

**APPROVED MINUTES¹
OPEN SESSION
406TH MEETING
NATIONAL SCIENCE BOARD**

University of Alaska, Fairbanks
Fairbanks, Alaska
September 22, 2008

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
Louis J. Lanzerotti
Alan I. Leshner
Douglas D. Randall*
Arthur K. Reilly
Jon C. Strauss
Richard F. Thompson

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

Members Absent:

G. Wayne Clough
Kathryn D. Sullivan
Thomas N. Taylor

¹The minutes of the 406th meeting were approved by the Board at the December 2008 meeting.

* Consultant pending Senate confirmation.

The National Science Board (Board, NSB) convened in Open Session at 11:22 a.m. on Monday September 22, 2008 with Dr. Steven Beering, Chairman, presiding (Agenda NSB-08-89, Board Book page 125). In accordance with the Government in the Sunshine Act, this portion of the meeting was open to the public.

Dr. Virgil (Buck) Sharpton, the University of Alaska, Fairbanks (UAF) Vice Chancellor for Research welcomed the Board to UAF. Both he and Dr. Beering thanked the UAF staff, especially Ms. Julie Benson, Assistant to the Vice Chancellor for Research, as well as the Board Office staff, particularly Ms. Beverly Sherman, for all the hard work they had done to arrange for the NSB meeting, retreat, and research site visits.

Before the proceedings began, Dr. Patricia Galloway, Vice Chairman, gave a presentation with slides of a Board research visit to the UAF Toolik Field Station (TFS) on Sunday, September 21, 2008. At TFS, Board Members were briefed on several research areas, which included the long-term ecological research (LTER) program, climate change on tundra, and fertilization of the river with nitrogen.

AGENDA ITEM 1: Approval of Open Session Minutes, August 2008

The Board unanimously APPROVED the Open Session minutes of the August 2008 Board meeting (NSB-08-79, Board Book page 127).

AGENDA ITEM 2: Closed Session Items for December 2008

The Board unanimously APPROVED the Closed Session items for the December 9-10, 2008 meeting (NSB-08-90, Board Book page 141).

AGENDA ITEM 3: Chairman's Introduction and Report

a. Webcast of NSB Open Sessions

For the first time, the NSB Open Sessions were Webcast. The Open Sessions of the Board at UAF were Webcast to the entire University of Alaska system.

b. NSB Office Staff Introduction

Dr. Beering introduced Dr. Matthew Wilson, who joined the Board Office staff as an American Association for the Advancement of Science (AAAS) Fellow. Among other responsibilities, Dr. Wilson will be working on STEM (science, technology, engineering, and mathematics) innovators with the Board's Education and Human Resources Committee (EHR). Dr. Wilson received his Ph.D. from the University of Pittsburgh, School of Medicine in 2004.

c. Presidential Nominees for NSB Class of 2014

Dr. Beering announced the names of Presidential Board nominees to the Board Class of 2014:

- Dr. France A. Córdoba, President, Purdue University,
- Dr. Esin Gulari, Dean of Engineering and Science, Clemson University,
- Dr. George P. (Bud) Peterson, Chancellor, University of Colorado at Boulder, and
- Dr. Diane L. Souvaine, Professor and Chair, Department of Computer Science, Tufts University.

The following Board Members were re-nominated to serve a second term:

- Dr. Barry C. Barish, Professor of Physics Emeritus and Director, LIGO Laboratory, California Institute of Technology,
- Dr. Ray M. Bowen, President Emeritus, Texas A&M University, and
- Dr. Douglas D. Randall, Professor and Thomas Jefferson Fellow, University of Missouri-Columbia.

d. Committee Announcements

The Board Chairman announced that Dr. John Bruer and Mr. Arthur Reilly will be members of the *ad hoc* Committee for the Vannevar Bush Award, chaired by Dr. Kathryn Sullivan.

He also announced that a former Board Member, Dr. Jo Anne Vasquez, will assume the chairmanship of the Public Service Award Advisory Committee from Dr. Warren Washington.

