AMENDMENT TO RULES COMM. PRINT 119–33

OFFERED BY M__. _____

Add at the end the following new division:

DIVISION E—NATIONAL QUANTUM INITIATIVE REAUTHORIZATION

SEC. 5001. SHORT TITLE.

This division may be cited as the ''National Quantum Initiative Reauthorization Act''.

SEC. 5002. DEFINITIONS.

Section 2 of the National Quantum Initiative Act (15 U.S.C. 8801) is amended—

(1) by redesignating paragraphs (3), (4), (5), (6), (7), the first paragraph (8) (relating to the definition of the ''Subcommittee on Economic and Security Implications''), and the second paragraph (8) (relating to the definition of the ''Subcommittee on Quantum Information Science'') as paragraphs (4), (8), (10), (13), (14), (16), and (17), respectively;

(2) by inserting after paragraph (2) the following new paragraph:

''(3) CONFUCIUS INSTITUTE.—The term 'Confucius Institute' has the meaning given such term in

section 10339A of the Research and Development, Competition, and Innovation Act (division B of Public Law 117–167; 42 U.S.C. 19039).'';

(3) by inserting after paragraph (4), as so redesignated, the following new paragraphs:

''(5) FEDERAL LABORATORY.—The term 'Federal laboratory' has the meaning given such term in section 4 of the Stevenson-Wydler Technology Innovation Act of 1980 (15 U.S.C. 3703).

''(6) FOREIGN COUNTRY OF CONCERN.—The term 'foreign country of concern' has the meaning given such term in section 10638 of the Research and Development, Competition, and Innovation Act (division B of Public Law 117–167; 42 U.S.C. 19237).

''(7) FOREIGN ENTITY OF CONCERN.—The term 'foreign entity of concern' has the meaning given such term in section 10638 of the Research and Development, Competition, and Innovation Act (division B of Public Law 117–167; 42 U.S.C. 19237).'';

(4) in paragraph (8), as so redesignated, by striking ''section 1001(a)'' and inserting ''section 1001'';

(5) by inserting after paragraph (8), as so redesignated, the following new paragraph:

''(9) NATIONAL LABORATORY.—The term 'National Laboratory' has the meaning given such term in section 2 of the Energy Policy Act of 2005 (42 U.S.C. 15801).'';

(6) by inserting after paragraph (10), as so redesignated, the following new paragraphs:

''(11) QUANTUM APPLICATIONS.—The term 'quantum applications' means applications that use quantum information science, engineering, and technology, including quantum algorithms and software, quantum computing and quantum-classical hybrids, quantum sensing, quantum networking, quantum encryption, or quantum communications applications.

''(12) QUANTUM COMPUTING.—The term 'quantum computing' means any of a variety of quantum computing technologies, including quantum annealing and quantum gate-model systems that utilize a variety of qubit architectures, such as superconducting, ion traps, photonics, neutral atoms, atomic spin, electron spin, or topological qubits.'';

(7) by amending paragraph (13), as so redesignated, to read as follows:

''(13) QUANTUM INFORMATION SCIENCE, ENGINEERING, AND TECHNOLOGY.—The term 'quantum information science, engineering, and technology' means the understanding, translation, use, or application of the laws of quantum physics for the storage, transmission, manipulation, computing, simulation, or measurement of information.''; and

(8) by inserting after paragraph (14), as so redesignated, the following new paragraph:

''(15) STEM.—The term 'STEM' means the academic and professional disciplines of science, technology, engineering, and mathematics, including computer science.''.

SEC. 5003. PURPOSES.

Section 3 of the National Quantum Initiative Act (15 U.S.C. 8802) is amended—

(1) in the matter preceding paragraph (1), by striking ''science and its technology applications'' and inserting ''science, engineering, and technology'';

(2) in paragraph (1)—

(A) in the matter preceding subparagraph (A), by striking ''science and technology'' and inserting ''science, engineering, and technology'';

(B) by amending subparagraph (A) to read as follows:

''(A) to expand the number of researchers, educators, and students with training in quantum information science, engineering, and technology to develop domestic workforce pathways and retain international talent to the extent consistent with national security and international competitiveness;'';

(C) in subparagraph (B), by striking ''science at the'' and inserting ''science, engineering, and technology at the primary, secondary,'';

(D) in subparagraph (C), by striking ''basic'';

(E) in subparagraph (D)—

(i) by striking ''science and technology'' and inserting ''science, engineering, and technology''; and

