NSB-2024-25
July 24, 2024

APPROVED MINUTES
PLENARY OPEN SESSION
488th MEETING
NATIONAL SCIENCE BOARD

National Science Foundation (NSF)
In Person and via Videoconference
May 1-2, 2024

Key Points

Session One, May 1, 2024, 8:30 am to 12:04 pm, EDT

Chair's Remarks: (8:30 – 8:40 am)

- Highlights of Chair Dan Reed's activities since the NSB February 2024 meeting included in-person and virtual Indicator roll-out events, meetings with congressional staff on topics including the budget and NSF's U.S. Extremely Large Telescopes program and co-authored an op-ed with Darío Gil on STEM workforce issues and challenges.
- Highlights of Vice Chair Victor McCrary's activities since the NSB February 2024 meeting included a series of meetings and events with student organizations, Department of Defense officials, AAAS, APLU, the American Council of Engineering, and the U.S. Navy for a briefing and tour on subjects ranging from the need for STEM talent and national security, talent development, and graduate stipends.

Director's Remarks (8:40 - 9:10 am)

- The fiscal year **(FY) 2025 President's Budget request for NSF is $10.183 billion** (FY 2024 budget was $9.06 billion).
- The Director offered examples of NSF-funded research projects demonstrating investment impact and alignment with NSF pillars and highlighted numerous external engagements.
- Senior Staff Updates
  - Mr. Clyde Richard, Deputy Chief Information Officer
  - Ms. Star Anderson, Deputy Division Director, Division of Human Resources.
  - Dr. Greg Hager, Assistant Director, Computer and Information Science and Engineering
  - Dr. Kaye Husbands Fealing, Assistant Director, Social, Behavioral and Economic Sciences
- Acknowledgements – Presidential Rank Awards (Sylvia Butterfield and Rebecca Keiser); the passing of long-time former NSF employee Mr. Charles Mayes.

NSB External Panel – "The Future is Now: Harnessing Artificial Intelligence for Good" (9:10 – 10:25 am)

The purpose of the panel was to help NSB Member explore topics related to the possibilities for positive impacts of AI as well as risks and negative impacts. Expert panelists included Ken Forbus (Cornell University), Eric Horvitz (Microsoft), Bart Selman (Northwestern University), and Lynn Parker (University of Tennessee). **Key messages included what is needed to ensure a workforce that is primed for current and future AI technologies.**

Panelists each described needs as it relates to using AI to supercharge scientific discovery:
(Horvitz)

1) Ensure that U.S. scientists and engineers gain access to computing infrastructure including computational resources, models and tools, and dataset and data hosting
2) Share resources and data on shared scientific goals
3) Update education AI curriculum that incorporates AI tools, from K-12 through higher education
4) Maintain scientific integrity with uses of the AI applications
5) Prioritize issues with safety and responsibility, taking proactive measures again possible misuse

(Selman)

6) Share resources such as data on a national level via a private-public partnership with sufficient R&D investments and the right policies in place

(Forbus)

7) Double down on open knowledge networks and invest in more human-like learning methods and reasoning methods

(Parker)

8) Accelerate progress on AI policy goals by making a closer alignment between the AI policy community and the AI R&D community
9) Pursue intentional active intervention in the area of expanding geographic participation in AI innovation
10) Enable broader participation in the new AI economy through a focus on AI education and workforce training. Ideas included outlining the knowledge, skills, and abilities that all workers need in various disciplines to fulfill roles in AI and to have the opportunities to participate in the AI enabled workforce

Q&A - Following the presentations, NSB Members and panelists engaged in a Q&A session. What is the scale and speed of investment required for a horizontal platform that can serve all sciences? (Darío Gil) The National AI Research Resource Task Force's report suggests that the bare minimum is in the billions of dollars for compute, data resources, tools, and models. A similar investment as that of national research labs for applied physics currently managed by the Department of Energy. (Horvitz, Selman, Parker)

How well prepared are the regulatory agencies to get the solutions that result from AI to the public? (Roger Beachy) Horvitz and Parker responded positively noting proactive efforts by the Executive Office, Congress and federal agencies and that it will require proactive participation by experts.