AGENDA ITEM 4: 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. Bement announced that Dr. Thomas W. Peterson was selected as the Assistant Director, Directorate for Engineering (ENG). Dr. Peterson has served as Dean of the Engineering College, University of Arizona (UA) since 1998, and will start at NSF in January 2009. Dr. Peterson was head of chemical and environmental engineering at UA, 1990-1998, and led the merger of those two programs. He received his Ph.D. in Chemical Engineering from the California Institute of Technology.

b. Congressional Update

For a congressional update, Dr. Bement reported that Congress was expected to pass a Continuing Resolution at the FY 2008 levels possibly until March 2009. He indicated that Congress was in recess for the month of August and early September 2008.

c. Presentation on NSF Response to NSB Recommendations, 2005 - 2008

Dr. Bement reported on the recommendations NSB has made to NSF management from 2005 to 2008. The purpose of this presentation was to provide a brief summary of the actions NSF has taken relative to the totality of the Board recommendations that were made during this 3-year period. Dr. Bement commented on the following 10 sets of recommendations in response to 10 NSB reports:

(1.) *National Science Board 2020 Vision for the National Science Foundation* (NSB-05-142), December 28, 2005

With input from the NSB and the community, NSF developed its *2006 -2011 Strategic Plan: Investing in America's Future*. The *Strategic Plan* explicitly addresses three enabling strategies identified by the Board in its recommendations, namely, providing infrastructure that enables transformative research, strengthening international and interagency partnerships, and maintaining the excellence of the NSF staff and management.

(2.) *Enhancing Support of Transformative Research at the National Science Foundation* (NSB-07-32), May 7, 2007

NSF took several specific steps to highlight and increase NSF's support of potentially transformative research. The Working Group on Facilitating Transformative and Interdisciplinary Research (FacTIR) was established in December 2007 to develop recommendations to facilitate transformative and interdisciplinary research across the Foundation. FacTIR is an NSF-wide working group that reports to the Office of Director. As reported to the Board in October 2007, NSF adopted a definition of transformative research, refined funding mechanisms to promote transformative research, and announced to the community through Important Notice No. 130 (dated September 24, 2007) the changes made by the Board in the Intellectual Merit Review criteria regarding transformative research. One of the funding mechanisms NSF is implementing to support transformative research is EARly-concept Grants for Exploratory Research (EAGER).

The NSF also developed its new Cyber-enabled Discovery and Innovation (CDI) initiative to solicit proposals that feature transformative research and to incorporate new practices for tailored panel review and selection of interdisciplinary proposals for funding. This new practice will be a test-bed to look at the further, broader application of this approach for interdisciplinary research. This work is ongoing as NSF continues to communicate the importance of promoting and supporting potentially transformative research, both internally and externally.

(3.) *Report to Congress on Pre-construction Funding and Maintenance and Operations Costs Associated with Major Research Equipment and Facilities at the National Science Foundation* (NSB-08-15), February 7, 2008

The Board made several recommendations regarding the Major Research Equipment and Facilities process. Dr. Kathie Olsen, NSF Deputy Director, made presentations to the Committee on Programs and Plans (CPP) in August and September 2008 and provided a summary of actions

on these recommendations, as well as other aspects of the Major Research Equipment and Facilities Construction (MREFC) process in which NSF would like to engage the Board more actively.

(4.) *Long-Lived Digital Data Collections: Enabling Research and Education in the 21st Century* (NSB-05-40), September 2005

The program on Sustainable Digital Data Preservation and Access Network Partners (DataNet) is a direct response to several NSB recommendations. Two recommended awards are scheduled for presentation to NSB at the December 2008 meeting. The second competition begins in November 2008.

The program on Community-Based Data Interoperability Networks (INTEROP) addresses the need for community engagement in developing standards for data-level interoperability as recommended by the Board. Seven awards were made in FY 2008, and another competition is scheduled to begin in July 2009.

With respect to a Board recommendation on data management, in May 2008 the NSF Data Working Group presented recommendations to NSF senior management regarding strengthening implementation of the existing NSF policy on data management requirements related to awards. At the request of NSF senior management, the Data Working Group arranged for two Town Hall meetings at NSF in August 2008 to gather input from NSF staff regarding the recommendations. Revised recommendations will be presented to NSF senior management in the fall of 2008.

NSF is also a participant in the National Science and Technology Council (NSTC) Interagency Working Group on Digital Data. This working group is tasked to develop a framework and strategic plan for digital data management, including preservation and access, across research agencies.

(5.) *National Action Plan for Addressing the Critical Needs of the U.S. Science, Technology, Engineering, and Mathematics Education System* (NSB-07-114), October 30, 2007

The Board made numerous recommendations to NSF to improve Science, Technology, Engineering, and Mathematics (STEM) education. NSF was in general agreement with the intent of the Board recommendations and made significant progress in many of these areas.

