

## EFMA 2022 Committee of Visitors Report: 2022 EFMA Response

### Introduction

This document is the response to the 2022 Committee of Visitors (COV) report for the Office of Emerging Frontiers and Multidisciplinary Activities (EFMA). The EFMA COV meeting was held June 22-23, 2022 and covered random samples of EFMA proposal actions for FY2018-FY2021.

### I. Quality and Effectiveness of Merit Review Process

#### COV Comment I.1

The committee acknowledged that many reviews were conducted during the COVID pandemic, and the program staff did an excellent job of managing reviews during that time.

#### EFMA Response

Thank you - the EFMA team appreciate this comment and value the important contributions made by Program Directors from across the Foundation in managing the EFRI Program.

#### COV Comment I.2

Generally, the pre-proposal reviews were not comprehensive. In some cases, these reviews were very short and had limited substantive content. There was little difference in the narrative between a pre-proposal that was invited to submit a full proposal and one that was not invited. As a result, unsuccessful applicants did not receive sufficient feedback to assist with future pre-proposals.

#### EFMA Response

The EFMA Office will seek to redress this issue. EFRI reviewers will be reminded of the importance to applicants of reviews and encouraged to provide constructive feedback during the review process.

#### COV Comment I.3

For preliminary proposals and declined proposals, the review analyses tended to consist of a duplicated context statement. The review analysis for proposals recommended for funding was more substantive.

#### EFMA Response

That is correct. With respect to Review Analyses (RAs), the EFRI program directs EFRI Program Directors (PDs) to utilize standard RA language for pre-proposals and for declined full proposals unless the declination decision is inconsistent with reviewer recommendations with the goal of reducing PD workload.

#### COV Comment I.4

**Recommendation:** The COV recommends that reviewers receive guidance/training on how to review BIs. The review guidance should include specific questions related to broader impacts, ensuring that specific features of BIs are addressed.

#### EFMA Response

We appreciate this and subsequent comments/suggestions relating to the Broader Impacts criterion. NSF's merit review criteria are determined by the National Science Board (NSB) and informed by input from Congressional legislation. In December 2022, the NSB voted to establish a commission to undertake a re-examination of NSF merit review policy, associated criteria and process. The CHIPS Act of 2022 also requires that NSF conducts an independent assessment of how the BI review criterion is applied across the Foundation. Outputs from these assessment activities are anticipated in 2024.

#### COV Comment I.5

**Recommendation:** The COV recommends that program officers ensure that each panel summary includes a substantive review of broader impacts and that that review criterion is seriously considered when recommending a proposal for funding.

#### EFMA Response

As described under COV Comment I.4, new assessments of NSF merit review criteria and process are currently in process. With respect specifically to EFRI proposal review, it's important to note that EFRI topics are by definition intended to address a national or societal need or grand challenge. Thus, if a program director considers that a project appropriately addresses the call in the EFRI solicitation, Broader Impacts should be inherent in the project.

#### COV Comment I.6

**Recommendation:** The COV recommends that EFMA highlight BI in the solicitation information for preliminary proposals (see "Other," section #1).

#### EFMA Response

See below under response to COV Comment V.2.

#### COV Comment I.7

It would be more useful to ask the question, what about the proposal is transformative versus, is this proposal transformative.

#### EFMA Response

Thank you for this interesting suggestion. We will consider changing the prompt for reviewers to ask what aspect of the proposal would be transformative.

#### COV Comment I.8

In some cases, individual reviews for a proposal spanned a large range (i.e., VG to P), but the proposal was recommended for funding. Panel summaries should include a justification for this.

#### EFMA Response

Panel Summaries do not provide an explanation of final funding recommendations; this is documented in the Review Analysis prepared by the cognizant PD following completion of proposal review. While Panel Summaries are prepared by reviewers during individual review panels, funding recommendations are made by the Program Director following all panels considering proposals submitted to the same topic in a given FY. PD funding recommendations take into account portfolio balance considerations based on all proposals received. Therefore, the Review Analysis should explain the final PD recommendation for a given proposal.

Justification for recommending funding of proposals with low review ratings (e.g., Poor) are provided in the Review Analysis rather than the Panel Summary because this is the account of the basis for the PD's recommendation.

