

**APPROVED MINUTES¹
OPEN SESSION
423RD MEETING
NATIONAL SCIENCE BOARD**

National Science Foundation
Arlington, Virginia
December 13-14, 2011

Members Present:

Ray M. Bowen, Chairman
Mark R. Abbott
Dan E. Arvizu
John T. Bruer
France A. Córdova
Kelvin K. Droegemeier
Patricia D. Galloway
José-Marie Griffiths
Louis J. Lanzerotti*
Alan I. Leshner
W. Carl Lineberger
G.P. “Bud” Peterson#
Douglas D. Randall
Arthur K. Reilly
Anneila I. Sargent
Diane L. Souvaine
Arnold F. Stancell
Claude M. Steele#
Richard F. Thompson

Subra Suresh, *ex officio*

Members Absent:

Esin Gulari, Vice Chairman
Bonnie L. Bassler*
Camilla P. Benbow
Thomas N. Taylor
Robert J. Zimmer

¹ The minutes of the 423rd meeting were approved by the Board at the February 2012 meeting.

* Consultant

#Attended the Plenary Open Session at 1:15 p.m., but absent from the Plenary Open Session at 11:45 a.m.

The National Science Board (Board, NSB) convened in Open Session at 11:45 a.m. on Wednesday, December 14, 2011, with Dr. Ray Bowen, Chairman, presiding (Agenda NSB-11-72, Board Book page 226). In accordance with the Government in the Sunshine Act, this portion of the meeting was open to the public.

AGENDA ITEM 8: Presentation: “Data Driven Discovery in Science,” Dr. Alexander Szalay, Alumni Centennial Professor of Astronomy, Professor in the Department of Computer Science, The Johns Hopkins University

Dr. Alexander Szalay is a cosmologist, working on the statistical measures of the spatial distribution of galaxies and galaxy formation. Also, he is the architect for the Science Archive of the Sloan Digital Sky Survey, and Project Director of the NSF-funded National Virtual Observatory. (Brief biography, Board Book page 244; presentation slides, Board Book Addendum)

Dr. Szalay presented the “big data” picture in science, and explained that science is increasingly driven by large data sets. Although large data sets are here, solutions have yet to be determined. Science is moving from hypothesis-driven to data-driven, and new “microscopes” and “telescopes” are needed for data. He explained that big data is a convergence of physical and life sciences as well as statistics and computer science, and that society needs to start training the next generation to be able to deal with big data in the future.

In the interest of time, questions from Board Members to the guest speaker were addressed during the luncheon following the presentation that was attended by Dr. Szalay and Board Members.

Dr. Bowen adjourned this portion of the Open Session at 12:15 p.m.

The Board reconvened in Open Session at 1:15 p.m. on Wednesday, December 14, 2011 with Dr. Bowen presiding (Agenda NSB-11-72, Board Book page 226). In accordance with the Government in the Sunshine Act, this portion of the meeting was open to the public.

AGENDA ITEM 9: Approval of Open Session Minutes, September 13, 2011

The Board unanimously APPROVED the Open Session minutes of the September 13, 2011 Board meeting (NSB-11-70, Board Book page 245).

AGENDA ITEM 10: Chairman’s Report

In the Chairman’s Introduction on Tuesday, December 13, 2011 and during the Chairman’s Report in the Plenary Open Session on Wednesday, December 14, 2011, Dr. Bowen announced and reported on several items, and held an open discussion with Board Members.

a. Continued Discussion of Issues from the Board Retreat in September

Dr. Bowen opened the floor to Board Members for a continuation of discussion items brought up at the Board Retreat in September 2011, and indicated that this portion would be an open discussion forum without decision making. For their reference, Board Members were provided with “Discussion Notes” along with an “Assessment” summary of the topics covered during the Retreat.

During the discussion, Dr. Bowen and Board Members addressed the following topics:

