CORE QUESTIONS and REPORT TEMPLATE

for

FY 2010 NSF COMMITTEE OF VISITOR (COV) REVIEWS

Guidance to the COV: The COV report should provide a balanced assessment of NSF's performance in two primary areas: (A) the integrity and efficiency of the ***processes*** related to proposal review; and (B) the quality of the ***results*** of NSF's investments that appear over time. The COV also explores the relationships between award decisions and program/NSF-wide goals in order to determine the likelihood that the portfolio will lead to the desired results in the future. Discussions leading to answers for Part A of the Core Questions will require study of confidential material such as declined proposals and reviewer comments. *COV reports should not contain confidential material or specific information about declined proposals.* Discussions leading to answers for Part B of the Core Questions will involve study of non-confidential material such as results of NSF-funded projects. The reports generated by COVs are used in assessing agency progress in order to meet government-wide performance reporting requirements, and are made available to the public. Since material from COV reports is used in NSF performance reports, the COV report may be subject to an audit.

We encourage COV members to provide comments to NSF on how to improve in all areas, as well as suggestions for the COV process, format, and questions. For past COV reports, please see http://www.nsf.gov/od/oia/activities/cov/covs.jsp.

Date of COV: April 28-30, 2010
Division: IIP
Directorate: ENG
Number of actions reviewed: **Awards: 81** **Declinations: 51** **Other: 0**
Total number of actions within Program/Cluster/Division during period under review: **Awards: 1,715** **Declinations: 4,119** **Other: 62**
Manner in which reviewed actions were selected: **Random sampling within 12 pre-defined categories (e.g. Phase I awards, Phase I declines, etc.)**

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

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

A.1 Questions about the quality and effectiveness of the program's use of merit review process. Provide comments in the space below the question**.** Discuss areas of concern in the space provided.

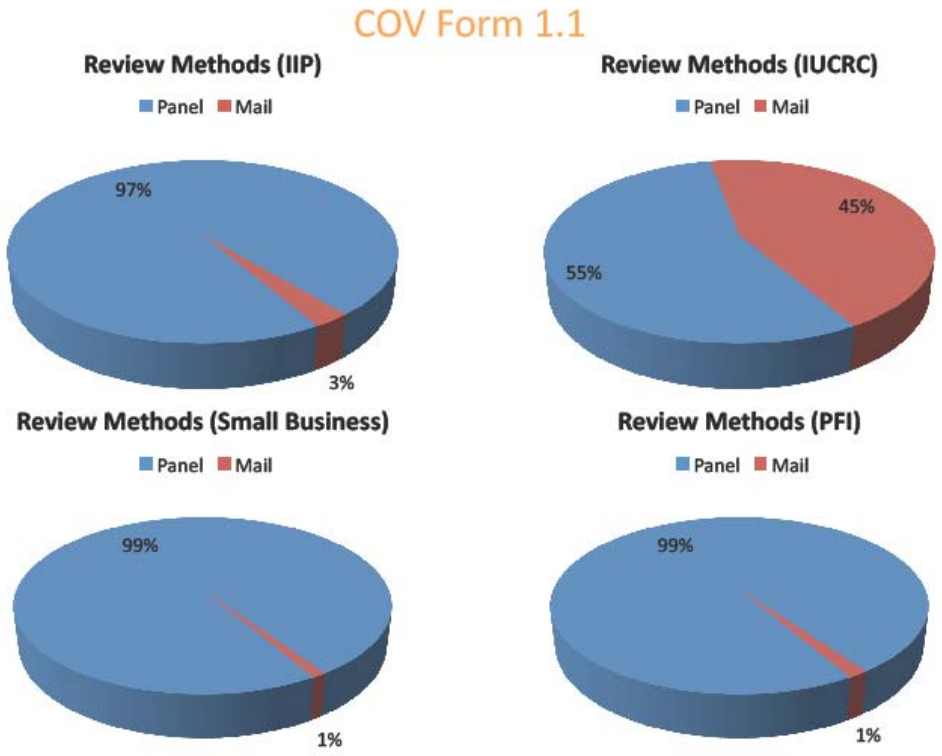
QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCESS	YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE[1]
1. Are the review methods (for example, panel, ad hoc, site visits) appropriate? Based on the materials reviewed by the COV, IIP review methods and processes seem appropriate, and in most cases excellent. Comments: The COV was provided 132 actions for review including 81 awards and 51 declinations. These 132 were selected from 5,896 actions, (1,715 awards, 4,119 declinations, 62 others) during the period under review. The 132 proposals were also randomly selected from 12 pre-defined categories, including awarded and declined SBIR/STTR (Phase I, II, IB and IIB), GOALI, IUCRC and PFI proposals. In most cases, independent panels were physically convened to review proposals (97% - 99% for SBIR/STTR, IIP and PFI, 55% of IUCRC). These panels seemed to be well structured. There is a good balance of reviewers (technical & commercial) from a variety of backgrounds (large corporate, startups, and/or academia). While the types of reviewers vary largely from panel to panel, in aggregate they tend to support the most meritorious proposals without prejudice. Each proposal was reviewed by several independent reviewers, and most of the written reviews were detailed and supported eventual recommendations. Budgets were compared to proposed work-plans and other applications for similar work were also noted to avoid "double dipping" by PIs. Discussion among panelists was encouraged to provide a more robust review process. Individual reviews varied greatly in length and detail; some were excellent, others perfunctory. Panel summaries also varied in quality and detail, but all seemed to capture the essence of the proposal and the spirit of the	YES

[1] If "Not Applicable" please explain why in the "Comments" section.

individual reviews and reflected the consensus of the panel discussion.

Occasionally, mail reviews were solicited by the responsible IIP Program Officer, especially in the case of IUCRC proposals, 45% of which were done by mail. With the IUCRC mail panelists there was no indication of exchanges among them, which may represent a lost opportunity for panel collaboration and synergy. A large number of PFI proposals also showed subsequent email reviews, which may have occurred as a result of subsequent questions being asked PIs and other supplements being considered solely by Program Manager for possible funding.

Post review communications seem adequate, although there does not seem to be a consistent approach taken in all cases.



2. Are both merit review criteria addressed
   a) In individual reviews? YES
   b) In panel summaries? YES
   c) In Program Officer review analyses? YES

Comments:

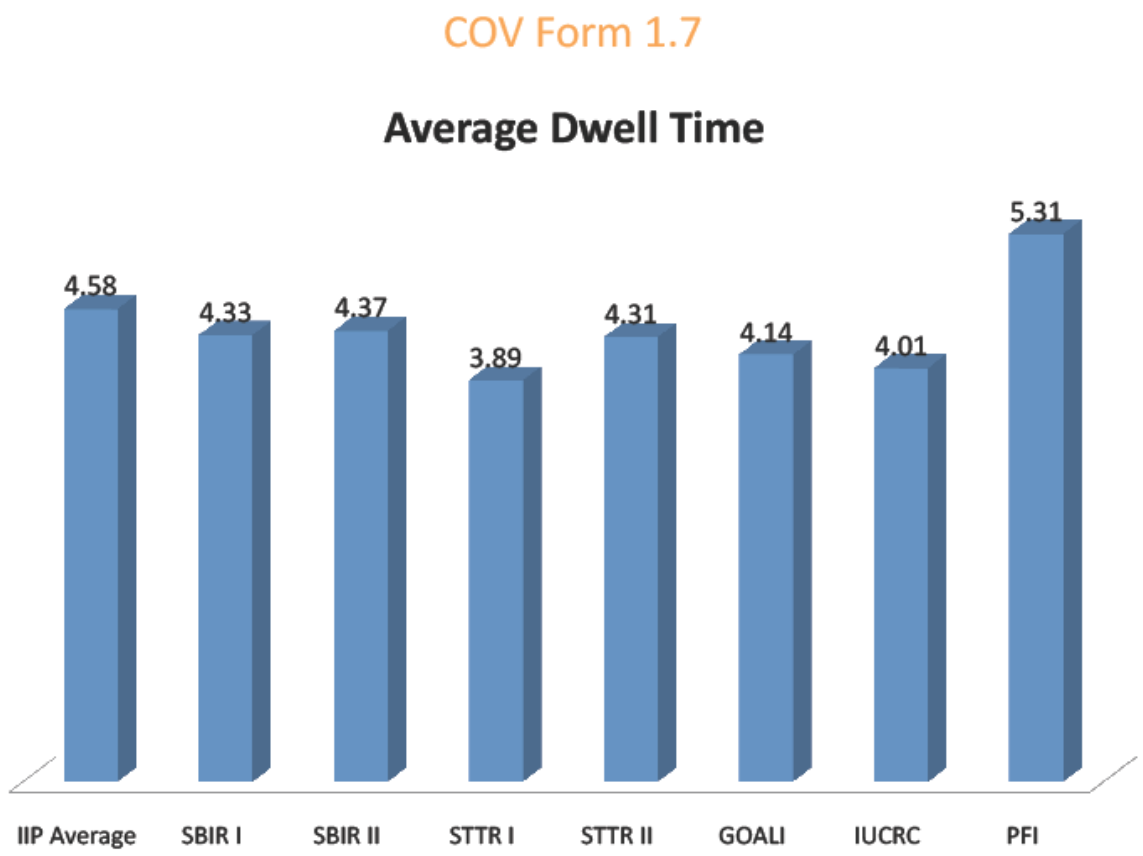
While both merit review criteria were considered in all three instances, often the terms “Intellectual Merit” and “Broader Impacts” seemed to be interpreted inconsistently across panels, and occasionally