(ii) by striking ''and'' after the semicolon; and

(F) by adding at the end the following new subparagraphs:

''(F) to support development of quantum applications, including quantum-hybrid applica-

tions, to promote innovation and commercialization; and

''(G) to support other emerging technologies that could benefit from or benefit the development of quantum technology and promote research, development, demonstration, and application of such technologies in quantum information science, engineering, and technology.'';

(3) in paragraph (2), by striking ''science and technology'' and inserting ''science, engineering, and technology'';

(4) in paragraph (3), by striking ''science and technology'' and inserting ''science, engineering, and technology'';

(5) in paragraph (4)—

(A) by inserting ''National Laboratories,'' after ''Federal laboratories,''; and

(B) by striking ''and'' after the semicolon;

(6) in paragraph (5)—

(A) in the matter preceding subparagraph (A)—

(i) by inserting ''partnerships, research collaborations, and'' after ''international''; and

(ii) by striking ''science and technology security'' and inserting ''science, engineering, and technology'';

(B) in subparagraph (A)—

(i) by inserting '', social benefit,'' after ''innovation''; and

(ii) by striking ''and'' after the semicolon;

(C) in subparagraph (B), by striking the period and inserting ''; and''; and

(D) by adding at the end the following new subparagraph:

''(C) to facilitate cooperative investment in quantum capabilities between the United States and its allies and partners to strengthen and secure the domestic supply chain and related ecosystem; and''; and

(7) by adding at the end the following new paragraph:

''(6) improving the maturity, scale, and short- and long-term viability of the quantum technology industry, including small and medium-sized businesses and startups representing a diversity of quantum specialties, and commercialization of domestic quantum capacity across modalities.''.

SEC. 5004. NATIONAL QUANTUM INITIATIVE PROGRAM.

Subsection (b) of section 101 of the National Quantum Initiative Act (15 U.S.C. 8811) is amended—

(1) in paragraph (1)—

(A) by striking ''development'' and inserting ''research development, and near- and medium-term, and long-term demonstration'';

(B) by striking ''information science and technology''; and

(C) by inserting ''in diverse sectors'' after ''applications'';

(2) in paragraph (2)—

(A) by striking ''fundamental'';

(B) by striking ''science and technology'' and inserting ''science, engineering, and technology''; and

(C) by inserting ''infrastructure,'' after ''demonstration,'';

(3) in paragraph (3)—

(A) by striking ''science and technology'' and inserting ''science, engineering, and technology''; and

(B) by striking ''pipeline'' and inserting ''pathway'';

(4) by amending paragraph (4) to read as follows:

''(4) provide for interagency planning and coordination of Federal quantum information science, engineering, and technology research, development, demonstration, standards engagement, and other activities under the Program, including activities authorized pursuant to section 234 of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (10 U.S.C. 4001 note), quantum educational activities and programs authorized pursuant to section 10661 of the Research and Development, Competition, and Innovation Act (42 U.S.C. 19261), and activities conducted at any Federal laboratory;''; and

(5) in paragraph (5)—

(A) by striking ''industry and universities'' and inserting ''industry, universities, nonprofit research organizations, and strategic allies''; and

(B) by inserting '', including human resources'' after ''resources''.

SEC. 5005. NATIONAL QUANTUM COORDINATION OFFICE.

Section 102 of the National Quantum Initiative Act (15 U.S.C. 8812) is amended—

(1) in subparagraph (A) of subsection (a)(2), by inserting ‘‘, and who shall serve a four year term, subject to renewal’’ before the semicolon; and

(2) in subsection (b)—

(A) in paragraph (3)—

(i) by striking ‘‘science and technology’’ and inserting ‘‘science, engineering, and technology research and workforce’’; and

(ii) by inserting ‘‘, nonprofit research organizations,’’ after ‘‘universities’’;

(B) by amending paragraph (4) to read as follows:

‘‘(4) ensure coordination among the collaborative ventures or consortia established under this Act;’’;

(C) in paragraph (6), by striking ‘‘and’’ after the semicolon;

(D) in paragraph (7)—

(i) by inserting ‘‘nonprofit research organizations,’’ after ‘‘universities,’’; and

(ii) by striking the period at the end and inserting a semicolon; and

(E) by adding at the end the following new paragraphs:

''(8) promote understanding and adoption of quantum capabilities throughout the United States economy, as appropriate; and

''(9) track and promote policies that will ensure stability of the United States quantum workforce, quantum supply chain, domestic quantum industry, and international trade.''.

