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Division of Industrial Innovation and Partnerships (IIP)
Response to the 2020 Committee of Visitors (COV) Report

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Introduction

The Division of Industrial Innovation and Partnerships (IIP) thanks the members of the 2020 Committee of Visitors (COV) for their time and effort in reviewing and evaluating the program management and investments of the Division. IIP is especially grateful to Dr. Eric Johnson and Mr. Tom Knight for their leadership as co-chairs; Together they developed a comprehensive and thoughtful report consisting of many clear and actionable recommendations that will positively position the Division for the next four years.

The IIP COV met on June 9-10, 2020 to review the Divisional programs for fiscal years (FY) 2016 - 2019 for both the "academic programs" (i.e., Industry-University Cooperative Research Centers (IUCRC), Innovation Corps (I-Corps), and Partnerships for Innovation (PFI)) and the Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR) Programs). The Chairs presented the COV report to the ENG Advisory Committee on October 21, 2020, and the Advisory Committee members voted unanimously to accept the report.

The COV evaluated over 550 randomly selected IIP proposal actions spanning FY 2016-2019, with approximately 45% of these actions from IIP academic programs and 55% from IIP SBIR/STTR Programs. The COV report addressed five topic areas:

       I.   Merit Review Process;
      II.   Selection of Reviewers;
     III.   Management of the Program;
     IV.   Portfolio of Awards; and
     V.   Other Topics.

Herein, we consider some of the common themes from COV report and IIP's initial (Year 1) response to these consolidated recommendations.

COV Recommendations with IIP Responses by Report Topic Area:

I.   Merit Review Process

Recommendation regarding individual reviews: The COV observed that, although the majority of individual reviews were appropriately thorough, there were a number of panelist and ad hoc reviews that simply restated assertions made in the proposal under review or provided non-substantive comments (especially in the case of declined proposals or when addressing broader impact and/or commercialization criteria). The COV recommended that reviewers be more explicit in their assessment of the intellectual merit, broader impact, and, for SBIR/STTR Programs, the commercial impact. The COV suggested that reviewers be provided with more detailed examples (or a rubric with more specific key elements) of broader impact and commercialization criteria. [I.2, I.3, 1.7]

Response: IIP seeks to convey NSF's best practices for Merit Review to ad hoc reviewers and panelists through a number of activities: for example, panelists are provided with information on

NSF Merit Review in their invitation letters as well as in pre-panel briefings. Notably, both the IUCRC and PFI Programs provide "reviewer orientation webinars" and invite reviewers to participate in these pre-panel briefings to learn more about Merit Review, conflicts of interest, and how to craft constructive feedback prior to writing their reviews or attending panels.

During FY 2020, IIP improved its processes to ensure high quality, constructive feedback on all proposals and has established quality control measures whereby additional reviews are requested if the Program Director (PD) or Division Director (DD or her designee, the Deputy Division Director, DDD) determines that reviews are incomplete, unsubstantive, or lacking in technical authority. As of this writing, the Division has added additional ad hoc reviewers to over 100 proposals where the panel reviews were not of sufficiently high quality to provide a clear and compelling justification for the award or declination decisions. Additionally, IIP recruited new Experts and trained them to assist the Program Directors, as needed, to verify that reviews and Panel Summaries represent thorough, fair, and consistent treatment for each proposal. Finally, the Division has also implemented a "Policy and Practice Minute" at weekly staff meetings. These minutes often highlight best practices used in other Divisions while they share and standardize IIP practices.

Recommendation regarding panel summaries: The COV observed that a small number of panel summaries did not clearly list strengths and weaknesses for all merit review and solicitation-specific criteria – while others used bulleted plus and minus lists to denote strengths and weaknesses. The COV also noted that it was unclear from some panel summaries how consensus and, ultimately, the panel's recommendation was reached given the diversity of individual review ratings. The COV recommended that panel summaries include comments that inform the issues that drive to panel consensus and ensure that the final recommendation be clearly marked in all panel summaries. [I.2, I.4, 1.6]

Response: As noted above, IIP Program Directors have been encouraged to work within their program team or with Experts to obtain thorough and comprehensive reviews for each proposal. Panel discussions integrate reviewer feedback but in cases where divergent views remain, the IIP Program Directors have been directed to explicitly address outlying ratings (e.g., an Excellent rating on a proposal recommended for declination or a Poor or Fair rating on a proposal recommended for award). Program Directors must provide compelling justification in their recommendations (Review Analysis) as evaluated by the IIP management prior to the decision being "DD Concurred" and released to the proposers.