- The role of the Executive Committee in the creation and approval of the Board agenda. Dr. Bowen will ask the Executive Committee to examine its role in approving the agenda, and the Board might build a new procedure for this process.
- The Board’s role as an organization that provides advice to Congress and the Executive Branch, and the possibility of establishing a subcommittee to do a priority report. Dr. Bowen will interact with the Executive Committee to set up the next step in the process to define this topic as a Board study for the Board’s review.
- The Board’s input in international science for NSF. Dr. Bowen stated that the Board should fold-in its possible contributions with NSF’s aspirations, and that the Board will try to frame a project on this topic.
- Committee meetings with the NSF Assistant Directors (ADs). The meetings have been helpful, and the Board looks forward to meetings with ADs next year. Dr. Bowen stated that these meetings need to get built into the regular pattern of business.
- Workload issues to include the amount of work that needs to be done and the Board’s requirements placed on NSF. This topic may also have some role with regard to the budget and the Committee on Strategy and Budget (CSB) and Committee on Programs and Plans (CPP) type of activities.
- The production of *Science and Engineering Indicators (Indicators)*. Are there better ways to ease the workload either within NSF or the Board in terms of production? Also, are there better ways to make *Indicators* available - with new tools, techniques, and approaches - to make the product of the Board and NSF more accessible?
- Program portfolio review and the connection between the science drivers and facilities. The question of how to handle sunseting or recompetition projects as part of this review, because sometimes facilities get proposed and the science moves on.
- Facilities operations and maintenance. As we are beginning to mortgage the future to a large extent as these facilities come online. The NSF Director’s issues on non-NSF payments might be a way to bring in extra revenue to operate and maintain facilities. It could be viewed as a CSB/CPP issue.
- Whether or not the CPP Subcommittee on Polar Issues (SOPI) should continue as a separate subcommittee or be rolled back into the regular business of CPP. Dr. Michael Van Woert, NSB Executive Officer and Board Office Director, will look into the background of SOPI. The Board will then evaluate whether the reasons for establishing this unit still apply today, and the Board, in due process, will make a decision about SOPI as a separate Board entity.
- Interactions with the NSF Advisory Committees. Dr. Subra Suresh, NSF Director, will try to find a mechanism for these conversations.

Dr. Bowen concluded that he and Dr. Van Woert will provide feedback on these topics and next steps. He encouraged Board Members to e-mail them with any other ideas.

b. Candidate Site for 2012 Board Retreat and Off-Site Meeting

During the Plenary Executive Closed Session, the Board reviewed and discussed proposed sites for the 2012 Board office meeting and retreat to be held in September 19-20, 2012. The Board decided to collect additional information and address this item at the February 2012 meeting.

c. Board Member Confirmations and Nomination

Dr. Bowen made the following announcements regarding recent Board Member confirmations:

- Dr. Anneila Sargent was confirmed by the Senate on November 18, 2011, and replaced Dr. G. Wayne Clough, for the Class of 2016.
- Dr. Arnold Stancell was confirmed by the Senate on September 26, 2011, and replaced Dr. Barry Barish, for the Class of 2014.
- Dr. Claude Steele was confirmed by the Senate on November 18, 2011, and replaced Dr. Elizabeth Hoffman, also for the Class of 2014.
- Dr. Robert Zimmer was confirmed by the Senate on September 26, 2011, and replaced Dr. Jon Strauss, for the Class of 2016.

Additionally, Dr. Bowen announced the following Board Member nomination:

- Dr. Bonnie Bassler was nominated by the President on October 20, 2011, to replace Dr. Steven Beering, for the Class of 2016.

To the newest Board Members, Dr. Bowen stated that the Board was delighted to welcome them as new Members. He added that they could be proud to be selected to this unique and uniquely important body, whose Members are appointed by law “solely on the basis of established records of distinguished service.”

d. Committee Announcement

The Chairman discharged the *ad hoc* Committee on Nominations for the Class of 2012 - 2018 with thanks for their considerable efforts to Dr. Droegemeier, chairman, and members Drs. Córdova, Lineberger, Randall, and Peterson, as well as Ms. Kim Silverman, Board Office staff, who served as Executive Secretary.

e. Board Member Recognition

Dr. Bowen announced the following recent recognitions bestowed upon Board Members.

Dr. Mark Abbott recently received the 2011 Jim Gray eScience Award. Each year, Microsoft Research presents this award to a researcher who has made an outstanding contribution to the field of data-intensive computing. The award recognizes innovators whose work makes sciences easier for other scientists. Dr. Abbott is Dean and Professor of the College of Oceanic and Atmospheric Sciences at Oregon State University.

Dr. Bonnie Bassler was named the 2012 Laureate for North America of the L'OREAL -UNESCO Awards "For Women in Science." Created in 1998, the awards recognize five outstanding women researchers who have contributed to scientific progress. Each year, a Laureate is chosen from each of five distinct regions. Dr. Bassler is a Professor in the Department of Molecular Biology at Princeton University, and a Howard Hughes Medical Institute Investigator. The awards ceremony will take place in March 2012 at the UNESCO Headquarters in Paris.

Dr. France Córdova was elected to a 3-year term as chairman of the Smithsonian Board of Regents. Dr. Córdova, who is an astrophysicist and President of Purdue University, will represent the Board of Regents in dealings with the Smithsonian Secretary and senior management. She will also work in partnership with the Secretary to carry out the policies of the Smithsonian.

Dr. Louis Lanzerotti was selected as the 2011 American Geophysical Union (AGU) William Bowie Medalist. The medal is awarded for "outstanding contributions to fundamental geophysics and for unselfish cooperation in research." Dr. Lanzerotti is the Distinguished Professor of Physics at the New Jersey Institute of Technology. The award was presented on December 7, 2011 at the 2011 AGU Fall Meeting in San Francisco.

