Evaluation of the NSF DEB and IOS Switch to Preliminary Proposal Review: Final Report

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Executive Summary

In 2012, the Divisions of Environmental Biology (DEB) and Integrative Organismal Systems (IOS) in the Biological Sciences Directorate (BIO) at the National Science Foundation (NSF) made three changes to the review of proposals to core programs. These included: a limit on the number of proposals that Principal Investigators (PIs) can submit per cycle, a new requirement for a preliminary proposal, and a switch to an annual submission deadline. The intent of these changes was to reduce researcher and NSF staff workload, increase funding rates for full proposals, and improve the quality of reviews - while preserving the diversity of the grant portfolio.

Three years after the new process took full effect, NSF contracted with Abt Associates to systematically examine whether the desired outcomes have been achieved and to gauge participant satisfaction. The study drew on three sources: administrative data on submitted proposals, surveys of recent applicants and reviewers, and interviews with NSF staff at DEB and IOS. Using administrative data, comparisons were made for the applicant, reviewer, and proposal characteristics three years before and three year after the switch in review. To isolate the changes associated with the new process from those occurring independently at NSF, the DEB and IOS core programs were compared to a sample of nine non-participating programs in biological sciences (hereafter, the "comparison group").

The evaluation found mixed evidence that changes to the review process had furthered the intended goals. Specifically, the findings indicated:

- **No effect on portfolio diversity.** Administrative data revealed that the change in review had little effect on the characteristics of funded PIs including gender, number of years since terminal degree, and prior history of NSF funding. Similarly, we found either no or positive changes in institutional diversity, percentage of collaborative projects, and reviewer and applicant interdisciplinarity. All trends were similar between DEB, IOS, and the comparison group. While some NSF staff noted in the interviews that interdisciplinary projects could have been disadvantaged by the new process, these concerns were not borne out by the available data.

- **Significant improvement in funding rates for full proposals.** Funding rates for full proposals doubled for the DEB and IOS core programs (from 15-17% to 28-34%), while declining for the comparison group (from 18% to 15%). These improvements occurred because approximately 75% of preliminary submissions do not proceed to the full proposal stage.

- **Applicant satisfaction with the submission process in a negative to weakly positive range.** Based on the survey data, applicants to the DEB and IOS core programs were dissatisfied with the switch to a single submission deadline per year (scores of 1.6 to 2.2 on a 5-point Likert scale, where 1 was very unsatisfied and 2 unsatisfied). The ratings for the preliminary proposal requirement, the limit of two proposals per PI, the timing of the preliminary proposal deadline, and the amount of time to prepare preliminary and full proposals were in the neutral to weakly positive range (2.8 to 3.5, where 3 was neutral and 4 satisfied). Funded DEB and IOS applicants were significantly less satisfied than the comparison group with the submission process overall (3.2 to 3.3 versus 3.9).

- **Preference for longer preliminary proposals and shorter full proposals.** Applicants and reviewers expressed a consistent preference for a 5-page limit for preliminary proposals and a 12 to 14-page limit for full proposals (compared to the current 4- and 15-page limits). Some NSF staff also commented that preliminary proposals could be longer, especially for complex projects.

- **Possible improvement in the quality of full proposals.** The NSF staff interviewed were in agreement that the new process led to better proposals. This view was supported by administrative data, which showed that scores for full proposals (funded and unfunded combined)

have improved at DEB and IOS (from 3.6-3.7 to 3.9), while declining slightly, although not significantly, for the comparison group (from 3.6 to 3.5). We found no differences in funded proposal scores and small differences in reviewer perception of proposal quality.

- **Satisfaction with quality of review in the positive range.** Reviewer satisfaction with the quality of review was between 3.5 and 4.5 on a 5-point scale and was similar across the DEB, IOS, and comparison group respondents. Applicant satisfaction was in the 3.0 to 3.5 point range for the unfunded and 3.5 to 4.0 range for the funded group. For funded applicants the ratings were similar across DEB, IOS, and comparison programs. Between 60% and 90% of the applicants, depending on the group, said that reviewer comments were somewhat or very helpful for developing a full proposal or for a resubmission. Most NSF staff believed that the review process remained rigorous and fair, although some conerns were expressed about gaps in prelimnary panel expertise and feedback provided to the applicants.

- **Mixed effect on workload.** Administrative data indicated that the number of proposals per Program Officer at DEB and IOS has increased by 96% and 56%, respectively, versus 16% for the comparison group. Most NSF staff interviewed reported that their proposal-associated workload has not changed or declined slightly, although some noted that the amount of work was uneven and could be overwhelming during the preliminary review period. We are uncertain how to reconcile these findings.

The workload for the applicant community has increased by a much larger margin for DEB and IOS than for the comparison group: by 36% and 16% versus 2%. In contrast, the workload for reviewers was reduced by 26% for DEB, 18% for IOS, and 24% for the comparison group. It is important to note that between 2009 and 2015 the volume of proposals at DEB and IOS has increased by 40% using a conservative estimate, compared to 2% for non-participating programs.

1.   Introduction

1.1   Background and Study Objectives

In 2007, the National Science Foundation (NSF) documented a possible erosion of its merit review process resulting from an increased number of proposal submissions, flat budgets, and inadequate staffing.[1] The NSF directorates were asked to introduce improvements to the review process that would best meet their individual needs. In response, the Divisions of Environmental Biology (DEB) and Integrative Organismal Systems (IOS) in the Biological Sciences Directorate (BIO) made three changes to the review of proposals funded by core programs (Figure 1). First, a new step was introduced requiring applicants to submit a 4-page preliminary proposal describing their idea and approach. Only the applicants whose preliminary proposals are found the most meritorious by a review panel are invited to submit a full proposal. Second, the semi-annual submission deadlines for full proposals were replaced with annual deadlines for both preliminary and full proposals (in January and August, respectively). Third, the number of proposal submissions was limited to two per Principal Investigator (PI)/Co-Principal Investigator per year. These changes were announced in 2011 and took full effect in 2012.

Figure 1: Review process adopted in 2012 by the Divisions of Environmental Biology and Integrative Organismal Systems
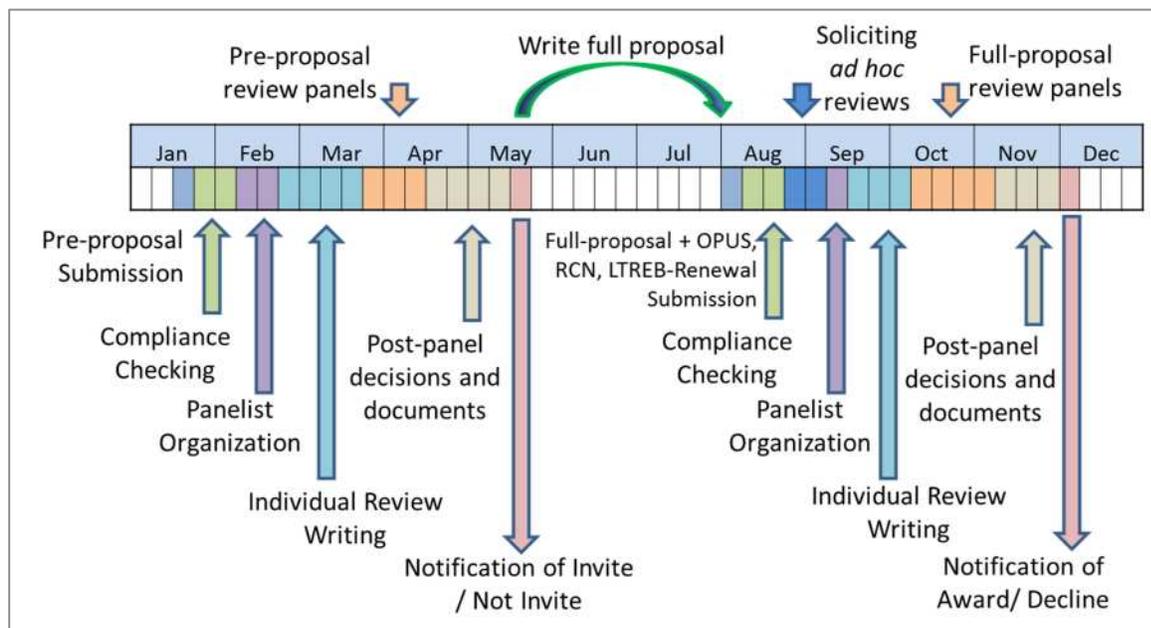
Source: debblog.nsfbio.com/2013/09/26/discussion-deb-review-calendar-part-2-of-2/. Included with permission from NSF.

NSF staff considered the potential benefits and possible drawbacks of the review changes, which were discussed in an internal document[2] and are summarized in Table 1. The benefits included a reduction in the workload for the applicants, reviewers, and Program Officers (POs) and an increase in funding rates for full proposals. At the same time, NSF staff were concerned about the possibility of reduced portfolio diversity, higher grant budgets, and longer times from proposal idea to award. Three years after the changes were enacted, NSF contracted with Abt Associates to systematically examine the outcomes of the new review process.

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[1] Impact of Proposal and Award Management Mechanisms. Final Report. August 2007.

[2] Assessment Plan for Preliminary Proposal Pilot. NSF. Undated.

Table 1: Benefits and limitations of the new review process anticipated by NSF

Anticipated Benefits	Possible Drawbacks
• Reduction in investigator workload due to a pre-screen requiring a short proposal • Reduction in reviewer burden, as fewer full proposals need to be reviewed and there are no ad hoc reviews for preliminary proposals • Improvement in review quality, resulting from higher ratio of reviewers per proposal and fewer proposals per reviewer • Reduction in Program Officer burden, resulting from fewer full proposals to manage • Increased funding rates for full proposals, resulting from a pre-selection step	• Reduction in participation from under-represented applicants and institutions • Reduction in participation from less established investigators or investigators new to NSF • Reduction in the funding for collaborative, interdisciplinary, and high-risk projects • Increase in grant budgets • Increase in the time from idea to award

1.2 Overview of Evaluation Approach

The study included four components:

- Review of administrative data for the DEB/IOS core programs and for non-participating programs in biological sciences. Two sets of comparisons were made: (1) between DEB/IOS and non-participating programs (called the comparison group in this report) and (2) three years before and three years after the change.

- Surveys of applicants submitting proposals in 2015. The following groups were included: (1) funded DEB/IOS applicants; (2) DEB/IOS applicants who were invited to submit full proposals, but were not funded; (3) DEB/IOS applicants who were not invited to submit full proposals; and (4) funded comparison applicants.

- Surveys of reviewers evaluating proposals submitted in 2015. The following groups were included: (1) ad hoc reviewers for DEB/IOS full proposals; (2) ad hoc reviewers for comparison proposals; (3) panel reviewers for preliminary DEB/IOS proposals; (4) panel reviewers for full DEB/IOS proposals; and (5) panel reviewers for comparison proposals.

- Interviews with the NSF Program Officers knowledgeable about the old and new review process.

Outcomes investigated in the study are mapped to performance indicators and data sources in Table 2.

Table 2: Outcome measures and sources of data used in the study

Outcome	Performance indicator	Administrative data	Applicant Survey	Reviewer Survey	NSF Interviews
				Source	
Applicant workload	Hours to prepare pre- and full proposal		✓		
Applicant satisfaction	Satisfaction with workload and review process		✓		
Reviewer workload	Number proposals per reviewer	✓			
	Hours spent on review			✓	
Reviewer satisfaction	Satisfaction with workload and review process			✓	
PO workload	Number of review requests and agreements	✓			
	Number of proposals to manage	✓			
	Time for identifying reviewers and organizing reviews				✓
PO satisfaction	Satisfaction with workload				✓
	Satisfaction with review process				✓
Quality of review	Number of reviewers per proposal	✓			
	Perception of fairness and quality of review		✓	✓	✓
	Usefulness of review to the applicants		✓		
	Review scores	✓			
Success rate	Number of submitted to funded proposals	✓			
Funded portfolio diversity	Distribution of Carnegie classifications	✓			
	Representation of MSU	✓			
	Representation of EPSCoR states	✓			
	Representation of women and URM	✓			
	Number of applicants new to NSF	✓			
	Number of years since terminal degree	✓			
	Number of collaborative proposals	✓			
	Median funded amount	✓			
	Support for high-risk/high-reward proposals			✓	
	Submission of high-risk, interdisciplinary, and collaborative proposals		✓		
Time to award	Time from idea to submission		✓		

1.3   Organization of the Report

The remainder of this report is organized as follows. In Chapter 2 we describe our methodology for administrative data analyses, applicant and reviewer surveys, and NSF staff interviews. In Chapter 3 we present findings from each of these sources, and in Chapter 4 discuss these findings in the context of the benefits and limitations of the new process that had been anticipated by NSF. The report also contains three appendices: Appendix A includes the survey and interview protocols, Appendix B the frequency tables for all survey questions, and Appendix C reviewer disciplinary codes.

2.   Methods

2.1   Analysis of Administrative Data

NSF staff provided us with a FastLane dataset of proposal submissions from 2009 to 2015 for the DEB and IOS core programs, and for the comparison programs (Table 3 describes the analysis sample). Variables used in analyses included reviewer and applicant names, institutions, demographic characteristics, and contact information; reviewer expertise; proposal fields; submission year; proposal type and funding status; number and type of reviewers; program name; budget; and review scores. Institution names in the dataset were standardized to match the Carnegie Foundation Classifications of Institutions of Higher Education.[3] When characterizing reviewer expertise, the following NSF codes were defined as being outside of the biological sciences: 10-21, 30-31, 40-42, 44-45, 49-59, 65, 70-72, 79, 80-92, 98-99 (code names are included in Appendix C).

For each variable, descriptive comparisons were made between the 2009–2011 and 2013–2015 submissions and between the DEB, IOS and comparison programs; 2012 was excluded from the study as the transition year. The programs used as comparisons included: Advances in Biological Informatics, Biological Oceanography, Cellular Dynamics and Function, Genetic Mechanisms, Mathematical Biology, Molecular Biophysics, Plant Genome Research Program Project, Plant Genome Research Program Resource, and Systems and Synthetic Biology. Statistical significance was determined using χ^2 tests for categorical data and F tests for continuous data.

Table 3: Sample sizes included in administrative data analysis

Proposal Status	DEB		IOS		Comparison	
	2009-2011	**2013-2015**	**2009-2011**	**2013-2015**	**2009-2011**	**2013-2015**
Preliminary proposal						
Invited	-	1,114	-	1,344	-	-
Not invited	-	3,598	-	4,458	-	-
Full proposals including non-lead						
Funded	710	503	788	576	1,046	937
Not funded	3,900	1,295	3824	1,126	4,658	5,154
Full proposals excluding non-lead						
Funded	484	330	679	468	890	761
Not funded	2,810	764	3404	901	4,118	4,348

2.2   Applicant and Reviewer Surveys

2.2.1   Sample Construction

Study sample sizes were calculated to achieve a 95% confidence level and a 4% confidence interval, with a 1.66 multiplier to account for an anticipated 60% response rate (Table 4).

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[3] http://carnegieclassifications.iu.edu/

Table 4: Sample sizes included in the survey

	Applicants		Reviewers
Comparison funded	314	Comparison ad hoc	748
DEB funded	165	Comparison panel	378
DEB invited, not funded	346	DEB ad hoc	591
DEB not invited	593	DEB full panel	115
IOS funded	193	DEB preliminary panel	194
IOS invited, not funded	316	IOS ad hoc	609
IOS not invited	634	IOS full panel	170
Total applicants	*2,561*	IOS preliminary panel	285
		Total reviewers	*3,090*

The FastLane dataset described in section 2.1 was used to construct the samples of the desired size. Many individuals had multiple records in FastLane, as both reviewers and applicants and from multiple proposal submissions, and we used the following rules to assign each to a single group:

1. Funded applicants were prioritized over any other status

2. DEB and IOS applicants were prioritized over the comparison group

3. Invited not funded applicants were prioritized over the applicants who were not invited

4. If a PI had a funded proposal from both DEB and IOS, a random assignment was made

5. If an applicant had an invited not funded proposal from both DEB and IOS, a random assignment was made

6. If an applicant had a not invited proposal from both DEB and IOS, a random assignment was made.

To construct the reviewer sample, proposal and reviewer information was merged on Proposal ID. Duplicate entries were found for 16 reviewer/proposal combinations and were removed. Based on the names and emails, 23 reviewers appeared to have multiple Reviewer IDs and these duplicates were resolved. Finally, 454 researchers were both reviewers and applicants. These subjects were removed from the reviewer sample but retained in the applicant sample. As many reviewers participated in multiple reviews, the following prioritization scheme was used to associate each individual with a single proposal:

1. Panel reviews on full proposals

2. Panel reviews on preliminary proposals

3. Ad hoc reviews on full proposals

4. Ad hoc reviews on preliminary proposals.[4]

Reviewers with multiple proposals within these categories were chosen at random.

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[4] Ad hoc reviews for preliminary proposals are not part of the standard review process, but occur in a small number of cases.

2.2.2   Survey Instrument Development

A separate survey instrument was developed for each of the seven respondent groups: (1) applicants from DEB and IOS who completed a preliminary proposal, were invited to complete a full proposal, and were funded (hereafter, "funded" applicants); (2) applicants from DEB and IOS who completed a preliminary proposal, were invited to complete a full proposal, but were not funded ("invited unfunded" applicants); (3) applicants from DEB and IOS who completed a preliminary proposal, but were not invited to submit a full proposal ("not invited" applicants); (4) comparison group applicants who completed a full proposal and were funded ("comparison funded" applicants); (5) full proposal ad hoc reviewers for DEB, IOS, and the comparison group ("ad hoc reviewers"); (6) full proposal panel reviewers for DEB, IOS, and the comparison group ("full panel reviewers"); and (7) preliminary proposal panel reviewers for DEB and IOS ("preliminary panel reviewers"). The instruments are included in Appendix A.

All surveys solicited information about rank, tenure status, and funding history with NSF; perception of proposal risk, collaborative nature, and interdisciplinarity; level of effort to prepare or review applications; satisfaction with the submission and review processes; and recommendations for changes. The applicant survey also included questions about discussions with NSF Program Officers, and the reviewer survey about proposal quality. All items were designed to be as similar as possible across the surveys to allow between-group comparisons.

The surveys were programmed using *FluidSurveys* software and pilot-tested by four Abt and five NSF staff. All glitches identified in the tests were corrected.

2.2.3   Survey Administration

An invitation letter introducing the study and explaining the importance of participation was sent by NSF to all applicants and reviewers in the sample. As a final check, the surveys were pre-released to 75 representative respondents (38 applicants and 37 reviewers). Minor changes were made and the surveys were pre-released to an additional 150 applicants and 150 reviewers. No problems emerged and no further changes were made.

On September 15, 2016 the surveys were released to the remaining 2,373 applicants and 2,903 reviewers. Four rounds of reminders were sent to increase response rates (on September 27, October 6, October 24, and November 3). A reminder was also posted on the DEB blog (DEBrief) on October 15. Each reminder generated a significant influx of new responses. The surveys were closed on November 6, 2016.

A dedicated email account was set up to contact our team while the survey was in the field and we received messages from 8 applicants and 33 reviewers. The majority of these were from ad hoc reviewers who said that they could not recall the experience in sufficient detail to answer the questions. A few additional individuals said that they were currently employed at NSF, and that it might not be appropriate for them to respond to the survey. All 41 individuals were excluded from the sample and did not receive any further communications.

In the first question, respondents were asked to verify whether they had submitted or reviewed the specific proposal or participated on the panel shown to them; those who indicated that they had not terminated the survey. Table 5 shows the number of terminations by respondent group. We checked a random sample of terminations against administrative data and found that all assignments were correct.[5]

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[5] Of the applicants who self-terminated, seven were non-lead PIs on collaborative proposals and one was an initial PI on a proposal that had a PI change.

Table 5: Survey terminations

	Applicants		Reviewers
Comparison funded	2	Comparison ad hoc	57
DEB funded	2	Comparison panel	13
DEB invited unfunded	5	DEB ad hoc	48
DEB not invited	6	DEB full panel	5
IOS funded	2	DEB preliminary panel	0
IOS invited unfunded	2	IOS ad hoc	45
IOS not invited	3	IOS full panel	6
Total	22	IOS preliminary panel	0
		Total	174

2.2.4 Data Processing and Analysis

Preparation of numerical data

Surveys responses were downloaded as SPSS files from *FluidSurveys*. Each dataset was processed using the Automatic Survey Analysis Package (ASAP) before being combined with the remaining surveys. Specifically, ASAP Excel macros were used to code responses, remove responses based on survey skip-logic, and investigate outlier data. Outliers were removed (see details below), and all records with outliers were checked for "bad actors," respondents who may have deliberately entered nonsensical data (none were found). All applicant surveys and all reviewer surveys were combined into two datasets and weights were generated for each set based on the available characteristics (see details below). Finally, ASAP SAS macros were used to generate customized descriptive statistics for each survey question (these tables are included in Appendix B).

Removal of outliers

Inspection of survey data revealed a small number of responses that were implausible, and these observations (outliers) were removed from the dataset. For reviewers we excluded panel sizes of >40, which are impossible due to space constraints at NSF (n=4). For both applicants and reviewers we excluded all workload values that were in the top and bottom 5% of the response distribution. For reviewers, this led to the removal of responses to the question "hours per review prior to panel" that were ≥10 (n=8). For applicants, we excluded: responses to "hours of work to prepare full proposal (comparison group)" that were >480 or <10 (n=22); responses to "hours of work to prepare full proposal (DEB/IOS)" that were >840 or 0 (n=15); responses to "hours of work to prepare preliminary proposal" (DEB/IOS) that were >300 or 0 (n=40).

Adjustment for non-response

A survey response rate of less than 100% creates a possibility that survey respondents are different from non-respondents, known as non-response bias. To examine the possibility of non-response bias, we compared respondent and non-respondent groups on a set of available characteristics including gender, minority status, survey group, degree year (applicants only), field of science (reviewers only), and review type (reviewers only). Table 6 shows that the two datasets were statistically different on at least some of the variables examined. For example, the respondent sample was 51% male compared to 56% for non-respondents (p<.05). To adjust for non-response bias, we weighted all analyses that used survey data, so that respondents who were less likely to complete the survey based on observable characteristics were given additional weight. We generated weights as follows: using the baseline covariates listed above, we stratified reviewers and applicants into their survey groups and predicted the probability of response for each individual participant using logistic regression. The survey non-response weight was defined as the

inverse of the predicted probability that the individual would have responded to the survey. All means for the survey data presented in the report have been weighted to correct for non-response bias. In contrast, sample sizes and standard deviations are unweighted.

Table 6: Characteristics of respondents versus non-respondents to investigate response bias

Variable	Reviewers			Applicants		
	Respondent, percent	**Non-respondent, percent**	**P-value (difference)**	**Respondent, percent**	**Non-respondent, percent**	**P-value (difference)**
Male	51	56	<.05	59	62	NS
Female	30	22	<.05	35	27	<.05
Minority	1	1	NS	8	6	NS
Not minority	40	28	<.05	84	82	NS
Race unknown	59	70	<.05	8	11	<.05

Workload calculations

Total workload for the applicant community was calculated as follows, where N = number of applicants and T = average hours to develop a proposal:

- $\text{Total}_{2009-2011} = [N * T]_{\text{funded}} + [N * T]_{\text{unfunded}}$

- $\text{Total}_{2013-2015} = [N * T]_{\text{invited preliminary}} + [N * T]_{\text{not invited preliminary}} + [N * T]_{\text{unfunded full}} + [N * T]_{\text{funded full}}$

Total workload for the reviewer community was calculated as follows, where N = number of reviewers and T = average hours to review a proposal:

- $\text{Total}_{2009-2011} = [N * T]_{\text{ad hoc}} + [N * T]_{\text{full panel}}$

- $\text{Total}_{2013-2015} = [N * T]_{\text{preliminary panel}} + [N * T]_{\text{full ad hoc}} + [N * T]_{\text{full panel}}$

Statistical analyses

We used t-tests for pairwise comparisons and F-tests for multiple comparisons of the weighted means to calculate p-values across different sub-groups. For applicants we pooled DEB and IOS data and compared those who were invited and funded, invited and unfunded, and not invited; we also compared funded applicants for DEB/IOS and for non-participating programs. For reviewers, we compared DEB, IOS, and the comparison group who participated in the full panel, preliminary panel, and ad hoc reviews. Because of the large number of statistical tests performed, we do not include statistical significance notations in the figures. Instead, the most pertinent significance tests are shown in the footnotes to the figures.

Multiple comparisons adjustment

Statistical analysis of a large number of correlated outcomes across a variety of sub-groups raises the concern of the multiple comparisons problem. That is, when performing a large number of statistical tests on a variety of correlated outcomes, we increase the likelihood of observing statistical significance merely by chance. However, because the goal of the study is the description of the survey outcomes, we present our statistical tests as if they were conducted independently, without applying multiple comparisons adjustments.

Coding of qualitative data

At the conclusion of the survey, the IOS/DEB respondents were asked to suggest one change to the new review process, and 1,094 of 1,646 applicants (66%) and 842 of 1,676 reviewers (50%) submitted a comment. All comments were reviewed to generate a set of initial codes, which were then systematically

applied to these data. As respondents were asked to make a single suggestion in the instructions, only the first item was coded for those comments that included multiple ideas because we assumed that the most desired change will be listed first. This approach was used to avoid giving more weight to the views of some respondents over others. Consequently, the counts presented in the report are meant to give the reader a sense of the relative importance of various proposed changes to the research community rather than to serve as an accurate quantitative measure.

2.3   Key Informant Interviews

NSF provided us with a list of 40 contacts for current and former staff at DEB and IOS who had experience with the review process before and after the change; all were invited for an interview. The list included Program Officers, Division Directors, and analysts/similar staff. Of the 40 subjects invited, 28 agreed to participate and were interviewed between May and August 2016 (Table 7). Eight individuals did not respond to our email requests, two declined to participate citing lack of knowledge, and two could not be reached because their email addresses were inactive. Nine of the respondents were no longer working at NSF.

Table 7: NSF Staff invited and interviewed

Group	Number Invited	Number Interviewed
DEB Program Officers, Division Directors	16	13
DEB Analysts	2	2
IOS Program Officers, Division Directors	14	12
IOS Analysts and similar staff	5	1
Total	*37*	*28*

The semi-structured interview protocol included questions about workload to manage proposal submissions and satisfaction with all steps of the new review process. Respondents were encouraged to contrast the new and old processes and were offered multiple opportunities to elaborate on all the topics being discussed. With respondent permission, the interviews were recorded. The notes were entered into *NVivo* qualitative analysis software and coded based on a set of *a priori* themes consistent with the interview protocol. Because the number of respondents in the sample was relatively small, we identify them only by division to protect their privacy.

2.4   Regulatory Approvals

All data collection instruments and procedures were reviewed by the Abt Institutional Review Board (exemption was granted, Abt IRB #0869). The survey protocols and data collection procedures were approved by the Office of Management and Budget (OMB Control Number 3145-0215).

2.5   Study Limitations

The study had several limitations. First, we documented a non-response bias, and while the data were adjusted based on the available characteristics, respondents could still be different from non-respondents in some unobservable way that is not addressed by the weights. Second, it is possible that some respondents could not fully recall the experience and consequently did not provide correct data. Third, it may have been difficult for respondents to accurately report some information, in particular the time it took them to complete various tasks. Finally, it was clear from the administrative records that many respondents have had multiple roles as reviewers and applicants and they may not have been able to distinguish between these various experiences when responding to the questions.

