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The National Science Foundation Support of Unsolicited Mid-Scale Research

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NATIONAL SCIENCE BOARD

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Robert J. Zimmer, President, University of Chicago

Subra Suresh, Director, National Science Foundation, Member *ex officio*

Michael L. Van Woert, Executive Officer, National Science Board, and National Science Board Office Director

Task Force on Unsolicited Mid-Scale Research

Kelvin K. Droegemeier, co-chairman
Diane L. Souvaine, co-chairman

Camilla P. Benbow
José-Marie Griffiths
Thomas N. Taylor

Mark R. Abbott, *ex officio*
Ray M. Bowen, *ex officio*
Esin Gulari, *ex officio*

Thomas Peterson, Assistant Director, NSF Directorate for Engineering
Joann Roskoski, Deputy Assistant Director, NSF Directorate for Biological Sciences

Sohi Rastegar, Executive Secretary
Matthew B. Wilson, NSB Office Liaison

* Consultant

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Task Force on Unsolicited Mid-Scale Research

National Science Board

May 4, 2012

MEMORANDUM FROM THE CHAIRMAN OF THE NATIONAL SCIENCE BOARD

SUBJECT: The National Science Foundation's Support of Unsolicited Mid-Scale Research

In August 2010, the National Science Board (Board) agreed to study whether NSF effectively supports unsolicited research projects whose budgets fall between an amount higher than a typical NSF award and a National Science Foundation (NSF) center—that is, "unsolicited mid-scale research." The Board elected to examine this issue because of the value mid-scale research offers our Nation. Mid-scale research is an important part of NSF's funding portfolio and is one of many sizes and types of opportunities that allows investigators to conduct their research efficiently and effectively. It can help create transformative knowledge that can lead to innovation, which in turn benefits our Nation's economic well-being.

During its nearly 2-year long study, the Board found that NSF supports a substantial amount of mid-scale research. During the past decade, across all of the directorates and offices, between 19 and 32 percent of research dollars were spent mid-scale research projects. The Board found that NSF funds a rich variety of activities that span the gamut between unsolicited and solicited, and the funding rate for mid-scale research at NSF is on par with the overall funding rate for all research awards at NSF.

Although mid-scale research contains many intrinsic benefits, due to its size and complexity, it presents significant, and often unique, challenges for NSF, the research community, and research institutions. The Board found that communication and coordination among all stakeholders concerning the development, submission, review, funding, and management of mid-scale research can enhance efficiency and effectiveness by leveraging years, if not decades, of "lessons-learned" and institutional wisdom.

Since the inception of this project, NSF has taken critical steps in the areas of improving both internal and external communication and increasing opportunities for unsolicited multidisciplinary research through the OneNSF Framework and the Director's Integrated NSF Support Promoting Interdisciplinary Research and Education (INSPIRE) initiative. NSF's FY 2013 budget request to Congress underscores the Foundation's commitment to continuing and extending these activities. The Board fully supports these and other related efforts.

Ray M. Bowen
Chairman, National Science Board

National Science Foundation
4201 Wilson Boulevard • Arlington, Virginia 22230 • (703) 292-7000 • http://www.nsf.gov/nsb • email: NationalScienceBrd@nsf.gov

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Dr. Asha Balakrishnan, Research Staff Member, Science and Technology Policy Institute

Ms. Abby Deift, Science Assistant, Directorate for Mathematical and Physical Sciences, NSF

Ms. Annette Dreher, Program Specialist, National Science Board Office, NSF

Mr. Darren Dutterer, Staff Associate for Budget, Directorate for Engineering, NSF

Dr. Dean Evasius, Senior Advisor for Science/Head of Multidisciplinary Activities, Directorate for Mathematical and Physical Sciences, NSF

Dr. Kelly Falkner, Office Head (acting), Office of Polar Programs, Office of the Director, NSF

Dr. Fran Featherston, Survey Statistician, National Center for Science and Engineering Statistics, Directorate for Social, Behavioral and Economic Sciences, NSF

Ms. Ann Ferrante, Writer/Editor, National Science Board Office, NSF

Mr. Tyrone Jordan, Staff Associate for Budget, Directorate for Education and Human Resources, NSF

Dr. Fae Korsmo, Acting Deputy Office Head, Polar Programs, NSF

Dr. Chuck Liarakos, Program Director, Division of Emerging Frontiers, Directorate for Biological Sciences, NSF

Ms. Pamela McKinley, Senior Associate for Operations, National Science Board Office, NSF

Dr. Jacqueline Meszaros, Science and Engineering Policy Analyst, National Science Board Office, NSF

Ms. Jennie Moehlmann, Policy Branch Chief, National Science Board Office, NSF

Mr. Mario Nuñez, Research Assistant, Science and Technology Policy Institute

Dr. Barbara Olds, Deputy Assistant Director (Acting), Directorate for Education and Human Resources, NSF

Ms. Vanessa Peña, Research Assistant, Science and Technology Policy Institute

Ms. Suzanne Plimpton, Office of Information and Resource Management, NSF

Ms. Jennifer Richards, Graduate Student, Emory University, Atlanta, GA (Served as a science assistant in the National Science Board Office from 2007-2011)

Dr. Celeste Rohlfing, Deputy Assistant Director, Directorate for Mathematical and Physical Sciences, NSF

Dr. Thomas Russell, Senior Staff Associate, Office of Integrated Activities, Office of the Director, NSF

Mr. William Smith, Staff Associate for Budget, Directorate for Geological Sciences, NSF

Mr. Payton Thomas, Program Analyst, Directorate for Biological Sciences, NSF

Dr. Jennifer Thornhill, Science Analyst, Directorate for Social, Behavioral and Economic Sciences, NSF

Ms. Beth Ann Velo, Information Technology Specialist, Office of Budget, Finance, and Award Management, NSF

Dr. John Veysey, Science Policy Analyst, National Science Board Office, NSF

Dr. Gina Walejko, Research Staff Member, Science and Technology Policy Institute

Ms. Carmen Whitson, Staff Associate for Budget, Directorate for Computer and Information Science and Engineering, NSF

Ms. Betty Wong, Program Analyst, National Science Board Office, NSF

The Board also would like to thank the NSF staff members, researchers, university administrators, and Federal Government officials who participated in the three small group discussions and workshop in 2011 (see Appendix C). We also are grateful to the researchers and NSF staff who pre-tested the customer satisfaction survey prior to implementation and the researchers and vice presidents for research who completed the survey.

EXECUTIVE SUMMARY

Realizing the full transformative benefits of basic research to both scientific understanding and to society in general requires that the National Science Foundation (Foundation, NSF) ensure the availability of a wide-variety of funding opportunities for researchers. The National Science Board (Board, NSB) embarked on a study of NSF's support for unsolicited mid-scale projects that do not fall under the purview of a particular program and whose budgets fall between an amount higher than a typical NSF award and an NSF center.

Mid-scale research is an important part of NSF's funding portfolio and offers value through several intrinsic benefits, including facilitating productive intra- or inter-disciplinary collaborations and allowing for the scale-up of smaller pilot studies. As one component of an effective research portfolio, mid-scale research can help create transformative knowledge that can lead to innovation, which in turn benefits our Nation's economy, improves national security, and leads to a better quality of life for our citizenry. The following summarizes the most consistent and compelling results of the Board's study:

NSF Currently Supports Mid-Scale Research. The Board found that NSF supports a wide range of mid-scale research activities. The funding rate of mid-scale research proposals was comparable to the overall research proposal funding rate at NSF.

NSF Provides a Spectrum of Funding Opportunities. Though the proportion of unsolicited awards diminished as budget size increased, a portion of awards at every budget level were unsolicited. Researchers would welcome additional opportunities for mid-scale research at NSF, but not if it meant fewer opportunities for other sizes or types of awards.

Communication is Essential. Increased communication across NSF regarding lessons-learned for effectively reviewing, supporting, and managing mid-scale proposals/projects, and increased communication with investigators could help establish a greater understanding of what NSF already does, and of how this process could be refined in the future for mid-scale research.

Unique Challenges. Investigators may modify their ideas/proposals in order to fit within an existing program or solicitation; and/or may elect not to submit mid-scale research proposals to NSF due to the perception that NSF is unlikely to support it. Complex, multidisciplinary unsolicited mid-scale research proposals present a challenge for NSF staff and reviewers.

Grantee Institution's Role. A grantee institution's support for mid-scale research includes institutional guidance, training, and administrative support regarding the development and management of a mid-scale research project; recognition of participation in multi-investigator projects during promotion and tenure decisions; and infrastructure support.

The Board affirms that no one-size-fits-all strategy exists for effectively reviewing, funding, and managing mid-scale research, nor is mid-scale research *a priori* essential for every NSF program. Unsolicited mid-scale research is one of a wide-array of opportunities that NSF provides to investigators to perform their research efficiently and one part of an effective research portfolio. ***The resounding conclusion of the Board is that NSF provides many diverse opportunities for mid-scale research to the researcher community***.

Since the inception of this project in May 2010, NSF has taken critical steps in the areas of improving both internal and external communication and increasing opportunities for unsolicited multidisciplinary research through the OneNSF Framework and the Director's Integrated NSF Support Promoting Interdisciplinary Research and Education (INSPIRE) initiative. The Board fully supports these and other related efforts.

INTRODUCTION

Background

NSF is the primary Federal agency supporting research at the frontiers of knowledge across all fields of science and engineering (S&E) and all levels of S&E education. NSF funds research projects using a variety of award mechanisms across a wide range of budget levels with varying numbers of investigators and institutions. Proposals are either unsolicited or submitted to NSF in response to specific solicited opportunities. In general, unsolicited proposals are submitted to NSF programs in response to a program description or program announcement. Within the given topical confines of a respective program, the scientific focus is at the discretion of the investigator, and the only administrative requirements for the proposal are those outlined by the NSF *Grant Proposal Guide* (*GPG*).[2] Collectively, these core programs cover a broad spectrum of fields in S&E. In contrast, solicited proposals are submitted in response to specific, usually temporary, announcements from the Agency of funding opportunities for specific topics of inquiry and types of projects. These often have administrative or other requirements that go beyond those outlined in the *GPG*.

Unsolicited Mid-Scale Research at NSF

NSF's support of typical single-investigator award or small group projects by its core programs, of larger center projects, and of research in response to targeted solicitations is well known. What was less well known and understood is whether gaps exist in both the opportunity to submit proposals for, and the availability of support for***, unsolicited*** mid-scale projects that do not fall under the purview of a particular program and whose budgets are significantly higher than typical projects funded by NSF core programs (referred to as "mid-scale," as defined below). This uncertainty underpinned the policy question motivating this study.