appeared to be incorrectly or arbitrarily defined. "Intellectual Merit" assessments often seemed to be just restatements of the course of research, rather than an actual evaluation of how much tangible new knowledge is being generated. Similarly, "Broader Impacts" assessments were sometimes just commentaries on commercial potential, and failed to consider collateral societal benefits. In the future, it might be useful for the program to better define these terms for the benefit of panel members and to ensure clarity and uniformity of application. Moreover, the focus on these two merit categories tended to be arbitrary, and forced some rather arbitrary analysis. A more thoughtful template to accommodate other relevant criteria might be more useful than forcing the entire review to relate only to Intellectual Merit and Broader Impacts. There seems to be more to a complete review than these two categories alone. Some reviewers seem more aware of the review criteria than others, which is reflected in their reviews. Occasionally, the reviewer must form his/her own view as to whether the proposal has addressed the two merit criteria, as the PI is silent on the subject. **The COV recommends IIP better define the terms "Broader Impact" as well as "Innovation" and "Transformative" to help reviewers best assess proposals with respect to these merit criteria.** (This is also discussed in Section C.3.)	
3. Do the individual reviewers provide substantive comments to explain their assessment of the proposals? Comments: While the response is "yes' it is important to note that only about one half of the written reviews examined by the COV gave substantive helpful comments to support their evaluations. Responses from others were short summaries of the proposals themselves and lacked substantive comments to support their assessments on merits of the proposals. It may be helpful to provide better or more consistent guidance to reviewers on review criteria. There also appeared to be variance in substance of comments from technical reviewers and from commercial reviewers in some cases, which may be normal and expected.	YES
4. Do the panel summaries provide the rationale for the panel consensus (or reasons consensus was not reached)? Comments: Panel summaries usually provided reasonable rationale for the panel consensus. In cases where the panel did not form a consensus the pros and cons were generally well presented. Nonetheless the quality of summaries varied greatly. Some were very well written while others less well written. Panel summaries were not present in some of the ejackets.	YES
5. Does the documentation in the jacket provide the rationale for the award/decline decision? (Note: Documentation in jacket usually includes context statement, individual reviews, panel	YES

summary (if applicable), site visit reports (not applicable for IIP), program officer review analysis, and staff diary notes/correspondents.) Comments: The Individual panelist's reviews, panel summaries, and program officer review analysis together provided good rationale for the award/decline decision in most proposals reviewed. The rationale was typically most well developed and articulated in the Program Manager's Review Analysis.	
6. Does the documentation to PI provide the rationale for the award/decline decision? (Note: Documentation to PI usually includes context statement, individual reviews, panel summary (if applicable), site visit reports (not applicable in IIP), and, if not otherwise provided in the panel summary, an explanation from the program officer (written or telephoned with diary note/correspondents in eJacket) of the basis for a award/declination.) Comments: The combination of individual reviews and panel summaries together articulate a rationale for a yes/no decision. In the case of decisions to decline proposals with strong reviews, it might be useful to provide the PI with more information as to rationale for the decision (e.g., budget constraints).	YES
7. Is the time to decision appropriate? Note: Time to Decision --NSF Annual Performance Goal: For 70 percent of proposals, inform applicants about funding decisions within six months of proposal receipt or deadline or target date, whichever is later. The date of Division Director concurrence is used in determining the time to decision. Once the Division Director concurs, applicants may be informed that their proposals have been declined or recommended for funding. The NSF-wide goal of 70 percent recognizes that the time to decision is appropriately greater than six months for some programs or some individual proposals. Comments: The large majority of the proposals were decided within the six-months, and many decided faster. An example of an exception is when a large grant had to be resized for a smaller funding amount, leading to more work cycles. The COV commented on various occasions regarding the issue of time from decision to disbursement and how this might be shortened especially in the case of SBIR proposals, where competitive issues mitigate in favor of fast action. Source: eJackets (where) and EIS-Web COV module. Select "Report View", then select "Average Dwell Time," and select any combination of programs or program solicitations that apply.	YES

8. Additional comments on the quality and effectiveness of the program's use of merit review process:

The COV has high regard for the IIP program's merit review process and feels that IIP practices are best-in-class among analogous federal programs.



A.2 Questions concerning the selection of reviewers. Provide comments in the space below the question. Discuss areas of concern in the space provided.

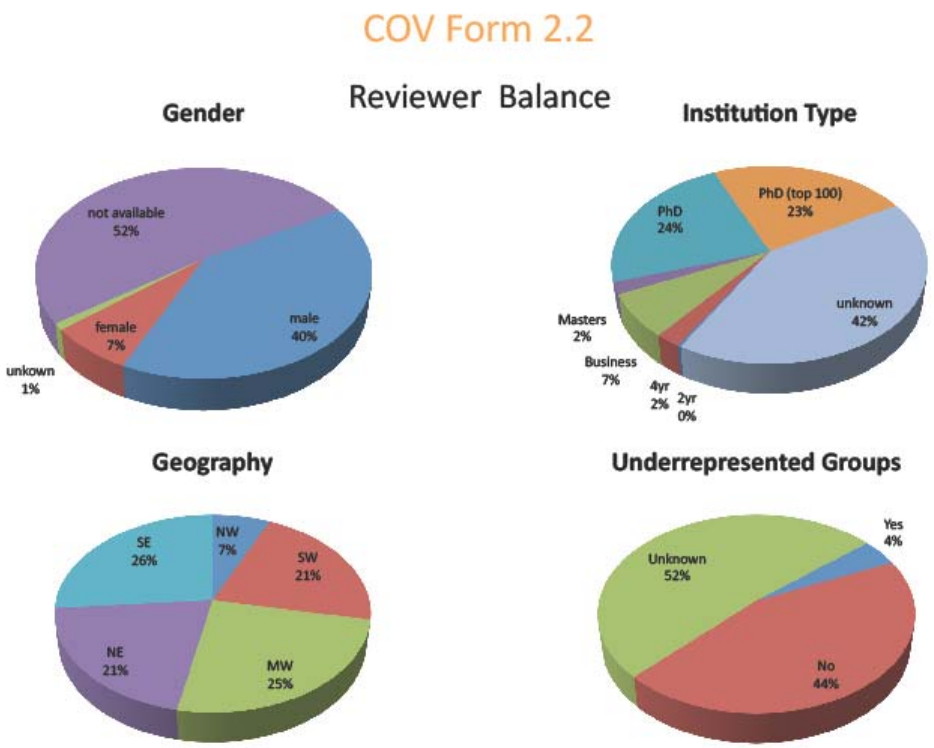
Selection of Reviewers	**YES , NO, DATA NOT AVAILABLE, or NOT APPLICABLE**[2]

[2] If "Not Applicable" please explain why in the "Comments" section.