3. Findings

This chapter is organized around the three study components. First, we present our findings from the administrative data, which provided insight into the diversity of the funded portfolio, funding levels, success rates, burden on reviewers and Program Officers, and review scores. For all analyses, we drew comparisons between the core DEB and IOS programs and a set of similar, but non-participating programs in biological sciences from across NSF. We also compared proposal submissions before and after the change in review. The second section in the chapter describes our findings from the surveys of recent applicants and reviewers for the same sets of programs, including their views on the proposal-associated workload, submission and review processes, and quality of review. Finally, we present the information on the review workload and satisfaction obtained in the interviews with DEB and IOS staff.

3.1 Administrative Data

3.1.1 Diversity of Funded Portfolio

To examine whether the change in review has affected portfolio diversity, we compared proposals funded under the DEB and IOS core programs in 2009–2011 (before the change) and 2013–2015 (after the change) on a set of demographic, institutional, and project characteristics. To distinguish between the changes which may have occurred due to the switch in review from those independently occurring at NSF, we compared the DEB and IOS programs to a sample of non-participating programs in biological sciences (the "comparison group").

We found no significant changes in the representation of women and minorities across the DEB, IOS, and comparison group or over time: approximately 30% of PIs were female and 7% were under-represented minorities (Figure 2A). PI seniority at the time of application, calculated as the mean number of years since highest degree, was also similar across groups and remained largely unchanged at 15 to 19 years (data not shown). The number of new PIs[6] remained statistically the same for the DEB and IOS core programs (26% to 24% and 30% to 28%), but was significantly lower for the comparison group (26% to 22%). In contrast, we observed a significant increase in the representation of collaborative projects for all groups: 55% vs 66% for DEB, 24% vs 34% for IOS, and 23% vs 33% for the comparison group (Figure 2B). We note that according to these data, DEB supports roughly twice as many collaborative projects as the other two groups.

To investigate whether the new process has affected the interdisciplinarity of submissions we used two methods. First, applicants to the programs funded by the Biological Sciences Directorate have an option to assign their proposals to scientific fields outside of biology using a set of codes. We calculated the percentage of funded proposals that included these non-biology codes. The same analysis was not performed for the comparison group because it contained proposals from the NSF directorates that do not collect this information.

We found that 35% of DEB and 33% of IOS proposals three years prior to the review change included an additional field code (Figure 2C). This number declined slightly for both groups, to 32%, but the change was not statistically significant. The most common additional code at DEB was geosciences, chosen by approximately half of the applicants (data not shown). This was followed by mathematics and computer science, selected by roughly a quarter of the applicants, and by chemistry, by 20% (the applicants could choose multiple fields, which is why the totals add up to more than 100%). For IOS, the most common codes were psychology, computer science, chemistry, and engineering, each selected by 20 to 25% of applicants (data not shown).

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[6] A new PI tag in FastLane data indicates that an applicant has not submitted a proposal within the preceding five years.

Interdisciplinarity of grant proposals can also be measured through reviewer expertise, which is indicated in the administrative data. We found that the percentage of reviewers with non-biology expertise increased in all three groups: from 44% to 50% for DEB, 17% to 21% for IOS, and 31% to 45% for the comparison group (Figure 2D). All increases were statistically significant.

Figure 2: Characteristics of funded proposals before (2009–2011) and after (2013–2015) the change in review

A. Demographic characteristics of PIs

B. Collaborative nature of proposals

C. Interdisciplinarity of funded proposals

D. Interdisciplinarity of reviewers
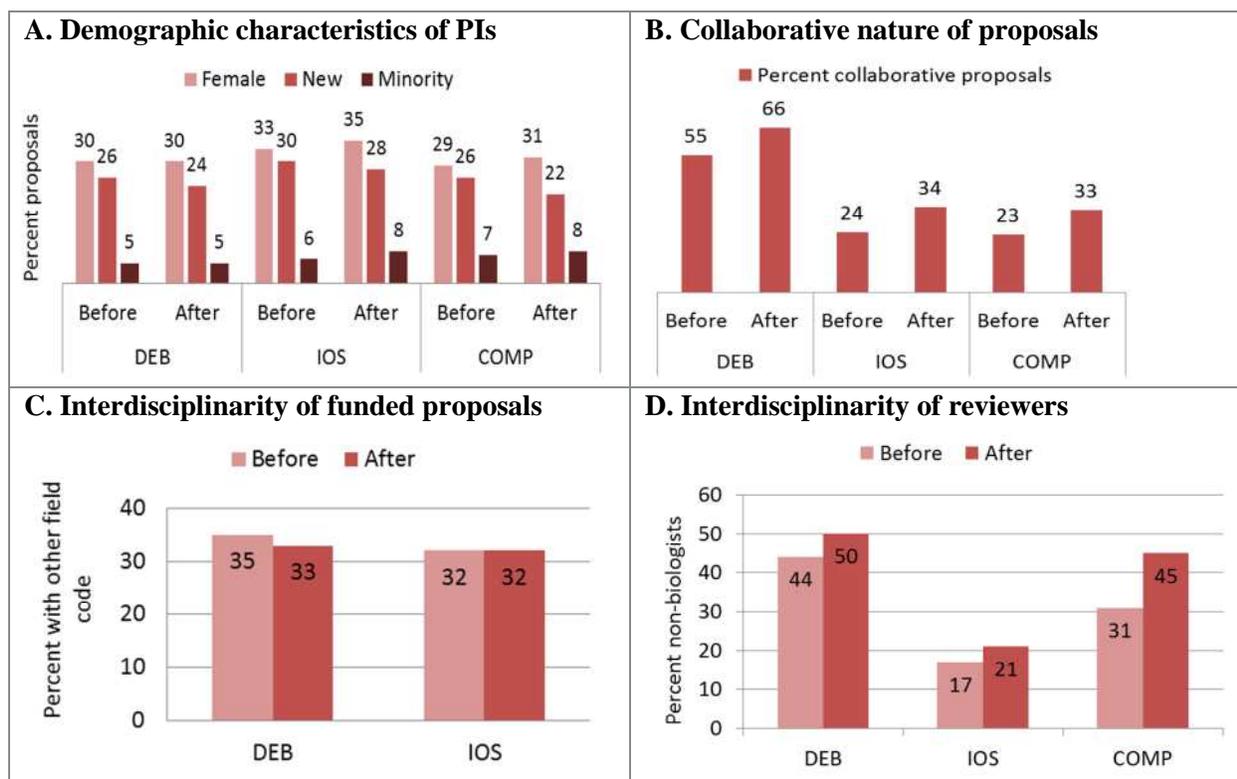
NOTE A: Significant differences at the p<0.05 level were observed only for new PI on comparison programs before vs after the change. Other before/after comparisons were not significant.
NOTE B: Significant differences at the p<0.05 level were observed for IOS before vs after the change, comparison before vs after, DEB vs comparison before, and DEB vs comparison after.
NOTE C: The differences for DEB and IOS before and after the change were not statistically significant.
NOTE D: Significant differences at the p<0.05 level were observed for reviewers for DEB, IOS, and comparison groups before vs after the change.

Finally, we investigated the changes in the characteristics of institutions receiving NSF funding. Grants to states with low research activity (Experimental Program to Stimulate Competitive Research, or EPSCoR) have increased significantly at IOS, from 19% to 24%, and marginally at DEB, from 23% to 25% (Table 8). These trends were in contrast to the comparison group, which experienced a significant decline, from 26% to 18%. No differences emerged either over time or across groups in the distribution of grants based on the Carnegie Classification of Institutions of Higher Education or in the representation of minority-serving institutions (Table 8).

Table 8: Characteristics of funded institutions before (2009-2011) and after (2013-2015) the change in review

Category	DEB, percent		IOS, percent		COMP, percent	
	Before	**After**	**Before**	**After**	**Before**	**After**
Doctoral universities highest research activity	70	71	72	72	77	77
Doctoral universities higher research activity	18	17	13	16	10	9
Doctoral universities moderate research activity	3	3	2	3	2	2
Master's colleges and universities	5	7	5	6	6	3
Baccalaureate colleges	3	2	6	6	4	3
Medical and other professional schools	0	0	2	2	2	0
Minority serving institutions	4	7	5	3	5	5
EPSCoR states	23	25	19	24	26	18

NOTE: Significant differences at the p<0.05 level were observed for EPSCoR states funding within IOS and comparisons before versus after the change, IOS versus comparison both before and after, and DEB vs comparison after. Other before/after comparisons were not significant.

3.1.2 Funding Level and Success Rate

The median annual award size in unadjusted dollars increased similarly for the three groups, from approximately $124,000 to $205,000 for DEB, from $118,000 to $200,000 for IOS, and from $142,000 to $225,000 for the comparison group (Figure 3A). Funding rates were also similar prior to the changes in review, at 15% to 18%. However, in 2013–2015 success rates for full proposals for the IOS and DEB core programs doubled – to 30% and 34% – while declining slightly for the comparison group (Figure 3B).

Analysis of administrative data showed a large increase in the number of submissions at DEB and IOS relative to the comparison group. Between 2009 and 2011, DEB and IOS received 3,294 and 4,083 proposals, respectively. In the three years following the change, the two divisions received 4,712 and 5,802 preliminary and 1,094 and 1,369 full proposals. This represents an increase of over 40% if only preliminary proposals are counted, and nearly 80% if both preliminary and full proposals are included in the calculation (Figure 3C). In contrast, the volume of full proposals for the comparison group has increased from 5,008 to 5,109, or 2%. We note that significant increase in funding rates at DEB and IOS was achieved by eliminating 75% of preliminary proposals from further competition (Figure 3C).

Figure 3: Award size and funding rate before (2009–2011) and after (2013–2015) the change in review

A. Median award size

B. Funding rate

C. Number of proposals

NOTE: Proposal counts exclude non-lead proposals.
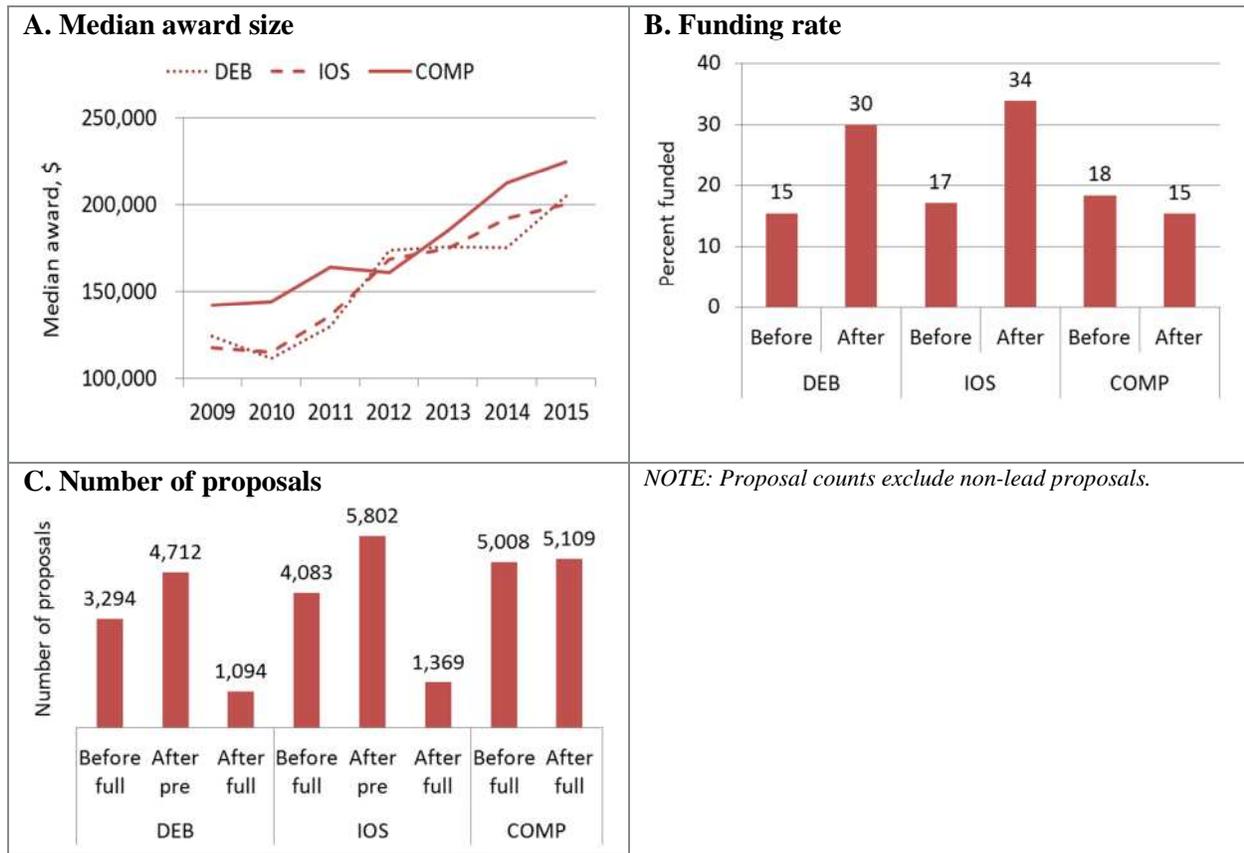
3.1.3 Workload

One of the anticipated benefits of the review change was a reduction in the reviewer workload. Administrative data revealed that the number of *full proposals* per panelist remained similar before and after the change and across the three groups: 12 versus 10 for DEB, 8 versus 7 for IOS, and 8 versus 9 for the comparison group (Figure 4A). The number of assignments was much higher for the *preliminary proposals*, with 21 per reviewer for DEB and 17 for IOS. We remind the reader that only core DEB and IOS proposals were included in our dataset.[7]

We also examined the number of proposals managed by Program Officers before and after the change in review and found that it has increased from 45 to 88 for DEB (96%) and from 73 to 115 for IOS (58%, Figure 4B). The increase for the comparison group was much smaller, from 57 to 66 proposals (16%).

Finally, we analyzed the trends in ad hoc reviewer participation. The number of requests made by NSF staff fell sharply for all groups, from approximately 16.5 thousand for DEB, 24.5 thousand for IOS, and 29 thousand for the comparison group to 6, 7, and 16 thousand, respectively (Figure 5). The decline was more pronounced for DEB and IOS, at 64% and 71%, than for the comparison group, at 45%. The number of ad hoc reviews received was approximately 8, 11, and 12 thousand for DEB, IOS, and the comparison group in 2009–2011 and 3, 3, and 7 thousand in 2012-2015 (Figure 5). Percent agreement to

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[7] According to NSF staff, core proposals represent approximately 75% of all DEB and IOS submissions.

provide a review, calculated as the ratio of requests to reviews received, remained the same for DEB before and after the change, at 52%, and increased for IOS and for the comparison group, from 49% to 56% and from 43% to 49% (data not shown).

Figure 4: Average number of proposals per panel reviewer and Program Officer before (2009–2011) and after (2013–2015) the change in review

A. Panel reviewer workload   B. Program Officer workload
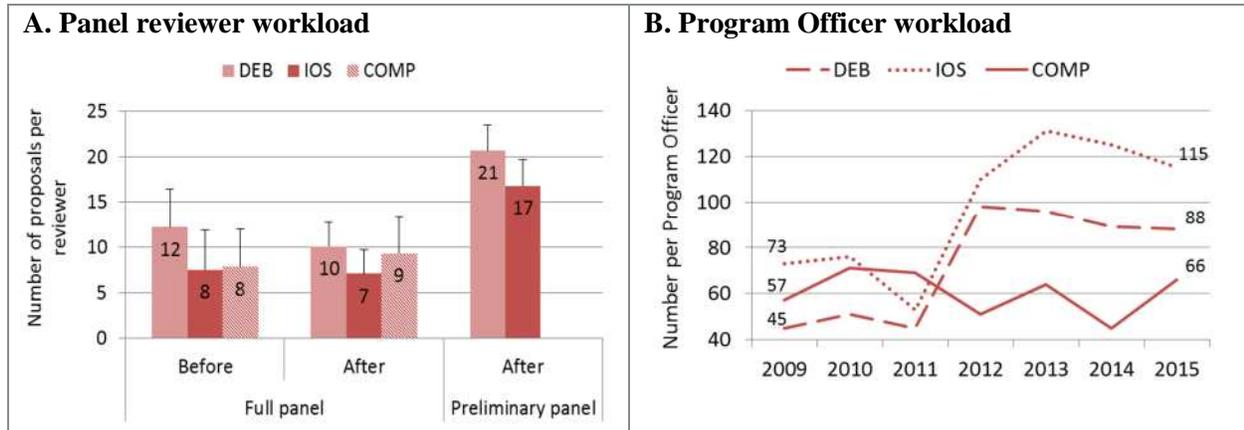
NOTE B: Counts exclude non-lead proposals.

Figure 5: Number of ad hoc requests and agreements before (2009–2011) and after (2013–2015) the change in review
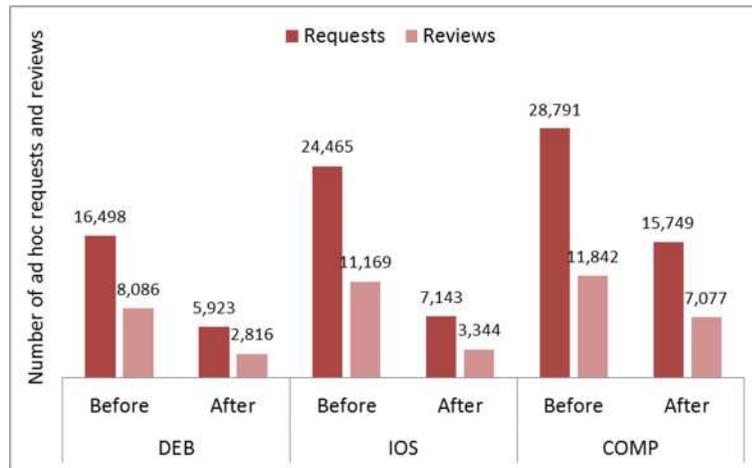
3.1.4   Reviewer Assignments and Proposal Scores

Administrative data revealed that the average number of reviewers per full proposal (ad hoc and panelists combined) has increased for DEB, from 5.7 to 6.0, but declined for the other two groups, from 4.5 to 4.0 for IOS and from 4.9 to 3.9 for the comparison group (Figure 6).

We also analyzed the changes in review scores. Figure 7 shows that the scores for all full proposals (funded and unfunded) improved significantly for DEB and IOS, from 3.6-3.7 in 2009–2011 to 3.9 in 2013–2015, while declining slightly for the comparison group, from 3.6 to 3.5 (the decrease was not statistically significant). The scores for funded proposals were similar for all groups before and after the change (Figure 7).

Figure 6: Average number of reviewers per full proposal before (2009–2011) and after (2013–2015) the change in review
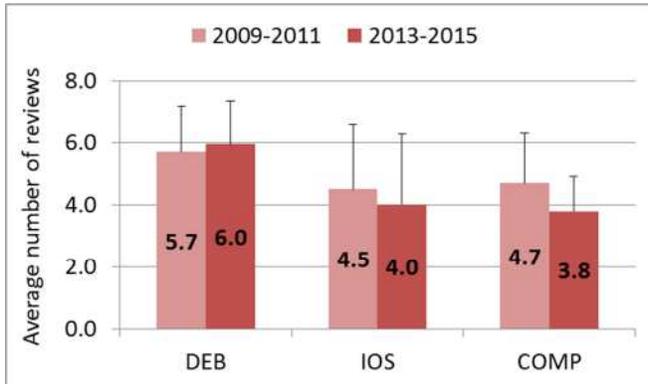
NOTE: Significant differences at the p<0.05 level were observed within all groups before and after the change, and between DEB/IOS and COMP before and after the change. Stems in the bar chart represent unweighted standard deviations.

Figure 7: Scores of full and funded proposals before (2009–2011) and after (2013–2015) the change in review
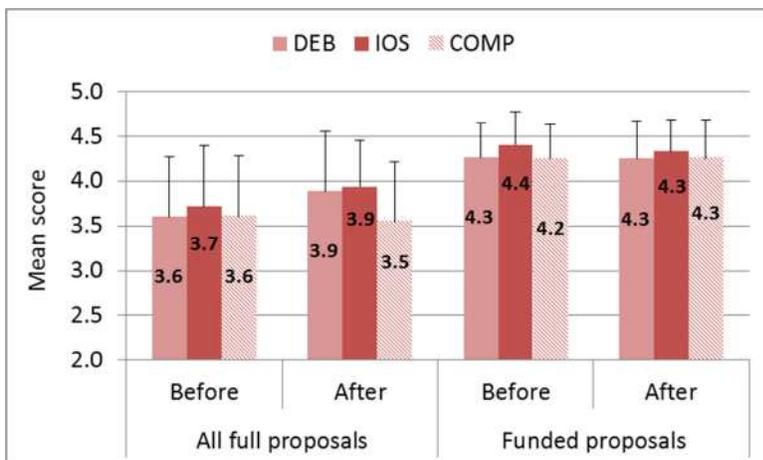
NOTE: Significant differences at the p<0.05 level were observed for DEB full proposals, IOS full proposals, and IOS funded proposals before and after the change. Stems in the bar chart represent unweighted standard deviations.

3.2   Reviewer and Applicant Surveys

To supplement the information available from administrative data, we surveyed a sample of researchers who submitted or reviewed proposals to the DEB/IOS core and to the comparison programs in 2015.

3.2.1   Response Rates

With multiple reminders, we received responses from 1,646 applicants and 1,676 reviewers, resulting in overall response rates of 66% and 62%, respectively. The DEB and IOS funded applicants were slightly more responsive than other applicant sub-groups, at 69% and 74% versus 63 to 64% (Figure 8A). Response rates were more varied for reviewers, with the ad hoc sub-group being the least responsive, at around 50% (Figure 8B). Based on the correspondence received from the field and on the statistics of self-terminations, we believe that ad hoc reviewers were less willing to complete the survey because they

could not recall the experience.[8] Response rates for panel reviewers were highest for DEB (73-75%), followed by IOS (63-68%), and by the comparison group (61%).

Figure 8: Response rates for applicants and reviewers
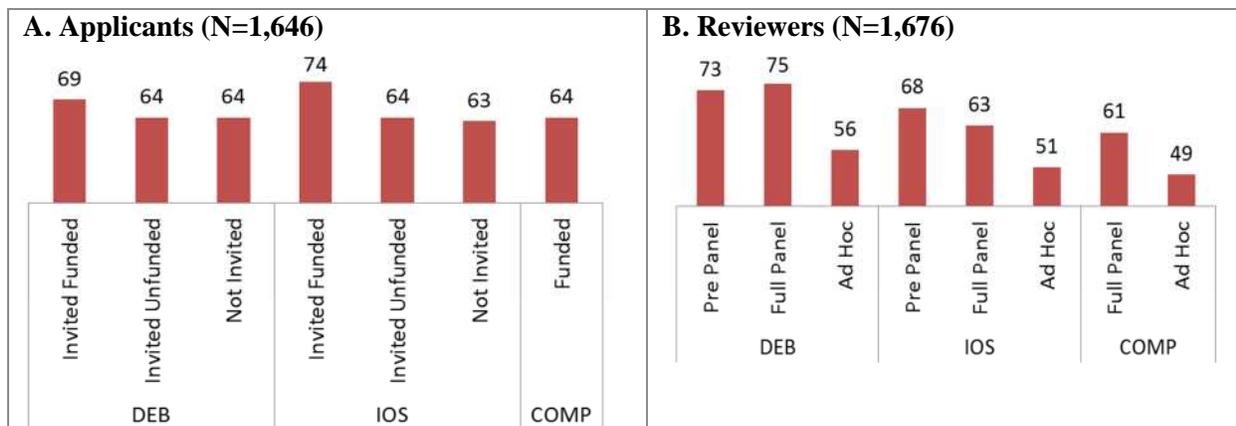
NOTE: Response rate was calculated as (partial + complete)*100 / (bounced + non-respondent + partial + complete). Terminations were excluded from response rate calculations.

3.2.2   Respondent Characteristics

Survey data revealed that between 20% and 50% of the applicants and reviewers were full professors and the majority was either associate or full professors (Figure 9). Not invited applicants tended to be more junior researchers, with 30% or less having earned the rank of full professor compared to 40% or higher for the funded and invited sub-groups. Reviewers were more senior than applicants and the distribution of ranks was similar across the programs. Tenure rates were at 50% or above for all groups, and were higher for reviewers than for applicants (Figure 10). The applicants who were not invited to submit a full proposal had the lowest tenure rates at both DEB and IOS.

We also examined the applicant and reviewer funding history with NSF. Nearly all funded applicants, regardless of the program, had at least one active grant at the time of the survey (Figure 11A). This number was progressively lower for invited unfunded applicants (64% at DEB and 46% at IOS) and for not invited applicants (42% at DEB and 30% at IOS). Survey data revealed that between 54% and 88% of the DEB and IOS reviewers, depending on the sub-group, had submitted a preliminary proposal as a PI (data not shown) and of these, between 36% and 49% were funded (Figure 11B). Submission and award rates were the lowest for ad hoc reviewers (data not shown and Figure 11B). Only 23% to 24% of comparison reviewers had submitted a preliminary proposal to DEB or IOS (data not shown) and 21% of these were awarded a grant (Figure 11B).

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[8] NSF asks reviewers to destroy review-related records, so reviewers could not refresh their memory.

Figure 9: Academic Rank of Applicants and Reviewers

A. Applicants
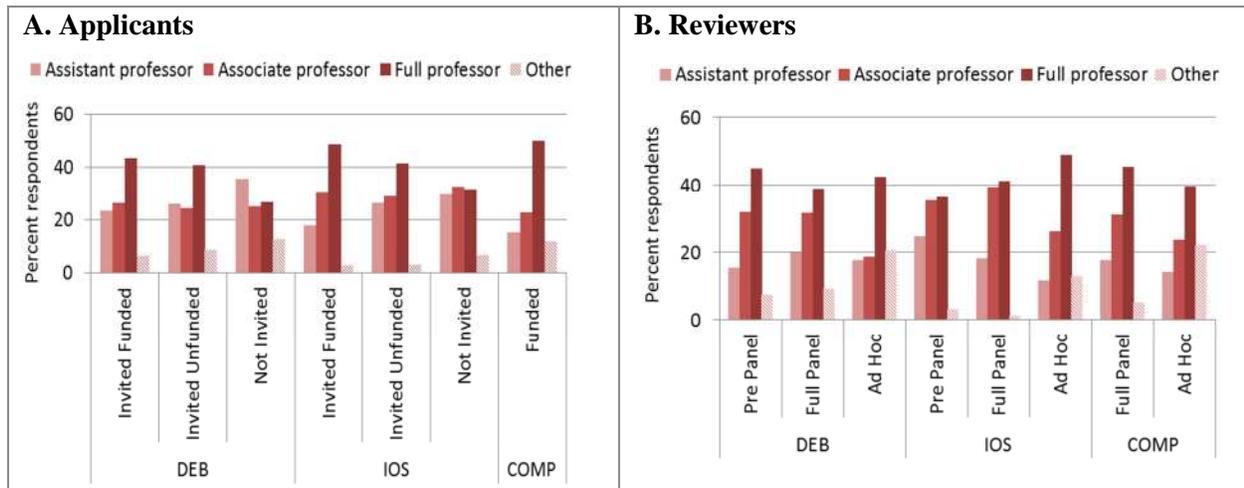
B. Reviewers

NOTE A: For percentage of assistant professors, DEB and IOS funded are no different from invited and unfunded, but different from not invited at the p<0.05 level.