Motivating Policy Question

If an investigator or group of investigators wishes to pursue a project having a scope and budget significantly larger than is typical for a given NSF program, will they view such an ***unsolicited*** *proposal as being appropriate for and welcome at NSF, and do review and other organizational processes exist at NSF to ensure effective review, funding, and management if the proposal is judged to be meritorious and awarded support?*

A single definition of "mid-scale" is not easy to establish owing to differences among disciplines regarding the nature of the project (e.g., complexity, single- or multi-investigator) and requirements (e.g., infrastructure needs, monetary support) necessary to execute a research project successfully. ***For the purposes of this report, mid-scale research projects are defined broadly as those with an average annual budget ranging from between an amount that is substantially higher than that which is typical for a single-investigator research project and an amount that is typical for a center in that field.***

[2] The 2011 NSF *Grant Proposal Guide* (NSF 11-1) is available at: http://www.nsf.gov/pubs/policydocs/pappguide/nsf11001/gpg_index.jsp

National Science Board Study of Mid-Scale Research

Motivated by the aforementioned policy question and definition, the National Science Board charged its Committee on Programs and Plans to establish a Task Force on Unsolicited Mid-Scale Research (MS Task Force) to study this question (see Appendix D). The MS Task Force was charged with examining the effectiveness of previous and current award mechanisms at NSF for accommodating unsolicited mid-scale research and the balance between prescription and flexibility in current structures for supporting mid-scale research.

In short, the Board considered two key dimensions of mid-scale research proposals/projects in this study: (1) proposal/project budget size, and (2) topical and administrative constraints set by NSF (e.g., whether a proposal/project is unsolicited, and subject only to the *GPG* guidance, or submitted in response to a specific NSF solicitation with additional requirements on scientific focus or administrative structure). A third related characteristic that was not addressed directly by the Board, but bears consideration, is disciplinarity—that is, whether a given proposal/project focuses on a single discipline or is interdisciplinary. The disciplinarity of a project has important implications for the program(s) within NSF to which the proposal is submitted, how the proposal is reviewed, and, if awarded, how the project is administered.

Mid-Scale Research: A Value Proposition to the Nation

NSF empowers the Nation through discovery and innovation by funding frontier research via a rigorous merit review process. A guiding principle identified by the MS Task Force during its 18-month long study is that ***NSF currently supports, and should continue to support, the best science with appropriate resources***.[3] This principle evokes the old adage of using the right tool for the task. Indeed, a one-size-fits-all model does not exist for the potentially transformative S&E research that NSF funds. This is true across disciplines and even within a given discipline. For instance, a small-scale study in theoretical physics by a single principal investigator (PI) at one institution requires a different budget and organizational/administrative structure than a project such as the Long Term Ecological Research Network, which is a collaborative effort involving more than 1800 scientists and students investigating ecological processes over long temporal and broad spatial scales. Each size and type of opportunity fills an equally vital role as NSF strives to create an effective research portfolio.

Realizing the full transformative benefits to both scientific understanding and to society in general requires that NSF ensure the ready availability of opportunities, funding, and tools. This includes not just the right size opportunities (in this case mid-scale) but also the right types of opportunities as well. In creating the right tools for the task of strengthening our Nation's S&E enterprise, it is essential that NSF encourage and support the types of mid-scale research opportunities that span the spectrum between unsolicited and solicited. This will allow NSF the flexibility it needs to respond to areas of national need while also providing the freedom necessary for supporting the most innovative research activities put forward by the community.

The Board elected to examine this issue because of the value mid-scale research offers our Nation. Mid-scale research is an important part of NSF's funding portfolio and imparts value to our S&E enterprise through several intrinsic benefits. First and foremost, mid-scale research

[3] Resources include the budget, research infrastructure, project duration, and other related items.

allows individual researchers to form productive intra- or inter-disciplinary collaborations at the scale needed to tackle important intellectual challenges that lie beyond the scope and duration of typical single-investigator grants. Second, it provides for scaling up of smaller pilot studies, thereby expanding and strengthening research as it evolves. Additionally, it increases efficiency by providing a single bolus of significant funding for substantial progress rather than making incremental progress through a series of smaller awards. Each of these benefits alone or together furthers the advancement of S&E research and the creation of new knowledge. As one component of an effective research portfolio that includes various sizes and types of awards, mid-scale research can help increase the likelihood of transforming this new knowledge into innovation, which in turn benefits our Nation's economy, improves national security, and leads to a better quality of life for our citizenry.

RESULTS

The Board's MS Task Force developed a data and information gathering strategy that included (1) holding three separate discussions involving small groups of NSF staff (one session) and NSF-funded researchers (two sessions); (2) hosting a three-day workshop of a larger group of key stakeholders; (3) analyzing relevant information within NSF's research award database; and (4) conducting a community satisfaction survey of mid-scale researchers and vice presidents for research at NSF-funded institutions (see Appendix B). The following is a summary of the most consistent and compelling results of that study relating to mid-scale research at NSF. Some of these results are unique to mid-scale research while others may apply to many or even all research award sizes and types at NSF.

1. **NSF Currently Supports Mid-Scale Research**. Because scientific progress often requires the pursuit of mid-scale research opportunities, NSF has developed a variety of mechanisms to support both solicited and unsolicited mid-scale projects. Although these mechanisms differ throughout the Agency in order to account for the unique characteristics of different disciplines, ***the Board found that NSF supports a wide range of mid-scale research activities***.

   Across all seven directorates and the office of the director, 4 percent to 11 percent of awards fall into the mid-scale range (see Table 1). These mid-scale awards represent 19 percent to 32 percent of the directorates' budgets (see Table 2). Between 2000 and 2010, the funding rate of mid-scale research proposals was comparable to the overall research proposal funding rate at NSF (17 percent to 31 percent across directorates and offices compared to 13 percent to 29 percent for mid-scale research;[4] see Figure).

2. **NSF Provides a Spectrum of Funding Opportunities with Varying Degrees of Administrative Structure, Budget Size, and Research Topic**. The funding opportunities at NSF are not appropriately reflected in a binary classification between unsolicited or solicited, but rather represent a continuum between the two extremes. Where an opportunity for

[4] Funding/success rate is the ratio of the number of full proposals received divided by the number funded. Due to the way that proposal submission data are collected at NSF, pre-proposals are not counted as full proposals and thus are not factored into the funding rate data. Following review of the pre-proposals, NSF staff will "invite" or "encourage" a subset of investigators to submit full proposals for consideration. Because these full proposals have undergone initial vetting by NSF staff, funding rate may be higher than if no pre-proposal mechanism was used.

funding falls along this continuum between unsolicited and solicited is subjective. For the purposes of the Board's study, proposals funded in response to program descriptions or program announcements (see definitions in Appendix A) were considered unsolicited.[5] Between 2007 and 2010, 26 percent of mid-scale awards representing 18 percent of the funding were funded via a program description. During this same period, the proportion of awards and proportion of funding given to awards submitted through a program description (i.e., unsolicited) varied depending on the size of the award. That is, 47 percent of small-scale, 26 percent of mid-scale, and 6 percent of large-scale research awards responded to program descriptions, representing 40 percent, 18 percent, and 4 percent of the research funding, respectively.

During its information gathering activities, the Board asked members of the research community if they would (1) favor a shift in NSF's research portfolio towards more mid-scale research and (2) if the balance between unsolicited and solicited research opportunities was appropriate. Researchers indicated they would welcome additional opportunities for proposing mid-scale research to NSF, but they did not favor more opportunities for, or a shift towards, mid-scale research if it meant fewer opportunities or diminished funding for other sizes and types of awards at NSF. There was no consensus among researchers as to whether they would favor a shift in the balance between solicited and unsolicited mid-scale research.

The Board also asked NSF-funded mid-scale researchers about their perspectives on barriers to mid-scale research they have experienced, including their perception of whether NSF welcomes mid-scale research proposals. A majority or near majority of researchers indicated that proposal budget size, the high-risk nature of their proposal, and the novelty of their project (and thus its unfamiliarity to reviewers) were potential barriers (discussed further in Results 4 and 5). Importantly, the vast majority of mid-scale researchers felt that NSF staff welcomed their mid-scale proposals, and of those who indicated that this was a barrier, most felt it was a minor barrier.

3. **NSF's Communication—Internally and Externally—is Essential to Effective Support of Mid-Scale Research**. NSF staff members with substantial experience in reviewing and stewarding mid-scale projects have a wealth of knowledge and "lessons-learned" that would benefit fellow program officers, NSF management, and the research community in general. During its informal group discussions, NSF staff suggested that strengthening internal communication within and between directorates in terms of effective strategies and lessons-learned for reviewing, supporting, and managing mid-scale research proposals and projects could help improve efficiency. Most investigators indicated that they were satisfied with the timeliness and clarity of NSF's communication regarding existing mid-scale research opportunities. Nevertheless, they offered that increased communication between NSF program staff and the research community could facilitate their development, submission, and subsequent administration of an effective mid-scale research proposal and project.

[5] This is likely an underrepresentation of what could be considered in the spirit of "unsolicited research" as some solicitations, such as the Faculty Early Career Development (CAREER) program, have administrative requirements that go beyond the *Grant Proposal Guide*, but allow researchers complete freedom to propose a project in any area that NSF funds.

4. **Unique Challenges Exist Regarding Mid-Scale Research at NSF**. NSF staff and NSF-funded researchers detailed a variety of challenges that attend to mid-scale research. Some of these challenges are unique to mid-scale research, specifically unsolicited mid-scale research, while other challenges are present in many or even most award sizes and categories throughout NSF.

   - To find a programmatic home within NSF for mid-scale research, investigators may modify their ideas, change the program scope or budget, or avoid proposing certain types of collaborations in order to fit within an existing program or solicitation. Thus, the overall process in such cases is driven more by actual or perceived program rather than research requirements. The goal of NSF management and staff as they create new programs, solicitations, and other types of opportunities is to help steer researchers toward areas of scientific and/or societal need, while still promoting innovative thinking. NSF programs and solicitations are not top-down, solely NSF-driven mechanisms, but rather represent the cumulative result of careful strategic planning drawing on regular feedback from a given research community.

   - Investigators sometimes divide a mid-scale idea or proposal into several smaller proposals to increase perceived "fundability." Although this approach may benefit scientific progress in some cases,[6] it also may increase considerably the administrative burden on researchers and NSF. Furthermore, there is no guarantee that each of these smaller proposals will receive funding from NSF, thus fragmenting the research program and potentially leading to unnatural sequencing of activities.

   - Researchers currently may elect to not submit mid-scale research proposals to NSF for several reasons, including perceptions that NSF is unlikely to support an unsolicited mid-scale project due to its budget size and/or that an unsolicited mid-scale research project may not receive an adequate review due to its novelty or because it is perceived as high risk (see Result 5).

