

**APPROVED MINUTES
PLENARY OPEN SESSION
451TH MEETING
NATIONAL SCIENCE BOARD**

National Science Foundation (NSF)
Arlington, Virginia
May 9-10, 2017

Members Present:

Maria T. Zuber, *NSB Chair*
Diane L. Souvaine, *NSB Vice Chair*
John L. Anderson
Deborah L. Ball
Arthur Bienenstock
Vinton G. Cerf
Vicki L. Chandler
Ruth A. David
W. Kent Fuchs
Inez Fung
Robert M. Groves
G. Peter Lepage
W. Carl Lineberger
Victor R. McCrary
Emilio F. Moran
Sethuraman Panchanathan*
G.P. Bud Peterson
Julia M. Phillips
Geraldine L. Richmond

France A. Córdova, *ex officio*

*Dr. Panchanathan attended via teleconference.

There being a quorum, the National Science Board (NSB, Board) convened in open session at 8:00 a.m. on Tuesday, May 9, 2017, with Dr. Zuber presiding.

NSB Chair's Opening Remarks

Dr. Zuber welcomed everyone to the NSB's 451st meeting.

Dr. Zuber began the meeting with an announcement acknowledging the passing of Amy Northcutt, former Deputy General Counsel and Chief Information Officer at NSF.

Dr. Zuber then congratulated the team responsible for developing the Companion Brief on Career Pathways for STEM Ph.Ds. that had a successful public rollout on April 19. The [infographic](#) is now live and accessible on the NSB website.

After a preview of the upcoming meeting agenda, the Chair turned the meeting over to the Director for her opening remarks.

NSF Director's Remarks

Dr. Córdova thanked the Chair for her comments.

Dr. Córdova began with a report on NSF engagement with the Administration and Congress. That engagement included two hearings in front of the House Science Committee, one in which Dr. Córdova joined the IG in testifying and the second in which Dr. Ferrini-Mundy and Dr. Zuber testified. Dr. Córdova stated that the summaries from both hearings would be included in the OLPA update in the final Plenary session of the meeting.

Congressional interactions also included several joint representations at which Dr. Córdova was joined by members of Congress. At a celebration of an Engineering Research Center at Rice University, Dr. Córdova was joined by Congressman John Culberson and Congresswoman Sheila Jackson Lee. Congressmen Gene Green and Pete Olson were in attendance for Dr. Córdova's delivery of the Rorschach Lecture at Rice University's Baker Center. At the celebration of a new science building at Northeastern University, Dr. Córdova shared the stage with Senators Elizabeth Warren and Ed Markey, and Congressman Joe Kennedy. Separate events were also held with Representatives Lamar Smith, Jim Banks, Charlie Crist, and David Price, as well as Senator Richard Burr. Dr. Córdova also reported that she was departing on the evening of May 10 to join a Congressional delegation to Greenland led by Chairman Smith.

On the Administration side, Dr. Córdova reported that she, Dr. Souvaine, Dr. Ferrini-Mundy, and Brian Stone visited with Secretary of Education Betsy DeVos, who expressed interest in some of the same education-related topics that are being discussed at NSF. NSF also hosted Michael Kratsios and Ted Wackler from the Office of Science and Technology Policy. In addition, Dr. Córdova and her team met with Jim Herz, NSF's Program Associate Director at the Office of Management and Budget (OMB).

Dr. Córdova also reported on a busy university engagement circuit visiting Morgan State University at the invitation of Dr. McCrary, touring the National High Magnetic Field Laboratory at Florida State University where she also spoke with Florida Governor Rick Scott, and joining David Rubenstein for a science policy discussion with Duke University's Board of Trustees. Dr. Córdova also delivered commencement remarks at the University of South Florida.

Internationally, NSF hosted the President of the European Research Council and the Canadian Minister of Science. Dr. Córdova also traveled to Australia for the World Science Festival where she represented NSF on two panels. Dr. Córdova and her international team also met with Ambassadors from Italy, Sweden, Mexico, and Ireland at various settings in the D.C. area.