Proposals processed exclusively by ad hoc reviews do not receive a Panel Summary and thus, divergent ratings are more common. In these cases, the Program Director must still justify the recommendation and account for all reviews received.

It is important to note that SBIR/STTR proposals are often submitted by small startup companies that do not have significant administrative support nor experience. Review ratings may be lower and/or more disparate due to reviewer biases regarding the level of polish or experience of the proposal writer, rather than intellectual merits. The IIP Program Directors are strongly encouraged to understand their community and take risks, incorporating scientific and programmatic

considerations into their process as they review the intellectual merits, broader impacts and commercialization potential of the projects.

Finally, NSF staff (Program Directors and DD/DDD) understand that it may be difficult for proposers to know how to contextualize divergent reviews and thus, all proposers are offered an individualized debrief call with the cognizant PDs should questions or concerns arise.

Recommendation regarding requests for more information or budget revisions from the proposer: In regard to SBIR/STTR proposals, the COV recommended that IIP develop written guidance on when and how a Program Director may ask proposers for additional information during due diligence and what type of information may/should be requested.

Response: SBIR/STTR due diligence efforts address multiple risks, including those identified by the reviewers; additional concerns identified by the Program Director; and certifications required by SBA policy. The due diligence process is critical to informing the Program Director about all of the review criteria (intellectual merits, broader impact, and commercial potential) and preventing or mitigating waste, fraud, and abuse.

At their discretion, PDs have the authority to seek feedback on specific reviewer/panel comments from the PI in order to reach fully informed recommendations. This authority is used judiciously and only in circumstances in which the PD believes that the feedback would assist in their decision making.

Diligence efforts are also initiated to identify potentially meritorious proposals from a pool reflecting the diversity of the community in terms of demographics, geography, institutional ties, experience as performers of federal research, length of operation as businesses, and other characteristics. As a result, Program Directors expend considerable effort to assist new and often inexperienced grantees through the complex NSF administrative and financial review processes (e.g., Cost Analysis and Pre-award (CAP) processes). This detailed instruction is often needed by newcomers to the potential NSF awardee community. IIP is considering several ways in which to standardize the due diligence process while maintaining PD flexibility, encouraging risk-taking, and understanding that the proposer's administrative and technical starting points are considerably varied.

II.   Selection of Reviewers

Recommendation regarding reviewer expertise: While the COV observed that IIP panels made use of reviewers having appropriate expertise and/or qualifications, it was noted that some panels appeared to have few or no industrial reviewers (in the case of Academic Programs) or were composed primarily of industrial reviewers (in the case of SBIR/STTR Programs). The COV recommended that IIP find more panelists with expertise relevant to broader impact and commercialization. [II.1]

Response: Both IIP Academic and SBIR/STTR Programs face the challenge of conducting merit review on proposals that span a broad range of research and technology topics. When creating a

review panel, IIP Program Directors must balance the principal needs for specific reviewer expertise with other factors, such as prevention of conflicts-of-interest, prospective panelist availability, and panel diversity (geographic, institutional, career stage, gender, race, ethnicity, etc.).

The current proposal and review processing systems (eJacket) only allows reviewers to provide one title/department. Often, IIP reviewers hold multiple titles, such as academicians with joint appointments or faculty with their own startup company(ies) – this is not reflected in eJacket but is often known the IIP PDs. IIP Program Directors intentionally look for reviewers with technical and commercial expertise, even though this is not captured comprehensively in NSF systems.

All IIP programs are working to develop a comprehensive reviewer database in order to provide robust, diverse, inclusive, and transparent review processes leading to sound funding recommendations. Specific efforts include the following:

- In FY 2019, all IIP outreach presentations began discussing all of IIP's programs to ensure cross-fertilization between our Academic and SBIR/STTR activities, including explicit requests to participate as reviewers. These outreach presentations often target diverse audiences including women (e.g., SWE and WISE), underrepresented groups (e.g., NSBE, SHPE, AISES, SACNAS, and NOBCChE) and geographically distant participants (e.g., SBIR/STTR Road Shows, EPSCoR NSF Days, etc.).
- In FY 2020, the SBIR/STTR Programs established a new digital communications system (a so-called "drip campaign") to facilitate email outreach focused on recruiting reviewers.
- In FY 2020, IIP Management began welcoming panels and encouraging current reviewers to recommend colleagues. Indeed, this method worked in recruiting one woman reviewer to serve as a Program Director in the Division.
- IIP Experts now partner with the Program Directors in identifying and recruiting new reviewers, including those from diverse institutions and communities.

