MEMORANDUM

To: Director, Office of Integrative Activities

From: Coordinator, Major Research Instrumentation Program

Subject: Demographics of the MRI COV

The Major Research Instrumentation Program held its COV meeting on September 22 and 23, 2005. The list of members is attached. Here is relevant information about the composition of the COV and procedures used to avoid any conflicts.

The MRI COV members were selected to provide a variety of institutional perspectives and disciplinary expertise. The COV included representatives from both public and private institutions. The members were selected to ensure representation from all types of institutions that participate in the MRI program, including research-intensive universities, small colleges, and minority serving institutions. One of the committee members serves on the MPS Advisory Committee. The following summarizes demographics of the members:

Gender: 3 Women, 7 Men
Geographic Distribution: 3 Northeast, 1 South, 3 West, and 3 Midwest
Distribution by Members' Institution Type: Large Research Institutions 7, Small Colleges 3 (1 Minority Serving Institution)
Minority Representation: 1 URM
Number of members with no NSF Support in past Five Years: 3
Past MRI Awardees: 2

The introductory session at the COV meeting included a conflicts briefing and review of confidentiality requirements. Jackets for actions pertaining to the two prior MRI awardees were not included in the review. None of the other members were involved in prior MRI competition as Pis or co-PIs, and none of the members were allowed to look at jackets from their own institutions. Also, the members were not allowed to look at any jackets that they have reviewed.

Report of the 2005 Committee of Visitors

Major Research Instrumentation (MRI) Program

September 22 – 23, 2005

Executive Summary

The 2005 MRI Committee of Visitors (COV) commends the National Science Foundation for the quality of the management of the Major Research Instrumentation Program, and for making effective investments that directly enable the scientific community and enhance the contributions of science to society; namely, the outcomes that can be summarized as the "people, ideas and tools" goals in NSF's Strategic Plan. The integrity and efficiency of the processes used for the proposal process is outstanding. Moreover, the COV notes that this level of quality for operations is achieved in an environment with numerous stakeholders with different expectations. Unlike most of NSF programs, the MRI Program reflects direct, highly specified instructions from Congress. The (nearly) Foundation wide MRI Program engages disparate scientific communities, and each has its own practices and expectations. MRI leadership addresses the expectations from Congress - ensuring that these are met - while very effectively coordinating the review management across the Foundation's research Directorates.

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COV Observations and Overall Recommendations

The 2005 COV notes, just as the 2000 COV observed, that the Program uses the merit review process for Criterion 1 in a very effective way. The awards in the MRI Program reflect very good to excellent quality science projects, an appropriate balance with respect to scope, size and duration of awards, and even the provision of opportunities for new investigators at a higher success rate than attained by the Foundation as a whole. The Program has been managed appropriately enough to ensure fully that review processes are timely and are balanced on scale of risk and for the inclusion of multidisciplinary and interdisciplinary projects. Similarly, reviewers were universally chosen to represent the needed expertise and to prevent the appearance of potential conflicts of interest. We do have some concerns and will discuss them below. In brief, one concern arises from the distribution of authority in review processes to the entire Foundation. Such distributed authority has consequences on investigators with regard to equity (in competing) and transparency (in learning the basis for NSF decisions and for the potential to create a more competitive proposal in subsequent resubmission). Similarly, across the Foundation, there is significant variation in the level (or extent) of recognition of the value of balance beyond that among scientific subdisciplines - i.e., diversity in gender, ethnicity, type and geographic location of institution represented - in the composition of the reviewers used.

A principle concern of the 2000 COV was that many reviewers (across the various research domains) did not comment on how the investigators had addressed Criterion 2. Looking broadly and extensively at the proposal reviews since that point, the 2005 COV found that the importance of Criterion 2 is now more often and more fully integrated into the written assessment by the reviewers then was the case in FY 2000 (as observed by that COV). However, some disparity still exists within the Foundation about the appropriate use of Criterion 2.

The following specific observations and recommendations should be considered in the light of our recognition of the overall excellence in management and full adherence to the NSF expectations, and also in the context of our comments on the individual questions, which are generally highly positive. In every case, our specific observations and recommendations have been chosen both because of their significance per se and because we found the same attributes for all elements of the Program; namely, those involving instrument development, those involving non-PhD granting institutions, and those involving PhD granting institutions.

The COV observed numerous examples of significant variation in the review process and its documentation, and in the communications to the Principle Investigators. The differences in documentation and communication appear to occur due to differences across the Foundation in the management processes

used for review. The COV believes that MRI Program should establish a common review process in order to achieve full equity and transparency across the entire distributed activity, or that is, uniformity across the management of review and decision making for the MRI Program (as distributed around nearly the entire Foundation). Currently, some Directorates use a comprehensive process for all of their MRI proposals, in which the proposals are subject to a panel review supplemented with ad hoc review as needed (to ensure enough expertise to evaluate all aspects of the science proposed). Some Directorates do not; that is, some only subject their MRI proposals to an ad hoc review (obtained by mail from the community with each reviewer typically evaluating only one proposal). In those cases that used this comprehensive process, the COV found, in general, better documentation as to the basis for the (award or decline) decision, and evidence for a more informative communication to the investigators for declines. The equity in process for proposals in the same discipline also appears higher for those cases that used panel review complemented by ad hoc review. Among those proposals for which only ad hoc reviews were obtained, the COV found numerous examples with inadequate documentation on the process and notably, as to the basis for the decision; furthermore, from the documentation provided, the process often included only poor communication to the investigator (lack of transparency), and sometimes raised questions about equity in competition (when only ad hoc review had been used). While some of the proposals handled by the combination of panel and ad hoc review also lacked adequate documentation – in this case, in terms of justification for NSF discretionary decisions - a higher frequency of cases with inadequate documentation of the basis for decisions and a lack of transparency occurred in the proposals for which only ad hoc review was conducted.

In a broadly distributed activity like the MRI Program, the COV believes the NSF staff as a whole (i.e., the Program Directors from across the Foundation who are involved in MRI activities) need to pay more attention to documenting the basis for decisions, especially when overturning the recommendations of the peer review, and they need to remember the importance of communicating fully to all investigators the basis of the respective individual decision. We believe that the MRI process, in order to meet the expectations of NSF, should universally include panel and ad hoc review as needed, but we do not believe that this change alone will solve all of the difficulties. Uniformity is a first step, but in addition, a strong emphasis should be placed on improving transparency and on achieving the consistent, routine presence of adequate documentation for the basis for discretionary decision. At the risk of redundancy but in the interest of clarity, the COV, appreciating that equity and transparency are essential and expected for any NSF Program, asserts that this need is even greater for a Program managed across all of the research Directorates. The MRI Program can not directly intercede in or even monitor the actions for every proposal given the magnitude of the task (in numbers and scientific breadth). To facilitate achieving uniformity in process (in order to aim for uniformity in quality), the COV suggests a solution for those areas that have too few proposals to justify the

creation of a separate panel. In such instances, the cognizant Program Manager(s) should conduct ad hoc review as done now, and then have the Manager(s) from a related discipline bring those proposals, with their extant ad hoc reviews, to the panel most likely to be capable of informed analyses. The second level of review via panel will bring the proposals more fully into the context of the overall MRI Program and provide a path for delivering better documentation, better communication, and a better means for ensuring the best opportunities are funded.

The NSF should require an explicit management plan for each instrument acquisition proposal that illustrates, at a minimum, the productive and effective use, maintenance and access for the instrument. The introduction of a management plan as a component of each proposal, in 2005, is a good, first step, but the management plan itself, not just its presence, needs to be reviewed to assess these specific attributes, and the Final Project Report, or any other subsequent reporting, needs to address how the management was implemented. To encourage and facilitate the best use of the instruments and thus the best use of the NSF funds, post-award information should be obtained to establish that instruments have been used as proposed and that equitable, productive access has been sustained, and to demonstrate how they have contributed in practice to the research and educational environment at the Institution.