Additionally, Dr. Bowen also mentioned the recognition bestowed upon Dr. Richard Tapia, a Member of the Board from 1996 to 2002 and a Rice University mathematician. Dr. Tapia received the National Medal of Science from President Obama in October 2011. The medal is the highest national honor for a U.S. scientist. His citation reads, "For his pioneering and fundamental contributions in optimization theory and numerical analysis and for his dedication and sustained efforts in fostering diversity and excellence in mathematics and science education."

f. Board Office Staff Introduction

Dr. Bowen welcomed Dr. Lisa Nichols to the Board Office staff (as of September 2011). Dr. Nichols is an Association for the Advancement of Science (AAAS) Science and Technology Policy Fellow, and will serve a 1-year term in the Board Office. She earned a Ph.D. in Neuroscience from Purdue University, and performed her dissertation research at the National Institute of Mental Health (NIH) through the NIH Graduate Partnership Program. A manuscript of her work relating to Alzheimer's disease and memory processing in healthy adults was recently accepted for publication in the *Archives of General Psychiatry*. Dr. Nichols will work on a number of STEM-related issues for the Board Office.

g. Webcast of Board Meeting

For the second time, the Board meeting held in Arlington, Virginia, was Webcast and simultaneously available to viewers over the Internet. The Webcast included all Plenary Open Sessions of the full Board as well as Open Sessions of its committees, subcommittees, and task forces. The Webcast link, <http://www.tvworldwide.com/events/nsf/111213/>, is available from the NSB and NSF Web sites.

AGENDA ITEM 11: Director's Report

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

a. NSF Staff Introductions

Dr. John C. Wingfield began serving as Assistant Director, Directorate for Biological Sciences on September 6, 2011. Prior to his reassignment, Dr. Wingfield served as Division Director for Integrative Organismal Systems (IOS) in the Directorate for Biological Sciences (BIO) from 2010. Dr. Wingfield came to NSF from the University of California - Davis where he served as a Professor in the Department of Neurobiology, Physiology, and Behavior. He received his Ph.D. in Zoology and Comparative Endocrinology from the University College of North Wales in 1970.

Dr. Cynthia Dion-Schwarz joined NSF on August 28, 2011 as Deputy Assistant Director, Directorate for Computer and Information Science and Engineering (CISE). Dr. Dion-Schwarz transferred to NSF from the Department of Defense, Defense Research and Engineering where she was the Director, Information Systems and Cyber Security. Dr. Dion-Schwarz has held a number of executive and managerial positions in the Department of Defense and the Naval Research Laboratory. She received her Ph.D. in Physics from the University of Maryland in 1995.

Mr. Paul Perez joined NSF as Director, Division of Administrative Services (DAS), Office of Information and Resource Management (OIRM) on August 14, 2011. Mr. Perez came to NSF in May 2010 as Chief, DAS Facilities and Operations Branch. Before coming to NSF, Mr. Perez served in managerial positions at the Export-Import Bank of the U.S., the National Institutes of Health, and the Department of Homeland Security. He is a veteran of the U.S. Army, and received his BA degree from New York Regents University.

b. Congressional Update

On December 1, 2011, Dr. Kelly Falkner, Deputy Director, Office of Polar Programs (OPP), testified on behalf of NSF before the House Committee on Transportation and Infrastructure's Subcommittee on Coast Guard and Maritime Transportation. The subject of the hearing was Protecting U.S. Sovereignty: Coast Guard Operations in the Arctic. Dr. Falkner discussed how NSF is meeting its icebreaking needs for research in the Arctic, as well as for research and operations of the U.S. Antarctic Program. Dr. Suresh recognized Dr. Falkner for her tremendous job on behalf of NSF on such short notice.

The most important congressional development since the last NSB meeting was the passage of the "mini-bus" on November 17, 2011 of a bill that included the FY 2012 NSF Appropriations. The bill provided NSF \$7.033 billion, a \$173 million, or 2.5 percent, increase above the FY 2011 enacted level. Having an Appropriations bill signed into law on November 18, 2011 was the earliest that NSF had received its full-year Appropriations in 11 years. The bill also provided NSF the authority, for the first time, to transfer into any account up to 15 percent of its appropriation, as well as transfer authority for the Major Research Equipment and Facilities Construction (MREFC) account.

Although he already privately thanked each of them, Dr. Suresh publicly recognized the House and Senate Committees on Appropriations, Subcommittees on Commerce, Justice, Science, and Related Agencies - Chairman Frank Wolf and Ranking Member Chaka Fattah, and Chairman Barbara Mikulski and Ranking Member Kay Hutchison respectively - for their considerable efforts on behalf of NSF. Congress' support showed a vote of confidence for NSF during these difficult economic times.

AGENDA ITEM 12: Open Committee Reports

[Note: The Executive Committee (EC) did not meet in December 2011.]

