NSB-2020-39
February 24, 2021

APPROVED MINUTES
PLENARY OPEN SESSION
470TH MEETING
NATIONAL SCIENCE BOARD

National Science Foundation (NSF)
Via Videoconference
December 9-10, 2020

Members Present:

Ellen Ochoa, *NSB Chair*
Victor McCrary, *NSB Vice Chair*
Sudarsanam Babu
Roger Beachy
Arthur Bienenstock
Maureen Condic
Aaron Dominguez
W. Kent Fuchs
Suresh Garimella
Dario Gil
Melvyn Huff
Steven Leath
W. Carl Lineberger
Emilio Moran
Julia Phillips
Daniel Reed
Geraldine Richmond
Anneila Sargent
Alan Stern
Stephen Willard
Heather Wilson
Maria Zuber

Sethuraman Panchanathan, *ex officio*

Members Absent:

There being a quorum, the National Science Board (NSB, Board) convened in Open Plenary Session at 11:00 a.m. on Wednesday, December 9, 2020, via videoconference with NSB Chair, Ellen Ochoa, presiding.

NSB Chair's Opening Remarks

NSB Chair Ochoa welcomed everyone to the NSB's 470th meeting. She began the meeting by acknowledging two newest Board members announced for appointment days before the meeting. They are Scott Stanley, Vice President of Technology at Techno Planet, and Matthew Malkan, Professor of astronomy at the University of California, Los Angeles. She then reviewed the meeting's agenda before turning the floor over to NSF Director Panchanathan to provide eh Director's remarks.

NSF Director's Remarks

NSF Director Panchanathan began by adding his welcome to Stanley and Malkan to the Board. He then reminded the Board of the three pillars of his vision for NSF, advancing the frontiers of research, ensuring accessibility and inclusivity, and securing global leadership. He continued by highlighting the key aspects of his vision including the focus on strengthening partnerships, people, and translation at speed and scale. In referencing translation, Panchanathan wanted to be clear that he did not see translations activities competing with NSF's widely regarded exploratory or fundamental research. He stated that he sees them intertwined with one another as co-equal strands of NSF's DNA.

Panchanathan then reported on the wide variety of S&E stakeholders with whom he has engaged since he became Director just before the July 2020 Board meeting. His list included a large number of US Government agency heads whose agencies either conducted research and/or funded other agency's research. His engagements also included Academic and Science community, industry and foundation, and international stakeholders.

Panchanathan continued his remarks by providing an update on the Arecibo Observatory following the December 4, 2020 collapse of the Observatory's 305-meter telescope. He expressed his sadness for the collapse and his acknowledgement of how serious an impact this will have on the science community in Puerto Rico. He also confirmed that the Observatory was not closing. He stated that the 12-meter telescope and other facilities would be reopened as soon as possible. Panchanathan also reported that he has asked the National Academies to conduct an expedited independent study to assess the causes of the cables failures that led to the collapse. He added that NSF would be releasing a Dear Colleague Letter to seek input from the science community for robust science programs at Arecibo.

Panchanathan transitioned to recognizing 2020 major award winners who had received NSF funding. Roger Penrose, Andrea Ghez, and Reinhard Genzel shared the Nobel Prize in Physics. Jennifer Doudna received the Nobel Prize in Chemistry, Paul Milgrom and Robert Wilson shared the Nobel Memorial Prize in Economic Sciences. MacArthur Fellowships were awarded to Isaiah Andrews, Paul Dauenhauer, Monika Schleier-Smith, and Mohammad Seyedsayamdost. Four University of Washington scientists won Breakthrough Prizes, David Baker in Life Sciences, and Eric Adelberger, Jens Gundlach, and Blayne Heckel in Fundamental Physics.

Panchanathan concluded his remarks by providing an update on the Antarctica procurement contract. He stated that NSF is initiating the acquisition planning for the new procurement contract that will replace the current one which expires in March 2025.