1. Did the program make use of reviewers having appropriate expertise and/or qualifications? Comments: The COV largely perceived that the reviewers selected had appropriate expertise and qualifications. There were a few concerns relating to the balance (or lack of balance) in some of the SBIR/STTR panels, especially with regard to the depth and relevancy of early-stage commercialization expertise. It is understood that given the proposal volume, finding appropriate and more closely-matched reviewers will continue to be a challenge, nonetheless IIP is encouraged to find ways to address this challenge. A possible increase in per diem (which does not appear to have changed in several years), was also mentioned to help IIP find well-matched reviewers. In any case, the **COV recommends that IIP review the reasons why potential reviewers decline to participate.** The COV observes that panels often include a wide variety of technologies. One potential way to address this may be to evaluate the type and/or narrow the technical scope of individual review panels, though COV has not attempted to determine whether or not this is feasible. Since commercially-oriented SBIR/STTR practices may have value in earlier-stage research, reviewers with industrial background who may place a greater emphasis on developments that may have real world impact should be brought in early in the review process. This balance will be different in IUCRC/GOALI/PFI, which are quite diverse in their goals and processes.	YES
2. Did the program use reviewers balanced with respect to characteristics such as geography, type of institution, and underrepresented groups? Note: Demographic data is self reported, with only about 25% of reviewers reporting this information. Comments: • Underrepresented minorities – Minorities are conspicuously underrepresented as reviewers and panelists. The COV noted that underrepresented minorities only accounted for ~2% of reviewers, which is an issue that requires additional thought. This may be partially due to a reporting issue, as self-reporting is required by reviewers. **COV recommends IIP adopt (and explain) the most recent census categories in order to increase the number and type of self-reported responses.** (see also A.4 and C.3) • Gender – Women were underrepresented on panels. The COV noted that women only represented 10% of reviewers. **COV recommends that IIP consider finding ways to increase participation of women in all types of review panels**. • Geographic diversity – The panelists are largely from the Eastern and Central U.S. This may be partially due to population density and the difficulties associated with travel to Arlington. It is easier for reviewers to participate if they are based in the central or eastern United States. **COV recommends that NSF expands its remote/phone review program to include videoconferencing or other internet-based mechanisms, and consider hosting a pilot review program with panels in geographically diverse locations, or otherwise.**	NO…. with respect to women and underrepresented groups

- Industry representation – There were few reviewers from industry, which is somewhat troubling for programs that are intended to bridge between academia and industry.

One general way to address these issues is to increase the pool of qualified potential reviewers, in ways that include these underrepresented groups. **The COV recommends that NSF/IIP should expand the processes and augment the tools by which they identify, invite and confirm the panel participants, and convene panels.**



YES

3. Did the program recognize and resolve conflicts of interest when appropriate?

Comments:

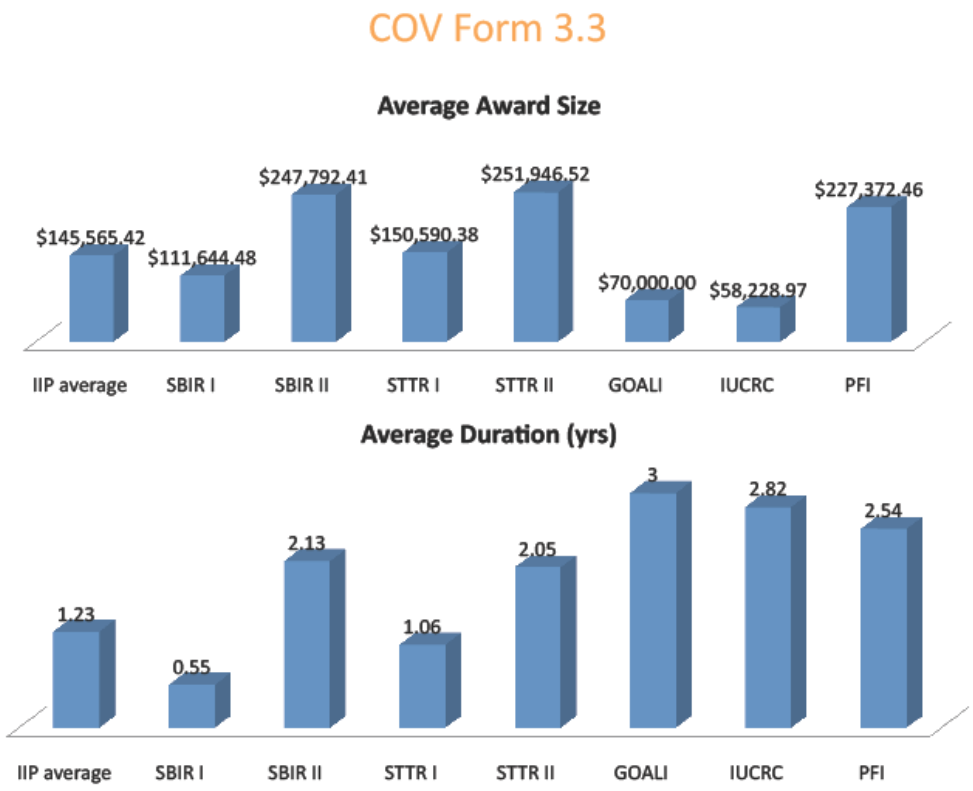
The COV observed that IIP has an adequate system for finding and avoiding potential conflicts of interest, based on self reporting.

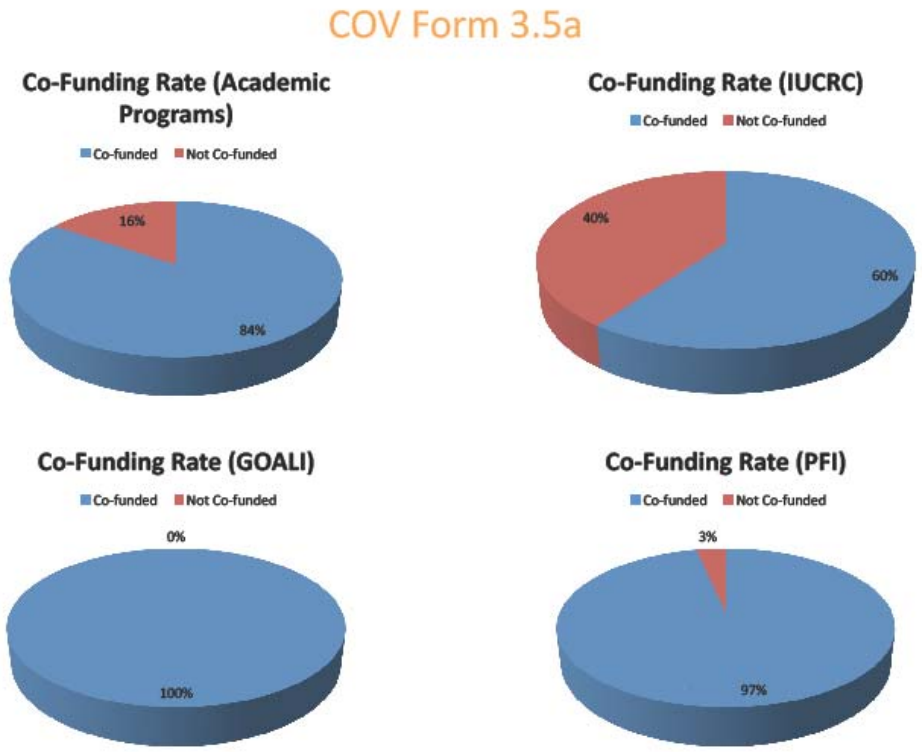
4. Additional comments on reviewer selection: The COV recognizes the unique constraints that IIP Program Officers have in finding a qualified and diverse group of candidates across such a broad spectrum of program areas and getting them to attend panels. This issue is exacerbated by the need to include a growing number of non-academic reviewers in the process. With this in mind, **the COV recommends that IIP move expeditiously to enhance its reviewer database and document the best practices for the reviewer selection process and/or mechanisms by which program managers identify, invite and vet individual reviewers.**	