We anticipate that success in this focus area will be measured by recruiting >250 SBIR/STTR reviewers from academic institutions, government, and industry (including small businesses) during FY 2020-2021. In order to obtain a critically needed diversity of perspectives, >10% of the reviewer pool will represent women, underrepresented groups (including veterans and the disabled), and geographically-dispersed communities.

Recommendation regarding reviewer demographics: Although the COV noted IIP's use of reviewers with appropriate expertise and/or qualifications, members noted that "panels should have greater diversity in terms of number of females and members of other underrepresented groups in STEM, and more representation from R2 universities." The COV recommended IIP aim for panels with "2 or more self-reported women" reviewers as well as 2 or more reviewers from "self-reported under-represented groups." [II.1, II.3]

Response: From FY 2016-2020, the IIP Academic and SBIR/STTR reviewers and panelist demographic self-reporting rate was ≤ 40%; thus, it is difficult to ascertain the exact composition of IIP panels or reviewer pool from self-reported metrics. As noted above, IIP is exploring the

development of a new comprehensive reviewer database and extensive outreach campaigns (e.g., drip campaign and outreach to professional societies and road shows) to ensure a diversity of perspectives. It is important to note that reviewer reporting of their demographic data is completely voluntary; NSF does not have the legal authority to require Principal Investigators or reviewers to provide demographic data. Since provision of such data is voluntary, the demographic data available are incomplete.

In an effort to increase the self-reporting rate, IIP Program Directors will continue to stress the importance of reporting demographics as part of reviewer orientation and at the start of panels.

III.   Management of the Program

Recommendation regarding over-ruling panel recommendations: The COV noted that IIP empowers PDs to overrule review panels and recommended this be continued. However, the COV recommended that there be clear documentation justifying why the panel recommendations were overruled in order to provide transparency into the decision-making process. [III.1]

Response: As noted above, the Division will continue to develop robust practices to thoroughly document and compellingly describe the Program Director's reasoning and justification for their decision-making processes, especially in cases where the PD incorporates additional scientific or programmatic considerations not available to the panel or receives disparate reviews to consider.

Recommendation regarding NSF SBIR/STTR Phase I Project Pitches: In the case of IIP SBIR/STTR Programs, the COV noted that members were not provided information on SBIR/STTR Phase I Project Pitches, and that the Project Pitch process was not in the COV's charge. Given that an Project Pitch invitation is now required for Phase I submissions, the COV recommended that the Project Pitch be fully documented in the proposal jacket, along with the documented result of the pitch, for future COVs to gauge the effectiveness of the pitch process. [III.1]

Response: SBIR/STTR Proposal Pitches are evaluated solely on program fit (e.g.: Are the proposed activities disallowed by NSF policy, such as clinical trials? Is there appropriate research and development to be done?) and conformity with SBA rules (for example: Is the company considered a small business? Is it a US-based company?). Project Pitches are not subject to NSF Merit Review.

The purview of an NSF COV excludes certain types of submissions not subject to NSF Merit Review, such as Letters of Intent (LOI) and Preliminary proposals. Similarly, the Project Pitch is a submission to NSF beyond the scope of the COV review process.

Recommendation regarding IIP outreach and in reach efforts: In the case of IIP SBIR/STTR Programs, the COV recommended a greater effort on behalf of IIP to leverage and enable education opportunities for PIs and startup employees; partner with (1) regional technology incubators, (2) entrepreneurship centers, and/or (3) Small Business Development Centers (SBDCs), who are already providing mentorship and entrepreneurial education opportunities; encourage further in-reach within NSF; and increase outreach that will broaden participation from women and

underrepresented groups, both in reviewer pools and PIs. [III.2, III.4]

Response: IIP has an extensive portfolio of outreach activities focused on broadening participation, as discussed further below. Regarding institutional partnerships, IIP efforts include the following:

- IIP partners with the SBA in participating on Road Tours to introduce the SBIR/STTR programs to geographically disparate communities.
- In FY 2020, IIP funded the first workshop (award 1952602) for the newly formed Engineering Innovation Leadership Council (EILC), consisting of university Vice Deans, Vice Presidents, and related roles focused on startup support.
- In FY 2020, IIP funded the first workshop (award 1953023) for Deep Dive into Deep Technologies to convene the technology incubator community, with a session scheduled in April 2021 focused on broadening participation.
- The new I-Corps Hubs (solicitation NSF 20-529) will have two new aspects to support broadening participation: 1) a Diversity and Inclusion Plan – every Hub must submit one as part of the proposal; and 2) a pathway for teams funded by other agencies – this is particularly helpful to recruit I-Corps teams funded by programs such as the DoD program funding research equipment for minority institutions.

