

**APPROVED MINUTES¹
OPEN SESSION
408TH MEETING
NATIONAL SCIENCE BOARD**

National Science Foundation
Arlington, Virginia
February 23-24, 2009

Members Present:

Steven C. Beering, Chairman
Patricia D. Galloway, Vice Chairman
Mark R. Abbott
Dan E. Arvizu
Barry C. Barish*
Camilla P. Benbow
Ray M. Bowen
John T. Bruer
Kelvin K. Droegemeier
José-Marie Griffiths
Esin Gulari
Louis J. Lanzerotti
Alan I. Leshner
G. P. “Bud” Peterson
Douglas D. Randall
Arthur K. Reilly
Diane L. Souvaine
Jon C. Strauss
Thomas N. Taylor
Richard F. Thompson

Arden L. Bement, Jr., *ex officio*

Members Absent:

G. Wayne Clough
France A. Córdova
Kathryn D. Sullivan

¹ The minutes of the 408th meeting were approved by the Board at the May 2009 meeting.

* Consultant

The National Science Board (Board, NSB) convened in Open Session at 2:05 p.m. on Tuesday, February 24, 2009 with Dr. Steven Beering, Chairman, presiding (Agenda NSB-09-8, Board Book page 263). In accordance with the Government in the Sunshine Act, this portion of the meeting was open to the public.

AGENDA ITEM 7: Approval of Open Session Minutes, December 2008

The Board unanimously APPROVED the Open Session minutes of the December 2008 Board meeting (NSB-08-123, Board Book page 281).

AGENDA ITEM 8: Chairman's Introduction and Report

In the Chairman's Introduction on Monday, February 23, 2009, and during the Chairman's Report of the Plenary Open Session on Tuesday, February 24, 2009, Dr. Beering announced and reported on several items.

a. Welcome to Acting NSF Deputy Director

Dr. Beering welcomed Dr. Cora Marrett to the Board table in her role as Acting NSF Deputy Director. Dr. Marrett served as the Assistant Director for Education and Human Resources (EHR) at NSF since February 2007, and as the first Assistant Director for the Directorate for Social, Behavioral and Economic Sciences (SBE) from 1992 to 1996.

b. Former Board Member Nomination

Dr. Beering also announced that since the last Board Meeting, former Board Member Dr. Jane Lubchenco was nominated to head the National Oceanic and Atmospheric Administration (NOAA). Dr. Lubchenco and Dr. John Holdren, President Obama's nominee to head the Office of Science and Technology Policy (OSTP), had their confirmation hearings on February 12, 2009.

c. NSB Communication Plan

The Chairman presented a draft of the Board's new Communication Plan (NSB-09-15, Board Book page 13) The plan, developed by Ms. Kim Silverman, Board Office staff, and Ms. Lisa-Joy Zgorski, Office of Legislative and Public Affairs (OLPA), outlines communications strategies to highlight the Board's role as a policy advising body. The objective is to establish an effective communications plan to increase awareness about the Board, its roles and responsibilities, and NSB studies and reports on a broad range of significant science and engineering, research and education policy topics.

The plan addresses various outreach mechanisms including: a re-design of the member "photo book;" presence on public information Web sites, including Wikipedia and Facebook, with the help of Dr. Matthew Wilson, Board Office AAAS Fellow; increasing the visibility of the Board website in results from search engines; using broadcast and webcast technologies for Board

policy reports and honorary awards; and establishing a network of former Board Members to promote and champion Board initiatives. The plan also proposes quantitative metrics to measure progress. Dr. Beering asked that Board Member comments on this new plan be provided to Dr. Craig Robinson, Acting Executive Officer.

d. Honorary Award Recipients

The Chairman announced that in the Executive Closed Session, the Board approved the recipient of the 2009 Alan T. Waterman Award:

- ♦ Dr. David Charbonneau, Associate Professor of Astronomy, Harvard University with the Harvard-Smithsonian Center for Astrophysics.

[The awardee was notified immediately following the Executive Closed Session.]