The MRI program has grown substantially in funding but still has the original limits in terms of the number of proposals and the maximum dollar amount that can be requested. The COV believes NSF can very effectively determine the best research investments; the current guidelines do not promote a process by which NSF will be able receive the best distribution of proposals across all of the science supported through the research Directorates and Offices. Opening up the Program to one proposal per research Directorate or Office per Institution would in turn open more opportunities for NSF to ensure the selection of those best investments.

Around the Nation and indeed, around the world, the scientific community and its federal representatives have recognized the increasing importance of interdisciplinary and Institutional collaborations to address the complexity of contemporary research questions in science and engineering. The MRI Program should reward such partnerships. For example, one could provide guidelines - such as establishing specific funding opportunities - that encourage investigators at major research-intensive institutions to collaborate with investigators at non-PhD granting institutions. The COV recommends that a separate limit be established for the number of collaborations or partnerships under such conditions. In having a singular, collective limit around investigator participation, the current guidelines not only penalize such collaborations, but might also serve to prevent such collaborations from going forward.

The COV would like to emphasize the importance of both Criterion 1 and 2 for all institutions, and would hope that any process established *ever* (in the fullness of time) will specify explicitly and ensure fully that the two Criteria are used for all institutions; namely, for both PhD granting institutions and the non-PhD granting institutions. The two criteria apply to all and underlie our (Nation's) expectations for the conduct of scientific research in the 21st Century. However, that does NOT mean that Criterion 1 and 2 should be employed in precisely the same way in the two cases. As an example of the types of problems that arise with the current situation (in terms of instructions to reviewers and the distributed authority for review), the COV found examples of reviewers holding investigators at non-PhD institutions to productivity standards that would only be possible at major, research intensive institutions. Bringing students into more effective research environments (with up-to-date, advanced instrumentation) that involve good science is an essential contribution; quality and effectiveness in such cases might be better metrics than quantity of publications.

NSF could provide examples that (1) would serve to inform the community in implementing improvements in their research environment and related aspects of their proposal preparation, and (2) would inform the peer reviewers at a greater depth about employing Criterion 1 and 2. The examples should be chosen to facilitate an equitable and effective review that ensures that non-PhD institutions are evaluated for their research while taking into account the impact of the instrumentation on the "culture" or educational environment (including that of the pipeline) of the institution. If implemented, this sophisticated consideration (reflecting the differences in the roles of different types of institutions) would provide another strong argument for uniformity in process, provision of comprehensive - or complete - documentation, and an appropriate level of transparency.

The COV found it difficult to assess the ultimate impact of individual projects from the documentation available. Acquiring better information on impact would facilitate NSF reporting functions, would help refine future programmatic efforts, and would allow a more insightful and informative review by any COV with regard to impact. Achieving such improved documentation would not be easy. Options include requiring a subsequent report about outcomes (in addition to the Final Project Report) two years after the completion of the grant, or - in what might be an easier method to adopt - extending all awards to a full five years with very explicit instructions to investigators as to what is required for Final Project Reports. Another would be for NSF to make the Final Project Reports available on an NSF web site; doing so should only follow a suitable period in which the community is forewarned and after the NSF has provided suitable examples to allow the final reports to be more responsive to the expectations (from the impact of the award). For many NSF Principle Investigators, the details and requirement for the Final Project Reports might well now appear as secondary in importance (to research productivity), and thus, obtaining recognition for their importance for the Foundation appears to be a difficult task. To achieve

community support for the change and subsequent compliance, the COV suggests that positive as well as any negative or compulsory methods be used to change the information content - and thus the utility and the impact - of the Final Project Reports. Clearly, the Principle Investigators and their Institutions would be served by a higher level of dissemination and greater public visibility for the output for scientists and society, which would be provided by the new web site (through contemporary software for information retrieval, commonly called search engines). NSF should publicize this feature to facilitate its recognition. Scientists and their Institutions, as well as the government, do business today in public, and we need broad support in order to sustain our contributions to society. NSF's web site is excellent and with this feature along with some effort by science writers and web developers, the site could offer another vehicle for engagement of the research community with the Nation's citizens.

Background on the COV Process

The Committee of Visitors (COV) for the Major Research Instrumentation (MRI) program met on September 21-23 at the NSF. This COV covered the time period for Program actions of FY 2000 - FY 2004. Members of the COV received a letter (e-mail) from NSF approximately 2 months prior to the scheduled visit concerning the trip, locale, and reimbursement arrangements. In addition, well in advance of the meeting, the COV members were provided with a URL containing all relevant data about the Program, and also received a packet of materials that included a) a Program overview; b) a formal charge and general instructions to the COV; c) the FY 20005 Core Questions for NSF COVs; d) relevant MRI Program solicitations; and f) a data book containing Program operating statistics. The data book contained an MRI overview, MRI award size and dollar amounts, MRI success rates, MRI proposals by PI and institution characteristics, and MRI proposals by review type and management and financial data.

An agenda for the meeting is attached in an Appendix, and essential features, some of which the COV believes will be important for other COV meetings to consider or implement, are outlined here. In the evening of September 21st, the COV met from 7pm – 9 PM. Dr. Dragana Brzakovic, Senior Staff Associate, Office of Integrative Activities welcomed the COV and provided an initial overview. To help provide context for the assignments and prepare for the actual analysis, the committee members (who are identified elsewhere in this report) introduced themselves and their professional expertise. Dr. Nathaniel Pitts, Director of the Office of Integrative Activities, expressed appreciation to the COV, presented a historical perspective of the MRI program, and answered questions from the COV. Dr. Fae Korsmo explained the GPRA role in the review content and the necessity for maintaining confidentiality and freedom from any appearance of a conflict of interest. Dr. Brzakovic discussed the MRI program in detail, followed by a description of COV organizational issues. The COV was divided into three subgroups that focused on: (1) acquisition proposals submitted

by Ph.D. granting institutions; (2) acquisition proposals submitted by non-Ph.D. granting institutions; and (3) instrument development proposals.

The briefing the previous evening, allowed the three subgroups to focus on their respective jackets during the morning of September 22nd. The members and the chair of COV recommend a similar process for future COV reviews, since the provision of material in advance and the briefing on the evening before the actual COV made the time far more productive and allowed us to reach consensus and complete the report during our visit.

Initially, the committee was given 220 jackets selected by representatives of individual Divisions (a total of 16 from across NSF) that participate in the Program. The selection criteria were the following: (i) samples of jackets that illustrate decision making (clear cut awards and declines, and difficult awards and declines), and (ii) samples of jackets that illustrate high risk projects, and ``the best investments``. Out of 220 jackets, 150 jackets illustrated decision making, and the remaining 70 illustrated category (ii). In addition, to these 220 jackets, during the first morning of the COV, i.e., on September 22nd, the COV requested additional 89 jackets corresponding to the new or first time Principle Investigators (PIs) who received an MRI award in FY 2000 and FY 2001 but have not received any subsequent awards from NSF as of the COV. All 89 jackets requested were available, of course, as e-jackets. In particular, access to all 309 jackets was provided via e-jacket COV module. In addition, the committee had hard copies of 220 original (paper copy) jackets, and of more than half of the 89 additional jackets.