SEC. 5006. SUBCOMMITTEE ON QUANTUM INFORMATION SCIENCE.

Section 103 of the National Quantum Initiative Act (15 U.S.C. 8813) is amended—

(1) in subsection (b)—

(A) in paragraph (8), by striking ''and'' after the semicolon;

(B) by redesignating paragraph (9) as paragraph (14); and

(C) by inserting after paragraph (8) the following new paragraphs:

''(9) the Department of Health and Human Services;

''(10) the Department of State;

''(11) the Department of Homeland Security;

''(12) the National Oceanic and Atmospheric Administration;

''(13) the Department of Education; and'';

(2) in subsection (d)—

(A) in paragraph (1), by striking ''the quantum information science and technology research'' and inserting ''quantum information science, engineering, and technology research and quantum application development, demonstration, and commercialization'';

(B) in paragraph (4), by inserting '', engineering, and technology'' after ''science'';

(C) in paragraph (5),

(i) by inserting '', engineering, and technology'' after ''science''; and

(ii) by inserting '', and conduct comparative benchmarking of Federal investments and research strategies relative to the investments and research strategies of the United States' strategic partners and other countries'' after ''development efforts'';

(D) in paragraph (6)—

(i) by striking ''science and technology'' and inserting ''science, engineering, and technology''; and

(ii) by striking ''and'' after the semicolon;

(E) in paragraph (7)—

(i) by inserting ‘‘, engineering and technology’’ after ‘‘science’’; and

(ii) by striking the period and inserting a semicolon; and

(F) by adding at the end the following new paragraphs:

‘‘(8) facilitate interagency partnership opportunities to advance quantum applications related to the environment, oceans and coastal systems, advanced manufacturing, biotechnology, space, and other sectors; and

‘‘(9) facilitate interagency partnership opportunities to support the innovation, entrepreneurial, educational, and research capacity of geographic regions with strength in quantum-related fields and industries to address, in partnership with industry, universities, small businesses, and strategic allies and partners, regional, national, societal, or geostrategic challenges.’’;

(3) in subsection (h)(2)(A), by inserting ‘‘, including a description of agency roles and responsibilities’’ before the period; and

(4) by adding at the end the following new subsections:

''(i) QUANTUM USE CASES.—

''(1) IN GENERAL.—The Subcommittee shall identify potential use cases with respect to which quantum computing could advance the missions of participating agencies, including through on-premises, cloud-based, hybrid, or networked approaches.

''(2) QUANTUM ON-RAMP.—For each potential use case identified pursuant to paragraph (1), the relevant Federal agency, in consultation with the Subcommittee, may develop a plan to enable such agency to address each such potential use case.

''(3) REPORTING.—The Subcommittee, as part of the annual report on the budget for the Program under subsection (g), shall report progress in carrying out the activities under this section, including information relating to the following:

''(A) The potential use cases identified pursuant to paragraph (1).

''(B) The status of plans developed pursuant to paragraph (2).

''(C) Any obstacles to implementing such—

''(i) potential use cases; or

''(ii) plans.

''(j) INTERAGENCY COORDINATION REGARDING HELIUM–3 FOR QUANTUM COMPUTING INFRASTRUCTURE AND INDUSTRY AND THE DOMESTIC HELIUM–3 SUPPLY CHAIN.—The Subcommittee shall—

''(1) include in coordination activities of such Subcommittee, as appropriate, the identification of Federal agency helium–3 requirements for quantum computing infrastructure; and

''(2) facilitate information sharing between Federal agencies regarding helium–3 demand projections and supply vulnerabilities.''.

SEC. 5007. NATIONAL QUANTUM INITIATIVE ADVISORY COMMITTEE.

Section 104 of the National Quantum Initiative Act (15 U.S.C. 8814) is amended—

(1) by amending subsection (b) to read as follows:

''(b) QUALIFICATIONS.—The Advisory Committee shall consist of members, appointed by the President, who are—

''(1) representative of industry, including end users likely to benefit from quantum technology and small and medium-sized businesses and startups representing a diversity of quantum specialties, univer-

sities, nonprofit research organizations, and Federal laboratories; and

''(2) qualified to provide advice and information on quantum information science, engineering, and technology research, development, demonstrations, standards, STEM education, technology transfer, commercial application, or national security and economic concerns.'';

(2) in subsection (d)(2)—

(A) in subparagraph (A), by striking ''science and technology'' and inserting ''science, engineering, and technology'';

(B) by redesignating subparagraphs (D), (E), (F), and (G) as subparagraphs (E), (F), (G), and (H), respectively;

