

**APPROVED MINUTES<sup>1</sup>  
OPEN SESSION  
418TH MEETING  
NATIONAL SCIENCE BOARD**

National Science Foundation  
Arlington, Virginia  
February 15-16, 2011

Members Present:

Ray M. Bowen, Chairman  
Esin Gulari, Vice Chairman  
Mark R. Abbott  
Dan E. Arvizu\* (2)  
Steven C. Beering\*  
Camilla P. Benbow  
John T. Bruer (1)  
France A. Córdova (2)  
Kelvin K. Droegemeier\* (2)  
Elizabeth Hoffman\* (2)  
Louis J. Lanzerotti\* (2)  
Alan I. Leshner\* (2)  
Patricia D. Galloway  
José-Marie Griffiths  
G.P. “Bud” Peterson (2)  
Douglas D. Randall  
Arthur K. Reilly  
Diane L. Souvaine  
Jon C. Strauss\*  
Thomas N. Taylor

Subra Suresh, *ex officio*

Members Absent:

Richard F. Thompson

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<sup>1</sup> The minutes of the 418<sup>th</sup> meeting were approved by the Board at the May 2011 meeting.

\* Consultant

(1) - Absent on February 15, 2011

(2) - Absent on February 16, 2011

The National Science Board (Board, NSB) convened in Open Session at 8:05 a.m. on Tuesday, February 15, 2011 with Dr. Ray Bowen, Chairman, presiding (Agenda NSB-11-4, Board Book page 193 and a revised Agenda in the Board Book Addendum). In accordance with the Government in the Sunshine Act, this portion of the meeting was open to the public.

AGENDA ITEM 1: Presentation on America COMPETES Reauthorization Act

Mr. Jeffrey Nesbit, Director, NSF Office of Legislative and Public Affairs (OLPA)  
“America COMPETES Act, H.R. 5116, P.L. 111-358” (Presentation Book, page 75)

Mr. Nesbit presented an overview of the America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science (COMPETES) Reauthorization Act of 2010, which reauthorizes programs at NSF and other science agencies. The presentation summarized significant policy actions and timelines for both NSF and the Board. A copy of COMPETES Act (H.R. 5116) was provided to Board Members (Board Book page 196).

Drs. Alan Leshner and Patricia Galloway asked for clarification on the COMPETES Act language regarding the scope of Board reports. Mr. Nesbit stated that the language was largely driven by Congressional staff as opposed to any specific Member of Congress. The intent was that the Board, as it works through its reports, should track with the NSF mission as opposed to taking on broader initiatives.

Mr. Arthur Reilly asked about the process for managing legislation or interactions with Congress so that the Board gets feedback to make sure that it is keeping track of responsibilities and deadlines. Mr. Nesbit noted that the burden of keeping track of requirements, studies and reports was far lower for the new COMPETES Act than for the 2007 authorization, the response to which required a permanent NSF working group, but that the COMPETES Act of 2010 requires more programmatic changes, i.e., NSF has more requirements to either develop new programs or modify existing programs.

Mr. Reilly also asked about follow-up interactions with congressional staff as part of the budget process and if the new requests are filtered into a working group or dealt with on an *ad hoc* basis. Mr. Nesbit responded that significant changes in leadership in the House necessitate a learning process by NSF staff. The major changes include the retirement of Congressman Bart Gordon, the former chairman of the House Science Committee, and the new House majority along with a new House Science Committee chairman with new priorities. There are new discussions about the implementation of the America COMPETES Act with new congressional staff, the new chairman, and a new set of priorities. Additionally, NSF is dealing with the FY 2011 budget, even as the NSF Director unveiled the FY 2012 budget request on February 14, 2011.

Mr. Nesbitt responded to a question from Dr. Esin Gulari on the make-up of the working group, explaining it would be similar in composition to the working group that responded to the 2007 COMPETES authorization. Dr. Gulari asked whether it would be good to point out things that are required under the new COMPETES legislation that NSF is already doing, especially the task forces that address some requirements.

Responding to Dr. Leshner's question, Mr. Nesbitt stated his understanding that the list of eight goals provided for the Broader Impacts Review Criterion (Section 526) should all be included in the definition of the broader impacts criterion provided to applicants for NSF grants. He further noted that NSF is required to implement this modification shortly after the May 2011 Board meeting. Dr. Subra Suresh, NSF Director, added that a report from him to Congress is due within 6 months of the enactment of the America COMPETES Act – around June 22, 2011. The May Board meeting will be the last opportunity for discussion on this topic. Given the timing, the various activities that are going on in parallel are not synchronized time-wise, such as the NSB Task Force on Merit Review and internal discussions within NSF among directorates and visiting committees and advisory boards. Further, a "Dear Colleague" letter was sent to the community and placed on the NSF Web site, seeking input from colleagues around the country. NSF is working quickly to collect and synthesize the broadest input and still meet the congressional deadline. Dr. José-Marie Griffiths commented that it would be helpful to see all the items to which NSF must respond in a timeline.

Continuing with the discussion on the Broader Impacts Review Criterion (Section 526), Dr. Elizabeth Hoffman asked if the broader impacts statement should be interpreted to mean that every NSF proposal must contain some or all of the criteria listed. She noted that the difference depending which interpretation is adopted is substantial. Mr. Nesbitt stated that there is confusion regarding the criterion. He felt that the decision would be left to the Board, the task force, and NSF to determine what to do with this list, how to explain it to the research community, and whether all eight of the criteria will be required. Dr. Suresh added that, given the broad definitions of each of the criteria, it would be difficult for every grant to meet each of the requirements, and discussion will be needed before the report to Congress is submitted. Dr. Hoffman asked Dr. Bowen for a follow-up discussion on this topic. Dr. Louis Lanzerotti also expressed agreement with Dr. Hoffman's concerns and likewise endorsed the importance of continued attention to this issue by NSF, the task force and the committee.

Mr. Nesbitt noted that the academic community talked to Congress about their concern that Congress would give them an unfunded mandate, shifting responsibility for the broader impacts criterion to institutions without additional resources.

#### AGEMDA ITEM 2: Presentations on National Research Council (NRC) Study on Research Universities

Dr. Peter Henderson, Director, Board on Higher Education and Workforce, The National Academies

“NRC Study on Research Universities” (Presentation Book page 93)

Dr. Robert Berdahl, President, Association of American Universities (AAU)

“Maintaining America's Competitive Edge: Revitalizing the Nation's Research Universities” (Board Book page 226)

Mr. Tony DeCrappeo, President, Council on Governmental Relations (COGR)

“Federal Funding Agency Limitations on Cost Reimbursement: A Request for Consistency in the Application of Federal Guidelines” (Board Book Addendum)

Mr. M. Peter McPherson, President, Association of Public Land-grant Universities (APLU)  
“APLU Suggested Recommendations for NRC Committee on Research University  
Competitiveness” (Board Book Addendum)

The NRC Study on Research Universities, Statement of Task was provided to Board Members (Board Book page 221), along with brief biographies on the speakers (Board Book page 222).