Chair's Activity Report

NSB Chair Ochoa continued the meeting by providing a summary of her activities since the July meeting. She noted that with the election season having just concluded, she did not have any meetings on Capitol Hill. She reported that she, Vice Chair McCrary, and Roger Beachy had been busy providing briefings to interested stakeholders on *Vision 2030*. They briefed the NSF Committee on Equal Opportunities in Science and Engineering (CEOSE) and an Arkansas public-private partnership, the Conductor, at their meeting of the Coalition to Advance Entrepreneurship. She reported that the response to the Vision was very favorable. She added that the Conductor is an example of a state-level organization with which the Board should be engaging to advance the goals of the Vision.

COVID-19 Impact on Women

NSB Chair Ochoa invited Committee on External Engagement Chair Geraldine Richmond to introduce the session and the panelists: Kyle Myers, Assistant Professor at Harvard Business School; Felicia Jefferson, Associate Professor at Fort Valley State University; Ellen Ernst Kossek, Professor at Purdue University, and Alex Hsain, Ph.D. student and NSF Graduate Research Fellow at North Carolina State University. The purpose of the session was to draw attention to emerging data on how the COVID-19 pandemic has magnified gender inequities in the STEM workplace.

Each speaker gave a five-minute presentation. Myers set the context, sharing results of surveys that looked at which scientists had seen the largest declines in research time and expressed the most pessimism about the future. The three groups of researchers who had seen the largest declines in research time were: "bench" scientists (defined as any researcher who must be in a specific locale to conduct research or who performs very time sensitive work), researchers with young children at home, and female scientists. His survey of researchers' forecasts for the future showed that those scientists who had lost the most research time were most pessimistic about the future and that those scientists who rated their institution's handling of the pandemic negatively also had a more pessimistic outlook. Myers took these findings as evidence that:1) the effects of the pandemic on the research enterprise could be lasting and 2) that some research institutions have been more successful than others in positioning scientists to recover. To address the uneven gender impacts of the pandemic on researchers, he recommended rethinking science's current "winner takes all" reward structure and encouraging universities to adopt tailored policies that reach groups that really need help rather than one-size-fits-all policies.

Jefferson shared preliminary findings from her research on women in STEM's reduction in productivity during the pandemic. Childrearing and household duties, academic service obligations, and personal consultations with students drove women's productivity loss. She noted, in particular, that black faculty at Research 1 institutions, and STEM faculty at Historically Black Colleges and Universities (HBCUs) and teaching institutions saw a shift toward service and advising during the pandemic. She connected this to the fact that COVID-19's health, mortality, and economic impacts have disproportionately affected communities of

color. In closing, she urged that service obligations during COVID-19 be considered in evaluating tenure clocks, career trajectories, and productivity.

Kossek spoke about how COVID-19 has exacerbated the blurring of the work/home boundary and its unequal impacts on the careers of women scientists. She cited, in particular, the impacts on women of childcare and eldercare responsibilities and the mismatch between what universities offered in response – tenure clock extensions – and what women in her survey needed – help with caretaking responsibilities. She identified "work-life" considerations including childcare, eldercare, geographic flexibility (including remote work), and flexible career paths as talent retention strategies that academic institutions should consider and suggested certifying universities for being leaders in this area. In closing, Kossek noted that it will be necessary to creatively address these work-life issues if the U.S. is to grow the number of women in STEM and in the labor market generally.

Hsain shared her perspective as a female, early career researcher, stating that COVID-19 posed an existential threat to female early career researchers. In particular, she highlighted the overlap between timelines for tenure and promotion and peak years for childbearing, noting that competing domestic and career considerations can make a woman's reproductive choice a direct barrier to career advancement. Noting that COVID-19 has exacerbated the disparities between women with children and those without, she urged culture change. Specifically, she called for more open and honest discussion about the pressures that women face in the academic workforce, greater support for career flexibility and "work-life balance," and paid parental leave for individuals at all stages of their academic career. She also noted the need for more informal opportunities for early career researchers to network and disseminate their research at time when conferences and other customary mechanisms for networking have been curtailed.