What competencies must be mastered in order for students to move into AI? (Julia Phillips) Even before trying to create a broad workforce that can create new AI systems is to create a broad workforce that is eager and willing to engage with and use AI tools that they do not have to build. But they must understand what these tools can do in whatever career path there is. (Lynn Parker)

The private sector is far ahead of universities in AI research. Computer science departments are bursting at the seams but less students go on to the PhD level. How can we address this? (Suresh Garimella) Selman offered an example whereby Cornell offers an AI for Science program funded by the Smith Foundation that integrates AI into any discipline. Students under this initiative might not work purely on AI technology but rather use AI technology as a tool to accelerate scientific discovery and material science. (Selman)

There is so much potential for misuse of AI, how can we guard against it? (Garimella) As we build collaborators / systems, they must share our moral and social norms. These will be the guardrails which is currently a very active area of research in AI. (Forbus)

The panelists were asked if funding and policies were in place, what are the top two areas they would scale? (Merlin Theodore) Panelists responded as follows:

- Double down on the open knowledge networks for common sense or tacit knowledge (Forbus)
- Invest in areas where we can see results (Horvitz)
- Prioritize AI for education and as a tool for collaboration and to help humans (Parker)
- It might be best to spread investments out over disciplines (Selman)

Can humans adapt to AI as fast as AI is developing? What are some of our biggest challenges and what can be done to address them? (Marvi Matos Rodriguez)

- Augment, not replace (Forbus and Selman)
- Promote AI literacy so people gain familiarity and comfort with the technologies. (Parker)

Members engaged in some discussion about the possibilities of using AI for STEM talent development (as opposed to STEM workforce needs for the future of AI), and the future of devices / hardware for collecting data and continuous learning. Selman offered that there are tremendous opportunities for improving education. (Stassun, Babu, all panelists)

Committee Reports (10:40 am – 12:04 pm)

Committee on External Engagements (EE) – Chair Darío Gil

- **Reflections on 2022-2024** - EE key initiatives since 2022, included a revision of the NSB awards criteria and streamlining nominations process, expanding the number of briefings and media events associated with NSB's Science and Engineering Indicators report, attending nearly 80 meetings with Congress, Office of Science Technology Policy, Office of Management and Budget (OMB), and members of the science and engineering community and production of two op-eds on a range of topics from NSF's key role in the U.S. economic and national security and way to address the STEM talent crisis
- **Road Ahead** – Using Indicators data, the Chair described the changing S&E landscape and the detrimental impacts on talent in the U.S. and asked Members to reflect on what NSB could do and how to motivate Congressional action to address the new realities.

Committee on National Science and Engineering Policy (SEP) – Chair Maureen Condic

- Condic provided an accounting of the numerous publication and roll-out activities of Indicators 2024 and reported positive feedback to the suite of 2024 Indicators-related products.
- Condic updated Members on the 2026 Indicators plan to streamline reports and make data more accessible through three thematic reports instead of nine and accessibility via a data dashboard. Stakeholder feedback about the2026 plan has shown enthusiasm for simpler access to data, increased utility, and the possibility of quick turn-around data-driven releases (as opposed to policy products).
- Members' review of revised detailed narrative outlines will be critically important to ensure the preservation of key indicators and no loss of data. NSB/NCSES will continue to seek ongoing user input and NSB output in real time.
    - **National Security working group – Lead Member Marvi Ann Matos Rodriguez** reported that the group's draft policy piece, *International STEM Talent is Crucial for U.S. STEM Workforce* is currently being reviewed by SEP. The group is also exploring the topic of STEM workforce needs in sectors essential for national security from the Skilled Technical Workforce to academia and will update the Board at the next meeting.
- **Talent Development Team working group – Lead NSB Member Julia Phillips** reported an update to the Board's 2019 STW with 2024 Indicators data. The new document is *The Skilled Technical Workforce: Crafting America's Science & Engineering Enterprise* and was approved by SEP. The group has also identified and prioritized the following areas for policy development – 1) developing a robust STEM instructional workforce for pre-K through 12th grade; 2) undergraduate students pursuing STEM bachelor's degrees; 3) community colleges. Plans include conducting listening sessions from which a report will be developed on the various roles of community colleges in expanding domestic STEM talent while paying attention to geography of STEM talent in connection with innovation.

