A Public Meeting of the

National Quantum Initiative Advisory Committee (NQIAC)

May 19, 2023

Meeting Minutes

MEETING PARTICIPANTS

Committee Members (in attendance)

- Kathryn Ann Moler, Co-Chair
- Charles G. Tahan, Co-Chair
- Jamil Abo-Shaeer
- James S. Clarke
- Deborah Ann Frincke
- Gilbert V. Herrera
- Nadya Mason
- William D. Oliver
- John Preskill
- Mark B. Ritter
- Robert J. Schoelkopf
- Krysta M. Svore
- Jun Ye

National Quantum Coordination Office Staff Supporting the NQIAC

- Charles G. Tahan, Director
- Gretchen K. Campbell, Deputy Director
- Tanner J. Crowder, Policy Analyst
- Thomas G. Wong, Quantum Liaison and NQIAC Designated Federal Officer (DOE)

Public Speakers

- No members of the public presented statements

START DATE AND TIME: Friday, May 19, 2023 at 1:00 PM Eastern Time

LOCATION: Virtual Meeting via Zoom for Government

OPENING

Wong called the meeting to order. Co-Chair Tahan presented the goal of the meeting, which was to deliberate draft findings and recommendations in hopes of approving the first report of the National Quantum Initiative Advisory Committee (NQIAC). He noted that the report would be timely with Congress considering the reauthorization of the National Quantum Initiative (NQI), and he expressed hope that the report will be impactful. Co-Chair Moler thanked the members for their hard work, as well as the staff and experts who supported the committee.

NQIAC FINDINGS: PRESENTATION AND DELIBERATION

The three draft findings were shared on a slide.[1] Moler read the findings and opened the floor for deliberation. Frincke expressed support. Herrera noted that the findings may seem obvious, but they really are not. He lauded DOE's ramp-up in QIS despite the COVID-19 pandemic, reiterated that QIST is critical to economic and national security, and highlighted that reauthorization is vital to realizing the benefits of QIST. Ritter reflected on the complex equipment and facilities that were established during the first five years of the NQI, remarking that these investments will accelerate the pace of research going forward. Moler noted that people's enthusiasm for what can be accomplished has not dimmed, and that the prospects for QIST seem more attainable now. Hearing no dissent, the findings were approved as written.

NQIAC OVERARCHING RECOMMENDATIONS: PRESENTATION AND DELIBERATION

Tahan read the four draft overarching recommendations from a slide and invited deliberation. In the first overarching recommendation, Moler, Tahan, Herrera, and Ritter suggested modifying the phrase "appropriated with funds" and settled on "funded at the authorized levels." Wong made live edits to the slide to reflect this change, marking the update in red.

For the second overarching recommendation, Frincke expressed the importance of educating home-grown talent, while avoiding the U.S. becoming a "quantum island" onto itself. Mason suggested adjusting the language to explicitly include developing new scientists, not just current scientists. Clarke expressed that the recommendation should reflect near-term immigration and retraining efforts, medium-term fellowships for graduate students, and long-term outreach and education at the K-12 levels. Ritter, Svore, Herrera, Schoelkopf, Moler, Mason, and Ye suggested various edits. In the end, "educate" was expanded to "attract, educate, and develop."

There were no comments on the third overarching recommendation, so it was accepted as-is.

In relation to the fourth overarching recommendation, Schoelkopf noted that the NQI has accelerated science and U.S. leadership in science, but the balance with technology transfer from laboratories to the commercial space should be considered. Clarke added that fundamental research and engineering form

[1] All slides presented are available in full online: https://www.quantum.gov/wp-content/uploads/2023/05/NQIAC-Slides-2023-05-19-Draft.pdf

a cycle, with engineering revealing new challenges that would cycle back to fundamental research. Svore suggested that wording around economic growth and value could be helpful. Ye suggested that such economic impact was implied, and then suggested striking "potential" from end-users. This later point was adopted. Building on the suggestion about economic impacts, Moler noted that national security and sustainability impacts might also be worth considering. Tahan stated that "society" in the recommendation includes all such impacts, so the suggested edits may not be necessary. Regarding "mature and scale" quantum systems, Tahan, Svore, Herrera, Moler, Ritter, Mason, Preskill, Ye, Oliver, and Clarke debated the language, with the consensus ultimately coalescing around Oliver's suggestion, "enable a virtuous cycle of maturation and scaling of" quantum systems.

