Audit of NSF's Policies on Public Access to the Results of NSF-Funded Research

**National Science Foundation
Office of Inspector General**

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OIG 06-2-004

Introduction

In early 2005, we began an audit to determine whether NSF provides the scientific community and the public with direct access to information resulting from the research it funds, and how NSF could improve its dissemination policies and practices. As we continue our work to examine whether more public dissemination is warranted, we have identified steps the agency can take in the near-term to improve its dissemination practices by providing the public with access to citations of publications that result from NSF-funded research.

Background

Communicating the results of scientific research is key to furthering science and ensuring accountability for federal research dollars. A fundamental principle followed by NSF and other federal agencies funding basic research is that the knowledge gained from the research should be widely disseminated in order to validate the results and help guide future research.   Communicating the results of the research funded with federal dollars advances the bodies of knowledge; fuels other research ideas; and helps train future scientists, engineers, and educators. Documenting and disseminating the findings and results of federally funded research also provides assurance to taxpayers that they have received value for their investments in research programs and can help increase the public's understanding and appreciation of science and technology.

As the primary federal agency funding the nation's science and engineering basic research enterprise, it is important that NSF ensure that the results of these investments are made available to both the scientific community and the general public.

Research Information Collected by NSF

Through proposals and project reports, NSF collects a wealth of information about the proposed research it will fund and the findings and results of these individual research projects. It maintains various databases with this information, yet it makes only its database of award abstracts of proposed research available to the research community and the public through its website. NSF does not make available to the research community or the public the extensive amount of information it collects from final project reports, including the large number of citations of publications resulting from the research.

We estimate, based upon a statistical sample of final project reports due to NSF in calendar year 2003,[1] that principal investigators provided NSF with over

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[1] We analyzed a statistical sample of the approximately 8,900 final project reports due to NSF in calendar year 2003. For more information on our methodology, please see Appendix B.

40,000 publication citations; 16,000 one-time publication citations (such as books, conference proceedings, or dissertations); and links to over 3,500 websites in their final project reports. On average, each of these reports contained information on 4.5 publication citations. With NSF's electronic database of final project reports currently containing approximately 58,500 reports going back to 1995, NSF has information on over 230,000 citations.[2] However, other than selected highlights and discoveries featured on NSF's website or in various agency reports or publications, NSF does not provide the public with any access to this information about the publication citations or research results contained in the reports. Instead, NSF relies on the researchers themselves to disseminate the results by publishing their findings in peer-reviewed journals and other publications, and by sharing information through other means such as conferences.

Comparison with Other Federal Agencies Funding Extramural Research

NSF's policy of not making research citations available to the public is inconsistent with other federal research agencies. We interviewed personnel from five other federal agencies[3] that fund extramural basic science and engineering research to determine what types of project information they maintain, and how and to whom they disseminate that information. Like NSF, all five agencies encourage the researchers they fund to publish their results in scientific journals. These agencies, like NSF, collect citations of the scientific journal articles resulting from the funded research.

However, unlike NSF, all five agencies make these citations available directly to the public (Table 1). These citations can either be searched through a database of citations maintained by the agency, as done by NASA, DoD/ONR, DOE, and NIH, or searched through final technical reports made available on-line, as done by USDA/CSREES. NASA, NIH, and DoD/ONR go a step further by providing free access to the full-text version of some journal articles through their websites.

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[2] Our results, based on final project reports, may undercount the actual number of publications resulting from NSF-funded research for two reasons. First, principal investigators may have provided publication citations in annual project reports that were not included in the final project report. Second, principal investigators may have had articles accepted for publication after they submitted their final project reports. For more information on our analysis of publication citations and final project reports, see Appendix C.

[3] The five federal science agencies we contacted were the National Aeronautics and Space Administration (NASA), the Department of Health and Human Services' National Institutes of Health (NIH), the Department of Defense's Office of Naval Research (DoD/ONR), the Department of Energy (DOE), and the Cooperative State Research, Education, and Extension Service at the Department of Agriculture (USDA/CSREES). In addition to funding intramural research conducted by their own federal employees, these five agencies, like NSF, support extramural basic research conducted by principal investigators at colleges, universities, and other research institutions.

Table 1: Extramural Research Results Available Publicly Via Agency Website Searches

	Information on Results Made Available to the Public					
Agency	Abstracts of Awarded Proposals	Journal Citations	Text of Journal Articles	Final Technical Reports	Full Conference Proceedings and/or References	Patent Information
NASA		X	X[a]	X	X	X
DOE	X	X		X	X	X
USDA/CSREES	X	X		X	X	X
DoD/ONR		X[b]	X	X	X	
NIH	X	X	X			
NSF	X					

[a]Copies of articles are available if they are preprints of articles written by NASA personnel or if NASA obtains copyright permission from the publishers for the full text.
[b]Citations are only available if the full text of the article is available. This occurs in cases where the articles are authored by DoD employees or where the award terms give the government unlimited data rights or the author has received publisher permission to post the article.