#### COV Comment I.9

**Recommendation:** The COV recommends that EFMA allow reviewers to change scores and reviews based on the panel discussion OR clearly explain the consensus in the panel summary. The decision should be consistent across the program.

#### EFMA Response

The EFMA Office works to ensure consistent practice across panels; and encourages EFRI PDs to allow reviewers to modify their individual reviews and scores. Nevertheless, we recognize that EFRI PDs hail from multiple Divisions and Directorates, which have different practices associated with review panels. The dynamic perspectives brought to the EFRI program are key to the vitality of the program.

#### COV Comment I.10

**Recommendation:** The COV recommends that EFMA consider using the terms "highly competitive" or "competitive" instead of "highly recommend" or "recommend."

#### EFMA Response

Thank you for this suggestion; we will consider implementing this change.

#### COV Comment I.11

In general, award/decline decisions were consistent with the Panel Summaries. However, there was at least one case in which a proposal rated less highly by one review panel was funded while another proposal rated more highly by a second review panel was not funded.

#### EFMA Response

Inter-panel comparison of panelist scores may not be informative in understanding final funding decisions. Firstly, individual panelists rate differently. Secondly, as discussed above, PD funding decisions involve portfolio balance considerations using data unavailable to panelists. Importantly, panel recommendations are advisory rather than funding decisions.

#### COV Comment I.12

For full proposals, the documentation to the PI should include sufficient feedback and recommendation to facilitate a revised proposal. The COV did not find consistent evidence of that.

#### EFMA Response

The EFMA Office will seek to address this issue. EFRI reviewers will be reminded of the importance to applicants of reviews and encouraged to provide constructive feedback during the review process.

#### COV Comment I.13

The COV commends EFMA for initiating the [Broader Impacts Quality Control] Pilot Study; however, the COV did not notice a significant improvement in the quality of the reviews of Broader Impacts. There was an increase in word count, but not in substance.

#### EFMA Response

We appreciate the COV investing effort to evaluate the value of a pilot real-time intervention to improve review quality with respect to Broader Impacts. We accept that this intervention was not effective. The COV analysis also illuminated the disconnect between length and substance.

#### COV Comment I.14

NSF should consider expectations around the balance of IM and BI and provide more information to the research community on these expectations. NSF should inform researchers if IM will be prioritized over BI.

#### EFMA Response

Please see above under response to COV comment I.4 for information on upcoming foundation-wide assessment of NSF merit review criteria and process.

#### COV Comment I.15

**Recommendation:** The COV recommends that NSF provide an assessment tool for Broader Impacts to be used by PIs. Additional instructions/training to either give thoughts on strengths or weaknesses or criteria to evaluate BI would improve the evaluative nature of the BI impacts. The COV suggests that reviewer training might include the NSF ARIS Center ideas and Toolbox.

#### EFMA Response

See below under response to COV Comment V.1.

### COV Comment I.16

The COV was impressed with the short proposal dwell time, especially concerning pre-proposals. EFMA should ensure that review quality remains high while maintaining a relatively short dwell time. The COV commends EFMA for convening panels with a wide range of disciplines for reviews, particularly during the COVID pandemic. The COV observed that panel summaries are more substantial than individual reviews, and documentation in panel summaries was very good.

### EFMA Response

We greatly appreciate these positive comments.

## II. Selection of Reviewers

### COV Comment II.1

The COV recommends that future EFMA panels engage at least one broader impact expert to ensure that proposals are evaluated thoroughly for BI and, as importantly, that the PI is given explicit reviewer guidance to strengthen the BI outcomes (awarded) or proposal resubmission (declined).

### EFMA Response

Needed expertise is broadly available on each panel with reviewers expected to bring their knowledge about how research in the fields under discussion can lead to broader impacts. Of note, EFMA proposals, even at the level of a single EFRI topic, encompass a wide range of potential broader impacts; it's unclear whether a single individual would have appropriate expertise to evaluate all of these.

### COV Comment II.2

The COV notes that review panels in FY18–FY21 were comprised of reviewers mostly from PhD-granting institutions. The COV recommends expanding the panel expertise to include more industry scientific experts as well as other types of institutions of higher education (IHE).

### EFMA Response

The recruitment of industry reviewers remains a perennial problem; EFMA will strive to emphasize the importance of industry perspectives for EFRI proposal evaluation and will seek reviewer suggestions from the newly instantiated Directorate for Technology, Innovation and Partnerships.