Throughout the COV, OIA verbally provided information and delivered various documents to the committee on an as-needed basis. The COV as a whole met regularly over the initial course of the analysis, in order ``to compare notes`` between the three subgroups, to look for findings in common among the subgroups or consistent patterns, and to organize the writing of the final report. In the afternoon of the first day, the Committee met with the representatives of the Directorates/Offices that participate in the MRI Program. The following were represented: a) Mathematical and Physical Sciences; b) Biological Sciences, c) Social, Behavioral, and Economic Sciences, d) Computer and Information Sciences, e) Geological Sciences and f) Polar Programs.

On the second day, after further perusal of the various documentation materials and intra-subgroup discussions, each subgroup was able to record its input to all questions in the COV template. The responses were integrated and the rough draft was made available in hard copy to the COV to permit further refinement. In the afternoon of September 23rd, the committee met in a closed session with OIA Director, Dr. Nathaniel Pitts, and with Dr. Dragana Brzakovic to discuss committee's findings. Further refinement of the draft report continued until 7pm by the chair, co-chairs and representatives of the three subgroups. The final version of the report was finished in the morning of September 24th.

Specific Answers to the 2005 COV Standard/Template Questions

Date of COV: *September 21-23, 2005*
Program/Cluster: *Major Research Instrumentation*
Office: *Office of Integrative Activities / Office of the Director*
Number of actions reviewed by COV: Awards: *230* Declinations: *79*
Total number of actions within Program/Cluster/Division during period being reviewed by COV: Awards: *1360* Declinations: *2142*
Manner in which reviewed actions were selected: ***Each of the 16 divisions that (independently) review MRI proposals was asked to select a set of jackets as follows:*** • ***8 representative jackets that illustrate the decision-making process — 2 clear cut cases of awards, 2 clear cut cases of declines and 4 difficult cases of awards and declines*** • ***6 representative jackets in their award portfolio with 4 awards that represent "the best" investments and 2 awards that represent high risk investments*** ***The COV requested 89 additional awards related to a group of principal investigators who received their first NSF award—an MRI award—in FY 2000 or FY 2001 but have since received no NSF awards.***

PART A. INTEGRITY AND EFFICIENCY OF THE PROGRAM'S PROCESSES AND MANAGEMENT

A.1 Questions about the quality and effectiveness of the program's use of merit review procedures.

QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCEDURES	YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE

1. *Is the review mechanism appropriate? (panels, ad hoc reviews, site visits)? Comments*: We strongly advocate a uniform review process across the Directorates for MRI reviews. In order to achieve equity and transparency, both ad hoc (mail) reviews and panel reviews should be required for all MRIs across all Directorates. There is currently a great deal of inconsistency across Directorates in the review process. The ad hoc review process and panel review process have respectively different strengths and weaknesses, and both approaches need to be used together to provide the best information for decision making. The GEO directorate serves as a model in two ways. First, by combining ad hoc review with panel evaluations, equity for review is established and well documented. Second, the reports of Program Officers clearly indicate the bases for recommendations of awards and the documentation indicates good communication to the Principle Investigators.	Qualified YES
2. *Is the review process efficient and effective? Comments*: Faculty whose proposals are declined should receive a more detailed review analysis of why their proposal was declined, especially when the decision appears to be inconsistent with the reviewer or panel comments. There is some concern about the loss of transparency in moving from the level of the review process to the decision. The review information is clearly available to the PI. However, in some cases Program Officer decisions do not transparently follow the recommendations of the reviewers. In these circumstances, the effectiveness of the process is compromised and the PI does not have sufficient information to understand the basis for the decision given only the reviews or panel summary. Information about the basis for decline decisions that are not clearly supported by the review comments need to be explained to the PI more clearly.	Qualified YES

3. *Are reviews consistent with priorities and criteria stated in the program's solicitations, announcements, and guidelines? Comments*: Overall, reviews are generally consistent with priorities and criteria. However, there is an apparent disparity in the application of Criteria 1 and 2 with respect to PhD and non-PhD granting institutions. For PhD granting institutions, criterion 1 is emphasized and criterion 2 may be ignored; in particular, very few proposals strong on criterion 1 obtain a poor review on the basis of failing – let alone just doing badly on - criterion 2. For non-PhD granting institution proposals, criterion 1 is sometimes over-emphasized by reviewers, who do not sufficiently consider the ways in which criterion 1 can be implemented in a non-PhD granting institution, and in their overall appraisal, do not take into account real, significant strengths apparent in criterion 2. The guidelines need to be more explicit on a number of "definitional" issues. For Non-PhD granting institutions: There needs to be a clearer explanation on the MRI website that the non-PhD institutions are competed separately from PhD granting institutions, and thus should highlight to a larger extent the educational aspects, in addition to the research benefits. This could include involvement of students in undergraduate research projects and the incorporation of the MRI equipment in new and existing courses. For "development proposals" The definition of "what is development" is not clearly spelled out or applied in a similar way across the NSF divisions. This is important because an extra proposal is permitted from an institution if it is "development". For all proposals: There is a need for more highly developed management plans. At the MRI website, several examples of good management plans should be provided (since one size does not fit all). The management plan must provide a roadmap to arrive at the NSF desired outcomes.	Qualified YES

4. *Do the individual reviews (either mail or panel) provide sufficient information for the principal investigator(s) to understand the basis for the reviewer's recommendation? Comments*: This question appears to be different from number 5, in that this is meant to address individual reviews and panel summaries only, not the overall decision making process as in number 5. By and large, all of the Program Officers across the Foundation use reviewers knowledgeable about NSF and about the proposal in question, and as such, the reviews themselves are not trivial but generally self explanatory and reasonably informative. In some instances we observed, the reviews were not be so informative, but this was only due to the rare vagaries that can be associated with an individual ad hoc review, which might occur due to lack of information on the part of the reviewer about the proposal, about the context for the proposal and the Program, or about NSF expectations. Given a set of reviews, the majority of the reviews for any given proposal certainly provide the right kinds of information so the PI will be quite clear about what are the reviewer's assertions and positions. This is an intrinsic strength of all of NSF, and other agencies that provide the unvarnished reviews, which are not captured in some agency processes that only provide edited snapshots of the actual review input. The COV wishes to emphasize its support for NSF continuing to provide the actual, original review input to the process.	YES
5. *Do the panel summaries provide sufficient information for the principal investigator(s) to understand the basis for the panel recommendation? Comments*: To being with, when there is no panel used, this question must be interpreted to ask is there sufficient information for the PI to understand the basis for the Program Officer recommendation. When proposals have been reviewed by a panel, and thus panel summaries are available, these are generally helpful and more inclusive of central information used in the decision making process, and more likely to provide clues as to the potential and the path for submission of a revised proposal. However, some panel summaries more fully and/or more specifically identify, explain and address the points from the reviews and the discussion that figured explicitly in the decision. While some variation is inevitable, these panel summaries better articulate the panel reasoning than others and thus provide in general fully sufficient information for the PI. This is one instance where perfection, perfection in the relevant transparency or communicating what needs to be known, does matter. It is important that all views considered seriously in turn be expressed in communication to the Investigators, and as the bottom line, that the rational leading to the	YES

recommendation be provided. The failure to provide a uniform standard process, involving combined ad hoc review with panel evaluation and with subsequent effective documentation, results in an inconsistent level of information being provided to Investigators across the Directorates. When panels are used, panel summaries provide some information not available from Directorates that do not use panels. Setting aside or leaving open the possibilities for unusual or exceptional proposals, including the need for site visits, for other aspects of further clarification or other nuances and specializations in review, and for which NSF staff are certainly the experts and can manage as needed, we think establishing a uniform core for the review process is an imperative to ensure NSF's objectives. Until this is in place, or simply to look at past actions, Program Officers need to provide the level of information content for decisions that panels provide when they choose to use ad hoc review coupled with some level of their own discretion. At a minimum, in these cases, Program Officers should provide this information more directly as a summary of critical review points that figure into final decisions, or the Investigator(s) will be left guessing as to the fundamental basis for the decision (save in strongly negative cases, which we do not mean to include in this context). Such clarity and informative communication is not always the case. The lack of time and pressures on the staff presumably prevent the time and effort that such individual attention would require. As such, the staff load is yet another strong argument for panel review. We learned from a representative from MPS that Chemistry turned to panel review due to the large work load, in order to be able to participate effectively in the cross-NSF activities. This represents major change over several decades and is very informative of the added value to be obtained from our recommendation of a more unified process.	