He also announced that at the December 2008 Board meeting, the Board approved the recipients of the 2009 Vannevar Bush and NSB Public Service Awards, which will be presented at the Board's annual awards dinner on Wednesday, May 13, 2009 at the Department of State's Diplomatic Reception Rooms:

- ♦ Vannevar Bush Award: Dr. Mildred Dresselhaus, Institute Professor and Professor of Physics and Electrical Engineering, Massachusetts Institute of Technology.
- ♦ "Individual" NSB Public Service Award: Dr. Roald Hoffmann, Frank H. T. Rhodes Professor Emeritus of Humane Letters and Professor of Chemistry, Cornell University.
- ♦ "Group" NSB Public Service Award: Project SEED (Summer Experiences for the Economically Disadvantaged), American Chemical Society (ACS).

e. *ad hoc* Committee on Nominating for NSB Elections

The *ad hoc* Committee on Nominating for NSB Elections, otherwise known as the Elections Committee, was appointed by the Chairman. Dr. Strauss will chair this committee and Drs. Randall and Taylor will serve with him. There will be two vacancies on the Executive Committee in May 2009 as the terms for Drs. Mark Abbott and Kathryn Sullivan end. The Elections Committee will prepare a slate of candidates for consideration and election at the May 2009 meeting for two 2-year terms from 2009 to 2011.

f. Board Member Recognition

Dr. G.P. "Bud" Peterson would soon be named President of Georgia Institute of Technology, and replace Board Member, Dr. G. Wayne Clough, the newly installed Secretary of the Smithsonian Institution and former President of Georgia Institute of Technology. Dr. Peterson currently serves as Chancellor of the University of Colorado at Boulder, a position he has held since 2006. He was previously the Provost at Rensselaer Polytechnic Institute in Troy, New York, for 6 years.

g. NSB Office Staff Introduction and Departure

The Chairman welcomed Ms. Betty Wong who joined the Board Office in February 2009 as a Program Analyst. A long-time NSF employee with the Office of Integrated Activities (OIA),

Betty will be working on the Board Office budget and other Board administrative operations. He also announced the departure of Mr. Brandon Powell, who worked for the Board Office for 2 years, who would join the Federal Air Marshals Program at the end of February 2009.

AGENDA ITEM 9: Director's Report and Presentation

Dr. Arden Bement, Jr., Director of the National Science Foundation (Foundation, NSF), reported on the following items:

a. NSF Staff Introduction

Dr. Harold Clarke joined NSF as Director, Division of Social and Economic Sciences (SES/SBE), on December 9, 2008. Dr. Clarke came to NSF from the University of Texas at Dallas where he was the Ashbel Smith Professor. He received his Ph.D. in 1971 from Duke University.

Dr. Thomas Peterson joined NSF as Assistant Director, Directorate for Engineering (ENG) on January 12, 2009. Dr. Peterson came to NSF from the University of Arizona, where he served as Dean of the College of Engineering. He received his Ph.D. in Chemical Engineering from the California Institute of Technology.

b. Congressional Update

Dr. Bement reported that President Obama signed the American Recovery and Reinvestment Act (ARRA) on February 17, 2009 at the Denver Museum of Science and Nature. The Act provides \$3 billion to NSF and is in recognition of the enormous role that NSF plays in job creation and innovation.

For FY 2009 appropriations, Congress was expected to take up the remaining FY 2009 appropriations bills in an Omnibus before the Continuing Resolution expires on March 6, 2009. On February 23, 2009, the House Appropriations Committee introduced a \$410 billion Omnibus bill. Under the bill, NSF would be funded at \$6.5 billion - \$363 million above the 2008 level.

Dr. Bement also reported on the following hearing and legislation. On February 26, 2009, Dr. Joan Ferini-Mundy, Division Director, Education and Human Resources' (EHR's) Research on Learning in Formal and Informal Settings, would testify before the House Science Committee's Subcommittee on Research and Science Education. On February 11, 2009, the House of Representatives passed H.R. 554, the National Nanotechnology Initiative Amendments Act of 2009 by voice vote. The bill was intended to strengthen and provide transparency in Federal research efforts to understand the potential environmental, health, and safety risks of nanotechnology.