### COV Comment II.3

The COV commends the NSF EFMA Program Directors in the Directorate for Engineering for their consistent efforts to identify and resolve conflicts of interest.

### EFMA Response

Thank you for recognizing the substantial effort the EFMA Office invests in attempting to avoid conflicts of interest.

### COV Comment II.4

The COV believes that an intentional laser focus on improved (demographic) reporting will facilitate an accurate assessment of the diversity and inclusion on respective panels.

### EFMA Response

NSF is currently piloting new approaches to solicit demographic information from applicants for NSF funding; the pilot has met with considerable success. This pilot will be extended to NSF panelists in FY23 as part of the SingleID effort, via which NSF is aiming to have all individuals who interact with NSF (as reviewer or applicant) have a single ID to access NSF systems, with a unified demographic profile.

#### COV Comment II.5

A dedicated effort to populate review panels with one or two BI experts is anticipated to provide PIs with important and specific input that will take the broader impact practices to the "next level."

#### EFMA Response

See above under response to COV Comment II.1.

#### COV Comment II.6

The COV advocates for more industry representation on the review panels. This is anticipated to facilitate collaboration between academia and industry and increase opportunity for impact in areas spanning from scientific innovation to broader impact.

#### EFMA Response

See above under response to COV Comment II.2.

### III. Management of the Program Under Review

#### COV Comment III.1

The program's pursuit of impactful, innovative research, integrating education and other experiences, is commendable and clearly aligned with relevant NSF strategic objectives. The commendable management of the EFMA portfolio is reflected in the average dwell time of less than five months across programs, which is outstanding.

#### EFMA Response

Thank you.

#### COV Comment III.2

While progress has been made in addressing gender differences, efforts need to continue with regard to other diversity metrics and the COV recommends disaggregation of funding data by institution type. This should align well with the goals of improving access and inclusivity while promoting cultural progress in science and engineering. The program should continue its strategic investments to drive discovery but employ creative strategies to enhance research capability in historically under-resourced institutions.

#### EFMA Response

In FY22, the EFRI program offered for the first time a Planning Grant opportunity intended to strengthen the capacity of teams from underserved institutions to apply for EFRI awards in FY23. We will consider repeating this in FY24.

#### COV Comment III.3

The COV recognizes the dedicated efforts, value, and impact of continuing and new program solicitations such as ERVA, GERMINATION, and REM. These largely result from engaging with the scientific and engineering communities, and the program appears to be highly responsive to opportunities arising in research and education. The GERMINATION stands out as a key emerging area, and the facilitation of conferences has been instrumental as a platform to drive interdisciplinary research and the convergence of ideas. These efforts should continue as they have transformative impacts program-wide.

#### EFMA Response

We greatly appreciate the enthusiasm of the COV for the GERMINATION program.

#### COV Comment III.4

EFMA leadership is encouraged to elevate the focus on URM engagement to drive and strengthen diversity in STEM expertise/capabilities and capacity development in relevant institutions.

#### EFMA Response

As noted under Comment III.2, we piloted Planning Grants for EFRI proposals in FY22. Additionally, the REM program, which provides mentored research experiences to research participants from groups underrepresented in engineering, offers the opportunity to build connections between research-intensive institutions and less well-resourced institutions (e.g., high schools, 2-year institutions).

#### COV Comment III.5

**Recommendation:** The COV recommends expanded marketing and outreach to industry and inter-governmental entities seeking additional resources and creative funding mechanisms to scale current programs' applied and translation impacts.

#### EFMA Response

EFRI has experienced successful cross-agency engagement through interactions at the ground level; but will explore additional outreach mechanisms. In terms of industry engagement, NSF/ENG as a whole recognizes the importance of this and is working to expand partnerships.

#### COV Comment III.6

**Recommendation:** An additional recommendation would be for the EFMA leadership to intentionally work with HBCU and TCU stakeholders to create benchmarks for diversity/inclusivity achievements/impact; maybe an evaluation beyond REM/training programs focused on outcomes and research capacity development/transformation.

#### EFMA Response

These issues are being considered at the Foundation level by the *Eddie Bernice Johnson INCLUDES* initiative. One of the EFMA Program Directors is a member of the NSF INCLUDES working group and will aim to infuse INCLUDES best practices in EFMA.