(C) by inserting after subparagraph (C) the following new subparagraph:

''(D) other countries' quantum programs and the progress of such countries and such programs relative to the Program;'';

(D) in subparagraph (E), as so redesignated—

(i) by striking ''to'' and inserting ''promote innovation, foster a robust

United States quantum industry, and''; and

(ii) by striking ''science and technology'' and inserting ''science, engineering, and technology''; and

(E) in subparagraph (F), as so redesignated, by inserting '', including to address any gaps that may exist'' before the semicolon;

(F) in subparagraph (G), as so redesignated, by striking ''open standards for, quantum information science and technology; and'' and inserting ''international standards in open and transparent standardization systems for quantum information science, engineering, and technology;'';

(G) in subparagraph (H), as so redesignated—

(i) by inserting ''educational, environmental, health,'' after ''legal,''; and

(ii) by striking the period and inserting a semicolon; and

(H) by adding at the end the following new subparagraphs:

''(I) the domestic and international cooperation needs and goals of the Program, in-

cluding needs and goals related to infrastructure and the supply chain of quantum information science, engineering, and technology; and

''(J) the degree to which quantum information science, engineering, and technology is enhancing or can enhance the capabilities of the United States advanced industrial economy and protect or optimize critical infrastructure (as such term is defined in section 1016(e) of Public Law 107–56 (42 U.S.C. 5195c(e))).'';

(3) in subsection (e), by inserting ''through December 31, 2030'' after ''thereafter'';

(4) by amending subsection (g) to read as follows:

''(g) FACA EXEMPTION.—The President shall charter the Advisory Committee in accordance with chapter 10 of title 5, United States Code (commonly referred to as the 'Federal Advisory Committee Act'), except that the Advisory Committee shall be exempt from section 1013 of such title.''; and

(5) by adding at the end the following new subsection:

''(h) INTERAGENCY COORDINATION REGARDING HELIUM–3 FOR QUANTUM COMPUTING INFRASTRUCTURE AND INDUSTRY AND THE DOMESTIC HELIUM–3 SUPPLY

CHAIN.—The Advisory Committee shall, in the exercise of its advisory functions, consider the state of the domestic helium–3 supply chain as such relates to the long-term viability and competitiveness of the United States quantum computing industry, and may include findings and recommendations regarding helium–3 supply chain security in the reports of such Committee to the President and''.

SEC. 5008. SUBCOMMITTEE ON THE ECONOMIC AND SECURITY IMPLICATIONS OF QUANTUM INFORMATION SCIENCE.

Section 105 of the National Quantum Initiative Act (15 U.S.C. 8814a) is amended—

(1) in subsection (b)—

(A) in paragraph (10), by striking ''and'' after the semicolon;

(B) by redesignating paragraph (11) as paragraph (14); and

(C) by inserting after paragraph (10) the following new paragraphs:

''(11) the Department of Health and Human Services;

''(12) the Department of State;

''(13) the National Aeronautics and Space Administration; and'';

(2) in subsection (c)—

(A) in paragraph (1)—

(i) by striking ''Office and Management and Budget'' and inserting ''Office of Management and Budget''; and

(ii) by striking ''information science'' and inserting ''information science, engineering, and technology'';

(B) in paragraph (2), by inserting ''or to supply chains'' before the semicolon;

(C) in paragraph (3), by inserting ''or supply chains'' before the semicolon;

(D) in paragraph (5), by inserting ''and engineering'' after ''quantum information science'';

(E) in paragraph (6), by striking ''information science'' and inserting ''information science, engineering, and technology'';

(F) in paragraph (7), by striking ''and'' after the semicolon;

(G) in paragraph (8), by striking the period and inserting a semicolon; and

(H) by adding at the end the following new paragraphs:

''(9) in coordination with the Subcommittee on Quantum Information Science, identify opportunities to increase coordination between civilian, military, and intelligence quantum research entities, reduce unnecessary duplicative quantum research activities, and facilitate collaboration between quantum research agencies with specialized capabilities or expertise in one or more aspects of quantum information science, engineering, or technology; and

''(10) recommend strategies for attracting and retaining students and scholars with expertise in quantum-related fields to Federal departments and agencies.''.

SEC. 5009. INTERNATIONAL QUANTUM COOPERATION STRATEGY.

The National Quantum Initiative Act is amended by inserting after section 105 the following new section:

''SEC. 105A. INTERNATIONAL QUANTUM COOPERATION STRATEGY.