Figure 10: Tenure Status of Applicants and Reviewers

A. Applicants
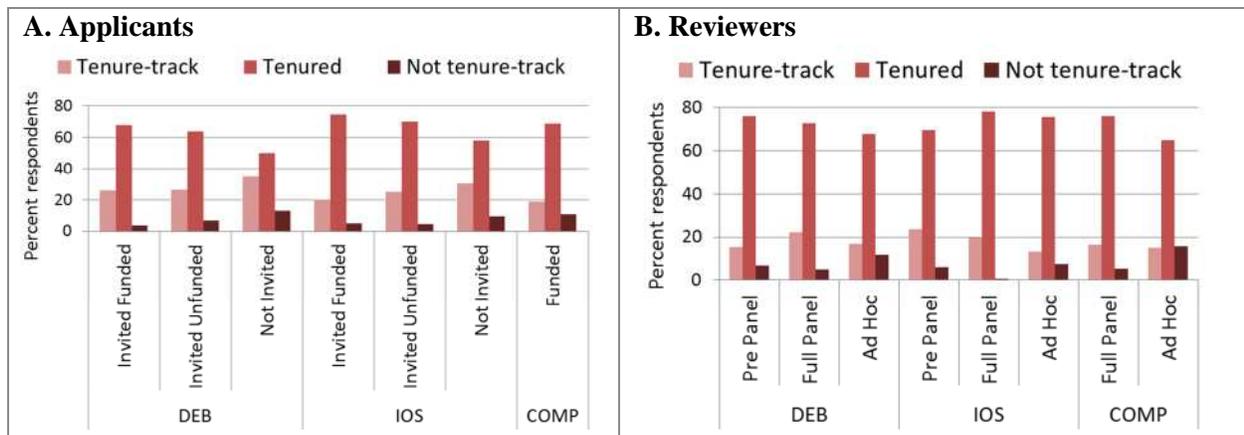
B. Reviewers

Figure 11: NSF Funding History of Applicants and Reviewers

A. Applicants

Q: *How many active NSF awards do you currently have as a PI or Co-PI?*

B. Reviewers

Q: *Have you ever been a PI or Co-PI on an award stemming from a preliminary proposal?*
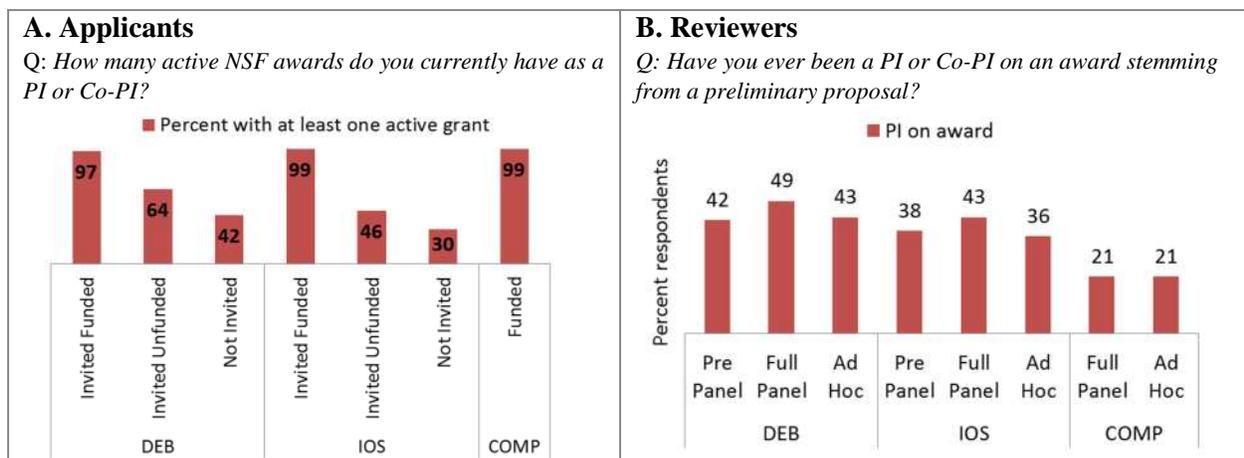
3.2.3 Proposals as Described by Applicants

Approximately two-thirds of the applicants described their proposals as very collaborative, half as very interdisciplinary, and one-third as very high-risk/high-reward (Figure 12). We observed some variation on these characteristics across the applicant groups: the DEB applicants regardless of funding status were more likely to say that their proposals were collaborative than either IOS or comparison applicants (Figure 12A). This trend was consistent with the administrative data (Figure 2B). For both DEB and IOS, not invited applicants were the least likely to indicate that their proposals were collaborative. Finally, funded DEB, IOS, and comparison proposals were not different from each other on this characteristic.

In contrast, funded comparison applicants were significantly more likely to rate their proposals as very interdisciplinary than DEB or IOS applicants: 64% versus 42-49% (Figure 12B). Fewer respondents across groups rated their proposals as very high-risk/high-reward than as collaborative or interdisciplinary (Figure 12).

Figure 12: Percent of applicants who described their proposals as collaborative, interdisciplinary, or high-risk/high-reward

Q: How would you rate your proposed project in terms of the following characteristics?

NOTE A: Statistical tests for equality of the percentages (differences at the p<0.05 level were considered significant):
- DEB and IOS invited and funded are no different from invited and unfunded, but significantly different from not invited.
- DEB and IOS invited and unfunded are significantly different from not invited.
- DEB and IOS invited and funded are no different from COMP.

NOTE B: Statistical tests for equality of the percentages:
- DEB and IOS invited and funded are no different from invited and unfunded and no different from not invited.
- DEB and IOS invited and funded are statistically different from COMP.

NOTE C: Statistical tests for equality of the percentages:
- None of the pairwise comparisons are different from each other.

3.2.4 Proposals as Described by Reviewers

Three questions in the survey measured reviewer satisfaction with submitted proposals. First, the subjects were asked to rate the proposals assigned to them on intellectual merit, broader impact, and potential to advance/transform the field (traditional NSF criteria). Figure 13 shows that the ratings from different types of reviewers and across programs were in the fairly narrow range of 3.4 to 4.4; the ratings for broader impact appeared to be the least consistent (3.8 to 4.3). We found no differences between the preliminary and full panel reviewers on any criterion. Among ad hoc reviewers, DEB proposals were scored slightly lower than IOS and comparison on intellectual merit and IOS proposals slightly higher than DEB and comparison on the potential to advance and transform the field and on broader impact. Overall, the reviewer assessments of DEB and IOS proposals appeared very similar to those for the comparison group.

Figure 13: Reviewer assessment of proposal intellectual merit, broader impact, and potential to advance/transform the field

Q: How satisfied were you with the proposals reviewed by your panel in terms of...
1=not at all satisfied, 2=somewhat satisfied, 3=neutral, 4=satisfied, 5=very satisfied
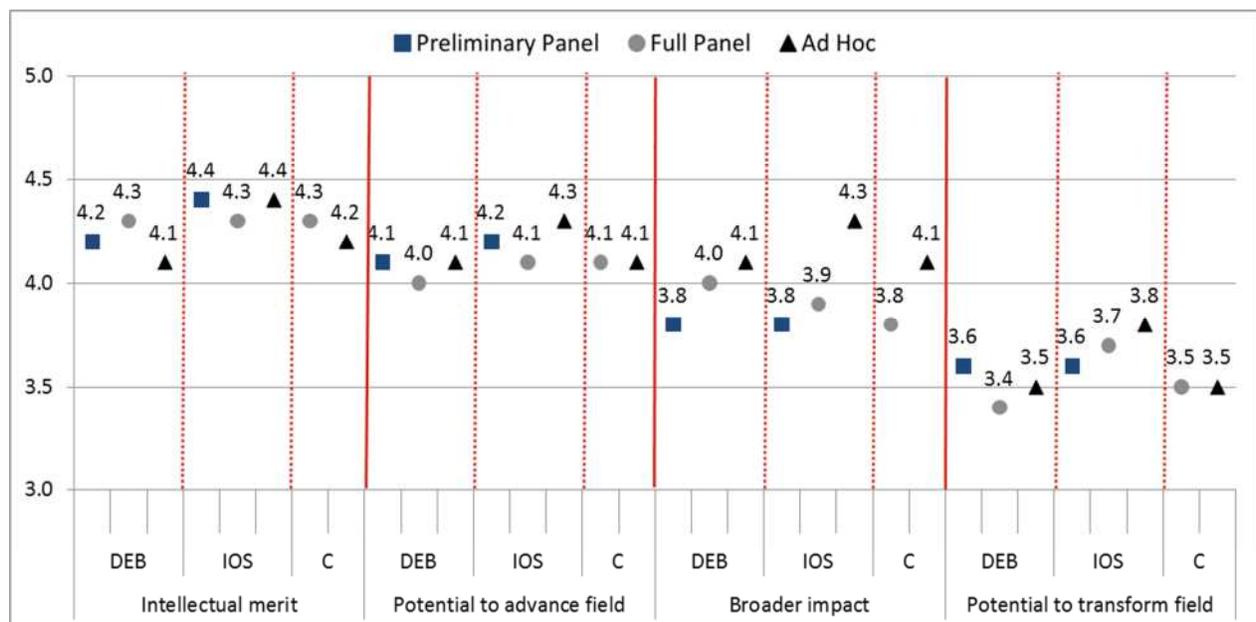
NOTE: Statistical tests for equality of the mean of the Likert Scale (differences at the p<0.05 level were considered significant):
- *For preliminary panel DEB responses are not different from IOS responses for all categories.*
- *For full panel DEB, IOS, and comparison responses are not different from each other for all categories.*
- *For ad hoc reviewers, DEB is statistically different from IOS for intellectual merit. All other pairwise comparisons are not different from each other.*
- *For ad hoc reviewers, IOS is statistically different from comparison, and DEB, IOS, and comparison are different from each other for potential to advance the field. All other pairwise comparisons are not different from each other.*
- *For ad hoc reviewers, IOS is statistically different from comparison on broader impact. All other pairwise comparisons are not different from each other.*
- *For ad hoc reviewers, DEB is statistically different from IOS, IOS from comparison, and DEB, IOS, and comparison from each other for potential to transform the field. All other pairwise comparisons are not different from each other.*

In addition to measuring satisfaction against the traditional NSF review criteria, we asked panel reviewers to estimate what percentage of proposals assigned to their panel addressed a significant question, clearly conveyed the idea and approach, presented an approach that was feasible and appropriate, contained convincing preliminary data, and demonstrated that investigators had the requisite expertise to conduct the proposed work. Panel reviewers indicated that between 43% and 67% of proposals assigned to their

panel had these characteristics, with the feasibility of proposed approach receiving the lowest percentages (43% to 56%) and preliminary data the highest (62% to 67%, Figure 14A). Panel reviewers estimated that between 36% and 47% of proposals could be characterized as collaborative/interdisciplinary and between 18% and 22% as high-risk/high-reward. We observed little variation between preliminary and full panels and across the programs - in all but one case of less than 10 percentage points. Figure 14B shows that between 59% and 91% of ad hoc reviewers indicated that the proposal they reviewed had the characteristics listed above. While we caution the reader against drawing a comparison in terms of percentages between panel and ad hoc reviewers because of the differences in their experiences and in the formulation of the question, the overall satisfaction trends were similar.

Finally, we asked panel reviewers to estimate the percentage of proposals assigned to their panel that were not worth funding. The estimates for the DEB, IOS, and comparison group were at 30-35% and there was little variation in the views of preliminary versus full proposal panelists (data not shown). Between 6% and 12% of ad hoc reviewers, depending on the program, said that the proposal they reviewed was not worth funding (data not shown). The DEB, IOS, and comparison groups were very similar to each other.

Figure 14: Reviewer assessment of proposal significance, approach, preliminary data, applicant expertise, level of risk, and collaboration

0-25%	>25-50%	>50-75%	>75%

A. Panel reviewers

	Percent proposals with these characteristics				
	DEB pre panel	DEB full panel	IOS pre panel	IOS full panel	COMP full panel
Addressed a significant question	55	59	52	58	53
Clearly conveyed the idea and approach	56	58	51	59	53
Presented an approach that was feasible and appropriate	43	52	48	56	50
Contained convincing preliminary data	66	67	62	65	63
Demonstrated that investigators had the expertise	56	60	54	62	56
Could be characterized as high-risk/high-reward	18	19	18	22	19
Could be characterized as collaborative and/or ID	45	47	36	39	41

B. Ad hoc reviewers

	Percent reviewers who said that their proposal had these characteristics		
	DEB	IOS	COMP
Addressed a significant question	86	88	85
Clearly conveyed the idea and approach	83	86	83
Presented an approach that was feasible & appropriate	74	80	72
Contained convincing preliminary data	68	70	59
Demonstrated that investigators had the experience	91	89	86
Could be characterized as high-risk/high-reward	17	16	17
Could be characterized as collaborative and/or ID	63	52	54

NOTE A: To calculate percent proposals for panel reviewers, we converted categorical responses to numeric values as follows: "<10%" to 5%; "~25%" to 25%; "~33%" to 33%; "~50%" to 50%; "~66%" to 66%; and ">66 to 75%.

3.2.5 Proposal Submission

Survey data showed that the DEB and IOS applicants were the least satisfied with the single submission deadline for preliminary proposals, which received ratings between 1.6 and 2.2 on a 5-point Likert scale, depending on the applicant sub-group (Figure 15). The ratings for the requirement to submit a preliminary proposal, the timing of the preliminary proposal deadline, and the limit of two proposals per PI were in the neutral range, and for the amount of time to prepare proposals/timing of full proposal deadline were slightly above neutral, 3.1 to 3.5. The overall level of satisfaction with proposal submission was significantly higher among the comparison group (funded) applicants than the DEB or IOS applicants, 3.9 versus 3.2-3.3 (Figure 15).

Applicants who indicated that they were unsatisfied with the amount of time to develop a full proposal were asked to estimate how much time they would ideally need. The average number of months ranged from 3.1 to 3.7, depending on the sub-group (data not shown). At present, the applicants have just over two months to prepare a full proposal (Figure 1).

Figure 15: Applicant satisfaction with proposal submission

Q: What is your level of satisfaction with the following steps in the submission process?
1=very unsatisfied, 2=unsatisfied, 3=neutral, 4=satisfied, 5=very satisfied

1.5-2.0	>2.0-3.0	>3.0-3.5	>3.5-4.0

	DEB			IOS			COMP
	Invited Funded	Invited Unfund	Not Invited	Invited Funded	Invited Unfund	Not Invited	Funded
Requirement to submit a pre proposal	3.4	2.9	3.1	3.1	2.8	2.9	
Single submission deadline for pre proposals	2.2	1.8	1.9	1.9	1.6	1.6	
Limit of two submissions per individual PI	3.2	2.8	2.9	3.3	2.9	3.2	
Timing of the preliminary proposal deadline	3.2	3.0	3.0	3.0	2.8	3.1	
Amount of time to prepare a pre proposal	3.5	3.2	3.2	3.4	3.1	3.2	
Timing of the full proposal deadline	3.2	3.2		3.5	3.2		
Amount of time to prepare a full proposal	3.4	3.1		3.4	3.1		
Submission process overall	3.3	2.8	3.0	3.2	2.7	3.1	3.9

NOTE: Statistical test for equality of the mean of the Likert Scale (differences at the $p<0.05$ level were considered significant):
- *DEB and IOS invited and funded and DEB and IOS invited and unfunded are statistically different from each other for all categories.*
- *DEB and IOS invited and funded and DEB and IOS not invited are no different from each other for the 2 submission limit per PI. They are statistically different from each other for all other categories.*
- *DEB and IOS invited and unfunded and DEB and IOS not invited are statistically different from each other for all categories other than for submission cap per PI.*
- *DEB and IOS invited and funded, DEB and IOS invited and unfunded, and DEB and IOS not invited are statistically different from each other for all categories other than timing of the preliminary deadline.*
- *DEB and IOS funded applicants were statistically different from comparison applicants on the submission process overall.*

In 2013, NSF surveyed nearly 20,000 researchers who had submitted a grant to DEB or IOS in the preceding five years to gauge their level of satisfaction with the new review process.[9] The study revealed that the research community at the time was the least satisfied with the single submission deadline (<20%

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[9] Rissler LJ and Adamec J. (2014) Gauging Satisfaction with the New Proposal Process in DEB and IOS at the NSF. *BioScience* 64: 837–843.

satisfied or very unsatisfied), but viewed the preliminary proposal requirement and the limit of two proposals per PI more favorably (about one-half were satisfied or very satisfied). If the rating data presented in Figure 15 are converted into percentages, our results are fairly consistent with this survey: 9% of the applicants in our study were satisfied or very satisfied with the single deadline, 41% with the preliminary proposal requirement, and 38% with the limit of two proposals.

Finally, we explored reviewer and applicant satisfaction with proposal length. First, respondents were asked to indicate whether the 4-page and 15-page limits on the project description narrative for the preliminary and full proposals, respectively, were *sufficient* to convey (applicants) and evaluate (reviewers) the idea and approach. For preliminary proposals, the percentage of applicants who thought four pages were sufficient ranged from approximately 60% for unfunded to 80% for funded applicants; 77% to 78% of DEB/IOS reviewers said that the length was sufficient (data not shown). For full proposals, 96% to 99% of the applicants and reviewers said that the length was sufficient (data not shown).

Survey respondents were then offered an opportunity to propose the *optimal* number of pages for each type of proposal. We found a notably high level of concurrence both within the reviewer and applicant sub-groups and between reviewers and applicants: 5 pages for a preliminary and 12-14 pages for a full proposal (Figure 16). While applicants suggested slightly longer page limits, both groups prefer a shorter full proposal than the current 15 pages.

Figure 16: Proposal length seen as optimal by applicants and reviewers

Q: How many pages would you recommend as optimal for the project description section in the preliminary/full proposal?
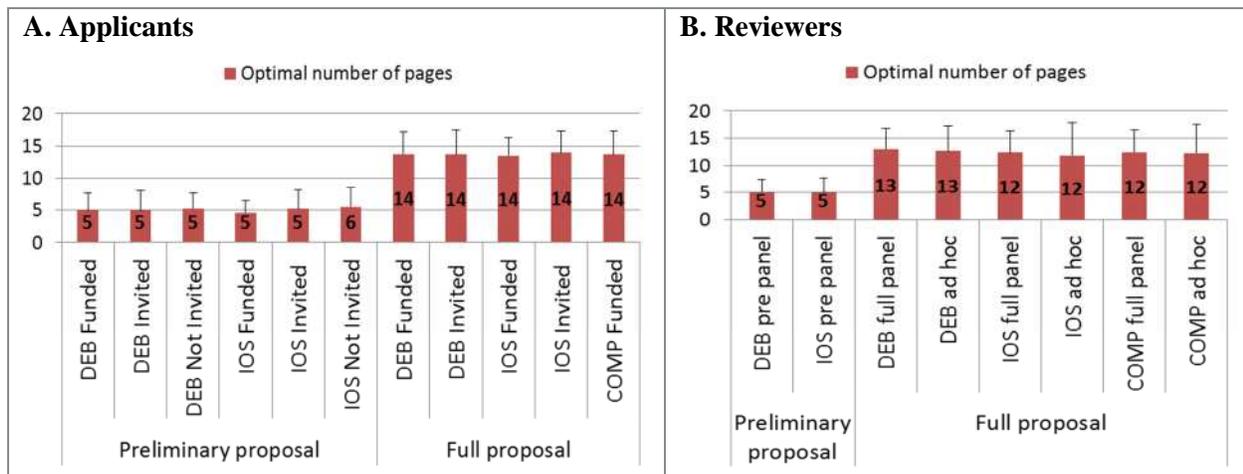
NOTE A: Statistical test for equality of the mean number of pages (differences at the p<0.05 level were considered significant):
- *For the preliminary proposal all pairwise comparisons of DEB and IOS are no different from each other.*
- *For the full proposal all pairwise comparisons of DEB and IOS invited and funded, DEB and IOS invited and unfunded, and comparison funded are no different from each other.*

NOTE B: Statistical test for equality of the mean of the number of pages:
- *DEB responses for the preliminary panel are no different from IOS responses.*
- *All pairwise comparisons for DEB and IOS are no different from each other.*

3.2.6 Workload

Applicant workload

One of the anticipated benefits of the new process was a reduction in the time to prepare and review proposals and we measured workload in the study. According to survey estimates, the applicants spent less time preparing a preliminary than a full proposal: 52-78 hours versus 101-134 hours, a saving of approximately 55 hours for a not invited applicant (Figure 17A). We also explored whether having written a preliminary proposal saved time on a full proposal. Between 48% and 60% of the applicants, depending on the group, said that this was the case (Figure 17B). We note that this view appears inconsistent with the finding that the workload estimates for the three funded groups were similar (120 for the comparison versus 115-134 hours for DEB and IOS), even though the comparison applicants did not go through the step of preparing a preliminary proposal. In total, funded DEB or IOS applicants spent 187 hours on proposal preparation versus 120 hours for the comparison group.

A combination of survey and FastLane data allowed us to estimate the total workload on the applicant community, which is a product of the average number of hours per proposal (collected in the survey) and the total number of submitted proposals (available from FastLane). We found that the total number of proposal hours at DEB and IOS increased by 123,444 (36%) and 82,209 (16%) after the review change. In contrast, the increase for the comparison group was 12,120 hours or 2% (Figure 17C).

Figure 17: Applicant workload to prepare proposals

A. Estimate of hour burden
Q. Approximately, how many hours of work did it take you to prepare your preliminary and full proposal?

B. Time saved from preparing a preproposal
Q: Which of the following is true? Having prepared the successful preliminary proposal: (a) saved or (b) did not save you time when preparing a full proposal

C. Total workload for the applicant community

NOTE A: *Statistical test for equality of the mean of hours (differences at the $p<0.05$ level were considered significant):*
- *For the preliminary proposal DEB and IOS invited and funded are no different from invited and unfunded. DEB and IOS invited and funded are different from not invited. DEB and IOS invited unfunded are different from not invited.*
- *For the full proposal all pairwise comparisons of DEB/IOS funded, invited unfunded, and COMP funded are statistically no different from each other.*

NOTE B: *Statistical test for equality of the percentage:*
- *DEB and IOS invited and funded are statistically different from invited and unfunded.*

Reviewer Workload

In the survey, we asked reviewers to quantify the effort to review preliminary and full proposals. The estimates per proposal by the panelists were as follows: preliminary 2.1 hours for DEB and 2.8 hours for IOS; full 3.1 hours for DEB, 3.3 for IOS, and 3.5 for the comparison group (Figure 18A). Based on these numbers, a preliminary proposal takes approximately 25% less time to review. In a separate survey question, we asked panel reviewers whether a preliminary proposal was faster to review than a full proposal and if yes, by how much. Ninety percent of panelists indicated that a preliminary proposal took less time; of these, approximately 10% said that it took a quarter of the time or less, 50% that it took half the time, and 25% that it took three-quarters of the time (Figure 18B). We note that panel reviewers perceived preliminary proposals as faster to review than what their own hour estimates indicate. Ad hoc reviewers gave higher estimates of time per proposal than panel reviewers (5.2 to 6.3 hours, depending on the subgroup, Figure 18A).

We asked panel reviewers to estimate the number of proposals they were assigned and to rate their satisfaction with this workload. A preliminary proposal panelist for DEB and IOS was assigned 18 and 15[10] proposals, on average; this difference was statistically significant (Figure 18C). A full proposal reviewer for DEB also had a heavier workload. Satisfaction with the number of proposals assigned was in the positive range of 3.5 to 3.9 for all reviewers, with the DEB full proposal panelists being significantly less satisfied than the other two groups (Figure 18D). Finally, we estimated the total burden to review the proposals, which is the product of the number of proposals reviewed and the average time to review them. We found that the reviewer workload was reduced by 19,443 hours or 26% for DEB, 17,889 hours or 18% for IOS, and 28,301 hours or 24% for the comparison group (Figure 18E).

Figure 18: Reviewer Workload

A. Total number of hours spent on a review

B. Effort to review preliminary vs full proposal

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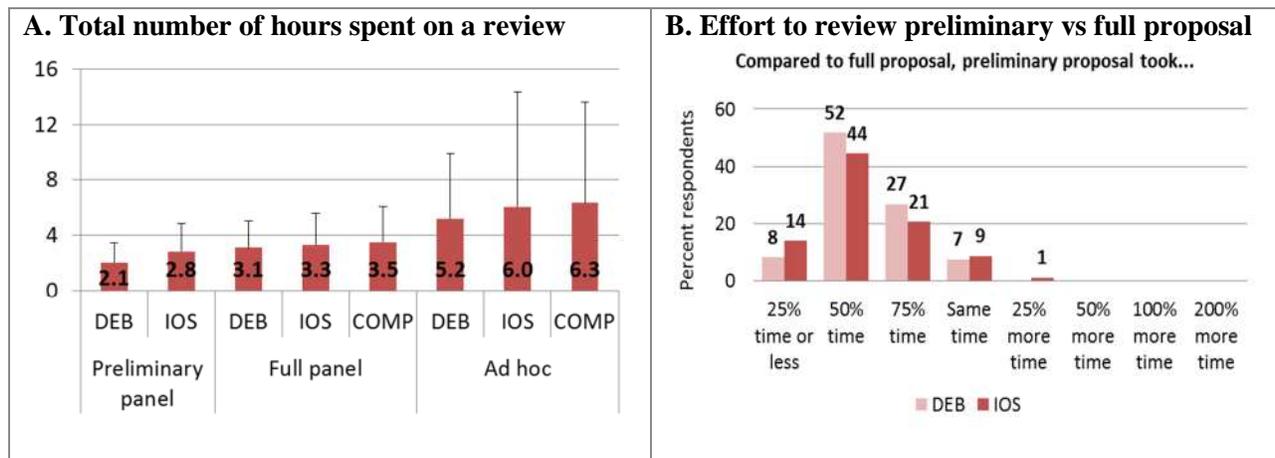
[10] The administrative dataset did not include proposals outside of the core DEB and IOS programs, most likely accounting for the discrepancy between the administrative and survey estimates.