5. **Unique Challenges Attend the Peer Review and Funding of Mid-Scale Research Proposals**. Specifically, NSF staff indicated that unsolicited mid-scale proposals may be reviewed by the same panel in conjunction with smaller proposals. Reviewers for programs with a known (and limited) budget may lean toward recommending small-budget proposals to maximize the number of proposals funded, thus putting a larger, mid-scale proposal at a disadvantage. Some unsolicited mid-scale proposals, because of their size, are often complex and/or multidisciplinary in nature. Consequently, these types of proposals may be outliers compared to the typical proposals reviewed in core program panels. This presents a challenge for NSF staff and reviewers. These views expressed by NSF staff appear to corroborate the perspectives of NSF-funded mid-scale researchers who participated in the Board's discussions (discussed in Result 2). Finally, multidisciplinary mid-scale research proposals may require peer review by multiple review panels, and if awarded funding, may require funding by multiple programs within or across directorates. As a result, these projects require a high degree of coordination among reviewers and NSF staff.

[6] For example, some fields, such a social media technology, evolve rapidly over an award period. Two or more, sequential, smaller proposals may provide much needed scientific flexibility for investigators compared to a single mid-scale proposal. Likewise, a smaller proposal also may serve as an ideal higher-risk pilot study in advance of subsequent follow-up small- or mid-scale proposals.

6. **Grantee Institutions Have an Important Role in Supporting Mid-Scale Research**. Research universities use a variety of mechanisms to support mid-scale research projects (e.g., core facilities, support staff, cyberinfrastructure, and research space). Researchers identified a few areas of need with respect to their home institution's support for mid-scale research. First, investigators, particularly those early in their career, may lack the institutional guidance/training necessary to navigate the proposal process successfully and build research networks that could facilitate research collaborations. Second, there are skills necessary for managing the unique challenges associated with larger, more complex interdisciplinary, multi-investigator, and/or multi-institution mid-scale research projects. Likewise, these types of projects may require increased institutional administrative support. Third, there was concern that the participation of junior faculty in mid-scale research collaborations will not be valued during tenure and promotion decisions in comparison with more traditional single-investigator grants, in which role and credit arguably are more straightforward. Lastly, researchers indicated that increased institutional support for research infrastructure needs (e.g., networking capabilities, shared equipment, research support personnel, and space/facilities) would benefit their research.

7. **Mid-Scale Research and Infrastructure are Intrinsically Linked**. Mid-scale research may require expensive equipment, facilities, and support personnel. Investigators—particularly those at smaller or less-well-funded institutions—may not have access to needed infrastructure.

DISCUSSION AND CONCLUSION

The motto of the National Science Foundation is "where discoveries begin." NSF's ability to fund a vast array of novel ideas—ideas that may not fit within the mandates or missions of other agencies, that come from a broad array of scientists and engineers at all career stages, and that advance frontiers of knowledge and lead to transformative outcomes—is an indispensible facet of its success. NSF should pride itself on its long history of funding the best science and providing the research community with the right resources and tools for the task.

Although mid-scale research contains intrinsic benefits, the qualities of mid-scale research that confer these benefits also create significant challenges that are distinct from other types of NSF research awards. For example, because mid-scale research often crosses disciplinary and administrative boundaries, including boundaries at NSF as well as at research institutions, it necessitates increased coordination and management. Likewise, by definition, mid-scale research will be more expensive than the typical NSF grant, may take longer to achieve its scientific objectives, and may have a deeper reliance on research infrastructure. At the same time, NSF management and staff face significant challenges that affect all types and sizes of research, including unsolicited mid-scale research (e.g., creating and managing an effective research portfolio in light of finite resources).

The National Science Board was motivated by the key question of whether NSF has appropriate opportunities and processes in place to meet these challenges and provide effective support for unsolicited mid-scale research. The initial focus of the MS Task Force was on <u>unsolicited</u> mid-scale research, but it became clear during its study that (1) there exists a continuum between solicited and unsolicited research rather than a binary classification, and (2) it is vital for NSF to

provide a wide variety of opportunities spanning this continuum tailored to a particular research community's needs. ***The resounding conclusion of the Board is that NSF provides many diverse opportunities for mid-scale research to the researcher community***. NSF currently supports a rich variety of single- and multi-PI mid-scale research projects that span the spectrum between solicited and unsolicited and focus on a single discipline or are multidisciplinary. Many of NSF's directorates, divisions, and programs have developed an array of structures and processes to manage all aspects of these opportunities, tailored to meet the needs of a given research community benefitting from years of lessons learned.

Communication is essential to the effective management of Federal funding agencies, and it is a theme woven throughout the results discussed above. Countless examples exist across the Foundation of effective and efficient strategies for accepting, reviewing, funding, and managing mid-scale research proposals and projects across the Foundation. These strategies are the result of careful planning and years, if not decades, of "lessons learned." Much could be gained by an increased leveraging of the wealth of institutional knowledge that exists within NSF through improved internal communication and coordination. This principle holds true for all sizes and types of awards, but may be particularly vital for mid-scale proposals and projects, which often span multiple programs within or across directorates.

> ***The Board sees value in NSF continuing to enhance both internal and external communication in order to help establish a greater understanding of what NSF already does, and of how this process could be refined in the future for mid-scale research.***

NSF is committed to funding the best science and providing the research community with the right resources, giving careful consideration to the many (often competing) factors that compose an effective research portfolio. The Board affirms that no one-size-fits-all strategy exists for effectively encouraging, reviewing, funding, and managing mid-scale research, nor is mid-scale research *a priori* essential for every NSF program. Mid-scale research, including unsolicited proposals and projects initiated independent of a specific solicitation or initiative, is one of numerous vital tools that NSF provides to investigators to perform their research efficiently and effectively. As such, unsolicited and solicited mid-scale research should continue to remain an integral facet of internal NSF strategic planning at every organizational level. For example, each organization within NSF routinely examines and modifies its internal structures and processes, such as the composition of core programs and solicitations, proposal deadlines, panel review, and award mechanisms (e.g., standard awards vs. annual awards). As part of this effort, the Board sees value in continuing these practices to foster efficient coordination in these and other areas as it applies to mid-scale research and consider the impact of these internal structural and process modifications on the research community.

> ***Given the variety of mid-scale opportunities, the diversity of research fields supported by NSF, and the lack of a one-size-fits all model for mid-scale research, the Board sees value in researchers and NSF staff continuing to demonstrate creativity and flexibility in proposing, reviewing, supporting, and managing mid-scale research.***

In the 24 months between the inception of the MS Task Force and the approval of this report, NSF has taken critical steps in the areas discussed above. Communication and coordination are major themes of the NSF Director's "OneNSF Framework."[7] The goal of this initiative is "to help NSF work seamlessly across organizational and disciplinary boundaries to create new knowledge, stimulate discovery, and address complex societal problems and promote national prosperity." The Board enthusiastically supports the OneNSF Framework and believes that it will strengthen and expand internal communication leading to improved efficiency in all aspects of NSF operations, including the challenges and lessons-learned related to mid-scale research.

Likewise, since the creation of the MS Task Force, the Foundation has expanded the opportunities for support in the area of unsolicited interdisciplinary mid-scale research through the Director's INSPIRE initiative.[8] The aim of INSPIRE is to "encourage cross-disciplinary science by breaking down any disciplinary barriers that may exist within NSF and encourage its program managers to use new tools, collaboration modes, and techniques in the merit-review process to widen the pool of prospective discoveries that may be hidden from or circumvented by traditional means."[9] As part of the INSPIRE initiative, NSF launched the CREATIV (Creative Research Awards for Transformative Interdisciplinary Ventures) pilot grant mechanism in FY 2012.[10] This award mechanism will empower NSF program officers to support high-risk/high-reward interdisciplinary proposals that some researchers may have been reluctant to submit to the regular merit review process. CREATIV is very much in the spirit of unsolicited, blue-sky research and provides funding for projects with an annual budget approaching or within what the Board has defined as "mid-scale." The Board fully supports this and other related efforts.

[7] http://www.nsf.gov/od/oia/OIABudget/NSFBudget/FY2013_BudgetRequestToCongress.pdf. See page "Overview – 3."
[8] http://www.nsf.gov/about/budget/fy2013/pdf/40_fy2013.pdf
[9] http://www.nsf.gov/news/speeches/suresh/11/ss110214_nsfbudget.jsp
[10] http://www.nsf.gov/pubs/2012/nsf12011/nsf12011.pdf

TABLES AND FIGURE

The Board conducted an analysis of the NSF research awards database from 2001 to 2010 using a systematic statistical approach to quantify mid-scale funding ranges based on each research division at NSF. The results revealed that 93 percent of awards were small-scale research awards representing 61 percent of the research funding (see Table 1 and Table 2). At the mid-scale level, 7 percent of awards represented 26 percent of the funding. Finally, large-scale awards comprised less than 1 percent of all awards, but were 13 percent of the funding. A detailed explanation of the methodology can be found in Appendix B.

Table 1: Breakdown of Number of Awards by Directorate by Range, Fiscal Years 2001–2010

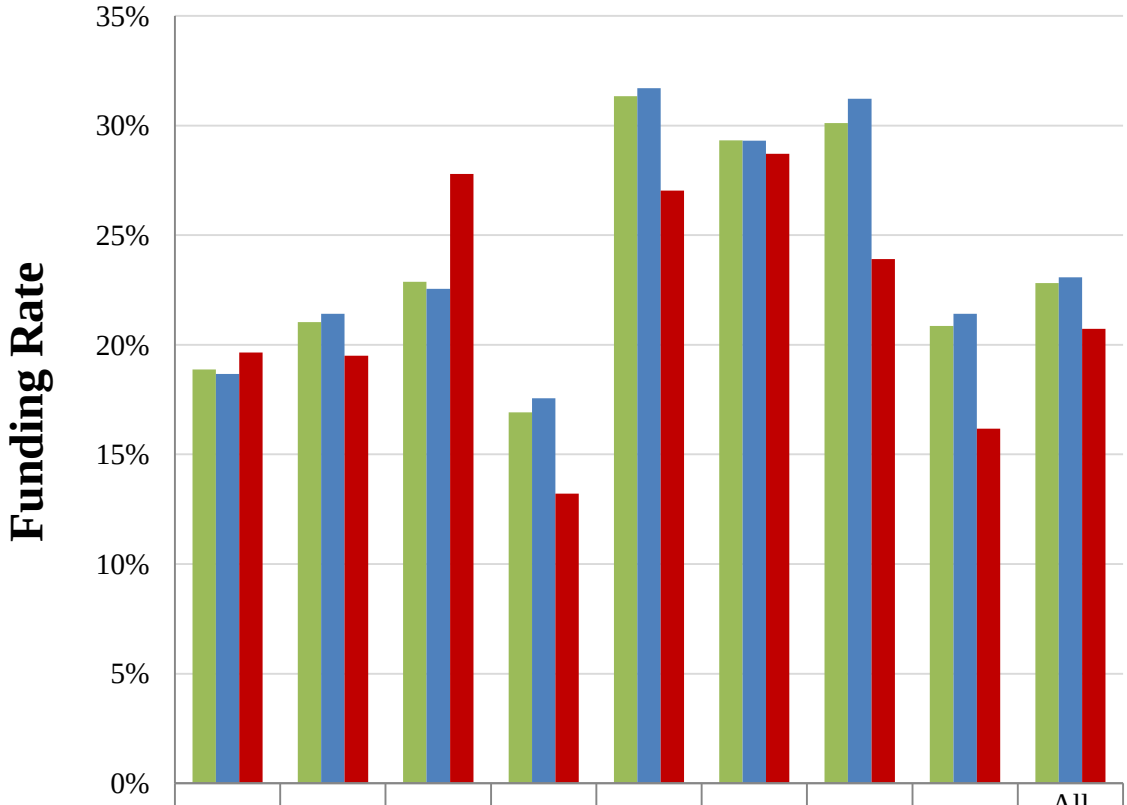
	All	Small-Scale		Mid-Scale		Large-Scale	
Organization	**# of Awards**	**# of Awards**	**% of Directorate Total**	**# of Awards**	**% of Directorate Total**	**# of Awards**	**% of Directorate Total**
BIO	8,861	8,204	93%	587	7%	70	0.8%
CISE	9,109	8,093	89%	994	11%	22	0.2%
EHR	7,730	7,260	94%	453	6%	17	0.2%
ENG	10,688	9,961	93%	707	7%	20	0.2%
GEO	8,452	7,987	94%	450	5%	15	0.2%
MPS	16,787	15,527	92%	1,136	7%	124	0.7%
O/D	3,348	3,086	92%	218	7%	44	1.3%
SBE	5,675	5,432	96%	226	4%	17	0.3%
NSF	**70,650**	**65,550**	**93%**	**4,771**	**7%**	**329**	**0.5%**