Locally, Dr. Córdova gave a policy address at the AAAS Science and Technology Policy Forum and participated in the Government-University-Industry Research Roundtable (GUIRR), the Research! America Annual Advocacy Awards, and the National Air and Space Museum Trophy Awards, which recognized the pilots involved in the South Pole Rescue last summer.

Following the report on a very busy engagement schedule, Dr. Córdova transitioned to highlighting some challenges and opportunities that NSF is addressing. The budgets for FY17 and FY18 were at the top of her list, but she deferred extensive comments to the planned in-depth discussion later in the meeting. She reported that the relocation of NSF headquarters from its current location to Alexandria is going well and is currently under budget and ahead of schedule. Dr. Córdova stated that there was a more in-depth update in the Board Book materials.

Looking beyond FY18, Dr. Córdova stated that OMB has directed NSF to participate in the Comprehensive Plan for Reforming the Federal Government and Reducing the Federal Civilian Workforce. The NSF draft “Agency Reform Plan” to OMB is due in late June.

Dr. Córdova also reported on a number of reports to which NSF leadership is preparing responses.

On the opportunity side, Dr. Córdova noted that NSF has seeded most of the Big Ideas. There is a Dear Colleague Letter soliciting new convergence research efforts for the Big ideas of Harnessing the Data Revolution, Navigating the New Arctic, The Quantum Leap, and Work at the Human-Technology Frontier. The NSF 2050 idea has been refocused to align it with the 2026 Sestercentennial of the United States.

Dr. Córdova concluded her report with a summary of the focus areas in the Agency Reform effort describing it as an opportunity to streamline, to get rid of practices that take a lot of time but have little efficacy, and to incorporate IT into all NSF processes to make them more efficient. She added that NSF is looking forward to tackling reform of business practices and program practices, including improving merit review.

The Chair thanked Dr. Córdova for her report.

Summary of Capitol Hill Meetings

Dr. Zuber then provided a summary of Capitol Hill meetings that had taken place in March and April. She stated that summaries of her testimony with Dr. Joan Ferrini-Mundy before the House Subcommittee on Research and Technology as well as summaries of office visits with Members of Congress and/or their staff by herself and Drs. Souvaine, David, Lineberger, and McCrary are included in the Board Book materials.

Dr. Zuber reported that the theme of the messages to Congress and its membership emphasized the key role NSF plays in the U.S. innovation ecosystem and reiterated the long-standing position this Board has taken to stand ready to serve as a resource for the Congressional members and their staffs. Dr. Zuber stated that the tenor of the meetings was overwhelmingly positive and supportive of the work NSF and its partners do. There was interest in both the Big Ideas and Skilled Technical Workforce initiatives.

In addition, in meeting with Reps Rodney Frelinghuysen (Chair, House Appropriations Committee), Katherine Clark and Daniel Lipinski (Ranking Member, House Subcommittee on Research and Technology), Dr. Zuber and Dr. Souvaine expressed their gratitude for the support the science community has received from all three members in recent years. Dr. Zuber added that their comments in support of the importance of fundamental research in the geosciences and social sciences was well-received. She added that overall these were very positive and engaging meetings.

With no questions or remarks forthcoming, Dr. Zuber adjourned the Plenary Session at 8:25 a.m. with the reminder that the Plenary Open session would reconvene at 11:30 a.m.

Session 2

Dr. Zuber reconvened the open Plenary session of the 451st Board meeting at 11:30 a.m. on May 9, 2017, to recognize and hear brief presentations by the 2017 Annual National Science Board and National Science Foundation Award recipients. The first four of six presentations took place in this session with a lunch intermission between speaker number two and three. The award recipients presenting in this session were: Dr. Arthur Eisenkraft (NSB Individual Public Service Award), Dr. John Pardon (Alan T. Waterman Award), Dr. Rita Rossi Colwell (Vannevar Bush Award), and Lt. Gen. James Abrahamson (USAF, Ret.) (NSF Distinguished Public Service Award).