NQIAC DETAILED RECOMMENDATIONS: PRESENTATION AND DELIBERATION

Moler read a slide containing a summary of the nine detailed recommendations. Svore question whether "enhance" was the correct verb or the second recommendation, and it was changed to "expand" in response. Regarding the fourth recommendation, Tahan asked if infrastructure included equipment, and Ritter expressed support for explicitly including equipment, and it was adopted. Preskill suggested changing Recommendation 6 from "Protect and support" to "Promote and protect," which was adopted Moler suggested that Recommendation 8, "Retain foreign talent," did not capture processes that could make it easier to recruit foreign talent; this was changed to "Attract and retain foreign talent" in response.

On the next slide, Recommendation 1 and its two sub-recommendations were read by Tahan. Schoelkopf asked if "ten-year tenure" could be improved, and Herrera suggested changing the ten-year "tenure" to "authorization" in response. Herrera, for Recommendation 1B, noted that $11B of the $52B for the CHIPS and Science Act was for research and development (R&D) of semiconductors, and suggested changing "semiconductor manufacturing capabilities" to "semiconducting research and manufacturing capabilities." Herrera's suggestions were adopted.

Recommendation 2 and its four sub-recommendations were read by Moler. The deliberation focused around Recommendation 2A, with Mason noting that there was no mention of funding amount or scale to the new centers, and the original intent was smaller scale centers. Moler suggested editing this to express nimbleness, while leaving the details and funding amounts to the agencies. Herrera suggested that "focused" would address the scale. After deliberation, "nimble and focused" was added. Ritter asked if Congress needed to be named in the recommendation. Wong responded that it is not necessary, that it is implied that Congress would authorize the agencies. Ye suggested language that centers be added "as needed," and this was adopted. The phrase, "and to continue to seed new multidisciplinary collaborations over time" was removed to focus the recommendation on science-focused centers. Svore expressed support for keeping it. Tahan responded that Recommendation 2C addresses engineering centers.

The next slide included Recommendations 3, 4, and 5, which do not have any sub-recommendations. Tahan read the recommendations. There were no comments on Recommendation 3. For Recommendation 4, Tahan and Ye suggested adding "equipment," and this was adopted Herrera asked if "international cooperation statements" would be understood in Recommendation 5. Ritter responded that details would be provided in the supporting text in the final report. Svore asked if "research funding" and "research activities" should be "research and development," and Mason asked for clarification of the intent was to stimulate research or some other goal. Tahan clarified that the United States has ten international quantum cooperation statements to prioritize and facilitate research

between countries with a set of shared values, and the United States would benefit to follow up more aggressively. Ritter raised that "development" was challenging internationally due to issues surrounding intellectual property (IP). Clarke, Moler, Ritter, Herrera, Tahan, and Svore debated this, eventually settling "funding" "activities" without specifying "research" or "research and development." Preskill suggested deleting the comma between "productive" and "collaborative," and this was adopted.

After a break, Tahan read a slide on Recommendation 6 and its four sub-recommendations. There was some conversation, but the text was adopted as-is. Svore noted that Recommendations 6A and 6B lacked specificity compared to other the recommendations, and she raised whether more details would be helpful. Herrera responded that it was intentional, that it is more important to recommend a culture that recommends a balance between protection and promotion, and that specifics might make the recommendations static. Frincke agreed with Herrera's point about a culture of balance given that there can be differing views on how to collaborate safely in areas of technology that impact national security. Preskill remarked that Recommendation 6A is alluding to export controls. Schoelkopf noted that the NQIAC is not the right forum to determine what to protect. Moler remarked that the intent of Recommendations 6A and 6B is to continually be really thoughtful about the state of the technology. Ritter emphasized Recommendation 6C, noting the importance of partnering with QIST-capable nations so the United States does not lose on economic or national security, and to do it in a very thoughtful and balanced way. Svore agreed, stating that national security starts with economic security. She asked if that was emphasized enough, while at the same time not implying that protective measures will never be important. Herrera responded that the NQIAC needs to be careful in its messaging because overhyping the state of the technology could cause decisionmakers to believe it is at the point where protections should be implemented. Ritter emphasized the importance of Recommendation 6D and expressed a desire to see accelerated migration to post-quantum cryptography.