Following the presentations, Dr. Kelvin Droegemeier noted: (1) there is a context of deregulation at both State and Federal levels, (2) Recovery of administrative costs (F&A) is significantly limited by the 26 percent cap for Federal research, noting as an example that the University of Oklahoma subsidized these costs in the amount of \$12 million in 1 year, (3) that research is one of the primary drivers of cost increases in higher education, and (4) the Board's report, *Investing in the Future, NSF Cost Sharing policies for a Robust Federal Research Enterprise* ([NSB-09-20](#)) has a recommendation for the need to look at F&A reform. He expressed the need for other agencies to look at F&A cost recovery also.

Dr. Lanzerotti commented that the country committed itself to instituting research at the universities in a major way, as the 1945 Vannevar Bush report, *Science - The Endless Frontier, A Report to the President on a Program for Postwar Scientific Research*, proposed. Deep study is required to ensure that the conditions that the country asked for at that time are maintained currently. Dr. Lanzerotti drew attention to another issue, related to Ph.D. programs, citing the article in *Chemical and Engineering News*, "The Doctoral Dilemma: Is Chemistry Facing a Glut of Ph.D.s?" He also noted that the issue of predictability in Federal research must be addressed in a way that does not offend the American public who pay the taxes - further noting that many members of the public would also like to have greater predictability in their income stream.

Dr. France A. Córdova addressed additional costs driven up by the state's funding for research and economic development on the state level, which compound the costs of doing research at a university. She noted that the most research intensive state funded institutions, like the land grant universities, are underfunded by about 30 percent for F&A costs. These costs include both underfunding at the Federal and State levels. She commented that factors involved include universities' embrace of globalization, which has led to a lowering of the public commitment to universities in the state; and the institution of on-line learning, which charges less per course, but costs the university more than traditional education. Because of these factors, her university over the next 10 years is directed towards the money flow - the stakeholders and what they are willing to fund. Whether it is in commercialization, research, globalization, or technology, it is all about how much it costs, and how to lower costs and institute new kinds of compacts with stakeholders to achieve sustainability instead of fluctuations from year to year.

Dr. Griffiths urged the speakers to make the case that education in all its forms is an economic development activity. All education is, in fact, preparing people for their contribution to the economy at the state and national levels.

Building on Dr. Griffiths comment, Mr. Reilly and noted the focus on competition in *Rising Above the Gathering Storm* and the America COMPETES Act; therefore, competition is also an important part of the context for this study. He also noted that there are seven Chief Executive Officers (CEOs) on the NRC study committee, and that commercialization and economic development is a key issue area. He asked about the role of industry in the partnership between

Government and research universities. He suggested that perhaps this area of regulation is something that might be looked at with regard to policies and regulations that may be obstacles towards tapping either the partnership or the relationship that exists between industry and government and research institutions to take advantage of companies that are, in large part, now growing their revenues to encourage them to invest more in university research.

Dr. Bowen adjourned this portion of the Open Session at 9:37 a.m.

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The Board reconvened in Open Session at 1:30 p.m. on Wednesday, February 16, 2011 with Dr. Bowen presiding (Agenda NSB-11-4, Board Book page 193 and a revised Agenda in the Board Book Addendum). In accordance with the Government in the Sunshine Act, this portion of the meeting was also open to the public.

#### AGENDA ITEM 8: Approval of Open Session Minutes, December 2010

The Board unanimously APPROVED the Open Session minutes of the December 2010 Board meeting (NSB-10-89, Board Book page 266).

Dr. Bowen noted that Appendix A to the December 2010 minutes includes a poem written by Dr. Galloway, “The Birth of NSF and NSB” to the refrain of “The Night Before Christmas.” He thanked Dr. Galloway for allowing the Board to make this poem a permanent part of Board history.

#### AGENDA ITEM 9: Chairman’s Report

Dr. Bowen announced and reported on several items:

##### **a. Electronic Participation of Board Members at Meetings**

Procedures are in place for electronic participation of Board Members at regularly scheduled meetings. The procedures (Board Book page 290) relate to the August 2010 Board approval of “Electronic Participation by NSB Members at Board, Committee, Subcommittee, and Task Force Meetings” (NSB-10-42).

##### **b. Board Retreat, Meeting, and Research Site-Visit for September 2011**

The retreat, meeting, and research site-visit location for September 2011, will be held in Tucson, Arizona. The Board agreed to this location during the Plenary Executive Closed Session of the December 2010 meeting.

### **c. Congressional Testimony**

The Chairman reported that on March 11, 2011, he and Dr. Subra Suresh, NSF Director, were scheduled to be on Capital Hill to provide testimony to the House Committee on Science, Space, and Technology regarding the NSF FY 2012 budget request.

### **d. Committee Announcement**

The *ad hoc* Committee on Nominating for NSB Elections, otherwise known as the Elections Committee, was appointed by the Chairman. Dr. Esin Gulari will be the chairman of this committee, and Drs. France Córdova and Douglas Randall will serve with her. In May 2011, there will be two vacancies on the Executive Committee as the terms for Drs. Camilla Benbow and Patricia Galloway end. The Elections Committee will prepare a slate of candidates for consideration and election at the May 2011 meeting for two 2-year terms from 2011 to 2013.

### **e. Board Member Nomination**

Dr. Kelvin Droegemeier was nominated for reappointment as a Member of the National Science Board for a term expiring in May 2016. Dr. Droegemeier is the Vice President for Research, the Regent's Professor of Meteorology and Weathernews Chair Emeritus at the University of Oklahoma.

Dr. Bowen also noted that the Board looked forward to the confirmation of the Acting NSF Deputy Director, Dr. Cora Marrett.

### AGENDA ITEM 10: Director's Report

Dr. Subra Suresh, NSF Director, reported on the following items:

#### **a. NSF Staff Introductions**

Dr. Kelly Falkner joined NSF as Deputy Head, Office of Polar Programs (OPP), on January 3, 2011. Dr. Falkner came to NSF from Oregon State University where she served as Professor in the College of Oceanic and Atmospheric Sciences. She received her Ph.D. in Chemical Oceanography from Massachusetts Institute of Technology / Woods Hole Oceanographic Institution Joint Program in 1989.