6. Is the documentation for recommendations complete, and does the program officer provide sufficient information and justification for her/his recommendation? Comments: We were concerned with the occasional occurrence of proposals which were mostly rated as excellent with a single dissenter, yet they were declined at higher levels with insufficient explanation in the jacket. While it is understood that proposals might not be funded because of a single negative review or other considerations, these considerations should be spelled out in a transparent manner when the final decision appears to deviate from the panel recommendation or ad hoc reviews. Clear policies should be established to guide such reversals. Faculty whose proposals are declined should receive a more detailed review analysis of why their proposal was declined. In these cases, a PI may currently have had a proposal declined and read excellent reviews and with no guidance as to the basis for the declination decision. This is a serious problem in communication that does not allow for the PI to subsequently revise a proposal to address concerns. This seriously jeopardizes the credibility of the NSF review process since the discrepancy between reviews and decisions can be extreme in some cases. We are concerned when program officers' form letters only report aggregate statistics and do not provide specific information about those particular aspects of reviewers' comments that figured prominently in the final decision. A good example of “hard decisions” with a well documented process for the outcome is jacket of a FY 04 proposal that was originally submitted in 2003, the proposal received 6-E, 1-VG, but was not funded because it lacked a statement of the relation to similar large programs. Clearly, turning down this proposal was difficult. This proposal was resubmitted in 2004 and received 5-E, 2-VG, and because a clear statement of the relationship to other programs was included, funding was granted. This is also a nice example of mentoring through the output from review. We congratulate the program officer for the efforts involved and for proper documentation, for effectiveness in wisdom and process as expected from the NSF. It is important to document reasons for overruling contrary opinions or disregarding review comments. We recognize that there is an issue with reviewer accountability, which necessitates overruling some reviews. When the decision on a proposal is significantly different than the score dictated by the average of the mail reviews, this action needs substantial explanation. We note that this is done in most cases but not always. A good example where this was done well is a proposal in division of Chemistry. An example where the explanation has not been well	NO

justified is a proposal in Division of Materials Research.	

7. *Is the time to decision appropriate?* *Comments*: MRI Program Officers do well in responding within 6 months. Informal phone calls indicating that the proposal has been "recommended for funding" while applying the caveat that it has not been approved, are helpful to the principle investigators and should be continued, despite the difficulties in providing clear communication within the process guidelines.	YES

8. Discuss any issues identified by the COV concerning the quality and effectiveness of the program's use of merit review procedures:

There do not seem to be clear guidelines for differences in judging proposal merit criteria for PhD and non-PhD institutions. While both Criteria 1 and 2 are important for the two types of institution, their relative importance and their individual evaluation should differ in the two cases. For non-PhD institutions, Criterion 2 should be given greater weight and the judging of Criterion 1 must differ because of the different resources for research. In some cases proposals from non-PhD degree granting institutions received negative reviews which seemed unfair, yet they formed they basis for declining the proposal in spite of otherwise positive reviews and recommendations. Specifically, it was held against the PI that the publication record was modest and that there was not related NSF supported work already at the institution. Clearly publication records from PIs at such institutions will usually be inferior to those from research institutions, and also clearly MRI grants can provide the seed money to provide equipment necessary to the growth of research at an institution where there has been little in the past. While it is evident that awards should not be made based on Criterion 2 alone, and that Program Officers in fact take into consideration the different nature of such institutions, it is not clear what the guidelines for making such decisions are and how decisions among different proposals with similar ratings should be made. We recommend that such a policy be established articulated.

Although the jackets and data indicate that there has been some improvement in composition of the reviewers, ad hoc reviewers and panels still have few women; every effort should be made both to improve the percentages and document them and the process and commitment to improve compositional equity. In particular, there is no reason why gender data should not be provided for all panel members (several were designated as unknown). Similar considerations hold even more strongly for underrepresented minority and disabled reviewers and panel members, and data is totally lacking in the latter case.

A.2 Questions concerning the implementation of the NSF Merit Review Criteria (intellectual merit and broader impacts) by reviewers and program officers.

IMPLEMENTATION OF NSF MERIT REVIEW CRITERIA	**YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE[1]**
1. *Have the individual reviews (either mail or panel) addressed both merit review criteria? Comments*: In 2005, the use of these criteria is still not consistent across Directorates, although the situation has improved greatly since the 2000 COV. Instructions to reviewers should be more specific in terms of the relative importance of both criteria for both PhD and non-PhD granting institutions. In particular, the differences between such institutions should guide the basis for instructions to both the proposers / Principle Investigators and to the reviewers. In general, criterion 1 is addressed more extensively and more effectively. It may be appropriate that the balance between criteria 1 and 2 be different for PhD and non-PhD granting institutions, or rather that full performance and outstanding ratings for criteria 1 and 2 might occur through a different weighting or a different metric for determining great research success. The MRI website might direct reviewers accordingly. In particular, more guidance on how different types of institutions (PhD-granting, non-PhD-granting, Research, etc) can best fulfill criteria 2 could be provided. The investigators themselves do not have a clear picture of what NSF is seeking (or what are the fine tuned metrics for the review) and how they can best explain their own internal use of criteria 2 in seeking excellence. It appears that consideration of Merit Criterion 2 is now receiving more attention in the reviews, panel reports, and analyses than in the past. Program directors in particular seem to be increasingly aware of these considerations. Some examples were found, however, where the consideration was nonexistent or inadequate. These seem to be mostly in the earlier years, but it would be worthwhile to do a more complete quantitative analysis of compliance than is possible in the time given for this meeting.	Qualified YES

2. *Have the panel summaries addressed both merit review criteria? Comments*: Panel summaries tend to emphasize criterion 1. There are exemplary cases in which panel summaries discuss how both criteria are addressed, but from our sampling, these cases are not routine, and appear to be more an exception, rather than the standard. Panel composition should reflect the balance of proposals that will be reviewed with respect to PhD and non-PhD granting institutions.	YES
3. *Have the review analyses (Form 7s) addressed both merit review criteria? Comments*: Although some of the analyses address both criteria, the use of Form 7s is inconsistent across Directorates. For example, we particularly noted and affirmed the informative analyses coming from GEO especially, and often from BIO, whereas other Directorates were often not as consistent. Some Form 7s only list reviewers and recommendations, whereas others carry out a thoughtful analysis of the review points that are prominent in the decision process. The inconsistency in Form 7s reflects the inconsistency in the use of the two criteria by reviewers as well as inconsistency by program officers in addressing these criteria. There do not seem to be clear guidelines for differences in judging proposal merit criteria for PhD and non-PhD institutions. While Criteria 1 and 2 are both important for both types of institution, their relative importance and their individual evaluation should differ in the two cases. For non-PhD institutions, Criterion 2 should be given proportionally greater weight, and the judging of or metrics for Criterion 1 should differ because of the different resources for research. In some cases proposals from non-PhD degree granting institutions received negative reviews that seemed unfair (to the COV), yet these reviews formed they basis for declining the proposal in spite of otherwise positive reviews and recommendations. Specifically, that the publication record was modest and that there was not related NSF supported work already at the institution was the deciding negative factor for proposals with numerous strong ratings on the core science proposed and the educational contributions. The COV appreciates that publication records from PIs at such institutions will usually be inferior to those from research institutions. Of particular relevance, MRI grants can provide the seed money to provide equipment necessary to the growth of research at an institution where there has been little in the past. While it is evident	Qualified YES

that awards should not be made based on Criterion 2 alone, and that Program Officers, in fact, take into consideration the different nature of such institutions, the COV noted that there does not appear to be explicit guidelines for making such decisions and for how decisions are made or should be made among different proposals with similar rating. We recommend that such a policy be articulated and implemented.	