AGENDA ITEM 10: Open Committee Reports

a. Executive Committee (EC)

Dr. Bement, EC chairman, provided an update on the status of the recruitment of Assistant Directors for SBE and the Directorate for Biological Sciences (BIO). He reported that he discussed the Committee on Equal Opportunities in Science and Engineering's (CEOSE's) interest in having the Board address the structure of the Broader Impact criterion. Additionally, he presented, and the committee discussed, a proposed plan on NSB priority setting, which EC will present to the full Board for approval at the May 2009 meeting.

b. Committee on Audit and Oversight (A&O)

Dr. Dan Arvizu, A&O chairman, noted that the search of the next NSF's Inspector General was proceeding smoothly. He also provided an update on activities related to partnerships with international organizations and the risks associated with them. Dr. Larry Weber, Director, Office of International Science and Engineering (OISE), was tasked to prepare a white paper in response to the forthcoming Organization for Economic Cooperation and Development (OECD) report on research ethics and accountability. The committee will provide input into that report.

For the agenda item relating to accountability under ARRA, Mr. Thomas Cooley, NSF Chief Financial Office (CFO), and Mr. Thomas (Tim) Cross, Interim Inspector General (IG), reported on the challenges in spending an unprecedented amount of funds in a responsible and transparent manner – within NSF and the grantee community - as NSF funds an additional \$3 billion by the end of FY 2010. The reporting requirements are detailed and include frequent agency and grantee reporting, with information to be posted on the “recovery.gov” Web site. Mr. Cross explained the IG role in the Act as ensuring the transparency and accountability required within the legislation and combating fraud, waste, and abuse in the use of those funds. The Office of Inspector General (OIG) was already engaged in planning its oversight activities.

Mr. Cross provided the IG's update and briefed the committee on efforts to launch the new IG Council, a product of the new IG Reform Act. He will continue Dr. Christine Boesz's efforts to lead an IG working group focused on misconduct in research.

Mr. Cooley noted the success of the FY 2008 financial audit outcomes and steps to sustain that success. He also discussed a review of controls related to international funding actions. Mr. Cooley noted activities being considered to mitigate the potentially high risks of these actions and improve practices and plans to develop additional data for further discussion.

Dr. Kelvin Droegemeier then discussed options for revising NSB award delegation thresholds to NSF, and discussion on this topic will continue at the May 2009 meeting with additional consideration given to the impact of cumulative award size, award duration, and the ARRA spending.

Ms. Emily Woodruff, OIG, presented the FY 2009 Audit Plan. In choosing its audit subjects, Ms. Woodruff explained that OIG develops a list of proposed audits from multiple sources and ranks them according to risk and potential impact in order to arrive at its final selection. Thirty percent of OIG's audit work is either obligated by law or requested by the agency. During follow-up conversations, Dr. Bement noted that NSF met with OIG and discussed how best to address audit activities including plans for audits that NSF will be arranging and paying for directly, in addition to the work that the OIG is undertaking.

c. Committee on Education and Human Resources (CEH)

Dr. John Bruer, CEH chairman, welcomed Dr. Diane Souvaine to the committee and the Expert Panel Discussion for the Next Generation of STEM Innovators. Dr. Bruer also introduced a new co-executive secretary, Dr. Jill Karsten, who leads GEO Education and Diversity efforts. The committee is also looking forward to working with Dr. Wanda Ward in her capacity as Acting EHR Assistant Director.

Dr. Bruer reported that Dr. Camilla Benbow provided the committee with an update on the planning of the workshop on preparing the Expert Panel Discussion for Preparing the Next Generation of STEM Innovators. She noted that the group reached general consensus on the agenda topics, meeting structure, and a pool of contributing participants. She indicated that there were two options for the workshop's dates, either August 3-4 or August 24-25, 2009. She also stated that the goal for the upcoming discussion with NSF professional staff [held immediately after the February 2009 Board meeting], was to refine and finalize the agenda as well as to review the list of contributing participants.