Mr. Jeffrey M. Lupis joined NSF as Director, Division of Acquisition and Cooperative Agreement Support (DACs), Office of Budget, Finance, and Award Management (BFA), on February 13, 2011. Mr. Lupis came to NSF from the National Aeronautics and Space Administration (NASA) where he served as Procurement Officer at the Ames Research Center, Moffett Field, California. Mr. Lupis received his Masters Degree in Business Administration from the Florida Institute of Technology.

Dr. Theresa Maldonado joined NSF as Director, Division of Engineering Education and Centers (EEC), Directorate for Engineering (ENG), on January 3, 2011. Dr. Maldonado came to NSF from Texas A&M University where she served as Associate Vice Chancellor for Research with

the Department of Electrical and Computer Engineering and Director of the Energy Engineering Institute. She received her Ph.D. in Electrical Engineering from the Georgia Institute of Technology in 1990.

Dr. Ian Robertson joined NSF as Director, Division of Materials Research (DMR), Directorate for Mathematical and Physical Sciences (MPS), on January 3, 2011. Dr. Robertson came to NSF from the University of Illinois at Urbana-Champaign where he served as the Donald B. Willett Professor of Engineering in the Department of Materials Science and prior to that as Head of the department. He received his Ph.D. from Oxford University in 1982.

## **b. NSF Congressional Update**

For the congressional update, Dr. Suresh reported that the most significant congressional development since the December 2010 meeting was the discussion regarding the House of Representatives Continuing Resolution, which cuts \$100 billion overall from the President's FY 2011 budget request. Under the bill, NSF budget would be lower by \$360 million, or 5.2 percent from the FY 2010 enacted level; and \$857.4 million, or 11.6 percent, below the President's FY 2011 request. These levels, if enacted, would put NSF marginally above the FY 2009 level.

The current Continuing Resolution runs through March 4, 2011. The situation with regard to the FY 2011 budget was still fluid. The Senate needed to act, and the President already issued a veto message on any bill that would cut funding that "curtails the drivers of long-term economic growth."

Next month will begin the process of presenting the NSF 2012 budget request before Congress. On March 11, Drs. Suresh and Bowen were scheduled to testify before the House Committee on Science, Space, and Technology. The preceding day, March 10, 2011, Dr. Suresh was scheduled to testify before the House Appropriations Subcommittee on Commerce, Justice, and Science and Related Agencies. Dr. Suresh was also slated to testify before the Senate Committee on Commerce, Science and Transportation the following week.

Dr. Suresh stated that he looked forward to working with Congress over the next several months on enacting the President's request for a 13 percent increase for NSF in the FY 2012 budget.

## AGENDA ITEM 11: Open Committee Reports

### **a. Committee on Audit and Oversight (A&O)**

Mr. Arthur Reilly, A&O chairman, reported that Ms. Allison Lerner, NSF Inspector General (IG), reported on her recent testimony to the House Appropriations Subcommittee. As part of the appropriations process, she was asked to testify about management challenges facing NSF and matters related to fraud, waste and abuse. Ms. Lerner spoke about an Office of Inspector General (OIG) report that found that NSF spends \$500,000 each year on light refreshments for visiting panelists. She noted that there were few controls over these purchases and recommended that they be reviewed in light of the Government-wide effort to curb spending. Mr. Reilly noted that Dr. Bowen commented that he hoped NSF could find a common sense solution to be able to

offer appropriate light refreshments to panelists without a “complicated process.” The remainder of the IG’s testimony focused on grant administration, contract management, and controls over contingency funds. House Members raised concerns in several areas, which included the pace of expenditure of stimulus funds, NSF’s reliance on cost-reimbursement contracts, education programs, and IT security. At the end of the hearing, Chairman Wolf emphasized that in an unprecedented period of austerity, it is critical to ensure that every dollar is spent properly.

On the topic of IT security, Dr. Suresh noted that he established a senior leadership group to assess current practices and policies regarding personally identifiable and business sensitive information. He will report back on the group’s recommendations at the July 2011 session.

Ms. Martha Rubenstein, Chief Financial Officer (CFO), reported that a process was underway with the OIG to assure that there was a clear understanding of what controls were in place with regards to construction contingency and how the process could be improved. She reported on the successful completion of the FY 2010 audit. The Corrective Action Plan was approved by the auditors, and it is possible that the significant deficiency in contract monitoring can be closed out in 2011. There were also no new findings in the management letter. A new contractor, Grant Thornton, has been competitively selected for the Internal Control Quality Assurance Program. NSF is also proceeding with the new financial system; plans were officially approved by the Office of Management and Budget (OMB) last month. NSF plans to switch from pooled to grant-by-grant payments, which will improve oversight and access to real-time data. The American Recovery and Reinvestment Act (ARRA) recipient reporting, enhanced by NSF outreach efforts and new tracking tools, continues to be successful. (Presentation Book page 273)

The committee received a brief update on human capital management from Dr. Judy Sunley, Interim Chief Human Capital Officer. She noted that NSF provided additional documentation to the Office of Personnel Management (OPM) on progress towards addressing the required and recommended actions of the Human Capital Management Evaluation Report. OPM staff appeared pleased with the progress to date. An OIG audit of NSF’s actions to improve workforce management and the work environment for employees is in its final stages, with NSF comments on the draft due by February 18, 2011. Further information will be provided to the Board at the May 2011 meeting. NSF made significant progress toward Model EEO Agency status, completing 8 of 16 open tasks in FY 2010, with 8 remaining for action in FY 2011. NSF instituted a Veterans Employment Program, and there has been significant progress in hiring veterans to NSF’s staff.

Finally, a joint teleconference meeting of the A&O and Committee on Programs and Plans (CPP) was held on January 24, 2011. The meeting was convened to consider changes to the award threshold amount, below which award approval authority is delegated to the Director. The meeting was a culmination of a long process of research, debate, and discussion among Board Members and NSF staff that took place over many months. Both committees voted to recommend to the full Board that the Resolution for the Delegation of Award-Approval Authority to the Director (NSB-11-2, Board Book page 288) be approved by the Board. The policy option that was selected will allow the award threshold amounts to grow in proportion to NSF’s budget. More importantly, the new policy will give the Board more flexibility to broaden and expand its other oversight activities and better fulfill its mission.



Based on this recommendation, the Board unanimously APPROVED the following:

The Board adopted the delegation of award-approval authority to the NSF Director. (See Appendix A for full Resolution)

Mr. Reilly stated that it was his understanding that it was NSF's intention to implement the new thresholds immediately in order for them to apply to the NSB meeting in May 2011.

