MEMORANDUM
DATE: December 15, 2005
TO: Bernice Anderson**,** Senior Advisor on Evaluation
                   Directorate for Education and Human Resources
FROM:
SUBJECT: COV for IGERT
                   COI and Diversity Memo

The Committee of Visitors report for the Integrative Graduate Education and Research Traineeship (IGERT) Program was approved at the EHR Advisory Committee meeting held at NSF on November 2-3, 2005. The COV consisted of five members selected for their expertise related to the goals of the program. They provided a balance with respect to the type of institutions supported through the program, gender, and representation from underrepresented groups. The following table shows the main features of the COV's diversity.

Category of COV Membership	No. of COV Members in Category
Member of EHR Advisory Committee………….	………….
Institution Type:	
❑ University…………………………………	5
❑ Four-year College………………………	0
❑ Two-year College………………………	0
❑ K-12 School or LEA……………………	0
❑ Industry………………………………..	0
❑ Federal Agency…………………………	0
Location	
❑ East…………………………………………..	2
❑ Midwest/North …………………………	2
❑ West………………………………………….	…………
❑ South…………………………………………	1
Gender	
❑ Female……………………………………….	4
❑ Male………………………………………….	1
Race/Ethnicity	
❑ White…………………………………………	3
❑ Black…………………………………………	1
❑ Hispanic…………………………………..	1
❑ Asian…………………………………………	0
❑ Pacific Islander…………………………..	0

The COV was briefed on Conflict of Interest issues and each COV member completed a COI form. COV members had no conflicts with any of the proposals or files. (or, if they did, use 'Proposals and files were not available to COV members in those cases where the member had a COI and members were not allowed to participate in discussions of actions with which they had conflicts.')

2005 COV Report---IGERT

Respectfully submitted by:

Victoria Rodriguez
University of Texas, Austin

Costel Denson
Costech Technologies, LLC

Ron Atlas
University of Louisville

Christina Gabriel
Carnegie Mellon University

Sally Mason, Chair
Purdue University

Submitted: 15 August 2005

CORE QUESTIONS and REPORT TEMPLATE
for
FY 2005 NSF COMMITTEE OF VISITOR (COV) REVIEWS

Guidance to NSF Staff: This document includes the FY 2005 set of Core Questions and the COV Report Template for use by NSF staff when preparing and conducting COVs during FY 2005. Specific guidance for NSF staff describing the COV review process is described in Subchapter 300- Committee of Visitors Reviews (NSF Manual 1, Section VIII) that can be obtained at http://www.inside.nsf.gov/od/gpra/.

NSF relies on the judgment of external experts to maintain high standards of program management, to provide advice for continuous improvement of NSF performance, and to ensure openness to the research and education community served by the Foundation. Committee of Visitor (COV) reviews provide NSF with external expert judgments in two areas: (1) assessments of the quality and integrity of program operations and program-level technical and managerial matters pertaining to proposal decisions; and (2) comments on how the results generated by awardees have contributed to the attainment of NSF's mission and strategic outcome goals.

Many of the Core Questions are derived from NSF performance goals and apply to the portfolio of activities represented in the program(s) under review. The program(s) under review may include several subactivities as well as NSF-wide activities. The directorate or division may instruct the COV to provide answers addressing a cluster or group of programs – a portfolio of activities integrated as a whole – or to provide answers specific to the subactivities of the program, with the latter requiring more time but providing more detailed information.

The Division or Directorate may choose to add questions relevant to the activities under review. NSF staff should work with the COV members in advance of the meeting to provide them with the report template, organized background materials, and to identify questions/goals that apply to the program(s) under review.

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. It is important to recognize that 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.

FY 2005 REPORT TEMPLATE FOR
NSF COMMITTEES OF VISITORS (COVs)

Date of COV 7/28-29/05	
Program/Cluster: IGERT	
Division: DGE	
Directorate: EHR	
Number of actions reviewed by COV[1]: Awards: 40 Declinations: 40 Other:	
Total number of actions within Program/Cluster/Division during period being reviewed by COV[2]: Awards: 46 Declinations: 116 Other:	
Manner in which reviewed actions were selected: Random	

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 procedures. Provide comments in the space below the question. Discuss areas of concern in the space provided.

| QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCEDURES	YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE[3]
1. Is the review mechanism appropriate? (panels, ad hoc reviews, site visits) Comments: *The use of pre-proposals that may or may not be invited for full proposal development appears to be an effective way of triaging the number of full proposals to a more manageable size. The multi-tiered review process, using review panels and the ICC, provides another means of managing the portfolio effectively. The review mechanism is exemplary.*	**YES**

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[1] To be provided by NSF staff.
[2] To be provided by NSF staff.
[3] If "Not Applicable" please explain why in the "Comments" section.

