

**APPROVED MINUTES
PLENARY OPEN SESSION
466TH MEETING
NATIONAL SCIENCE BOARD**

National Science Foundation (NSF)
Alexandria, Virginia
February 4–5, 2020

Members Present:

Diane Souvaine, *NSB Chair*
Ellen Ochoa, *NSB Vice Chair*
John Anderson
Roger Beachy
Arthur Bienenstock
Vicki Chandler
Maureen Condic
W. Kent Fuchs*
Suresh Garimella*
Robert Groves*
James Jackson
Steven Leath
W. Carl Lineberger
Victor McCrary
Emilio Moran
Sethuraman Panchanathan
G.P. Bud Peterson
Julia Phillips
Daniel Reed
Geraldine Richmond
Anneila Sargent
Alan Stern
Stephen Willard
Maria Zuber*

France Córdova, *ex officio**

*Present for February 4 sessions only.

Members Absent:

There being a quorum, the National Science Board (NSB, Board) convened in Open Plenary Session at 8:36 a.m. on Tuesday, February 4, 2020, in joint session with the President's Council of Advisors for Science and Technology (PCAST) with NSB Chair, Dr. Diane Souvaine, and the Director of the White House Office of Science and Technology Policy (OSTP), Dr. Kevin Droegemeier, presiding.

NSB Chair's Opening Remarks

Dr. Souvaine welcomed everyone to the NSB's 466th meeting and thanked Dr. Droegemeier and the OSTP staff for their hospitality in hosting the meeting at the Eisenhower Executive Office Building. She reviewed the NSB mandate and highlighted some of the Board's work on issues of recent importance such as Administrative Burdens. Dr. Souvaine added that the Board is excited to discuss areas in which the PCAST mandate and the Board's mandate can be mutually supportive without compromising each entity's prerogatives. Dr. Droegemeier seconded Dr. Souvaine's comments and requested that her remarks be saved for posterity on the PCAST website.

Science and Engineering Indicators and NSB Vision Presentation with PCAST

Dr. Souvaine, Dr. Phillips, and Dr. Beachy provided a presentation on the recently released *Science and Engineering Indicators 2020* and the Board's Vision 2030 project. Dr. Souvaine began by thanking Dr. Phillips for her leadership throughout the *Indicators* development and release and to Dr. Beachy for his leadership on the Vision Task Force. She then provided a general overview of the National Science Board and its dual roles as governance body for the National Science Foundation and advisor to Congress and the Administration on science and engineering matters.

Dr. Souvaine then turned the floor over to Dr. Phillips who provided a summary of the recently released *Science and Engineering Indicators 2020* report. She highlighted the three macro trends of a changing global landscape: increased globalization of the S&E enterprise, increasing pace with which S&E developments drive growth across the global economy, and the complacent approach to cultivating STEM talent in the U.S. She noted that much of the data supporting the trends lag current realities. This places greater urgency on calls to respond to the current developments. Dr. Phillips added that the role of partnerships and collaboration is growing as they are seen as accelerants to S&E outcomes. She concluded by noting that the Board is very interested in the thoughts of PCAST members on industry-academia and industry-government partnerships.

Dr. Beachy followed Dr. Phillips with a presentation on the Board's Vision 2030 project. He highlighted that much of the Vision is following trends identified in the *Indicators* report. The message the Vision hopes to convey is that doing the same things the same way is not sustainable if the U.S. is to remain a global leader in S&E research and innovation. Dr. Beachy added that the U.S. must lean into the strengths of the current U.S. system that champion openness, integrity, and bottom-up entrepreneurial inquiry. He joined Dr. Phillips in identifying

the poor record in the U.S. of developing STEM talent as a major area for immediate improvement.