Additionally, the Joint A&O and CPP Committee members voted to recommend the Resolution for the Delegation of Authority to the Executive Committee (NSB-11-3, Board Book page 289), which reaffirms the Board's current policy.

Based on this recommendation, the Board unanimously APPROVED the following:

The Board reaffirmed the delegation of authority to the Executive Committee of the Board. (See Appendix B for full Resolution)

#### **b. Committee on Education and Human Resources (CEH)**

Dr. Camilla Benbow, CEH chairman, directed committee members to an article on Ph.D.s in Chemistry that was recommended by Dr. Lanzerotti, and she apprised CEH of a study undertaken by the Government Accountability Office (GAO) on Federal STEM education programs. The study will catalogue existing STEM education programs, identify overlaps, and review programmatic assessment mechanisms and practices. GAO included NSB as well as NSF in its request to meet with relevant staff. The Board Office staff participated in the entrance conference and is collaborating with NSF on this activity.

The committee continued the discussion begun at the December 2010 meeting on to how NSF can achieve the goals of the report, *Preparing the Next Generation of STEM Innovators (Innovators)* (NSB-10-33), as well as to leverage relevant recommendations of other recent STEM education reports. Mr. Michael Town, an Einstein Fellow in the Board Office, introduced a document that summarized and cross-walked the recommendations of recent STEM education reports. Dr. Benbow thanked Mr. Town as well as Ms. Rebecca Sanders-Demott, Science Assistant, Directorate for Education and Human Resources (EHR), the latter who provided input on behalf of EHR. This comparison grid is a useful tool, and shows both common recommendations as well as the added dimensions of the *Innovators* report.

Dr. Joan Ferrini-Mundy, Acting EHR Assistant Director, described how NSF was already implementing or could readily implement some recommendations through core programs – for example, through the Robert Noyce Teacher Scholarship Program (Noyce), Innovative Technology Experiences for Students and Teachers (ITEST), and Math-Science Partnerships (MPSs); how NSF could partner with other groups to pursue other recommendations – such as the Department of Education, Head Start programs, and early childhood educators; and potential areas for NSF focus – including talent assessment systems, catalyzing research agenda-setting, and teacher preparation and professional development.

Committee members, in keeping with Dr. Suresh's call at the December 2010 meeting to identify "low-hanging" action items, discussed several first-order priority areas including: talent assess-

ment systems, particularly those that address spatial abilities; cyber learning and online resources; proactively encouraging focus on advanced students within existing programs; leveraging national or NSF STEM initiatives, such as Cyberinfrastructure Framework for 21st Century Science and Engineering (CIF21) and Science, Engineering, and Education for Sustainability (SEES); and transitioning from pilot projects to large-scale implementation.

The committee agreed that a list of recommended action items would be finalized and conveyed to Dr. Suresh in May 2011. To accomplish that, CEH agreed that next steps would include: developing a draft options list; circulating the list to members in March 2011; setting up a teleconference to refine the list; and work to reach consensus and approve the recommended action list at the May 2011 meeting.

### **c. Committee on Science and Engineering Indicators (SEI)**

Dr. José-Marie Griffiths, SEI chairman, reported that the committee meeting began with the announcement that the Division of Science Resources Statistics was renamed as the National Center for Science and Engineering Statistics. The name change is part of an America COMPETES Act provision. She stated that she was pleased that the Act mandates the Center's work on competitiveness and innovation and recognizes the importance of the data it collects and publishes. The Center's work for the Board on *Science and Engineering Indicators (Indicators)* will continue as before.

SEI considered three possible cover designs for *Indicators 2012*. The committee preferred the idea behind a cover that had a light bulb and some drawings and words relating to innovation, and asked the staff for an image to replace the light bulb and to experiment with adding color to the design.

Dr. Griffiths thanked Dr. Jon Strauss for volunteering to serve as lead reviewer for Chapter 4. She also reminded the Board to review the list of prospective expert chapter reviewers (Board Book page 184), and to send additional suggestions to her and Executive Secretaries by March 1, 2011. She announced that Board Members will be receiving draft *Indicators* chapters for review in about a month. Additionally, she stated that she has information from most Board Members about their chapter review preferences, and she will be requesting information from other Board Members within the next few days.

Dr. Myron Gutmann, Assistant Director, Directorate for Social, Behavioral, and Economic Sciences (SBE), presented his recommendations from the SBE review of the adult science knowledge measures reported in *Indicators*. For *Indicators 2012*, he recommended that the Board report data on all of the existing science knowledge questions and include a sidebar explaining the context for the SBE review and the Board's future plans. For *Indicators 2014*, he outlined plans for question experiments that would improve understanding of how to interpret the survey results. He also promised consultations with science and science education experts about the scientific adequacy of the current question wordings. For the longer term, he recommended work toward a new conceptual framework that would try to address how adults use science knowledge in practice. (Presentation Book page 289)

The committee also discussed the 2012 Companion Piece. Dr. Griffiths asked the Board Office to assemble some systematic data on references to past Companion Pieces in an effort to address doubts about whether the Companion Piece has sufficient impact to warrant the work involved in developing it. At the same time, SEI constituted a working group consisting of Drs. Esin Gulari, Dr. Louis Lanzerotti, Mr. Arthur Reilly, and herself to flesh-out ideas for a possible Companion Piece on the S&E workforce and innovation, including the relation between innovation and R&D.

The Committee also heard a brief update on plans for improving the graphic presentation of data in Chapter 8, both on the Web and in print.

#### **d. Committee on Programs and Plans (CPP)**

Dr. Mark Abbott, CPP chairman, reported that the committee conducted all of its Open Session business on Monday, February 14, 2011, a day prior to the Board meeting. CPP found that meeting a full day before the Board was working well, and allows for more deliberation and discussion. The committee plans to continue this process for the May 2011 meeting, subject to polling results being conducted by the Board Office.

Discussion Item: NSB Threshold Modification, CPP Impact and Next Steps (NSB/CPP-11-13, Board Book page 29)

Dr. Abbott reported that he summarized the joint CPP/A&O teleconference meeting held on January 24, 2011, where both committees and NSF, including Dr. Suresh, discussed two potential options for a threshold change. Both committees voted on recommending to the Board the new NSB threshold policy [see page 6]. Upon approval by the Board, the committee proposed implementation immediately. The impact is that up to seven award actions will be removed from the list of May 2011 action items.