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	YES
2. Is the review process efficient and effective? Comments: *Despite the large number of pre-proposals and the length of the eventual full proposals, the subsequent thoroughness of the review process is laudable. Our concerns are twofold: (a) The large number of pre-proposals results in considerable disappointment among principal investigators when an invitation to submit a full proposal is not forthcoming. (b) It appeared that constructive feedback to PIs who were not invited to submit full proposals was not leading to either improved resubmissions, or in the case of feedback to those submitting full proposals, flaws were repeated.* ***Suggestion 1: The program management team might discuss whether it would be possible to pare down the number of full proposals that are submitted for full review and/or provide more directive feedback to PIs at each level of the review stage.*** *Note: In the most recent proposal jackets that were examined, it appeared that more careful reviews were indeed being provided to the PIs. So this issue may be moot thanks to the new leadership.* ***Program response: We have already acted on the COV concern that the number of preproposal submissions is very high. This issue was discussed within DGE and at the ICC resulting in a new policy recommendation to restrict institutions to a maximum of four preproposal submissions per cycle. The FY 2006 (under development at the time of this writing) incorporates this new policy.*** ***Current guidelines restrict institutions to a maximum of two full proposal submissions per cycle. The number of full proposals cannot be reduced without imposing further restrictions. The review quality and consistency are being reviewed by DGE and a sub-committee of the ICC].***	
3. Are reviews consistent with priorities and criteria stated in the program's solicitations, announcements, and guidelines? Comments: *As a result of the previous COV suggestions it is clear that reviewers are adhering to the template and thus more fully addressing the NSF criteria as well as the program-specific criteria.*	YES
4. Do the individual reviews (either mail or panel) provide sufficient information for the principal investigator(s) to understand the basis for the reviewer's recommendation? Comments: *See 2 above. The COV noticed distinct improvement in the feedback*	
	YES

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provided to PIs in the most recent proposal jackets. We trust this very positive trend will continue.	
5. Do the panel summaries provide sufficient information for the principal investigator(s) to understand the basis for the panel recommendation? Comments: *Program officers should remain vigilant in ensuring that the individual reviewers' comments are accurately reflected in the panel summaries insofar as panel members are not changing their views from the benefit of discussion. As noted above, when thorough panel summaries are provided, it is clear that feedback is sufficient.* **Program response: Explicit instructions regarding the composition of panel summaries will be given to the panel moderators and panelists during the orientation.**	**YES**
6. Is the documentation for recommendations complete, and does the program officer provide sufficient information and justification for her/his recommendation? Comments: *There are some instances where reviews did not provide full context for a decision, this was especially true for some of the context summaries for proposals that were accepted or declined in opposition to the panel reviews. Once again, in the more recent jackets, much more attention has been paid to being explicit about the reasons for acceptance or declination of a proposal.* **Suggestion 2: The program managers need to continue to emphasize communicating the explicit reasons for accepting or declining a proposal, much as we are seeing in the most recent proposal jackets.** **Program response: With the exception of those proposals that are not funded due primarily to budget limitations, we will continue to enhance the clarity of reasons for action taken..**	**YES**
7. Is the time to decision appropriate? Comments: *The vast majority of all proposals are reviewed within the six-month standard review period.*	**YES**
8. Discuss any issues identified by the COV concerning the quality and effectiveness of the program's use of merit review procedures: *There were no major issues of concern raised about the IGERT merit review process. Indeed, the process is thorough and the current management team is paying careful attention to detail in both the preparation of summary reviews and in providing useful feedback to the PIs.*	

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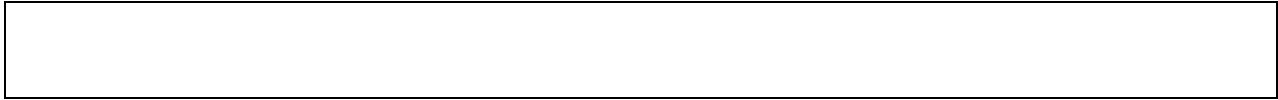
A.2 Questions concerning the implementation of the NSF Merit Review Criteria (intellectual merit and broader impacts) by reviewers and program officers.
Provide comments in the space below the question. Discuss issues or concerns in the space provided.