Table 2: Breakdown of Total Funding by Directorate by Range, Fiscal Years 2001–2010

	All	Small-Scale		Mid-Scale		Large-Scale	
Organization	**Adjusted Funding ($Million)**	**Adjusted Funding ($Million)**	**% Small-Scale**	**Adjusted Funding ($Million)**	**% Mid-Scale**	**Adjusted Funding ($Million)**	**% Large-Scale**
BIO	$6,188	$3,849	62%	$1,550	25%	$789	13%
CISE	$4,995	$3,044	61%	$1,619	32%	$332	7%
EHR	$8,743	$5,909	68%	$2,425	28%	$409	5%
ENG	$4,834	$2,951	62%	$1,226	25%	$657	14%
GEO	$4,424	$2,844	64%	$1,180	27%	$400	9%
MPS	$9,160	$5,278	58%	$1,948	21%	$1,934	21%
O/D	$2,509	$916	36%	$627	25%	$966	39%
SBE	$1,835	$1,257	69%	$343	19%	$235	13%
NSF	**$42,688**	**$26,048**	**61%**	**$10,918**	**26%**	**$5,722**	**13%**

Notes for Table 1 and Table 2: Values may not sum due to rounding. Data were collected across the seven NSF directorates: Biological Sciences (BIO); Computer and Information Science and Engineering (CISE); Education and Human Resources (EHR); Engineering (ENG); Geosciences (GEO); Mathematical and Physical Sciences (MPS); Social, Behavioral, and Economic Sciences (SBE); and the Office of the Director (O/D). For the purposes of this analysis, O/D included data from the Office of Cyber Infrastructure, Office of Integrative Activities, Office of International Science and Engineering, and Office of Polar Programs.

In order to answer the question, "How do the funding rates of mid-scale research proposals compare to other NSF proposals?", NSF research proposals and research awards databases from 2001 to 2010 were analyzed using a systematic statistical approach to quantify mid-scale funding ranges based on each division. The data analysis showed that across the NSF, mid-scale proposals were awarded at similar rates to small-scale proposals, though there were variations across the directorates (see Figure). The mid-scale funding rates ranged from 13 percent to 29 percent, depending on the directorate. For all NSF research awards funded between 2001 and 2010, the overall research proposal funding rate was 23 percent, and the mid-scale funding rate was 21 percent. A detailed explanation of the methodology can be found in Appendix B.



	BIO	CSE	EHR	ENG	GEO	MPS	O/D	SBE	All NSF
Overall Funding Rate	19%	21%	23%	17%	31%	29%	30%	21%	23%
Small-Scale Funding Rate	19%	21%	23%	18%	32%	29%	31%	21%	23%
Mid-scale Funding Rate	20%	19%	28%	13%	27%	29%	24%	16%	21%

Figure: Funding Rates for Small-scale, Mid-scale, and All Proposals per Directorate, Fiscal Years 2001–2010

Notes: *Funding rate does not include American Recovery and Reinvestment Act (ARRA) proposals or awards. Any discrepancies between the Budget Office data and Merit Review Report data are due to different definitions of "research awards." The Merit Review Reports exclude Small Grant for Exploratory Research (SGER), Early Concept Grants for Exploratory Research (EAGER), Rapid Response Research (RAPID), Small Business Innovation Research (SBIR), and centers and facilities grants from the research award classification. In contrast, data provided for the mid-scale analysis include SGER, EAGER, RAPID, SBIR, and centers and instrumentation, but exclude operations funding for Major Multi User Research Facilities. Collaborative awards for this analysis were considered as one award, while the Merit Review Report considers each collaborative award individually.

APPENDIX A: DEFINITIONS

CREATIV: CREATIV[11] (Creative Research Awards for Transformative Interdisciplinary Ventures): a pilot grant mechanism under the Integrated NSF Support Promoting Interdisciplinary Research and Education (INSPIRE) initiative, to support bold interdisciplinary projects in all NSF-supported areas of science, engineering, and education research. The goals of the CREATIV grant mechanism are to: (1) Create new interdisciplinary opportunities that are not perceived to exist presently; (2) Attract unusually creative high-risk / high-reward interdisciplinary proposals; (3) Provide substantial funding, not limited to the exploratory stage of the pursuit of novel ideas; and (4) Designate no favored topics; be open to all NSF-supported areas of science, engineering, and education research. Proposals on any NSF-supported topic will be accepted; awards will generally support an individual PI or a small team. The allowable duration is up to five years. A CREATIV award must be substantially co-funded by at least two intellectually distinct NSF divisions or programs. The maximum total award is $800,000 for two co-funding programs and $1,000,000 for three or more co-funding programs.

INSPIRE: INSPIRE[12] was established to address some of the most complicated and pressing scientific problems that lie at the intersections of traditional disciplines and to advance the NSF's strategic goal of Transform the Frontiers.[13] INSPIRE will strengthen NSF's support of interdisciplinary, potentially transformative research by complementing existing efforts with a suite of new, highly innovative Foundation-wide activities and funding opportunities.

INSPIRE was announced in February 2011 in the NSF FY 2012 Budget Request to Congress, which included funding of $12.35 million in the Integrative Activities (IA) budget for new funding opportunities, to be augmented by co-funding from directorates and offices. It responds to issues raised in a variety of external and internal publications, including a National Academies report[14] that identified barriers to interdisciplinary research (IDR), documents relating to the reauthorization of the America COMPETES Act, the report of the NSF Facilitating Transformative and Interdisciplinary Research (FacTIR) Working Group,[15] and to perceptions in the research community that NSF does not always provide good opportunities for comprehensive review and support of unsolicited ID proposals that cross traditional boundaries. INSPIRE directly supports NSF's strategic goal of Transform the Frontiers and the goal to make investments that lead to emerging new fields of S&E and shifts in existing fields.

INSPIRE has two overarching goals: (1) NSF program officers will have the necessary tools and management support to empower crosscutting collaboration and risk-taking in developing and managing their awards portfolio; (2) Researchers will submit and NSF will support a greater proportion of unusually novel, creative interdisciplinary proposals.

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[11] http://www.nsf.gov/pubs/2012/nsf12011/nsf12011.pdf
[12] http://www.nsf.gov/about/budget/fy2013/pdf/EntireDocument_fy2013.pdf. See "NSF-Wide Investments – 21"
[13] Empowering the Nation Through Discovery and Innovation: NSF Strategic Plan for Fiscal Years (FY) 2011-2016, www.nsf.gov/news/strategicplan/index.jsp (2011).
[14] Committee on Facilitating Interdisciplinary Research, Committee on Science, Engineering, and Public Policy (2004). Facilitating interdisciplinary research. National Academies. Washington: National Academy Press.
[15] Final Report, Facilitating Transformative and Interdisciplinary Research (FacTIR), www.inside.nsf.gov/od/factir/FacTIRFinalReport_091221.pdf (2009).

Mid-Scale Research: Mid-scale research projects are defined broadly as those having an average annual budget that is substantially greater than a typical single-PI research project and less than a typical center in a given field. See "NSF Award Data Analysis" in Appendix B.

OneNSF Framework: OneNSF[16] aims to enable seamless operations across organizational and disciplinary boundaries. OneNSF empowers the Foundation to respond to new challenges in a changing global environment, leverage resources and opportunities for maximum impact, and provide leadership to establish innovative practices, programs, and paradigms that advance scientific knowledge and science, technology, engineering, and mathematics (STEM) education.

Program Description: The term *program description* includes broad, general descriptions of programs and activities in NSF directorates/offices and divisions. Program descriptions are often posted on Directorate/Division websites to encourage the submission of proposals in specific program areas of interest to NSF. Program descriptions, like program announcements, utilize the generic eligibility and proposal preparation instructions specified in the *GPG*, as well as the Board-approved merit review criteria. See *GPG* Chapter III for additional information.[17]

Program Announcement: The term *program announcement* refers to formal NSF publications that announce NSF programs. Program announcements and program descriptions (see "Program Descriptions" above) are the primary mechanisms used by NSF to communicate opportunities for research and education support, as well as to generate proposals. Program announcements utilize the generic eligibility and proposal preparation guidelines specified in the *GPG* and incorporate the Board-approved merit review criteria.

Program Solicitation/Solicited Research: The term *program solicitation* refers to formal NSF publications that encourage the submission of proposals in specific program areas of interest to NSF. They generally are more focused than program announcements and normally apply for a limited period of time. Competition among proposals is more precisely defined than with program announcements, and proposals received compete directly with each other. Program solicitations are issued when the funding opportunity has one or more of the following features:

- Provides supplemental proposal preparation guidance or deviates from the guidelines established in the *GPG*;
- Contains additional specially crafted review criteria relevant to the program;
- Requires submission of a letter of intent or preliminary proposal;
- Deviates from (or restricts) the standard categories of proposers specified in the *GPG* (Section E);
- Limits the number of proposals that may be submitted by any organization and/or researcher/educator;
- Specifies additional award conditions or reporting requirements;
- Anticipates use of a cooperative agreement; or
- Permits inclusion of the payment of fees to awardees, when appropriate.