Dr. Droegemeier continued the meeting by stating that he was happy to hear that so many of the Board's issues resonate with the priorities of OSTP. He then introduced the three PCAST subcommittees for their reports from work completed the previous day. Dr. Birgitta Whaley reported for the subcommittee on Industries of the Future (IoTF). She said the ultimate goal is to ensure U.S. leadership in all five IoTFs (artificial intelligence, quantum information sciences, 5G/advanced communications, biotechnology, and advanced manufacturing). She stated that, while the industries are at different stages of maturity, there are new opportunities in each of them to be leveraged through cross sectoral and international collaborations. Dr. Shannon Blunt reported on the subcommittee looking at national labs. He stated the goal of the subcommittee was to learn a greater understanding of how the national labs operate and where there are gaps between their current activities and what they could do to advance the U.S. work in the IoTFs. He added that the subcommittee is looking at this from five vantage points: personnel, facilities and missions, ideas and intellectual property, risk mitigation, and funding and oversight. Dr. Bienenstock noted that lab leadership, in general, does not have the unilateral flexibility to redirect work to national priorities not identified in their budgets. Dr. Phillips added that labs involved in national security work have even less latitude in this area. Dr. Droegemeier suggested that these realities argued for the creation of a national lab specifically targeting the IoTF research and innovation space. Dr. Catherine Bessant reported on the subcommittee examining STEM education and workforce issues. Consistent with the messages of Drs. Phillips and Beachy, she stated that the U.S. needs a large and more diverse and inclusive STEM workforce. The country needs to undertake a multigenerational talent development project. There was a growing consensus in the meeting that STEM Education was an area ripe for NSB-PCAST collaboration.

Following the reports, Dr. Droegemeier opened the floor for open discussion. His introduction to this session was focused on getting clarity on the intersections of NSB and PCAST work streams and what were possible action steps each body could take separately or collectively.

Dr. Ochoa highlighted the diversity of perspectives available when combining the PCAST and Board membership. While the Board is dominated by academic and government scientists and engineers, PCAST has a wealth of industry representation. She acknowledged that the two organizations have their respective lanes, the observation that partnerships are critical to maintaining U.S. leadership in S&E is an area of relevance to both. She also pointed out that the recently published NSB report on the skilled technical workforce identified several areas in which academic-government-industry collaborations could accelerate pace of advancement in this area of workforce development. Dr. Ochoa reminded the group that the common link in all of these conversations is the need for talent; talent that is geographically and demographically diverse and technically proficient.

The conversation continued on the talent theme as Dr. Droegemeier raised the issue of competing but complementary foci: growing domestic talent and attracting foreign-born talent. Dr. Reed highlighted the demographic realities of the U.S. over the next decade. He predicted a decline in college population as the country continues its trend toward becoming a majority minority country. He added that this puts even more pressure on the U.S. education system to up its STEM education game. A number of other Board members echoed this and added that the cost of higher education will further exacerbate the problem.

Mr. Shane Wall, PCAST member and CTO for HP Technologies, transitioned the conversation to tech transfer and explained the challenges the private sector faces when trying to do business in China. He said that the principles of openness that have been the hallmark of the U.S. system are not reciprocated by the Chinese. Making it worse, the Chinese government requires that U.S. companies share their intellectual property and patents in order to gain access to Chinese markets.

Dr. Droegemeier emphasized the need to stay aligned with the Congress and the Administration on both STEM Ed and tech transfer fronts.

Drs. Garimella and Richmond pointed out the importance of partnerships in the talent development and innovation space. They called out organizational cultural differences and synergies between universities and community colleges as challenges and opportunities, respectively. Dr. Matt Wilson provided additional background into OSTP's work in fostering partnerships between the academic and industry sectors.

Several participants suggested engaging the National State Governor's Association as a venue through which to engage the state governments and education systems. Recommendation was made that Board members meet with their respective governor's office on issues revolving around STEM education, STW development and partnerships between business and state universities.

Dr. Groves summarized his observations of the session by applauding the joint PCAST-NSB session and encouraged the two bodies to continue to work together to bring their respective mandates to the urgent tasks facing the U.S. science and engineering enterprise. He further challenged the Board to think consistently long term about these issues since there are few short-term fixes.

Session 2 (February 4, 2:00–3:30 p.m. at NSF Headquarters)

Dr. Souvaine reconvened the plenary of the 466th meeting of the National Science Board at NSF Headquarters in Alexandria, VA at 2:00 p.m. She began by acknowledging African-American History Month and thanking the many African-American researchers, NSF staff, and NSB members, Drs. Jackson and McCrary, for their dedication to the NSF mission and the advancement of science and engineering. She then turned the floor over to Dr. Córdova for her Director's presentation.