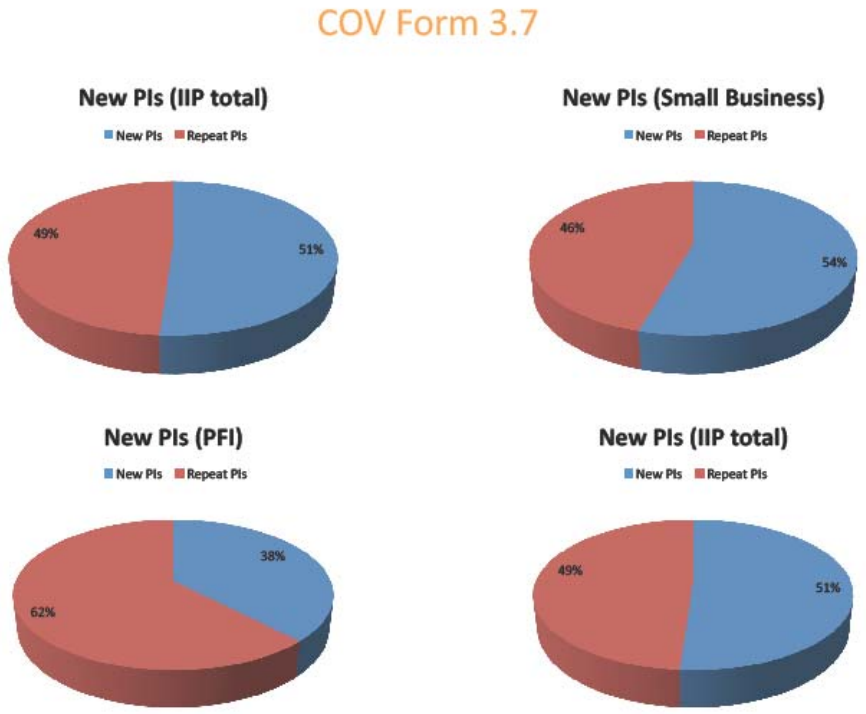
A.3 Questions concerning the resulting portfolio of awards under review. Provide comments in the space below the question. Discuss areas of concern in the space provided.

RESULTING PORTFOLIO OF AWARDS	APPROPRIATE, NOT APPROPRIATE[3], OR DATA NOT AVAILABLE
1. Overall quality of the research and/or education projects supported by the program. Comments: It is the consensus of the COV that the better proposals have been funded. The quality of the portfolio appears to be maximized for the proposals received. IIP uses a dynamic allocation of funds so that the best proposals can be funded across different sections of a program. The only constraint is that SBIR/STTR funds cannot be co-mingled with the academic programs	APPROPRIATE
2. Does the program portfolio promote the integration of research and education? Comments:	APPROPRIATE

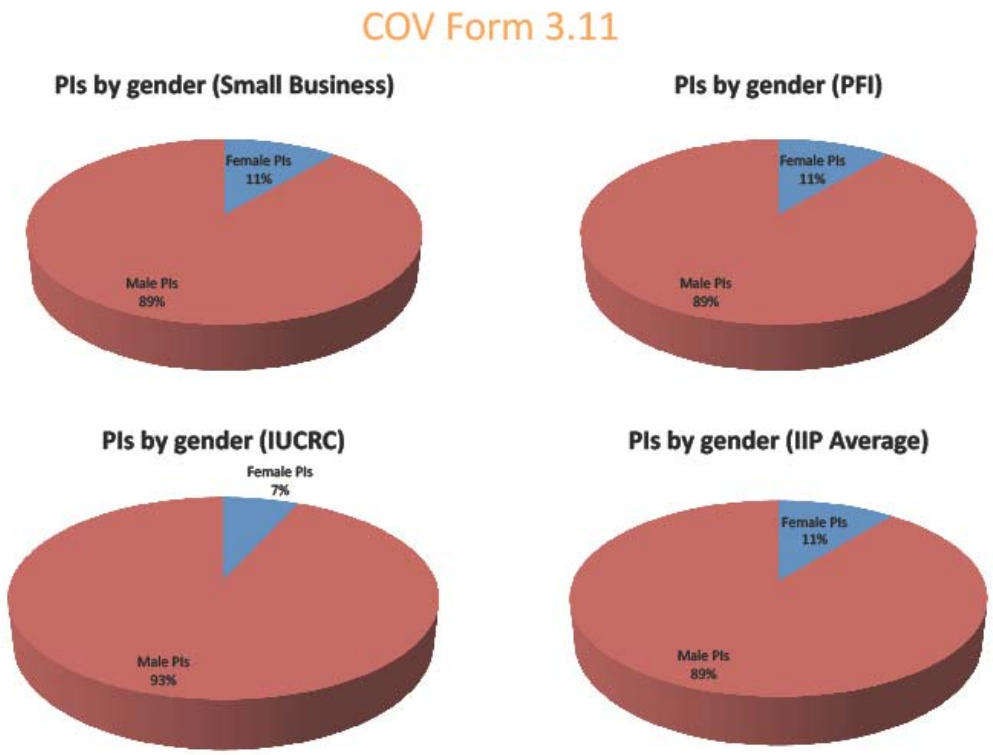
[3] If "Not Appropriate" please explain why in the "Comments" section.

Most of the STTRs and academic projects have research and educational components; however, it is not always the case that the integration of these elements is achieved. The COV commented that it should not be an expectation that SBIR projects include education.	
3. Are awards appropriate in size and duration for the scope of the projects? Comments: Yes. The proposals are written to the size and duration of the grants given. The more important question is whether increases in the size and duration can better assist IIP in achieving its strategic imperatives.  	APPROPRIATE
4. Does the program portfolio have an appropriate balance of: • Innovative/potentially transformative projects? Comments: Yes. Within budgetary and time limits, there is innovation. Larger budgets and longer time limits could bring different proposals that are more innovative and potentially transformative.	APPROPRIATE

5. Does the program portfolio have an appropriate balance of: Comments: The projects whose success depends upon inter- and multi- disciplinary collaboration appears to have such in the awards sampled. There is appropriate cross-funding for GOALI, PFI, and IUCRC. Cross-funding is not relevant for SBIR/STTR.  	APPROPRIATE
6. Does the program portfolio have an appropriate balance considering, for example, award size, single and multiple investigator awards, or other characteristics as appropriate for the program? Comments: Yes, the IUCRC's, PFI's and GOALIs have the appropriate balance. SBIR/STTR are allowed only one PI and a university collaborator.	APPROPRIATE

7. Does the program portfolio have an appropriate balance of: • Awards to new investigators Comments: There appears to be nearly a 50/50 balance between new and repeat PIs across IIP according to the graph noted. This is impressive.  	APPROPRIATE
8. Does the program portfolio have an appropriate balance of: • Geographical distribution of funds and awards Comments: There is a broad distribution of funding and awards among states with the majority going to those areas that are densely populated with academic institutions and technology industry.	APPROPRIATE
9. Does the program portfolio have an appropriate balance of: • Institutionnel types One of the primary strengths of the IIP division is how it allows, and in some programs requires, varying institutions to partner.	APPROPRIATE

10. Does the program portfolio have an appropriate balance: • Across disciplines and subdisciplines of the activity? Comments: There appears to be no bias in the process. The disciplines and subdisciplines of the IIP solicitations are all represented.	APPROPRIATE
11. Does the program portfolio have appropriate participation of underrepresented groups? • Underrepresented groups Comments: There is inadequate participation of underrepresented groups. Women definitely do not have adequate participation. For other groups the information comes from self-reporting and is not complete. There are a few projects that have a focus on ensuring the participation of underrepresented groups as defined by NSF/IIP. **Although some reviewers do a good job on considering participation of underrepresented groups, reviewers should be reminded that they should seriously regard social issues of gender and underserved populations.**	NOT APPROPRIATE



12. Is the program relevant to national priorities, agency mission, relevant fields and other constituent needs? Include citations of relevant external reports. Comments: Most of the projects are relevant to national priorities, and agency mission as documented in the federal, NSF and IIP plans. Source: Program information Obama's Strategies for Innovation NSF's Strategic Plan IIP's Division Plan	APPROPRIATE

13. Additional comments on the quality of the projects or the balance of the portfolio:

- Awarded projects are solid and in many cases logical extensions of prior work. The risk is mostly on the ability

to bring technology closer to market and commercialization either directly or through the participation of industrial entities.