The committee also discussed a programmatic portfolio review, and Dr. Abbott suggested the following next steps in 2011 for that process: June/July - a Joint Committee on Programs and Plans / Committee on Strategy and Budget (Joint CPP/CSB) meeting at NSF to meet with Assistant Directors (AD) on programmatic planning already in process; October/November - NSF provides a list of recommended program for review and NSB considers additions from committee suggestions; November/December - the committee selects between two and four items for review during the next calendar year. Dr. Abbott will work with the Board Office to explore scheduling and organizing the first CPP-CSB-AD meeting in June/July 2011.

Dr. Abbott proposed that CPP create a small working group to discuss the logistics and content of these programmatic reviews. He thanked Dr. Kelvin Droegemeier, Dr. Diane Souvaine, and Mr. Arthur Reilly for agreeing to help him work on this process. Dr. Droegemeier also asked this working group to review the CPP charge to align it with other committees. CPP will continue the discussion over the next few months and at the May 2011 meeting.

Discussion Item: Continuing Discussion on Recompetition Policy Implementation  
(NSB/CPP-10-75, Board Book page 38)

NSB Statement on Competition, Recompetition, and Renewal of NSF Awards  
(NSB-08-16, Board Book page 34)

NSB Resolution: Competition and Recompetition on NSF Awards (NSB-08-12,  
(Board Book page 37)

In December 2010 NSF presented a draft implementation document for recompetition. CPP members were asked to send comments to Ms. Sonya Mallinoff, CPP Executive Secretary. The comments were collated, and copies were provided to the Office of the Director and CPP. Dr. Lanzerotti, who has been involved in the Board's examination of recompetition from the early stages, stated that the majority of comments noted that recompetition should be the default for awards, not the exception. If recompetition is the default position, any costs resulting from recompetition can be built in every step of the way. On behalf of the NSF Director, Dr. Fae Korsmo, Senior Advisor, Office of the Director (OD), affirmed NSF's commitment to working with the Board on implementation of the policy. NSF will continue to work on this draft and plans to present a revised version at the May 2011 meeting.

NSB Information Item: Renewal of Support for Large Hadron Collider (LHC)

Dr. Edward Seidel, MPS Assistant Director, gave scientific update on the support for U.S. collaborations in the Large Hadron Collider (LHC) project. He reported that the LHC accelerator performance was improving dramatically and was expecting 100 times more collected data in the next run. At this point, 75 papers have been published, and the facility is expected to run for another 20 years. The science at LHC is truly just beginning. (Presentation Book page 1)

NSB Information Item: Update on NEON Airborne Observation Platform

Dr. Joann Roskoski, Acting Assistant Director, Directorate for Biological Sciences (BIO), and Dr. Elizabeth Blood, Program Officer, National Ecological Observatory Network (NEON), gave an update on the status of the NEON Airborne Observation Platform. Dr. Blood noted that the NEON spectrometer is designed and under construction by the Jet Propulsion Laboratory (JPL). NSF anticipates an on-time delivery in January 2012. The first test flights have been completed and data analysis is underway. (Presentation Book page 13)

NSB Information Item: TeraGrid XD

Dr. Barry Schneider, Program Director, Office of Cyberinfrastructure (OCI), provided an update on TeraGrid eXtreme Digital Resources for Science and Engineering (XD), and the rigorous review process. Two teams were each awarded a planning grant for a year, and the grants were reviewed by a panel of 14 people, whose feedback was incorporated into the final proposal. OCI deemed the outcome of this process excellent, and the impact on Computational Data Science and Engineering is potentially transformative. NSF plans to bring an award for TeraGrid XD before the Board at the May 2011 meeting. (Presentation Book page 27)

NSB Information Item: Incorporated Research Institutions for Seismology (IRIS)

Dr. Timothy Killeen, Assistant Director, Directorate for Geosciences (GEO), and Dr. Robert Detrick, Division Director of Earth Sciences (EAR) GEO, provided an update on the Incorporated Research Institutions for Seismology (IRIS). IRIS operates a distributed multi-user national facility in service of the earth sciences community. A 27-month renewal proposal for IRIS was reviewed in fall 2010. A proposal for an integrated facility is due in fall 2012, and operations of the facility are expected to begin in fall 2013. A recompetition of all seismic facilities management and operations will occur in 2017 or 2018. NSF expects to bring an action item regarding IRIS renewal before the Board in May 2011. (Presentation Book page 35)

NSB Information Item: EPSCoR Research Infrastructure Improvement Track-1

Dr. Clifford Gabriel, Acting Director, Office of Integrative Activities (OIA), provided an update on the Experimental Program to Stimulate Competitive Research (EPSCoR) program's Research Infrastructure Improvement (RII) Track-1 awards. These actions are impacted by the change in threshold, and will not be presented to the Board in May 2011 as previously planned.

Dr. Gabriel noted that the RII Track 1 proposals are currently under review and will go to the

Director's Review Board (DRB) in March 2011. The committee requested that they hear an information item on the results of the DRB review at the May 2011 meeting. (Presentation Book page 47)

CPP Subcommittee on Polar Issues (SOPI)

Dr. Abbott reported that the SOPI chairman, Dr. Thomas Taylor, and subcommittee members heard a presentation by Dr. Kelly Falkner, Deputy Director, Office of Polar Programs (OPP), who provided the OPP Director's report on issues including the untimely death last month of Mr. William Colston, Division Director, Antarctic Infrastructure and Logistics (AIL), recent personnel accolades and changes in OPP, OPP-supported education-related activities, some research highlights and the U.S. Antarctic Program (USAP) National Research Council (NRC) panel that held its first face-to-face panel meeting on January 1-2, 2011.

Dr. Falkner noted that a request for proposals was released in mid-January 2011 for the contract on polar research vessel services. A University-National Oceanographic Laboratory System (UNOLS) committee was charged with addressing the science requirements for a polar research vessel, with a workshop scheduled for later in February 2011. The U.S. Coast Guard and NSF formed a working group to address congressional authorization for a study of ice breaker business case analysis, and the first meeting is scheduled for late February 2011. (Presentation Book page 223)

Dr. Falkner also reported that OPP received a proposal to extend the U.S. Antarctic Program prime contract an additional year through March 31, 2012.

Dr. "Bud" Peterson presented an overview of the site-visit that he and some of his fellow Board members took to Antarctica in December 2010. He especially noted the strong attention to sustainability and conservation at the research sites, the scientists' dedication to their work under very stark conditions, and the importance and integration of logistical support to the science

mission. He described their visits to the Dry Valley Camps at McMurdo, and IceCube, power and waste water treatment plants and telescope installations at the South Pole. (Presentation Book page 233)

#### CPP Task Force on Unsolicited Mid-Scale Research (MS)

Dr. Abbott reported that the task force is holding a series of Discussion Groups and plans to conduct a survey of ‘mid-scale’ researchers to examine the issues and questions. It will hold a workshop with key stakeholders from the research community, NSF staff, and other agencies to explore possible solutions.