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

Mr. Arthur Reilly, A&O chairman, reported that Ms. Allison Lerner, NSF Inspector General (IG), presented an update on the Office of the Inspector General's (OIG's) recent activities. She testified before Congress twice during November 2011: at a Senate Homeland Security and Governmental Affairs hearing on "Weeding Out Bad Contactors," and before the House Committee on Science, Space, and Technology Subcommittee on Investigations and Oversight to speak about American Recovery and Reinvestment Act (ARRA) oversight. The IG reported that her office continues to work with the agency, Defense Contract Audit Agency (DCAA), and the financial auditors to resolve the issue of how NSF oversees the use of contingency costs in cooperative agreements. The parties are reaching out to Office of Management and Budget (OMB) to help interpret their guidance in this area. She concluded by stating that the Government Accountability and Transparency Board, to which she was appointed, will be sending a report to the President today proposing methods to increase accountability and transparency of all Federal funds.

Mr. Sal Ercolano, Clifton Gunderson LLP and Partner-in-Charge of the NSF financial statement audit, presented the results of his final report. The auditors gave NSF its 14th consecutive unqualified "clean" opinion, and found no material weaknesses. In addition, the auditors found that NSF had substantially corrected last year's one significant deficiency, "Monitoring of Cost Reimbursement Contracts," and they have therefore downgraded its significance. However, a part of that deficiency, "Monitoring of Construction Type Cooperative Agreements," will remain classified as significant for the coming year. This issue refers to the manner in which the agency budgets and manages contingency costs, something that A&O has been actively monitoring. Mr. Ercolano recommended continued communications between the agency and the auditors to resolve this issue. Regarding the Federal Information System Management Act (FISMA) report on NSF's IT security program, Mr. Ercolano stated that no significant deficiencies were found. However, three of seven matters classified last year as "other weaknesses" remain outstanding, and are likely to take time to resolve.

Ms. Martha Rubenstein, NSF Chief Financial Officer (CFO), discussed the audit and NSF's pleasure at the removal of last year's significant deficiency on contracting. Although NSF disagrees with the auditor's conclusions on this year's finding on contingencies, she and NSF have committed to ongoing improvement of business processes. At the request of Dr. Bowen, she gave a brief tutorial on the difference between risk-based contingency budgeting and actual expenditures of funds in accordance with the applicable cost principles. Ms. Rubenstein also provided an

update on the new financial system, NSF membership on the new interagency Council on Financial Assistance Reform (COFAR), and a myriad of new Administration issuances that will require significant work by NSF on addressing cost efficiencies, ARRA spending acceleration and oversight of conference expenditures.

Ms. Amy Northcutt, NSF Chief Information Officer (CIO), reported that NSF looks forward to receipt of the FY 2010 FISMA report. NSF is pleased that Clifton-Gunderson has reported no significant findings in this year's report. She also announced that the Department of Homeland Security awarded NSF the "2011 Federal Cybersecurity Award" for "Best Security Posture for a Small Agency."

Dr. Judith Sunley, Acting Chief Human Capital Officer, covered two items: the Staff Engagement, Education, and Development (SEED) program; and the new requirement that NSF develop a plan for diversity and inclusion in its workforce. The SEED program aims to create learning and development opportunities for NSF's administrative professionals that enable them to enhance work performance and develop skills for advancement. Executive Order 13583 required the development of both Government-wide and agency plans for diversity and inclusion in the workforce.

Dr. Brett Baker, Assistant IG for Audit, presented the OIG FY 2011 Audit Plan. He stated the audit's chosen focus on what represents the greatest risk to NSF, and explained the factors that are considered in making that determination. OIG is implementing a new audit planning methodology that uses data analytics to better identify high risk areas for further audit. Dr. Baker then discussed some of the audit projects that are planned for the coming year. They are varied and include an audit of the Alaska Region Research Vessel (ARRV) and an analysis of the impact of increased workload on the Office of Budget, Finance, and Award Management (BFA). (Presentation Book)

Lastly, Dr. Dedric Carter, the Director's Senior Advisor for Strategic Initiatives, reported on the NSF Committee on Sensitive Information and Personally Identifiable Information, which was convened by Dr. Suresh in response to congressional inquiries and an incident in late 2010. He gave a preview of some of the draft recommendations expected at the end of calendar year 2011. The committee, which engaged broadly within NSF, expressed an overall goal of implementing modern, professional business and best practices for management of sensitive information both in electronic and paper form and in reducing the volume of sensitive information outside NSF's critical business systems and secure physical places. The committee expects to encourage NSF to take a swift approach to address concerns that are tempered with business reality and caution with respect to business disruption.

b. Committee on Education and Human Resources (CEH)

Dr. Douglas Randall reported on behalf of Dr. Camilla Benbow, CEH chairman. He stated that the committee initiated a discussion of the NSF strategic priorities for STEM education and education research. This topic will be the primary focus of the February 2012 CEH meeting. The goal of the discussion was to establish some of the foundations for a deeper conversation.