''(a) STRATEGY REQUIRED.—Not later than one year after the date of the enactment of this section, the Director of the Office of Science and Technology Policy, in consultation with the Secretary of Commerce, the Secretary of State, the Secretary of Energy, the Director of the National Science Foundation, the Administrator of the Na-

tional Aeronautics and Space Administration, and the heads of other Federal agencies, as appropriate, shall submit to the Committee on Commerce, Science, and Transportation, the Committee on Energy and Natural Resources, and the Committee on Foreign Relations of the Senate, and the Committee on Science, Space, and Technology and the Committee on Foreign Affairs of the House of Representatives a strategy to carry out the following:

''(1) Establish collaborative international partnerships, including co-funded international programs, to advance research and development, testing and evaluation, commercialization, and interoperability in quantum information science, engineering, and technology with allies and partners of the United States, and other countries, when in the security, strategic, technological, and scientific interests of the United States.

''(2) Ensure continued United States participation in bilateral and multilateral efforts to advance quantum information science, engineering, and technology on the international stage.

''(3) Promote the integrity and impartiality of international standards organizations and processes

related to quantum information science, engineering, and technology.

''(4) Ensure ethical application of quantum information science, engineering, and technology to protect civil liberties and basic human rights.

''(b) DESIGNATION.—The strategy under subsection shall be known as the 'International Quantum Cooperation Strategy' (in this section referred to as the 'Strategy').

''(c) ELEMENTS.—In the development of the Strategy, the Director of the Office of Science and Technology Policy, the National Quantum Coordination Office, the Subcommittee on Quantum Information Science, the Subcommittee on the Economic and Security Implications, and other appropriate Federal agencies should consider the following:

''(1) The establishment of international partnerships to advance research and development in quantum information science, engineering, and technology.

''(2) Key partners that are allies of the United States and have demonstrated unique capabilities in one or more areas of quantum information science, engineering, or technology.

''(3) Efforts and plans to address risks to the national security or economic interests of the United

States during development or deployment of quantum technologies worldwide, including plans for diplomatic engagement with allies and partners, and other countries.

''(4) Efforts and plans to promote responsible global development and deployment of quantum technologies, including through international engagement and leadership in the development of international standards.

''(5) Efforts and plans to develop, attract, and retain international talent.

''(6) The ability and risks of domestic manufacturers and suppliers and those of allies and partners of the United States to satisfy the needs of the global quantum supply chain, including raw materials such as Helium–3, plans for engagement with allies and partners, manufacturers, and suppliers, and options to mitigate gaps and vulnerabilities in the global quantum supply chain.

''(7) A plan to safeguard research and technology supported through international cooperation, as appropriate, in whole or in part, including in quantum technologies critical to national security, from malign influence, theft, or exfiltration by foreign entities of concern.

''(8) As necessary, a description of such legislative or administrative action needed to carry out the Strategy.

''(d) BRIEFING.—Not later than 30 days after the date on which the Strategy is completed, the Director shall brief the committees specified in subsection (a) on the Strategy.''.

SEC. 5010. SUNSET.

Subsection (a) of section 106 of the National Quantum Initiative Act (15 U.S.C. 8815) is amended by striking ''the date that is 11 years after the date of enactment of this Act'' and inserting ''December 30, 2032''.

SEC. 5011. NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY ACTIVITIES AND QUANTUM CONSORTIUM.

Section 201 of the National Quantum Initiative Act (15 U.S.C. 8831) is amended—

(1) in subsection (a)—

(A) in paragraph (1)—

(i) by striking ''basic and applied''; and

(ii) by striking ''science and technology'' and inserting ''science, engineering, and technology'';

(B) in paragraph (2)—

(i) by inserting ''attract, educate, and'' before ''train''; and

(ii) by striking ''science and technology'' and inserting ''science, engineering, and technology'';

(C) by amending paragraph (3) to read as follows:

''(3) shall carry out research to facilitate the development and standardization of quantum cryptography, post-quantum cryptography (as such term is defined in section 3 of the Quantum Computing Cybersecurity Preparedness Act (6 U.S.C. 1526 note; Public Law 117–260)), and practices to replace cryptographic keys or algorithms with minimal disruption to current applications and systems;''.

(D) by amending paragraph (4) to read as follows:

''(4) shall carry out research, development, and demonstration projects, as appropriate, to facilitate the development and standardization of quantum networking, communications, computing, metrology, sensing technologies and quantum applications, including supply chain enabling technologies and other supporting technologies;''.