Unsolicited Research: The term *unsolicited research* refers to proposals/projects that are submitted to NSF in response to a program description or program announcement (see above). The scientific topical area is typically broad and, in general, the only administrative requirements placed on researchers are those outlined in the *GPG*.

[16] http://www.nsf.gov/od/oia/OIABudget/NSFBudget/FY2013_BudgetRequestToCongress.pdf. See page "Overview – 3."
[17] http://www.nsf.gov/pubs/policydocs/pappguide/nsf11001/gpgprint.pdf. See page "I-2."

APPENDIX B: PROCESS FOR PRODUCING THE REPORT

In order to accomplish its charge, the MS Task Force developed a data and information gathering strategy that included (1) holding three separate discussions involving small groups of NSF staff (one session) and NSF-funded researchers (two sessions); (2) hosting a three-day workshop of a larger group of key stakeholders; (3) analyzing relevant information within NSF's research award database; and (4) conducting a customer satisfaction survey of mid-scale researchers and vice presidents for research.

Discussion Groups/Workshop

The three group discussions were held in early 2011, with the first engaging NSF staff having prior university research administration experience. The two subsequent discussions engaged small groups of university researchers who are or have been engaged in NSF-funded mid-scale research. A list of guiding questions and participants can be found in Appendix C. The larger workshop held in June 2011 included university researchers and research administrators, representatives from other Federal agencies having similar mid-scale programs, NSF staff at all levels, and NSB members. Further details about the workshop agenda and participants also are located in Appendix C.

NSF Award Data Analysis

The following data methodology was adapted from the methodology provided to the National Science Board by the Science and Technology Policy Institute

In May 2011, the Board Office (NSBO) asked the IDA Science and Technology Policy Institute (STPI) to provide analytical support to the National Science Board Task Force on Unsolicited Mid-Scale Research by examining research awards made by NSF between 2001 and 2010. The purpose was to understand better the extent of funding appropriated for mid-scale research. The following sections define "mid-scale research" as understood by the MS Task Force, discuss the data sources and variables for the analysis, review the steps taken to clean the data before the analysis was performed, and explain the methodology that was employed for the analysis.

Nearly all directorates that STPI studied were found to fund mid-scale research in the 2001–2010 timeframe. The results from using the accepted methodology are provided below.

Definition of Mid-Scale Research

The STPI study team used a definition of mid-scale research drawn from the MS Task Force charge, as published on February 16, 2011.[18] The charge states:

> *The definition of a "mid-scale" budget varies among NSF directorates due to differences in each directorate's average award size. For the purposes of this Task Force, mid-scale research projects are defined broadly as those with an average annual budget ranging from between an amount that is substantially higher than that which is typical for a single-PI research project and an amount that is typical for a center in that field.*

[18] National Science Board, "Committee on Programs and Plans (CPP) Task Force on Unsolicited Mid-Scale Research (MS)," NSB-10-59, Revised February 16, 2011, available in Appendix D and online at http://www.nsf.gov/nsb/committees/tskforce_ms_charge.jsp.

Based on this definition, the STPI study team developed a systematic approach to quantify the mid-scale research funding range. Thus, the lower bound of mid-scale research represented an annual funding amount that is "substantially higher than a single-PI research award." The upper bound of the mid-scale research range represented an annual funding amount for a "typical center in that field."

Data Sources

The MS Task Force provided STPI with a database of research awards obtained from the NSF Budget Office. The original NSF Budget Office database included 64,043 awards in the 4110 Research Grant Class Code.[19] In order to analyze the Directorate for Education and Human Resources (EHR) awards, the NSF Budget Office provided an additional database of 7,606 EHR awards for a total award database of 71,649. The awards were granted from 2001 through 2010 for standard grants, continuing grants, and cooperative agreements. The database did not include funding from the American Recovery and Reinvestment Act (ARRA) of 2009.

The unit of analysis in the database was an award. For each award, the following information was provided: (1) total funding; (2) annual funding; (3) duration of award in years; (4) directorate; (5) division; (6) number of principal investigator(s) (PI)s; (7) program solicitation code; and (8) whether the award was unsolicited or solicited based on solicitation code.

Subsequent to receiving the database of NSF awards, STPI received a database of 350,364 NSF proposals from 2001 to 2010 in the 4110 Research Grant Class Code and EHR proposals. The NSF Budget Office provided this data to STPI in order to determine the rate at which mid-scale awards are funded (i.e., success rate). Similar to the awards dataset, the proposal dataset included: proposed total funding, proposed duration, proposed number of PIs, program solicitation code, directorate, division, and whether or not the proposal was awarded.

Cleaning and Removing Data

STPI identified the following attributes of the data that required discussion, modification, or additional coding: (1) inaccurate data on the funding and duration of cooperative agreement awards; (2) inclusion of awards that fund large facilities or major-multiuser research facilities; (3) awards reporting no funding amounts; (4) award funding amounts not adjusted for inflation; (5) insufficient numbers of awards in directorates and divisions, (6) attribution of co-funded awards to single divisions; (7) award program type based on program solicitation codes; and (8) data quality between the award dataset and proposal dataset. The following subsections explain how STPI addressed these issues. Points 1 through 8 specifically refer to the awards dataset.

Errors in Funding Amount and Duration of Cooperative Agreement Awards

Through discussions with directorates, the study team discovered that cooperative agreement funding levels and award durations were inaccurate. For example, NSF program solicitations generally call for Engineering Research Centers (ERCs) to be eight-year awards, but the database listed ERCs as 5-year grants.

[19] The NSF Budget office described 4110 as the code by which they identify research awards. Examples of other codes are for education, graduate research fellowships and workshops.

In follow-up discussions with the NSF Budget Office, the STPI study team learned that the forecasting method used by the NSF Budget Office for cooperative agreements did not always accurately capture the actual amounts awarded. The NSF Budget Office explained that because each directorate or division allocates cooperative agreement funding in increments, the final expected award amount is not often well documented. In addition, cooperative agreement duration data did not often match with expected durations for certain centers.[20] These findings persuaded the study team to use an alternate approach to determining the annual funding for any cooperative agreement award in the dataset.

The team used the public NSF Fastlane database to gather amounts awarded to date and expected duration data for 478 cooperative agreements. For expired awards, STPI divided the Fastlane funding by duration to get cooperative agreement annual funding. However, this conversion did not apply to active cooperative agreement awards because Fastlane reports only actual amount awarded to date. To calculate *projected* total funding for active cooperative agreement awards, STPI first multiplied amount awarded to date by total (anticipated) days of the award, and then divided by the number of days since the start date (see Equation).

$$\text{Total Projected Funding} = \text{Amount Awarded to Date} \times \left(\frac{\text{Estimated Number of Award Days}}{\text{Days Since Start Date}}\right)$$

Equation: Calculated Projected Total Award Funding for Cooperative Agreements

For example, if a ten-year award was in its fifth year and had received $4 million (M), the projected funding for the total award would be $8M. Thus, this approach assumed a uniform disbursement of funding. Note that duration was calculated using days as the unit of analysis.

Removal of Large Facility Award

Based on input from the MS Task Force, cooperative agreements that fund major multi-user facilities or operations of large facilities were not considered in the analysis. The study team systematically removed any cooperative agreement that funded either a major multi-user research facility based on the facilities listed in the NSF Budget Request,[21] or the operations of a facility originally funded through the Major Research Equipment and Facilities Construction (MREFC) Account.

In total, STPI removed 52 major multi-user facility awards from the dataset, all of which were cooperative agreements. As a result of excluding these awards, 426 cooperative agreements remained for the analysis.

Errors in Total Funding Variable

Thirty-three awards did not contain total funding data, and 31 awards listed only one dollar. The NSF Budget Office explained that these award amounts were placeholders and not reflective of their funding. Accordingly, STPI removed these awards from our analyses of the mid-scale boundaries.

[20] Discussion with the MS Task Force Executive Secretary revealed errors in the duration of particular centers.
[21] For a copy of the FY 2012 NSF Budget Request to Congress, see http://www.nsf.gov/about/performance/.

Inflation Adjustment for Funding
The study team converted total funding to 2010 constant U.S. dollars using the gross domestic product chained price index from Historical Table 10.1 in the U.S. Budget.[22] STPI then divided this adjusted total funding amount by the duration of the award to get the adjusted annual funding. STPI used adjusted annual funding for all annual funding calculations in this report.

Divisions with Limited Data
STPI could not determine appropriate upper and lower mid-scale bounds for certain divisions given the small number of associated awards. STPI required at least 30 awards for inclusion in the analysis. For example, the Division of Experimental and Integrative Activities (EIA) in the Directorate for Computer and Information Science and Engineering (CISE) had only 19 awards and the division was excluded from the analysis as a result. Furthermore, due to the different criteria by which Office of the Assistant Director awards are issued across directorates, these were excluded from analysis. After all removals, STPI was left with 70,650 awards.

Contribution of Multiple Directorates or Divisions to Co-funded Awards
In the dataset, each award was assigned to one directorate and one division. However, in many cases, awards were co-funded by multiple divisions or directorates, especially in the case of centers. For STPI's analysis, each award was classified based on the data provided by the NSF Budget Office – which assigns a single division the award as the primary management division.

Award Program Type Based on Program Solicitation Codes
STPI identified the program name and type for each award funded between 2007 and 2010 using the unit of consideration an award was submitted to as well as an award's program solicitation code. Awards funded through a program description were considered unsolicited for the purposes of this analysis.

Data Quality between Proposal and Award Datasets
STPI received data for 350,364 proposals from 2001 to 2011 for all NSF divisions. To ensure the correct proposal data were used, STPI eliminated all 2011 awards and only included proposals from divisions that met the standards described above. Similar to the awards dataset, 843 unique proposals listed either zero for the proposed duration or proposed total funding. These 2011 and proposals with zero duration or funding were removed from mid-scale funding rate analysis, resulting in a total pool of 309,676 proposals. All of the award numbers in the award dataset were found in the proposal dataset, providing a quality check to the data. Awards were matched with their respective proposal information to calculate mid-scale funding rates.

As a further check for data quality, STPI compared the original Budget Office data to the FY 2010 Merit Review Process Report to the NSB.[23] In general, funding rates between the Budget Office and Merit Review data typically differed by one percent. This comparison did not suggest substantial differences between the two datasets. Table 3 shows the difference between funding rates for Budget Data and Merit Review Report data by year.

[22] U.S. Office of Management and Budget, *Budget of the United States Government: Fiscal Year 2011*. Washington: U.S. Government Printing Office, 2010.
[23] http://www.nsf.gov/nsb/publications/2011/nsb1141.pdf.