Thus, while the federal agencies we reviewed, including NSF, collect similar information on the findings and results of their funded research, the other federal science agencies have done much more than NSF to share this information with the taxpayers who provided that funding.

Public Demand for Information on Findings and Results

A demand for information about the results of federally funded research appears to exist. For example, the websites of the other federal science agencies, which include publication citations, experience a high volume of use by the public. During fiscal year 2005, the DOE website with results information had approximately 38 million user transactions, and the Defense Technical Information Center's public site, which includes the results of research funded by DoD/ONR, received over 20.3 million hits. NIH's PubMed site, which contains only publication citations, receives approximately 2.1 million search requests *per day*.

Additionally, anecdotal evidence suggests that there is a demand for NSF to provide similar information. For example, staff within NSF stated that they receive requests for information about the outcomes of specific research projects from scientists and the general public. NSF's Division of Undergraduate Education, for example, established the Project Information Resource System to handle these types of requests and provide the information on funded research to interested educators. While there are no readily available statistics on the extent to which this database is accessed, according to the program officer, anecdotal information suggests this information provides a valuable service to the education community.

Finally, in the course of our audit work, we interviewed 24 current and former NSF officials and staff, as well as members of the National Science Board. Over half of these individuals suggested NSF could do more to disseminate the results of the research it funds, with some recommending providing publication citations directly to the public through its website.

NSF, however, does not know the extent of the demand for project information from its website. The agency tracks "hits" on the public website, yet at the time of our audit, no one within the agency consistently tracked the access or use of the awards abstract database, which is NSF's primary means of providing the public with information on individual projects. Nevertheless, given the extensive use of other federal agencies' websites and anecdotal information from agency staff, it seems likely that NSF's website incurs similar demand.

What Should Be Done

We are continuing audit work to assess the demand for and feasibility of NSF implementing additional practices to disseminate the findings and results of the research it funds. Nevertheless, in the interim, NSF has an opportunity to quickly, and at a reasonable cost, provide much more information on research results directly to the public. By adding or otherwise linking the listing of citations submitted by principal investigators in their final project reports to the award abstracts already available on NSF's public website, NSF can quickly and easily share with fellow researchers and the public the knowledge and outcomes of NSF's investment in basic research. An interested party, after searching the awards abstract dataset on NSF's website, would be able to obtain a summary of the proposed research along with the citations of documents resulting from that work. (See Appendix D for flow chart.) With this information in hand, the user could search for the referenced sources to obtain the actual published articles or documents.

Combining award abstracts and publication citations would benefit scientists and the general public. By using its existing informational resources and infrastructure, NSF would assist principal investigators in sharing the results of their research, in accordance with the agency's current dissemination policy. In addition, such information would provide the public with a record of some of the products resulting from each of the research projects the agency funds.

Additionally, these benefits can be derived at a reasonable cost to the agency. NSF staff indicates that linking the award abstracts database to publication citations would require a minimal investment in infrastructural change. No additional personnel resources would be needed to review the documents because NSF program officers already prepare the award abstracts, principal investigators already provide the citations data, and program officers already review and approve the final project reports.

<u>Recent Developments</u>

Providing publication citations with the currently available award abstracts would be a useful dissemination practice for NSF. However, the ability to provide this information is dependent on having both sets of data available. Current activities, both internal and external to NSF, could negatively impact NSF's ability to make publication citations available to the public.

First, NSF is currently undertaking a review of the information collected in final project reports to determine ways to reduce the time it takes principal investigators to complete these reports. Based on surveys of principal investigators regarding filing *annual* project reports, NSF estimates that it currently takes principal investigators about 17 hours to complete an annual project report. While 89 percent of the principal investigators surveyed stated that the time required to prepare an annual project report was reasonable, some principal investigators indicated concerns about the information collected and the reporting format, including the current format used for entering publication citations. Based upon these comments about annual project reports, NSF staff is now in the process of developing recommendations to NSF management to streamline the format of final project reports. They have indicated to this office that these recommendations could include eliminating the system of entering citation data into individual data fields or eliminating entirely the requirement to provide NSF with publication citations.

Second, the National Science and Technology Council's Research Business Models Subcommittee[4] is developing a proposal to establish a common format for interim progress reporting for all Federal research agencies (at NSF, these are the annual project reports). The underlying reason for this change is that variations in reporting formats across agencies can increase the administrative effort and costs for recipients of Federal awards and make it difficult to compare research programs across the government. Once the interim progress reporting format is finalized, the Subcommittee plans to examine the feasibility of using this same format for final reports.