4. *Discuss any issues the COV has identified with respect to implementation of NSF's merit review criteria*.

The relative application of NSF's merit review criteria needs to consider more thoughtfully and consistently the differences between PhD and non-PhD granting institutions. In order to increase the quality of proposals from non-PhD granting institutions, there should be more detailed and suggestive feedback with regard to the deficiencies of a proposal.

Transparency is also an issue. An example is trying to follow what happened to a particular proposal, which received 3 Excellent's and was ranked by the panel as "Fund" at number 1 priority, but was apparently not forwarded to the Large Proposal Panel. We would like to understand better why this happened. The review suggests that the proposal was in a "Must Fund" category, in effect, at the first level review and absolutely should have been forwarded to the Large Proposal Panel – that is, the review suggests that the level of support from peer review should have meant the proposal would go forward and there was no basis for discretion. If there were other reasons unknown to the reviewers, then this certainly should have been very carefully and fully documented.

Also, the COV did not find documentation in jackets that we could identify with respect to the specific decision making processes for the Large (> $800k) Proposal Panel.

We are also concerned that of the first 16 approved proposals we were supplied in the e-jacket list, five did not have any excellent ratings. This could be due to a number of factors. For example, the Division in which they were submitted may not typically receive reviews with ratings of "E". Thus, we do want to flag this as a concern, while noting there may be a good, fully adequate explanation.

In addition, for both the initial proposals and the later evaluation of results and impact, the term ``broader impact'' should be taken in a general sense. Proposals and reports should treat outreach efforts to broad constituencies as a means of increasing awareness of the program and the project, and to provide evidence of their successes. Although specifically requested in the RFP, we found the outreach aspect often to be little more than lip service and to be lacking in concrete examples, such as websites and references and documentation for publications for a wider audience in the proposals and in the few Final Project Reports where this could be tracked.

It is difficult to judge the success or impact of a project based only on information available in the proposal. These judgments should be made in hindsight, and hence should at least be included the Final Project Report. Any COV or other analysis of the impact would be helped a great deal by the existence of a "post-final report" two years after the conventional NSF Final Project Report that would consist of a short description of the primary accomplishments of the project. This "post-final" report should include publications and the activities of the students involved with the project subsequent to the instrument acquisition. In the case of non-PhD institutions, the report should include courses developed or modified using the equipment, information about the specific projects conducted using the equipment, notable successes of the project participants, subsequent grants and awards, and any other evidence of the impact.

A.3 Questions concerning the selection of reviewers.

SELECTION OF REVIEWERS	**YES , NO, DATA NOT AVAILABLE, or NOT APPLICABLE**
1. *Did the program make use of an adequate number of reviewers? Comments:* In most circumstances, three to five reviewers were used and this is sufficient. The reviewers also appeared to have in toto the right expertise to address the content of the proposal. In some cases with panels, even more reviewers were used. Unfortunately, there are a number of proposals that were reviewed only by two reviewers, which is not sufficient both in a formal sense and with respect to providing confidence about obtaining an appropriate analysis of the content and value of the proposal. Given the need to review very different proposals, the COV thinks the range itself, from two to eleven reviewers, is not a problem, and the main issue is being sure at least three reviewers are used.	Qualified YES
2. *Did the program make use of reviewers having appropriate expertise and/or qualifications?* *Comments*: The problem of identifying and recruiting sufficient technical expertise for reviewing certain kinds of instrumentation proposals might be difficult to achieve in a single panel considering other qualifications and considerations for reviewer selection that must be satisfied. This adds to the need for ad hoc reviewers to supplement panels and achieve all the goals for reviewer selection. In one case a panel noted they had no expertise with a specific instrument, and the proposal was turned down	Qualified Yes.

with 3 E's and 1F, on the basis of the single F-review. The program director made the decision that the reviewer providing the F had the most expertise. Additional expertise might have been useful in this case.	
3. *Did the program make appropriate use of reviewers to reflect balance among characteristics such as geography, type of institution, and underrepresented groups? Comments:* We do not have data available specifically for geographical distribution and for the types of institutions of reviewers. We believe based on our sampling that there is variation across the Foundation, and that some Directorates are more sensitive the need to consider the composition of the reviewers chosen; that is, those Directorates that use combined panel and ad hoc review are in general more sensitive to this issue, as far as we could tell from sampling jackets. Although the jackets and data indicate that there has been some improvement, reviewers and even many panels still have few women and every effort should be made both to improve the percentages and to document them. In particular, there is no reason why gender data should not be provided for all panel members. (Several were designated as unknown!) Similar considerations hold even more strongly for underrepresented minority and disabled reviewers and panel members, and data is totally lacking in the latter case.	Sufficient data not available – as explained in text
4. *Did the program recognize and resolve conflicts of interest when appropriate? Comments:* There is clearly considerable sensitivity to this issue throughout the NSF, and it appears that conflicts of interest are recognized and resolved in advance. There are not enough data to draw a definite conclusion as to what happens if a conflict is found during "in real time" – during the actual review, that is, after a panel meeting has started. We cannot assess the frequency of conflict of interest issues that are not reported but are resolved in advance. However, the COV believes based on the data in hand that the appearance of conflicts are effectively prevented in advance and that even for ad hoc review, this matter is considered carefully.	Yes, for reviewers chosen
5. *Discuss any issues the COV has identified relevant to selection of reviewers.* The selection of reviewers is certainly appropriate with respect to scientific expertise and relevant disciplinary understanding. The concern is about balance including diversity. Please see our comments above on women, underrepresented minorities, and disabled reviewers.	

A.4 Questions concerning the resulting portfolio of awards under review.

RESULTING PORTFOLIO OF AWARDS	APPROPRIATE, NOT APPROPRIATE, OR DATA NOT AVAILABLE
1. Overall quality of the research and/or education projects supported by the program. Comments: Cutting edge research funded by NSF or "nugget projects" (eg., Imaging at TeraHertz Frequency) prepared for the Government Performance and Results Act are outstanding in creativity and global impact in technology development. These appear to be a significant step above most of the remaining projects funded by the NSF. These projects should serve as a goal in quality for which the MRI program should strive. Overall quality is high.	APPROPRIATE
2. *Are awards appropriate in size and duration for the scope of the projects?* *Comments*: We recommend that the limit on number of proposals be expanded to one proposal/directorate/applying institution (which we anticipate can result in up to seven proposals per institution) for several reasons. At large universities many meritorious proposals are blocked from submission because of the limit. Permitting more proposals also has the advantage of allowing more lower-cost proposals to be submitted. Our recommended increase in the limit is consistent with the fact that the program has grown by a factor of two. Due to the combination of inflation, the removal of institutional matching, and the weakening dollar we recommend the cap on dollar cost be raised to $4-6M. This does not mean that grants that meet the limit will be commonly given, but the program should have the opportunity to support a few excellent programs in this range. This is especially important for those divisions that have no other funding mechanism in this range, for example GEO. Inter-institutional and interdisciplinary research should be encouraged, not penalized. The present system of counting MRI proposals will naturally penalize collaboration, because universities may not prioritize inter-institutional grants as highly, and each major effort by an investigator counts against the Institution's total. Each MRI proposal should be counted against only one institution; namely, the one that is considered the "host" institution for the equipment or management thereof.	NOT APPROPRIATE