CPP discussed a minor modification to the Charge to the Task Force on Unsolicited Mid-Scale Research agreed by the task force during an earlier MS teleconference. On behalf of Dr. Souvaine, MS chairman, Dr. Droegemeier described the modification for the charge to state, “an amount that is typical for a center in that field” as the funding level. It allows NSF to be more flexible while still providing a ballpark range that is easily understood. Based on this recommendation:

The Board unanimously APPROVED the revised charge of the CPP Task Force on Unsolicited Mid-Scale Research (NSB-10-59, Revised; Board Book page 114) (Appendix C).

#### **e. Joint Committee on Programs and Plans / Committee on Strategy and Budget (Joint CPP-CSB)**

Dr. Abbott reported for the Joint CPP-CSB, which met to review overlapping interests on several topics, including cyber-infrastructure planning and the 2011 NSF Facilities Plan.

Mr. Alan Blatecky, Acting Director, Office of Cyberinfrastructure (OCI), presented information on NSF’s cyberinfrastructure planning, including investments for High Performance Computing (HPC) and a new initiative, Cyberinfrastructure for the 21st Century (CIF21), which was previewed in NSF’s budget roll-out on February 14, 2011 (Presentation Book page 145). Members from Joint CPP-CSB will continue this valuable discussion with Mr. Blatecky and NSF, and help with program planning and implementation as CIF21 moves forward. In addition to Drs. Abbott and Souvaine, chairmen of CPP and CSB respectively, and Drs. Droegemeier, Griffiths, Gulari and Randall and Mr. Reilly volunteered to assist with this endeavor.

Dr. Mark Coles, Deputy Director, Large Facility Projects, presented the NSF Annual Facilities Plan to the joint committee. The background document, “2011 NSF Facility Plan,” and the chart “Large Facilities ‘Horizon’ Projects,” were provided to the members in advance of the meeting (Presentation Book pages 165 and 221). Additionally, the following documents “National Science Board MREFC Process” (NSB-10-65, Board Book page 77) and “Annual Timeline for Integration of Board MREFC Process with NSF Budget Process” (NSB-10-66, Board Book page 78) helped to provide context for Dr. Coles’ presentation. The annual NSF facilities plan presentation by Dr. Coles complies with the process outlined in these documents.

Dr. Coles reviewed the various stages of the large facility planning process, discussed the NSF risk management approach and the oversight policies for Major Research Equipment and Facilities

construction (MREFC) projects, described the purpose and need for use of budget contingency, and provided a closer look at current and “horizon” MREFC projects. The discussion focused on the use of contingency, criteria to determine which projects should be included on the Horizons list, and other issues. The joint committee noted that the background information and slide presentation prepared by Dr. Coles were excellent, and would be a valuable primer for new Board Members.

In May 2011, the Board will conduct a portfolio review of NSF facilities through the Subcommittee on Facilities (SCF) under the purview of CSB. Dr. Coles’ presentation will serve as an informative precursor to the more extensive portfolio review in May. CPP will continue to review proposals for planning and design, project inclusion in future budgets, and obligation of construction funds. Both committees will provide guidance to the Board on the prioritization order of new construction starts as needed.

#### **f. Committee on Strategy and Budget (CSB)**

Dr. Diane Souvaine, CSB chairman, reported that the committee met the day after the release of the President’s FY 2012 budget request to Congress. At the February 14, 2011 budget rollout, Dr. Suresh noted that NSF maintains strong support within the Administration as evident by the \$894 million increase over the FY 2010 enacted level budget - a total request level of \$7.767 billion. The NSF budget request reflects the President’s emphasis on science and engineering research and education as an important component in retaining U.S. global status in the science community and strengthening the Nation’s overall economic position.

CSB reviewed various FY 2011 Continuing Resolution scenarios. These bills would have different impacts on NSF, and appear to be reductions below the President’s FY 2011 request level. CSB will continue to carefully follow the FY 2011 Appropriations process as it comes to final resolution, and will monitor the progress of the FY 2012 budget process. The committee encourages the entire science and engineering community to be strong advocates for NSF to achieve these full budget requests.

Dr. Michael Van Woert, Executive Officer and Board Office Director, provided the committee with a brief update on Board Office operations. He presented a schematic of the Board Office organization and a brief overview of staff duties (Presentation Book page 143). Dr. Van Woert also discussed progress made on digitizing Board documents, in particular the Board Books for this meeting were made available electronically for NSF staff and historical Board Books from 1950 to 2003 were scanned and are now digitally available.

On February 8, 2011, NSF learned that OMB provided clearance for the NSF Strategic Plan. Clearance was granted with the condition of one revision - that NSF indicate in the introductory text a commitment to revise the plan in 2013 to comply with requirements set forth in the recently passed Government Performance and Results Act (GPRA) modernization Act of 2010, which will impact future revisions and reporting. OMB also emphasized that the 2013 revision will need to include more measurable performance targets. NSF made this final revision and publicly released the final document on February 14, 2011.

Dr. Gabriel thanked the Board for their review and comments during the development of the Strategic Plan for which he served as Chairman of NSF's Strategic Plan Working Group.

Dr. Gabriel noted that although it was a long development process, the final Plan will position NSF well for the future. CSB members remarked that they were pleased with the final Strategic Plan, citing that it was clear, coherent, and straight forward. The Board thanked Dr. Gabriel, and NSF staff for their tremendous efforts on revamping the Plan.

Mr. Michael Sieverts, Director, Budget Division (BD), presented the NSF Performance Plan integration with the Strategic Plan. Mr. Sieverts identified critical connections between the Strategic Plan and the NSF budget, highlighting how the two documents are intertwined. (Presentation Book page 135)

#### CSB Subcommittee on Facilities (SCF)

Dr. Souvaine reported that the SCF chairman, Dr. José-Marie Griffiths reviewed the SCF past and upcoming activities, including a required America COMPETES Act (ACA) report on mid-scale infrastructure, discussion of ACA recommendations to NSF on external partnering, and execution of the annual portfolio review of facilities. To assist SCF with work on the infrastructure report, the Board Office distributed copies of the 2001 NSF Directorate/Office infrastructure reports and the 2003 Board report, *Science and Engineering Infrastructure for the 21st Century: The Role of the National Science Foundation* (NSB-02-190) to Board Members.