NSF Director's Remarks

Dr. Córdova took the occasion of her final NSB meeting as Director to present a retrospective of her tenure leading the Foundation as well as her time on the NSB. She noted the progress that had been made in those 12 years. She highlighted early challenges of public and Congressional perceptions of NSF and its work. She acknowledged that relations between the Board and NSF were stressed at times due to issues with large research facilities. She added that extended periods with flat budget appropriations limited the ability of NSF to fund the full complement of research proposals worthy of funding. In response to these challenges and others, Dr. Córdova stated that the Foundation made great strides forward by expanding outreach to Congressional leaders and critics and by building partners in the Administrations of President Obama and President Trump. In expanding NSF's engagement with the National Science and Technology

Council, the Foundation built strong relationships with sister government S&T agencies, such as NIST, NOAA, NIH, and NASA. Dr. Córdova also credits the improved relations with the Board to improved communication and collaboration on facility issues, the launch of the 10 Big Ideas, and cooperation on Board reports dealing with Facility O&M, Mid-scale Research Infrastructure, and the Skilled Technical Workforce. Dr. Córdova also highlighted the work done to call attention to and improve research environments, singling out the NSF Harassment Policy. She concluded by looking forward on the occasion of the Foundation's 70th anniversary. She stated that she was excited about the future of the Foundation and its leading role in promoting the progress of science and engineering. She called attention to the importance of partnerships between government, industry and academic stakeholders. She called on the Board and her successors to continue to put people first as they are the cornerstone of NSF and the science and engineering enterprise.

Following Dr. Córdova's presentation, Dr. Souvaine presented Dr. Córdova with a farewell gift and the heartfelt gratitude of the Board for her tireless efforts on behalf of the Foundation, its staff, and the thousands of researchers who benefit from the Foundation's mission. Dr. Ochoa requested the floor to offer a resolution of appreciation into the record. The resolution read:

Whereas, Dr. Córdova has completed her full 6-year term as director, an accomplishment infrequent enough to merit acclamation;

Whereas, Dr. Córdova served admirably on the National Science Board for over 5 years, including as Chair of the Committee on Strategy;

Whereas, the NSF budget has increased from \$6.1 Billion to \$8.2 Billion under her strong leadership and expert strategic direction;

Whereas, as a direct result of improvements made under her leadership, NSF is significantly improved in oversight, relationship with OIG, management of facilities and capacity for agency-wide strategy;

Whereas, the 10 Big Ideas, particularly the Convergence Accelerators represent a bold, necessary direction for the Foundation, that will benefit the NSF for years to come;

Whereas, during Dr. Córdova's tenure, NSF's profile greatly increased, and the incredible discoveries it enabled, including the first observation of gravitational waves and the Event Horizon Telescope that produced an image of a black hole, captivated the world;

Whereas, Dr. Cordova's leadership in diversity and inclusion and strong stance on harassment have positively impacted the S&E research environment across the country; therefore, be it

RESOLVED, that the National Science Board honors France A. Córdova for her tremendous internal and external contributions to the National Science Foundation as its 14th Director.

The resolution was approved as presented.

NSF 2026 Idea Machine Recipients

Dr. Souvaine continued the meeting by inviting Dr. Suzanne Iacono and Dr. Lin He to the table to present the winners of the NSF 2026 Idea Machine competition. Dr. Iacono provided some historical background to the evolution of the Idea Machine 2026 program. Dr. Lin presented a video that introduced each of the recipients and their winning ideas. Four Grand Prizes were awarded with each recipient receiving \$26,000 to continue research on their idea. The four Grand Prize winners were: Abraham Herzog-Arbeitman for “Emergence: Complexity from the Bottom Up,” Nell Joshi, Anna Duraj-Thatte, and Avinash Manjula Basavanna for “Engineering Living Materials,” Matthias Scheutz and Vasanth Sarathy for “From Thinking to Inventing,” and Karin Pfennig for “Public Carbon Capture and Sequestration.” Three Meritorious Prizes were awarded with each recipient receiving \$10,000 to continue their research. The three Meritorious Prize winners were: Jason Williams for: “Reinventing Scientific Talent,” Vincent Conitzer for “Theory of Conscious Experience,” and Juan Pablo Gevaudan and Chelsea Heveran for “Unlocking the Future of Infrastructure.”