Dr. Bement highlighted a few of the developments relative to specific Board recommendations. He stated that it was important to remember that, particularly in the area of education, the America COMPETES Act mandated several new programs and requirements in specific areas that impacted the Foundation's priorities (COMPETES: Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science.) Also, again particularly in education, appropriations have established budgets at the program level that resulted in increases and decreases in comparison with the levels set in the NSF request.

As observed by the Board, it is important that support for STEM education and training activities be provided agency-wide, not only by the Directorate for Education and Human Resources (NSF EHR) but also all research and research related directorates and offices. The integration

of research and education is a primary thrust promoted by NSF. Several NSF STEM education and workforce initiatives are funded primarily or exclusively through the Research and Related Activities (R&RA) account. These programs are budget priorities, as reflected in recent budget requests. Additionally, many research grants address the broader impact merit review criterion through education and training activities.

To leverage its impact, NSF collaborates with other Federal agencies, such as the National Air and Space Administration (NASA), the National Institutes of Health (NIH), the Department of Energy (DOE), and the Department of Education. For example, in a current cooperative effort with DOE, NSF is supporting students and faculty involved in eligible NSF projects to conduct hands-on research at DOE laboratories during summer months.

With respect to the role of technology in education, which is another area of interest to the Board, NSF has numerous efforts underway. For example, the recent report of the NSF Task Force on Cyberlearning notes, “Cyberlearning offers new learning and educational approaches and the possibility of redistributing learning experiences over time and space, beyond the classroom and throughout a lifetime.”

NSF has several programs that support projects that advance the use of technology and cyberlearning in education. An example of an agency-wide effort is CDI, which is a bold initiative to support the development of far-reaching, high-risk science and engineering research and education agendas that capitalize on innovations in, and/or innovative use of, computational thinking. This initiative integrates education with research to advance computational thinking.

With respect to supporting behavioral and cognitive scientists in educational research as suggested by the Board, the Science of Learning Center Program has been an important activity managed by the NSF Directorate for Social, Behavioral, and Economic Sciences (SBE), and represents a growing partnership between SBE and NSF EHR.

Finally, the National Governors Association and NSF together recently hosted a workshop and exhibition on science education and workforce development. One of the outcomes of this activity was the development of a “Science and Innovation” prototype Web site that will highlight outcomes of NSF-funded work in research and education on a state-by-state basis.

(6.) *Moving Forward to Improve Engineering Education* ([NSB-07-122](#)), November 19, 2007

In its recommendations, the Board endorsed NSF’s current efforts in engineering education and suggested that several of these be expanded or enhanced. These areas include engineering education research with dissemination of results; efforts to broaden the education of engineering students; public outreach promoting engineering careers; and expanded participation in several NSF-wide programs such as Research Experiences for Undergraduates (REU), Integrative Graduate Education and Research Traineeships (IGERT), Advancement of Women in Academic Science and Engineering Careers (ADVANCE), Graduate Research Fellowships (GRF), Research Experiences for Teachers (RET), and NSF graduate teaching fellows in K-12 education (GK-12).

(7.) *International Science and Engineering Partnerships: A Priority for U.S. Foreign Policy and Our Nation's Innovation Enterprise* (NSB-08-4), February 14, 2008

The NSF Office of International Science and Engineering (OISE), housed in the Office of the Director, provides a lead role in working with the directorates and other offices to promote building international partnerships while implementing practices recommended by the Board. For example, OISE promotes, both within NSF and to the larger community, the NSF's practice of providing supplemental funding for investigators to include international components in its proposal. OISE also facilitates research matchmaking as well as provides assistance for organizational and other issues in international partnerships.

A recent development related to a recommendation by the Board is the Memorandum of Understanding (MOU) between NSF and the United States Agency for International Development (USAID). With this MOU, USAID and NSF seek to leverage respective resources and investments to pursue broadly scoped initiatives focused on supporting research and higher education projects which is aimed at building capacity in developing countries.