C. Number of proposals assigned
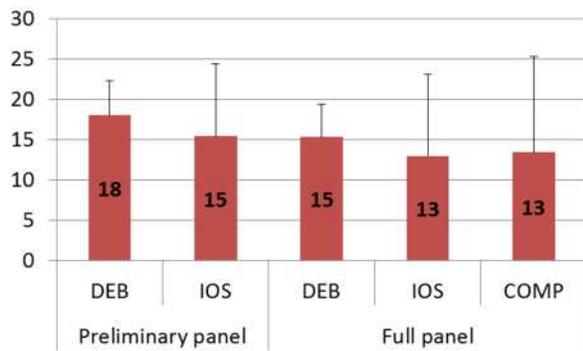
D. Satisfaction with number of proposals assigned
1=very unsatisfied, 3=neutral, 5=very satisfied
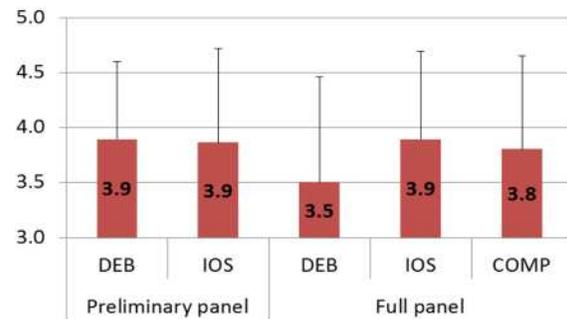
E. Total workload for the reviewer community
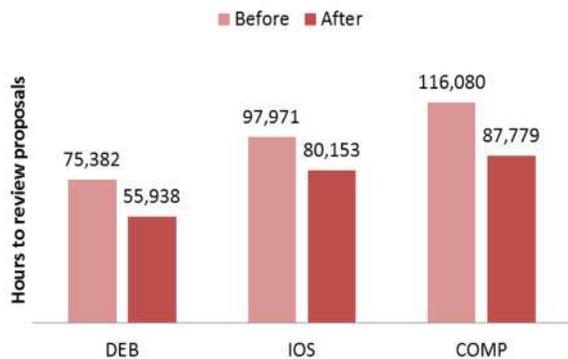
NOTE A: Statistical test for equality of the mean of hours:
- *DEB and IOS responses for the preliminary panel are different at the p<0.05 level.*
- *DEB, IOS, COMP responses for full panel are not different.*
- *IOS and COMP responses for ad hoc are not different. All other pairwise comparisons of DEB, IOS, and COMP are different from each other at the p<0.05 level.*

NOTE C: Statistical test for equality of the mean of N prop:
- *DEB and IOS responses for preliminary panel are different at the p<0.05 level.*
- *IOS and COMP responses for the full panel are not different. All other pairwise comparisons are different.*

NOTE D: Statistical test for equality of the mean of scores:
- *DEB and IOS responses for prelim panel are not different.*
- *IOS and COMP responses for full panel are not different. All other pairwise comparisons are different.*

3.2.7 Proposal Review

Applicants

The survey measured the level of applicant satisfaction with various elements of the review, including reviewer understanding of the proposal, technical accuracy and fairness, balanced consideration of proposal strengths and weaknesses, and the process overall. We found that the ratings were the lowest among the not invited applicants: 2.7 to 3.1 on a 5-point scale (Figure 19A). Progressively higher ratings were received from the invited unfunded, followed by the funded applicants (the range of 3.3-3.5 and around 4.0 respectively, Figure 19). The ratings for different elements of the review were very consistent within the applicant sub-groups - 0.3 points apart or less. Funded DEB and IOS applicants appeared to be more satisfied with the full review and invited unfunded applicants with the preliminary review. The ratings were very similar between the DEB, IOS, and comparison groups.

Figure 19: Applicant satisfaction with review
Q: What is your level of satisfaction with the following elements of the review process?
1=not at all satisfied, 2=somewhat satisfied, 3=neutral, 4=satisfied, 5=very satisfied

A. Preliminary proposal
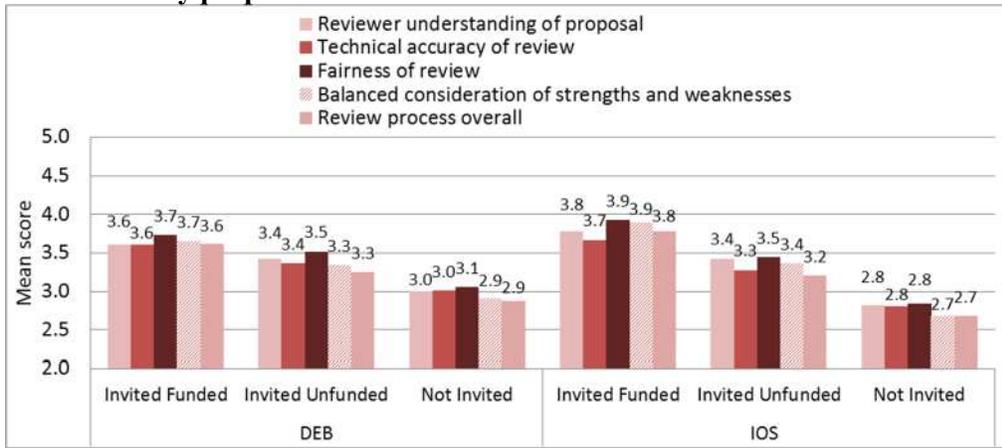
B. Full proposal
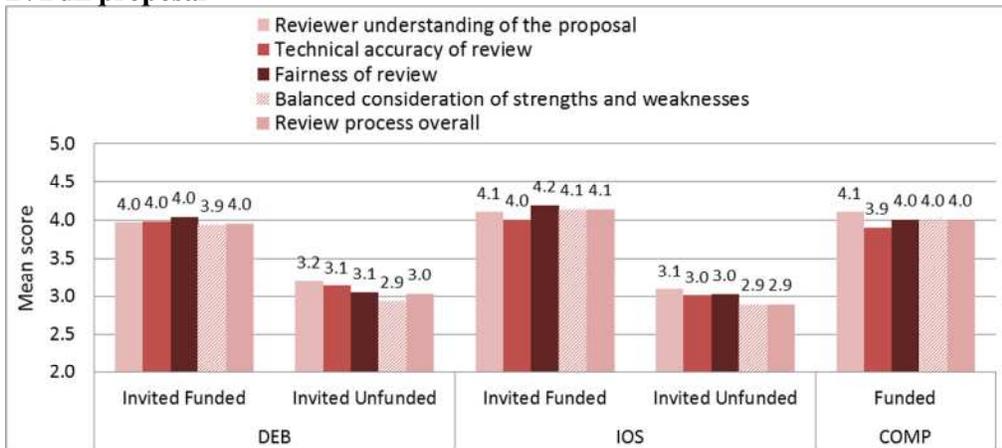
NOTE A: Statistical test for equality of the means of proposal ratings (differences at the p<0.05 level were considered significant):
- *DEB and IOS invited and funded, invited and unfunded, and not invited are different for all categories.*

NOTE B: Statistical test for equality of the mean of proposal ratings:
- *DEB and IOS invited and funded are no different from comparison funded for all categories. DEB and IOS invited and funded, invited and unfunded, and comparison funded are different for all categories.*

For the DEB and IOS groups, we investigated whether the preliminary proposal reviews were helpful for preparing a full proposal (for funded and invited applicants) or for a resubmission (for not invited applicants). Survey data revealed that the reviews were most helpful to the funded applicants, followed by invited unfunded, and by not invited (Figure 20A). Between 70% and 90% of all applicants indicated that the reviews were somewhat or very helpful.

During the proposal process, applicants have an option of discussing preliminary reviews with a Program Officer. Based on the survey data, about 25% of not invited applicants, and 40-50% of invited and funded applicants did so (Figure 20B). Of the funded applicants who had the discussion, approximately 60% said that it was very helpful and the rest that it was helpful (Figure 20C). Invited not funded and not invited applicants found the discussion less helpful.

Figure 20: Helpfulness of reviewers and discussion with a Program Officer for developing full proposal or resubmission

A. Helpfulness of reviewer comments

Q: How helpful were the reviewer comments on the preliminary proposal to developing the full proposal or resubmission?

Legend: Unsure/NA | Not at all | Somewhat | Very

Percent respondents

DEB:
- Funded: 7, 62, 31
- Invited Unfunded: 27, 60, 13
- Not Invited: 11, 28, 50, 11

IOS:
- Funded: 10, 66, 24
- Invited Unfunded: 34, 54, 12
- Not Invited: 10, 31, 47, 12

B. Frequency of discussion with a PO

Q: Did you speak with a PO after receiving the review for your pre proposal?

Legend: Percent who spoke with PO

DEB:
- Funded: 41
- Invited Unfunded: 38
- Not Invited: 21

IOS:
- Funded: 54
- Invited Unfunded: 48
- Not Invited: 26

C. Helpfulness of discussion with a PO

Q: How helpful was this discussion?

Legend: Not at all | Somewhat | Very

Percent respondents

DEB:
- Funded: 4, 39, 57
- Invited Unfunded: 16, 46, 38
- Not Invited: 19, 42, 39

IOS:
- Funded: 1, 36, 63
- Invited Unfunded: 24, 47, 29
- Not Invited: 18, 49, 33

NOTE A: Statistical test for equality of the percent indicating "very helpful":
- *DEB and IOS invited unfunded are not different from not invited. DEB and IOS funded, invited unfunded, and not invited are different for all other pairwise comparisons.*

NOTE B: Statistical test for equality of the mean of the percentages:
- *DEB and IOS funded are not different from invited and unfunded. DEB and IOS funded, invited unfunded, and not invited are different for all other pairwise comparisons.*

NOTE C: Statistical test for equality of the probability that the discussion being "very helpful:
- *DEB and IOS funded is different from invited unfunded.*
- *DEB and IOS funded is not different from not invited.*
- *DEB and IOS funded, invited and unfunded, and not invited are not different from each other.*

Reviewers

Panel reviewer satisfaction with the review process was higher than that of the applicants, in the 3.4 to 4.3 range (Figure 21). Overall, the DEB reviewers appeared to be less satisfied than their peers in the other two groups, but the differences were small. Satisfaction ratings were consistently lower for the quality of written reviews (3.7 to 3.9) and for the willingness to support high-risk/high-reward projects (3.4 to 3.7) than for other elements of the review. This trend held across the reviewer sub-groups and the programs.

Figure 21: Reviewer satisfaction with review

Q: What is your level of satisfaction with the following elements of the review process?
1=not at all satisfied, 2=somewhat satisfied, 3=neutral, 4=satisfied, 5=very satisfied

3.25-4.0	>4.0-4.25	>4.25

	DEB	IOS	DEB	IOS	COMP
	Preliminary proposal		**Full proposal**		
Quality of written reviews	3.7	3.9	3.8	3.7	3.9
Rigor of proposal discussion	4.0	4.3	4.0	4.3	4.2
Balanced consideration of strengths and weaknesses	3.9	4.1	3.9	4.0	4.1
Level of consensus among reviewers	4.0	4.2	3.9	4.1	4.2
Fairness of final ratings	4.0	4.3	4.0	4.2	4.3
Quality of panel summaries	3.9	4.0	3.9	4.0	4.2
Willingness to support high-risk/high-reward projects	3.4	3.7	3.4	3.7	3.7
Review process overall	4.0	4.2	4.0	4.2	4.3

NOTE: Statistical test for equality of the mean of the Likert Scale (differences at the $p<0.05$ level were considered significant):
- *DEB responses for the preliminary proposals are different from IOS for quality of written reviews, rigor of proposal discussion, willingness to support high-risk/high-reward projects, and fairness of final panel ratings. All other characteristics are no different from each other.*
- *DEB responses for the full panel are different from comparison for fairness of final panel ratings and level of consensus among the reviewers. DEB, IOS, and comparison are no different for all other characteristics.*

3.2.8   Recommendations for Improvement Made by Survey Respondents

The DEB and IOS survey respondents were invited to suggest one change to the two-step review process. We received comments from 1,094 applicants (66%) and 842 reviewers (50%), which were coded and analyzed. As can be seen from Table 9, the most frequent suggestions were to essentially return to the old review process of two (or more) deadlines per year (n=333), with no preliminary proposal (n=229). An additional 89 respondents proposed having no deadlines at all or changing the preliminary proposal deadline from January to another month. Eighteen respondents suggested funding the best preliminary proposals directly or even using preliminary proposals to make award decisions. Other relatively frequent comments were related to proposal length: suggestions included both longer and shorter preliminary proposals (n=54 and n=24, respectively) and shorter full proposals (n=51).

A number of comments were related to proposal review. The most frequent recommendation was to use better qualified panel reviewers (n=115), particularly for the preliminary panel. This comment was made by invited and funded applicants (n=27), by not invited applicants (n=40), and by reviewers (n=48). Another frequent recommendation was to provide clearer guidance and/or more training to panel reviewers about the goal of preliminary proposals and how to evaluate them (n=105). This recommendation was also made by both applicants (n=57) and reviewers (n=48).

Many respondents (n=103) commented about the discrepancies in the preliminary and full proposal reviews and recommended that at least some of the same reviewers be involved at both steps. Other suggestions included double-blind reviews (n=33), greater transparency of the review process (n=29), a mechanism for reviewers and applicants to interact during the review ("prebuttal," n=26), shortening the amount of time between preliminary proposal submission and funding (n=25), and sharing prior reviews with subsequent reviewers or including a summary of changes in full proposals (n=20). A number of respondents (n=28) suggested that nearly-funded full proposals should be allowed to skip the preliminary step in the next review cycle. A number of reviewers and applicants wrote about challenges evaluating the broader impact section (n=67).

Reviewers made several suggestions for improving specific review steps, such as eliminating virtual panels (n=21), assigning fewer preproposals per panelist (n=14), allowing more time for reviews (n=13), increasing the number of reviewers per proposal (n=12), and giving greater weight to ad hoc reviewers relative to panelists (n=7). Finally, respondents recommended changing funding priorities, although these were contradictory: some advocated for more support for new PIs (n=18) and high-risk/high-reward projects (n=15), while others for more experienced PIs and incremental research (n=6 in each group). Eighteen respondents suggested funding more proposals at a lower dollar amount.

Table 9: Changes suggested by applicants and reviewers

Theme	N total	N applicants	N reviewers
Proposal submission			
Two or more proposal deadlines per year	333	286	47
Eliminate preliminary proposal	229	151	78
Eliminate proposal deadlines	40	29	11
Change submission deadlines	20	20	0
Allow more than two submissions per year per PI	29	27	2
Eliminate full proposals entirely or in some cases	18	10	8
More time to prepare full proposals, revise/resubmit	14	13	1
Proposal length and guidelines			
Shorter full proposal with or without preproposal	56	23	33
Longer preproposal	54	39	15
Shorter preproposal	25	18	7
Other suggestion on proposal guidelines	39	14	25
Proposal review			
Find better qualified reviewers/include ad hoc reviews	115	67	48
Clearer guidance to reviewers about expectations and process	105	57	48
More consistency across review stages	103	73	30
More/less emphasis on broader impacts	67	6	61
More consideration for interdisciplinary proposals	8	5	3
Double blind reviews	33	13	20
Clearer feedback to applicants, more transparency	29	17	12
Do not require preproposal resubmission in some cases	28	20	8
Allow applicant/reviewers to interact during review	26	10	16
Shorten review process	25	17	8
Share preliminary reviews with full proposal reviewers	20	11	9
Eliminate virtual panels	21	0	21
Fewer proposals per reviewer	14	0	14
More time for review	13	0	13
More reviewers per proposal	12	7	5
More emphasis on ad hoc reviews	7	0	7
Invite more full proposals	6	2	4
Invite fewer full proposals	5	0	5
Funding priorities			
New PIs	18	6	12
Transformative or innovative proposals	15	3	12
Experienced PIs	6	0	6
Incremental science	6	2	4
Funding level			
Fund more projects at a lower dollar amount	18	6	12

Theme	N total	N applicants	N reviewers
Other			
Comments not containing suggestions for improvement	111	25	86
Comments unrelated to 2-step review or with <5 respondents	268	117	151

3.3 NSF Staff Interviews

We interviewed 28 staff at DEB and IOS to understand the changes in their workload and to capture their perspective on the two-step review.

3.3.1 Effects of Change on Workload

The majority of respondents reported that the total annual workload related to proposal management either marginally decreased or remained the same. Most of the time was saved on not having to recruit ad hoc reviewers for preliminary proposals (the task described by NSF staff as "arduous"), but we were also told that review analyses could be done faster for preliminary proposals. Not all respondents believed that the new process saved time, however:

> *[The change in proposal process] was supposed to reduce time, but preproposals took as much time as full proposals because there were more of them. You didn't have to get ad hoc reviewers and write review analyses for preproposals. On the other hand, we had to have an extra panel, which is a lot of work. [DEB]*

Many respondents commented that the new process has resulted in a very unequal distribution of work, with a busy preliminary proposal season in winter and early spring and a slower full proposal season in the fall. The NSF staff appeared to appreciate the extra time available during the slower periods to attend conferences, analyze administrative data, and take vacation. On the other hand, a few appeared overwhelmed by the amount of work in the busy season, and suggested that it adversely affected the review process:

> *In the spring the work is unmanageable. A person can only put in so much effort when they are working flat out, and that effort is not enough to manage the number of preproposals. So [the preproposals] don't get the attention they need. We have lost preproposals that never went to panel because we have too much to worry about, and we didn't notice that they were missing. We have had several instances where panel members were in conflict but no one noticed it because there is so much happening we are making mistakes. [IOS]*

> *We are all putting in 15 hour days for the whole month of March. I can get ready for the first panel, but I can't get ready for the second panel because I am running the first one, and on and on. It is all compressed into this unmanageable crush of work. [IOS]*

> *The effort to process the preproposals is enormous. From my perspective there is practically no time to think about what we should be thinking about, which is the science. [IOS]*

NSF staff gave several examples of how the review process had become more efficient. These included the introduction of new tools which enabled more automated handling of preliminary proposals. We were told that NSF was generally resistant to automation, but that the "crushing volume" of preliminary proposals left the staff no choice and the resulting process had been an improvement. Also, knowing ahead of time how many full proposals to expect and making funding decisions once a year simplified planning and management. Finally, some staff believed that the two-step review had slowed down quick resubmission of proposals that had not been sufficiently improved (called "churning" by respondents).

While we did not plan to discuss the changes in the applicant and reviewer workloads with NSF staff, many spontaneously brought up the topic in the context of their own time management. Almost all said that the workload for the research community had improved. Respondents pointed out that it had become easier to recruit ad hoc reviewers because they receive fewer requests and panel reviewers because they prefer evaluating shorter preliminary proposals. NSF staff believed that the burden on the applicants had also decreased, because preliminary proposals are shorter and do not require a budget. However, some respondents noted that writing a preliminary proposal may take just as long as a full proposal for applicants who are not accustomed to the format.

3.3.2 Satisfaction with the New Process

Submission format

Most staff interviewed believed that the four pages allotted for the preliminary proposal were sufficient for the applicant to convey their idea and approach. While acknowledging that many reviewers prefer more detail, these respondents thought that increasing the length would defeat the purpose of a preliminary step, which was to reduce the burden on applicants and reviewers. A minority of respondents thought that four pages were too short and that broader impacts, in particular, were poorly presented by applicants:

> *In some cases [the four page length] is not adequate…The proposals that suffer most are those involving the development of complex models where there is not enough space to adequately explain the elements of the model and present preliminary or hypothetical data on tests of the model. [IOS]*

> *I think the only place where the space limit really showed was in the explanation of the broader impacts. Typically people really focus on the science and only leave three lines or so to explain the broader impacts. [IOS]*

Another topic discussed in the interviews was a single submission deadline per year. Several NSF staff reported that applicants perceive this to be a serious, and potentially career damaging, limitation:

> *It takes twice as long for them to get funded. It used to be 6 months to get funded, now it takes a year. Previously those that were good but were not funded could be resubmitted right away, now they have to wait a full year, even if they just missed [the funding cutoff]. [IOS]*

Some respondents pointed out, however, that the applicants can submit another proposal under a different program in parallel and that internal NSF studies show that only a minority of applicants submit more than one proposal a year to NSF.

Quality of review

NSF staff told us that reviewers were becoming more accustomed to the preliminary proposals, although some remained uncomfortable with the lack of detail about the project. A few respondents expressed concerns about the gaps in expertise of preliminary panel reviewers:

> *We span a huge range of organisms, etc. and it is really hard to get more than one maybe two experts on any panel, and we don't have ad hoc reviews [for preproposals], so a lot of times the science isn't fully appreciated by more than one panelist, which can affect the review. [IOS]*

> *A preproposal could be reviewed by three really inexperienced panelists and not get as rigorous of a review as it should get…I think there is a lot of variation in how the preproposals are reviewed [DEB]*

Respondents from IOS noted that the ratings given in preliminary reviews (outstanding, high, medium, low, and non-competitive) were not predictive of the full review outcome. Finally, a few commented that the new process might favor researchers with better grant-writing skills over those with better ideas:

The weakness [of the new process] is a potential for something to not get invited because the applicant does not know how to write a short proposal even if they could have written a great full proposal. [DEB]

In general, many NSF staff believed that reviews of preliminary proposals were rigorous and fair, and some said that the new process was an improvement.

In many ways [the review of a preproposal] is not that different from a full proposal in terms of fairness. We are asking reviewers to evaluate the idea and the basic feasibility. So I think it is an appropriate level of rigor for what they have and for what the goal is, which is to narrow the set. [IOS]

One of the reasons I favor the new system is because the panel is more fun, there is...not so much detail to wade through, the panel discussion is focused on the science, and not the other stuff. [IOS]

Quality of feedback to the applicants

On balance, interviewees appeared satisfied with the quality of feedback provided to the applicants. Some said that it was adequate and similar to full proposals. Others acknowledged that it may be less extensive, but they did not view this as a problem:

The comments are less likely to be expansive, but that isn't necessarily a bad thing. It might be appropriate. It is not the job of the reviewer to help the PI redesign their proposal. [DEB]

The main idea of the preproposal is to present the idea. It is hard to give a lot of detailed feedback on just the idea, so [the feedback] is somewhat limited based on the nature of the preproposals themselves. [DEB]

We were also told that the quality of feedback had been improving:

It started out being really bad. Some of the reviews were really short and the summaries of panel discussions were too short. We got a lot of feedback from the scientific community that the feedback the investigators was getting wasn't adequate. We have been trying to address that by taking the time to look over all of the panel summaries, and they are getting better. [DEB]

Quality of proposals

According to the majority of respondents, the quality of full proposals had improved because weaker projects are eliminated at the preliminary step and also because the applicants have an opportunity to make improvements based on reviewer input. To support this view, some NSF staff favorably contrasted core DEB/IOS proposals with CAREER proposals, which do not undergo a pre-selection step. Only one respondent thought that the quality of full proposals may have declined because the applicants do not have enough time between the preliminary and full submissions.

All NSF staff agreed that the problem with the system was not in the submissions or how reviews are conducted, but rather the amount of available funding, which is far too low to support all good projects. Respondents were confident that all awarded grants deserved to be funded:

I could be comfortable funding the top 25% [of proposals that come in], and we are so far below this that I am fully confident that we are funding good work. We make good investments. [IOS]

Effect on portfolio diversity

One of the concerns about the new review process was a possible reduction in the diversity of the DEB and IOS portfolios, and we explored this topic in the interviews. Most respondents believed that the scientific, demographic, and institutional diversity of awards remained unchanged, and some mentioned

having performed portfolio analyses or spoken with PIs to support this position. We were told that NSF Program Officers carefully review all competitive proposals to achieve a balanced portfolio. A few interviewees argued that the effect on diversity might even be positive, as institutions with higher teaching loads and fewer resources could more easily submit preliminary proposals. The only concern about portfolio diversity that emerged from the interviews was about a possible decline in interdisciplinary submissions:

> *One thing that is kind of unfortunate, our program used to work pretty closely with other groups, but because they have a different review system, it made co-reviews at the preproposal stage impossible. [IOS]*

> *Scientifically [proposals are] more narrow, because preproposals do not go through co-review. The community has figured that out and the proposals they send us have a narrower scope than what we got before the preproposal system. [DEB]*

Suggested changes

At the conclusion of the interview, we asked the staff whether they would go back to the old system. Only two said that they would. The remaining believed that while the two-step review has its flaws, the change was a necessary compromise because the old approach was unsustainable. Some staff pointed out that going back would cause more disruption and would not allow sufficient time for the new process to be fully tested. However, most if not all respondents were interested in exploring other review options. The idea of eliminating deadlines altogether (the Geosciences Directorate model) appeared to be a particular favorite. Other suggestions included limiting the number of applications per investigator to one per year or returning to a single-step review, but with shorter proposals.

Finally, we asked interviewees what, if anything, they would change about the two-step process. One suggestion was to allow the broader impacts and/or personnel section to be included as a supplemental page, to leave more space to describe the idea and approach. Another was to amend the conflict of interest rules, which these interviewees understood to prohibit a preliminary proposal applicant from serving as a full proposal reviewer.[11] Respondents argued that this policy deprived younger investigators of a valuable experience and made it difficult to find qualified reviewers. Other recommendations included simplifying the review summaries prepared for not invited proposals, and having an additional panelist serve as a "reader" at the preliminary stage – someone who reviews the proposal and contributes to the discussion, but does not serve as a formal reviewer.

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[11] According to the NSF staff who reviewed the draft of this report, the conflict rules do not preclude a preliminary proposal applicant from serving as a reviewer for full proposals.

4.   Summary and Conclusions

In 2012, the DEB and IOS divisions initiated a new review process for core programs. Our study examined the effects of this change as well as participant satisfaction through analysis of administrative grant data three years before and after the change, surveys of recent applicants and reviewers, and interviews with knowledgeable NSF staff. In this section, we summarize findings in the context of benefits anticipated by NSF.

Has the new process changed the diversity of the NSF portfolio?

The NSF staff we interviewed believed that the review change had little or no effect on the diversity of the NSF portfolio and some cited portfolio analyses they had performed to support this position. The only concern that emerged was a possible decrease in interdisciplinary projects, which may have occurred because preliminary proposals are not co-reviewed by multiple programs within NSF. We found no support for this concern in the administrative data, which showed no change in the percentage of applicants who indicated that their proposals were interdisciplinary. Further, representation of reviewers with non-biology expertise has increased since the review change. In the survey, the DEB and IOS applicants were less likely to describe their proposals as very interdisciplinary than the comparison applicants, but we did not have the data to determine whether this difference was due to a change in review.

Analysis of administrative records showed either no change or small improvements in the demographic and institutional diversity of the funded grants, as well as more support for collaborative projects and for states with low research activity. Changes in grant size were similar for the DEB, IOS, and comparison programs.

How satisfied is the research community with the proposal format and submission?

Most NSF staff interviewed thought that the 4-page limit for preliminary proposals was sufficient for the applicants to convey their idea and approach, although a view was also expressed that it could be longer for complex proposals. Feedback provided in the applicant and reviewer surveys indicated a consistent preference for a 5-page preliminary proposal. In contrast, 15 pages for full proposals was seen as too long by both reviewers and applicants, with 12-13 pages recommended as optimal by reviewers and 14 by applicants.

NSF staff were aware that a single submission deadline was problematic for some applicants, although we were also told that most investigators submit one proposal a year even when there is no restriction. Survey data revealed that applicants were strongly unsatisfied with the single submission: the ratings were in the negative range of 1.6 to 2.2 for all sub-groups. The most common change proposed by both reviewers and applicants was to return to at least two deadlines per year.

The level of satisfaction with the requirement to submit a preliminary proposal, the limit of two proposals per PI, and the timing of the preliminary proposal deadline received ratings in the neutral to negative range for unfunded applicants (2.8 to 3.1) and in the neutral to weakly positive range for funded applicants (3.0 to 3.4). Eliminating a preliminary proposal was the second most common suggestion for change among respondents. The ratings for the amount of time to prepare preliminary/full proposals and for the timing of the full proposal deadline were between 3.1 and 3.5 across applicant sub-groups. Finally, satisfaction with the submission process overall among funded applicants was significantly higher for the comparison group than for DEB and IOS (3.9 versus 3.2–3.3).

Did the new process improve the quality of submissions?

Almost all NSF staff agreed that the quality of full proposals had improved, through the elimination of weaker submissions at the preliminary stage and by giving invited applicants an opportunity to improve their proposals based on reviewer feedback. This view was borne out by administrative data: the combined scores for funded and unfunded full proposals have increased significantly after the change for DEB and IOS (from 3.6 to 3.9 and from 3.7 to 3.9), while declining slightly for the comparison group (from 3.6 to 3.5, although the change was not statistically significant). On the other hand, we found no or small differences in funded proposal scores and in reviewer ratings of proposal quality.