During the question-and-answer session, members asked the panelists about graduate students' experiences during the pandemic, whether universities and funding agencies are treating the issue of the retention of women in STEM with the urgency the issue merits, whether other sectors were handling this situation better than academia, and whether these findings were applicable to the non-bench sciences. Hsain noted that restrictions on laboratory access due to social distancing protocols made it hard for many graduate students to keep up with experiments and will delay students' graduation, receipt of first jobs, etc. Due to limited data, the panel was unable to answer the questions about other sectors and the applicability of their findings to non-bench sciences. Anecdotally, Geri Richmond offered that leaders at the Department of Energy Laboratories are concerned that women will leave the workforce and Emilio Moran observed that researchers who conduct international research will have lost as much as a year to a year and half of field time.

Julia Phillips stated that since most women in STEM do not end up working in academia, it will be important to look at what's happening with women in STEM in other sectors. Maureen Condic and NSF Director Sethuraman Panchanathan stated that the pandemic has created an opportunity to address these longstanding inequities related to women in STEM in a systemic and sustained manner. Panchanathan urged industry, academia, and government to each identify two or three things that they could do now to start to make rapid progress.

Richmond closed the session urging continued listening and attention to how the pandemic is affecting women and people at career transition points. She reiterated the time sensitiveness of the matter, and the vital need to mitigate the loss of women in STEM.

NSF Planning and Response to COVID-19

NSB Chair Ellen Ochoa invited NSF Chief Operating Officer Fleming Crim to provide an update on how NSF is supporting the research community during the COVID-19 pandemic. Crim began his remarks by noting that the panel discussion on COVID-19 and Women resonated with him and that NSF shares a sense of urgency in supporting members of the research community hit hardest by the pandemic.

Crim reviewed the actions that NSF has taken to assist the research community. These included using existing and new flexibilities, expanding existing programs, and introducing new programs. In terms of flexibilities, NSF continues to issue no-cost extensions, supplements, and deadline extensions. Crim reported that use of no-cost extensions has increased by 50% over the same period last year and that supplements increased by 10%. From March 2020 through September 30, 2020, OMB also permitted NSF to offer salary flexibility that allowed Principal Investigators (PIs) to pay people on their awards even if they were not able to get into the laboratory; those flexibilities expired at the end of Fiscal Year (FY) 2020. He encouraged NSF-supported researchers to speak with their program officers about their needs. In terms of programs, NSF has expanded or created post-doc programs in the Biological Sciences (BIO), Mathematics and Physical Sciences (MPS), and Computer and Information Science and Engineering (CISE) Directorates. CISE has expanded its Research Experiences for Undergraduates (REU) program. NSF's HBCU-Up and Tribal Colleges and Universities programs have provided funds to those institutions to address infrastructure challenges, like WiFi access. NSF has also issued a new solicitation aimed at mid-career faculty and expanded its career-life balance program.

Crim noted the NSF is receiving information about community needs from NSF Advisory Committees, professional societies, national associations, and PIs. He echoed the prior panel in noting that the most affected groups were minority Serving Institutions (MSIs), less affluent institutions, women researchers, researchers from under-represented groups, post-docs, and early career faculty. Noting that career transitions are time of particular vulnerability, he stressed the need, even in a flat budget, to support graduate students, post-docs, and early career faculty. With additional money, NSF could consider more support for undergraduates and mid-career faculty.

Crim shared several scenarios to provide a rough sense of the scale of funds that would be needed to support the community. He echoed the prior panel in noting the importance of NSF taking a targeted approach to helping affected individuals and institutions; a blanket 1-year extension of $100,000 to 30,000 NSF awards would be prohibitive as share of NSF's budget and eat too much into NSF support for new research grants. As NSF decides what it needs to do going forward to support individuals and academic institutions in need, it will also need to

consider he needs of its major research facilities and centers, which have also been affected the pandemic.

Members asked about the fraction of grants renewed each year and about the thinking behind new programs like the CISE post-docs. They expressed support for NSF's targeted approach to COVID-relief, stressing the need for NSF to also have money funds to support new research at a time when the number of grant submissions has increased. Arthur Bienenstock encouraged NSF to coordinate with universities and university organizations; the Director noted that such work is already underway and that he wants NSF to be an exemplar in how to partner on these matters. In light of concerns about the challenges facing graduate students and early career faculty, Geraldine Richmond urged the need for metrics that track which institutions do best in mentoring and retaining women and under-represented minorities.