The committee then heard from Dr. Betty Tuller, Program Director, Division of Behavioral and Cognitive Sciences (BCS), SBE, and Dr. Gregg Solomon, Program Director, Division of Research on Learning in Formal and Informal Settings (DRL), EHR. They spoke on NSF's activities, challenges, and opportunities regarding basic social and behavioral research, and how it is relevant to teaching and learning. The presenters gave a broad overview of works on topics in cognitive science and their relevance to an applied science of learning, both from the SBE and the EHR perspectives. They emphasized an evolving understanding of what children understand and when as well as how children learn. Additionally, they noted opportunities in the transitional space between traditional SBE and EHR research activities, challenges that affect the research and/or application of findings for teacher development and student learning, and NSF's role to foster increased collaboration among basic and applied scientists and educators. Committee members and NSF presenters discussed specific facets of the presentations, particularly work on intelligent tutors and the possible relevance of social-psychological research to teaching and learning.

At the conclusion of the committee meeting, members were asked to reflect on what was presented and to provide the CEH chairman with recommended topics for the committee to consider. The aim is to identify a slate of topics to develop a consensus-based list of priority issues and topics around which future committee meetings and work might be organized.

d. Committee on Science and Engineering Indicators (SEI)

Dr. Louis Lanzerotti, SEI chairman, reported on the first SEI meeting as a standing committee of the Board. He reported that the committee considered two possible cover designs for *Science and Engineering Indicators (Indicators) 2010*, and selected a cover depicting a Mach I turbulence, developed with an NSF-funded visualization system used to develop, test, and validate theoretical models of turbulence.

The committee covered chapter review assignments. Draft chapters of *Indicators* are being compiled, and the May 2009 committee meeting will be devoted to discussion of chapter revisions in light of the Board and expert reviews. Board reviewers' chapter assignments were provided to Board Members (NSB/SEI-09-2, Board Book page 53), and Dr. Lanzerotti asked Board Members to notify him of any changes to the assignments. He also reminded Board reviewers to consider any additional topics that might be considered for possible inclusion for coverage in 2010 *Digest of Key S&E Indicators (Digest)*.

For the *Digest*, Mr. John Gawalt, Division of Science Resource Statistics (SRS/SBE), showed the committee prototypes of the print and Web designs for the *Digest*. Board Members were pleased with the way in which "general indicators" from the 2008 *Digest* were incorporated into the current "stories." Several committee members suggested useful content and format enhancements, and the SRS staff promised to address these. An *ad hoc* group of reviewers consisting of Drs. Bement, Clough, Gulari, Lanzerotti, and Leshner will continue to review new *Digest* materials as they are developed.

The committee discussed the Companion Piece document that would accompany *Indicators 2010*. Dr. Lanzerotti emphasized the need for the committee to focus on a topic and initiated the discussion by presenting a possible idea for a piece on Federal priority setting for research and development (R&D) (Board Book page 77). It was agreed that the Companion Piece topic required further discussion and Dr. Lanzerotti asked Board Members and committee members to send him their thoughts about the priority-setting proposal and other possible topics by March 23, 2009.

Dr. Lynda Carlson, SRS Director, described new data that will appear in *Indicators 2012*, and will address data gaps identified by the Board in *Indicators 2008*. These include data from an extensively redesigned survey on industry R&D, with new data on lines of business, technology areas, R&D employment, intellectual property, and innovation; expanded data on higher education R&D; and continuously updated data that will now be available on the science and engineering (S&E) workforce via the Census Bureau's American Community Survey.

e. Committee on Programs and Plans (CPP)

Dr. Kelvin Droegemeier, CPP chairman, reported that the committee had been working on a list of issues raised by CPP for committee consideration in 2009 and beyond as well as considering a revision to the CPP Charge. CPP anticipates input from EC on priority considerations for Board activities and postponed discussion on both topics until the May 2009 meeting. Dr. Droegemeier also called attention to the FY 2009 Schedule of Action and Information Items for NSB Review (NSB/CPP-09-7, Board Book page 35).

Dr. Joann Roskoski, BIO Executive Officer, presented an information item on the status of iPlant. iPlant, or the Plant Science Cyberinfrastructure Collaborative, is one of BIO's three synthesis centers. It does not focus on creating new data, but instead uses extant data to extract new knowledge. iPlant has a robust oversight system, including a project advisory team similar to those found for Major Research Equipment and Facilities Construction (MREFC) projects.