Committee on Oversight (CO) – Chair Stephen Willard

- **Activities – In March, the OIG gave a presentation on research misconduct.** The Office of Inspector General (OIG) recommendations associated with investigations in this area are not aimed at penalizing honest errors but designed to protect NSF and other federal interests. The OIG's contractor Kearney & Company's reported that its audit of NSF's FY 2023 financial statements found no material weaknesses nor instances of noncompliance and its Federal Information Security Management Act audit showed improvement. NSF's Chief Financial Officer (CFO) presented highlights from the CFO's quarterly report including the work to achieve favorable audit results.
- **Reflections on 2022-2024 –** Substantive areas of focus included broader impacts, NSF's Merit Review digest and related data, enterprise risk management and the EPSCoR program. CO helped establish the NSB-NSF Merit Review Commission in December 2022. Beyond specific initiatives and programs, CO fulfilled its charge through reviews of quarterly CFO reports, OIG's annual financial statement audits and management challenges and semi-annual reports.
- **Road Ahead** – In addition to completing the Merit Review Reexamination, CO encourages the annual collaboration with the Committee on Strategy (CS) to review NSF's annual

performance goals and the Committee on Awards and Facilities (A&F) for continued attention to NSF's efforts related to the Sexual Assault and Harassment Prevention Report.

Committee on Strategy (CS) – Chair Suresh Garimella

- **Reflections on 2022-2024** – CS worked with NSF on planning and strategy activities related to budget, talent development and research infrastructure (with the Committee on Awards and Facilities). Results included NSF's earlier engagement with OMB allowing for timely input by NSB into the budget process and an increased focus on performance and metrics. The work of CS also contributed to the launch of the Directorate for Technology, Innovations, and Partnerships (TIP).
- **Road Ahead** – Further integration of NSF's strategic plan, long-term planning, annual budget, and performance activities, develop strategies to navigate the constrained budget environments and continuation of expert panels at NSB meetings on emerging technologies to help Members, NSF, and audiences see what's ahead. Identifying a few areas and revisiting the same topics regularly is important because of the pace of change. Combining the panel discussion with position papers using Indicators data and op-eds will also be important.

Sub-committee on Technology, Innovation, and Partnerships (S-TIP) - Chair Darío Gil

- **Reflections on 2022-2024** – Gil outlined the charge of S-TIP and the ways in which Members collaborated with NSF and TIP leadership to focus on the vision and roadmap for TIP including the budget, strategy and objectives, partnerships and feedback loops between TIP and NSF research directorates. Gil acknowledged NSF / TIP leaders and staff for successfully launching the new directorate and competition of the first Regional Innovation Engines (RIE) program competition and announced the sunsetting of S-TIP.
- **Road Ahead** – S-TIP identified topics for consideration by CS and CO to continue effectively engaging with and monitoring TIP including TIP's relationship to NSF's 5- and 10-year strategy, TIP budgetary sufficiency, the execution of RIEs and the TIP roadmap, the integration of TIP within the agency to maximize synergies between TIP and other directorates, and the annual update of the list of 10 critical technology areas and five societal challenges.

Session Two, May 2, 2024, 8:30 am to 11:35 am, EDT

Chair's Remarks: (8:30 – 8:35 am)

- Reed announced and congratulated the Chair-elect Darío Gil and Vice Chair-elect Victor McCrary for the term 2024-2026.
- Reed offered some retrospective remarks and outlined opportunities ahead. Highlights of his message included gratitude for his colleagues' partnership with the Board's work, the progress on NSB's Vision 2030, and references to data and trends from the Board's Indicators report touching on where there is work to do.
- Reed noted that a change in messaging and action is needed to change the current dynamic and conversation about the importance of science and technology and encouraged embracing a 21st century version of the National Defense and Education Act to galvanize the county's thought about education, mobilize all the assets of the country

including government, industry, academia and nonprofits, reinspire people, and think strategically.

NSB Chair's Farewell to Members (8:35 – 10:05 am)

NSB held a brief ceremony in which Reed thanked and acknowledged the individual contributions of the members of the class of 2018 – Deborah Loewenberg Ball, Vicki Chandler, Maureen Condic, Suresh Garimella, Steven Leath, Alan Stern, and Stephen Willard. Vice Chair Victor McCrary delivered a tribute to Reed for his service to the Board. The Director concluded the session with remarks to members of the class of 2018.

Q&A with the 2024 NSB Vannevar Bush and Science and Society Awardees and the NSF Alan T. Waterman Awardees (10:05 – 10:50 am)

Ball introduced the awardees and moderated a question and answer session with Members. Awardees of 2024 included: John Hennessy (Vannevar Bush Award); Sheri McGuffin & Eric Wooldridge and Paul Sandberg on behalf of the National Academy of Inventors (Science & Society Award); Muyinatu "Bisi" Bell, Katrina G. Claw, Rebecca Kramer-Bottiglio (Waterman Award).