Dr. Zuber adjourned the second session at 1:35 p.m., following the presentation by Gen. Abrahamson, to be reconvened at 10:40 a.m. on Wednesday, May 10.

Session 3

The National Science Board (NSB, Board) reconvened in open session at 10:40 a.m. on Wednesday, May 10, with Dr. Zuber presiding.

Chair's Remarks

Dr. Zuber welcomed the guests to the meeting and provided a framework for the discussion to be had on a proposed Board work plan about the Skilled Technical Workforce. Dr. Zuber recalled Dr. McCrary's presentation at the 450th Board meeting in February 2017 on his thoughts about a possible Board role to supplement the NSF work on STEM education, focusing on those individual outside the traditional four-year and higher academic institutions. To further the conversation, the Board invited Dr. James Lewis and Dr. Celeste Carter from NSF's Directorate for Education and Human Resources (EHR) to discuss current NSF activities and investments in this arena.

Dr. Zuber also announced that she plans to establish a formal working group of the Board around this issue based on the initial work Dr. McCrary, Dr. Richmond, and a few others have already undertaken.

Skilled Technical Workforce

Dr. Lewis began the presentation by offering an overview of EHR's efforts connected to workforce development. He highlighted three areas of investment. First was Direct Student Support, which is packaged in the NSF Scholarships for STEM and CyberCorps Scholarships for Service Programs. The second area was identified as Institutional Capacity, which includes the Tribal Colleges and Universities Program and the Improving Undergraduate STEM Education Program, and the HSI Dear Colleague Letter. The third topic focused on Research and Development. This area includes Innovative Technology Experiences for Students and Teachers, Advancing Informal STEM Learning, and the EHR Core Research Programs. Dr. Lewis concluded his introductory remarks by offering some statistics on EHR's work. Since the passage of the Science and Advanced Technology Act of 1992 that created the Advanced Technical Education program (ATE), NSF has awarded more than \$950 million supporting almost 500 distinct institutions. The ATE program has grown from \$13.5 million in 1994 to \$66 million in the current fiscal year.

Dr. Carter then provided more details about the ATE program. She stated that the program has supported awards in every state and several U.S. Territories. Of the 1,108 community and technical colleges in the U.S., ATE has supported awards in almost 40% of them. Dr. Carter characterized the ATE program as an agent of catalytic change. While its awards may not be as large as some agencies, its ability to make a difference is huge. Dr. Carter added that the one of the strengths of the ATE program is its focus on partnerships. To be competitive a proposal for

ATE funding must include a committed industry partner. The program focuses on sub-baccalaureate success. Community and Technical colleges are the most common recipients of support. She added that with 7-20 technicians required to support each engineer or scientist in the laboratory, the need for a skilled technical workforce is not decreasing. In closing, she referred to research conducted by Anthony Carnevale at Georgetown University, which predicts that by 2018, roughly 35% of the STEM workforce will be composed of those with sub-baccalaureate training, including: 1 million associate degrees, 745,000 certificates, and 760,000 industry-based certifications.

Following the presentation, Board members posed questions.

Dr. Richmond asked about the link between ATE and the EPSCoR (Established Program to Stimulate Competitive Research) and whether EPSCoR investigators were being encouraged to participate in ATE. Dr. Carter responded that EPSCoR PIs were definitely being encouraged to participate and that there had been some documented success with EPSCoR experience being successful in ATE. The key was the partnership possibilities with local industry.

Dr. Cerf commented that NSF should investigate the linkages between ATE and the work of other Federal agencies like the Department of Labor and the Department of Commerce.