Table 3: Proposal Data from NSF Budget Office vs. Merit Review Report of Research Awards

	Budget Data		Merit Review Data		Budget Data	Merit Review Data	
Year	**Proposed**	**Awarded**	**Proposed**	**Awarded**	**Funding Rate**	**Funding Rate**	**% Diff**
2003	30,136	7,416	28,676	6,846	24.6%	23.9%	–0.7%
2004	32,794	6,902	31,553	6,509	21.0%	20.6%	–0.4%
2005	31,506	6,530	31,574	6,258	20.7%	19.8%	–0.9%
2006	31,048	6,963	31,514	6,708	22.4%	21.3%	–1.1%
2007	32,849	7,459	33,705	7,415	22.7%	22.0%	–0.7%
2008	32,118	7,229	33,643	6,999	22.5%	20.8%	–1.7%
2009	30,648*	6,400*	35,609	10,011	—	—	—
2010	39,472	8,062	42,225	8,639	20.4%	20.5%	0.0%
2011	37,127	7,167	—	—	—	—	—
Total	**297,698**	**64,128**	**232,890**	**49,374**	**21.5%**	**21.2%**	**–0.3%**

Note: *Does not include ARRA proposals or awards; discrepancies between the Budget Office data and Merit Review Report data are due to different definitions of "research awards." The Merit Review Reports exclude SGER, EAGER, RAPID, SBIR and centers and facilities grants from the research award classification. In contrast, data provided for the mid-scale analysis include SGER, EAGER, RAPID, SBIR and centers and instrumentation, but exclude operations funding for Major Multi User Research Facilities. Collaborative awards for this analysis were considered as one award, while the Merit Review Report considers each collaborative award individually.

Approach to Calculating Mid-Scale Research Range

The following sections describe how the study team calculated the lower and upper bounds for mid-scale research. Note that the lower bound approach is applicable at the division level, while the upper bound approach is applicable at the directorate level. The lower bound was calculated by division given the diversity of funding strategies across divisions within a single directorate. The upper bound was calculated at the directorate level because it was based on funding for centers and several divisions do not have any centers awards.

Calculating Lower Bound of Mid-Scale Research Range

As part of this work, the STPI study team helped the MS Task Force identify an approach to quantifying mid-scale research. This section focuses on the lower bound, which is defined as awards with an amount "substantially higher than that which is typical for a single-PI research award."

The dataset contained three types of awards—standard grants, continuing grants, and cooperative agreements. Exploratory STPI data analysis revealed substantial differences in the funding amounts between cooperative agreements and the standard and continuing grants for all awards, as well as single-PI awards. For example, the difference in median annual funding between single-PI cooperative agreements and single-PI standard and continuing awards was roughly $2.2M. It was decided that these awards were not in the spirit of most single-PI research and should be disregarded when making lower-bound calculations. In total, STPI removed 96 single-PI cooperative agreements from mid-scale lower-bound calculations.

No initial agreed upon definition was given for what constitutes "substantially higher that individual PI award." A variety of approaches to calculating this quantity were explored, and

ultimately a logarithm approach[24] was selected. Therefore, values derived from the logarithm approach were used as the lower bound cutoffs for each division.

Using the multiplying factor of two standard deviations implies that STPI considered anything in the upper 2.3 percent of the single-PI distribution to be an outlier and, thereby, mid-scale or large-scale. The magnitude of the standard deviation multiplier is directly correlated to the percentage of awards that that are identified to be "substantially higher." For instance, a multiplying factor of three standard deviations would imply that STPI consider anything in the upper 0.1 percent of the data to be substantially higher.

Calculating Upper Bound of Mid-Scale Research Range

The MS Task Force defined the upper bound of the mid-scale range as those awards that are less than a typical "center grant" in a given field. Thus, it was first necessary to classify all possible centers in our dataset. The study team identified center awards by looking up centers listed in NSF budget requests to Congress and annual appropriations for the fiscal years 2001 through 2010.[25] STPI then matched center names listed in the NSF budgets by title to awards listed in the dataset. In total, STPI identified 275 center awards in fourteen programs across eight of the NSF directorates.[26]

To determine the upper bound, the study team explored ways to quantify a "typical" center grant. Ultimately, the study team calculated the mid-scale upper bound for each directorate based on the median annual funding of all the centers identified in each directorate. Because the MS Task Force defined the upper bound as an attribute of the directorate, and several divisions did not have centers associated with them, STPI used the median center annual funding per directorate for the mid-scale analysis.

Feedback on Methodology from NSF Directorates

The STPI study team met with a point of contact for each directorate and several offices to discuss the approach for calculating a mid-scale range and the results of the analysis. The suggestions of the directorates were incorporated into the final analysis shown in Tables 1 and 2 and Figure.

[24] The logarithm approach involves taking the natural logarithm of the data, calculating the mean plus two times the standard deviation of that distribution, and exponentiating that value using base *e*. The rationale is that the data for each division tend to follow a log-normal distribution, This transformation provides a coherent method for identifying the outliers.

[25] The NSF centers are listed in the "NSF-Wide Investments" section of each fiscal year's budget request. *See* U.S. National Science Foundation (NSF), "NSF Budget Requests to Congress and Annual Appropriations," last modified August 5, 2011, http://nsf.gov/about/budget.

[26] Industry/University Cooperative Research Centers and the Long-Term Ecological Research network were removed as centers based on discussions with the directorates. In addition, smaller ITR grants were removed from the CISE upper bound calculation.

APPENDIX C: TASK FORCE ON UNSOLICITED MID-SCALE RESEARCH DISCUSSION GROUPS AND WORKSHOP

DISCUSSION GROUPS

Small Group Discussion 1: Purpose, Guiding Questions, and Participants
Materials as distributed to participants on January 6, 2011

Date and Location: January 6, 2011; National Science Foundation, Arlington, VA

Purpose: The primary goal of the National Science Board Task Force on Unsolicited Mid-Scale Research is to determine whether NSF is effectively supporting unsolicited mid scale research. Related to this central question is whether there are potentially transformative projects that investigators have not proposed to NSF because they do not fit in the current mid scale administrative or scientific structure, or because of the perception that NSF would not fund these projects for other reasons. Moreover, are there high quality ground-breaking research projects that are submitted to core programs but cannot be supported because of budgetary constraints and interest in the rightful goal of supporting as many investigators as possible?

The goal of this discussion group is to gain insights into these and other related questions (see thought questions below). The MS Task Force would like to hear the thoughts of the participants from both the perspective of a university administrator and as NSF staff. Based on this discussion, the MS Task Force expects to (1) gain a better understanding of the issues and questions surrounding unsolicited mid scale research, and (2) gain insight into how best to address these issues moving forward.

Thought Questions

1. Do the scientific and structural requirements of NSF programs and solicitations encourage researchers, hinder them, or have no affect on developing and proposing unsolicited mid-scale research projects?
2. Do you think an unsolicited, mid-scale research project would be more likely, less likely, or equally likely to be successfully funded compared to a proposal written in response to an NSF solicitation and designed to meet specific scientific and structural requirements?
3. Are there unsolicited mid-scale research projects that you know some researcher(s) would like submit to NSF but have not or will not? If so, why not?
4. Has your perspective changed in transition from university administrator to NSF staff in relation to MS Task Force policy objectives (e.g., with balance of prescription and flexibility in current NSF structures for supporting unsolicited mid-scale research)? If so, how?
5. How would you suggest support of unsolicited mid-scale research be structured?
6. As part of this project, the MS Task Force plans to hold two additional "discussion groups" with external participants (e.g., research innovators identified by vice presidents for research (VPRs) as well as by NSF). Following these discussion groups, the MS Task Force will hold a workshop with both internal and external stake-holders. Do you have any recommendations on how the MS Task Force could improve these activities to ensure they are successful?

Participants[27]

National Science Board Members

Diane L. Souvaine, Chairman, Task Force on Unsolicited Mid-Scale Research
Kelvin K. Droegemeier,[28] Member, Task Force on Unsolicited Mid-Scale Research

Invited National Science Foundation Staff

David Conover, Division Director, Division of Ocean Sciences, Directorate for Geological Sciences
Robert Detrick, Division Director, Division of Earth Sciences, Directorate for Geological Sciences
Myron Gutmann, Assistant Director, Directorate for Social, Behavioral and Economic Sciences
Steve Howell, Division Director, Division of Molecular and Cellular Biosciences, Directorate for Biological Sciences
Caesar Jackson, Program Officer, Division of Human Resource Development, Directorate for Education and Human Resources
Demetrios Kazakos, Program Officer, Division of Human Resource Development, Directorate for Education and Human Resources
Pamela O'Neil, Senior Advisor, Office of Integrated Activities, Office of the Director
Thomas Peterson, Assistant Director, Directorate for Engineering
Matthew Platz, Division Director, Division of Chemistry, Directorate for Mathematical and Physical Sciences
Richard Smith, Program Officer, Division of Human Resource Development, Directorate for Education and Human Resources
Howard Wactlar, Division Director, Division of Information and Intelligent Systems, Directorate for Computer and Information Science and Engineering

Small Group Discussion 2: Purpose, Guiding Questions, and Participants
Materials as distributed to participants on February 25, 2011

Date and Location: February 25, 2011; National Science Foundation, Arlington, VA

Purpose: The primary goal of the MS Task Force is to determine whether NSF is effectively supporting unsolicited mid-scale research. Related to this central question is whether there are potentially transformative projects that investigators have not proposed (or have substantially altered) because they do not fit within NSF's current mid-scale administrative or scientific structure, or because of the perception that NSF would not fund these projects for other reasons. If so, how has this affected scientific progress in your discipline?

The goal of this discussion group is to gain insights into these and other related questions (see thought questions below). Based on this discussion, the MS Task Force expects to (1) gain a better understanding of the issues and questions surrounding unsolicited mid-scale research, and (2) gain insight into how best to address these issues moving forward.

[27] Affiliations as of date of meeting
[28] Dr. Kelvin K. Droegemeier was appointed co-chairman of the MS Task Force after his nomination to be a member of the National Science Board was confirmed by the U.S. Senate on April 14, 2011.

Thought Questions

1. ***Scientific Requirements***: What effect do the scientific requirements of NSF solicitations have on developing and proposing unsolicited mid-scale research projects?
2. ***Structure/Programmatic Requirements***: What effects do the structural/programmatic requirements (e.g., administrative, broadening participation) of NSF solicitations have on developing and proposing unsolicited mid-scale research projects?
3. ***Perception & Likelihood of Funding***: What is your perception of NSF's attitude towards an unsolicited mid-scale proposal compared to a proposal written in response to an NSF solicitation and designed to meet specific scientific and structural requirements?
4. ***Your Mid-Scale Research Ideas***: Are there unsolicited mid-scale research projects that you know some researcher(s) would like submit to NSF but have not or will not? If so, why not? Similarly, have you substantially modified your proposal to better align with your perception of what NSF is likely to fund? How does this affect the science, if at all?
5. ***Your Suggestions I***: Do you have any suggestions on how NSF could support mid-scale research more effectively? For instance: Does a "centers" model meet your needs? Would a "frontiers" model be a better fit (e.g., EFRI,[29] FESD[30])?
6. ***Your suggestions II***: As part of this project, the MS Task Force plans to hold an additional "discussion group" with mid-scale researchers. Following this discussion group, the MS Task Force will hold a workshop with both internal and external stake-holders. The MS Task Force is also planning to administer an online survey. Do you have any recommendations on how the MS Task Force could improve these activities to ensure they are successful?