The Office of Science and Technology Policy and the Office of Management and Budget plan to propose for public comment a standard format for interim progress reporting. Draft documents indicate the proposed new format would contain two mandatory categories to address accomplishments and changes to the research, while reporting on publication citations, conference papers, and

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[4] The Subcommittee's objectives include facilitating a coordinated effort across Federal agencies to address policy implications arising from the changing nature of scientific research, and examining the effects of these changes on business models for the conduct of scientific research sponsored by the Federal government.

presentations would be optional.[5]   The proposed format is expected to be published for public comment in the near future. After the proposed government-wide format is finalized, NSF will have to make decisions about which, if any, of the optional sections it will include in its reporting format.   Final agency decisions could be implemented by mid-2006.

These efforts to standardize interim and, in the future, final project reports directly affect NSF's efforts to streamline its current final project reports. As changes are made, either by government-wide mandates or NSF management decisions, NSF must be very thoughtful when considering what information it will continue to collect and what information it will no longer require. In reviewing its options, NSF must not only consider the time spent by principal investigators to complete the reports, but also consider what information is important to the agency in order to manage the various projects and what information should be provided to the public to ensure transparency and accountability of public funds.

Conclusion

NSF relies on its award abstracts database to inform interested parties outside of NSF, including the research community and the public, about the proposed research NSF has selected to fund. Yet NSF does little to inform interested parties about the findings resulting from this research. Instead, NSF relies on the researchers themselves to disseminate information about their work through peer-reviewed publications and other means, such as professional conferences or meetings, or informal requests to the NSF program officer or the principal investigator. Such dissemination methods do not easily reach all interested parties, such as students and educators outside of the scientific community.

NSF is in a unique position of possessing both proposals of research work as well as listings of the publications resulting from that work. It has the opportunity to immediately improve its dissemination practices by adding these publication citations to its award abstracts database. Such actions on the part of the agency would help inform scientists and the public about what publications resulted from NSF's research investment.   Similarly, it would also be useful to know which projects did not result in any publications. These steps would also provide transparency and accountability to the public and Congress by providing a public record of what resulted from the research funded with public dollars. Furthermore, the cost to the agency of undertaking this change would be minimal when compared to the billions of federal research dollars NSF awards each year.

NSF must also give serious consideration to its current discussions regarding the basic policy of collecting publication citations. Eliminating a requirement for this

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[5] The other two proposed optional categories are Participants (other individuals and organizations involved in the project) and Impact (how the project has contributed to such things as other disciplines or technology transfer).

information would severely undermine NSF's ability to ensure that principal investigators are publishing the results of their research, and that it has effectively invested taxpayers' dollars.

Recommendations

We recommend that the Deputy Director, NSF:

1. Make publication citations publicly available by adding the citations to the award abstracts database. By leveraging its current informational resources and infrastructure, the agency will be able to provide the public with a record of some of the products resulting from each of the research projects the agency funds. It will also provide another means of sharing sources of research results with other researchers and the public.

2. In conjunction with efforts to revise and streamline its final project report format and implement a new standardized interim progress report format, NSF should continue its current policy requiring principal investigators to submit publication citations resulting from NSF-funded research. Citations play a critical role in NSF's ability to determine if the cornerstone of its dissemination policy – encouraging principal investigators to publish the results of their research – is being implemented. Collecting citation information helps the agency ensure that researchers are held accountable for the federal funds they receive.

Agency Response

NSF agreed with our findings and recommendations. Appendix A contains the agency's response in full.

Appendix A: Agency Response

Office of Information and Resource Management

MEMORANDUM

Date: February 7, 2006

To: Deborah H. Cureton
Associate Inspector General for Audit

From: Anthony Arnolie
Director, Office of Information & Resource Management

Subject: Requested Response to Draft Interim Report, Audit of NSF's Policies on Public Access to the Results of NSF-Funded Research

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Thank you for your memorandum of November 21, 2005 and the accompanying draft report (OIG 06-2-004) dated November 22, 2005. Public access to and understanding of science is a very important issue. As you know, the review criteria approved by the National Science Board include the questions,

> *Will the results be disseminated broadly to enhance scientific and technological understanding? What may be the benefits of the proposed activity to society?*

We agree with the theme of your memorandum, that NSF shares a responsibility (with our Principal Investigators) to "provide the scientific community and the public with direct access to information resulting from the research [NSF] funds." We too believe we can and should do more in this area, and have already begun working toward that goal. For these reasons, we accept your recommendations, and I have asked NSF staff to prepare an implementation plan for recommendation one, to make citations to literature resulting from NSF-supported projects publicly available. I will forward our implementation plan to you when it is completed. As we prepare this plan, we will also consider the broader policy and management implications of reporting, accessibility, and achieving results while working to avoid any negative "unintended consequences" of this project.