Chair’s Summary of Activities

Dr. Souvaine concluded this session of the plenary with a brief summary of the meeting’s remaining agenda and her activities since the last meeting. She noted that she would report on her testimony before the House Committee on Science, Space, and Technology during the External Engagement Committee session and address the *SEI 2020*, rollout activities during the Science and Engineering Policy Committee session.

Session 3 (February 5, 3:00–3:30 p.m.)

Chair’s Remarks

Dr. Souvaine welcomed the NSF staff, guests, and members of the public listening via webcast. Dr. Souvaine began by recognizing the nomination of Dr. Sethuraman Panchanathan to be the next Director of NSF following the retirement of Dr. Córdova in March. Dr. Souvaine also welcomed Dr. Portia Flowers to the Board Office as a new Science Policy Analyst.

Approval of Prior Minutes

Dr. Souvaine presented the minutes of the November Open Plenary for approval. Those minutes were approved as presented.

NSF Director’s Remarks

Dr. Córdova noted the written OLPA update in the Board Book and announced senior management changes across the Foundation. Dr. Kim Barrett is the new Division Director for the Division of Graduate Education in the Directorate for Education and Human Resources. Dr. Diana Elder is the new Division Director for the Division of Human Resource Development and

the Director for Education and Human Resources. Dr. Margaret Martonosi is the new Assistant Director for the Directorate for Computer and Information Science and Engineering. Dr. Córdova concluded her remarks with a reflection on the life of Dr. Karen King who passed away in December. Dr. King was a long-time project director at NSF in the Directorate for Education and Human Resources and an executive secretary to numerous committees of the NSB.

Open Committee Reports

Dr. Souvaine then turned to the open committee reports.

Dr. Beachy reported for the Committee on Strategy (CS). He stated that the only CS agenda item was the approval of the committee's open session minutes from the November meeting. Dr. Beachy also offered his thoughts on the passing of Dr. King and presented a resolution in her honor for approval by the Board. The Resolution read:

Whereas, the National Science Board lost a valued Executive Secretary on December 24, 2019, with the death of Dr. Karen D. King;

Whereas Dr. King provided valuable advice and assistance to the National Science Board's Committee on Education and Human Resources, Committee on Strategy and Vision 2030 Task Force;

Whereas, Dr. King had a distinguished career furthering mathematics education and a tireless passion for increasing participation of African Americans, particularly young women, in STEM fields; and

Whereas, Dr. King's dedication, energy and insight enriched those fortunate to know and work with her, therefore, be it,

RESOLVED, that the National Science Board honors the memory of Karen King and recognizes with great admiration and appreciation her contributions to the National Science Board and the National Science Foundation.

The resolution was approved as presented.

Dr. Phillips reported for the Committee on National Science and Engineering Policy (SEP). She stated that SEP presented the activities associated with the rollout of the *SEI 2020* report. The committee also discussed the upcoming SEP retreat.

Dr. Sargent reported for the Committee on Oversight (CO). She stated that the committee approved the 2018 Merit Review Digest NSB Overview and forwarded it to the full Board for consideration. The committee also heard updates from the Office of Inspector General (OIG) and the Chief Financial Officer. The OIG presented the office's FY 2020 Audit Plan.

Dr. Lineberger reported for the Committee on Awards and Facilities (A&F). He stated that the committee heard a presentation from Board members and Dr. Córdova on their visit to Antarctica in December 2019. The committee also discussed the proposed NSB approval and oversight process for the Mid-scale program. NSF presented briefings on the merger of the management of the SAGE and GAGE Facilities.

Dr. Jackson reported for the Committee on External Engagement (EE). He stated that the committee heard a report from Dr. Souvaine about her testimony before the House Science, Space, and Technology Committee.

Dr. Beachy reported on the status of the *Vision 2030* and the work of the Task Force.

Votes

Dr. Souvaine then turned to the item needing Board approval. She asked for a motion to approve the FY 2018 Merit Review Digest Overview as presented to the Board by the Committee on Oversight. This were approved as presented.

Dr. Souvaine conclude the meeting by reminding everyone of NSF 70th Anniversary Symposium that was being conducted at NSF on February 6-7, 2020. There being no further business, the meeting was adjourned at 3:30 p.m.

X 

Dr. Brad A. Gutierrez
NSB Executive Secretary
Signed by: BRAD A GUTIERREZ