Following the conclusion of the presentation by Dr. Lewis and Dr. Carter, Dr. Zuber invited Dr. McCrary to present the draft Board workplan on the Skilled Technical Workforce initiative. Dr. McCrary began by reminding the Board about its 2015 report on the STEM workforce, one of the main findings of which was the recognition that the STEM workforce comprises individuals at all different education levels, across all demographics, working in the country. He continued by stating that this reality combined with the recent release by the Board of its statement and infographic on career pathways for STEM Ph.Ds. makes it a natural suggestion that the Board should look at how to strengthen all segments of the STEM-capable workforce.

Dr. McCrary's draft workplan looks to investigate the following questions:

1. Why is the NSB interested in this issue?
2. How should the NSB define the Skilled Technical Workforce?
3. What has been or is being done in this space by NSF and others?
4. What data resources are available? What do the data say?
5. What are the opportunities and challenges with respect to the Skilled Technical Workforce?
6. What is the optimal role for the NSB and NSF in this area?
7. What would a range of possible good outcomes for the NSB and NSF look like?

Dr. Zuber then opened the floor for questions.

Dr. Cerf asked about the industry reaction to the issue of STEM education. He cited the example of MCI, which started its own college to satisfy the workforce demands of its technology company 15-20 years ago. He specifically asked what is the current industrial landscape learning from experiences such as MCI to ensure there are enough skilled workers to meet the demand.

Dr. McCrary responded that the data is still being collected, but the recent experience of Boeing when it decided to open a plant in South Carolina may be indicative of current challenges. He explained that Boeing decided to go to South Carolina because of the generous tax incentives offered by the state. When the company set up shop, it ended up consuming almost all the tax savings in investments in workforce education because of the shortage in skilled workers.

Dr. Carter added that training of incumbent workers is also part of the ATE program.

Several other comments were made supporting the need for lifelong learning programs and the investments companies will need to make in the future to ensure they have a sustainable workforce.

Dr. Zuber concluded the discussion by informally polling the Board members to gain consensus on the workplan to gain information on how the Board can add value to this issue. She received consensus.

Before closing the session of the Open Plenary, Dr. Zuber announced the results of the election for the Executive Committee that was held during the Closed Executive Plenary. Dr. Peterson and Dr. Jackson were re-elected by acclamation to serve another two-year term.

The final piece of business for this session was the fifth presentation by one of the annual award recipients. Dr. Baratunde Cola (Alan T. Waterman Award) was the presenter for this session.

Dr. Zuber adjourned the Plenary at 12:00 noon for lunch, to be reconvened at 1:00 p.m.

Session 4

Dr. Zuber opened the final Plenary session with an introduction of Dr. Lance Bush, who would be presentation the final annual award recipient presentation. Dr. Bush was representing the Challenger Center (NSB Group Public Service Award).

Chair's Remarks

Following Dr. Bush's presentation, Dr. Zuber continued by recognizing that May 10th marked the 67th Anniversary of the signing of the National Science Foundation Act creating NSF. She then recognized notable achievements of five Board members. Dr. Panchanathan received the 2017 Distinguished Alumnus Award for outstanding achievements from the Indian Institute of Technology, Madras and the 2017 Alumnus of the Year Award from the University of Ottawa. Dr. Sargent was inducted as an Honorary Fellow into the Royal Society of Edinburgh. Dr.

McCrary was recognized as the 2017 Distinguished Alumnus of the Howard University Graduate School. Dr. Ball assumed her new duties as President of the American Educational Research Association. Dr. Córdova received the Optical Association's 2017 Advocate of Optics recognition.

Dr. Zuber went on to welcome three new Committee Executive Secretaries, Sarah Bates to External Engagement, Paul Filmer to National Science and Engineering Policy, and Mary Koskinen to Strategy.

On the administrative side, Dr. Zuber announced that she would be soon sending out a letter to Board members soliciting their annual contribution to the Board Trust Fund. She also announced that she would be establishing the Nominations Committee in the coming weeks to prepare for the Board elections in May 2018. Additionally, she notified the Board that the Board Office would be polling for Board meeting dates within the next month.