The implementation of recommendation two will, of course, depend on the completion of the National Science and Technology Council (NSTC) Research Business Models Subcommittee-led project to standardize research project reporting, and the subsequent implementation of those standards by the participating agencies. Pursuant to those

standards, we accept your suggestion that the anticipated scientific literature citation field should be a required field for NSF-supported projects.

Access to scientific information is a large and important subject. Moreover, some of the parameters of this subject are changing markedly as more and more scientific information becomes digital. We are and have been for some time considering this subject "in the large." For example, for the past three years, NSF has been undertaking a comprehensive business analysis of human capital, business processes, and technologies and tools management in an effort to achieve our strategic goals. The business analysis has addressed merit review, award management and oversight, and performance assessment and accountability activities. The topic of enhancing the process and the utility of project reporting, as well as other information access issues, has been included in the analysis, receiving a great deal of attention from the NSF teams. Also, as you know, the NSTC activity on project reporting is addressing all aspects of information collected in project reports. Once the NSTC has finished developing these guidelines, we will be in a better position to consider modifications to our project reporting requirements, processes, and/or information resources to better meet the needs of our research community as well as provide information for the general public about the results of NSF investments.

Your draft report is a welcome addition to our overall effort to examine broader policy and management implications of reporting, accessibility, and achieving results. I look forward to a continued dialog on public access to and understanding of scientific research.

Should you have any additional questions, please contact George Strawn, NSF CIO, (gstrawn@nsf.gov; 703 292 8102).

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Appendix B: Objective, Scope and Methodology

The objective of our audit is to determine whether NSF provides the scientific community and the public with direct access to information resulting from the research it funds, and if not, how it could improve its dissemination policies.

We completed a variety of audit steps involving NSF and other federal agencies funding basic research. We reviewed current and previous NSF policies, and interviewed current and former members of the National Science Board and appropriate agency officials and program managers. In addition, we met with personnel from the five other federal agencies that provide the most funding for extramural scientific research to colleges and universities:
- U.S. Department of Energy's Office of Science;
- Department of Health and Human Services' National Institutes of Health;
- National Aeronautics and Space Administration;
- Department of Defense's Office of Naval Research; and
- U.S. Department of Agriculture's Cooperative State Research, Education and Extension Service.

We interviewed officials and reviewed information available on each of these agencies' public websites; however, we did not assess the adequacy of these agencies' policies and activities nor did we test the completeness of the information collected by the agencies. We also interviewed other federal and non-federal professionals with knowledge of scientific dissemination policies and practices.

To obtain an estimate of how much information NSF collects on the findings and results of the research it funds, we analyzed a statistical sample of the 8,946 final project reports that were due to NSF during calendar year 2003.   We selected a random sample of these reports using a 95 percent confidence interval with an error rate of +/- 5 percent. We counted the number of publications, books, and websites cited in each of the 361[6] final project reports in the resulting statistical sample and then projected the total number of such documented research results to the universe of final project reports for 2003. We did not differentiate between peer-reviewed journals and documents that were not peer reviewed.

We conducted our work between February and September 2005 in accordance with generally accepted government auditing standards.

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[6] The original sample size contained 368 final project reports, but the random number generator pulled only 361 unique project numbers, resulting in 7 duplicates that were excluded from the sample.

Appendix C: Results of Analysis of Publication Citations

Following the methodology described in Appendix B, we obtained a statistical sample from the 8,946 final project reports that were due to NSF during calendar year 2003.   We counted the number of publications, books, and websites cited in each of the final project reports we sampled. We then projected the total number of such documented research results to the universe of final project reports for 2003.

We found that principal investigators reported publishing or presenting in some fashion the findings and results of their research in about 80 percent of the NSF-funded research projects in our sample. We projected that, for the approximately 8,900 final project reports due in calendar year 2003, principal investigators provided over 40,000 publication citations; 16,000 one-time publications (such as books, conference proceedings, or dissertations); and links to over 3,500 websites.

Of the 20 percent of awards that did not report publications to NSF, about half (10 percent of the total sample) were for work where publications would not be expected, such as grants for equipment or conferences. Of the remaining 10 percent, which were research awards where publication would be expected, 6 percent reported no publications, and NSF had not received final project reports for the remaining 4 percent.

Appendix D: Option for NSF to Link Award Abstracts with Publication Citations

New Annual or Final Project Report submitted by PI, approved by PO

Did PI submit citations in Fastlane's FPR format?

Yes

No

Citations in report automatically inserted at end of each award abstract

Citations converted to Fastlane's format

Award Abstract

Citations stored in database; Can be searched through NSF's public website

User directed to more information; public record established