Dr. Tony Chan, Assistant Director, Directorate for Mathematical and Physical Sciences (MPS), presented an update on the Planning for Coherent Light Source Development. He noted that an NSF Advisory Panel was charged with providing guidance to MPS regarding the future role for NSF in light source facilities and instrumentation and was asked to provide information on all possible outcomes. The Panel released a report in November 2008, which recommended NSF continue to play a stewardship role for fourth generation light sources. MPS will likely bring an action related to coherent light source development before the Board at the August 2009 meeting.

Dr. Edward Seidel, Director, Office of Cyberinfrastructure (OCI), gave an update on Track 2D (High Performance Computing System Acquisition: Towards a Petascale Computing Environment for Science and Engineering). He noted that Track 2D awards will be cooperative agreements between NSF and the awardees. The solicitation is designed to encourage more innovation and broaden the range of high performance computing resources provided to the community. OCI received proposals in November 2008 and was conducting reviews and site visits. OCI expects to present recommendations for four awards to the Board at the May 2009 meeting.

The CPP chairman reported that during the last year, the committee has considered various modifications to the MREFC process that would create a more enhanced role for the Board. Dr. Abbott has led that review along with a working group that included Drs. Droegemeier, Lanzerotti, Griffiths, and Mr. Reilly as CSB chairman. One of the recommendations included the establishment of a CSB Subcommittee on Facilities (SCF). Mr. Cooley presented a proposed NSF implementation plan and a timeline for implementation. The new subcommittee expects to test the process at the May 2009 meeting using either GEO or MPS actions as a pilot.

CPP approved the draft report *Building a Sustainable Energy Future* (NSB/CPP/SE-09-1) for public comment, subject to additional edits submitted by Board Members and subject to final approval by the SE co-chairmen, CPP chairman, and Board Chairman. Based on the committee's recommendation:

The Board unanimously APPROVED the draft report *Building a Sustainable Energy Future* (NSB/CPP/SE-09-1) for public comment, subject to additional edits submitted by Board Members and subject to final approval by the SE co-chairmen, CPP chairman, and Board Chairman.

CPP Subcommittee on Polar Issues (SOPI), Dr. Strauss, chairman

Dr. Karl Erb, Director of the Office of Polar Programs, noted that despite rising fuel prices and fewer airplanes, several significant research goals were met or exceeded in the Antarctic season that ended in February 2009. Dr. Erb also gave special recognition to the Wisconsin Consortium

for its efficiency and to the 109th Airlift Wing of the New York Air National Guard for contributions to OPP's goals. He also noted that Canada recently passed an economic recovery act that includes \$86 million for renovating Arctic facilities, as well as substantial funding to design a major Arctic research station. A celebration of the 50th anniversary of the Antarctic Treaty signing will take place at a meeting in April 2009, and Secretary of State Hillary Clinton will open the meeting.

Dr. Erb also presented a synopsis of the Arctic Region Policy National/Homeland Security Presidential Directive that was signed by President Bush in mid-January 2009. This document supersedes the comparable directive signed in 1994 for Arctic Policy, and does not change current U.S. policy in the Antarctic. The U.S. will continue to be an active partner in the Arctic Council.

Finally, Ms. Renee Crain, OPP Research Support and Logistics Manager, and Ms. Valentine Kass, EHR Program Director, provided an overview of many International Polar Year (IPY)-related education activities. In collaboration with the National Air and Space Administration (NASA) and NOAA, NSF has invested \$15.6 million to support 27 education-related grants of which one-third involve international activities.