(E) by redesignating paragraphs (5), (6), and (7) as paragraphs (8), (9), and (13), respectively;

(F) by inserting after paragraph (4) the following new paragraphs:

''(5) shall carry out, in coordination with the Director of the Defense Advanced Research Projects Agency, research to support the measurement of comparative performance and progress of quantum technologies, including, as practicable, technology readiness assessments of quantum technologies;

''(6) shall promote United States participation in international standards organizations related to quantum information science, engineering, and technology;

''(7) shall establish or expand partnerships with the public sector and private sector to—

''(A) accelerate the development of domestic quantum supply chain and supply chain-supporting technologies; and

''(B) reduce quantum supply chain vulnerabilities;'';

(G) in paragraph (8), as so redesignated, by striking ''infrastructure'' and inserting '', communications, sensing, and computing'';

(H) in paragraph (9), as so redesignated—

(i) by inserting ''nonprofit research organizations,'' after ''universities,''; and

(ii) by striking ''and engineering; and'' and inserting '', engineering, and technology, and expanding the domestic STEM workforce;''; and

(I) by inserting after paragraph (9) the following new paragraphs:

''(10) shall establish such infrastructure as is necessary to carry out title II;

''(11) shall establish guidance for the interoperability, portability, testing, evaluation, verification, validation, and security of quantum software and software supply chains;

''(12) shall support best practices and evaluation methods for the security of quantum software supply chains, including with respect to—

''(A) open-source development; and

''(B) provenance; and'';

(2) in subsection (b)—

(A) in paragraph (1)—

(i) by striking ''future'' and inserting ''research''; and

(ii) by striking ''science and technology'' and inserting ''science, engineering, and technology'';

(B) in paragraph (2)—

(i) by amending subparagraph (A) to read as follows:

''(A) to gather and assess information on the quantum industry to address the needs identified in paragraph (1);'';

(ii) by striking subparagraphs (B) and (C) and inserting the following new subparagraphs:

''(B) to provide recommendations regarding how the National Institute of Standards and Technology, the Program, and other Federal agencies, as appropriate, can address the gaps in the research necessary to satisfy the needs identified in paragraph (1) and accelerate real-world uses of quantum information science, engineering, and technology;

''(C) to identify enabling technologies and the relevant supply chain essential to foster research and industrial competitiveness in quantum information science, engineering, and technology, and communicate findings to Federal

agencies and other domestic and international stakeholders; and

''(D) to assess and identify key areas for establishing, expanding, or developing international partnerships that will facilitate United States quantum-related business engagement.'';

(C) in paragraph (3)—

(i) by striking ''Not later than 2 years after the date of enactment of this Act, the'' and inserting ''The''; and

(ii) by inserting ''periodically, but not less frequently than once every five years,'' after ''shall''; and

(D) by adding at the end the following new paragraph:

''(4) COORDINATION.—As appropriate, Federal agencies specified in section 103(b) that—

''(A) are involved in the transition or translation of practical quantum applications, or

''(B) have a mission that could benefit from the development of quantum technologies, may engage with the consortium to inform and accelerate progress in such applications or technologies, as the case may be.''; and

(3) by striking subsection (c) and inserting the following new subsections:

''(c) INTERNATIONAL QUANTUM RESEARCH AND METROLOGY.—

''(1) IN GENERAL.—The Director of the National Institute of Standards and Technology, in coordination with the Secretary of State and the Director of the National Science Foundation, shall support international quantum information science, engineering, and technology research, metrology research, and standardization, as appropriate, to enhance international cooperation, satisfy United States commitments, and support United States engagement in international standards for quantum information science, engineering, and technology.

''(2) ALIGNMENT.—In carrying out this section, the Director of the National Institute of Standards and Technology shall ensure alignment with the National Quantum Information Science Strategy and the U.S. Government National Standards Strategy for Critical and Emerging Technology, or successor strategies.

''(3) RESTRICTIONS.—

''(A) CONFUCIUS INSTITUTES.—None of the funds made available under this section

may be obligated or expended to an institution of higher education that maintains a contract or agreement between such institution and a Confucius Institute or any successor of a Confucius Institute.

''(B) FOREIGN COUNTRIES OF CONCERN OR ENTITIES OF CONCERN.—None of the funds made available under this section may be obligated or expended to promote, establish, or finance quantum research activities between a United States entity and a foreign country of concern or foreign entity of concern, except such restriction shall not apply to participation by awardees in consensus-based international standardization activities.