IMPLEMENTATION OF NSF MERIT REVIEW CRITERIA	YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE[4]
1. Have the individual reviews (either mail or panel) addressed both merit review criteria? Comments: *The COV notes that while this was an issue for the previous COV, it no longer remains as an issue. The program directors have clearly worked hard to make certain that reviewers adhere to the template provided and exercise thoroughness in their reviews.*	**YES**
2. Have the panel summaries addressed both merit review criteria? Comments: *None.*	**YES**
3. Have the *review analyses* (Form 7s) addressed both merit review criteria? Comments: *Again, although the COV only had two years of panel summaries and review analyses to review, there was a clear improvement in the quality of the more recent summaries and analyses.*	**YES**
4. Discuss any issues the COV has identified with respect to implementation of NSF's merit review criteria. *The COV has no issues with respect to implementation of NSF's grant review criteria. However, we do offer one suggestion.* ***Suggestion 3: Now that this program is six years old, it may be appropriate for the program management team, perhaps in consultation with an ad hoc group of advisors, to revisit the program-specific criteria and assess whether adjustments might be appropriate.*** ***Program response: We agree with the COV that it is an appropriate time for revisiting***	

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[4] In "Not Applicable" please explain why in the "Comments" section.

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program-specific issues. Discussions have already begun within DGE and at the ICC and a preliminary analysis & action plan (AAP) will be developed soon outlining the steps forward.

A.3 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[5]
1. Did the program make use of an adequate number of reviewers? Comments: *What impressed the COV are the two levels of external reviews that are applied to proposals before final review by the ICC. This is an extraordinary level of peer review. It is most appropriate for a program like IGERT, which is still in its early experimental years and where awards are typically quite large.*	**YES**
2. Did the program make use of reviewers having appropriate expertise and/or qualifications? Comments: *The COV was further impressed that the NSF was able to assemble a large group of reviewers who were very capable of analyzing these large, interdisciplinary proposals. We know how difficult a task this can be given that proposals ranged from the social sciences to nanotechnology and often combined multiple areas of expertise from extraordinarily diverse disciplines. Particularly notable are the numbers of quality reviewers from various industrial and other private sector organizations. This growing "stable" of reviewers no doubt will continue to serve the IGERT program well for the foreseeable future.*	**YES**
3. Did the program make appropriate use of reviewers to reflect balance among characteristics such as geography, type of institution, and underrepresented groups? Comments*: Again, the COV offers compliments to the program managers for their fine work in this regard. If there was a specific process for selecting this large pool of diverse and well-qualified reviewers, we suggest that the process be shared with other programs within the Foundation.* **Program response: DGE thanks COV for the compliments and shares it with the ICC members and panel moderators.**	**YES**
4. Did the program recognize and resolve conflicts of interest when appropriate?	**YES**

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

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Comments: *None.*	
5. Discuss any issues the COV has identified relevant to selection of reviewers. *See our comments above. We found this to be a particularly impressive feature of IGERT.*	

A.4 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[6], OR DATA NOT AVAILABLE
1. Overall quality of the research and/or education projects supported by the program. Comments: *The IGERT program is effectively a training grant that allows the simultaneous development of research and graduate education. It provides the stability and opportunities for students to explore emerging fields. It advances the modes of delivery of graduate education while allowing the exploration of frontier areas of research. The mandate for multidisciplinary programs is critical for providing and educational experience that will allow the entry of the students into the global marketplace.* *The overall quality of the projects in IGERT proposals is outstanding; the standards maintained within the IGERT program are clearly consistent with those across the Foundation. Given the highly experimental and interdisciplinary nature of the IGERT program, we find the quality factor to be most impressive.*	**APPROPRIATE**
2. Are awards appropriate in size and duration for the scope of the projects? Comments: *IGERTs are large, multi-year awards as they should be for a training grant.* ***Suggestion 4: Another issue for the management team to discuss is whether the size and duration of projects will begin to vary in the future. By the time the next COV is convened, the program will have accumulated a significant track record that will allow better and more longitudinal assessment and may well lead to the necessity of a strategic planning process for IGERT.*** ***Program response: The size and duration of IGERT projects will be considered in the AAP development mentioned earlier.***	**APPROPRIATE**
3. Does the program portfolio have an appropriate balance of: • High risk projects?	**APPROPRIATE**