The first agenda item focused on the broad Federal context for STEM education and NSF's role within that context. Dr. Michael Feder, Policy Analyst, Office of Science and Technology Policy

(OSTP), provided an update on activities of the National Science and Technology Council (NSTC) Committee on STEM Education (also known as Co-STEM) and summarized key findings of the recently completed inventory of STEM education investments at 11 Federal agencies. (Presentation Book) The OSTP data demonstrates NSF's important and dominant contributions to STEM education at the Federal level, particularly in the areas of basic STEM education research and post-secondary STEM education, and also reveal the complementary focus of NSF's investments compared with those of the Department of Education.

The inventory reveals limited overlap among the different agencies, but identifies some opportunities for greater coordination, collaboration, and efficiency. These factors will be emphasized in a cohesive 5-year strategic framework for Federal STEM education investments currently under development at OSTP. When the strategic framework has been released in February 2012, Co-STEM expects to invite input from outside experts to help flesh out specific details based on more detailed evaluation of past investments.

Dr. Joan Ferrini-Mundy, Assistant Director, Directorate for Education and Human Resources (EHR), and Dr. Timothy Killeen, Assistant Director, Directorate for Geosciences (GEO), also provided brief comments about internal NSF conversations underway regarding STEM education priorities. These discussions were focused on: identifying valuable internal and external partnerships; strengthening the research and development (R&D) and evaluation base upon which educational practice decisions are being made; augmenting the use and impact of collaborations between EHR and the research and related activities (R&RA) directorates; addressing the national diversity crisis; and developing an action agenda to make real impact in STEM education. They invited Board input to help NSF define a clear statement of intent regarding specific focus areas; articulate NSF's proper role, goals, and objectives; and craft an appropriate implementation plan that can be evaluated for impact.

Subsequent CEH discussion considered whether relevant lessons learned may exist within the health and medical fields, which have made significant advances over the past century. The question of whether NSF's primary goal is general public science literacy or development of the future scientific workforce also arose, and CEH expects that this question will be a major topic of discussion at the February 2012 meeting.

The remainder of the committee meeting highlighted examples of NSF's current STEM education research portfolio to show the breadth of these activities and the opportunities for transitioning the results of such research for greater strategic impact. The committee heard a presentation by Dr. Douglas Clements, Distinguished Professor of Learning and Instruction, University of Buffalo, State University of New York (SUNY), on some of his elementary math education research. He illustrated a multi-step sequence for developing and testing a new curriculum and taking it to scale – a model that could be generalized for other types of STEM education research. (Presentation Book)

Dr. Clement's curricular approach shows significant impact at small scales in student performance. Subsequent research by the team examined the question of scale-up and the importance of adding in technology-enhanced instruction, professional development, and assessment. Providing educators with an understanding of the theory behind learning trajectories and the

curriculum for educators has found to greatly improve student learning and substantial reduction of achievement gaps for minority students is also observed.

Additionally, subsequent discussion by the committee considered other contributing factors, such as parental involvement and socio-economic status, comparisons with educational approaches in other countries like Singapore, and the long timescales needed to complete an end-to-end STEM education research effort.

c. Committee on Science and Engineering Indicators (SEI)

Dr. José-Marie Griffiths, SEI chairman, reported that Mr. Rolf Lehming, Director, National Center for Science and Engineering Statistics (NCSES), *Science and Engineering Indicators (Indicators)* Program, summarized that *Indicators* and the Digest are on schedule and on the verge of being printed. For this edition, *Indicators* and related products will have a QR to enable access via mobile devices and an app that will enable people to access the state data tool is being developed, but the QR will be available soon after the rollout of *Indicators* 2012 slated for January 18, 2012.

An *ad hoc* Working Group, consisting of Drs. José-Marie Griffiths, Esin Gulari, Lou Lanzerotti, and Mr. Art Reilly, developed a draft Companion Piece. It draws on *Indicators* data and other sources to address how R&D fosters innovation and implications for the workforce. The working group plans to make some revisions to the nearly final Companion Piece, and hold a committee teleconference on the next draft that will yield a draft and a title that the committee can recommend to the Board for approval. Unlike *Indicators*, the Companion Piece is not required to be published on January 15, 2012, and there may be some increased impact in having the different *Indicators*-related products appear at different times during the next few months.

The committee also agreed to recommend to the Board a second Companion Piece targeted for early summer 2012 on “Trends in State Funding for Public Research Universities.” Dr. Bowen has articulated concern about this topic and Dr. Lisa Nichols, AAAS Fellow, has prepared background material. Drs. Camilla Benbow, Ray Bowen, France Córdova, Kelvin Droegemeier, and Mr. Arthur Reilly volunteered to serve on an *ad hoc* group to develop this second Companion Piece. Based on this recommendation:

The Board unanimously APPROVED the preparation of a second Companion Piece to *Science and Engineering Indicators 2012* on the topic of state funding for public research universities.

Dr. Matthew Wilson, Board Office staff, described the public release strategy for *Indicators*. Instead of focusing on a single media event, the strategy aims to generate sustained interest over a period of months in the various issues that *Indicators* data address. Publication of more than one Companion Piece is consistent with this strategy. This new strategy also broadens the focus beyond “tier one” national media and the science press to also emphasize state and local media and specialized business and education media.