Did the two-step review improve the NSF staff, applicant, and reviewer workload?

The majority of NSF respondents reported in interviews that the workload to review core program proposals either decreased slightly or remained the same, but that it was very uneven throughout the year and at times overwhelming. According to administrative data, the number of proposals managed by a Program Officer had increased by 96% for DEB and 56% for IOS versus 16% for the comparison group between 2009 and 2015. We are unsure why staff perception did not match administrative data.

We used administrative and survey data to estimate changes in workload for the applicant and reviewer community. We found that for applicants the number of proposal-hours has increased by 36% for DEB and 16% for IOS versus 2% for the comparison group. In contrast, the workload on reviewers was reduced by 26% for DEB, 18% for IOS, and 24% for the comparison group. We note that these small differences in the workload should be considered in the context of a large increase in proposal volume at DEB and IOS relative to the comparison group. Depending on whether both preliminary and/or full proposals are included in the count, the number of submissions for DEB and IOS has increased by approximately 40-80% versus 2% for the comparison group. Thus, a two-step process has the potential to be more efficient for reviewers, if the number of preliminary proposals can be reduced or if these proposals can be processed more rapidly by NSF.

What is the level of satisfaction with the quality of review?

Perhaps not surprisingly, the level of applicant satisfaction with review quality was correlated with the proposal outcome: the ratings for preliminary proposals were in the somewhat unsatisfied to neutral range for not invited applicants; in the neutral to satisfied range for invited applicants; and in the satisfied range for funded applicants. Satisfaction with full proposal review was slightly higher than with preliminary review and similar between the DEB, IOS, and comparison applicants. Reviewer satisfaction with review was in the 3.5 to 4.5 range and the ratings were similar for the DEB, IOS, and comparison groups. The NSF staff views were fairly consistent with survey data. Most said that reviews remained rigorous and fair, although a few raised some concerns about preliminary panel expertise and the quality of feedback to the applicants. Based on these data, it appears unlikely that the new process had changed the quality of review.

In conclusion, we found mixed evidence that the new process had advanced the intended goals. The change had not compromised the diversity of NSF portfolio or the quality of review, while resulting in a significant positive effect on funding rates for full proposals. On the other hand, a large increase in submissions appeared to have offset the efficiencies resulting from shorter proposals and panel-only preliminary reviews. We also found that the applicant community was strongly dissatisfied with the single proposal deadline and that researchers funded through DEB and IOS core programs were less satisfied with the review process than their peers funded through non-participating programs.

Appendix A: Data Collection Instruments

Applicant Surveys

A1 = invited unfunded and funded
A2 = comparison funded
A3 = not invited

A1

The first three questions are collecting background information about you. The remaining questions refer to your experience with the proposal #_____ entitled "_____" submitted to NSF in FY2015.

- □ I did not submit this proposal → Exit. Message "Please accept our apologies, you received this survey by mistake."

A2

The first three questions are collecting background information about you. The remaining questions refer to your experience with the proposal #_____ entitled "_____" submitted to NSF in FY2015.

- □ I did not submit this proposal → Exit. Message "Please accept our apologies, you received this survey by mistake."

A3

The first three questions are collecting background information about you. The remaining questions refer to your experience with the proposal #_____ entitled "_____" submitted to NSF in FY2015.

- □ I did not submit this proposal → Exit. Message "Please accept our apologies, you received this survey by mistake."

RESPONDENT CHARACTERISTICS

A1-A3

Which of the following best describes your current academic rank?

- □ Postdoctoral fellow
- □ Research scientist
- □ Adjunct professor
- □ Assistant professor
- □ Associate professor
- □ Full professor
- □ Other _____

A1-A3

What is your tenure status?

- □ Tenure-track, but not yet tenured
- □ Tenured
- □ Not tenure-track
- □ Other

A1-A3

How many <u>active</u> NSF awards do you currently have as a PI or co-PI? Please enter number equal to or greater than 0.

_____

☐   Unsure/do not know

PROJECT CHARACTERISTICS

A1

As a reminder, all questions in the survey refer to your experience with the proposal #_____ entitled "_____" submitted to NSF in FY2015.

A2

As a reminder, all questions in the survey refer to your experience with the proposal #_____ entitled "_____" submitted to NSF in FY2015

A3

As a reminder, all questions in the survey refer to your experience with the proposal #_____ entitled "_____" submitted to NSF in FY2015

A1-A3

How would you rate your proposed project in terms of the following characteristics?

	Not at all	Somewhat	Very	Unsure
Collaborative	☐	☐	☐	☐
Interdisciplinary	☐	☐	☐	☐
High-risk/high-reward	☐	☐	☐	☐

A1-A3

Approximately how many years prior to this submission did you first conceive the idea described in this proposal? If less than a year, please enter a fraction (e.g. 0.5 for 6 months).

_____

APPLICATION WORKLOAD

A1

Approximately, how many hours of work, to the nearest hour, did it take you to prepare your preliminary and full proposal?

Preliminary proposal: _____
Full proposal: _____

A2

Approximately, how many hours of work, to the nearest hour, did it take you to prepare this proposal?

_____

A3

Approximately, how many hours of work, to the nearest hour, did it take you to prepare this preliminary proposal?

_____

A1

Which of the following is true? Having previously prepared the successful preliminary proposal…

- □ Saved you subsequent time/effort spent developing a full proposal
- □ Did not save you subsequent time/effort spent developing a full proposal
- □ Do not know

SATISFACTION WITH THE APPLICATION PROCESS

A1

What is your level of satisfaction with the following aspects of the submission process?

	Not at all	Somewhat	Very	Unsure
Requirement to submit a preliminary proposal	□	□	□	□
The single submission per year for preliminary proposals	□	□	□	□
The cap of 2 submissions per individual PI	□	□	□	□
Timing of the preliminary proposal deadline	□	□	□	□
Amount of time to prepare a preliminary proposal	□	□	□	□
Timing of the full proposal deadline	□	□	□	□
Amount of time to prepare a full proposal	□ →A	□ →A	□	□
Submission process overall	□	□	□	□

    A. How many months would be <u>optimal</u> to prepare a full proposal?

         _____

A2

What is your level of satisfaction with the submission process overall?

- □ Very unsatisfied
- □ Unsatisfied
- □ Neutral
- □ Satisfied
- □ Very satisfied

A3

What is your level of satisfaction with the following aspects of the submission process?

	Very unsatisfied	Unsatisfied	Neutral	Satisfied	Very satisfied	Not applicable No opinion
Requirement to submit a preliminary proposal	☐	☐	☐	☐	☐	☐
The single submission deadline per year for preliminary proposals	☐	☐	☐	☐	☐	☐
The cap of 2 submissions per individual PI	☐	☐	☐	☐	☐	☐
Timing of the preliminary proposal deadline	☐	☐	☐	☐	☐	☐
Amount of time to prepare a preliminary proposal	☐	☐	☐	☐	☐	☐
Submission process overall	☐	☐	☐	☐	☐	☐

A1 and A3

Was the 4-page preliminary proposal limit <u>sufficient</u> for you to convey your idea and approach?

    ☐ Yes

    ☐ No

A1 and A3

How many pages would you recommend as <u>optimal</u> for the Project Description section in a preliminary proposal?

    _____

A1-A2

Was the 15-page Project Description section in the full proposal <u>sufficient</u> for you to convey your idea and approach?

    ☐ Yes

    ☐ No

A1-A2

How many pages would you recommend as <u>optimal</u> for the Project Description in a full proposal?

    _____

SATISFACTION WITH THE REVIEW PROCESS

A1

What is your level of satisfaction with the following elements of the review process? 1 = Very Unsatisfied, 2 = Unsatisfied, 3 = Neutral, 4 = Satisfied, 5 = Very Satisfied

	Preliminary proposal		Full proposal	
	Enter number 1-5 for each row	Not applicable/no opinion	Enter number 1-5 for each row	Not applicable/no opinion
Conceptual understanding of the proposal by reviewers	□	□	□	□
Technical accuracy of review	□	□	□	□
Fairness of review	□	□	□	□
Balanced consideration of proposal strengths and weaknesses	□	□	□	□
Review process overall	□	□	□	□

A2-A3

What is your level of satisfaction with the following elements of the review process?

	Very unsatisfied	Unsatisfied	Neutral	Satisfied	Very satisfied	Not applicable No opinion
Conceptual understanding of the proposal by reviewers	□	□	□	□	□	□
Technical accuracy of review	□	□	□	□	□	□
Fairness of review	□	□	□	□	□	□
Balanced consideration of proposal strengths and weaknesses	□	□	□	□	□	□
Review process overall	□	□	□	□	□	□

A1 and A3

Did you speak directly with a Program Officer/Program Director after receiving the review decision for your preliminary proposal?

- □ Yes → A
- □ No
- □ Do not know/unsure

A. How helpful to you was this discussion?
  □ Not helpful
  □ Somewhat helpful
  □ Very helpful

A1

How helpful were the reviewer comments on the preliminary proposal to developing the full proposal?
  □ Not helpful
  □ Somewhat helpful
  □ Very helpful

A3

How helpful were the reviews for revising the proposal for another submission?
  □ I do not plan to resubmit
  □ Not helpful
  □ Somewhat helpful
  □ Very helpful
  □ Unsure

A1 and A3

Please describe one change you would make to the new submission/review process.
  □ I would not make any changes
  □ I do not know

Use the space below to enter comments.
_____

Reviewer Surveys

R1 = Ad hoc full proposals
R2 = Panel full proposals
R3 = Panel preliminary proposals

R1

The first three questions are collecting background information about you. The remaining questions refer to your experience as an ad hoc reviewer between August 2014 and July 2015 on the proposal entitled "[title]" for the _____ [NSF Division (NSF program name)].

  □   I did not serve as an ad hoc reviewer for this proposal → Exit. Message "Please accept our apologies, you received this survey by mistake."

R2

The first three questions are collecting background information about you. The remaining questions refer to your experience as a panel reviewer between August 2014 and July 2015 for the _____ [NSF Division (NSF program name)].

  □   I did not serve on this panel → Exit. Message "Please accept our apologies, you received this survey by mistake."

R3

The first three questions are collecting background information about you. The remaining questions refer to your experience as a preliminary proposal panel reviewer between August 2014 and July 2015 for the _____ [NSF Division (NSF program name)].

  □   I did not serve on this panel → Exit. Message "Please accept our apologies, you received this survey by mistake."

RESPONDENT CHARACTERISTICS

R1-R3

Which of the following best describes your current academic rank?

  □   Postdoctoral fellow
  □   Research scientist
  □   Adjunct professor
  □   Assistant professor
  □   Associate professor
  □   Full professor
  □   Other _____

R1-R3

What is your tenure status?

  □   Tenure-tracked or equivalent, but not yet tenured
  □   Tenured or equivalent
  □   Not tenure-tracked
  □   Other

R1-R3

Have you ever been a PI or Co-PI on a <u>preliminary proposal</u> submitted to core programs in the Division of Environmental Biology (DEB) or the Division of Integrative Organismal Systems (IOS)?

- □ Yes → A
- □ No
- □ Unsure

A. Have you ever been a PI or Co-PI on an award from the core programs in DEB or IOS stemming from a preliminary proposal?

- □ Yes
- □ No
- □ Unsure

WORKLOAD

As a reminder, all questions in the survey refer to your experience as an ad hoc reviewer in FY2015 on the proposal entitled "[title]" for the _____ [NSF program name]

As a reminder, all questions in the survey refer to your experience as a panel reviewer in FY2015 for the _____ [NSF program name].

As a reminder, all questions in the survey refer to your experience as a preliminary proposal panel reviewer in FY2015 for the _____ [NSF program name].

R1

Approximately how many hours of work, to the nearest hour, did it take you to review this proposal?

_____

R2-R3

Please complete the following information about this panel experience. Do not include travel and panel meeting time in your estimates and estimate to the nearest hour.

Review format: Was your participation in the panel primarily in-person or primarily through virtual meeting technologies?	Approximate number of reviewers on the panel, including yourself	Number of proposals assigned to you for review (N)	Approximate <u>number of hours</u> you spent per review prior to the panel meeting (H)	Total number of hours you spent on all reviews, T=N * H [automatically calculated]
□ Virtual □ In-person	____	____	____	

R3

How would you compare the time and effort to review each preliminary proposal to a full proposal? On average, a preliminary proposal took approximately…

- □ ¼ of the time or less to review
- □ ½ of the time to review
- □ The same time to review
- □ 25% more time to review
- □ 50% more time to review
- □ 100% more time to review
- □ More than twice the amount of time to review
- □ I do not know. I have never reviewed a full proposal

SATISFACTION WITH PROPOSALS

R1

How satisfied were you with the proposal in terms of…

	Not at all satisfied	Somewhat satisfied	Neutral	Satisfied	Very satisfied	Do not know
Intellectual merit	□	□	□	□	□	□
Broader impact	□	□	□	□	□	□
Potential to advance your field	□	□	□	□	□	□
Potential to transform your field	□	□	□	□	□	□

R2-R3

How satisfied were you with the proposals reviewed by your panel in terms of…

	Not at all satisfied	Somewhat satisfied	Neutral	Satisfied	Very satisfied	Do not know
Intellectual merit	□	□	□	□	□	□
Broader impact	□	□	□	□	□	□
Potential to advance your field	□	□	□	□	□	□
Potential to transform your field	□	□	□	□	□	□

R2-R3

Approximately what fraction of the proposals reviewed by your panel had the following characteristics?

	<10%	~25%	~33%	~50%	~66%	>66%	Do not know
Addressed a significant question/problem/opportunity	□	□	□	□	□	□	□
Clearly conveyed the idea and approach	□	□	□	□	□	□	□
Presented an approach that was feasible and appropriate	□	□	□	□	□	□	□
Contained convincing preliminary data	□	□	□	□	□	□	□
Could be characterized as high-risk/high-reward	□	□	□	□	□	□	□
Demonstrated that investigators had the requisite expertise	□	□	□	□	□	□	□
Were collaborative and/or interdisciplinary	□	□	□	□	□	□	□

R2-R3

What percentage of the proposals reviewed by your panel was clearly not worth funding?

    □ Do not know/recall

    _____

R1

Did this proposal have the following characteristics?

Addressed a significant question/problem/opportunity	□
Clearly conveyed the idea and approach	□
Presented an approach that was feasible and appropriate	□
Contained convincing preliminary data	□
Could be characterized as high-risk/high-reward	□
Demonstrated that investigators had the requisite expertise	□
Was collaborative and/or interdisciplinary	□
Was clearly not worth funding	□

SATISFACTION WITH REVIEW PROCESS

R1-R2

Was the 15-page Project Description narrative sufficient for you to evaluate the proposed idea and approach?

    □ Yes

    □ No

R1-R2

How many pages would you recommend as <u>optimal</u> for the Project Description section in a full proposal?

_____

R3

Was the 4-page Project Description narrative <u>sufficient</u> for you to evaluate the proposed idea and approach?

☐ Yes
☐ No

R3

How many pages would you recommend as <u>optimal</u> for the Project Description section in a preliminary proposal?

_____

R2-R3

What is your level of satisfaction with the following….

	Very unsatisfied	Unsatisfied	Neutral	Satisfied	Very satisfied	Do not know
Number of proposals you were assigned to review	☐	☐	☐	☐	☐	☐
Quality of written reviews by other panelists/ad hoc reviewers	☐	☐	☐	☐	☐	☐
Rigor of proposal discussion	☐	☐	☐	☐	☐	☐
Balance in the reviewers' consideration of proposal strengths and weaknesses	☐	☐	☐	☐	☐	☐
Willingness of other reviewers to support high-risk/high-reward projects	☐	☐	☐	☐	☐	☐
Fairness of final panel ratings	☐	☐	☐	☐	☐	☐
Level of consensus among the reviewers	☐	☐	☐	☐	☐	☐
Quality of panel summaries	☐	☐	☐	☐	☐	☐
Review process overall	☐	☐	☐	☐	☐	☐

R1-R3

Please describe one change you would make to the merit review process.

☐ I would not make any changes
☐ I do not know

Use the space below to enter your comments.
_____

Interview Questions for NSF Program Directors

1. How would you compare the old and new process in terms of time and effort to identify and recruit reviewers, manage the review process, develop review documents, and make award decisions?

2. With the new process, do you have more, less, or the same amount of time in which to accomplish these tasks? Are you under greater pressure to get the same work done within a shorter period of time?

3. In your view, is the 4-page project description sufficient for the applicant to convey the idea and approach? What would you change, if anything, about the preliminary proposal requirements?

4. Do the applicants appear to use the opportunity of the preliminary step, which is focused on evaluating an idea, to propose more risky, innovative ideas?

5. Have you noticed any differences in how reviewers evaluate 4-page pre-proposals versus full proposals? In your experience, do the reviewers appear comfortable making recommendations based on the information available to them?

6. How satisfied are you with the rigor and fairness of the preliminary proposal review?

7. How satisfied are you with the feedback provided to the applicant? Do you think this feedback will be helpful to the uninvited applicants who wish to revise and resubmit their proposals?

8. How satisfied are you with the recommendations made by the preliminary panel? To what extent do you agree with them? How are these recommendations used by the program to make the final invite/not-invite decision?

9. How would you compare the full proposals that had undergone a preliminary review with the top-tier full proposals that had not in terms of quality?

10. How satisfied are you with the awards being made under the new process? Are there any differences with the old process?

11. Has the new process affected the scientific, demographic, or institutional diversity of the funded projects? Is there any reason to believe that it might?

12. What are the strengths and weaknesses of the two-step review process? What would you change about it? Would you go back to the old system?

13. Do you think the new process is achieving its intended goals of reducing the workload without compromising the quality of review and the diversity of NSF portfolio?

Interview Questions for NSF Staff Other Than Program Directors

1. What are your responsibilities related to peer review?

2. How would you compare the old and new process in terms of your time and effort?

3. In your view, is the 4-page project description sufficient for the applicant to convey the idea and approach? What would you change, if anything, about the preliminary proposal requirements?

4. Do the applicants appear to use the opportunity of the preliminary step, which is focused on evaluating an idea, to propose more risky, innovative ideas?

5. Have you noticed any differences in how reviewers evaluate 4-page pre-proposals versus full proposals? In your experience, do the reviewers appear comfortable making recommendations based on the information available to them?

6. How satisfied are you with the rigor and fairness of the preliminary proposal review?

7. How satisfied are you with the feedback provided to the applicant? Do you think this feedback will be helpful to the uninvited applicants who wish to revise and resubmit their proposals?

8. How satisfied are you with the recommendations made by the preliminary panel? To what extent do you agree with them? How are these recommendations used by the program to make the final invite/not-invite decision?

9. How would you compare the full proposals that had undergone a preliminary review with the top-tier full proposals that had not in terms of quality?

10. How satisfied are you with the awards being made under the new process? Are there any differences with the old process?

11. Has the new process affected the scientific, demographic, or institutional diversity of the funded projects? Is there any reason to believe that it might?

12. What are the strengths and weaknesses of the two-step review process? What would you change about it? Would you go back to the old system?

13. Do you think the new process is achieving its intended goals of reducing the workload without compromising the quality of review and the diversity of NSF portfolio?

Appendix B: Survey Data Tables

Applicant Surveys

Q1: Which of the following best describes your current academic rank?

Exhibit 1a. Comparison: Current Academic Rank

	Funded	
	n	Percent
Postdoctoral fellow	1	1
Research scientist	12	6
Adjunct professor	1	0
Assistant professor	32	15
Associate professor	49	23
Full professor	96	50
Other	10	5

Note: Funded (N=201, Missing=0); Overall (N=201, Missing=0)

Exhibit 1b. DEB: Current Academic Rank

	Funded		Invited, not funded		Not invited		Overall	
	n	Percent	n	Percent	n	Percent	n	Percent
Postdoctoral fellow	1	1	1	1	5	1	7	1
Research scientist	2	2	10	5	34	9	46	7
Adjunct professor	1	1	1	0	3	1	5	1
Assistant professor	25	23	53	26	133	36	211	31
Associate professor	28	26	54	25	91	25	173	25
Full professor	51	44	90	40	99	27	240	34
Other	3	3	7	3	7	2	17	2

Note: Funded (N=112, Missing=1); Invited, not funded (N=218, Missing=2); Not invited (N=377, Missing=5); Overall (N=707, Missing=8)

Exhibit 1c. IOS: Current Academic Rank

	Funded		Invited, not funded		Not invited		Overall	
	n	Percent	n	Percent	n	Percent	n	Percent
Postdoctoral fellow	0	0	0	0	4	1	4	1
Research scientist	3	2	2	1	15	4	20	3
Adjunct professor	0	0	0	0	3	1	3	0
Assistant professor	25	18	50	26	114	29	189	27
Associate professor	42	31	59	30	126	32	227	31
Full professor	70	48	87	41	123	31	280	37
Other	1	1	4	2	5	1	10	1

Note: Funded (N=141, Missing=0); Invited, not funded (N=202, Missing=0); Not invited (N=395, Missing=5); Overall (N=738, Missing=5)

Q2: What is your tenure status?

Exhibit 2a. Comparison: Tenure Status

	Funded	
	n	**Percent**
Tenure-track or equivalent, but not yet tenured	39	19
Tenured or equivalent	138	69
Not tenure-track	22	11
Other	2	1

Note: Funded (N=201, Missing=0); Overall (N=201, Missing=0)

Exhibit 2b. DEB: Tenure Status

	Funded		Invited, not funded		Not invited		Overall	
	n	**Percent**	**n**	**Percent**	**n**	**Percent**	**n**	**Percent**
Tenure-track or equivalent, but not yet tenured	28	26	54	26	130	35	212	31
Tenured or equivalent	77	69	141	64	186	50	404	58
Not tenure-track	4	4	15	7	49	13	68	10
Other	2	2	6	3	6	2	14	2

Note: Funded (N=112, Missing=1); Invited, not funded (N=218, Missing=2); Not invited (N=377, Missing=6); Overall (N=707, Missing=9)

Exhibit 2c. IOS: Tenure Status

	Funded		Invited, not funded		Not invited		Overall	
	n	**Percent**	**n**	**Percent**	**n**	**Percent**	**n**	**Percent**
Tenure-track or equivalent, but not yet tenured	28	21	47	25	116	30	191	27
Tenured or equivalent	106	74	145	70	228	58	479	64
Not tenure-track	7	5	9	4	38	10	54	7
Other	0	0	1	0	7	2	8	1

Note: Funded (N=141, Missing=0); Invited, not funded (N=202, Missing=0); Not invited (N=395, Missing=6); Overall (N=738, Missing=6)

Q3: How many active NSF awards do you currently have as a PI or Co-PI? Please enter number equal to or greater than 0.

Exhibit 3a. Comparison: Number of Active NSF Awards as a PI or Co-PI

	n	Mean	SD	Max	Min
Funded					
Number of awards	201	1.64	1.18	5	1

Note: Funded (N=201, Missing=0); Overall (N=201, Missing=0)

Exhibit 3b. DEB: Number of Active NSF Awards as a PI or Co-PI

	n	Mean	SD	Max	Min
Funded					
Number of awards	110	1.88	1.24	6	1
Invited, not funded					
Number of awards	213	1.17	1.57	6	0
Not invited					
Number of awards	361	0.65	1.14	5	0
Overall					
Number of awards	684	1	1.41	6	0

Note: Funded (N=111, Missing=1); Invited, not funded (N=218, Missing=5); Not invited (N=373, Missing=12); Overall (N=702, Missing=18)

Exhibit 3c. IOS: Number of Active NSF Awards as a PI or Co-PI

	n	Mean	SD	Max	Min
Funded					
Number of awards	141	1.43	0.88	5	1
Invited, not funded					
Number of awards	198	0.66	1.14	5	0
Not invited					
Number of awards	384	0.39	0.86	4	0
Overall					
Number of awards	723	0.65	1.06	5	0

Note: Funded (N=141, Missing=0); Invited, not funded (N=202, Missing=4); Not invited (N=394, Missing=10); Overall (N=737, Missing=14)

Q4: How would you rate your proposed project in terms of the following characteristics?

Exhibit 4a. Comparison: Proposed Project Rating by Characteristic

	n	Not at all Percent	Somewhat Percent	Very Percent	Average	SD
Funded						
Collaborative	200	6	26	68	2.62	0.6
Interdisciplinary	200	3	33	64	2.61	0.55
High-risk/high-reward	192	11	56	33	2.22	0.63

Note: Funded (N=201, Missing=1, Unsure=0-8); Overall (N=201, Missing=1, Unsure=0-8)

Exhibit 4b. DEB: Proposed Project Rating by Characteristic

	N	Not at all Percent	Somewhat Percent	Very Percent	Average	SD
Funded						
Collaborative	109	6	12	82	2.76	0.54
Interdisciplinary	108	12	47	41	2.29	0.67
High-risk/high-reward	110	9	62	29	2.21	0.58
Invited, not funded						
Collaborative	213	2	19	79	2.76	0.48
Interdisciplinary	212	9	47	45	2.36	0.64
High-risk/high-reward	207	9	59	31	2.22	0.6
Not invited						
Collaborative	368	12	17	71	2.59	0.69
Interdisciplinary	366	8	48	44	2.36	0.63
High-risk/high-reward	356	14	56	30	2.16	0.64
Overall						
Collaborative	690	8	17	75	2.67	0.62
Interdisciplinary	686	9	47	44	2.35	0.64
High-risk/high-reward	673	12	58	30	2.19	0.62

Note: Funded (N=112, Missing=2, Unsure=0-2); Invited, not funded (N=218, Missing=4-6, Unsure=1-5); Not invited (N=377, Missing=8-11, Unsure=0-11); Overall (N=707, Missing=14-18, Unsure=3-16)

Exhibit 4c. IOS: Proposed Project Rating by Characteristic

	n	Not at all Percent	Somewhat Percent	Very Percent	Average	SD
Funded						
Collaborative	141	10	30	60	2.49	0.67
Interdisciplinary	140	6	46	48	2.42	0.6
High-risk/high-reward	140	10	59	31	2.21	0.6
Invited, not funded						
Collaborative	201	11	29	60	2.49	0.68
Interdisciplinary	199	6	47	47	2.41	0.6
High-risk/high-reward	196	6	60	34	2.29	0.57
Not invited						
Collaborative	383	19	30	52	2.33	0.77
Interdisciplinary	384	5	40	55	2.5	0.59
High-risk/high-reward	370	8	58	33	2.25	0.6
Overall						
Collaborative	725	15	29	56	2.41	0.74
Interdisciplinary	723	5	43	51	2.46	0.6
High-risk/high-reward	706	8	59	33	2.25	0.59

Note: Funded (N=141, Missing=0-1, Unsure=0-1); Invited, not funded (N=202, Missing=1-2, Unsure=0-4); Not invited (N=395, Missing=9-13, Unsure=1-12); Overall (N=738, Missing=12-15, Unsure=1-17)

Q5: Approximately how many years prior to this submission did you first conceive the idea described in this proposal? If less than a year, please enter a fraction (e.g. 0.5 for 6 months).