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

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Comments: *The COV was again impressed by the range of projects, some of which clearly could be categorized as high risk. When the PIs themselves were asked to comment on the high-risk nature of their efforts, the responses were often exceedingly thoughtful and creative. (See nuggets prepared for the COV.)*	
4. Does the program portfolio have an appropriate balance of: • Multidisciplinary projects? Comments: *This is a hallmark of the IGERT program.*	**APPROPRIATE**
5. Does the program portfolio have an appropriate balance of: • Innovative projects? Comments: *There are numerous examples of innovative curricular initiatives and intern opportunities for graduate students that are nontraditional in nature.*	**APPROPRIATE**
6. Does the program portfolio have an appropriate balance of: • Funding for centers, groups and awards to individuals? Comments: *IGERT is all about funding groups and it does that very well.*	**APPROPRIATE**
7. Does the program portfolio have an appropriate balance of: • Awards to new investigators? Comments: *An IGERT is all about funding for graduate students, and rarely can a new investigator lead such an effort. However, within the large groups involved in IGERTs, there are a number of early career faculty who are benefiting tremendously from both access to very fine graduate students, interactions with the senior members of the IGERT leadership teams, and participation on the leadership teams within this program.*	**APPROPRIATE**
8. Does the program portfolio have an appropriate balance of: • Geographical distribution of Principal Investigators? Comments: *The award distribution appears to be typical of most NSF programs. However, we note a scarcity of awards particularly in the central plains EPSCoR states. Indeed, it appears that the only states that are not*	**APPROPRIATE**

showing evidence of successful IGERT initiatives are all EPSCoR states.

Clearly, program managers are paying attention to this fact. In at least one case, a proposal was noted to have come from an EPSCoR state and this appeared to be a factor in the ultimate positive funding decision.

Suggestion 5: As the EPSCoR management team is in the process of considering what the future composition of its programs might be, it may be worthwhile to explore whether a co-funding mechanism between IGERT and EPSCoR might be possible.

Program response: In the existing model EPSCoR occasionally provides first year funding for one or two IGERTs upon recommendation of DGE and availability of funds. Further strengthening the partnership with EPSCoR is certainly of interest to us and will be explored.

9. Does the program portfolio have an appropriate balance of: • Institutional types? Comments: *The portfolio includes every type of institution from Tuskeegee and Southern Mississippi to Harvard and Michigan. Also included are partnerships between institutions such as Vanderbilt/Fisk and Michigan Tech/Southern.*	**APPROPRIATE**
10. Does the program portfolio have an appropriate balance of: • Projects that integrate research and education? Comments: *Again, this is what IGERT is all about.*	**APPROPRIATE**
11. Does the program portfolio have an appropriate balance: • Across disciplines and subdisciplines of the activity and of emerging opportunities? Comments: *The range of disciplines and sub-disciplines represented in IGERTS is vast. In many cases, the research and internship opportunities for the students placed them very prominently at the frontier of an emerging technology or endeavor.*	**APPROPRIATE**
12. Does the program portfolio have appropriate participation of underrepresented groups? Comments: *This continues to be an area of concern, as it is in many places and programs nationally. In some cases, good progress and efforts are being made in this regard. The Abt Associates report discusses this issue in depth*	**APPROPRIATE**

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and offers some suggestions. Clearly some sites are doing better than others in this regard, and a thorough examination of the reasons for success and whether some practices may be translatable should be undertaken. ***Suggestion 6: We believe that continued vigilance and more and/or different efforts need to be made to improve in the area of underrepresented participation. There are clear efforts being made to address this issue and we encourage these to continue.*** ***Program response: Agree. A diversity sub-committee of the ICC was established last year. This sub-committee has developed a first set of recommendations that are being incorporated in the 2006 solicitation. We will continue to develop and explore new ideas for broadening participation of underrepresented minorities, women and people with disabilities in IGERT projects. Strategies to work closely with HRD, AGEP, LSAMP, etc., will be explored in the AAP.***	
13. Is the program relevant to national priorities, agency mission, relevant fields and other customer needs? Include citations of relevant external reports. Comments: *Many of the programs that are embedded within IGERT grants are cutting edge and reflect national priorities. The students trained on these grants are anticipated to be leaders in their fields; they are intended to be nationally and globally prepared to join the workforce at a very high level even right out of graduate school.*	**APPROPRIATE**
14. Discuss any concerns relevant to the quality of the projects or the balance of the portfolio. *From the comments in the sections above, it should be clear that the COV is much impressed by the quality and balance of the IGERT portfolio.*	

A.5 Management of the program under review. Please comment on:

1. Management of the program. Comments*: The program is managed very effectively, especially given the complexity of the proposal preparation and review process. It appears that proposals that were managed during the administrative transition of this program were not as well prepared as those since the addition of the two new program managers, who appear to be doing a very fine job.*

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Suggestion 7: There is clearly enough work for two directors, as is currently in place. We urge that this practice be continued, especially if one of the directors is a rotator. This provides excellent continuity and distributes the workload in a more manageable fashion.