The SEI meeting closed with a tribute to Dr. Lynda Carlson, NCSES Director, whose staff prepare *Indicators* under the Board’s direction. Dr. Carlson will retire in February 2012. Over the last

12 years, she has successfully institutionalized a series of valuable innovations while consistently producing a timely and high quality edition of *Indicators* every 2 years. The Board is much in her debt, and the committee congratulated her on her accomplishments.

d. Committee on Programs and Plans (CPP)

Dr. Mark Abbott, CPP chairman, reported that the new Calendar Year 2012 Schedule of Action and Information Items (Board Book page 17) was provided to the committee. CPP has only four actions scheduled for FY 2012, which will leave ample time for a new portfolio planning process.

Discussion Item: Status of CPP Program Portfolio Planning

CPP continued discussion of the proposed CPP Program Portfolio Planning. The goal of this activity is to provide stewardship to NSF on a broader portfolio of programs, intended to complement the strong involvement of the committee in reviewing NSF's largest awards. There has been a series of discussions during the past several meetings involving the CPP working group of Drs. Abbott, Droegemeier, Souvaine, and Mr. Reilly and the NSF working group, which includes Drs. Machi Dilworth, Joan Ferrini-Mundy, Fae Korsmo, and Clifford Gabriel. The candidate programs have not yet been finalized, and the committee is continuing discussions on a science activity/initiative. CPP will finalize the plan at the February 2012 meeting and identify the first activity for review at that time. Reports will be scheduled at the May, July, and December 2012 meetings.

NSB Information Item: Update on Arctic Contract

Drs. Patrick Haggerty and Renee Crane, both OPP Research Support and Logistics Managers, provided an update on the Arctic Research Support and Logistics Services Contract. (Presentation Book) This is an annual requirement, which was included in the resolution passed by the Board in December 2010 (Resolution NSB-10-81). Dr. Haggerty informed the committee about the new contract that was awarded in September 2011, and Dr. Crain explained some of the science that takes place in Greenland.

NSB Information Item: Update on Subcommittee on Recompetition of NSF Facilities

CPP continued its discussion with NSF regarding development of an implementation plan for the NSB policy on recompetition. Dr. Cora Marrett, NSF Deputy Director, provided an overview, and noted that NSF's Business and Operations Advisory Committee (BOAC) is expected to provide a set of recommendations to NSF in May 2012. It will then be NSF's responsibility to establish an implementation plan responsive to the Board's policy.

Dr. Mark Coles, Deputy Director, Large Facilities Office, noted that after receiving the recommendations, NSF expects some discussions with BOAC during the first quarter of 2012, after which a report will be provided to NSF and then made public. Dr. Bowen asked about exceptions to the recompetition policy, and Dr. Coles noted that the subcommittee discussed barriers and determined that there was rarely, if ever, a need for an exception. In response to a request from the CPP chairman for a briefing at the May NSB meeting, Dr. Marrett noted that BOAC only meets twice a year, and its next meeting is in May 2012, but that NSF would make

every effort to move more aggressively. At CPP's request, NSF agreed to provide a brief status update at the February 2012 meeting.

NSB Information Item and Discussion: NSF High Performance Computing (HPC) Strategy

Dr. Abbott asked NSF for its strategic vision in this area. Mr. Alan Blatecky, Director, Office of Cyberinfrastructure (OCI), led the discussion, and was joined by several NSF Assistant Directors (ADs): Dr. Ferrini-Mundy, EHR; Dr. Myron Gutmann, Directorate for Social, Behavioral, and Economic Sciences (SBE); Dr. Farnam Jahanian, CISE; Dr. Joann Roskoski, BIO; and Dr. Edward Seidel, Directorate for Mathematical and Physical Sciences (MPS). The ADs provided an overview of the big issues for NSF in the HPC arena, both as it pertains to their directorates and to NSF overall. Mr. Blatecky provided a slide showing the biggest users of the NSF-provided HPC resources, and agreed to send that to CPP at Dr. Lanzerotti's request. (Presentation Book) Mr. Blatecky noted a shift to a balanced portfolio of nationally distributed cyberinfrastructure, including software, data, algorithms, storage, hardware, and access; the "escalating arms race" of supercomputing centers will not be a primary focus.

Dr. Abbott noted that supercomputing is now a commodity, which represents a significant shift for the industry and its R&D strategy, as well as for the science community that no longer drives the technology forward. There is a fundamental change in the nature of the communities and institutions that are emerging within this framework of highly-distributed (and capable) cyberinfrastructure.