- Many SBIR/STTR awardees generally do not understand the work involved in the goal of SBIR/STTR, i.e. commercialization of their technology.

A.4 Management of the program under review. Please comment on:

1. Management of the program.

Comments:

- Even though IIP Program Managers deal with a wide variety of unique proposals, it is clear that they are following the established NSF standards.
- Program management for the proposals examined appeared appropriate with significant documentation from the Program Managers on panel reviews and the award/decline decision. It is clear from the e-jackets that Program Managers exercised informed judgment in the award/decline decisions taking panel reviewers evaluations into their decision process.
- Program Managers positive actions were evident in correspondence with PI's and in resolving unusual circumstances.
- IIP seems to have a well managed system for handling the volume and type of grants submitted. The organization found a way to handle increased volume of proposals in a fair and timely manner. Further reducing the time from proposal to fund disbursement is a positive direction.
- Furthermore, it seems that IIP was responsive to the prior COV recommendations, and is committed to process improvement/measurement.
- Panel review process was appropriate. Project Managers were diligent in following up on panel concerns.

Recommendation

- The COV supports that Program Managers continue to have discretion to make a judgment that is consistent with IIP's mission, and possibly not the same as the panel consensus. Nonetheless, it is important to note that there was not clear documentation to justify this decision in a few of the relevant eJackets. **The COV recommends Project Managers document their decision (for internal NSF use only) which can be reviewed by IIP management and future COVs, particularly when their decision is not the same as the panel consensus.**

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

Comments:

- Given the stated vision and mission of IIP, **the COV recommends updating/modifying the report template on this section to add, "Responsiveness of the program to emerging needs for innovation and partnerships." (As also discussed in section C.5.)**

- An example of this responsiveness is the IUCRC centers and PFI program which are aimed at stimulating and developing effective processes in cross-fertilization and cooperation between industry and academia.
- The list of IUCRC participants listed on the IIP website gives a good indication of the high level of effort being made in this area. The PFI projects listed point to a strong effort in encouraging and facilitating technology transfer from the universities to industry.
- In the programs presented there seems to be a strong emphasis on building infrastructure and processes to facilitate cooperative efforts. Building this infrastructure will facilitate a greater proportion of collaborative technology projects between universities and industry.
- The IIP portfolio represents a set of projects covering: technologies that are national priorities; collaborations investigating competitiveness, and innovation.
- The SBIR/STTRs have criteria that require commercial viability and seek truly innovative projects. This program is achieving the goal to foster innovation in small companies.
- With regard to education opportunities, these are responsively pursued when they compliment the goals for innovation and partnerships. Driving innovation in education through partnerships should be considered as a topic of interest.

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

About: IUCRC, PFI, GOALI, SBIR/STTR

Comments:

The COV member responses for this section were widely different and no consensus remarks can be made from them. The COV was not clear as to what planning and prioritization process guided the development of the IIP portfolio. **The COV recommends that future COVs be provided clearer documentation on the planning and prioritization process that generated solicitation and the portfolio** so that relevant comments can be generated.

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

Comments:

Overall the COV recognized IIP actions taken in response to the 2007 COV comments and recommendations.

- There appears to be more reviewers from the commercial sector, which was an issue for 2007 COV. But this is still an area for further improvement. **The COV recommends continuing the increase the number of reviewers from the commercial sector.**
- Consistent with 2007 COV report, the variance in the quality and substance of individual reviews within the panel process remains an area for further improvement. **The COV recommends increasing the use of external written reviews from reviewers, with deep domain knowledge, that should be integrated into the panel review process.**
- The 2007 SBIR COV recommended that a third review criterion, "Innovation", be added. It was not clear that this suggestion has been implemented, although the response indicated NSF would emphasize innovation within the two existing merit review criteria. The COV is not clear on how innovation criterion is defined today. **The COV agrees with the 2007 recommendation, and further recommends IIP clarify**

"Innovation" within the existing merit criteria, and emphasize its importance in solicitations and reviews (as is also discussed in Section C.3).

- This COV recognizes some of the concerns identified by the previous COV are very difficult to fix (e.g., the diversity issues). There does not seem to be significant improvement in this area. There should be a defined plan on how to countermeasure this, as discussed in Sections A.2.2, A.3.11, and C.3. What expanded resources will IIP use to generate proposals with increased PI diversity? What expanded resources will IIP provide to Program Managers to enable more diversity in recruiting reviewers?

5. Additional comments on program management:

- Overall, the program management is good. **The COV recommends continued and expanded engagement with industry on program direction.**
- IIP management in the various areas appears well executed and responsive to proposers. The COV recommends continued and expanded use of SBIR Phase I grantee workshops and the Phase II grantees conferences.

PART B. RESULTS OF NSF INVESTMENTS

The NSF mission is to promote the progress of science; advance national health, prosperity, and welfare; and secure the national defense (NSF Act of 1950).

In this Section, the COV is asked to comment on (1) noteworthy achievements based on NSF awards in the portfolio under discussion; (2) ways in which funded projects have collectively affected progress toward NSF's mission and the strategic outcome goals of Discovery, Learning, and Research Infrastructure: and (3) expectations for future performance based on the current set of awards.

NSF investments produce results that appear over time. Consequently, the COV review may 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.

In addition to identifying particularly noteworthy accomplishments or "highlights," the COV is encouraged to comment on the impact of NSF supported contributions to the field. For example, the COV report may include comments on NSF supported work in context of contributions to advance a field, impact of NSF investments to stimulate emerging new areas, and potential for transformative impact in research or education.

To assist the COV, NSF staff will provide award "highlights" as well as information about the program and its award portfolio. The COV is asked to use this information, members' own knowledge of the field, and other appropriate information to develop its comments for this section.

B. Please provide comments on the activity as it relates to NSF's Strategic Outcome Goals. Provide examples of outcomes ("highlights") as appropriate. Examples should reference the NSF award number, the Principal Investigator(s) names, and their institutions.

B.1 OUTCOME GOAL for Discovery: "*Foster research that will advance the frontier of knowledge, emphasizing areas of greatest opportunity and potential benefit and establishing the nation as a global leader in fundamental and transformational science and engineering.*"

This category includes NSF's disciplinary and interdisciplinary research in science and engineering, education research, and centers.

Comments:

Overall assessment:

The COV concludes that IIP enthusiastically embraces the NSF mission to promote the progress of science; advance

national health, prosperity, and welfare; and secure the national defense (as established by NSF Act of 1950).

The COV reviewed 132 proposals, and saw a number of noteworthy achievements by projects within the IIP portfolio that support the Outcome Goal of Discovery -- from accelerating knowledge in scientific and technical areas to promoting a range of potentially beneficial industrial and consumer benefits. This is the result of IIP's intentionally wide criteria in its RFPs, allowing "bottom up" solicitation of ideas from the public and contrasts IIP from other agencies which have specific needs and invite specific solutions. The COV endorses the IIP's current "bottom up' approach as it increases the likelihood of successful and transformative projects. This allows the COV to have high expectations for future outcomes based on the current set of awards.

1. Promote the Progress of Science. Examples include:

- Award 0823027 to develop robotic stem cell propagation technology
- Award 0450619 microscale modulated laser that could allow a new class of communication devices.
- Award 0848285 would develop radical new architecture for fast Fourier transform (FFT) circuits.
- Award 0700700 seeks to develop sensors printed on textiles to monitor medical conditions.