For non-PhD granting institutions, the lower funding level for access to the MRI program may be too high. What counts as a major research instrument should be treated as different between PhD and non-PhD granting institutions. Given the nature of research carried out at non-PhD institutions and the importance of such instrumentation for training undergraduates for future research careers, it is critical to have some grant venue to support this kind of need.	
3. Does the program portfolio have an appropriate balance of • *High risk projects?* *Comments*: The COV observed that the definition of "high risk" varies depending on the Directorate and on the category of proposal (PhD vs. non-PhD). Risk needs to be clarified. Are we discussing risky science, untested PIs, or unspecified management plans? The first is acceptable in this program, the second is acceptable under certain circumstances and the third should not be acceptable.	NOT APPROPRIATE
4. *Does the program portfolio have an appropriate balance of:* • *Multidisciplinary projects?* *Comments*: It is difficult to assess whether the proposal description / specification of multidisciplinarity is really carried out given the paucity of information in final reports. It does appear that on the basis of what is proposed there is an appropriate balance of multidisciplinary projects.	APPROPRIATE
5. *Does the program portfolio have an appropriate balance of:* • *Innovative projects?* *Comments*: There is an ongoing problem in the "development MRI" area in encouraging those proposals that will lead to truly new instruments and technologies. Some suggestions include: • Raising the dollar cap • Allowing software development (fundamental to any modern instrument!) • Partnering with instrument companies and other institutions (see for example the U Mass partnering with CAMECA (a company) to develop a new type of electron microprobe for chemical dating of monazite—a GEO supported activity) NSF in some capacity should work with institutions to help them develop flexibility on intellectual property policies that promote these	NOT APPROPRIATE

partnerships. This is probably not an appropriate role for the Officers of the MRI Program, but the MRI Program should give advice to any staff engaged in such outreach. Guidelines, examples and tutorial sessions, not policy, are what we are referring to – the COV understands that the Bayh-Dole legislation and other federal legislation is the essential factor in informing universities what they should and can do, but universities vary greatly on their responsiveness to the opportunities. For the development feature of the MRI Program to be utilized fully, the NSF needs to work with universities and colleges who are outside of the tier 1, major research institutions, in order to broaden the potential for the awards, and perhaps with all universities to be sure opportunities are not missed.	
6. *Does the program portfolio have an appropriate balance of:* • *Funding for centers, groups and awards to individuals?* *Comments:* The COV found no difficulties here. In any case, the MRI Program is about funds to groups and centers, by and large – except for the instrument development aspects. To answer this question, we have to turn the question around to a balance between development and acquisition and we recognize the proactive efforts of the Program to expand development opportunities. However, it could also be said that this question is not relevant for the MRI Program.	APPROPRIATE
7. *Does the program portfolio have an appropriate balance of:* • *Awards to new investigators?* *Comment*s: This program has a much higher level of percentage of awards to new investigators than the foundation average. For this reason, comprehensive follow-up evaluation of grant impact (see A5-4) is important.	APPROPRIATE
8. *Does the program portfolio have an appropriate balance of:* • *Geographical distribution of Principal Investigators?* *Comments*: There is a significant degree of EPSCoR co-funding.	APPROPRIATE
9. *Does the program portfolio have an appropriate balance of:* • *Institutional types?* *Comment*s: Larger universities are under-represented on a per-scientist basis is due to the cap on the number of proposals. We would like to see NSF expand opportunities for partnerships in which investigators at major research intensive institutions contribute to a proposal from a non-	APPROPRIATE

major research institution and especially from non-PhD granting institutions, and help that institution advance, as well as drive good science.	
10. *Does the program portfolio have an appropriate balance of:* • *Projects that integrate research and education?* *Comments*: Although many proposals from PhD granting institutions specify both research and educational components, Final Project Reports do not provide sufficient details to evaluate the success on both these aspects of the projects. In many cases, the education component seems to be superficial and is not well integrated into the research component. Precise scientific impact of any project is difficult to assess due to the shortness of the project time. The major near term impact should thus be greater on education. However, in most reports, we found that the educational accomplishments are not clearly stated in either quantitative or qualitative terms. Educational achievement indicators such as student recruitment efforts should be used to report the progress with the availability of the new instrument. Additional measures of educational effectiveness should include improvements in course content, the development of new courses, increases in graduate school enrollment and job successes, and improvements in lab course requirements and participation. Student presentations at scientific meetings and students' winning research awards are also an indication of the recognition of the educational accomplishments.	APPROPRIATE
11. Does the program portfolio have an appropriate balance: • Across disciplines and subdisciplines of the activity and of emerging opportunities? Comments: As noted before in an earlier COV, there continues to be less participation in instrument development by SBE. This may reflect a need to clarify the definition of development to include software development. Also some programs, including GEO, appears to suffer due to the limitation in dollar value.	NOT APPROPRIATE
12. Does the program portfolio have appropriate participation of underrepresented groups? Comments: This continues to be a problem for the MRI program. In addition, with respect to the education component of most MRI proposals , there was little effort made in the recruiting of a diversified (gender, race etc.) student body. Special attention in this regard is deemed necessary.	NOT APPROPRIATE

13. *Is the program relevant to national priorities, agency mission, relevant fields and other customer needs? Include citations of relevant external reports.* *Comments*: The program is doing an excellent job in responding to congressional mandates and to the overall expectations of NSF as defined in the strategic plans and annual budget documents, as well as various technical reports. An especially relevant external report that provides the relevance of the MRI Program to national priorities, to agency mission, to all of the fields of science and engineering, and ultimately, for serving society, is a National Science Board study, NSB 02-190, **Science and Engineering Infrastructure for the 21st Century** (subtitle:The Role of the National Science Foundation). This report can be obtained from the NSF web site via http://www.nsf.gov/nsb/documents/2002/nsb02190/nsb01290.htm .	APPROPRIATE
14. *Discuss any concerns relevant to the quality of the projects or the balance of the portfolio.* The COV has no major concerns; for the specific, more minor suggestions, see above.	

A.5 Management of the program under review.

1. *Management of the program.* *Comments*: The management of the program by OIA seems outstanding in general. Many of the concerns appear to reflect differences among the directorates in handling aspects of the review, decision, and reporting processes. OIA has been successful in tracking most aspects of performance that is under the control of OIA. Some of the problems and suggestions noted in the consideration of process are essentially management issues. These include a) There is a need to standardize proposal reviewing and assessment procedures across divisions. b) The response to PIs of declined proposals must be more informative and complete, especially when it does not appear consistent with the reviewer and panel readings. c) As an aid to later evaluation of management of the program, Final Project Reports should include comments on the success of the project management plan.
2. *Responsiveness of the program to emerging research and education opportunities.* *Comments*: The MRI Program appears to be appropriately responsive.

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

This generally appears to be appropriate. However, the COV had difficulties in fully understanding the process of how large projects (>$800k) competed against one another.

4. *Additional concerns relevant to the management of the program*.

Long-term evaluation is very difficult. This arises partly from the facts that MRI's are one-time grants; some time is taken up in purchasing and installing an instrument, and productive usage might originate after the grant is over, and the research productivity will certainly continue well after the grant period.

Possible metrics for PhD granting institutions (for both PIs and co-PIs) include subsequent funding based on availability of the instrument, publications, talks at conferences, theses, student involvement in research, technology transfer and patents.

For non-PhD granting institution, good measures of outcome include student theses, course projects, publications, abstracts, posters and talks at conferences, graduate school placements, etc.

