”. With this comment, the COV is addressing differences in merit review processes (i.e., the use of panels, ad hoc + panel review, or solely ad hoc reviews) for award/decline recommendations, even as they elsewhere in the Report praised the flexibility the Program provides to NSF Divisions / Directorates. Nevertheless the 2016 COV, like prior COVs, recommends a “common format” for the Review Analyses (RA) which should uniformly address

details about the composition of panels, number of proposals under review, institutions involved (MSI, PHD, PUI, etc.), a brief summary about the panel discussion and final proposal rankings, and a detailed rationale about the funding decision. As in the past the MRI Program (including Foundation-wide MRI program officers) believe that the current balance between MRI Program uniformity and managing-Division expectations for RA content and format is largely appropriate.

- ***The MRI Program will continue to explore the degree to which RA content/format can be improved to better align with COV recommendation, with an understanding that award/decline actions, based in part on the content of the RA, are undertaken within NSF Divisions and may be expected to conform to Division guidelines. (Note: OIA can provide some level of “quality control” only on award recommendations, which require OIA concurrence. OIA does not review proposals recommended for decline.)***

The COV was generally impressed with the documentation contained in eJacket. However, COV members found difficulty in uniformly translating the meaning of information contained in “Form 7”, and spent considerable time discussing how to interpret its meaning when review processes (e.g., panel versus ad hoc reviews) differed. Although Program staff attempted to clarify Form 7 entries, the COV recommended in the future that a Form 7 “summary sheet” be provided to clarify keyword and definitions of entries.

- ***The MRI Program will provide a Form 7 summary sheet to future COVs as part of the briefing process.***

PI Feedback

The COV commented on the feedback to PIs about their reviews, especially for proposals with competitive reviews but that were not awarded. The COV noted that “The Review Analysis explained this decision, but it is not clear how PIs receive feedback”. As a result, the COV recommended that “a more formal process for feedback (be implemented) in the case that the panel recommendation and the program officer recommendation differ. The process should be documented for the benefit of the program management”. The COV did not wish to prescribe a specific format for this feedback, but suggested “a PO Comment or Diary Note about a phone call or an email to the PI about how additional information derived from the Review Analysis was conveyed to the PI”. The Report notes that “a few COV members noted that providing the PIs with access to the contents of (the RA) minus the confidential parts would be deemed helpful for transparency”.

- ***The MRI Program wishes to retain flexibility in the way in which MRI Program Officers convey information to PIs, but will encourage Program Officers to document within the jackets how feedback on award and decline decisions were conveyed to PIs. Some Program Officers do use PO comments to convey what information from the Review Analyses was conveyed, and this appears to be an effective and easily documented method for proposal-specific information to be sent to the PI. The MRI Program will encourage MRI Program Officers to utilize this feature.***

Broadening Participation / Gender Parity

The COV was provided data relating to MRI PI/co-PI gender representation, and was asked to comment on whether the COV might identify issues that the MRI Program should address and specifically if there is an incentive structure MRI might implement to better achieve balanced gender representation. Among their findings and recommendations were:

The COV determined that the program funds women at a similar rate as men based on the number of proposals submitted by PIs of each gender. However, the COV noted that “the proportion of submissions from women to the MRI program is smaller than the NSF-wide average” (by a few percent). This led the COV to conclude that the “bottleneck” to a more diverse group of PIs is at the university level due to their limited submission competitions. The committee Report stresses that “the issues surrounding gender equity extends more broadly to underrepresented minorities”.

The COV reached consensus on an approach to sensitize institutions to diversity in their MRI PI pool:

- Institutions should provide a one page summary of the demographics of its STEM faculty along with the demographics of the PIs who submitted an MRI from their institution over the previous five years.

The COV was not in agreement about how the demographic information should be provided:

- The COV discussed including a one-page list of demographic data in (1) the supplemental documents section of each proposal to allow reviewers to have access to these data. (This option did not receive uniform support by the committee). Some members of the COV felt quite strongly that a statement regarding institutional culture and diversity should be provided.

The COV was asked explicitly to address a model whereby an institution may submit an additional (fourth) proposal if at least two of the four submissions have a female PI. The COV discussed this at great length but came to no consensus on the merits of this approach. Among the obvious benefit is that it would increase the number of proposals from women, but a serious weakness of the approach is that institutions “can ‘game’ the system by having a woman as PI in name only”.

- ***The MRI Program acknowledges that while the funding rate for women PIs in the MRI Program is comparable to (actually slightly higher) than for men PIs, the percentage of women PIs who submit to the MRI Program is generally below that found in the academic ranks. The MRI Program agrees with the COV that this is a likely due to limited submissions at the institutional level. In response to this issue and to address COV recommendations:***
 - ***The Program will now emphasize in its solicitation, under “Who May Serve as PI”, that the MRI Program especially “seeks broad representation of PIs in its***

award portfolio, including women, underrepresented minorities and persons with disabilities”.

- *The MRI Program, in consultation with NSF’s Policy Office and OGC, will explore piloting the COV recommendation to require institutions to submit, as a single copy document viewable only by NSF, demographic information on their STEM faculty and their MRI PIs over a five-year period. The goal will be to “sensitize” institutions to demographic discrepancies that might arise due to their selections in limited submission competitions.*
- *An internal NSF MRI working group has thoroughly discussed the model whereby (for MRI) a fourth proposal may be submitted if at least half of the submissions have a woman PI. The working group agrees with the COV that for a shared-use instrumentation program, with proposals with typically 4-5 PIs/co-PIs, this is an easily-gamed model that likely will lead to little/no practical gain in the desired outcome. Additionally, it guarantees a heavier workload for NSF Program Officers.*

A recommendation of the COV is that “the guidelines to the institutional internal MRI selection committee should indicate that the submitting PI’s technical expertise related to the requested instrument is more important the PI seniority or status”.

- *The MRI Program will explore the practicality of incorporating this sentiment into future solicitations.*

MRI Program Value / Opportunities

The COV validated the MRI Program’s goal of supporting both the acquisition of state-of-the-art instrumentation as well as the development of instruments with new capabilities. The COV recommends that the MRI Program continue to support both of these types of requests. A “more ambitious” recommendation of the COV was for NSF to consider a new investment area within the MRI program portfolio, similar to the NSF Early-concept Grants for Exploratory Research (EAGER), to provide a mechanism for early-stage development of new, proof-of-concept instruments using emerging technologies.

- *A recent internal “MRI Evolution” working group explored a similar idea for an MRI “track” for early-stage efforts that focused more on technology development that would enable new instrument capabilities. The MRI Program finds the idea of an “EAGER-like” track within MRI to be an intriguing idea and will continue to discuss such options over the coming year.*

The COV also felt that a “critical limitation in the MRI instrument acquisition” track is the (perceived) “lack of funds” for training specific to the instrument acquired. This need was felt to be especially acute in the context of educating students and postdoctoral researchers on new technologies and the operations of complex scientific instruments. The COV noted that “This type of educational experience has a modest cost and would enhance the education

opportunities provided by the program, as well as ensure that the required knowledge base for optimal instrument operation is available at the funded institution”.

- ***The MRI Program already allows for training expenses associated with the person(s) most directly associate with the operations and maintenance of the instrument. The Program will explore the practicality further expanding reference to student/postdoc training.***