#### COV Comment III.7

**Recommendation:** The COV recommends that EFMA program leadership reviews the solicitation process and consider making adjustments necessary to reduce inconsistencies in investigators' responses and reviewers' feedback. Specific clarifications are needed for members of the research community. (See "Other," Section 1)

#### EFMA Response

See below under response to COV Comment V.2.

#### COV Comment III.8

**Recommendation:** The EFMA leadership should consider benchmarking IM and BI as well as criteria and rationale for project selection for funding.

#### EFMA Response

Currently NSF reviewers are asked to provide a holistic analysis of each proposal and provide a single rating encompassing both merit review criteria. As noted under response to COV comment I.4, assessments of NSF merit review criteria and process are in planning.

### IV. Resulting Portfolio of Awards

#### COV Comment IV.1

The COV commends EFMA for an appropriate balance of awards across disciplines and sub-disciplines of each topic based on the PI discipline. Topics address emerging areas of science and technology with high potential scientific and societal impact. The solicitations were developed to engage experts from various engineering and science fields.

#### EFMA Response

The EFMA Office values this recognition of the importance of the EFRI portfolio.

#### COV Comment IV.2

**Recommendation:** Bridging to other areas of NSF and industry will further strengthen the program portfolio.

#### EFMA Response

NSF Engineering is increasingly active in pursuing partnership opportunities both within and beyond the federal government.

#### COV Comment IV.3

**Recommendation:** The COV recommends that EFMA consider increasing the EFRI awards size to ensure that the program can support genuinely transformative interdisciplinary research. One possible approach to increasing the size of EFRI awards without decreasing the number of awards would be to pursue partnership or teaming arrangements with other federal funding agencies, philanthropic organizations, and industry.

#### EFMA Response

The EFRI program has historically had productive relationships with other federal agencies, particularly AFOSR, which have resulted in co-funding of multiple awards. However, these co-funding opportunities have been leveraged to increase award number rather than size. We will consider strategies to engage additional partners.

#### COV Comment IV.4

The selected research topics and the awards in the program portfolio are innovative or potentially transformative. The Engineering Research Visioning Alliance (ERVA) will identify topics of national relevance to a wide variety of diverse stakeholders. The Research Experience and Mentoring (REM) awards are very important for broadening the participation of researchers from underrepresented groups and attracting students from underrepresented groups into STEM careers. ERVA also brings an opportunity for industry engagement and building public-private partnerships.

EFMA is meeting the goal of funding high-risk, high-reward ideas and creating exciting topics.

#### EFMA Response

The EFMA Office greatly appreciate COV recognition of the value of EFMA activities.

#### COV Comment IV.5

**Recommendation:** We recommend that EFMA considers collaborating with ERVA on the selection of topics.

#### EFMA Response

Thank you for this interesting suggestion. We value the parallel opportunities to canvas and develop ideas provided by the EFRI Topic Selection process and by ERVA activities. We see significant benefit in having one process helmed by NSF and the other (ERVA ideation activities) led by non-NSF personnel. Nevertheless, we will explore opportunities for cross pollination between ERVA and EFRI.

#### COV Comment IV.6

**Recommendation:** The COV recommends that EFMA considers using planning grants and Germination to help obtain a broader geographical distribution and diversity in the types of institutions and PIs/co-PIs (see below).

#### EFMA Response

As noted above under Comment III.2, in FY22, the EFRI program piloted a Planning Grant opportunity intended to strengthen the capacity of teams from underserved institutions to

apply for EFRI awards in FY23; and will consider repeating this in FY24. We appreciate COV recognition that the GERMINATION program offers the potential to strengthen capacity of investigators from diverse institutions and backgrounds. We will continue to explore opportunities for leveraging GERMINATION approaches to increase diverse participation.

#### COV Comment IV.7

**Recommendation:** PI demographics and type of institution affiliation of PIs and Co-PIs should be tracked and used to design targeted interventions (e.g., Planning Grant, GERMINATION) and measure their impact. For example, with the data on institutional demographics, one goal for EFRI for the next three years might be to focus on grooming potential PIs at MSIs to lead, or partner to lead, an EFRI. This could be done through a Dear Colleague Letter (DCL) with a track for inviting MSI-based PIs to apply for the planning grant and/or the GERMINATION grant (in collaboration with a well-established research-intensive institution as a partner). This could result in realistically helping the MSI compete for an EFRI award effectively.