Exhibit 5a. Comparison: Years since Conception of Proposal Idea

	n	Mean	SD	Max	Min
Funded					
Number of years	198	2.7	3.57	25	0.25

Note: Funded (N=201, Missing=3); Overall (N=201, Missing=3)

Exhibit 5b. DEB: Years since Conception of Proposal Idea

	n	Mean	SD	Max	Min
Funded					
Number of years	109	4.23	6.35	30	0.2
Invited, not funded					
Number of years	212	3.22	4.01	36	0.4
Overall					
Number of years	321	3.54	4.96	36	0.2

Note: Funded (N=112, Missing=3); Invited, not funded (N=218, Missing=6); Overall (N=330, Missing=9)

Exhibit 5c. IOS: Years since Conception of Proposal Idea

	n	Mean	SD	Max	Min
Funded					
Number of years	139	3.23	3.12	19	0.4
Invited, not funded					
Number of years	198	3.21	3.26	25	0.25
Overall					
Number of years	337	3.22	3.2	25	0.25

Note: Funded (N=141, Missing=2); Invited, not funded (N=202, Missing=4); Overall (N=343, Missing=6)

Q6: Approximately, how many hours of work, to the nearest hour, did it take you to prepare your preliminary and full proposal?

Exhibit 6a. Comparison: Hours of Work to Prepare Full Proposal

	n	Mean	SD	Max	Min
Funded					
Full proposal:	193	132.57	170.07	1200	12

Note: Funded (N=201, Missing=0-8); Overall (N=201, Missing=0-8)

Exhibit 6b. DEB: Hours of Work to Prepare Preliminary and Full Proposal

	n	Mean	SD	Max	Min
Funded					
Preliminary proposal:	104	94.46	369.89	3200	0
Full proposal:	103	207.43	779.29	6400	4
Invited, not funded					
Preliminary proposal:	202	51.91	74.24	400	0
Full proposal:	203	103.78	149.36	1200	0
Not invited					
Preliminary proposal:	361	92.81	174.19	1600	5
Overall					
Preliminary proposal:	667	80.22	199.55	3200	0
Full proposal:	306	136.28	470.78	6400	0

Note: Funded (N=112, Missing=8-9); Invited, not funded (N=218, Missing=15-16); Not invited (N=377, Missing=0-16); Overall (N=330-707, Missing=24-40)

Exhibit 6c. IOS: Hours of Work to Prepare Preliminary and Full Proposal

	n	Mean	SD	Max	Min
Funded					
Preliminary proposal:	134	66.99	76.66	500	0
Full proposal:	135	146.48	183	1000	20
Invited, not funded					
Preliminary proposal:	192	62.96	110.82	1000	0
Full proposal:	190	125.83	148.81	720	0
Not invited					
Preliminary proposal:	382	81.34	97.51	700	8
Overall					
Preliminary proposal:	708	73.92	98.29	1000	0
Full proposal:	325	133.75	164.08	1000	0

Note: Funded (N=141, Missing=6-7); Invited, not funded (N=202, Missing=10-12); Not invited (N=395, Missing=0-13); Overall (N=343-738, Missing=18-30)

Q7: Which of the following is true? Having previously prepared the successful preliminary proposal…

Exhibit 7a. DEB: Time and Effort Saved by Preparing the Successful Preliminary Proposal

	Funded		Invited, not funded		Overall	
	n	Percent	n	Percent	n	Percent
Saved you subsequent time/effort spent developing a full proposal	64	59	102	50	166	53
Did not save you subsequent time/effort spent developing a full proposal	34	31	89	43	123	39
Do not know	11	10	15	7	26	8

Note: Funded (N=112, Missing=3); Invited, not funded (N=218, Missing=12); Overall (N=330, Missing=15)

Exhibit 7b. IOS: Time and Effort Saved by Preparing the Successful Preliminary Proposal

	Funded		Invited, not funded		Overall	
	n	**Percent**	**n**	**Percent**	**n**	**Percent**
Saved you subsequent time/effort spent developing a full proposal	83	60	95	48	178	53
Did not save you subsequent time/effort spent developing a full proposal	50	36	88	45	138	41
Do not know	6	4	15	8	21	6

Note: Funded (N=141, Missing=2); Invited, not funded (N=202, Missing=4); Overall (N=343, Missing=6)

Q8: What is your level of satisfaction with the following aspects of the submission process?

Exhibit 8a. Comparison: Satisfaction with Aspects of the Submission Process

	n	Very Unsatisfied Percent	Unsatisfied Percent	Neutral Percent	Satisfied Percent	Very Satisfied Percent	Average	SD
Funded								
Submission process overall	199	1	3	16	62	17	3.91	0.75

Note: Funded (N=201, Missing=0-2, Not Applicable=0); Overall (N=201, Missing=0-2, Not Applicable=0)

Exhibit 8b. DEB: Satisfaction with Aspects of the Submission Process

	n	Very Unsatisfied Percent	Unsatisfied Percent	Neutral Percent	Satisfied Percent	Very Satisfied Percent	Average	SD
Funded								
Requirement to submit a preliminary proposal	105	11	13	20	40	16	3.37	1.22
The single submission deadline per year for preliminary proposals	109	33	34	17	10	6	2.21	1.17
The cap of 2 submissions per individual PI	105	10	17	28	31	14	3.21	1.19
Timing of the preliminary proposal deadline	108	6	18	36	34	6	3.16	0.99
Amount of time to prepare a preliminary proposal	105	4	10	25	56	7	3.52	0.89
Timing of the full proposal deadline	108	5	23	28	35	9	3.21	1.04
Amount of time to prepare a full proposal	108	4	11	31	48	7	3.42	0.9
Submission process overall	109	4	18	28	44	5	3.28	0.97
Invited, not funded								
Requirement to submit a preliminary proposal	206	13	28	22	29	7	2.9	1.18
The single submission deadline per year for	206	45	36	10	8	1	1.84	0.97

	n	Very Unsatisfied Percent	Unsatisfied Percent	Neutral Percent	Satisfied Percent	Very Satisfied Percent	Average	SD
preliminary proposals								
The cap of 2 submissions per individual PI	205	19	24	22	25	10	2.82	1.26
Timing of the preliminary proposal deadline	205	8	23	31	31	6	3.03	1.06
Amount of time to prepare a preliminary proposal	206	6	19	26	44	5	3.23	1.01
Timing of the full proposal deadline	205	10	14	33	36	7	3.16	1.07
Amount of time to prepare a full proposal	204	6	23	31	36	4	3.11	0.99
Submission process overall	207	12	30	24	32	2	2.84	1.07
Not invited								
Requirement to submit a preliminary proposal	364	16	19	20	32	12	3.05	1.29
The single submission deadline per year for preliminary proposals	365	48	32	9	8	3	1.87	1.07
The cap of 2 submissions per individual PI	358	16	22	27	26	9	2.91	1.21
Timing of the preliminary proposal deadline	361	10	20	32	34	5	3.04	1.06
Amount of time to prepare a preliminary proposal	363	7	18	29	39	6	3.19	1.03
Submission process overall	361	11	20	32	30	7	3.02	1.1
Overall								
Requirement to submit a preliminary proposal	675	15	21	21	32	11	3.05	1.25
The single submission deadline per year for preliminary proposals	680	45	34	11	8	3	1.91	1.07
The cap of 2 submissions per individual PI	668	16	22	26	26	10	2.92	1.23
Timing of the preliminary proposal deadline	674	9	20	32	33	5	3.06	1.05
Amount of time to prepare a preliminary proposal	674	6	17	28	43	6	3.25	1.01
Timing of the full proposal deadline	313	8	17	32	36	8	3.18	1.06

	n	Very Unsatisfied Percent	Unsatisfied Percent	Neutral Percent	Satisfied Percent	Very Satisfied Percent	Average	SD
Amount of time to prepare a full proposal	312	5	19	31	40	5	3.21	0.98
Submission process overall	677	10	23	29	33	5	3	1.08

Note: Funded (N=112, Missing=3-4, Not Applicable=0-4); Invited, not funded (N=218, Missing=11-13, Not Applicable=0-1); Not invited (N=377, Missing=0-14, Not Applicable=0-5); Overall (N=330-707, Missing=16-30, Not Applicable=1-9)

Exhibit 8c. IOS: Satisfaction with Aspects of the Submission Process

	n	Very Unsatisfied Percent	Unsatisfied Percent	Neutral Percent	Satisfied Percent	Very Satisfied Percent	Average	SD
Funded								
Requirement to submit a preliminary proposal	138	13	18	31	22	16	3.11	1.24
The single submission deadline per year for preliminary proposals	138	44	36	12	7	1	1.85	0.97
The cap of 2 submissions per individual PI	137	7	13	36	28	16	3.33	1.11
Timing of the preliminary proposal deadline	136	10	18	38	30	4	3	1.02
Amount of time to prepare a preliminary proposal	138	4	16	29	43	8	3.36	0.96
Timing of the full proposal deadline	137	1	11	31	49	8	3.5	0.84
Amount of time to prepare a full proposal	139	2	17	28	48	4	3.35	0.89
Submission process overall	138	4	23	26	40	6	3.22	1
Invited, not funded								
Requirement to submit a preliminary proposal	196	24	21	16	28	11	2.81	1.36
The single submission deadline per year for preliminary proposals	196	59	28	7	6	1	1.62	0.91
The cap of 2 submissions per individual PI	194	13	17	37	28	5	2.94	1.08
Timing of the preliminary proposal deadline	195	15	20	37	25	2	2.79	1.06
Amount of time to prepare a preliminary proposal	195	10	19	27	40	3	3.08	1.06
Timing of the full proposal deadline	194	9	11	36	40	3	3.18	0.99
Amount of time to prepare a full proposal	196	8	17	36	36	4	3.1	0.98

	n	Very Unsatisfied Percent	Unsatisfied Percent	Neutral Percent	Satisfied Percent	Very Satisfied Percent	Average	SD
Submission process overall	197	17	34	22	24	4	2.65	1.13
Not invited								
Requirement to submit a preliminary proposal	383	19	22	22	28	9	2.87	1.27
The single submission deadline per year for preliminary proposals	384	55	33	7	4	1	1.64	0.86
The cap of 2 submissions per individual PI	373	12	13	34	30	12	3.15	1.17
Timing of the preliminary proposal deadline	379	8	20	36	31	5	3.05	1.01
Amount of time to prepare a preliminary proposal	380	7	15	36	34	7	3.2	1.02
Submission process overall	386	11	21	25	38	5	3.05	1.12
Overall								
Requirement to submit a preliminary proposal	717	19	21	22	27	11	2.9	1.29
The single submission deadline per year for preliminary proposals	718	54	32	8	5	1	1.67	0.9
The cap of 2 submissions per individual PI	704	12	14	35	29	11	3.13	1.14
Timing of the preliminary proposal deadline	710	10	20	36	29	4	2.97	1.03
Amount of time to prepare a preliminary proposal	713	7	17	33	37	6	3.19	1.02
Timing of the full proposal deadline	331	6	11	34	43	5	3.3	0.95
Amount of time to prepare a full proposal	335	6	17	33	40	4	3.2	0.95
Submission process overall	721	11	25	24	35	5	2.97	1.12

Note: Funded (N=141, Missing=2, Not Applicable=0-3); Invited, not funded (N=202, Missing=5-6, Not Applicable=0-3); Not invited (N=395, Missing=0-11, Not Applicable=0-12); Overall (N=343-738, Missing=7-18, Not Applicable=1-17)

Q8A: How many months would be optimal to prepare a full proposal?

Exhibit 8A.1. DEB: Optimal Number of Months to Prepare a Full Proposal

	n	Mean	SD	Max	Min
Funded					
Number of Months	16	3.07	1.64	6	1
Invited, not funded					
Number of Months	58	3.64	2.3	8	0.25
Overall					
Number of Months	74	3.53	2.19	8	0.25

Note: Funded (N=16, Missing=0); Invited, not funded (N=59, Missing=1); Overall (N=75, Missing=1); responses limited to DEB/IOS funded and invited, unfunded applicants who were unsatisfied with the amount of time to prepare a full proposal

Exhibit 8A.2. IOS: Optimal Number of Months to Prepare a Full Proposal

	n	Mean	SD	Max	Min
Funded					
Number of Months	26	3.53	2.24	9	1
Invited, not funded					
Number of Months	49	3.71	1.91	8	0.5
Overall					
Number of Months	75	3.66	2.01	9	0.5

Note: Funded (N=27, Missing=1); Invited, not funded (N=49, Missing=0); Overall (N=76, Missing=1); responses limited to DEB/IOS funded and invited, unfunded applicants who were unsatisfied with the amount of time to prepare a full proposal

Q9: Was the 4-page Project Description section in the preliminary proposal sufficient for you to convey your idea and approach?

Exhibit 9a. DEB: Proposal Limit (4-Page) Sufficient to Convey Idea and Approach

	Funded		Invited, not funded		Not invited		Overall	
	n	Percent	n	Percent	n	Percent	n	Percent
Yes	84	78	139	68	221	61	444	66
No	24	22	67	32	143	39	234	34

Note: Funded (N=112, Missing=4); Invited, not funded (N=218, Missing=12); Not invited (N=377, Missing=13); Overall (N=707, Missing=29); responses limited to DEB/IOS funded and invited, unfunded applicants as well as not invited applicants

Exhibit 9b. IOS: Proposal Limit (4-Page) Sufficient to Convey Idea and Approach

	Funded		Invited, not funded		Not invited		Overall	
	n	Percent	n	Percent	n	Percent	n	Percent
Yes	109	79	121	61	209	55	439	61
No	30	21	76	39	176	45	282	39

Note: Funded (N=141, Missing=2); Invited, not funded (N=202, Missing=5); Not invited (N=395, Missing=10); Overall (N=738, Missing=17); responses limited to DEB/IOS funded and invited, unfunded applicants as well as not invited applicants

Q10: How many pages would you recommend as optimal for the Project Description section in a preliminary proposal?

Exhibit 10a. DEB: Recommended Number of Pages as Optimal for Project Description Section in a Preliminary Proposal

	n	Mean	SD	Max	Min
Funded					
Number of Pages	107	4.92	2.7	15	0
Invited, not funded					
Number of Pages	203	4.93	3.11	20	0
Not invited					
Number of Pages	343	5.24	2.39	15	1
Overall					
Number of Pages	653	5.09	2.69	20	0

Note: Funded (N=112, Missing=5); Invited, not funded (N=218, Missing=15); Not invited (N=377, Missing=34); Overall (N=707, Missing=54); responses limited to DEB/IOS funded and invited, unfunded applicants as well as not invited applicants

Exhibit 10b. IOS: Recommended Number of Pages as Optimal for Project Description Section in a Preliminary Proposal

	N	Mean	SD	Max	Min
Funded					
Number of Pages	138	4.58	1.82	15	0
Invited, not funded					
Number of Pages	193	5.18	2.94	15	0
Not invited					
Number of Pages	350	5.51	2.99	18	0
Overall					
Number of Pages	681	5.25	2.81	18	0

Note: Funded (N=141, Missing=3); Invited, not funded (N=202, Missing=9); Not invited (N=395, Missing=45); Overall (N=738, Missing=57); responses limited to DEB/IOS funded and invited, unfunded applicants as well as not invited applicants

Q11: Was the 15-page Project Description section in the full proposal sufficient for you to convey your idea and approach?

Exhibit 11a. Comparison: Project Description (15-Page) Sufficient to Convey Idea and Approach

	Funded	
	n	Percent
Yes	194	97
No	5	3

Note: Funded (N=201, Missing=2); Overall (N=201, Missing=2); responses limited to funded and invited, unfunded applicants

Exhibit 11b. DEB: Project Description (15-Page) Sufficient to Convey Idea and Approach

	Funded		Invited, not funded		Overall	
	n	**Percent**	**n**	**Percent**	**n**	**Percent**
Yes	106	97	199	97	305	97
No	3	3	7	3	10	3

Note: Funded (N=112, Missing=3); Invited, not funded (N=218, Missing=12); Overall (N=330, Missing=15); responses limited to funded and invited, unfunded applicants

Exhibit 11c. IOS: Project Description (15-Page) Sufficient to Convey Idea and Approach

	Funded		Invited, not funded		Overall	
	n	**Percent**	**n**	**Percent**	**n**	**Percent**
Yes	135	97	188	96	323	96
No	4	3	8	4	12	4

Note: Funded (N=141, Missing=2); Invited, not funded (N=202, Missing=6); Overall (N=343, Missing=8); responses limited to funded and invited, unfunded applicants

Q12: How many pages would you recommend as optimal for the Project Description section in a full proposal?

Exhibit 12a. Comparison: Recommended Number of Pages as Optimal for Project Description Section in a Full Proposal

	n	**Mean**	**SD**	**Max**	**Min**
Funded					
Number of Pages	197	13.7	3.58	20	0

Note: Funded (N=201, Missing=4); Overall (N=201, Missing=4); responses limited to funded and invited, unfunded applicants

Exhibit 12b. DEB: Recommended Number of Pages as Optimal for Project Description Section in a Full Proposal

	n	**Mean**	**SD**	**Max**	**Min**
Funded					
Number of Pages	108	13.73	3.4	20	3
Invited, not funded					
Number of Pages	202	13.67	3.76	20	1
Overall					
Number of Pages	310	13.69	3.63	20	1

Note: Funded (N=112, Missing=4); Invited, not funded (N=218, Missing=16); Overall (N=330, Missing=20); responses limited to funded and invited, unfunded applicants

Exhibit 12c. IOS: Recommended Number of Pages as Optimal for Project Description Section in a Full Proposal

	n	Mean	SD	Max	Min
Funded					
Number of Pages	138	13.51	2.77	20	5
Invited, not funded					
Number of Pages	194	13.95	3.38	20	4
Overall					
Number of Pages	332	13.78	3.15	20	4

Note: Funded (N=141, Missing=3); Invited, not funded (N=202, Missing=8); Overall (N=343, Missing=11); responses limited to funded and invited, unfunded applicants

Q13: What is your level of satisfaction with the following elements of the review process? (Preliminary Proposal)

Exhibit 13a. DEB: Satisfaction with Elements of Review Process - Preliminary Proposal

	n	Very Unsatisfied Percent	Unsatisfied Percent	Neutral Percent	Satisfied Percent	Very Satisfied Percent	Ave	SD
Funded								
Reviewer understanding of the proposal	99	2	14	22	44	18	3.61	1
Technical accuracy of review	98	0	16	21	47	15	3.61	0.93
Fairness of review	100	3	10	23	41	24	3.73	1.02
Balanced consideration of proposal strengths and weaknesses	100	2	14	20	45	19	3.65	1
Thoughtfulness of review	101	3	16	29	37	15	3.46	1.02
Review process overall	103	2	11	26	47	15	3.61	0.93
Invited, not funded								
Reviewer understanding of the proposal	196	8	11	22	49	10	3.42	1.07
Technical accuracy of review	196	6	17	21	45	10	3.37	1.07
Fairness of review	195	6	10	24	44	15	3.52	1.06
Balanced consideration of proposal strengths and weaknesses	197	8	16	21	43	11	3.34	1.12
Thoughtfulness of review	195	9	18	28	38	7	3.17	1.09
Review process overall	198	11	12	25	46	6	3.25	1.1
Not invited								
Reviewer understanding of the proposal	364	10	28	19	36	7	3	1.15
Technical accuracy of review	361	8	29	23	34	6	3.01	1.1
Fairness of review	359	7	23	33	32	5	3.06	1.01
Balanced consideration of	361	8	33	25	30	4	2.9	1.05

	n	Very Unsatisfied Percent	Unsatisfied Percent	Neutral Percent	Satisfied Percent	Very Satisfied Percent	Ave	SD
proposal strengths and weaknesses								
Review process overall	364	9	31	29	27	5	2.87	1.06
Overall								
Reviewer understanding of the proposal	659	8	21	20	41	9	3.22	1.13
Technical accuracy of review	655	6	23	22	39	9	3.2	1.09
Fairness of review	654	6	17	29	37	11	3.3	1.06
Balanced consideration of proposal strengths and weaknesses	658	7	25	23	36	8	3.14	1.1
Thoughtfulness of review	296	7	17	28	38	10	3.26	1.08
Review process overall	665	9	22	27	36	7	3.09	1.09

Note: Funded (N=112, Missing=9-14, Not Applicable=0); Invited, not funded (N=218, Missing=20-23, Not Applicable=0); Not invited (N=377, Missing=0-14, Not Applicable=0-4); Overall (N=330-707, Missing=34-49, Not Applicable=0-4); responses limited to DEB/IOS funded and invited, unfunded applicants as well as not invited applicants

Exhibit 13b. IOS: Satisfaction with Elements of Review Process - Preliminary Proposal

	n	Very Unsatisfied Percent	Unsatisfied Percent	Neutral Percent	Satisfied Percent	Very Satisfied Percent	Ave	SD
Funded								
Reviewer understanding of the proposal	137	1	8	21	50	20	3.78	0.9
Technical accuracy of review	137	1	10	27	46	17	3.67	0.89
Fairness of review	137	1	6	18	48	27	3.93	0.88
Balanced consideration of proposal strengths and weaknesses	135	1	9	15	52	24	3.89	0.9
Thoughtfulness of review	136	1	16	23	46	15	3.59	0.95
Review process overall	136	2	9	18	50	21	3.78	0.95
Invited, not funded								
Reviewer understanding of the proposal	189	4	18	21	47	10	3.43	1.01
Technical accuracy of review	185	6	17	28	42	7	3.28	1.02
Fairness of review	189	5	13	27	43	12	3.45	1.02
Balanced consideration of proposal strengths and weaknesses	189	6	18	23	40	13	3.36	1.11
Thoughtfulness of review	188	7	23	26	35	10	3.18	1.1
Review process overall	189	7	23	22	39	9	3.2	1.1

	n	Very Unsatisfied Percent	Unsatisfied Percent	Neutral Percent	Satisfied Percent	Very Satisfied Percent	Ave	SD
Not invited								
Reviewer understanding of the proposal	379	15	31	17	29	7	2.82	1.22
Technical accuracy of review	378	15	31	19	32	4	2.81	1.16
Fairness of review	372	13	26	28	29	3	2.84	1.09
Balanced consideration of proposal strengths and weaknesses	380	13	37	22	25	3	2.68	1.09
Review process overall	380	14	34	25	24	3	2.68	1.08
Overall								
Reviewer understanding of the proposal	705	10	24	19	37	10	3.15	1.18
Technical accuracy of review	700	10	23	23	37	7	3.08	1.13
Fairness of review	698	9	19	26	36	10	3.19	1.12
Balanced consideration of proposal strengths and weaknesses	704	9	27	21	34	9	3.07	1.16
Thoughtfulness of review	324	5	20	25	39	12	3.34	1.07
Review process overall	705	10	27	23	33	8	3.01	1.14

Note: Funded (N=141, Missing=4-6, Not Applicable=0); Invited, not funded (N=202, Missing=13-17, Not Applicable=0); Not invited (N=395, Missing=0-14, Not Applicable=0-9); Overall (N=343-738, Missing=19-35, Not Applicable=0-9); responses limited to DEB/IOS funded and invited, unfunded applicants as well as not invited applicants

Q14. What is your level of satisfaction with the following elements of the review process? (Full Proposal)

Exhibit 14a. Comparison: Satisfaction with Elements of Review Process - Full Proposal

	n	Very Unsatisfied Percent	Unsatisfied Percent	Neutral Percent	Satisfied Percent	Very Satisfied Percent	Ave	SD
Funded								
Reviewer understanding of the proposal	193	2	6	9	51	32	4.05	0.9
Technical accuracy of review	193	2	4	17	56	21	3.91	0.83
Fairness of review	191	2	3	17	47	32	4.04	0.86
Balanced consideration of proposal strengths and weaknesses	193	1	6	18	48	27	3.95	0.88
Review process overall	195	3	3	11	56	27	4.02	0.87

Note: Funded (N=201, Missing=0-6, Not Applicable=0-4); Overall (N=201, Missing=0-6, Not Applicable=0-4); responses limited to funded and invited, unfunded applicants

Exhibit 14b. DEB: Satisfaction with Elements of Review Process - Full Proposal

	n	Very Unsatisfied Percent	Unsatisfied Percent	Neutral Percent	Satisfied Percent	Very Satisfied Percent	Ave	SD
Funded								
Reviewer understanding of the proposal	102	1	8	11	57	24	3.96	0.86
Technical accuracy of review	100	1	7	12	55	26	3.98	0.85
Fairness of review	102	2	6	12	45	35	4.04	0.94
Balanced consideration of proposal strengths and weaknesses	102	1	8	12	53	26	3.94	0.89
Thoughtfulness of review	102	2	7	18	53	21	3.85	0.89
Review process overall	103	2	5	15	52	26	3.96	0.87
Invited, not funded								
Reviewer understanding of the proposal	178	4	25	23	42	6	3.2	1.02
Technical accuracy of review	178	7	23	27	37	7	3.14	1.05
Fairness of review	176	8	25	30	27	9	3.05	1.1
Balanced consideration of proposal strengths and weaknesses	178	10	29	26	28	7	2.94	1.12
Review process overall	178	8	22	32	34	4	3.04	1.02
Overall								
Reviewer understanding of the proposal	280	3	19	19	47	12	3.46	1.03
Technical accuracy of review	278	5	17	22	43	13	3.42	1.06
Fairness of review	278	6	19	24	33	18	3.39	1.15
Balanced consideration of proposal strengths and weaknesses	280	7	22	21	37	13	3.28	1.15
Thoughtfulness of review	102	2	7	18	53	21	3.85	0.89
Review process overall	281	6	16	26	40	12	3.36	1.07

Note: Funded (N=112, Missing=9-12, Not Applicable=0); Invited, not funded (N=218, Missing=0-42, Not Applicable=0); Overall (N=112-330, Missing=10-52, Not Applicable=0); responses limited to funded and invited, unfunded applicants

Exhibit 14c. IOS: Satisfaction with Elements of Review Process - Full Proposal

	n	Very Unsatisfied Percent	Unsatisfied Percent	Neutral Percent	Satisfied Percent	Very Satisfied Percent	Ave	SD
Funded								
Reviewer understanding of the proposal	127	1	5	9	54	32	4.1	0.81
Technical accuracy of review	127	0	3	18	54	24	4	0.74
Fairness of review	127	0	2	14	46	38	4.19	0.76
Balanced consideration of proposal strengths and weaknesses	127	0	6	10	49	35	4.14	0.82
Thoughtfulness of review	128	0	4	12	60	23	4.03	0.72
Review process overall	127	0	2	13	54	31	4.14	0.7
Invited, not funded								
Reviewer understanding of the proposal	177	9	24	24	37	7	3.09	1.1
Technical accuracy of review	175	8	25	30	32	6	3.01	1.06
Fairness of review	177	8	23	32	30	6	3.03	1.06
Balanced consideration of proposal strengths and weaknesses	177	10	31	23	30	6	2.9	1.12
Review process overall	176	10	27	30	28	5	2.9	1.06
Overall								
Reviewer understanding of the proposal	304	6	17	18	43	16	3.48	1.12
Technical accuracy of review	302	5	17	25	40	13	3.4	1.06
Fairness of review	304	5	15	25	36	18	3.47	1.11
Balanced consideration of proposal strengths and weaknesses	304	6	21	18	37	17	3.38	1.18
Thoughtfulness of review	128	0	4	12	60	23	4.03	0.72
Review process overall	303	6	17	24	38	15	3.38	1.12

Note: Funded (N=141, Missing=13-14, Not Applicable=0); Invited, not funded (N=202, Missing=0-27, Not Applicable=0); Overall (N=141-343, Missing=13-41, Not Applicable=0); responses limited to funded and invited, unfunded applicants

Q15: Did you speak directly with a Program Officer/Program Director after receiving the review decision for your preliminary proposal?