Program response: Agree.

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

Comments: The yearly competition is one important way in which IGERT ensures that emerging opportunities are realized. If there is not enough money to do annual competitions, this may seriously impair the responsiveness of IGERT to maintain its reputation as being transformational and cutting edge.

Suggestion 8: Program managers may wish to consult with appropriate advisory boards and/or agency-wide managers on how to deal with the need to balance constrained budgets with emerging priorities. IGERT is an experiment with tremendous potential for driving meaningful institutional change and its progress and evolution need to be managed with great care.

Program response: Agree. The program anticipates the possibility of operating under a flat or declining budget for two years. With the stipend increase (to $30,000/year) mandated by congress two years ago, the flat budget is resulting in fewer students per award. A reduced budget could result in fewer awards per cycle. DGE will work with the EHR leadership on this issue.

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

Comments: *The COV is favorably impressed by the current management of IGERT within the Foundation. We believe that the time is ripe to begin planning for the future, given that such good progress has been made in addressing all of the concerns raised by the initial COV. As we suggest above, it may be time to begin a long-term planning and assessment exercise for IGERT.*

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

None.

PART B. RESULTS OF NSF INVESTMENTS

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

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

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

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

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

Comments: *The IGERT programs are designed to develop "a diverse, competitive and globally engaged workforce of scientists, engineers, technologists and well-prepared citizens." This clearly is a major review criterion and only proposals that have promise for succeeding in this regard are rated highly and funded. The inclusion of real world experiences appears to be an important methodology for preparing students for careers beyond the bounds of academia.*

As pointed out by the Abt report the IGERT program builds on current research on STEM graduate education which calls for graduate programs to increase the versatility (and therefore the career options) of doctoral students, stresses the importance of interdisciplinary work, and suggests

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programmatic improvements (such as exposing students to a broad base of state-of-the-art research tools and methodologies, providing instruction in ethics, and fostering an international perspective. The 100 IGERT projects funded through 2002 average 15 trainees per project. Students from minority groups underrepresented in STEM fields (African American, Native American, and Hispanic) constitute 9% of trainees, and women constitute 35% of trainees.

Reports from the site visits indicate that IGERT trainees are virtually unanimous in reporting that their IGERT projects provide them with a much broader, more interdisciplinary education than they would have received in a traditional program. Students report valuing the "real world" problems being addressed in some IGERTs, and almost uniformly report feeling well positioned to enter the job market—whether in Academia or in other venues.

The examples cited below were all extracted from the Abt Associates impact study:

- *94% of IGERT PIs, and 72% IGERT department chairs, report that they can recruit more students because of IGERT.*

- *85% of IGERT PIs, and 72% IGERT department chairs, report that they can recruit better academically qualified students because of IGERT.*

- *49% of IGERT PIs report that their IGERT grant has led to increased interest among undergraduates in pursuing STEM fields.*

- *More IGERT students (83%) than non-IGERT students (57%) feel that they have developed the ability to communicate and work on research projects with researchers from more than one discipline.*

- *IGERT students (74%) are significantly more likely to have received formal training in the responsible conduct of research (ethics) than non-IGERT students (39%).*

- *IGERT students (58%) are also significantly more likely to have received formal training in "state-of-the-art instrumentation" than non- IGERT students (37%).*

- *IGERT students are somewhat more likely than non- IGERT students to have received training in professional speaking or presentation skills (51% versus 42%) or in communicating to the general public (31% versus 20%). They are equally likely to have received training in professional writing (36% versus 32%).*

- *IGERT students are more likely (77%) than non-IGERT students (66%) to report having worked within the US with scientists of other nationalities.*

- *IGERT students (71%) are significantly more likely than non- IGERT students (47%) to receive opportunities to conduct research, work, or study off campus as part of their graduate program.*

- *More IGERT students (42%) than non-IGERT students (27%) report that they have had research interactions (other than internships) with industry professionals or with government of other public sector professionals.*

- *IGERT students (29%) are twice as likely as non-IGERT students (15%) to have participated in an internship as part of their graduate program.*

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- As a result of these and other experiences, more IGERT students (63%) than non- IGERT students (44%) believe that they are being "prepared for a wide range of career possibilities."