2. Advance National Health, Prosperity, and Welfare, and Secure the National Defense. Examples include;

- Award 0848854 would develop pest resistant corn, grapes and tomatoes by transgenic control of nematodes.
- Award 0750515 would aid in rehabilitation of stroke victims by using remote diagnostic tools.
- Award 0750549 would develop biopesticides to combat the intrusive migration of exotic mussel species.
- Award 0750247 provides rotational support for knee joints.
- Award 0822746 provides a non-invasive glucose monitoring device for diabetes.
- Award 0724478 would develop nanoscale ceramic technology to produce microchannel plates that can be used for night vision systems, scientific detectors, and biomedical imaging systems.

The COV finds IIP is promoting research that otherwise would not be funded because of high-risk or high commercialization challenges. Many of these have the potential to be transformative and would likely go unexplored without IIP funding. With IIP, researchers have access to funds that allow successful innovation, commercialization, and societal benefits. The IIP portfolio includes many projects whose success would bring benefits to society at large, but which cannot be easily promoted, monetized or assigned a "valuation" of the sort required to attract private-equity (or in most cases, even corporate-internal funding).

The COV recommends IIP continue to investigate broader assessment methodologies to assess the outcomes across the IIP portfolio delivered by taxpayer investments (as is also discussed in section C1.)

B.2 OUTCOME GOAL for Learning: "*Cultivate a world-class, broadly inclusive science and engineering workforce, and expand the scientific literacy of all citizens.*"

This category includes K-12, undergraduate, graduate, and postdoctoral education and training; public understanding of science; and lifelong learning.

Comments:

The COV finds that IIP is successfully cultivating a "world-class, broadly inclusive science and engineering workforce," and expanding the "scientific literacy of all citizens" by incorporating a variety of programs that address the outcome goal for learning, in ways appropriate to their specific missions.

The portfolio of SBIR/STTR awardees provides supporting evidence that the award-review process gives weight to the learning-outcome benefits of projects that directly explore the application of advanced science and engineering to the principles and infrastructure of learning. A conspicuous example is the case of Agile Mind, Inc. (final Award number: 0450380), where Phase I, Phase II and Phase IIB awards assisted in bringing to market learning management and authoring systems based on "internet programming" technologies such as Java and XML. With deployments in at least 7 States that target math curriculums from the middle school to advanced high school levels, this case demonstrates how the SBIR/STTR program not only allows technologists to learn how to successfully commercialize technology, but can also directly "expand the scientific literacy" of a the citizenship at large with the capabilities of the products being commercialized.

Similarly, the REU program provides an important opportunity for a small pool of the most promising undergraduate students to be introduced to an environment of commercial innovation that fosters their future classification as “world class” members of the science and engineering workforce.

By the very nature of their structure, the PFI and IUCRC programs involve the participation of institutions of higher learning, and hence, are also responsive to the outcome goal for learning, as it applies to graduate and undergraduate training. Due to their multi-institutional-partnership mission, these programs can (and do) provide learning outcome benefits to a larger number of individuals than the SBIR/STTR/GOALI programs. For example, “The University of Florida IUCRC Center for Particulate and Surfactant Systems” engaged 37 financially participating Industrial Partners and many students in collaborative research and product technology development. Industrial participation within these centers have successfully sparked innovation within the partner companies, and increased the capabilities of their associates. Moreover, as in the SBIR/STTR programs, the IIP portfolio provides evidence that the review-process assigns intrinsic merit to the direct targeting of learning outcomes. For example, "PFI: Developing Infrastructure for Innovation in Downeast Maine" (Award number 19384), brings four regional institutions together to explicitly partner in the development of new educational programs in science, technology, engineering and mathematics at the K-12 level.

The COV also notes that by supporting projects across a wide geographic area and numerous types of academic and commercial institutions, the learning outcomes of the IIP programs are indeed "broadly inclusive." The previously cited case of "PFI: Developing Infrastructure for Innovation in Downeast Maine" serves as an instructive contrast with “PFI: Alaska Native Science & Engineering Program Indigenous Alliance (Proposal number 0836986) which targets similar explicit learning-outcome goals, but in opposite ends of the nation.

The COV recommends IIP seek to increase the number of people who understand innovation and successfully

commercialize their research. These people will become leaders, mentors, and ambassadors for the nation's research community as they will thereafter be capable of further spreading their experience to a wider set of the scientific and engineering communities. SBIR/STTR/GOALI awards typically expose senior and junior scientific researchers, technologist and academics to important commercialization concepts and skills that are critical to IIP's mission. For example, IIP might expand the opportunities for small groups of Co-PIs on a single IIP project.

B.3 OUTCOME GOAL for Research Infrastructure: "*Build the nation's research capability through critical investments in advanced instrumentation, facilities, cyberinfrastructure and experimental tools.*"

This category includes facilities, research instrumentation, and cyberinfrastructure.

Comments:

IIP serves an important role in building the nation's research infrastructure by supporting the development of novel research tools and user facilities at universities and in the private sector. Each program within IIP has the potential to help advance this mission. **The COV recommends increased emphasis on the B.3 Outcome Goal for Research Infrastructure.**

The COV reviewed the outcomes from many IIP projects (an average of 10 NSF Highlights and 10 NSF Stars per member), and reached the following conclusions:

1. 10-15% of the Highlights and Stars reviewed have some level of impact on this B.3 Outcome Goal for Research Infrastructure. (Roughly 5% have a strong emphasis.)

2. The I/UCRC and PFI programs achieve research infrastructure goals that are notable for their effectiveness across varied technical fields, and are achieved primarily with industrial funds, not NSF funds.

3. The SBIR program represents one of the few sources of funding to develop research infrastructure because these products and services sometimes sell into very specialized markets that may not be large enough to attract venture capital or to represent a medium-sized business opportunity. The SBIR program supports efforts to develop and commercialize products and technologies that potentially support important scientific investigations. For example, see *Highlight ID 0750406 "Advanced Simulator for Development and Employment of Accurate Reaction Kinetics in Design, Control and Optimization of Engine and Exhaust After Treatment Device"*

The COV noted several examples in the reviewed projects that directly address the Outcome Goal of Research Infrastructure, including:

- Highlight ID 20458 - Novo-G: NSF Center for High Performance Reconfigurable Supercomputing for the New Decade – University of Florida. Reconfigurable computing by its very nature is transformative, an entirely new approach to computing, with the promise of much higher speed yet lower energy, cooling, etc. These innovations and technologies have the potential to revolutionize the manner by which computers are used, from terrestrial supercomputers to space satellites to consumer electronics and much more.

- Highlight ID 19676 - Phase II SBIR – Automated culture and differentiation of human Embryonic Stem Cells,

Stem Cell Products, Inc. Human stem cells have the potential to generate every cell type in the body, and hence present exciting opportunities as tools for various biomedical applications. The project highlights the automation of growth, maintenance and expansion of stem cells using a commercially relevant robotic platform. The industrialized production of human stem cells and their derivative cell types under good manufacturing practice (GMP) conditions is an essential prerequisite to enable advances in personalized therapeutic applications.

- Highlight ID 19435: STTR Phase II: Planar Array Infrared (PA-IR): A Compact Rugged Double Beam Infrared Spectrometer for Laboratory and Field Analysis, PAIR Technologies, LLC. Planar array infrared spectroscopy has the potential for transformative research. PA-IR has speed capabilities previously unavailable to analysts working in the mid-IR region. These capabilities will allow a new perspective from which to view complex, rapid and irreversible reactions and processes. A new understanding of the nature of these reactions can lead to a paradigm shift or significant scientific or engineering development.

- Highlight ID 19477: SBIR Phase II: Visualization Toolkit for 3D Photography, Brainstorm Technology LLC. This offers a significant improvement in image-based modeling to assist in the generation of 3D models directly from photographs. The goal of this NSF-funded SBIR project is to minimize the effort of building models of high geometric and photometric accuracy that are suitable for efficient rendering, manipulation, and analysis.