''(d) POST QUANTUM CRYPTOGRAPHY DEPLOYMENT.—

''(1) IN GENERAL.—The Director of the National Institute of Standards and Technology, in consultation with the Secretary of Homeland Security, the heads of Sector Risk Management Agencies (as such term is defined in section 2200 of the Homeland Security Act of 2002 (6 U.S.C. 650)), and private sector entities, as appropriate, shall promote the voluntary development, adoption, and de-

ployment of standards relating to post-quantum cryptography (as such term is defined in section 3 of the Quantum Computing Cybersecurity Preparedness Act (6 U.S.C. 1526 note; Public Law 117–260)), including by carrying out the following:

''(A) Disseminating and making publicly available guidance and resources to help organizations adopt and deploy standards relating to post-quantum cryptography and minimize disruptions to current applications and systems caused by cryptographic updates.

''(B) Providing technical assistance, as practicable, to entities that are at high risk of quantum cryptoanalytic attacks, such as State and local governments, entities determined to be critical infrastructure (as such term is defined in section 1016(e) of Public Law 107–56 (42 U.S.C. 5195c(e))) or digital infrastructure providers.

''(C) Conducting such other activities as determined necessary by the Director to promote the development, adoption, and deployment across the United States of standards relating to post-quantum cryptography.

''(2) GRANT PROGRAM.—

''(A) IN GENERAL.—Subject to the availability of appropriations, the Director of the National Institute of Standards and Technology may establish a program to identify and provide technical assistance through the award of grants to entities that are at high risk of quantum cryptoanalytic attacks, including by awarding grants for the adoption of such standards and the remediation of quantum-related vulnerabilities.

''(B) USE OF FUNDS.—Grants awarded to entities under this paragraph may be used to cover reasonable costs, up to a specified amount established by the Director of the National Institute of Standards and Technology, for activities to adopt standards relating to post-quantum cryptography and remediate quantum-related vulnerabilities, including with respect to technology transitions to satisfy post quantum cryptography standards for entities at high risk of quantum cryptoanalytic attacks.

''(C) GUIDANCE.—The Director of the National Institute of Standards and Technology may develop, and periodically update, guidance, including relating to eligibility, application dis-

closure requirements, grant amount and duration, and any additional requirements regarding the award of grants under this paragraph.

''(D) CONSULTATION.—If the grant program described in this paragraph is established, the Director of the National Institute of Standards and Technology shall consult with the Director of the Cybersecurity and Infrastructure Security Agency of the Department of Homeland Security, the heads of other Sector Risk Management Agencies, State and local governments, and appropriate representatives of private sector entities, including nonprofit organizations, to share information regarding such grant program and guidance developed and updated under subparagraph (C).''.

SEC. 5012. NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY QUANTUM ACCELERATION CENTERS.

Title II of the National Quantum Initiative Act is amended by adding at the end the following new sections:

''SEC. 202. NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY QUANTUM ACCELERATION CENTERS.

''(a) ESTABLISHMENT.—

''(1) IN GENERAL.—Subject to the availability of appropriations, the Director of the National Institute of Standards and Technology, in consultation with the heads of other Federal departments and agencies, as appropriate, shall carry out a program to establish at least one, but not more than three, centers to accelerate research, development, deployment, and standardization of quantum information science, engineering, and technology.

''(2) PROGRAM DETAILS.—

''(A) COMPETITIVE, MERIT-REVIEWED PROCESS.—The centers described in paragraph (1) shall be established through a competitive, merit-reviewed process.

''(B) APPLICATIONS.—An eligible applicant described in subparagraph (C) shall submit to the Director of the National Institute of Standards and Technology an application at such time, in such manner, and containing such information as the Director determines to be appropriate.

''(C) ELIGIBLE APPLICANTS.—Eligible applicants described in this subparagraph are the following:

''(i) Institutions of higher education.

''(ii) Nonprofit organizations.

''(iii) Multi-institutions collaborations, including multiple types of research institutions, private sector entities, small business concerns (as such term is defined under section 3 of the Small Business Act (15 U.S.C. 632)), Federal laboratories, and nonprofit organizations, or a consortia thereof.

''(iv) Any other entity the Director determines appropriate.

''(3) SELECTION OF TOPICS.—The Director of the National Institute of Standards and Technology shall solicit proposals and prioritize the following topics in the initial selection of centers, subject to merit-review:

''(A) Quantum sensing and measurement technologies.

''(B) Advancing the manufacturing and scale-up of quantum systems and quantum enabling technologies.