NSB *Vision 2030* Implementation Working Group Update

Ochoa began this session by reminding the Board that *Vision 2030*'s bold words need to be complemented by actions and metrics. She then turned the session over to NSB Vice Chair McCrary, chair of the Vision Implementation Working Group (VIWG), to report on the group's recent activities.

McCrary's update focused on activities related to communicating the Board's vision with other audiences and on steps that NSB and NSF have taken to date to implement Vision Roadmap items. On the communications front, McCrary described recent presentations that he, Ochoa, and Roger Beachy had made to CEOSE (Committee on Equal Opportunity in Science and Engineering) and the Coalition to Advance Arkansas Entrepreneurship. He announced that he was slated to present the *Vision* to the American Chemical Society the following week. Beachy had also recently presented *Vision 2030* to Washington University in St. Louis' Biology Department and Michigan State's College of Agricultural Sciences. McCrary asked all NSB to set a goal to present *Vision 2030* to their institutions and networks in 2021. Beachy seconded this request, noting that his presentations attracted a wider audience at these institutions, including administrators, and that he learned a lot from the ensuing dialogue.

McCrary reminded members that NSB is currently prioritizing the "Delivering Benefits from Research" and "Developing STEM Talent for America" focus areas. The Board, the Director, and the Assistant Directors had generative conversations at the NSB Retreat and subsequently in smaller group settings on how NSF can help advance progress in these areas. He observed that Director Panchanathan's vision for NSF is extremely well aligned with *Vision 2030* and noted that this is key because so much of *Vision 2030*'s success depends on NSF.

In terms of "Delivering Benefits from Research", the Committee on Oversight has developed a plan to examine NSF's Broader Impacts criterion, the Committee on Awards and Facilities has been working on agency-level research infrastructure planning, and Panchanathan and Dario Gil have been hosting roundtables with industry to gather input on how NSF can advance discovery and innovation through partnership, and Suresh Babu is tackling how to advance partnerships at the state level, starting in his home state of Tennessee. Several members noted the importance of also focusing in the future on cross-federal government partnerships, particularly to get to the Department of Education to bring the findings of NSF-funded education research into classrooms

and to address issues identified in *Science and Engineering Indicators* that go beyond NSF's and NSB's remit.

In terms of "Developing STEM Talent for America," McCrary reported the Committee on Science and Engineering Policy is developing policy products on this topic, that *Indicators 2022* will present S&E workforce data in a manner that fully integrates data on the skilled technical workforce, and that continued attention is being drawn to the experiences of blacks in S&E through the Mathematical and Physical Science's Directorate's Black Lives in S&E Panel and a NSF Science Matters blogpost on "The Science Behind HBCU Success." Recognizing that NSF has some outstanding examples in Sean Jones, Beethika Khan and Claudia Rankins, among others, he called for an expansion of the S&E leadership pool from these populations. McCrary ended his update by previewing a dashboard that NSBO is developing to track progress on Vision implementation.

McCrary then initiated a generative discussion around the Board's goals for cultivating diverse domestic STEM talent. Members considered where in the funnel from K-12 through Ph.D. to focus NSB's energies, potential target goals, and possible mechanisms. Several members urged a focus on recruitment, retention, and training from the undergraduate level through the Ph.D. Possible mechanisms to support this focus included rating departments/institutions on graduate student retention and commitment to diversity and inclusion; gathering and disseminating best practices on recruitment and retention to colleges and universities; tying levels of NSF indirect cost recovery to institutional scores on recruitment/retention; developing NSF programs to support institutions in implementing best practice mentoring programs for undergraduate and graduate students; and shifting more money from traineeships to graduate fellowships. Some members offered numeric targets for these goals such as doubling or tripling the number of individuals from underrepresented groups at a given career stage over a period of years. Other members felt that the Board needed more data on the current recruitment and retention situation to set informed growth goals. Members cautioned that as part of any metric, NSB must consider whether people leave the path to academic careers to go into STEM careers or whether they are dropping out of STEM entirely, noting that the goal is to keep the pipeline full and that there are many workforce pathways in STEM.