A method of collecting the data needs to be identified. Possible means include:

- Offering supplemental funding
- Cross referencing "results of prior support" from other NSF programs
- Mandatory 5 year reports (a solution we favor)
- Questionnaires

Finding a solution for this challenge of doing long term evaluation is extremely important for the COV evaluation and GPRA. It is very difficult to review a program and understand its success without knowing the outcome of the research.

PART B. RESULTS OF NSF INVESTMENTS

B. Please provide *comments* on the activity as it relates to NSF's Strategic Outcome Goals.

B.1 <u>OUTCOME GOAL for PEOPLE</u>: Developing "a diverse, competitive and globally engaged workforce of scientists, engineers, technologists and well-prepared citizens."
Comments:

This is a very important program that fulfills a unique niche for training future scientists and for research. Two projects (EAR-0321299/Schwalm/Oglala Lakota College and EAR-0321119 /Porter/Elizabeth City State University) do an excellent job of providing

sophisticated equipment to diverse constituencies for both training and genuine research opportunities on topics of strong scientific merit and community importance. A third project (0116435/Shields/Hamilton College)is distinguished by the broad participation of undergraduates from multiple institutions and their subsequent success in publishing. All three projects provide a rich research environment for students.

B.2 OUTCOME GOAL for IDEAS: Enabling "discovery across the frontier of science and engineering, connected to learning, innovation, and service to society."
Comments:

The MRI seems to succeed generally in this respect. Specific projects, such as EAR-0116129 (PI: Lathrop at the University of Maryland), reflect the unique ability of the MRI to support extremely high-risk projects that present important opportunities to explore new scientific ideas.

Two additional projects (9724246/Strait/ Williams College and 0116435/ Shields/Hamilton College) were ranked high even though they were from non-PhD granting institutions.

This level of outstanding intellectual merit from a non-PhD granting institution is a remarkable feat.

B.3 OUTCOME GOAL for TOOLS: Providing "broadly accessible, state-of-the-art S&E facilities, tools and other infrastructure that enable discovery, learning and innovation."
Comments:

Naturally, the MRI awards for instrumentation are all applicable to this category, that is, in general, the MRI proposals largely fit the category of providing tools and infrastructure to enable basic scientific discovery. BCS-0215700, PI: Aslin at the University of Rochester represents an excellent example of an instrument that enables new scientific discovery. This instrument allows behavioral scientists to measure neural activity directly, and ascertain how it changes as a result of learning. This instrument also has broad application even for the physicists who are improving the functionality of the instrumentation. In addition, two projects (0421287/Gyamerah/Prairie View University and 0420848/ Yu/Lafayette College) bring important research tools that are critical for training new researchers at non-PhD granting institutions.

B.4 OUTCOME GOAL for ORGANIZATIONAL EXCELLENCE: Providing "an agile, innovative organization that fulfills its mission through leadership in state-of-the-art business practices."
Comments:

A clear example of the way that MRI promotes the development of organizational excellence is MPS-0420532, PI: Seidman at Northwestern University. This proposal involves coordination of research activity among scientists at Argonne National Lab, OSU, the University of Wisconsin-Madison, UIUC, and other institutions ; this award spans multiople universities, corporate labs (IBM Watson), and institutions in other countries. The PIs have

also sought to recruit students and researchers from diverse institutions, such as Harold Washington College and Saint Mary's College in Notre Dame.

PART C. OTHER TOPICS

C.1 Please *comment* on any program areas in need of improvement or gaps (if any) within program areas.

The role of sustainability and maintenance of instrumentation (technical personnel, upgrades, repair, etc) is not addressed explicitly in the review process or in the annual or final reports. One can not tell if a management plan is actually put into practice and whether or not if the management plan has resulted in sustainability – continued productivity - of the instrument. (This may be a much more difficult problem for non-PhD granting institutions to address.)

Regional instrumentation centers that can be hosted at one institution and shared among several should be explored as potential approaches to more effectively increase the impact of the MRI.

C.2 Please provide *comments* as appropriate on the program's performance in meeting program-specific goals and objectives that are not covered by the above questions.

The previous COV recommended a follow-up, detailed technical audit of completed projects. This remains a concern--how are instruments used following the end of the award period? The award period may be too short to demonstrate significant scientific impact and in some cases, only an educational impact would be expected. However, hiring firms to do a detailed technical audit does not per se seem like a good use of the funds and a more typical self-reporting function placed on universities as a condition on their ability to continue to apply to NSF seems adequate as well as more cost effective.

Helping the non-PHD granting institutions to develop / submit better proposals should be a priority. There are two aspects: the writing of better proposals, per se, and the development of better programs. The MRI could provide a web-library of excellent proposals (perhaps with budget deleted). This is the best way for people to learn to write good proposals. It is also a nice way to feature the good work of the program.

The MRI program should make it clear to undergraduate institutions that availability of faculty time is an important aspect of a grant management plan. It assures that the equipment will be productive. Teaching credit for seminars and courses, which use the equipment, should be strongly encouraged.

C.3 Please identify agency-wide issues that should be addressed by NSF to help improve the program's performance.

As noted earlier, it is important to make consistent the review and decision process across directorates and to improve the communication of the decision process to the PI.

C.4 Please provide comments on any other issues the COV feels are relevant.

The COV wishes to make a strong point that involves the interaction between the Universities and the NSF in the absence of cost sharing, on one hand, and the need to ensure maximum utilization of an instrument and the best use of the Nation's funds as granted by NSF.

> Our major comment is:
> personnel support and maintenance for acquired instruments is critical and should be supportable under the MRI even if this increases direct costs for awards.

C.5 NSF would appreciate your *comments* on how to improve the COV review process, format and report template.

The difficult task of evaluating a program would be much helped by having the material even earlier. In particular, it would help to have all hard copy material at least one month before the meeting, and to have as much material as possible available online via confidential / limited access Web pages or as "PDF" files at least two weeks before the meeting. This will be particularly helpful to committee members who are traveling prior to the meeting and would provide all COV members with more time for careful review.

The information dissemination process should include the early access to e-jacket as well as guidelines for browsing the files. The importance of jacket review must be stressed in the initial advice to COV members, and this could be provided in early communications.

The ``nuggets'' to be described by the Directorates should be provided as a list to allow perusal by committee members before the COV actually meets. In general, for Program as distributed in authority for process as the MRI Program, somewhat more time with Program Directors across the Foundation would be useful and to be effective, this would need to be organized well in advance of the COV. We appreciate the time we did have and the process, but in retrospect, we believe we could have benefited from being able to address more questions about specific jackets to the Program Directors involved.

It would also be helpful to have the e-jacket confidential web pages include columns designating the institution type (PhD, non-PhD, development) and a summary of review ratings. This would allow browsing for examples.

Some of the following suggestions were indeed already in place, or nearly in place, but to summarize our thinking about the process in which we were involved and about how to enable the next COV to be even more productive and effective, we provide the following.

Key 2005 COV Suggestions/Ideas for the next COV:

- All Information mailed at least 4 weeks in advance;
- Information electronically available at least 2 weeks in advance;
- Include a random sample of jackets, in addition to program-officer selected jackets;
- Ask the Program Officers across NSF to identify strengths and weaknesses of the Program in their mind and to point to jackets that illustrate their assertions.
- Provide more time or opportunities for interactions with Program Officers across NSF with respect to the COV's analysis of jackets from their authority / from their domain.

Acknowledgements

The COV appreciates the meticulous assistance and attention to administrative and operations requirements that were provided by the MRI Program staff from OIA, notably Ms. Betty Wong, Ms. Amanda Meeker, Ms. Karen Geary, and Mr. Gregory Martin, and to the Program Head - formally, Senior Staff Associate - Dr. Dragana Brzakovic for her detailed instructions, careful attention to details, and enthusiasm for our efforts to do an exhaustive, complete job.