Participants[27]

National Science Board Members

Diane L. Souvaine, Chairman, Task Force on Unsolicited Mid-Scale Research
José-Marie Griffiths, Member, Task Force on Unsolicited Mid-Scale Research

Invited Researchers

Steven Boker, Professor of Quantitative Psychology, University of Virginia
Karen Burg, Professor of Bioengineering; Professor of Electrical and Computer Engineering, Clemson University
Sandra Calvert, Professor of Psychology, Georgetown University
Douglas Doren, Affiliated Professor and Associate Dean of Physics of Astronomy, University of Delaware
Glenda Gillaspy, Associate Professor of Biochemistry, Virginia Polytechnic Institute
Yury Gogotsi, Professor of Materials Science and Engineering, Drexel University
Anthony Johnson, Professor of Physics, Professor of Computer Science and Electrical Engineering, University of Maryland, Baltimore County
Jerzy Leszczynski, Professor of Chemistry, Jackson State University
Dimitris Metaxas, Professor of Computer Science and Biomedical Engineering, Rutgers, The State University of New Jersey
Margaret Palmer, Professor of Entomology, University of Maryland

[29] Emerging Frontiers in Research and Innovation (EFRI): http://www.nsf.gov/div/index.jsp?div=EFRI
[30] Frontiers in Earth System Dynamics (FESD): http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=503525&org=GEO&sel_org=GEO&from=fund

Julio Ramirez, Professor of Civil Engineering, Purdue University
Russell Taylor, Professor of Computer Science, The Johns Hopkins University
Prasad Tetali, Professor of Mathematics and Computer Science, Georgia Institute of Technology
Maya Tolstoy, Associate Professor of Earth and Environmental Sciences, Columbia University

Small Group Discussion 3: Purpose, Guiding Questions, and Participants
Materials as distributed to participants on March 31, 2011

Date and Location: March 31, 2011; Denver, CO

Purpose: The primary goal of the MS Task Force is to determine whether NSF is effectively supporting unsolicited mid-scale research. Related to this central question is whether there are potentially transformative projects that investigators have not proposed (or have substantially altered) because they do not fit within NSF's current mid-scale administrative or scientific structure, or because of the perception that NSF would not fund these projects for other reasons. If so, how has this affected scientific progress in your discipline?

The goal of this discussion group is to gain insights into these and other related questions (see thought questions below). Based on this discussion, the MS Task Force expects to (1) gain a better understanding of the issues and questions surrounding unsolicited mid-scale research, and (2) gain insight into how best to address these issues moving forward.

Thought Questions

1. ***Scientific Requirements***: What effect do the scientific requirements of NSF solicitations have on developing and proposing unsolicited mid-scale research projects?
2. ***Structure/Programmatic Requirements***: What effects do the structural/programmatic requirements (e.g., administrative, broadening participation) of NSF solicitations have on developing and proposing unsolicited mid-scale research projects?
3. ***Perception & Likelihood of Funding***: What is your perception of NSF's attitude towards an unsolicited mid-scale proposal compared to a proposal written in response to an NSF solicitation and designed to meet specific scientific and structural requirements?
4. ***Your Mid-Scale Research Ideas***: Are there unsolicited mid-scale research projects that you know some researcher(s) would like submit to NSF but have not or will not? If so, why not? Similarly, have you substantially modified your proposal to better align with your perception of what NSF is likely to fund? How does this affect the science, if at all?
5. ***Your Suggestions I***: Do you have any suggestions on how NSF could support mid-scale research more effectively? For instance: Does a "centers" model meet your needs? Would a "frontiers" model be a better fit (e.g., EFRI, FESD)?
6. ***Your suggestions II***: As part of this project, the MS Task Force plans to hold an additional "discussion group" with mid-scale researchers. Following this discussion group, the MS Task Force will hold a workshop with both internal and external stake-holders. The MS Task Force is also planning to administer an online survey. Do you have any recommendations on how the MS Task Force could improve these activities to ensure they are successful?

Participants

National Science Board Members

Diane L. Souvaine, Chairman, Task Force on Unsolicited Mid-Scale Research
Kelvin K. Droegemeier, Member, Task Force on Unsolicited Mid-Scale Research

Invited Researchers

Patricia Conrad, Professor of Pathology, Microbiology and Immunology, University of California Davis
Julie Dickerson, Associate Professor of Electrical and Computer Engineering, Iowa State University
Joan Fujimura, Scholar, Russell Sage Foundation
Ann Gates, Professor of Computer Science and Associate Vice President for Research, University of Texas at El Paso
Lou Gross, Professor of Ecology and Evolutionary Biology and Mathematics, University of Tennessee
Gwen Jacobs, Professor of Systems Neuroscience, Informatics and Information Technology, Montana State University
Chenyang Lu, Professor of Computer Science and Engineering, Washington University in St. Louis
Massoud Motamedi, Center for Biomedical Engineering, University of Texas Medical Branch
Clark Miller, Associate Professor, School of Politics and Global Studies, Arizona State University
Thomas "Zack" Powell, Professor of Integrative Biology, Professor, University of California, Berkeley
Mike Tomz, Professor of Political Science, Stanford University
Mark Williams, Professor, Department of Geography, University of Colorado, Boulder
May Yuan, Professor of Geoinformatics, University of Oklahoma
Cynthia Zoski, Professor of Chemistry and Biochemistry, New Mexico State University

WORKSHOP ON MID-SCALE RESEARCH

Date and Location: June 5-7, 2011; National Science Foundation, Arlington, VA

Participants

National Science Board Members

Mark R. Abbott, chairman, Committee on Programs and Plans
Camilla P. Benbow, Member, MS Task Force
Ray Bowen, Chairman, National Science Board
Kelvin K. Droegemeier, MS Task Force co-chairman
José-Marie Griffiths, Member, MS Task Force
Douglas D. Randall, Member, Committee on Programs and Plans
Diane L. Souvaine, MS Task Force co-chairman

Michael Van Woert, Executive Officer, National Science Board; Director, National Science Board Office

National Science Foundation Staff

Machi Dilworth, Director, Office of International Science and Engineering
Karl Erb, Director, Office of Polar Programs
Joan Ferrini-Mundy, Assistant Director, Directorate for Education and Human Resources
Myron Gutmann, Assistant Director, Directorate for Social, Behavior, and Economic Sciences
Farnam Jahanian, Assistant Director, Directorate for Computer and Information Science and Engineering
Chuck Liarakos, Senior Science Advisor, Office of the Assistant Director, Directorate for Biological Sciences
Tom Peterson, Assistant Director, Directorate for Engineering, Member, MS Task Force
Ed Seidel, Assistant Director, Directorate for Mathematical and Physical Sciences

**Numerous NSF program officers and several NSF division directors participated in the workshop breakout sessions*

Research Community

Douglas Arnold, McKnight Presidential Professor of Mathematics, University of Minnesota
Robert Axtell, Department Chair, Computational Social Science, George Mason University
William "Breck" Bowden, Patrick Professor of Watershed Science and Planning, University of Vermont
Richard Buckius, Vice President for Research, Professor of Mechanical Engineering, Purdue University
Sandra Calvert, Professor of Psychology, Georgetown University
Deborah Crawford, Vice Provost for Research, Drexel University
Greg Farber, Director, Office of Technology Development and Coordination, U.S. National Institutes of Health
Alison Flatau, Associate Dean of Research and Professor of Aerospace Engineering, University of Maryland, College Park
John Horack, Vice President for Research, University of Alabama, Huntsville, Vice President for Research and Sponsored Programs, Director, Center for Advanced Materials, Tuskegee University
Anthony Johnson, Professor of Physics and Computer Science and Electrical Engineering, University of Maryland, Baltimore County
Miguel José-Yacaman, Department Chair and Professor of Astronomy and Physics, University of Texas, San Antonio
Susan Larson, Professor of Anatomical Sciences, Stony Brook University
Carolyn Maher, Professor of Mathematics Education; Director, Robert B. Davis Institute for Learning, Rutgers University
Robert Nerem, Parker H. Petit Distinguished Chair for Engineering in Medicine and Institute Professor; Director, Parker H. Petit Institute for Bioengineering and Bioscience, Georgia Tech Institute of Technology
Thomas "Zack" Powell, Professor of Integrative Biology, Professor, University of California, Berkeley
Beth Pruitt, Professor of Mechanical Engineering, Stanford University
Mike Reiter, Lawrence M. Slifkin Distinguished Professor, Department of Computer Science, University of North Carolina, Chapel Hill

Rick Spinrad, Vice President for Research, Oregon State University
Robin Staffin, Director for Basic Research, U.S. Department of Defense
Leslie Tolbert, Vice President for Research, University of Arizona
Barry Trimmer, Henry Bromfield Pearson Professor of Natural Sciences; Director, Tufts Biomimetic Devices Laboratory, Tufts University
David Waldeck, Professor and Chair, Department of Chemistry, University of Pittsburgh
Mark Williams, Professor, Department of Geography, University of Colorado, Boulder

NATIONAL SCIENCE BOARD
TASK FORCE ON UNSOLICITED MID-SCALE RESEARCH

JUNE 5-7, 2011

FINAL WORKSHOP AGENDA

Sunday, June 5

6:00 – 8:30 p.m. **Welcome Discussion & Dinner**

Venue: The Front Page (NSF Atrium)
4201 Wilson Blvd, Arlington, VA 22230
Click for Map

Dinner available for purchase (optional, see menu below)

Tentative Schedule

6:00 p.m. – 6:15 p.m.	Informal reception
6:20 p.m.	Dinner orders placed
6:25 p.m.	Welcome remarks
6:35 p.m. – 8:20 p.m.	Presentations and discussion
8:20 p.m.	Wrap up

Introductions: **Drs. Diane Souvaine and Kelvin Droegemeier**, Co-Chairs, National Science Board (Board) Task Force on Unsolicited Mid-Scale Research (MS Task Force)

Speakers (15 minutes each)

Dr. Susan Larson, Stony Brook University
Dr. Barry Trimmer, Tufts University
Dr. Rich Behnke, National Science Foundation, Directorate for Geosciences

Guiding Questions

- What is/has been the impact of mid-scale research in your field?
- What are the advances that would not have been possible without mid-scale level funding?
- How did you secure funding for your mid-scale research project?