Committee Reports (11:05 – 11:26 am)

Commission on NSB-NSF Merit Review (MRX) – Chair Stephen Willard

Willard described the purpose of the merit review process and presented a brief history of merit review policy and the charge of the commission. He reminded Members that MRX is reexamining the two-board approved Merit Review criteria by which all proposals are evaluated, as well as the principles and elements that provide additional guidance to reviewers and proposers. Over the last year, MRX has engaged in thoughtful discussions at a frequency of about twice a month for two and three-hour sessions to develop preliminary recommendations to the Board. Work has consisted of gathering information through reviews of relevant literature and discussions with subject-matter experts both internal and external to NSF. Subjects have included federal policies and processes, additional criteria and guidance, criteria evaluation, high-risk high-reward research, portfolio balance, broadening participation, and diversity, equity, inclusion, and accessibility. MRX is currently analyzing data gathered from NSF leaders and program staff about their experiences with merit review. This summer, MRX will launch an external data collection effort.

Willard presented the following high-level *preliminary* policy recommendations to NSB:

- NSF's Merit Review is the Gold Standard for awarding grants and should be reaffirmed as such;
- The two current criteria – intellectual merit and broader impact - meet NSF's mission and MRX anticipates recommending clarifications to more clearly recognize their alignment;
- Ensure that NSF delivers societal benefits in addition to promoting the progress of science in accordance with the NSF Act and other applicable statutes;
- Improve portfolio construction and monitoring to maximize NSF intellectual and societal impact; and

- Strengthen Broadening Participation in the Merit Review process as it applies to both Intellectual Merit and Broader Impacts.

MRX anticipates delivering its final policy recommendations to the Board in December 2024. Willard added that the Commission would deliver preliminary suggestions as it relates to implementation and accountability to the Board in July 2024. Finally, he reminded Members and guests that MRX invites feedback from the public/community via **meritreviewcommission@nsf.gov**.

Follow-up Items for NSB

N/A

Motions / Votes

SEP reported a motion to approve the plan for the described revision to the Indicators suite of products for the 2026 cycle. NSB voted unanimously to approve the plan for revisions (See resolution and DocLog number below).

Attendance on May 1 and 2, 2024

Members Present
Dan Reed, *NSB Chair*
Victor McCrary, *NSB Vice Chair*
Sudarsanam Babu
Deborah Ball
Roger Beachy
Vicki Chandler
Maureen Condic
Aaron Dominguez
Suresh Garimella
Darío Gill
Dorota Grejner-Brzezinska
Melvyn Huff
Steven Leath
Matthew Malkan
Marvi Ann Matos Rodriguez
Julia Phillips
Scott Stanley
Keivan Stassun
S. Alan Stern
Merlin Theodore
Wanda Ward
Bevlee Watford
Stephen Willard
Heather Wilson
Sethuraman Panchanathan, *ex officio*

Members Absent

There being a quorum, the National Science Board (NSB, Board) convened in Plenary Open Session from 8:30 a.m. to 12:04 p.m. EDT on Wednesday, May 1, 2024, and from 8:30 a.m. to 11:35 a.m. EDT on Thursday, May 2, 2024, with NSB Chair, Dan Reed, presiding on both days.

Approval status of previous meeting minutes

Date of Meeting(s): February 21, 2024 Approved: _X_Yes __No

Notes (optional)

Resolution, NSB, Science and Engineering Indicators (NSB-2024-18)

WHEREAS, Congress charges the National Science Board (NSB) to "render to the President and the Congress … a report on indicators of the state of science and engineering in the United States"[1];

WHEREAS, *Science and Engineering Indicators* (*Indicators*) comprises high-quality objective data on the U.S. and international science and engineering enterprise;

WHEREAS, *Indicators* is an integrated, comprehensive collection of reports and data access tools that is prepared under the guidance of the NSB by the National Center for Science and Engineering Statistics (NCSES);

WHEREAS, it is a shared NSB-NCSES priority to maintain and improve relevance, accessibility, and Timeliness of *Indicators* data and analysis;

- RESOLVED, NSB approves modifying *Indicators* products in the 2026 and future *Indicators* cycles to comprise 1 summary report, *The State of U.S. Science & Engineering (S&E)*, in service of the statutory requirement; 3 thematic reports on umbrella topics related to talent, discovery, and translation/impact; a data dashboard that preserves the breadth of S&E indicators deemed relevant and high-quality; and timely special topic releases unique to each cycle.

7/24/2024

X Andrea Rambow

Andrea Rambow

Signed by: ANDREA I RAMBOW

Executive Secretary to the National Science Board