The faculty leading the IGERT programs are paying particular attention to the goal of improving the diversity of trainees. As examples:

- *The faculty members participating in the University of Washington IGERT on "Multinational Collaborations on Challenges to the Environment" include several women (about one-third) and eight individuals who are Asian-American, Hispanic and African-American.*

- *The IGERT at Rutgers on "Integrative Education and Research on Biointerfacial Engineering" includes a number of innovations, such as the 'Trainee Advisory Board,' and 'Graduate Survival Skills for the 21st Century,' that will prepa2re students for diverse careers.*

- *The Vanderbilt/Fisk IGERT interaction merges the traditional strengths of minority students from HBCUs (recruiting and mentoring) with the facilities and environment of a research university. A reviewer comments that this represents an "excellent balance between curriculum development, research, and under-represented minority recruiting."*

- *Five of the 16 (31%) IGERT trainees appointed in the IGERT at the University of South Florida have been from underrepresented groups (African-American or Hispanic), while 7 of the 16 (43%) have been women. The PI's goal for this project is to achieve 50% of the trainees to be from underrepresented groups.*

- *Increasing representation of women and minorities in science and engineering, which is an important component of the IGERT program at the University of Delaware, is reflected in the participation of 10 women and 4 African-Americans among the participating faculty and 12 women and 2 African-Americans among the current students.*

- *More than half the students in the IGERT at CUNY are female, and numerous female faculty, often in senior positions, serve as role models. Several students are members of minority groups, and the program is constantly trying to recruit additional minority students by a variety of methods.*

Clearly, the influence that IGERT has had on the "People" outcome goal is broad and significant.

Suggestion 9: We urge the program directors to consider developing a set of "best practices" for People development that can be shared among institutions. Such practices could include how to recruit and retain underrepresented groups to STEM fields and how to provide training experiences that allow students to enter the global marketplace.

Program response: Abt Associates have been contracted to conduct an "impact of IGERT" study. The final report will be made available to DGE in early 2006. We will consider developing a follow-up strategy that will include the COV suggestion.

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

Comments: *Within the context of the IGERT proposals that were reviewed, nanotechnology and sustainable environments stand out as two key frontier issues that are being addressed across*

broad elements of this program. The merging of cutting edge disciplines, such as within life sciences and engineering and across the social and physical sciences, is also well represented by the efforts outlined in IGERT proposals.

Perplexing questions of a scientific, engineering, and societal nature have been raised around the uncertain effects of nanotechnology on human kind. IGERT has addressed this issue by providing funding to a wide array of partnering institutions, most notably involving those classified as HBCUs--- Tuskegee, Vanderbilt/Fisk. The inclusion of other institutions, such as Drexel and the University of California at Berkeley, shifts the focus from institutions that do not specifically involve HBCUs to ones with different kinds of alliances. The Drexel/University of Pennsylvania partnership involves two universities whose campuses are contiguous and who developed a strategic alliance through their joint Nanotechnology Institute, which was funded through a $10.5 M grant from the State of Pennsylvania. The IGERT grant to UC Berkeley involves a national lab, a local company and an international institution. Interestingly, the Berkeley grant involves underrepresented students who will matriculate at Berkeley, as opposed to the case of partnering with a minority institution.

Global concerns related to the sustainability of world resources (where environmental, industrial and societal issues are interwoven) are best addressed by multinational collaborations. This emphasis requires both a broad spectrum of talents and a multinational focus. An IGERT grant to the University of Washington has met this need with a project entitled, "Multinational Collaborations on Challenges to the Environment". This institution has for some time had collaborations with institutions around the world, including in countries such as China, Japan, New Zealand, Namibia, South Africa, Viet Nam, and Mozambique.

A grant to the partnership involving Michigan Tech and Southern University, Sustainable Futures Model, combines cutting edge environmental, industrial and societal issues important to sustainability. An important aspect of this partnership is that it involves underrepresented minorities.

Suggestion 10: The nature and importance of the IGERT projects described here indicate the need for significant interaction with the national and global industrial sector. We urge the Foundation to direct the PIs, where appropriate, to be certain that industry partners are well represented on individual IGERT advisory boards.