Panchanathan noted that NCSES, SBE, and EHR have data that could be useful to NSB. Richmond added that a RFI may be needed to obtain graduate student retention data at the department level.

In closing, Panchanathan stressed that addressing these challenges will require multi-agency collaboration and engagement with academic institutions. To this end, he encouraged NSB to capitalize on its convening power and its links to the academic community. McCrary encouraged members to continue to share ideas with him.

Session 2 **(December 9, 5:00–6:30 p.m.)**

Celebrating Science & Public Service with the 2020 Waterman and Honorary Award Winners

NSB Chair Ochoa opened this special session acknowledging the unfortunate impact the COVID-19 pandemic had had on the traditional Honorary Awards celebration held in May each year. She welcomed the award recipients for the 2020 NSB Vannevar Bush and Public Service Awards, as well as those for the NSF Alan T. Waterman Award. The awardees were Ralph Gomory, IBM, (Vannevar Bush Award), William Jackson, University of California, Davis (Public Service Award), William Hammack, University of Illinois at Urbana-Champaign (Public Service Award), Emily Balskus, Harvard University (Waterman Award), and John Dabiri (California Institute of Technology (Waterman Award). Ochoa explained the significance to the NSB awards and congratulated all the winners before handing the floor to NSF Director Panchanathan, who spoke about the Waterman Award and congratulated the winners.

Ochoa then introduced former NSB member Vint Cerf, the moderator for the evening's panel discussion. Cerf provided longer bios of each awardee and led a rich interview style panel highlighting the work and contributions of each awardee.

Session 3 **(December 10, 11:00–11:30 a.m.)**

Committee on Equal Opportunities in Science and Engineering (CEOSE) Briefing

NSB Chair Ochoa welcomed Jose Fuentes, Professor of Meteorology at Pennsylvania State University and Chair of the Committee on Equal Opportunities in Science and Engineering (CEOSE), and Alicia Knoedler, Vice President for Research and Innovation at Miami University and Vice Chair of CEOSE to the meeting. Ochoa began the session by highlighting the synergies between the work of CEOSE, a Congressionally-mandated NSF advisory committee, and NSB's focus in Vision 2030 on developing domestic STEM talent. She noted that she, NSB Vice Chair Victor McCrary, and *Vision 2030* report chair Roger Beachy had presented *Vision 2030* at CEOSE's October meeting and that the purpose of this discussion was for the Board to learn more about CEOSE's work and identify possibilities for future collaboration.

Fuentes and Knoedler provided an overview of CEOSE's activities. These include reviewing NSF's policies and funding opportunities with an eye toward broadening participation of underrepresented groups, working closely with NSF staff, and producing a biannual report to the NSF Director and Congress that presents the state of participation of underrepresented groups in NSF-supported activities and offers recommendations for improvement. Past CEOSE recommendations lead to what is now NSF's Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science (INCLUDES) program.

Fuentes and Knoedler stressed the need to change mindsets about broadening participation to enhance recognition and valuing of underrepresented groups and making the entire community – not just underrepresented groups and campus diversity offices – responsible for progress. Areas they identified for future CEOSE-NSB collaboration included: integrating broadening participation more explicitly in NSF's Merit Review criteria, promoting effective broadening participation strategies, and engaging stakeholders to promote systemic change.

Anneila Sargent, Chair of the Committee on Oversight (CO) expressed enthusiasm for partnering with CEOSE as CO undertakes work on the broader impacts merit review criterion. Knoedler noted that CEOSE is ready to go when NSB is and Fuentes stressed that all investigators need to take broadening participation seriously.

Session 4 **(December 10, 6:15–6:45 p.m.)**

NSB Chair's Remarks

NSB Chair Ochoa welcomed the NSF staff, guests, and members of the public listening via webcast. She began the session by requesting a moment of silence in remembrance for the late James Jackson, a former NSB member who had passed away in September. She also acknowledged and thanked for their many years of service to NSF James Hamos and Sherrie Green, who had announced their retirements, and Beethika Khan, who had announced her move to a new position at the Food and Drug Administration.