Exhibit 15a. DEB: Direct Communication with a Program Officer/Program Director after Receiving Preliminary Proposal Review Decision

	Funded		Invited, not funded		Not invited		Overall	
	n	Percent	n	Percent	n	Percent	n	Percent
Yes	45	41	77	38	79	21	201	29
No	54	51	114	56	283	78	451	67
Do not know/unsure	9	9	13	6	0	0	22	3

Note: Funded (N=112, Missing=4); Invited, not funded (N=218, Missing=14); Not invited (N=377, Missing=12); Overall (N=707, Missing=30); responses limited to DEB/IOS funded and invited, unfunded applicants as well as not invited applicants

Exhibit 15b. IOS: Direct Communication with a Program Officer/Program Director after Receiving Preliminary Proposal Review Decision

	Funded		Invited, not funded		Not invited		Overall	
	n	Percent	n	Percent	n	Percent	n	Percent
Yes	74	54	94	48	101	26	269	37
No	54	39	92	47	274	71	420	59
Do not know/unsure	10	7	10	5	0	0	20	3

Note: Funded (N=141, Missing=3); Invited, not funded (N=202, Missing=6); Not invited (N=395, Missing=11); Overall (N=738, Missing=20); responses limited to DEB/IOS funded and invited, unfunded applicants as well as not invited applicants

Q15A: How helpful to you was this discussion?

Exhibit 15A.1. DEB: Helpfulness of Discussion with Program Officer/Program Director

	Funded		Invited, not funded		Not invited		Overall	
	n	Percent	n	Percent	n	Percent	n	Percent
Not helpful	2	4	12	16	14	19	28	15
Somewhat helpful	17	39	36	46	34	42	87	43
Very helpful	26	57	29	38	31	39	86	42

Note: Funded (N=45, Missing=0); Invited, not funded (N=77, Missing=0); Not invited (N=79, Missing=0); Overall (N=201, Missing=0); responses limited to DEB/IOS funded and invited applicants as well as not invited applicants who spoke directly with a Program Officer/Program Director after receiving the review decision for their preliminary proposal

Exhibit 15A.2. IOS: Helpfulness of Discussion with Program Officer/Program Director

	Funded		Invited, not funded		Not invited		Overall	
	n	Percent	n	Percent	n	Percent	n	Percent
Not helpful	1	1	22	24	18	18	41	16
Somewhat helpful	26	36	44	47	49	49	119	45
Very helpful	47	63	28	29	33	33	108	39

Note: Funded (N=74, Missing=0); Invited, not funded (N=94, Missing=0); Not invited (N=101, Missing=1); Overall (N=269, Missing=1); responses limited to DEB/IOS funded and invited applicants as well as not invited applicants

who spoke directly with a Program Officer/Program Director after receiving the review decision for their preliminary proposal

Q16: How helpful were the reviewer comments on the preliminary proposal to developing the full proposal?

Exhibit 16a. DEB: Helpfulness of Reviewer Comments on Preliminary Proposal to Developing Full Proposal

	Funded		Invited, not funded		Overall	
	n	**Percent**	**n**	**Percent**	**n**	**Percent**
Not helpful	8	7	53	27	61	20
Somewhat helpful	65	62	122	60	187	61
Very helpful	33	31	27	13	60	19

Note: Funded (N=112, Missing=6); Invited, not funded (N=218, Missing=16); Overall (N=330, Missing=22); responses limited to DEB/IOS funded and invited, unfunded applicants

Exhibit 16b. IOS: Helpfulness of Reviewer Comments on Preliminary Proposal to Developing Full Proposal

	Funded		Invited, not funded		Overall	
	n	**Percent**	**n**	**Percent**	**n**	**Percent**
Not helpful	14	10	65	34	79	25
Somewhat helpful	90	66	105	54	195	58
Very helpful	34	24	23	12	57	17

Note: Funded (N=141, Missing=3); Invited, not funded (N=202, Missing=9); Overall (N=343, Missing=12); responses limited to DEB/IOS funded and invited, unfunded applicants

Q17: How helpful were the reviews of the preliminary proposal for informing development of future submissions?

Exhibit 17a. DEB: Helpfulness of Reviews on Preliminary Proposal for Future Submissions

	Not invited	
	n	**Percent**
I do not plan to resubmit	29	8
Not helpful	102	28
Somewhat helpful	182	50
Very helpful	40	11
Unsure	12	3

Note: Funded (N=0, Missing=0); Not invited (N=377, Missing=12)

Exhibit 17b. IOS: Helpfulness of Reviews on Preliminary Proposal for Future Submissions

	Not invited	
	n	**Percent**
I do not plan to resubmit	32	8
Not helpful	118	31
Somewhat helpful	179	47
Very helpful	46	12
Unsure	7	2

Note: Funded (N=0, Missing=0); Not invited (N=395, Missing=13)

Q18: Please describe one change you would make to the new submission/review process.

Exhibit 18a. DEB: Proposed Change to the New Submission/Review Process

	Funded		Invited, not funded		Not invited		Overall	
	n	**Percent**	**n**	**Percent**	**n**	**Percent**	**N**	**Percent**
I would not make any changes	15	14	11	6	27	11	53	10
Changes specified	73	69	167	83	152	62	392	71
I do not know	17	16	23	12	70	28	110	20

Note: Funded (N=112, Missing=7); Invited, not funded (N=218, Missing=17); Not invited (N=377, Missing=128); Overall (N=707, Missing=152); responses limited to DEB/IOS funded and invited, unfunded applicants as well as not invited applicants

Exhibit 18b. IOS: Proposed Change to the New Submission/Review Process

	Funded		Invited, not funded		Not invited		Overall	
	n	**Percent**	**n**	**Percent**	**n**	**Percent**	**N**	**Percent**
I would not make any changes	17	13	9	5	23	9	49	8
Changes specified	107	77	168	85	160	64	435	74
I do not know	14	10	19	10	64	26	97	17

Note: Funded (N=141, Missing=3); Invited, not funded (N=202, Missing=6); Not invited (N=395, Missing=148); Overall (N=738, Missing=157); responses limited to DEB/IOS funded and invited, unfunded applicants as well as not invited applicants

Reviewer Surveys

Q1: Which of the following best describes your current academic rank?

Exhibit 1a. Comparison: Current Academic Rank

	Ad Hoc		Full Panel		Overall	
	n	Percent	n	Percent	n	Percent
Postdoctoral fellow	15	5	0	0	15	3
Research scientist	30	9	3	1	33	6
Adjunct professor	4	1	2	1	6	1
Assistant professor	47	15	37	18	84	16
Associate professor	78	23	71	32	149	26
Full professor	132	40	98	45	230	42
Other	24	7	8	4	32	6

Note: Ad Hoc (N=340, Missing=10); Full Panel (N=221, Missing=2); Pre Panel (N=0, Missing=0); Overall (N=561, Missing=12)

Exhibit 1b. DEB: Current Academic Rank

	Ad Hoc		Full Panel		Pre Panel		Overall	
	n	Percent	n	Percent	n	Percent	n	Percent
Postdoctoral fellow	13	4	0	0	0	0	13	3
Research scientist	25	9	4	6	5	4	34	7
Adjunct professor	4	1	1	1	0	0	5	1
Assistant professor	55	18	15	20	22	16	92	18
Associate professor	56	19	26	31	44	33	126	23
Full professor	128	43	33	40	58	44	219	43
Other	19	6	2	3	5	4	26	5

Note: Ad Hoc (N=305, Missing=5); Full Panel (N=83, Missing=2); Pre Panel (N=135, Missing=1); Overall (N=523, Missing=8)

Exhibit 1c. IOS: Current Academic Rank

	Ad Hoc		Full Panel		Pre Panel		Overall	
	n	Percent	n	Percent	n	Percent	n	Percent
Postdoctoral fellow	6	2	0	0	0	0	6	1
Research scientist	14	5	0	0	3	2	17	3
Adjunct professor	3	1	0	0	1	1	4	1
Assistant professor	32	12	17	18	44	24	93	16
Associate professor	75	26	38	38	63	35	176	30
Full professor	138	49	46	43	67	37	251	45
Other	12	4	1	1	2	1	15	3

Note: Ad Hoc (N=289, Missing=9); Full Panel (N=103, Missing=1); Pre Panel (N=181, Missing=1); Overall (N=573, Missing=11)

Q2: What is your tenure status?

Exhibit 2a. Comparison: Tenure Status

	Ad Hoc		Full Panel		Overall	
	n	Percent	n	Percent	n	Percent
Tenure-track or equivalent, but not yet tenured	49	15	34	17	83	16
Tenured or equivalent	213	65	166	76	379	69
Not tenure-track	52	16	13	5	65	12
Other	15	5	4	2	19	4

Note: Ad Hoc (N=340, Missing=11); Full Panel (N=221, Missing=4); Pre Panel (N=0, Missing=0); Overall (N=561, Missing=15)

Exhibit 2b. DEB: Tenure Status

	Ad Hoc		Full Panel		Pre Panel		Overall	
	n	Percent	n	Percent	n	Percent	n	Percent
Tenure-track or equivalent, but not yet tenured	52	17	17	22	23	17	92	17
Tenured or equivalent	203	67	60	73	100	75	363	70
Not tenure-track	36	12	4	5	9	7	49	10
Other	11	4	0	0	2	1	13	3

Note: Ad Hoc (N=305, Missing=3); Full Panel (N=83, Missing=2); Pre Panel (N=135, Missing=1); Overall (N=523, Missing=6)

Exhibit 2c. IOS: Tenure Status

	Ad Hoc		Full Panel		Pre Panel		Overall	
	n	Percent	n	Percent	n	Percent	n	Percent
Tenure-track or equivalent, but not yet tenured	36	13	18	19	43	24	97	17
Tenured or equivalent	215	76	82	79	125	70	422	75
Not tenure-track	20	8	1	1	11	6	32	6
Other	9	3	1	1	1	1	11	2

Note: Ad Hoc (N=289, Missing=9); Full Panel (N=103, Missing=1); Pre Panel (N=181, Missing=1); Overall (N=573, Missing=11)

Q3: Have you ever been a PI or Co-PI on a preliminary proposal submitted to core programs in the Division of Environmental Biology (DEB) or the Division of Integrative Organismal Systems (IOS)?

Exhibit 3a. Comparison: Served as PI or Co-PI on a Preliminary Proposal

	Ad Hoc		Full Panel		Overall	
	N	Percent	n	Percent	n	Percent
Yes	76	23	52	24	128	23
No	235	71	157	72	392	72
Unsure	18	6	8	4	26	5

Note: Ad Hoc (N=340, Missing=11); Full Panel (N=221, Missing=4); Pre Panel (N=0, Missing=0); Overall (N=561, Missing=15)

Exhibit 3b. DEB: Served as PI or Co-PI on a Preliminary Proposal

	Ad Hoc		Full Panel		Pre Panel		Overall	
	N	Percent	n	Percent	n	Percent	n	Percent
Yes	213	70	71	88	115	86	399	76
No	84	28	10	12	18	13	112	23
Unsure	5	2	0	0	1	1	6	1

Note: Ad Hoc (N=305, Missing=3); Full Panel (N=83, Missing=2); Pre Panel (N=135, Missing=1); Overall (N=523, Missing=6)

Exhibit 3c. IOS: Served as PI or Co-PI on a Preliminary Proposal

	Ad Hoc		Full Panel		Pre Panel		Overall	
	N	Percent	n	Percent	n	Percent	n	Percent
Yes	155	55	72	70	138	78	365	64
No	120	43	28	28	39	21	187	35
Unsure	5	2	2	2	2	1	9	2

Note: Ad Hoc (N=289, Missing=9); Full Panel (N=103, Missing=1); Pre Panel (N=181, Missing=2); Overall (N=573, Missing=12)

Q3A [For those who answered "Yes" to question 3]: Have you ever been a PI or Co-PI on an award from the core programs in DEB or IOS stemming from a preliminary proposal?

Exhibit 3A.1. Comparison: Served as PI or Co-PI on a core programs in DEB or IOS stemming from a preliminary proposal

	Ad Hoc		Full Panel		Overall	
	n	Percent	n	Percent	n	Percent
Yes	16	21	10	20	26	21
No	56	75	42	80	98	77
Unsure	3	4	0	0	3	3

Note: Ad Hoc (N=76, Missing=1); Full Panel (N=52, Missing=0); Pre Panel (N=0, Missing=0); Overall (N=128, Missing=1)

Exhibit 3A.2. DEB: Served as PI or Co-PI on a core programs in DEB or IOS stemming from a preliminary proposal

	Ad Hoc		Full Panel		Pre Panel		Overall	
	n	Percent	n	Percent	n	Percent	n	Percent
Yes	90	43	34	48	47	42	171	43
No	117	56	36	50	67	58	220	56
Unsure	3	1	1	2	0	0	4	1

Note: Ad Hoc (N=213, Missing=3); Full Panel (N=71, Missing=0); Pre Panel (N=115, Missing=1); Overall (N=399, Missing=4)

Exhibit 3A.3. IOS: Served as PI or Co-PI on a core programs in DEB or IOS stemming from a preliminary proposal

	Ad Hoc		Full Panel		Pre Panel		Overall	
	n	Percent	n	Percent	n	Percent	n	Percent
Yes	56	36	32	43	51	38	139	38
No	92	60	40	57	86	62	218	60
Unsure	5	3	0	0	1	1	6	2

Note: Ad Hoc (N=155, Missing=2); Full Panel (N=72, Missing=0); Pre Panel (N=138, Missing=0); Overall (N=365, Missing=2)

Q4: Approximately how many hours of work, to the nearest hour, did it take you to review this proposal?

Exhibit 4a. Comparison: Hours of Work to Conduct Proposal Review

	n	Mean	SD	Max	Min
Ad Hoc					
Hours of work	324	6.31	7.26	40	0
Overall					
Hours of work	324	6.31	7.26	40	0

Note: Ad Hoc (N=340, Missing=16); Full Panel (N=0, Missing=0); Pre Panel (N=0, Missing=0); Overall (N=340, Missing=16); responses limited to full proposal ad hoc reviewers

Exhibit 4b. DEB: Hours of Work to Conduct Proposal Review

	n	Mean	SD	Max	Min
Ad Hoc					
Hours of work	291	5.18	4.7	24	1
Overall					
Hours of work	291	5.18	4.7	24	1

Note: Ad Hoc (N=305, Missing=14); Full Panel (N=0, Missing=0); Pre Panel (N=0, Missing=0); Overall (N=305, Missing=14); responses limited to full proposal ad hoc reviewers

Exhibit 4c. IOS: Comparison: Hours of Work to Conduct Proposal Review

	n	Mean	SD	Max	Min
Ad Hoc					
Hours of work	264	6.03	8.3	72	1
Overall					
Hours of work	264	6.03	8.3	72	1

Note: Ad Hoc (N=289, Missing=25); Full Panel (N=0, Missing=0); Pre Panel (N=0, Missing=0); Overall (N=289, Missing=25); responses limited to full proposal ad hoc reviewers

Q5_1: Review format: Was your participation in the panel primarily in-person or primarily through virtual meeting technologies?

Exhibit 5_1a. Comparison: Mode of Participation in the Panel

	Full Panel	
	n	**Percent**
Virtual	52	24
In person	161	76

Note: Ad Hoc (N=0, Missing=0); Full Panel (N=221, Missing=8); Pre Panel (N=0, Missing=0); Overall (N=221, Missing=8); responses limited to full and preliminary proposal panel reviewers

Exhibit 5_1b. DEB: Mode of Participation in the Panel

	Full Panel		Pre Panel		Overall	
	n	**Percent**	**n**	**Percent**	**n**	**Percent**
Virtual	3	4	1	1	4	2
In person	77	96	131	99	208	98

Note: Ad Hoc (N=0, Missing=0); Full Panel (N=83, Missing=3); Pre Panel (N=135, Missing=3); Overall (N=218, Missing=6); responses limited to full and preliminary proposal panel reviewers

Exhibit 5_1c. IOS: Mode of Participation in the Panel

	Full Panel		Pre Panel		Overall	
	n	**Percent**	**n**	**Percent**	**n**	**Percent**
Virtual	8	8	34	19	42	15
In person	88	92	142	81	230	85

Note: Ad Hoc (N=0, Missing=0); Full Panel (N=103, Missing=7); Pre Panel (N=181, Missing=5); Overall (N=284, Missing=12); responses limited to full and preliminary proposal panel reviewers

Q5_2: Approximate number of reviewers on the panel, including yourself

Exhibit 5_2a. Comparison: Number of Reviewers on Panel

	n	**Mean**	**SD**	**Max**	**Min**
Full Panel					
Approximate number of reviewers on the panel, including yourself	209	13.33	5.07	30	5

Note: Ad Hoc (N=0, Missing=0); Full Panel (N=221, Missing=12); Pre Panel (N=0, Missing=0); Overall (N=221, Missing=12); responses limited to full and preliminary proposal panel reviewers

Exhibit 5_2. DEB: Number of Reviewers on Panel

	n	Mean	SD	Max	Min
Full Panel					
Approximate number of reviewers on the panel, including yourself	81	21.06	7.31	40	8
Preliminary Panel					
Approximate number of reviewers on the panel, including yourself	131	22.95	7.13	40	3
Overall					
Approximate number of reviewers on the panel, including yourself	212	22.24	7.27	40	3

Note: Ad Hoc (N=0, Missing=0); Full Panel (N=83, Missing=2); Pre Panel (N=135, Missing=4); Overall (N=218, Missing=6); responses limited to full and preliminary proposal panel reviewers

Exhibit 5_2.c. IOS: Number of Reviewers on Panel

	n	Mean	SD	Max	Min
Full Panel					
Approximate number of reviewers on the panel, including yourself	96	14.85	4.94	25	6
Preliminary Panel					
Approximate number of reviewers on the panel, including yourself	170	15.88	5.51	25	7
Overall					
Approximate number of reviewers on the panel, including yourself	266	15.49	5.34	25	6

Note: Ad Hoc (N=0, Missing=0); Full Panel (N=103, Missing=7); Pre Panel (N=181, Missing=11); Overall (N=284, Missing=18); responses limited to full and preliminary proposal panel reviewers

Q5_3: Number of proposals assigned to you for review (N)

Exhibit 5_3a. Comparison: Number of Proposals Assigned for Review

	N	Mean	SD	Max	Min
Full Panel					
Number of proposals assigned to you for review	212	13.42	11.86	50	4

Note: Ad Hoc (N=0, Missing=0); Full Panel (N=221, Missing=9); Pre Panel (N=0, Missing=0); Overall (N=221, Missing=9); responses limited to full and preliminary proposal panel reviewers

Exhibit 5_3b. DEB: Number of Proposals Assigned for Review

	N	Mean	SD	Max	Min
Full Panel					
Number of proposals assigned to you for review	80	15.3	4.05	25	6
Preliminary Panel					
Number of proposals assigned to you for review	131	17.94	4.35	30	6
Overall					
Number of proposals assigned to you for review	211	16.96	4.5	30	6

Note: Ad Hoc (N=0, Missing=0); Full Panel (N=83, Missing=3); Pre Panel (N=135, Missing=4); Overall (N=218, Missing=7); responses limited to full and preliminary proposal panel reviewers

Exhibit 5_3c. IOS: Number of Proposals Assigned for Review

	N	Mean	SD	Max	Min
Full Panel					
Number of proposals assigned to you for review	95	12.93	10.17	50	4
Preliminary Panel					
Number of proposals assigned to you for review	173	15.48	9.05	50	6
Overall					
Number of proposals assigned to you for review	268	14.52	9.58	50	4

Note: Ad Hoc (N=0, Missing=0); Full Panel (N=103, Missing=8); Pre Panel (N=181, Missing=8); Overall (N=284, Missing=16); responses limited to full and preliminary proposal panel reviewers

Q5_4: Approximate <u>number of hours</u> you spent per review prior to the panel meeting (H)

Exhibit 5_4a. Comparison: Number of Hours Spent per Review Prior to Panel

	N	Mean	SD	Max	Min
Full Panel					
Approximate number of hours you spent per review	210	3.51	2.55	10	0.75

Note: Ad Hoc (N=0, Missing=0); Full Panel (N=221, Missing=11); Pre Panel (N=0, Missing=0); Overall (N=221, Missing=11); responses limited to full and preliminary proposal panel reviewers

Exhibit 5_4b. DEB: Number of Hours Spent per Review Prior to Panel

	n	Mean	SD	Max	Min
Full Panel					
Approximate number of hours you spent per review	79	3.11	1.92	8	1
Preliminary Panel					
Approximate number of hours you spent per review	133	2.06	1.37	10	0.5
Overall					
Approximate number of hours you spent per review	212	2.44	1.71	10	0.5

Note: Ad Hoc (N=0, Missing=0); Full Panel (N=83, Missing=4); Pre Panel (N=135, Missing=2); Overall (N=218, Missing=6); responses limited to full and preliminary proposal panel reviewers

Exhibit 5_4c. IOS: Number of Hours Spent per Review Prior to Panel

	n	Mean	SD	Max	Min
Full Panel					
Approximate number of hours you spent per review	91	3.33	2.23	10	1
Preliminary Panel					
Approximate number of hours you spent per review	171	2.82	2.02	10	0.5
Overall					
Approximate number of hours you spent per review	262	3.01	2.12	10	0.5

Note: Ad Hoc (N=0, Missing=0); Full Panel (N=103, Missing=12); Pre Panel (N=181, Missing=10); Overall (N=284, Missing=22); responses limited to full and preliminary proposal panel reviewers

*Q5_5: Total number of hours you spent on all reviews, T=N*H [automatically calculated]*

Exhibit 5_5. Comparison: Number of Hours Spent on all reviews

	n	Mean	SD	Max	Min
Full Panel					
Total number of hours you spent on all reviews	210	40.11	34.36	128	5

Note: Ad Hoc (N=0, Missing=0); Full Panel (N=221, Missing=11); Pre Panel (N=0, Missing=0); Overall (N=221, Missing=11); responses limited to full and preliminary proposal panel reviewers

Exhibit 5_5b. DEB: Number of Hours Spent on all reviews

	n	Mean	SD	Max	Min
Full Panel					
Total number of hours you spent on all reviews	79	47.43	33.26	150	12
Preliminary Panel					
Total number of hours you spent on all reviews	131	36.12	21.87	110	9
Overall					
Total number of hours you spent on all reviews	210	40.3	27.46	150	9

Note: Ad Hoc (N=0, Missing=0); Full Panel (N=83, Missing=4); Pre Panel (N=135, Missing=4); Overall (N=218, Missing=8); responses limited to full and preliminary proposal panel reviewers

Exhibit 5_5c. IOS: Number of Hours Spent on all reviews

	n	Mean	SD	Max	Min
Full Panel					
Total number of hours you spent on all reviews	91	37.41	28.75	140	13
Preliminary Panel					
Total number of hours you spent on all reviews	171	39.77	31.27	140	6
Overall					
Total number of hours you spent on all reviews	262	38.9	30.4	140	6

Note: Ad Hoc (N=0, Missing=0); Full Panel (N=103, Missing=12); Pre Panel (N=181, Missing=10); Overall (N=284, Missing=22); responses limited to full and preliminary proposal panel reviewers

Q6: How would you compare the time and effort to review each preliminary proposal to a full proposal? On average, a preliminary proposal took approximately…

Exhibit 6a. DEB: Average Time and Effort to Review Each Preliminary Proposal Compared to a Full Proposal

	Preliminary Panel	
	n	Percent
¼ of the time or less to review	11	8
½ of the time to review	68	52
¾ of the time to review	36	27
The same time to review	10	7
25 more time to review	0	0
50 more time to review	0	0

	Preliminary Panel	
	n	**Percent**
100 more time to review	0	0
More than twice the amount of time to review	0	0
I do not know. I have never reviewed a full proposal	8	6

Note: Ad Hoc (N=0, Missing=0); Full Panel (N=0, Missing=0); Pre Panel (N=135, Missing=2); Overall (N=135, Missing=2); responses limited to preliminary proposal reviewers

Exhibit 6b. IOS: Average Time and Effort to Review Each Preliminary Proposal Compared to a Full Proposal

	Preliminary Panel	
	n	**Percent**
¼ of the time or less to review	24	14
½ of the time to review	77	44
¾ of the time to review	35	21
The same time to review	16	9
25 more time to review	2	1
50 more time to review	0	0
100 more time to review	0	0
More than twice the amount of time to review	0	0
I do not know. I have never reviewed a full proposal	19	11

Note: Ad Hoc (N=0, Missing=0); Full Panel (N=0, Missing=0); Pre Panel (N=181, Missing=8); Overall (N=181, Missing=8); responses limited to preliminary proposal reviewers

Q7: How satisfied were you with the proposals reviewed by your panel in terms of…

Exhibit 7a. Comparison: Satisfaction with Aspects of Proposals

	n	Not at all satisfied Percent	Somewhat satisfied Percent	Neutral Percent	Satisfied Percent	Very Satisfied Percent	Ave	SD
Ad Hoc								
Intellectual merit	281	4	11	7	34	44	4.04	1.13
Broader impact	279	1	10	21	35	32	3.86	1.02
Potential to advance your field	280	2	11	15	36	35	3.89	1.08
Potential to transform your field	277	9	14	32	32	12	3.25	1.12
Full Panel								
Intellectual merit	211	0	8	5	37	50	4.3	0.88
Broader impact	212	1	12	18	45	24	3.79	0.99
Potential to advance your field	211	0	8	8	47	36	4.1	0.9
Potential to transform your field	210	3	14	30	41	12	3.44	0.98
Overall								
Intellectual merit	492	2	10	6	35	47	4.14	1.05
Broader impact	491	1	11	20	39	29	3.83	1.01

	n	Not at all satisfied Percent	Somewhat satisfied Percent	Neutral Percent	Satisfied Percent	Very Satisfied Percent	Ave	SD
Potential to advance your field	491	2	10	13	40	35	3.97	1.02
Potential to transform your field	487	7	14	31	35	12	3.32	1.07

Note: Ad Hoc (N=340, Missing=31-32, Do not know=27-31); Full Panel (N=221, Missing=9, Do not know=0-2); Overall (N=561, Missing=40-41, Do not know=28-33)

Exhibit 7b. DEB: Satisfaction with Aspects of Proposals

	n	Not at all satisfied Percent	Somewhat satisfied Percent	Neutral Percent	Satisfied Percent	Very Satisfied Percent	Ave	SD
Ad Hoc								
Intellectual merit	254	4	13	7	35	41	3.95	1.17
Broader impact	247	3	10	14	41	31	3.87	1.07
Potential to advance your field	253	4	13	10	34	40	3.93	1.16
Potential to transform your field	249	13	10	27	37	13	3.27	1.2
Full Panel								
Intellectual merit	80	0	11	4	23	61	4.34	1
Broader impact	80	0	10	15	40	35	3.99	0.95
Potential to advance your field	80	1	15	5	39	40	4.01	1.08
Potential to transform your field	80	7	17	21	42	14	3.38	1.12
Preliminary Panel								
Intellectual merit	132	1	10	5	39	46	4.19	0.96
Broader impact	132	4	11	18	40	28	3.77	1.08
Potential to advance your field	130	0	10	11	40	40	4.09	0.95
Potential to transform your field	129	2	16	24	42	17	3.56	0.99
Overall								
Intellectual merit	466	3	12	6	34	45	4.06	1.11
Broader impact	459	3	10	15	41	31	3.86	1.06
Potential to advance your field	463	3	13	9	36	40	3.98	1.1
Potential to transform your field	458	9	12	26	39	14	3.35	1.15

Note: Ad Hoc (N=305, Missing=26-29, Do not know=24-31); Full Panel (N=83, Missing=3, Do not know=0); Pre Panel (N=135, Missing=3, Do not know=0-3); Overall (N=523, Missing=32-35, Do not know=25-31)

Exhibit 7c. IOS: Satisfaction with Aspects of Proposals

	n	Not at all satisfied Percent	Somewhat satisfied Percent	Neutral Percent	Satisfied Percent	Very Satisfied Percent	Ave	SD
Ad Hoc								
Intellectual merit	235	2	12	4	28	54	4.2	1.09
Broader impact	234	2	9	10	37	42	4.06	1.05
Potential to advance your field	234	3	9	9	30	49	4.13	1.08
Potential to transform your field	232	6	9	22	46	17	3.57	1.07
Full Panel								
Intellectual merit	94	1	8	3	38	50	4.28	0.93
Broader impact	94	0	10	13	50	27	3.93	0.9
Potential to advance your field	93	1	12	4	40	42	4.1	1.03
Potential to transform your field	91	0	13	25	51	11	3.59	0.85
Preliminary Panel								
Intellectual merit	172	1	6	2	42	50	4.35	0.82
Broader impact	172	4	12	11	45	28	3.81	1.09
Potential to advance your field	172	0	8	7	46	39	4.16	0.86
Potential to transform your field	170	4	16	23	39	19	3.53	1.07
Overall								
Intellectual merit	501	1	10	3	34	52	4.26	0.99
Broader impact	500	2	10	11	42	35	3.96	1.04
Potential to advance your field	499	2	9	8	37	45	4.13	1.01
Potential to transform your field	493	4	12	23	45	16	3.56	1.04

Note: Ad Hoc (N=289, Missing=30-31, Do not know=24-26); Full Panel (N=103, Missing=8, Do not know=1-4);
Pre Panel (N=181, Missing=8, Do not know=1-3); Overall (N=573, Missing=46-47, Do not know=26-33)

Q8: Approximately what fraction of the proposals reviewed by your panel had the following characteristics?