Dr. Griffiths outlined an approach for executing these activities, and the subcommittee discussed the scope of the tasks and expressed concern about the schedule to complete them. SCF concurred that the subcommittee should undertake both the mid-scale report and the annual portfolio review. The subcommittee also identified a number of issues that required particular attention, which included consideration of science budgets, challenges for universities, plans for recompetition, partnering, and managing the MREFC process.

#### CSB Task Force on Data Policies (DP)

Dr. Souvaine also reported that the DP chairman, Dr. Griffiths, and the task force discussed plans for its upcoming workshop to be held on March 27-29 in Arlington, Virginia. The list of invitees was nearly complete and the agenda is full. Several Board Members expressed interest in participating.

The task force received an update from NSF Liaisons, Drs. Seidel and Gutmann and Mr. Blatecky on the activities of the NSF internal working group on both data policies and issues related to open access publications. Working through Dr. Suresh, the NSF group was tasked to look at the implications, costs and benefits of alternatives, including consideration of NSF signing-on to the Berlin Declaration, NSF adopting the National Institutes of health (NIH) open access policies, and other approaches to NSF open access that include the role of publishers, institutional repositories and others. Dr. Seidel indicated that the discussion, which combines data and scholarly publications, is complicated and why the new working group includes representation from the different communities and cultures. The NSF working group is considering pilot projects that demonstrate the types of policies that will allow NSF to lead the way in the digital world where there is fundamental change in the nature of publication and communication. Dr. Griffiths noted that the NSF working group will help inform the Board's deliberations. It will be a way to



demonstrate closer activity between NSF and NSB as well as a way to divide the workload and explore options.

CSB approved the “Statement of Principles” (NSB/CPP/DP-10-2, Revised January 31, 2011; Board Book page 86) developed by DP and recommended approval by the full Board.

The Board unanimously APPROVED the Task Force on Data Policies Statement of Principles (NSB-11-20) (Appendix D).

**g. Task Force on Merit Review (MR)**

Dr. Randall reported for Dr. John Bruer, MR chairman, and stated that MR discussed articulating guiding principles for the development of the review criteria. Among the issues discussed was distinguishing between intrinsic broader impacts of a particular project and the potential broader impact a given principal investigator (PI) may have through ongoing activities. The task force also discussed the merits of measuring broader impacts at a project level versus a higher aggregated level. There was general agreement that institutional buy-in is important for facilitating PI efforts related to broader impacts and for fostering an environment that supports creative and innovative approaches.

Finally, the task force agreed to set an aggressive schedule to have draft recommendations ready for the May 2011 Board meeting. To that end, the task force will meet via teleconference in early March 2011 and again in April 2011. The teleconferences will focus on incorporating the input from stakeholder groups into the draft guiding principles and proposed review criteria, and in preparing draft recommendations for NSF.

Dr. Bowen thanked Board Members and Board Office staff for all the work they perform in preparation for the meetings. He especially thanked the NSF staff for the enormous amount of information they provide to the Board, and for the support given during the meeting. Dr. Bowen then adjourned the Open Session at 2:13 p.m.

*[signed]*

Ann A. Ferrante  
Executive Secretary  
National Science Board

**Attachments:**

- Appendix A: Resolution – Delegation of Award-Approval Authority to the Director (NSB-11-2)
- Appendix B: Resolution – Delegation of Authority to the Executive Committee (NSB-11-3)
- Appendix C: Charge to the Task Force on Unsolicited Mid-Scale Research (NSB-10-59, Revised)
- Appendix D: Statement of Principles, Task Force on Data Policies (NSB-11-20)

## RESOLUTION

### NATIONAL SCIENCE BOARD

#### DELEGATION OF AWARD-APPROVAL AUTHORITY TO THE DIRECTOR

RESOLVED, that the National Science Board (Board) adopted the delegation of award-approval authority to the National Science Foundation (NSF) Director as below:

- (1) The Director of the National Science Foundation may make no award involving an anticipated average annual amount of the greater of either 1 percent or more of the awarding Directorate's or Office's prior year current plan *or* 0.1 percent or more of the prior year total NSF budget without the prior approval of the National Science Board.
- (2) The Director may make no award under any program of NSF that has not been approved by the Board when that program: (A) is expected to involve annual expenditure of more than 3 percent of the awarding Directorate's or Office's prior year current plan, (B) involves sensitive political or policy issues, or (C) will be funded as an ongoing NSF-wide activity.
- (3) The Director may make no award from the Major Research Equipment and Facilities Construction (MREFC) account without the prior approval of the Board.
- (4) Except as provided in paragraphs (1), (2), and (3) or by special resolution of the Board, the Board delegates to the Director authority to make any award within the authority of NSF.
- (5) When the Board approves an award, the Director may subsequently amend the award to change the expiration date of the award and/or to commit additional sums, not to exceed the lesser of 10 million dollars or 20 percent of the amount specified in the Board resolution. In the case of procurements, when the Board approves or authorizes the Director to make an award and no amount is specified in the Board resolution, the Director may subsequently amend the award to change the expiration date of the award and/or to commit additional sums not to exceed the lesser of 10 million dollars or 20 percent of the contract ceiling award amount.
- (6) This delegation supersedes and replaces the delegation of award-approval authority adopted by the Board in November 1999 (Attachment A to NSB-99-158) and amended by the Board in October 2007 (NSB-07-120).

*[signed]*  
Ray M. Bowen  
Chairman

**RESOLUTION**

NATIONAL SCIENCE BOARD

DELEGATION OF AUTHORITY TO THE EXECUTIVE COMMITTEE

RESOLVED, that the National Science Board (Board) reaffirmed the delegation of authority described below to the Executive Committee of the Board:

- (1) The Executive Committee of the National Science Board may approve awards where Board approval is required or otherwise act for the Board in those rare instances when immediate decision is required between Board meetings and when the necessary action is not within the authority of the Director of the National Science Foundation.
- (2) This delegation reaffirms and supersedes the delegation of authority adopted by the Board in November 1999 (Attachment B to NSB-99-158).

*[signed]*  
Ray M. Bowen  
Chairman

## **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.”<sup>3</sup>*

### Action Recommended

The National Science Board (Board) Task Force on Unsolicited Mid-Scale<sup>4</sup> 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 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<sup>5</sup>.

### Policy Objectives

The following issues will be analyzed by the Task Force:

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<sup>2</sup> Revised version approved at the February 16, 2011 Board Meeting

<sup>3</sup> Title 42 U.S. Code Section 1863(j)(2)

<sup>4</sup> Here, mid-scale refers to the financial size of the project.