Monday, June 6
National Science Foundation, Room 1235
Open to the Public

8:00 a.m. **Welcome**

Dr. Ray Bowen, Chairman, National Science Board

Dr. Mark Abbott, Chairman, Committee on Programs and Plans, Member *ex officio* MS Task Force

Drs. Diane Souvaine and Kelvin Droegemeier, Co-Chairs, National Science Board MS Task Force

8:15 **Workshop Process and Participant Introductions**

8:30 – 10:30 **Session I: What do we know about unsolicited mid-scale research at NSF? Summary from data gathering activities**

Moderators: **Dr. Diane Souvaine**
Dr. Camilla Benbow, Member, MS Task Force and Member, National Science Board

Critical Topics

1. *Overview of the project*

   The Task Force will explain the relevant definitions, policy objectives, and final product for the project.

   Lead Discussant: **Dr. Kelvin Droegemeier**

2. *Summary of investigatory work*

   The Task Force held three small discussion group meetings from January to March, 2011. The first discussion group was composed of NSF staff, and the second two included members of the research community. The Task Force will summarize the findings from the three discussion groups. An analyst from the Science and Technology Policy Institute (STPI) also will present a ***preliminary*** summary of an analysis of NSF's awards database as it relates to solicited and unsolicited mid-scale research at NSF.

   Lead Discussant: **Dr. Diane Souvaine**
   Discussants: **Dr. Asha Balakrishnan**, STPI

3. *Past and current NSF mid-scale opportunities/structures*

   Lead Discussants: **Dr. Tom Peterson**, Assistant Director, Directorate for Engineering
   Dr. Farnam Jahanian, Assistant Director, Directorate for Computer and Information Science and Engineering

Guiding Questions for NSF Assistant Directors (ADs)/Office Directors

- What are the current opportunities for mid-scale research—particularly unsolicited mid-scale research—within your directorate/office?
- What are the challenges you have experienced?
- What are the success stories?
- How/why did you develop these current mid-scale opportunities?
- What are the lessons you have learned?

10:30 – 10:45 **Break**

10:45 – 1:45 **Session II: What are the main obstacles for unsolicited mid-scale research at NSF?**

Moderators: **Dr. Kelvin Droegemeier**
Dr. Mark Abbott, Board Member, Member *ex officio* Task Force on Unsolicited Mid-Scale Research

Critical Topics

1. *What are the main obstacles from the perspective of NSF?*

   - Budget obstacles, such as maintaining portfolio balance with a constrained budget (small awards vs. mid-scale awards)
   - Directorate specific obstacles
   - Barriers to engaging the research community
   - Stove-piped structure of NSF
   - Conservative mind-set of panelists/reviewers
   - Others?

   Lead Discussants: **NSF ADs/Office Directors**

2. *What are the main obstacles from the perspective of the research community?*

   - Finding a "home" at NSF for an unsolicited mid-scale project
   - The panel review process for unsolicited mid-scale research proposals
   - The scientific and/or administrative requirements of existing mid-scale research mechanisms
   - Barriers to engaging NSF and university administration
   - Others?

   Lead Discussants: **Vice Presidents for Research**

12:30 **Continuation of Session II over Lunch**

Lunch is available for purchase for invited guests only, including Assistant Directors and Office Directors. However, NSF program directors, other NSF staff, and members of the public are welcome to attend the lunch discussion.

1:45 – 3:30 **Session III: What scientific progress can be achieved only through unsolicited and topically broad solicited mid-scale research opportunities?**

Moderator: **Dr. José-Marie Griffiths**, Member, MS Task Force and Member, National Science Board

Guiding Questions

- What are scientific advances that have been or only could be achieved in the future through mid-scale research?
- How has mid-scale impacted various research communities?
- How has mid-scale research impacted research universities?
- Are unsolicited mid-scale research opportunities an effective mechanism to promote transformative research?
- What are the lessons from other Federal agencies regarding mid-scale research?

Lead Discussants: **All**
Dr. Greg Farber, U.S. National Institutes of Health
Dr. Robin Staffin, U.S. Department of Defense

3:30 – 3:45 **Break**

3:45 – 5:30 **Session IV: Potential solutions for overcoming the obstacles: Setting the stage for the Tuesday breakout sessions**

Moderators: **Dr. Diane Souvaine**
Dr. Kelvin Droegemeier

Guiding Questions

- In light of the previously discussed obstacles, how can NSF more effectively support unsolicited mid-scale research in the near-term, mid-term, and long-term?
- How do other Federal agencies address mid-scale research?
- What are the topics for the Tuesday breakout sessions?

Lead Discussants: **All**
Dr. Greg Farber
Dr. Robin Staffin

5:30 **Wrap-Up**

5:45 **Adjourn for the Day**

Tuesday, June 7
National Science Foundation, Room 1235

8:00 a.m. **Welcome to Day 2**

Drs. Diane Souvaine and **Kelvin Droegemeier**, Co-Chairs, MS Task Force

8:10 **Instructions for Breakout Sessions**

8:30 **Depart for Breakout Rooms**
Rooms to be announced

8:45 – 10:30 **Breakout Sessions** *(closed to the public)*

Description: The six small group breakout sessions will comprise Task Force members, invited participants, NSF ADs/Deputy ADs, and invited NSF program officers. This will allow for an in depth discussion of a range of possible solutions as identified on Monday, June 6. *Room assignments for the breakout session participants will be determined in advance and announced on Tuesday.*

Each breakout group will have a primary topic that they are responsible to report on to the full group following the session. Each group should discuss the other questions if time permits. There will be 3-4 topics total, which will be determined by the group during Session IV on Monday. Each of these topics will be a primary topic for at least two groups (i.e., two groups will focus on topic A, two groups on topic B, and so on…). A Task Force/Board member will moderate each breakout group. *Each group should designate a leader who will be responsible for the report-out to the full group.* Contractor and/or Board Office support will be available in each breakout room.

For assistance, please contact the Board Office (x7000).

Topic A: TBD on Monday
Topic B: TBD on Monday
Topic C: TBD on Monday

10:30 – 11:00 **Preparation of Breakout Session Reports** (Break for all others)

Each report to the full group should last no longer than 7 minutes.

11:00 – 12:30 **Reconvene in Room 1235: Group Discussion of Breakout Sessions**
(The full group discussion is open to the public)

12:30 **Wrap-Up & Next Steps for the Task Force**

12:45 **Adjourn**

APPENDIX D: CHARGE TO THE NSB COMMITTEE ON PROGRAMS AND PLANS TASK FORCE ON UNSOLICITED MID-SCALE RESEARCH

NSB-10-59
August 26, 2010[31]

Charge to the Task Force on Unsolicited Mid-Scale Research

Statutory Basis
"The Board shall render to the President and the Congress reports on specific, individual policy matters within the authority of the Foundation (or otherwise as requested by the Congress or the President) related to science and engineering and education in science and engineering, as the Board, the President, or the Congress determines the need for such reports."[32]

Action Recommended
The National Science Board (Board) Task Force on Unsolicited Mid-Scale[33] Research (MS) will be created under the Committee on Programs and Plans (CPP). The Task Force is charged with examining and making recommendations regarding National Science Foundation (NSF) support of unsolicited MS research. This type of research often requires funding that is not obtainable via proposals submitted in response to specific solicitations or that potentially reside within the scope of specific programs.

Background
NSF utilizes a variety of mechanisms to fund research projects across a wide spectrum of topics and size (e.g., standard and continuing grants, cooperative agreements, centers, programs linking industry and academia, and Major Research Equipment and Facilities Construction (MREFC) projects). The Agency's supported projects range from single investigator grants to multi-institutional (and sometimes multi-national), long-term projects.

NSF funds projects in response to unsolicited and solicited proposals. Unsolicited proposals are submitted to core programs in their specific research areas. Solicited proposals are submitted in response to specific requests from the agency to fund specific topics of inquiry and types of projects.

Many directorates have programs that actively solicit and support mid-scale research projects. These programs often set structural and/or topical requirements for proposed projects. Currently, the question exists as to whether there are any gaps in both the opportunity to submit proposals in support of, and the availability of funding to support, unsolicited mid-scale projects that do not fall under the purview of a particular program. There may be a need to ensure that proposers in the research community have the ability to submit a proposal without procedural constraints in structural framework, topic of inquiry, and research methodology.

The definition of a 'mid-scale' budget varies among NSF directorates due to differences in each directorate's average award size. For the purposes of this Task Force, mid-scale research projects

[31] Revised December 13, 2011
[32] Title 42 U.S. Code Section 1863(j)(2)
[33] Here, mid-scale refers to the financial size of the project.

are defined broadly as those with an average annual budget ranging from between an amount that is substantially higher than that which is typical for a single-PI research project and an amount that is typical for a center in that field.[34]

Policy Objectives

The following issues will be analyzed by the Task Force:

- Examine the effectiveness of previous and current mechanisms at NSF for accommodating unsolicited mid-scale research.
- Examine the balance of prescription and flexibility in current structures for supporting mid-scale research.
- Evaluate the appropriateness of reporting requirements for current mid-scale research activities and the extent to which uniformity now exists, or should exist, in the information being provided.
- Determine whether requirements for education, outreach, broadening participation, and other related activities are appropriately integrated into current mid-scale research activities.

The Task Force will seek to compile data and information on past and current practices at NSF in supporting mid-scale research, and perspectives from NSF staff and the research community. Based upon the work of this Task Force, the Board will provide guidance to NSF on the necessity of action to modify NSF's support structures for unsolicited mid-scale research, and potential means to achieve such actions.

Product

The outcome of this project will be a report or set of recommendations for internal NSF distribution. These recommendations will be accompanied by an implementation plan from NSF management. The report or set of recommendations will be made available on the Board website for all interested parties.

Logistics

A variety of methods will be used by the Task Force to gather relevant information: briefings from NSF staff, review of the current NSF research portfolio, review of techniques for supporting unsolicited mid-scale research at NSF and possibly across other Federal Government agencies, a possible survey of the research community, and a workshop to gather stakeholder perspectives. The stakeholders involved in this workshop will include individuals from NSF directorates, Advisory Committees, and NSF PIs.

The review of the current NSF practices in supporting mid-scale research activities will include an analysis of requirements in NSF's current mid-scale programs (e.g., centers programs), and in other Federal agencies' solicitations for centers-type programs.

A regular and proactive outreach effort to communicate task force activities will be implemented throughout the duration of the task force life. The task force expects to conclude its activities by May 2012. The Board Office will serve as the focal point for coordination and implementation of all task force activities.

[34] The definition of "mid-scale" represents an operational "ballpark" estimate for the Task Force, and is not meant to indicate a rigid threshold.

Recommended Citation:

National Science Board. 2012. *The National Science Foundation Support of Unsolicited Mid-Scale Research.* Arlington VA: National Science Foundation (NSB-12-22).

Obtaining the Board Report:

The report is available electronically at: http://www.nsf.gov/nsb/publications/2012/nsb1222/
For special orders or additional information, contact the National Science Board Office: NationalScienceBrd@nsf.gov or 703-292-7000

NSB-12-22