NSB Briefing: Update on Changes in BIO Process in Receipt of Proposals

Dr. Joann Roskoski, BIO Deputy Assistant Director, and Dr. Jane Silverthorne, Acting Division Director, BIO Integrated Organismal Systems, reported. Dr. Silverthorne told the committee about measures that BIO has taken to manage their ever-increasing workload, including a number of measures, such as moving to an 8-month proposal cycles, instead of 6-month, and requiring pre-proposals, where the best prospects are invited to submit full proposals. (Presentation Book) Dr. Silverthorne stated that the changes benefit NSF, but also principal investigators by lessening their initial time investments in writing proposals, and increasing NSF's success rates. The changes also decrease the burden on the scientific community by decreasing the number of requests for proposal review. Dr. Carl Lineberger urged care about increasing the success rate, because it may create the appearance to Congress that NSF is better funded than it actually is. Dr. Roskoski agreed that this will need to be monitored.

CPP Subcommittee on Polar Issues (SOPI)

Dr. Abbott reported that Dr. Douglas Randall led the SOPI meeting on behalf of Dr. Thomas Taylor, SOPI chairman. Dr. Karl Erb, OPP Director, provided an update on the Blue Ribbon Panel, which is tasked with conducting a review of the U.S. Antarctic Program to ensure a sustainable long-term strategy for science and diplomacy in Antarctica. Panel activities were underway and expected to conclude in March 2012. A preliminary report should be ready this spring to brief the Board. The U.S. and the Russian Federation drafted a Memorandum of Understanding (MOU) for cooperation in the Antarctic. It is anticipated that the MOU will be signed by both parties shortly, after which it will be shared with the Board.

The Interagency Arctic Policy Coordinating Committee, chaired by Dr. Suresh, operates under NSTC. Dr. Suresh noted that this committee is making progress in developing several interagency research programs. The U.S. hosted a Norwegian Delegation, including the Prime Minister, at the Amundsen-Scott South Pole Station to commemorate the 100th Anniversary of Amundsen reaching the South Pole – December 14, 1911. In preparation for this visit and an increase in tourism due to the anniversary, NSF created two temporary visitor centers at the South Pole, which highlight the work of U.S. Antarctic Program scientists funded by NSF.

Dr. George Blaisdell, Operations Manager, OPP Antarctic Infrastructure and Logistics, provided an update on icebreaker support. (Presentation Book) This year, icebreaker support was provided by a commercial shipping company, and activities to supply the U.S. Antarctic program will commence mid-January and run until mid-February 2012. The current plan for icebreaker support is to engage the current contractor until the U.S. Coast Guard's *Polar Sea* has completed its refit plan in 2012. NSF has a firm contract that includes options for service through the 2012-2014 operating season. There have been ongoing discussions between OPP, Congress, and White House regarding a long-term solution for icebreaking, and NSF's position is that the agency is uncomfortable with relying on non-U.S. sources to support such a critical point in the supply chain. The Board discussed the importance of having a clear long-term strategy, and agreed to send a letter to the Blue Ribbon Panel emphasizing this. Dr. Erb noted that the panel identified this issue as high priority, and offered to relay the Board's interest to the panel.

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

Dr. Abbott reported that Drs. Diane Souvaine and Kelvin Droegemeier, MS co-chairmen, provided an update on this task force. The Science and Technology Policy Institute (STPI), provided an update on their analysis of 10 years worth of NSF data. (Presentation Book) STPI focused on how much mid-scale research NSF funds and if the funding is solicited or unsolicited. They found that during the past decade, 4-10 percent of awards were mid-scale research awards, which represented about 19-28 percent of funding, depending on the directorate. The task force agreed to continue to work with each directorate/office to refine the data further. When the analysis is complete, it will form an appendix in the final report. The task force also discussed the revised report outline. Board Members provided useful feedback on both high level issues and specific details for the report.

The task force provided an update on the customer satisfaction survey. The survey was targeted to both researchers and Vice Presidents for Research of about 125 NSF-funded institutions. The survey was deployed on December 9, 2011, and already 70 responses out of a possible 320 were received. The analysis of the survey data will be completed by the end of January 2012, and will help inform the final report of the task force.

Finally, CPP approved a minor revision to the timeline within the MS charge. Based on this recommendation:

The Board unanimously APPROVED a revised charge and timeline to the Task Force on Unsolicited Mid-Scale Research to conclude activities in May 2012 when the final report will be brought before the full Board for approval.

e. Committee on Strategy and Budget (CSB)

Dr. Diane Souvaine, CSB chairman, reported that Dr. Suresh provided an update on the status of the FY 2012 budget. He remarked that the FY 2012 Appropriation was approved 47 days after the start of the fiscal year, which is the earliest NSF has received its' annual Appropriation since 2001. Dr. Suresh observed that the Appropriation included a 2.5 percent increase over the FY 2011 enacted level – a solid increase in light of the current fiscal situation, although it was significantly below the FY 2012 request level.

Dr. Souvaine stated that CSB appreciated the significant amount of work that the NSF Director and the NSF staff devoted towards budget activities. On behalf the committee, she thanked the NSF for all of this support, especially the NSF Budget Division staff who worked on the FY 2012 budget process.