We very much appreciate that Dr. Nathaniel Pitts was able to meet with us to provide a context and to listen to our concerns. We found it especially useful that he could introduce us to the complexities of the MRI Program and OIA's responsibility, and to give us the charge, and help us understand fully the context in which our analyses were to be conducted. We also appreciate his meeting with us on the second day, to spend so much time listening to our concerns and engaging activity with us in a discussion about the Program, and about how our comments and concerns might be implemented.

Dr. Fae Korsmo provided helpful information about COV processes in general and numerous NSF computer support staff also helped with our efforts to understand how best to use e-jackets and manage operations issues. To give us insight into the perspective of Program Directors across the Foundation, Drs. Joan Frye (MPS), Rita Rodriguez (CISE), Helen Hansma (BIO), Dan Newlon (SBE), Denis Conlon (OPP) and David Lambert (GEO) provided a very informative roundtable discussion concerning the MRI Program process, operation and impact. They also provided us with specific details about proposals in their area and scientific advances arising from Program activities. Dr. Frye provided additional assistance to us in our analysis of the relationship of the Program to NSF "people" goals. The COV recognized the enthusiasm and support for the MRI Program from these external or Foundation-wide Program Directors, and appreciates this level of community service in the broadest context is essential to the operations of any Foundation-wide activity.

That Ms. Geary, Mr. Martin and Dr. Brzakovic were able to stay to respond to our questions and provide assistance late into each evening, and that we could get further support on a Saturday to finish the editing is also much appreciated.

This was a very informative management review activity for all of us, and we are glad we were asked and able to participate.

Appendix I: The Charge

Specific Charge to the MRI Program COV

The COV review of program management will consider Major Research Instrumentation (MRI) proposal actions that were completed during five fiscal years: FY 2000, FY 2001, FY 2002, FY 2003, and FY 2004[1]. The COV Core Questions and Reporting Template will address the program portfolio, the proposal review process used by the program, program management, and the results of NSF investments. Specific questions to be addressed and reported on are:

a) The integrity and efficiency of processes used to solicit, review, recommend, and document proposal actions, including such factors as:

- Selection of an adequate number of highly qualified reviewers who are free from bias and/or conflicts of interest
- Appropriate use of NSF merit review criteria
- Documentation related to program officer decisions regarding awards and declines, and the scope, duration, and size of projects
- Balance of awards in terms of subject matter; emerging opportunities; high risk and innovation; size versus number of awards; new investigators; diversity of underrepresented groups; geographic distribution of principal investigators; and,
- Overall technical management of the program.

b) The relationships among award decisions, program goals, and Foundation-wide programs and goals.

c) Results, in the forms of outputs and outcomes[2] of NSF investments for the relevant fiscal years, as they relate to the Foundation's current strategic goals and annual performance goals.

d) The significant impacts and advances that have developed since the previous COV review and are demonstrably linked to NSF investments, regardless of when these investments were made. Examples might include new products or processes, or new fields of research whose creation can be traced to the outputs and outcomes of NSF-supported projects over an extended period of time.

e) Response of the program under review to recommendations of the previous COV review.

[1]The overall MRI program evaluation is held periodically. It is organized by the Office of Integrative Activities (OIA). The program is not required to conduct a

COV on a three-year basis because its actions are reviewed on a three-year basis in the directorates and divisions that recommend and award grants.

[2]By its very design the MRI program enables research and research training. It closely relates to the NSF strategic goal related to Tools. In many cases, the impact of an award in terms of People and Ideas takes much longer than the award duration.

General Charge for 2005 to all COVs

NSF investments produce results that appear over time. The answers to the first three (People, Ideas and Tools) questions in this section are to be based on the COV's study of award results, which are direct and indirect accomplishments of projects supported by the program. These projects may be currently active or closed out during the previous three fiscal years. The COV review may also include consideration of significant impacts and advances that have developed since the previous COV review and are demonstrably linked to NSF investments, regardless of when the investments were made. Incremental progress made on results reported in prior fiscal years may also be considered.

The following questions are developed using the NSF outcome goals in the NSF Strategic Plan. The COV should look carefully at and comment on (1) noteworthy achievements of the year based on NSF awards; (2) the ways in which funded projects have collectively affected progress toward NSF's mission and strategic outcomes; and (3) expectations for future performance based on the current set of awards. NSF asks the COV to provide comments on the degree to which past investments in research and education have contributed to NSF's progress towards its annual strategic outcome goals and to its mission:

- To promote the progress of science.
- To advance national health, prosperity, and welfare.
- To secure the national defense.
- And for other purposes.

Excellence in managing NSF underpins all of the agency's activities. For the response to the Outcome Goal for Organizational Excellence, the COV should comment, where appropriate, on NSF providing an agile, innovative organization. Critical indicators in this area include (1) operation of a credible, efficient merit review system; (2) utilizing and sustaining broad access to new and emerging technologies for business application; (3) developing a diverse, capable, motivated staff that operates with efficiency and integrity; and (4) developing and using performance assessment tools and measures to provide an environment of continuous improvement in NSF's intellectual investments as well as its management effectiveness.

Appendix II: Members of the 2005 MRI COV

Christopher Allen, Co-chair
University of Vermont

Janet Conrad
Columbia University

Liang-Shih Fan
Ohio State University

Robert Gray
Stanford University

J.K. Haynes
Morehouse College

Karen Morse
Western Washington University

Howard Nusbaum, Co-Chair
University of Chicago

Zorica Pantic-Tanner, Co-Chair
Wentworth Institute of Technology

John Valley
University of Wisconsin-Madison

John Wooley, Chair
University of California-San Diego

Appendix III:

AGENDA

Committee of Visitors
Major Research Instrumentation (MRI) Program
September 21-23, 2005

Wednesday, September 21 7:00pm-9:00pm, Stafford I, Room 120

Orientation (Discussion led by NSF staff)

Welcome and Introductions
Charge to the 2005 MRI COV (Nathaniel Pitts)
Review of COV, GPRA, and Confidentiality Issues (Fae Korsmo)
Overview of the MRI Program and the 2005 MRI COV (Dragana Brzakovic)

Thursday, September 22 8:30am-6:15pm, Stafford I, Room 365 & Room 390

Program Review (COV, NSF staff as noted)

8:30-9:00 Process & Mechanics: Reviewing Jackets and e-Jacket, Room 390
9:00-9:15 Break
9:15-12:00 Review of MRI Program, Rooms 365, 390
12:00-1:00 Working Lunch, Room 390
1:00-2:00 Continue Review of MRI Program, Rooms 365, 390
2:00-3:30 Discussions with Directorate Representatives, Roundtable, Room 390

Dennis Conlon (OPP), Joan Frye (MPS), Helen Hansma (BIO), David Lambert (GEO), Dan Newlon (SBE), Rita Rodriguez (CISE), Robert Wellek (ENG)

3:30-3:45 Break
3:45-4:30 Committee Discussion (OIA staff available for questions), Room 390
4:30-5:45 Continue Review of MRI Program, Rooms 365, 390
5:45-6:15 Discussion on Final Report Writing, Room 390

Friday, September 23 8:30am-7:00pm, Stafford I, Room 365 & Room 390

Program Review and Report Writing (COV, NSF staff)

8:30-9:00	Committee Discussion
9:00-12:00	Program Review & Report Writing, Rooms 365 and 390
12:00-1:00	Working Lunch, Room 390
1:00-3:00	Continue Discussion & Report Writing, Rooms 365 and 390
3:00-4:00	Feedback to OIA and NSF Staff
4:00-7:00	Report Writing (only committee members that are staying late)