Recommendation 7 and its three sub-recommendations were read by Moler. Mason asked what "QIST enabling technologies" meant in Recommendation 7C. Ritter responded that it is looking at the whole supply chain to ensure that QIST does not end up like the semiconductor industry, alluding to recent efforts from the U.S. Government to reestablish semiconductor manufacturing in the United States. Ritter remarked that ancillary technologies or enabling technologies could be developed through grants and incentives. Abo-Shaeer suggested changing "support QIST enabling technologies" to "support the development of QIST-enabling technologies." Herrera suggested saying "domestic supply chain" over "U.S. supply chain." Ritter suggested changing "to bolster the domestic supply chain" to "to help de-risk the domestic supply chain." Preskill suggested that "as part of efforts" is superfluous. These suggestions were all adopted.

Recommendations 8 on foreign talent and Recommendation 9 on domestic talent, along with Recommendation 9's four sub-recommendations, were on the next slide. Tahan read them. Abo-Shaeer suggested changing the order of the recommendations to first emphasize domestic talent over foreign talent. Moler remarked that the order does not coincide with importance, but the order can be changed. Adopting this, Recommendation 8 and its four sub-recommendations were now on domestic talent, and Recommendation 9 was now on foreign talent. For Recommendation 8A, "NSF and other Federal agencies" was changed to "Federal agencies" to emphasize that many agencies have roles to play in creating fellowships and traineeships. For Recommendation 8D, Schoelkopf asked who would do the "holistic, systematic study of quantum workforce needs." Tahan replied that NSF is the right lead agency since the NQI calls them out for workforce development, and that NSF was called to do a quantum education pilot program as part of the CHIPS and Science Act. He further emphasized that the important part is "for the duration of the NQI." Mason mentioned that the DOE National QIS Research

Centers shared a lot with the NQIAC Science and Infrastructure Subcommittee about their workforce development efforts. Wong remarked that it is true that the DOE Centers do a lot of workforce development, but they are not mandated to do it as part of the NQI, in contrast to NSF's Centers which are. Clarke asked who was asked to do the workforce study legislated by the CHIPS and Science Act. Wong replied that NSF was tasked with funding a National Academies study, so it would be the National Academies, but they typically only analyze existing data, not collect new data, which may be the real need. Ritter agreed that NSF was the natural agency given their work with academia to develop the workforce and engagement in the National Q-12 Education Partnership, and having too many agencies listed may create confusion, overlap, and duplication. Ye shared that he was part of a National Academies panel that was surveying workforce needs before the NQI, and it was difficult to gather all the data. Mason noted a risk that no one will take ownership if it is not specified. She also asked about the scale of efforts. Wong responded that Recommendation 8B is that QIST education and training programs be appropriated, and the quantum education pilot program was authorized by the CHIPS and Science Act at $8M per year. In the end, adding "NSF should lead" to Recommendation 8D was adopted.

Svore noted that for Recommendation 9, the supporting text should have clear, specific callouts. Tahan suggested that the Committee wordsmith that live. Wong pulled up a slide with draft supporting text. Moler shared that the NQIAC is not the only committee thinking about the issue of STEM talent, and she gave the proposed Keep STEM Talent Act as an example. Tahan noted that the NQIAC Workforce and Industry Subcommittee thought foreign talent was critical to the quantum industry. Moler described seeing data indicating that the United States is not cultivating enough homegrown talent, and so if the United States wants to be a nation where advances are happening, it needs to bring in international talent. Svore remarked that in industry, they see substantial delays in the processing of international talent, that it is hard to retain talent, and there are issues with hitting caps in the number of people they can bring in. She noted its important to raise those specific concerns in the supporting text. Preskill noted hesitancy about being overly prescriptive about particular actions, but the paragraph of supporting text did include several potential actions. Svore suggested that separating the paragraph into bullets would address the clarity she was looking for. The Committee accepted this change, with some additional wordsmithing and comments from Ye, Moler, Clarke, Herrera, Ritter, Tahan, Schoelkopf, Svore, and Preskill.

CLOSING AND ADJOURNMENT

Moler opened the floor for any additional edits. Hearing none, the Committee approved the recommendations in the report. She thanked all the virtual participants for joining, and the meeting was adjourned at 4:00 PM Eastern Time.

CERTIFICATION

I hereby certify that, to the best of my knowledge, the foregoing minutes are accurate and complete.

Kathryn Ann Moler, PhD
Co-Chair
National Quantum Initiative Advisory Committee

Charlies G. Tahan, PhD
Co-Chair
National Quantum Initiative Advisory Committee