#### EFMA Response

EFMA collaborated with the EDU directorate to achieve outreach to targeted groups (e.g., HBCUs, Tribal Colleges and Universities, HSI) to apprise them of the EFRI Planning Grant opportunity; we will plan to continue this approach.

#### COV Comment IV.8

The data provided suggests that the participation across the EFRI topics mirrors the community data in terms of gender and race.

#### EFMA Response

The EFMA Office strives for representative demographic participation.

#### COV Comment IV.9

**Recommendation:** Connect topics to national grand challenges intentionally while not impeding the grassroots approach. The blue-ribbon panel is unique and effective in selecting topics to provide this alignment purposefully. For example, suppose topics are solicited to address the national priority topic of "climate change and its impact on society". In that case, the grassroots approach may still come up with topics from green chemistry, recycling of plastics, and distributed chemical manufacturing as topics that will fit the national priority by design and not impede on the creativity of the research community, only gently direct them towards a grand challenge. The blue-ribbon panel can have the big picture in mind when selecting topics.

#### EFMA Response

Using a single challenge-directed selection process for identifying new EFRI topics runs the risk of missing topic ideas that may lead to research that could impact multiple areas of societal need. Both the *Soft Robotics* and *Chromatin & Epigenetic Engineering* topics provide important proof of principle in this respect; both resulted in funding of projects with potential applications across a range of societal challenges. Of note, our current process has resulted in selection of multiple topics that address national priorities such as energy, critical infrastructures, and elimination of end-of-life plastics.

#### COV Comment IV.10

The selection of topics and overall quality and balance of funded projects are appropriate and have the potential for transformative impact on research, education, and innovation. The COV commends the work of EFMA leadership, program directors, and staff members for their outstanding program stewardship.

#### EFMA Response

Thank you.



## V. Other Topics

### COV Comment V.1

**Recommendation:** We recommend that both proposers and reviewers are provided with additional guidance (with reference to NSF ARIS, BI Guidelines, and Toolbox) to help define these expectations, which may lead to better articulation and review of how the proposal addresses the specific BI criteria.

### EFMA Response

Thank you for this suggestion. The Proposal & Award Policies & Procedures Guide (PAPPG) Chapter III.A.2 specifies the elements to be considered in reviewing both the Intellectual Merit and Broader Impacts criteria. Additionally, examples provided to applicants of societally relevant outcomes that could constitute Broader Impacts (in PAPPG Chapter II.C.2.d.i) are also available to reviewers. Importantly, the PAPPG clearly prefaces this list with "Such (societally relevant) outcomes include, **but are not limited to:...**". Use of a Broader Impacts "checklist" such as the *ARIS Broader Impacts Plan Checklist* potentially risks imposing a prescriptive lens on what constitutes Broader Impacts.

### COV Comment V.2

**Recommendation:** Harmonize solicitation language describing the requirements for the expression of BI and BP ideas and the review criteria communicated to the reviewers/panelist.

- Align the written requirements in different parts of the program solicitation to those found in the current Introduction: "The Broadening Participation Plan must be described as part of Broader Impacts of the proposal both in the Project Summary and in the Project Description. It may include, but is not limited to, any of the following menu of activities as appropriate for your project and the circumstances of your institution(s)..." as described below:
  - In proposal preparation instructions, the Project Summary section currently states, "Describe the *broader impacts* of the proposed work, including the potential long-term impact on national needs or a grand challenge."  
**Recommended change:** "Describe the *broader impacts* of the proposed work, including the potential long-term impact on national needs or a grand challenge **and plans for broadening participation.**"
  - The current statement in the Project Description section reads: "The project description of the preliminary proposal is limited to five pages and should include the following three sections: Vision and Goals, Approach and Methodology, Transformative Impact." **Recommended change:** Add an additional section: "...four sections: Vision and Goals, Approach and Methodology, Transformative Impact, and Broader Impacts including Broadening Participation."

### EFMA Response

Thank you for these suggestions. We will work to harmonize the solicitation language between the Introduction and the individual sections providing instructions for pre-proposals and full proposals in future solicitations.