(8.) *Guidance for National Science Foundation, Average Award Size and Duration, and Proposal Success* (NSB-08-14), January 22, 2008

The Board made several recommendations based on the NSF Study: Impact of Proposal and Award Management Mechanisms (IPAMM). Several of the IPAMM recommendations have been implemented, which include the following: improved accessibility to NSF funding data, improved communications with internal and external communities when implementing new management practices, and use of practices to help break the decline-revise-resubmit cycle. The Foundation continues its efforts to strike an appropriate balance between considerations such as funding rates and award size. Long-term planning must take into account growth in various research communities.

(9.) *Report to Congress on Cost Sharing Policies at the National Science Foundation* (NSB-08-17), February 7, 2008

As stated by the Board, NSF reinstated cost sharing for three programs: Engineering Research Centers, Experimental Program to Stimulate Competitive Research (EPSCoR), and Industry/University Cooperative Research Centers (IUCRC). As required by the America COMPETES Act, NSF also reinstated cost sharing for Ph.D. granting institutions in the Major Research Instrumentation (MRI) Program. The specific goals and expected outcomes of cost sharing are stated in the relevant program solicitations.

As recommended by the Board, NSF continued its practices to ensure no inappropriate use of voluntary cost sharing and that institutions understand requirements regarding tracking and reporting of mandatory cost sharing. The ongoing cost sharing discussions being held by the Board are informing NSF's policies, and, likewise, the Board will continue to be apprised of the NSF cost sharing policies and impacts of those policies.

10.) *Hurricane Warning: The Critical Need for a National Hurricane Research Initiative* (NSB-06-115), January 12, 2007

NSF placed a high priority on research related to hurricanes. In FY 2007, NSF awarded approximately \$14 million to about 80 research projects dealing with the geophysical, social and engineering aspects of hurricane processes and the resultant impacts on society and the environment.

As recommended by the Board, NSF coordinates activities with other relevant agencies, including National Oceanic and Atmospheric Administration (NOAA), NASA, and the Department of Defense (DOD). The coordinated efforts take into account the priorities related to hurricanes under development by the Disaster Reduction Subcommittee of the NSTC's Committee on Environment and Natural Resources Research. These coordinated efforts include the following:

- NSF and NOAA: hurricane forecasting using NSF Track 2 Teragrid Center as part of the Texas Advanced Computing Center and its Ranger Computer
- NSF, NOAA, NASA, Office of Naval Research (ONR), and international partners: study of tropical systems from formation, through maturity, to eventual recurvature and downstream effects.
- NSF, NOAA, DOD, and NASA: study of Atlantic Ocean pre-storm disturbances.
- NSF and NOAA: next generation numerical weather forecasting models for hurricane research.
- NSF and NOAA: fundamental understanding of the communication of hurricane outlooks, forecasts, watches, and warnings both to decision makers, such as emergency managers and elected officials, and to the general public.

AGENDA ITEM 5: Open Committee Reports**

Committee on Programs and Plans (CPP)

Dr. Kelvin Droegemeier, CPP chairman, reported that the committee heard an information item from Dr. Lawrence Goldberg, Acting Division Director, Division of Electrical Communications and Cyber Systems (ECCS), on the National Nanotechnology Infrastructure Network via teleconference from NSF in Arlington, Virginia. This is an information item that will precede an action item coming before the Board in December 2008. The committee noted that the 6-month rule would, in principle, be violated if this item came before the Board in December 2008 with the renewal becoming effective in March 2009. Dr. Olsen commented that she will address that issue.

The CPP chairman reported that the committee discussed the NSF Major Research Facilities and MREFC Process. Dr. Olsen gave a briefing on the Horizon projects, and Dr. Mark Abbott gave a briefing on his thoughts and plans for modifying the process to more effectively engage the

** Only the Committee on Programs and Plans and its Task Force on Sustainable Energy held meetings in September 2008.

Board in a variety of issues related to cost management and planning. Both Drs. Olsen and Abbott will work on a draft implementation plan to come before the Board in December 2008 and possibly a final plan will be considered in February 2009. Dr. Droegemeier commented that the committee would be taking up the issue of facilities more broadly.

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

The task force reviewed the roundtable discussion held on September 4, 2008 at the University of California, Berkeley. The task force also discussed a list of draft major findings and recommendations for inclusion in a future draft report. Numerous comments and insights were provided from the SE members and other Board Members. SE will revise and develop a consensus position on findings and recommendations that will provide the basis of a more comprehensive draft report.

Dr. Beering adjourned the Open Session at 12:00 Noon.

[signed]
Ann A. Ferrante
Executive Secretary
National Science Board