On the welcoming side, Ochoa welcomed Alexandra Surcel, new AAAS Science and Technology Policy Fellow, and Kaela Washler and Nate Atlas, contractors with the Windsor Group to the Board Office.

Approval of Prior Minutes

Ochoa presented the minutes of the July Open Plenary for approval. Those minutes were approved as presented.

NSF Director's Remarks

NSF Director Panchanathan began by calling the Board's attention to the written update of OLPA activities that was in the Board Book. He then announced some senior leadership moves across the Foundation. Sean Jones will be the new Assistant Director for the Directorate for Mathematical and Physical Sciences. Kendra Sharp will be the new Head of the Office of International Science and Engineering. Shekhar Bhansali joined NSF as the new Division Director for the Division of Electrical Communication and Cyber Systems in the Directorate for Engineering. Stephen Goldstein will be the new Division Director for the Division of Earth Sciences in the Directorate for Geosciences. Peggy Gardner has been promoted to the position of Deputy Head of the Office of Information and Resource Management. Alexandra Isern was

promoted in September to be the Deputy Assistant Director in the Directorate for Geosciences. Maren Williams will be the new Division Director of the Division of Administrative Services in the Office of Information and Resource Management. Finally, Panchanathan announced the retirements of NSF General Counsel Lawrence Rudolph and Senior Advisor James Hamos.

Open Committee Reports

NSB Chair Ochoa then turned to the open committee reports.

Maria Zuber reported for the Committee on Strategy (CS). She stated that the committee received updates on NSF's FY 2021 appropriations and received a number of briefings from NSF. These included an introductory briefing on the development of the NSF Strategic Plan 2022-2026, a presentation on the HER Advisory Committee's Report on STEM education, and two companion briefings on NSF's Missing Millions and Translation, Innovation and P Partnerships initiatives being developed as part of Director Panchanathan's vision for NSF.

Julia Phillips reported for the Committee on National Science and Engineering Policy (SEP). She stated the committee received an update from NCSES on the status of the 2022 edition of the *Science and Engineering Indicators* thematic reports. The committee also received an update on the July briefing on the impact of COVID-19 on data collection and data quality. Finally, Phillips stated that the committee provided updates on the two policy papers being developed based on the *2020 SEI*, nurturing U.S. science and engineering talent and economic impact of international students and workers.

Stephen Willard reported for the Committee on Oversight (CO). He stated that the committee provided a brief description on the Board's Overview for the 2019 Merit Review Digest and recommend it to the full Board for approval. The Committee also heard two briefings on Broader Impacts, one from NSF's Suzanne Iacono and the other from Susan Renoe from the Advancing Research Impact in Society organization. The committee also heard updates from the Office of Inspector General (OIG) and the Chief Financial Officer. For the 23rd consecutive year, NSF received a clean audit.

Dan Reed reported for the Committee on Awards and Facilities (A&F). He stated that he briefed the Board that A&F has developed and adopted a new document that outlines the Board's, oversight responsibilities and plans for midscale research infrastructure. He also stated that he had requested from NSF a written context item for the February 2021 meeting related to the Gemini Observatory spending cap increase.

Geri Richmond reported for the Committee on External Engagement (EE). She stated that the committee unveiled a new *Vision 2030* video that members can use as a part of their outreach efforts. She also reported that Maria Zuber and Heather Wilson discussed recommendations for NSB Congressional engagement and Suresh Babu described a related, but slightly broader, potential Vision listening session with Tennessee stakeholders focused on building partnerships.

Vote

Ochoa then turned to the item needing Board approval. She asked for a motion to approve the Board's Overview to the 2019 Merit Review Digest that was recommended to the full Board from the Committee on Oversight. The Overview was approved as presented.

Chair's Closing Remarks

Ochoa concluded the meeting by thanking all the external speakers and panelists who contributed to a very productive meeting. She also congratulated, once again, the 2020 Honorary Award winners.

There being no further business, the meeting was adjourned at 6:45 p.m.

X 

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