Exhibit 8a. Comparison: Fraction of Proposals Reviewed by Panel with Various Characteristics

	n	<10%	About 25%	About 33%	About 50%	About 66%	>66%
Full Panel							
Addressed a significant question/problem/opportunity	200	4	9	12	24	23	28
Clearly conveyed the idea and approach	199	2	5	17	25	32	20
Presented an approach that was feasible and appropriate	199	0	8	9	25	36	23
Contained convincing preliminary data	190	3	6	19	27	29	16
Could be characterized as high-risk/high-reward	198	47	24	19	8	1	0
Demonstrated that investigators had the requisite expertise	200	0	2	7	14	27	49
Were collaborative and/or interdisciplinary	180	7	15	19	24	18	17

Exhibit 8b. DEB: Fraction of Proposals Reviewed by Panel with Various Characteristics

	n	<10%	About 25%	About 33%	About 50%	About 66%	>66%
Full Panel							
Addressed a significant question/problem/opportunity	77	1	11	4	23	11	50
Clearly conveyed the idea and approach	76	0	6	13	19	24	38
Presented an approach that was feasible and appropriate	77	0	3	9	20	38	30
Contained convincing preliminary data	73	2	7	12	35	24	19
Could be characterized as high-risk/high-reward	75	48	25	15	9	0	3
Demonstrated that investigators had the requisite expertise	77	0	1	4	13	19	62
Were collaborative and/or interdisciplinary	70	3	7	14	36	15	25
Preliminary Panel							
Addressed a significant question/problem/opportunity	125	2	9	10	26	20	34
Clearly conveyed the idea and approach	126	0	4	13	25	36	21
Presented an approach that was feasible and appropriate	125	0	4	10	30	30	25
Contained convincing preliminary data	121	2	12	21	42	12	10
Could be characterized as high-risk/high-reward	118	39	40	17	3	0	0
Demonstrated that investigators had the requisite expertise	126	0	2	1	13	20	65
Were collaborative and/or interdisciplinary	110	5	5	17	25	22	25
Overall							
Addressed a significant question/problem/opportunity	202	2	10	7	25	17	40
Clearly conveyed the idea and approach	202	0	5	13	23	32	27
Presented an approach that was feasible and appropriate	202	0	4	10	27	33	27
Contained convincing preliminary data	194	2	10	18	40	17	13
Could be characterized as high-risk/high-reward	193	43	34	16	6	0	1
Demonstrated that investigators had the requisite expertise	203	0	2	2	13	20	64
Were collaborative and/or interdisciplinary	180	4	6	16	29	20	25

Exhibit 8c. IOS: Fraction of Proposals Reviewed by Panel with Various Characteristics

	<10%	About 25%	About 33%	About 50%	About 66%	>66%	<10%
Full Panel							
Addressed a significant question/problem/opportunity	92	5	6	3	28	24	34
Clearly conveyed the idea and approach	92	1	5	4	28	31	31
Presented an approach that was feasible and appropriate	90	1	2	0	22	39	36
Contained convincing preliminary data	90	1	1	9	31	38	19
Could be characterized as high-risk/high-reward	90	36	28	28	7	1	0
Demonstrated that investigators had the requisite expertise	91	0	0	6	12	24	58
Were collaborative and/or interdisciplinary	82	4	22	16	36	15	8
Preliminary Panel							
Addressed a significant question/problem/opportunity	164	4	10	13	21	23	29
Clearly conveyed the idea and approach	164	2	11	12	29	25	21
Presented an approach that was feasible and appropriate	162	1	8	12	24	34	21
Contained convincing preliminary data	161	2	11	16	34	24	13
Could be characterized as high-risk/high-reward	162	50	26	16	3	4	1
Demonstrated that investigators had the requisite expertise	163	0	5	9	10	19	58
Were collaborative and/or interdisciplinary	144	10	16	24	27	10	13
Overall							
Addressed a significant question/problem/opportunity	256	4	9	9	24	23	31
Clearly conveyed the idea and approach	256	2	9	9	28	27	25
Presented an approach that was feasible and appropriate	252	1	6	8	23	35	27
Contained convincing preliminary data	251	2	8	13	33	29	15
Could be characterized as high-risk/high-reward	252	45	27	21	4	3	1
Demonstrated that investigators had the requisite expertise	254	0	3	8	11	21	58
Were collaborative and/or interdisciplinary	226	7	19	20	30	12	11

Note: Full Panel (N=103, Missing=9-10, Do not know=2-12); Pre Panel (N=181, Missing=9-11, Do not know=8-26); Overall (N=284, Missing=18-21, Do not know=10-38); responses limited to full and preliminary proposal panel reviewers

Q9: What percentage of the proposals reviewed by your panel was clearly not worth funding?

Exhibit 9a. Comparison: Percentage of Proposals Reviewed by Panel that was Clearly Worth Not Funding

	n	Mean	SD	Max	Min
Full Panel					
Percent not worth funding	147	32.15	25.5	90	0

Note: Ad Hoc (N=0, Missing=0); Full Panel (N=161, Missing=14); Pre Panel (N=0, Missing=0); Overall (N=161, Missing=14); responses limited to full and preliminary proposal panel reviewers who knew what percentage of proposals reviewed by their panel was clearly worth funding

Exhibit 9b. DEB: Percentage of Proposals Reviewed by Panel that was Clearly Worth Not Funding

	n	Mean	SD	Max	Min
Full Panel					
Percent not worth funding	58	31.79	25.22	80	2
Preliminary Panel					
Percent not worth funding	105	35.24	21.54	80	5
Overall					
Percent not worth funding	163	34.03	22.92	80	2

Note: Ad Hoc (N=0, Missing=0); Full Panel (N=63, Missing=5); Pre Panel (N=116, Missing=11); Overall (N=179, Missing=16); responses limited to full and preliminary proposal panel reviewers who knew what percentage of proposals reviewed by their panel was clearly worth funding

Exhibit 9c. IOS: Percentage of Proposals Reviewed by Panel that was Clearly Worth Not Funding

	n	Mean	SD	Max	Min
Full Panel					
Percent not worth funding	68	26.86	25.53	80	2
Preliminary Panel					
Percent not worth funding	124	28.22	22.74	100	0
Overall					
Percent not worth funding	192	27.72	23.71	100	0

Note: Ad Hoc (N=0, Missing=0); Full Panel (N=78, Missing=10); Pre Panel (N=145, Missing=21); Overall (N=223, Missing=31); responses limited to full and preliminary proposal panel reviewers who knew what percentage of proposals reviewed by their panel was clearly worth funding

Q10: Did this proposal have the following characteristics?

Exhibit 10a. Comparison: Characteristics of Proposal

	Ad Hoc	
	n	Percent
Addressed a significant question/problem/opportunity	241	85
Clearly conveyed the idea and approach	232	83
Presented an approach that was feasible and appropriate	203	72
Contained convincing preliminary data	165	59
Could be characterized as high-risk/high-reward	47	17
Demonstrated that investigators had the requisite experience	243	86

	Ad Hoc	
	n	Percent
Was collaborative and/or interdisciplinary	150	54
Was clearly not worth funding	34	12

Note: Ad Hoc (N=340, Missing=59); Full Panel (N=0, Missing=0); Pre Panel (N=0, Missing=0); Overall (N=340, Missing=59); responses limited to full panel ad hoc reviewers; responses do not sum to 100 because multiple responses were permitted

Exhibit 10b. DEB Characteristics of Proposal

	Ad Hoc	
	n	Percent
Addressed a significant question/problem/opportunity	217	86
Clearly conveyed the idea and approach	208	83
Presented an approach that was feasible and appropriate	186	74
Contained convincing preliminary data	172	68
Could be characterized as high-risk/high-reward	42	17
Demonstrated that investigators had the requisite experience	228	91
Was collaborative and/or interdisciplinary	158	63
Was clearly not worth funding	23	9

Note: Ad Hoc (N=305, Missing=54); Full Panel (N=0, Missing=0); Pre Panel (N=0, Missing=0); Overall (N=305, Missing=54); responses limited to full panel ad hoc reviewers; responses do not sum to 100 because multiple responses were permitted

Exhibit 10c. IOS Characteristics of Proposal

	Ad Hoc	
	N	Percent
Addressed a significant question/problem/opportunity	211	88
Clearly conveyed the idea and approach	206	86
Presented an approach that was feasible and appropriate	191	80
Contained convincing preliminary data	169	70
Could be characterized as high-risk/high-reward	37	16
Demonstrated that investigators had the requisite experience	215	89
Was collaborative and/or interdisciplinary	125	52
Was clearly not worth funding	14	6

Note: Ad Hoc (N=289, Missing=49); Full Panel (N=0, Missing=0); Pre Panel (N=0, Missing=0); Overall (N=289, Missing=49); responses limited to full panel ad hoc reviewers; responses do not sum to 100 because multiple responses were permitted

Q11: Was the 15-page Project Description narrative sufficient for you to evaluate the proposed idea and approach?

Exhibit 11a. Comparison: Sufficiency of 15-page Project Development Narrative for Evaluating Proposed Idea and Approach

	Ad Hoc		Full Panel		Overall	
	n	Percent	n	Percent	n	Percent
No	2	1	2	1	4	1
Yes	291	99	206	99	497	99

Note: Ad Hoc (N=340, Missing=47); Full Panel (N=221, Missing=13); Pre Panel (N=0, Missing=0); Overall (N=561, Missing=60); responses limited to full proposal ad hoc and panel reviewers

Exhibit 11b. DEB: Sufficiency of 15-page Project Development Narrative for Evaluating Proposed Idea and Approach

	Ad Hoc		Full Panel		Overall	
	n	Percent	n	Percent	n	Percent
No	3	1	2	2	5	1
Yes	260	99	77	98	337	99

Note: Ad Hoc (N=305, Missing=42); Full Panel (N=83, Missing=4); Pre Panel (N=0, Missing=0); Overall (N=388, Missing=46); responses limited to full proposal ad hoc and panel reviewers

Exhibit 11c. IOS: Sufficiency of 15-page Project Development Narrative for Evaluating Proposed Idea and Approach

	Ad Hoc		Full Panel		Overall	
	n	Percent	n	Percent	n	Percent
No	3	1	0	0	3	1
Yes	249	99	93	100	342	99

Note: Ad Hoc (N=289, Missing=37); Full Panel (N=103, Missing=10); Pre Panel (N=0, Missing=0); Overall (N=392, Missing=47); responses limited to full proposal ad hoc and panel reviewers

Q11A: How many pages would you recommend as optimal for the Project Description section in a full proposal?

Exhibit 11A1. Comparison: Recommended Number of Pages as Optimal for Project Description Section in a Full Proposal

	n	Mean	SD	Max	Min
Ad Hoc					
Number of pages	290	12.28	5.26	20	1
Full Panel					
Number of pages	202	12.47	3.97	20	3
Overall					
Number of pages	492	12.34	4.77	20	1

Note: Ad Hoc (N=340, Missing=50); Full Panel (N=221, Missing=19); Pre Panel (N=0, Missing=0); Overall (N=561, Missing=69); responses limited to full proposal ad hoc and panel reviewers.

Exhibit 11A2. DEB: Recommended Number of Pages as Optimal for Project Description Section in a Full Proposal

	n	Mean	SD	Max	Min
Ad Hoc					
Number of pages	263	12.69	4.49	20	1
Full Panel					
Number of pages	79	13.02	3.75	30	8
Overall					
Number of pages	342	12.75	4.33	30	1

Note: Ad Hoc (N=305, Missing=42); Full Panel (N=83, Missing=4); Pre Panel (N=0, Missing=0); Overall (N=388, Missing=46); responses limited to full proposal ad hoc and panel reviewers.

Exhibit 11A3. IOS: Recommended Number of Pages as Optimal for Project Description Section in a Full Proposal

	n	Mean	SD	Max	Min
Ad Hoc					
Number of pages	250	11.88	6	25	0
Full Panel					
Number of pages	93	12.39	3.89	17	5
Overall					
Number of pages	343	12	5.51	25	0

Note: Ad Hoc (N=289, Missing=39); Full Panel (N=103, Missing=10); Pre Panel (N=0, Missing=0); Overall (N=392, Missing=49); responses limited to full proposal ad hoc and panel reviewers

Q12: Was the 4-page Project Description narrative sufficient for you to evaluate the proposed idea and approach?

Exhibit 12a. Comparison: Sufficiency of 4-page Project Description Narrative for Evaluating Proposed Idea and Approach

	Ad Hoc		Full Panel		Overall	
	n	Percent	n	Percent	n	Percent
No	8	1	4	1	12	1
Yes	800	99	376	99	1176	99

Note: Ad Hoc (N=0, Missing=0); Full Panel (N=0, Missing=0); Pre Panel (N=0, Missing=0); Overall (N=0, Missing=0); responses limited to preliminary proposal panel reviewers

Exhibit 12b. DEB: Sufficiency of 4-page Project Description Narrative for Evaluating Proposed Idea and Approach

	Preliminary Panel	
	n	Percent
No	29	22
Yes	102	78

Note: Ad Hoc (N=0, Missing=0); Full Panel (N=0, Missing=0); Pre Panel (N=135, Missing=4); Overall (N=135, Missing=4); responses limited to preliminary proposal panel reviewers

Exhibit 12c. DEB: Sufficiency of 4-page Project Description Narrative for Evaluating Proposed Idea and Approach

	Preliminary Panel	
	n	**Percent**
No	40	23
Yes	132	77

Note: Ad Hoc (N=0, Missing=0); Full Panel (N=0, Missing=0); Pre Panel (N=181, Missing=9); Overall (N=181, Missing=9); responses limited to preliminary proposal panel reviewers

Q12A: How many pages would you recommend as optimal for the Project Description section in a preliminary proposal?

Exhibit 12A1. DEB: Recommended Number of Pages as Optimal for Project Description Section in a Preliminary Proposal

	n	**Mean**	**SD**	**Max**	**Min**
Preliminary Panel					
Number of pages	129	5.02	2.34	20	2
Overall					
Number of pages	129	5.02	2.34	20	2

Note: Ad Hoc (N=0, Missing=0); Full Panel (N=0, Missing=0); Pre Panel (N=135, Missing=6); Overall (N=135, Missing=6); responses limited to preliminary proposal panel reviewers

Exhibit 12A2. IOS: Recommended Number of Pages as Optimal for Project Description Section in a Preliminary Proposal

	n	**Mean**	**SD**	**Max**	**Min**
Preliminary Panel					
Number of pages	166	4.93	2.85	15	0
Overall					
Number of pages	166	4.93	2.85	15	0

Note: Ad Hoc (N=0, Missing=0); Full Panel (N=0, Missing=0); Pre Panel (N=181, Missing=15); Overall (N=181, Missing=15); responses limited to preliminary proposal panel reviewers

Q13: What is your level of satisfaction with the following…

Exhibit 13a. Comparison: Satisfaction with Various Aspects of the Proposal Review Process

	n	**Very Unsatisfied Percent**	**Unsatisfied Percent**	**Neutral Percent**	**Satisfied Percent**	**Very Satisfied Percent**	**Ave**	**SD**
Full Panel								
Number of proposals you were assigned to review	206	0	9	19	53	18	3.81	0.85
Quality of written reviews by other panelists/ad hoc reviewers	205	1	6	16	57	21	3.89	0.83
Rigor of proposal discussion	206	1	7	13	30	49	4.2	0.97
Balance in the reviewers' consideration of proposal strengths and weaknesses	204	1	6	12	44	37	4.11	0.88

	n	Very Unsatisfied Percent	Unsatisfied Percent	Neutral Percent	Satisfied Percent	Very Satisfied Percent	Ave	SD
Willingness of other reviewers to support high-risk/high-reward projects	189	2	13	25	36	24	3.66	1.05
Fairness of final panel ratings	205	1	6	8	37	48	4.26	0.89
Level of consensus among the reviewers	205	1	3	12	48	37	4.17	0.79
Quality of panel summaries	206	1	4	11	47	38	4.18	0.81
Review process overall	204	1	5	7	45	43	4.26	0.82

Note: Full Panel (N=221, Missing=15-17, Do not know=0-17); Overall (N=221, Missing=15-17, Do not know=0-17); responses limited to full and preliminary proposal panel reviewers

Exhibit 13b. DEB: Satisfaction with Various Aspects of the Proposal Review Process

	n	Very Unsatisfied Percent	Unsatisfied Percent	Neutral Percent	Satisfied Percent	Very Satisfied Percent	Ave	SD
Full Panel								
Number of proposals you were assigned to review	79	1	18	21	49	11	3.5	0.96
Quality of written reviews by other panelists/ad hoc reviewers	79	1	7	23	52	17	3.75	0.87
Rigor of proposal discussion	79	2	11	9	37	41	4.04	1.07
Balance in the reviewers' consideration of proposal strengths and weaknesses	79	1	9	13	53	23	3.88	0.91
Willingness of other reviewers to support high-risk/high-reward projects	69	7	16	26	31	19	3.39	1.17
Fairness of final panel ratings	77	3	4	16	44	33	3.97	0.98
Level of consensus among the reviewers	79	2	4	17	55	22	3.9	0.87
Quality of panel summaries	79	2	10	13	43	32	3.93	1.02
Review process overall	79	3	7	10	43	37	4.03	1.02
Preliminary Panel								
Number of proposals you were assigned to review	131	0	5	15	65	15	3.89	0.71
Quality of written reviews by other panelists/ad hoc reviewers	131	2	9	19	59	12	3.69	0.87
Rigor of proposal discussion	131	2	8	17	41	33	3.95	0.98
Balance in the reviewers' consideration of proposal strengths and weaknesses	131	0	9	18	47	26	3.9	0.89
Willingness of other reviewers to support high-risk/high-reward projects	120	2	19	33	33	13	3.38	0.99
Fairness of final panel ratings	131	1	5	19	43	31	3.98	0.92

	n	Very Unsatisfied Percent	Unsatisfied Percent	Neutral Percent	Satisfied Percent	Very Satisfied Percent	Ave	SD
Level of consensus among the reviewers	130	1	6	13	51	29	4.02	0.86
Quality of panel summaries	131	1	6	16	54	23	3.91	0.86
Review process overall	131	0	5	18	46	30	4.01	0.84
Overall								
Number of proposals you were assigned to review	210	1	10	17	59	13	3.75	0.83
Quality of written reviews by other panelists/ad hoc reviewers	210	2	8	21	56	14	3.71	0.87
Rigor of proposal discussion	210	2	9	14	39	36	3.98	1.01
Balance in the reviewers' consideration of proposal strengths and weaknesses	210	0	9	16	49	25	3.89	0.9
Willingness of other reviewers to support high-risk/high-reward projects	189	4	18	31	32	15	3.38	1.06
Fairness of final panel ratings	208	2	5	18	43	32	3.97	0.94
Level of consensus among the reviewers	209	1	5	14	52	27	3.97	0.87
Quality of panel summaries	210	2	7	15	50	26	3.92	0.92
Review process overall	210	1	6	15	45	33	4.02	0.91

Note: Full Panel (N=83, Missing=4-5, Do not know=0-10); Pre Panel (N=135, Missing=4, Do not know=0-11); Overall (N=218, Missing=8-9, Do not know=0-21); responses limited to full and preliminary proposal panel reviewers.

Exhibit 13c. IOS: Satisfaction with Various Aspects of the Proposal Review Process

	n	Very Unsatisfied Percent	Unsatisfied Percent	Neutral Percent	Satisfied Percent	Very Satisfied Percent	Ave	SD
Full Panel								
Number of proposals you were assigned to review	93	1	4	19	55	20	3.89	0.8
Quality of written reviews by other panelists/ad hoc reviewers	93	0	11	24	51	14	3.68	0.85
Rigor of proposal discussion	93	0	4	7	44	44	4.28	0.78
Balance in the reviewers' consideration of proposal strengths and weaknesses	92	0	10	13	43	34	4.01	0.93
Willingness of other reviewers to support high-risk/high-reward projects	90	3	13	23	37	25	3.67	1.07
Fairness of final panel ratings	93	0	5	10	47	38	4.18	0.8
Level of consensus among the reviewers	91	1	1	12	54	31	4.13	0.76
Quality of panel summaries	92	1	6	12	55	26	3.98	0.85
Review process overall	93	1	2	8	53	36	4.21	0.77

	n	Very Unsatisfied Percent	Unsatisfied Percent	Neutral Percent	Satisfied Percent	Very Satisfied Percent	Ave	SD
Preliminary Panel								
Number of proposals you were assigned to review	172	1	8	19	52	21	3.86	0.86
Quality of written reviews by other panelists/ad hoc reviewers	169	1	7	16	51	26	3.94	0.86
Rigor of proposal discussion	172	0	8	7	31	54	4.32	0.9
Balance in the reviewers' consideration of proposal strengths and weaknesses	171	1	9	15	35	40	4.05	0.98
Willingness of other reviewers to support high-risk/high-reward projects	161	2	16	25	28	29	3.67	1.11
Fairness of final panel ratings	169	1	2	12	36	49	4.31	0.81
Level of consensus among the reviewers	172	0	5	11	48	36	4.16	0.79
Quality of panel summaries	172	1	8	13	47	32	4.02	0.91
Review process overall	172	1	7	7	45	40	4.17	0.89
Overall								
Number of proposals you were assigned to review	265	1	6	19	53	21	3.87	0.84
Quality of written reviews by other panelists/ad hoc reviewers	262	0	8	19	51	22	3.85	0.87
Rigor of proposal discussion	265	0	6	7	36	50	4.31	0.86
Balance in the reviewers' consideration of proposal strengths and weaknesses	263	0	9	14	38	38	4.03	0.96
Willingness of other reviewers to support high-risk/high-reward projects	251	2	15	24	31	27	3.67	1.1
Fairness of final panel ratings	262	0	3	11	40	45	4.26	0.81
Level of consensus among the reviewers	263	1	3	11	51	34	4.15	0.78
Quality of panel summaries	264	1	7	12	50	30	4	0.88
Review process overall	265	1	5	7	48	39	4.18	0.84

Note: Full Panel (N=103, Missing=9-10, Do not know=1-4); Pre Panel (N=181, Missing=9-10, Do not know=0-11); Overall (N=284, Missing=18-19, Do not know=1-15); responses limited to full and preliminary proposal panel reviewers.

Q14: Please describe one change you would make to the merit review process.

Exhibit 14a. Comparison: Desired Changes to Merit Review Process

	Ad Hoc		Full Panel		Overall	
	n	**Percent**	**n**	**Percent**	**N**	**Percent**
I would not make any changes	101	34	56	26	157	31
[Changes specified]	126	42	123	60	249	48
I do not know	71	24	27	14	98	20

Note: Ad Hoc (N=340, Missing=42); Full Panel (N=221, Missing=15); Pre Panel (N=0, Missing=0); Overall (N=561, Missing=57)

Exhibit 14b. DEB: Desired Changes to Merit Review Process

	Ad Hoc		Full Panel		Preliminary Panel		Overall	
	N	**Percent**	**n**	**Percent**	**n**	**Percent**	**n**	**Percent**
I would not make any changes	73	27	15	20	27	21	115	24
[Changes specified]	142	53	58	73	87	67	287	58
I do not know	56	21	6	8	17	13	79	17

Note: Ad Hoc (N=305, Missing=34); Full Panel (N=83, Missing=4); Pre Panel (N=135, Missing=4); Overall (N=523, Missing=42)

Exhibit 14c. IOS: Desired Changes to Merit Review Process

	Ad Hoc		Full Panel		Preliminary Panel		Overall	
	n	**Percent**	**n**	**Percent**	**n**	**Percent**	**n**	**Percent**
I would not make any changes	70	28	17	19	36	21	123	24
[Changes specified]	130	52	66	69	109	64	305	58
I do not know	50	20	11	12	26	15	87	17

Note: Ad Hoc (N=289, Missing=39); Full Panel (N=103, Missing=9); Pre Panel (N=181, Missing=10); Overall (N=573, Missing=58)

Appendix C: Reviewer Disciplinary Codes

Code	Discipline	Code	Discipline
10	Physical Sciences	58	Engineering-Engineering Technology
11	Astronomy	59	Engineering NEC
12	Chemistry	60	Life Sciences
13	Physics	61	Life Science Biological
14	Condensed Matter Physics	62	Life Science Clinical Medical
15	Metals, Ceramics & Electronic Materials	63	Life Science Other Medical
16	Solid State Chemistry and Polymers	64	Environmental Biology
17	Materials Theory	65	Agricultural
18	Materials NEC	69	Life Sciences NEC
19	Physical Sciences NEC	70	Psychology
20	Mathematics	71	Psychology Biological Aspects
21	Mathematics	72	Psychology Social Aspects
30	Computer Science & Engineering	79	Psychology Sciences NEC
31	Computer Science & Engineering	80	Social Sciences
40	Environmental Sciences	81	Anthropology
41	Atmospheric Sciences	82	Economics
42	Geological Sciences	83	History
43	Biological Oceanography	84	Linguistics
44	Physical & Chemical Oceanography	85	Political Sciences
45	Ecology	86	Sociology
49	Environmental NEC	87	Law
50	Engineering	88	Geography
51	Engineering-Aeronautical	89	Social Sciences NEC
52	Engineering-Astronautical	90	Other Sciences
53	Engineering-Chemical	91	Science Technology Assess
54	Engineering-Civil	92	Science Policy
55	Engineering-Electrical	98	Multi-Disciplinary
56	Engineering-Mechanical	99	Other Sciences NEC
57	Engineering-Metallurgy & Material		