CPP Task Force on Sustainable Energy (SE) - Drs. Arvizu and Strauss, co-chairmen

Task force co-chairmen, Drs. Dan Arvizu and Jon Strauss, summarized recent revisions to the draft report, *Building a Sustainable Energy Future* (NSB/CPP/SE-09-1), which were based on comments from Board Members and NSF staff. Key revisions included a re-organization of the report's six themes, as well as the inclusion of a new appendix section. Dr. Arvizu reviewed the draft report's major findings, recommendations to the U.S. Government, and guidance to NSF. The task force discussed the importance of implementing an outreach strategy to U.S. Government stakeholders before the draft report is released for public comment. The task force recommended approval by CPP of the draft report for public comment.

f. Committee on Strategy and Budget (CSB)

The committee recommended the approval of the draft report, *Investing in the Future: NSF Cost Sharing Policies for Sustaining a Robust Federal Research Enterprise* (NSB-09-20) for publication, subject to final edits to be approved by the CS chairman, CSB chairman, and Board Chairman. Based on this recommendation:

The Board unanimously APPROVED the draft report, *Investing in the Future: NSF Cost Sharing Policies for Sustaining a Robust Federal Research Enterprise* (NSB-09-20) for publication subject to final edits approved by the CS chairman, CSB chairman, and Board Chairman.

CSB reviewed and discussed the draft Charge to the new CSB Subcommittee on Facilities (SCF) (NSB/CSB-09-4, Board Book page 215). It was noted that SCF would report to CSB providing guidance to CSB and the Board on strategic planning for the NSF-funded research equipment and facilities portfolio. This would include an annual review of existing MREFC and research and related activities (R&RA) large and medium-size research facilities and infrastructure, and

their impact on long-term budgets within NSF. The subcommittee review would include a look at all phases of the facility to include design, development, construction, operation, and retirement. The subcommittee would also have the important role of prioritizing projects that have successfully completed the conceptual design review and are being considered for preliminary design funding.

The committee anticipated that SCF will meet by teleconference prior to the May 2009 meeting. At the May 2009 Board meeting, the subcommittee will convene and work through its first review in a pilot mode, focusing on projects identified by NSF. As discussed with CPP, it is likely that for the first year of the subcommittee's work, SCF will only consider MREFC projects and serve as a limited pilot of the new process. In subsequent years, SCF will broaden its efforts to consider other large and medium-size facilities, as described in the draft Charge. Upon recommendation by CSB, the Board acted as follows:

The Board unanimously APPROVED the draft Charge to the CSB Subcommittee on Facilities (SCF) (NSB/CSB-09-4).

Dr. Beering announced that Dr. Griffiths will chair the new subcommittee and that Drs. Abbott, Barish, and Gulari will serve as members.

CSB continued its review of the NSF Strategic Plan Investment Priorities. A draft document reflecting the input from Board Members during and since the December 2008 CSB meeting was compiled and provided for review. Further input from Members was also sought and any insights will be incorporated before the May 2009 meeting when the committee will provide the document to the full Board for approval and then to NSF.

Lastly, CSB discussed the NSF budget update. Dr. Bement provided the committee with an update on the FY 2009 appropriations. He also provided a brief overview of ARRA and the implications for NSF. Plans for obligating the ARRA funds in a timely, transparent and accountable manner were also being developed. The combination of the anticipated FY 2009 appropriation coupled with the funds from ARRA would bring the 2009 budget of NSF to a potential funding total of \$9.492 billion.

CSB Task Force on Cost Sharing (CS) – Dr. Droegemeier, chairman

Dr. Droegemeier, CS chairman, reported on the status of the task force. The draft report, *Investing in the Future: NSF Cost Sharing Policies for a Robust Federal Research Enterprise* (NSB-09-20), was reviewed and discussed. This report incorporates the formal NSF policy statement and an implementation plan, which makes the report more comprehensive. There were minor edits suggested to Recommendations 1 and 5 to give authority to the NSF Director, rather than the NSF senior management, to review and approve mandatory cost sharing requirements. In addition, Dr. Bement raised an issue with Recommendation 8 because the language did not clearly convey the intent of the recommendation. The intent of Recommendation 8 was to recommend that NSF not create NSF-wide special exemptions applicable in all NSF programs for certain types of institutions, following-on the recommendation made in Recommendation 4 that individual programs be given discretion to implement cost sharing requirements that best fit the needs and goals of the program. The task force recommended approval by CSB of the draft report for publication.

Dr. Beering adjourned the Open Session at 2:40 p.m.

A handwritten signature in cursive script, reading "Ann A. Ferrante".

Ann A. Ferrante
Executive Secretary
National Science Board