IIP also has close connections to other agency-wide broadening participation initiatives and has been extending its in-reach efforts within the Foundation:

- In the summer of 2020, the IIP team conducted an extensive study of the lineage of the I-Corps program and identified both diverse and successful teams from all the other Directorates. IIP has been communicating these back to colleagues throughout the agency to share success stories and best practices.
- As part of the synergy between SBIR/STTR and I-Corps, IIP has begun inviting Program Directors throughout the agency to be a "fly on the wall" in the experiential training through the new Federal Learning in I-Corps (FLI-Corps) Program for NSF employees and rotators. One of the purposes of this in-reach activity is to promote translationally-focused proposals from throughout the entire NSF community.
- Through the I-Corps program, IIP participates in the "BP Innovate" effort (Dear Colleague Letter NSF 21-023) researching critical factors and promising practices to support diversity in technology translation.

IV. Resulting Portfolio of Awards
Recommendation regarding participation of underrepresented groups: Although the COV noted that broadening participation is a national problem, and recognized that IIP supports broadening participation, the COV gave several specific recommendations for improving diversity and inclusion. [IV.9]

- Provide an "SBIR/STTR Outreach and Broadening Participation Strategy," and publish that on their website.
- Create a new page on the IIP website focused on broadening participation from women and unrepresented groups and highlight successful PIs from these groups.
- Partner with stakeholders who will lead to more quality proposals from females and members of underrepresented groups.

<u>Response:</u> IIP is committed to enhancing diversity along all elements of our programs and aligning with the published agency vision and strategy. The SBIR/STTR, I-Corps, and PFI programs collaborate closely in the Inclusion in Innovation Initiative (I4), launched across the programs in FY 2019. Specific activities include:

- To better reflect the diversity of the community, as the Division has grown in FY 2019-2021, the proportion women on the IIP scientific staff (Program Directors and Experts) has increased from roughly 20% to 40%.
- In a typical year, all IIP Program Directors participated in > 60 outreach events in-person in over two dozen states: these events included dozens of presentations as well as over 300 one-on-one meetings with potential applicants and other stakeholders.
- The SBIR/STTR Program Directors participate in quarterly SBIR Road Tours supporting Small Business Administration events in several underserved states and regions.
- The SBIR/STTR annual Phase II Grantee Conference has featured a dedicated networking session for female entrepreneurs and innovators.
- IIP sponsors Office Hours and related engagement with several organizations, including: the National Society of Black Engineers (NSBE), Society of Hispanic Professional Engineers (SHPE), American Indian Science and Engineering Society (AISES), Women in Science and Engineering (WISE), and others.
- In partnership with American Society for Engineering Education (ASEE), the SBIR/STTR program (award 1853888) supports the Innovative Postdoctoral Entrepreneurial Research Fellowship (I-PERF) recruiting underrepresented scientists to work for 1-2 years in a startup, many of whom are subsequently hired for a longer term.
- Between FY 2016-2019, the PFI program launched several initiatives through a pilot Accelerating Women and Underrepresented Entrepreneurs (AWARE), including several conferences and training sessions.
- Drawing from the lessons of PFI, the SBIR/STTR programs piloted Culturally Relevant Enterprise Development (CRED) – an abbreviated I-Corps program focused on the Native American/Alaska Native (NA/AN) populations, supporting the development of entrepreneurial skills toward new ventures aligned with their community values.
- The lessons learned from I-PERF, AWARE and CRED were integrated into the IIP Inclusion in Innovation Initiative (I4), which led to the development of a project funding The GEM Consortium (award 1940055) to recruit URM STEM graduate students to pursue translational research, starting with outreach to guide students into the I-Corps regional activities, and then on to national I-Corps activities and from there to SBIR/STTR proposals. Since the summer of 2020, over 200 students (estimated 80% PhD, 20% MS) have participated in the initial outreach activities, with several teams now entering I-Corps programs.

Based on feedback from the COV, IIP will provide an "SBIR/STTR Outreach and Broadening Participation Strategy," to be published on our website by FY 2022.

V.   Other Topics
<u>Recommendation regarding participation of underrepresented groups</u>: The COV noted that "NSF

should consider providing additional funding specifically for administrative support to enable broadening participation. This funding should be made available as part of an original funded application or as a supplement." [V.3 also in IV.9]

Response: As noted in prior responses, IIP will expand the portfolio of pilot activities and leverage best practices from all NSF programs to attract and retain talent from all our nation's communities.