PART C. OTHER TOPICS

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

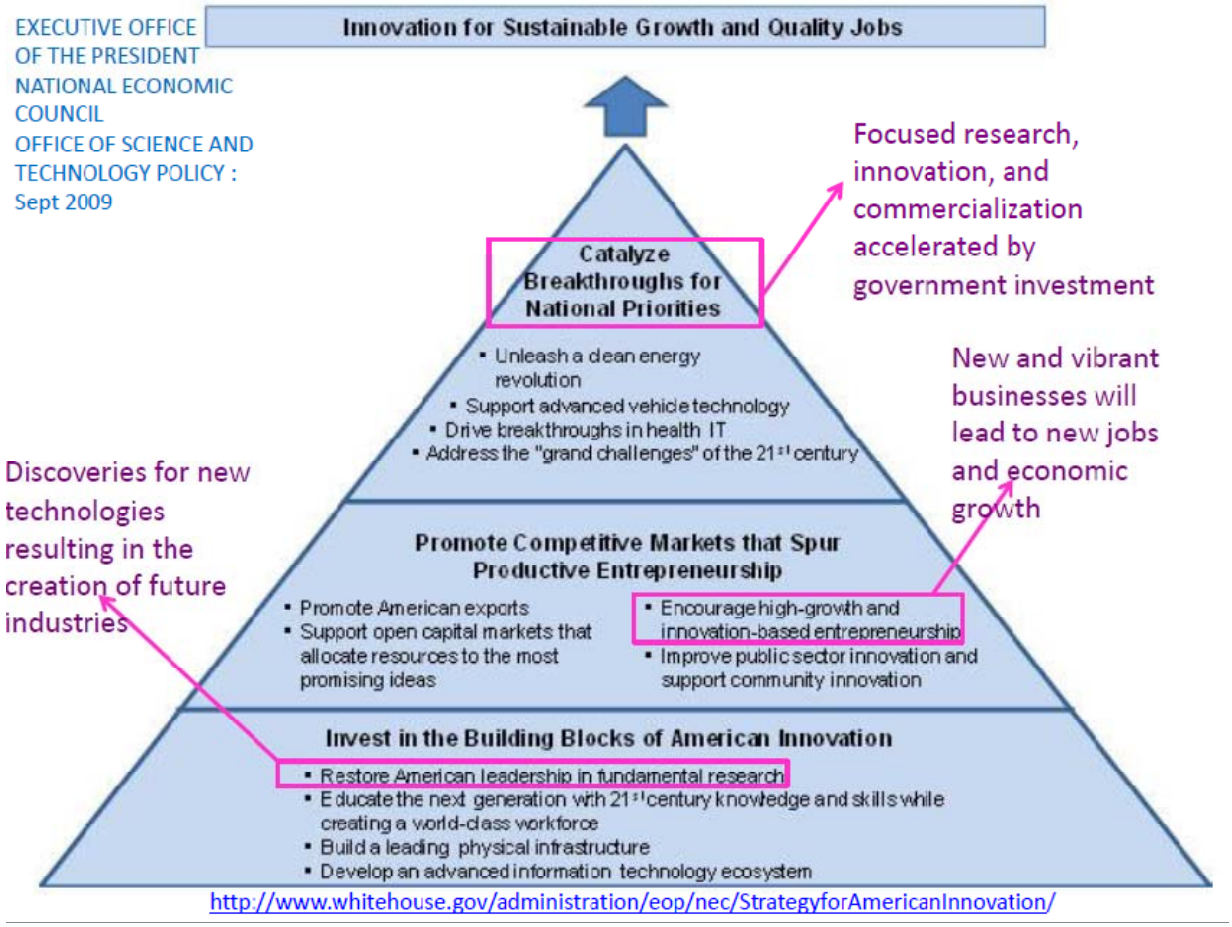
According to the IIP Divisional Plan from 2006:

> *The IIP vision is to be the pre-eminent federal resource driving the expansion of the nation's innovation capacity by stimulating partnerships among industry, academe, investors, government and other stakeholders.*
>
> *The IIP mission is to enhance the nation's economic competiveness by catalyzing the transformation of discovery into societal benefits through stimulating partnerships and promoting learning environments for innovators.*

The COV applauds the IIP division for its ambitious vision and mission. The COV sees a strong commitment to this vision and mission throughout the IIP staff and leadership. In particular, the COV supports the reorganization that created this division, and supports the future plans and goals of IIP. The IIP, through its programs, engages each of its stakeholder groups and each program does have aspects that could expand the nation's innovation capacity.

The COV recommends that the IIP explore mechanisms by which IIP can help the learning and innovation capacity growth of all applicants, including those that are not funded.

The COV endorses the mapping of the IIP program into the OSTP's strategy in order to promote innovation for sustainable growth and quality job creation, as illustrated below.



http://www.whitehouse.gov/administration/eop/nec/StrategyforAmericanInnovation/

Top Tier of OSTP Pyramid:

The COV believes that IIP has done well in promoting good research. However, the focus on innovation may not yet be fully implemented and some ambiguity seems to exist on the status of innovation and commercialization when compared to the traditional two merit criteria of NSF (as discussed in other sections of this report). **The COV recommends commercialization should be expanded beyond SBIR to other existing and new IIP programs.**

The COV has not seen specific mapping of IIP investments to address Grand Challenges of the 21st century, and therefore **recommends IIP place greater emphasis on Grand Challenges within its solicitations and portfolio.**

Tier Two of OSTP Pyramid:

The COV believes that SBIR is well aligned with the stated goals of promoting competitive markets, high growth and entrepreneurship.

Bottom Tier of OSTP Pyramid:

The COV notes that IIP's emphasis on partnerships is a logical and productive method of restoring America's leadership in fundamental research, particularly IUCRC and GOALI. The promotion of education, physical infrastructure and IT ecosystems are uniformly well supported by the IIP program.

Program Gaps

The COV observes several gaps in program implementation, including:

Diversity. Women and some minority groups continue to be underrepresented. **The COV recommends (a) a greater sense of urgency, (b) increased resources, and (c) the development of objective measures of success with time-based goals to attract proposals and panelists from underrepresented groups (as was discussed in Sections A.2.2 and A.3.11).**

Assessment The COV strongly endorses and is excited about the work underway to better assess IIP outcomes, as this will further demonstrate and improve the outcomes generated from taxpayer investments. We acknowledge this is responsive to the 2007 COV. **The COV recommends IIP continue to investigate better methods to assess the impact of their grants, including their impact on global competitiveness and commercialization success.**

IIP Collaboration and Consistency Across the IIP Programs **The COV recommends IIP investigate methods to cross-pollinate best practices and technical information across its programs.** Examples include:

- The COV notes inconsistency in the format of Highlights across IIP programs and **recommends that the format for the Highlights be revised and improved to be consistent across IIP programs**.
- The COV notes lack of synergistic interaction across IIP programs and **recommends increased communication of technical content across IIP programs, e.g., sharing Highlights between SBIR grantees and IUCRC participants.**
- The COV notes the IIP programs hold separate grantee conferences and **recommends combined conferences to cross-pollinate technologies and best practices across IIP programs, and to form a community "driving the expansion of the nation's innovation capacity."**

Crossing the Valley of Death continues to be a major challenge to achieving the OSTP's and IIP's stated goals. **The COV recommends the consideration of new approaches to meeting this critical challenge, including new programs that will:**

1. **stimulate earlier investment and partnering, especially from large corporations and the investor community.**
2. **increase industry-university programs with significant industry co-investment of funds from companies that are larger than SBIR-eligible companies.**
3. **improve pre-proposal training for SBIR/STTR Phase 1 proposal writers, especially on how to write the commercialization section of their proposal. This can be an on-line link from the solicitation, similar to those currently provided for Broader Impacts.**
4. **provide SBIR Phase II commercialization assistance, including incubation and acceleration support, and commercial, legal, accounting, marketing and/or matchmaking resources to assist worthy projects to overcome the "Valley of Death".**

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 IIP Plan dated June 2008 responds to the American Competitiveness Initiative (ACI) and the America COMPETES Act (ACA). In this context, **five major goals** are identified:

1. *Innovation Partnership – enhance the nation's innovation capacity through public and private partnerships*
2. *Global Innovation Leadership – cultivate innovation by promoting the exchange of discoveries, technologies and expertise between industry and academe*
3. *Pre-eminent, Globally-Adept Workforce – stimulate the growth of a competitive workforce by encouraging innovation through relevant training and education*

4. *Increased Commercialization – enhance the commercial success of business opportunities arising from innovative research through partnerships with the industrial and investment sectors*
5. *Stewardship - maximize the division's impact on the nation's economy by continually improving the effectiveness of operations and developing and sustaining a world-class team.*

A total of **20 objectives** complement the five goals.