For the item on strategic planning, Dr. Sally Rockey, Deputy Director for Extramural Research and Director of Office of Extramural Research, National Institutes of Health (NIH), was a guest speaker and presented information on NIH strategic planning in challenging budget times. Her talk was entitled, “Potential Levers for Dealing with Budget Challenges.” (Presentation Book)

Dr. Suresh then discussed some of the models and mechanisms that NSF is currently evaluating to deal with proposal pressure and grant demand management. Dr. Stephen Meacham, Senior Staff Associate, Office of Integrated Activities (OIA), presented information on the NSF Merit Review Working Group activities. (Presentation Book) The NSF Merit Review Working Group was charged to look for potential enhancements to the merit review process, design pilot activities to be tested, and engage NSF staff and the research community in testing and assessing these pilot activities. The working group aims to have an interim report completed at the end of December 2011 and a final report in March, 2012.

CSB also discussed agency perspectives and provided thoughts on potential new strategies that NSF might consider and the activities of the NSF Merit Review Working Group. The committee will continue to consider this important issue and may hold discussions on this topic at a future meeting.

CSB Subcommittee on Facilities (SCF)

Dr. Souvaine reported that SCF chairman, Dr. José-Marie Griffiths, and SCF members discussed the final draft of the mid-scale instrumentation report to Congress, which the subcommittee had approved during its previous meeting subject to final edits. CSB approved the draft report (NSB/CSB-11-25). Based on this recommendation:

The Board unanimously APPROVED the *Report to Congress on Mid-Scale Instrumentation at NSF* (NSB-11-80), due before January 4, 2012, subject to final edits approved by the SCF chairman, the CSB chairman, and the Board Chairman.

The subcommittee also began planning for upcoming activities in 2012 including the Annual Portfolio Review of facilities.

CSB Task Force on Data Policies (DP)

Dr. Souvaine also reported that the DP chairman, Dr. José-Marie Griffiths, and DP members discussed the final draft of the *Report on Digital Research Data Sharing and Management* (NSB/CSB-11-24), which the joint meeting of DP and CSB had approved, subject to final edits, during a teleconference on December 9, 2011. The report will be made available for public comment for several weeks on the NSB Web site. This report, and associated recommendations, was prepared for approval in December 2011 in order to be forwarded to OSTP for critical input into other related reports. During the teleconference, DP and CSB approved bringing the report forward to the full Board for consideration.

The Board unanimously APPROVED the report, *Digital Research Data Sharing and Management* (NSB-11-79), subject to final edits approved by the DP chairman, the CSB chairman, and the Board Chairman.

f. Task Force on Merit Review (MR)

Dr. John Bruer, MR chairman, reported that the main item on the agenda was a discussion of the MR final report. (Board Book Addendum; Presentation Book). This report, *NSF's Merit Review Criteria: Review and Revisions* (NSB/MR-11-22), represents the culmination of more than 1 ½ years of data-gathering, outreach to multiple stakeholder groups, and analysis across several issues related to the interpretation and use of the current review criteria. The task force met 16 times during this time period, working to identify the critical issues to be explored, and then to develop a strategy for obtaining input from a broad range of stakeholders and identifying other relevant data sources that would allow MR to address those issues.

At the MR meeting, Dr. Bruer provided a summary of the process that the task force used and the major observations that emerged from the data analyses. After much discussion at several meetings, and with the benefit of additional community feedback on a first draft of the revisions, the task force developed a final set of recommendations, which are included in this report. The report reaches the following conclusions: (1) the Intellectual Merit and Broader Impacts review criteria together capture the important elements that should guide the evaluation of NSF proposals, (2) revisions to the descriptions of the Broader Impacts criterion and how it is implemented are needed, and (3) use of the review criteria should be informed by a guiding set of core principles. The report includes an articulation of the guiding principles, to help clarify the intent of the review criteria, and how they should be used by Principal Investigators (PIs), reviewers, and NSF staff. Additionally, the report identifies a common set of review elements that should be used to in the review of both criteria.

The task force then engaged in some discussion of the report and subsequent implementation steps. Of particular interest is the consensus that emerged around the importance of individual PI involvement and accountability for broader impacts activities, even as it is acknowledged that assessment of the effectiveness of broader impacts activities may best be done at a higher aggregated level. The discussion also recognized the fact that Intellectual Merit and Broader Impacts are not two separate and independent concepts, but are intrinsically connected.

The task force concluded its meeting by approving the final report. Based on this recommendation:

The Board unanimously APPROVED the report, *NSF's Merit Review Criteria: Review and Revisions (NSB-11-86)*, subject to final edits approved by the MR chairman and the Board Chairman.

Before adjourning, Dr. Bowen noted that the Board appreciates the hard work on the part of the Board Office staff and the NSF staff. On behalf of the Board, he wished everyone a wonderful holiday season.

Dr. Bowen adjourned the Open Session at 2:23 p.m.

[signed]

Ann A. Ferrante
Executive Secretary
National Science Board