Program response: There is a significant interaction with industry in many IGERT projects via advisory boards, student internships, and research. The panels seek out opportunities to comment and advise PIs to establish / sustain industry linkages. The program agrees with the COV suggestions and will continue to emphasize the importance of industry partners and panelists.

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

Comments: *The 2002 COV emphasized that this is not a key feature of IGERT. A review of the jackets by the 2005 COV indicates that this continues to be the case; the focus is clearly on research and teaching.*

Suggestion 11: It may be beneficial to applicants to clarify what exactly is meant by "tools." At present the indication is that these refer to facilities and other infrastructure, which leads applicants to include in their proposals requests for equipment (computers, microscopes). The COV agreed that this is a broad concept that in many ways is tied to innovation, and that tools such as new courses, videoconferencing, and web-based instruction and research

should be encouraged and are legitimate examples for the "Tools" goal.

Examples from the nuggets produced by IGERT PIs :

"The education of our graduate students uses vehicles (journal clubs, group meetings, lab rotations) that are completely foreign to the traditional disciplinary training in Mathematics" (University of Utah).

"Students all have to attend a two week "boot camp" where they are trained in perception and psychophysics, human learning and development, machine learning, computer vision, and fMRI, with lab exercises, and a week long project out of their home area… we are the only institution I know of that has integrated the study of vision and learning in this way – we not only cross the boundary between vision and learning, but between humans and machines" (University of California, San Diego).

"The key elements of the inter-center/department education and training program are 4-5 new courses (multipurpose seminar course, overview course, sensor technology, nanotechnology and membrane science and technology); an interdisciplinary curriculum; an interdisciplinary advisory team for each student with faculty and an external mentor; dedicated research at two or more centers; industry internships and national/international internships at national laboratories; travel to national and international meetings; and tours and visits to research labs in the U.S. and abroad" (The Ohio State University).

"Research-wise, our student projects have the goal of developing novel technologies that have not been seen previously. Educationally, we are implementing team-taught courses as well with faculty from differing departments and co-advising by faculty from distinct disciplines. This has never been done before here at USF! Additionally, we have established new programmatic activities that have strengthened the interdisciplinary direction of student research-training at USF (e.g. Annual Interdisciplinary Research Poster Symposium)" (University of South Florida).

"We have designed new team based research courses and require students to form graduate committees that have a strong interdisciplinary flavor. In addition, students sponsors are required to give something back to the program" (Colorado State University).

"We have also established two semester-long laboratory courses for PhD students, which is very unusual" (CUNY).

"We have implemented unique programming elements such as an annual retreat, where trainees present their research in an informal setting; and a series of non-technical seminars, whose topics have included grant writing and intellectual property" (Drexel University/University of Pennsylvania).

"Many programs at the intersection of art and engineering merely use science as a tool to create art. Our program aims one step further: namely, to facilitate novel research in all areas involved. There are only a handful of media research programs in the nation, and few, if any of them, also incorporate geography, psychology, or engineering as fully as we do" (University of California, Santa Barbara).

Program response: We fully agree with the COV's broader interpretation of tools and their important role in the increasingly "flattened" world we live in. We will use formal and informal ways to communicate this interpretation to the IGERT community.

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

Comments: *Since the last COV, leadership and management changes have been made by NSF that have clearly improved the organizational effectiveness of the IGERT program. The most recent proposal and award jackets reviewed by this COV indicate that there is now stronger management of the review process as well as more thorough and substantive documentation of actions taken. DGE has also clearly become more actively engaged to improve program oversight and financial management. Currently, two program directors are assigned to IGERT, one of whom is a rotator. This team approach, combining a fresh, external-community perspective with important institutional memory, appears to serve the program and the community well.*

The active role that the ICC plays in proposal review as well as portfolio management is a valuable complement to the panel review process. IGERT has used the ICC effectively to help provide the breadth and depth of participation required from across the Foundation to implement the mission of IGERT. The COV applauds the current program directors for beginning to provide more complete documentation in proposal and award jackets about the ICC's role and the rationale for award recommendations made by DGE. In particular, the current practice of providing a separate context statement as well as a thorough review analysis are important steps. Drawing upon this information in developing feedback and guidance for proposers will help principal investigators understand individual decisions and, if they receive a declination, improve their ability to develop successful IGERT proposals in the future.