In addition to the working group on Skilled Technical Workforce, Dr. Zuber also thanked Dr. David for her leadership to date on the Risk Working Group and recognized the work of Drs. Anderson, Lineberger, Phillips, Sargent and Cerf on this important endeavor.

Approval of Prior Minutes

Dr. Zuber presented the minutes of the February Open Plenary for approval. Those minutes were approved as presented.

Director's Remarks

Dr. Córdova began her remarks by thanking the staff who put the Annual Awards Ceremony and Dinner together. She specifically noted the work of Kim Silverman for her leadership on this event.

Dr. Córdova continued by advising Board members that written updates from Amanda Greenwell on Legislative and Public Affairs and from Joanne Tornow on the headquarters relocation were in the Board Book. She reiterated that the relocation remains on schedule and as the move nears, there will be increased communication and engagement for NSF staff.

Dr. Córdova then announced two new senior appointments. Dr. William Easterling will be joining GEO as the new Assistant Director in June and Dr. Dawn Tilbury will be the new Assistant Director for Engineering, also beginning in June. Staying with the Engineering theme, Dr. Córdova announced that the acting Assistant Director, Barry Johnson was recently elected to the National Academy of Inventors.

Dr. Córdova concluded by expressing her appreciation to all the public servants at NSF on the occasion of Public Servant Recognition Week. She highlighted their commitment to excellence

across the NSF mission. Dr. Córdova also thanked the members of the National Science Board for their service to NSF and the nation.

Open Committee Reports

Dr. Zuber then turned to the open committee reports, noting that the full record of committee activities would be detailed in the respective committee minutes.

Dr. Anderson reported for the Committee on Oversight (CO). He reported that CO reviewed the semi-annual report of the Office of the Inspector General and approved the motion to send it to the full Board for review. He stated that the CO will review the NSF response to the report when it is ready and provide its recommendation to the Board. Dr. Anderson also reported that CO received a brief from Chief Financial Officer, Marty Rubenstein, stating that NSF successfully met the Digital Accountability and Transparency Data Act implementation deadline of May 2017.

Dr. Groves reported for the Committee on Strategy on behalf of Dr. Panchanathan. He stated that the Committee on Strategy received presentations on two Big Ideas, Convergence and NSF INCLUDES.

Dr. Lepage reported that the Committee on Awards and Facilities (A&F) received a briefing from AST on the possible formation of NSF's National Center for Optical-Infrared Astronomy.

Dr. Richmond began her National Science and Engineering Policy (SEP) committee report by stating that they had completed the chapter reviews for the 2018 Science and Engineering Indicators publication. She then opened a discussion about Chapter 6, Emerging Technologies. The question was raised regarding whether these items should be treated in a separate chapter or in sidebars within the overall publication. After a lengthy discussion, it was decided to have NCSSES work on providing ideas on how best to handle these going forward.

Dr. Cerf represented the Committee on External Engagement (EE) in reporting that the Committee held discussions on Board listening session in conjunction with their LIGO site visit to Louisiana in October. Dr. Cerf also reported on discussions about best practices for op-ed articles, noting that it is important the Board Chair and the communications office is alerted to any planned article submissions for possible editorial assistance. Lastly, Dr. Cerf stated that Dr. Fuchs volunteered to be the first pilot participant in the initiative for Board members to host their Congressional representatives at their institutions to showcase the research and researchers funded by NSF.

Executive Committee Annual Report

Dr. Córdova presented a brief comment on the Executive Committee Annual Report. Noting that the report was in the Board Book materials, Dr. Zuber asked if there were any questions or corrections. Hearing none, the Report was approved as presented.

Chair's Closing Remarks

Dr. Zuber made one closing announcement regarding bus transportation for the new headquarters tour. There being no further business, Dr. Zuber adjourned the meeting at 2:00 p.m.

X 

Brad Gutierrez
Executive Secretary, NSB
Signed by: BRAD A GUTIERREZ