<sup>5</sup> The definition of “mid-scale” represents an operation “ballpark” estimate for the Task Force and is not meant to indicate a rigid threshold.

- 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 within 12 months from the date that formation of the task force is approved. The Board Office will serve as the focal point for coordination and implementation of all task force activities.

Task Force Activity Timeline

|                 |   |
|-----------------|---|
| Summer 2010     | Collection of background information on current NSF funding mechanisms for unsolicited mid-scale research         |
| August 12, 2010 | Mid-Scale Research Task Force Teleconference  |
| August 26, 2010 | Approval of Task Force charge by full Board   |
| Fall 2010       | Continue information gathering at NSF   |
| Feb 2011        | Mid-Scale Research workshop   |
| Spring 2011     | Draft outline of workshop findings and preliminary recommendations submitted to workshop participants for comment |
| Summer 2011     | Preparation of report and recommendations   |
| August 2011     | Approval of the report and recommendations by the full Board  |

**National Science Board  
Committee on Strategy and Budget  
Task Force on Data Policies**

**Statement of Principles**

The progress of science and engineering has always been dependent on the collection of data through observation, experimentation and, more recently, computation. A core expectation of the scientific process is the documentation and sharing of results along with the underlying data and methodology, thereby allowing others to verify data, reproduce results or validate interpretations, and build upon previous work. The processes of peer review and formal publication have been pillars of scientific openness for centuries.

Recently, the increasing ease with which data can be gathered, processed, analyzed, and disseminated and funding of large-scale collaborative projects have greatly expanded the scale, scope and complexity of science and engineering data collections and highlighted the need for improved data policies. Furthermore, NSF has a commitment to broadening the participation of those involved in scientific and engineering research and education and access to data is intricately linked to this commitment. The accessibility of data created with NSF funds represents an opportunity to maximize the size and diversity of the user community for data.

The NSB is committed to the development, implementation and assessment of data sharing and data management policies for NSF-funded activities. This includes the sharing of results, data, physical collections and other supporting materials created or gathered in the course of NSF-funded work. The current policy appears in Chapter VI, Section D, of the NSF Proposal and Award Policies and Procedures Guide (pages VI-8 and VI-9 of NSF Document 10-1):

***4. Dissemination and Sharing of Research Results***

*a. Investigators are expected to promptly prepare and submit for publication, with authorship that accurately reflects the contributions of those involved, all significant findings from work conducted under NSF grants. Grantees are expected to permit and encourage such publication by those actually performing that work, unless a grantee intends to publish or disseminate such findings itself.*

*b. Investigators are expected to share with other researchers, at no more than incremental cost and within a reasonable time, the primary data, samples, physical collections and other supporting materials created or gathered in the course of work under NSF grants. Grantees are expected to encourage and facilitate such sharing. Privileged or confidential information should be released only in a form that protects the privacy of individuals and subjects involved. General adjustments and, where essential, exceptions to this sharing expectation may be specified by the funding NSF Program or Division/Office for a particular field or discipline to safeguard the rights of individuals and subjects, the validity of results, or the integrity of collections or to accommodate the legitimate interest*

*of investigators. A grantee or investigator also may request a particular adjustment or exception from the cognizant NSF Program Officer.*

*c. Investigators and grantees are encouraged to share software and inventions created under the grant or otherwise make them or their products widely available and usable.*

*d. NSF normally allows grantees to retain principal legal rights to intellectual property developed under NSF grants to provide incentives for development and dissemination of inventions, software and publications that can enhance their usefulness, accessibility and upkeep. Such incentives do not, however, reduce the responsibility that investigators and organizations have as members of the scientific and engineering community, to make results, data and collections available to other researchers.*

*e. NSF program management will implement these policies for dissemination and sharing of research results, in way appropriate to field and circumstances, through the proposal review process; through award negotiations and conditions; and through appropriate support and incentives for data cleanup, documentation, dissemination, storage and the like.*

The Board is working with NSF leadership and other science and engineering stakeholders to frame and examine current and emerging issues associated with science and engineering data and develop relevant policies. This preliminary statement of principles will guide these efforts.

Note:

- 1. Openness and transparency are critical to continued scientific and engineering progress and to building public trust in the nation's scientific enterprise. This applies to all materials necessary for verification, replication and interpretation of results and claims, associated with scientific and engineering research.*

**A strong statement about openness and transparency is an important first step.**

- 2. Open Data<sup>6</sup> sharing is closely linked to Open Access<sup>7</sup> publishing and they should be considered in concert.*

**This principle is included because there need to be bidirectional pointers between peer-reviewed and other published literature and the available supporting materials. All these materials need be made discoverable and the discoverability will require relevant metadata, ontologies, standards, etc., to be applied.**

- 3. The nation's science and engineering research enterprise consists of a broad array of stakeholders<sup>8</sup>, all of which should participate in the development and adoption of policies and guidelines.*

**It is important to recognize the many different stakeholders and their respective roles and current/potential responsibilities. Their involvement in the development and implementation of policies is crucial to successful implementation.**

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<sup>6</sup> Open Data refers to the concept and practice that certain data be made freely available, without restrictions, for no more than the cost of reproduction and distribution.

<sup>7</sup> Open Access publishing refers to the free availability of publications (either immediately upon publication or within a specified time period) on the public internet, permitting users to perform a variety of functions – read, download, copy, distribute, print, search, link, etc.

<sup>8</sup> Stakeholders include researchers, research institutions, research funders, various government agencies, professional societies, publishers, data repositories, data and metadata libraries and archives, and public advocacy groups.

4. *It is recognized that standards and norms vary considerably across scientific and engineering fields and such variation needs to be accommodated in the development and implementation of policies.*

**The statement will be important to signal that we do not anticipate a “one size fits all” solution.**

5. *Policies and guidelines are needed for open data sharing which in turn requires active data management.*

**Our primary goal is the sharing of data and other supporting materials. Once available for sharing, there is a need for proactive management and preservation for long-term accessibility. The policies, roles and responsibilities vary across these different but related functions.**

6. *All data and data management policies must include clear identification of roles, responsibilities and resourcing.*

**These 3 R’s are often omitted from consideration while the more technical aspects of policies are developed. However, in the increasingly complex scientific and engineering research enterprise, the likelihood of success will improve with consideration of the socio-economic issues that can impede or facilitate acceptance and implementation.**

7. *The rights and responsibilities of investigators are recognized. Investigators should have the opportunity to analyze their data and publish their results within a reasonable time.*