As is true with many NSF programs, proposal pressure is intense for IGERT and this problem is likely to grow worse with time even if funding levels do not remain constant. There is no obvious or easy solution to this problem, but the COV urges NSF to continue to experiment with ways to encourage innovative, high-quality proposals while also preventing the excess of wasted effort throughout the community in nonproductive proposal preparation that results when success rates are very low.

Because IGERT is a large, high-profile program that embodies many of the core elements of NSF's mission, innovations in program management, portfolio management, financial management, outcomes assessment and evaluation can become models for other NSF programs. The COV encourages IGERT and DGE to continue and even deepen the active engagement they have across NSF in order to learn, share and disseminate best practices in the management of integrative activities.

Program response: Increasing cooperation and collaboration with other directorates of NSF is an EHR goal and DGE will continue to be collaborative and seek opportunities for deepening engagement.

NSF FY 2005 CORE QUESTIONS FOR COVs

PART C. OTHER TOPICS

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

The COV was impressed by the thoroughness of the initial COV review of this program three years ago. Not only was this first review thorough and thoughtful, but the response by the program management team was equally thorough and thoughtful. Thus, with only two years of proposals to review since the last COV, and with the program still in the early and exciting formative stages, most of our suggestions are forward looking. This reflects the excellent state of management that IGERT currently enjoys and the effectiveness of the adjustments made in the wake of the initial COV review.

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.

As currently defined, the program is meeting the program-specific goals very well. Thus, we suggest that now may be an opportune time to reassess whether the current goals and objectives need to be expanded or changed in any way. This type of exercise requires input from the many interested constituents both internal and external to the NSF. It should not be an exercise that results in change simply for the sake of change, but only after careful analysis and extensive consultation. We believe that by the next COV (three years hence), questions about program performance will become far more relevant than they are at this young stage of the program. Now is the time to anticipate and plan for that eventuality.

In anticipation of the need for both future evolution of the program and for assessment with regard to outputs and outcomes, we suggest that now is the time to begin collecting metric data on such things as attrition, time to degree completion, career placement and other indicators of the effectiveness of graduate education.

An impressive feature of IGERT is that it recognizes the traditions of training students in STEM disciplines but couples that with the broader needs to instill cultural and ethical values in students that are a reflection of the experiences that they will have as members of a global workforce.

Program response: We agree with the COV that a strategic planning exercise for IGERT will be very useful and we are beginning to plan for it within DGE and discussing with the ICC.

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

The one area of concern that involves an agency-wide issue continues to be the issue of participation of underrepresented groups. As we note earlier in this report, we must remain vigilant in exploring every possible means for enhancing the broader participation goals of the Foundation.

Program response: We agree with the COV comment and are continuously exploring ways by which NSF's broadening participation goal is reflected in the IGERT program. For example, the upcoming (FY 2006) solicitation has new features that promote the participation of underrepresented minorities and women.

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

We applaud the management team for contracting with a consulting group to begin longitudinal assessment of IGERT. The Abt Associates impact study report can provide substantial information for future planning. It is hoped that as the impact study continues to evolve that the cumulative work product will help direct the future planning for IGERTs.

Were a strategic planning group to consider the future of IGERT, they might be asked to consider the following questions.

- *Should IGERT become a more focused or targeted program?*
- *Should more awards of smaller size be made? Or conversely, should awards continue to grow in size and potentially in prestige?*
- *Do IGERT trainees fully appreciate the nature of the positions they hold? If not, what efforts should be made to acknowledge the very special nature of these students?*
- *Has sustainability been achieved for elements of the IGERT programs? When do we/will we know when a true institutional culture change has been achieved?*
- *Are there elements of particular IGERT projects that are especially effective and can they yield some best practices that are fully translatable?*
- *And finally, can we meet the challenge of broadening participation with regard to underrepresented groups within a reasonable time frame and across the variety of institutions that hold IGERTs?*

Program response: We thank the COV for its comments and for outlining issues such as the ones stated above for consideration by a future strategic planning group.

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

Several members of the COV have participated in this process before for other programs. The help and information provided to us was outstanding and is an exemplary model of how a COV should function. The level of detail and the materials made available to the committee beforehand contributed to our efficient production of this report. We are extremely grateful to the management team for their hard work and obviously significant efforts to facilitate our work. The Foundation is fortunate to have this talented and dedicated group of individuals within the EHR.

SIGNATURE BLOCK:

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For the IGERT COV
Sally Mason
Chair