Based on a review of a selected set of eJackets, "Highlights" and "Stars", the 2010 COV arrived at the following conclusions:

- The Division strategic goals and priorities are aligned with national priorities (e.g. OSTP goal of "Innovation for Sustainable Growth and Quality Jobs") and NSF investment priorities (NSF Strategic Plan, September 2006).
- The program portfolio is aligned with the five program-specific strategic goals and the 20 objectives.
- The "bottoms up' approach to the solicitation of ideas from the public increases the likelihood of successful fundamental and transformative projects.
- The program portfolio has an appropriate balance of awards relative to: size; single and multiple investigators; new and seasoned investigators; geographical distribution of investigators; disciplinary, interdisciplinary and multidisciplinary projects.
- The overall quality of funded projects is high, with many projects showing potential for fundamental knowledge to be advanced, and transformative outcomes to occur.
- Success of IIP investments will be demonstrated by whether new technologies are discovered and nurtured such that new industries and jobs are created.
- The Highlights and Stars statements illustrate that strong partnerships exist as a result of IIP investments, and that the potential exists for new and vibrant businesses to emerge, for new jobs and economic growth to occur, and for substantial societal benefits to be realized.
- The integrity and efficiency of processes used to solicit, review, recommend, document, and justify proposal actions is appropriate.
- The average time from submission to award decision of 6 months is reasonable, although shorter times would be desirable, especially for SBIR/ STTR awards.
- The external review processes (panel and mail) include appropriate considerations of intellectual merit, broader impacts, and commercial potential (SBIR/STTR)

Concerns

- It was difficult for the COV to judge how the IIP portfolio contributed <u>quantitatively</u> to establish the nation as a "global leader in fundamental and transformational science and engineering."
- Appropriate metrics are not yet in place to assess on a continuing basis the outcomes of IIP investments.
- While there is considerable innovation in the award projects, larger budgets and longer time limits could bring different proposals that are potentially more innovative and transformative
- The Program Officers do not seem to have adequate time and resources to manage and monitor funded proposals due to the sheer number of projects and budget considerations, e.g., the on-going concern that travel funds are not available for visiting grantees.

- The Program Officers do not seem to have adequate time for strategic planning, particularly given recent increases in the numbers of submitted proposals.
- Time between award decision to award disbursement should be shortened.
- The COV was not able to see sufficient progress in the very challenging area of increasing diversity and the outcome goal for learning for many proposals.
- The COV was not able to see sufficient progress towards the outcome goal for infrastructure development within the context of grants made.

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

Assessment **The COV recommends NSF improve its assessment methodologies to better demonstrate its broader impact on the nation's long-term economic growth and global competitiveness. IIP can lead these efforts.**

Broadening Participation **The COV recommends NSF development of a plan to increase participation of under-represented groups in all NSF levels and functions, including metrics and goals to measure progress from a baseline condition.**

The COV recommends increasing the quality and diversity of reviewers by adding resources to broaden the pool of reviewers and finding methods and tools to streamline the assembly of review panels.

COV recommends NSF adopt (and explain) the most recent census categories in order to increase the number and type of self-reported responses. (see also A.2 and A.4)

Timeliness of Award Disbursement. The COV commends IIP for achieving their stated goals for time of review and selection. **The COV recommends NSF take the following two steps to shorten the timeliness of award disbursement:**

- The current "dwell time" metric includes "time to decision" but excludes time from decision to disbursement of funds. **The COV recommends tracking the time from proposal submission to disbursement of award funds because this impacts commercialization success.**
- **The COV recommends IIP partner with Contracts and Grants to accelerate the time between award decision and disbursement of funds, particularly in areas where commercial competitiveness is related to faster funding.**

Review Criteria **The COV recommends NSF adopt consistent definitions of "innovation" within the existing "broader impact" review criteria, and emphasize its importance in solicitations and reviews. There is difficulty in evaluating projects within the diverse NSF programs, particularly SBIR, without such consistency.**

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

The COV endorses the NSF goals to double its budget.

The COV recommends IIP continue to investigate methods to find matching funds from partners to further leverage the size of NSF investments.

The COV is aware of increased scrutiny by federal auditors on how universities report the use of NSF/federal funds with regard to faculty pay, particularly during the summer. It appears that disconnect exist between auditors' review,

perception and interpretation of effort reporting and how actually faculty, in the University operational context, spend their time over the course of the year working on federal grants. This issue impacts IIP grantees, and is also impacting other NSF divisions and directorates. **The COV recommends NSF address this issue in a way that does not adversely impact the engagement of faculty in NSF programs.**

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

Preparations Prior to the On-Site COV Meetings. The COV acknowledges and appreciates the efforts made by the IIP staff to provide the COV with information and material prior to and during our meetings. Many of the 2007 COV recommendations for improving the COV review process have been acted upon including early orientation to the COV process via teleconferencing, the use of a common electronic workspace, and the inclusion of graphical summaries of program data.

For future COVs **the COV recommends that all relevant information about the IIP programs be included in the electronic workspace or sent directly to the members including solicitations for the various programs, prior COV reports, and IIP responses, and summary data about commercialization outcomes.** We would note that the Sharepoint server was occasionally difficult to navigate and use.

The COV recommends the expanded use of teleconferencing and working groups prior to the onsite meeting in order to allow fuller discussions about the strategic direction of the IIP at the meeting and to enable the committee to spend more time addressing questions with the program managers and the Division Directors.

The COV recommends IIP continue to invite COV members to grantee conferences as this allows the COV to evaluate the post grant program management process. The COV recommends IIP establish the COV membership farther in advance as this will allow easier scheduling of attendance at these conferences.

The COV recommends more information be provided on the process used to create solicitations.

Agenda During the On-Site COV Meetings **The COV recommends the on-site COV meetings start with a short review by the IIP Division Director of the IIP strategy, mission, and vision, along with a discussion of progress to date, current status, and future plans and key challenges facing IIP.**

COV Membership **The COV recommends additional continuity of membership from one COV to the next.**

Assessment Methodologies for Section B To improve the ability of future COVs to assess the outcomes of IIP investments, the COV recommends:

- **The next COV should be given appropriate access to the assessment databases currently in development to better assess IIP outcomes.**
- It was surprisingly difficult to differentiate the Stars from the Highlights. **The COV recommends better definition on what constitutes a "Star", and clear articulation of those Stars that represent the best investment of taxpayer funds.**
- In future COVs, **the COV recommends IIP reach back farther than 3 years when communicating "Super-Stars" to allow the identification of commercially successful projects.**

COV Report Template The COV Core Questions and Report Template is a "one size fits all" approach. **The COV recommends COV templates be customized based on division and program missions.** Such templates could be more effective for the COV to provide targeted feedback. For example, **the COV recommends updating/modifying the report template for Section A.4.2 to include, "Responsiveness of the program to emerging needs for innovation and partnerships."**

Future Responses to this COV The COV felt the response to the 2007 SBIR COV Report was qualitatively detailed, but lacked quantitative details or hard metrics. **The COV recommends future responses include more measurable outcomes, such as time to disbursement of funds, and participation underrepresented groups among panels and grantees, jobs created, or other metrics selected by IIP leadership to support their mission and vision.**

SIGNATURE BLOCK:

_____

For the [Replace with Name of COV]

[Name of Chair of COV]

Chair