''(C) Address technology barriers to quantum networking and communications.

''(D) Quantum engineering.

''(b) REQUIREMENTS.—To the maximum extent practicable, centers established under this section shall serve the mission of the National Institute of Standards and Technology, for the benefit of the broader United States quantum information science community, to develop processes for the following purposes:

''(1) Advancing research and standardization in quantum information science, engineering, and technology.

''(2) Advancing technology development.

''(3) Improving the competitiveness of the United States.

''(c) COORDINATION.—The Director of the National Institute of Standards and Technology shall ensure coordination, and avoid unnecessary duplication of, the activities carried out under this section with existing activities of the Institute, other activities carried out under this Act, and other related programs, as appropriate.

''(d) SELECTION AND DURATION.—

''(1) IN GENERAL.—The centers established under this section are authorized to carry out activities for a period of five years.

''(2) RENEWAL.—Each center established under this section may be renewed for additional periods of

five years following a successful merit-based review by the Director.

''(3) TERMINATION.—Consistent with the authorities of the National Institute of Standards and Technology, the Director of the National Institute of Standards and Technology may terminate an underperforming center for cause during the performance period.

''SEC. 203. RESEARCH SECURITY.

''The activities authorized under title II shall be applied in a manner consistent with subtitle D of title VI of the Research and Development, Competition, and Innovation Act (enacted as division B of Public Law 117–167; 42 U.S.C. 19231 et seq.).''.

SEC. 5013. NATIONAL SCIENCE FOUNDATION QUANTUM INFORMATION SCIENCE RESEARCH AND EDUCATION ACTIVITIES.

Section 301 of the National Quantum Initiative Act (15 U.S.C. 8841) is amended—

(1) in the heading, by inserting ''**, ENGINEERING, AND TECHNOLOGY**'' after ''**SCIENCE**'';

(2) in subsection (a)—

(A) by striking ''basic''; and

(B) by striking ''science and engineering'' and inserting ''science, engineering, and technology'';

(3) in subsection (b)—

(A) in paragraph (1)—

(i) in subparagraph (A)—

(I) by striking ''basic''; and

(II) by striking ''science and engineering'' and inserting ''science, engineering, and technology''; and

(ii) in subparagraph (B)—

(I) by striking ''human resources'' and inserting ''education and workforce''; and

(II) by striking ''science and engineering'' and inserting ''science, engineering, and technology''; and

(B) in paragraph (2)—

(i) in subparagraph (A)—

(I) in clause (i)—

(aa) by striking ''science and engineering'' and inserting ''science, engineering, and technology'';

(bb) by inserting ''K–12, vocational,'' before ''undergraduate''; and

(cc) by striking ''and'' after the semicolon;

(II) in clause (ii), by inserting ''and'' after the semicolon; and

(III) by adding at the end the following new clause:

''(iii) to pursue research at the frontiers of quantum information science, engineering, and technology, and explore solutions to important challenges for the development, application, and commercialization of quantum technologies;'';

(ii) in subparagraph (B), by striking ''science and engineering'' and inserting ''science, engineering, and technology''; and

(iii) in subparagraph (C), by striking ''science and engineering'' and inserting ''science, engineering, and technology'';

(iv) in subparagraph (D), by striking ''and'' after the semicolon;

(v) in subparagraph (E), by striking the period and inserting a semicolon; and

(vi) by adding at the end the following new subparagraphs:

''(F) providing infrastructure to support academic quantum information science, engineering, and technology, including through existing infrastructure programs and new activities; and

''(G) supporting, in collaboration with the Secretary of Commerce and Secretary of Energy, regional innovation initiatives in quantum information science, engineering, and technology, and the adoption of viable quantum capabilities, which may include the activities carried out pursuant to an award of funds under section 10388 of the Research and Development, Competition, and Innovation Act (Public Law 117–167; 42 U.S.C. 19108).'';

(4) by amending subsection (c) to read as follows:

''(c) STUDENT TRAINEESHIPS, FELLOWSHIPS, AND OTHER MODELS.—

''(1) IN GENERAL.—The Director of the National Science Foundation, in consultation with

heads of Federal agencies the Director considers appropriate, shall make awards to institutions of higher education or eligible nonprofit organizations (or consortia thereof) to increase capacity and broaden participation, including through provisioning of experiential opportunities, where appropriate, in quantum information science, engineering, and technology and other related disciplines.

''(2) QUANTUM TRAINEESHIPS.—The Director of the National Science Foundation may establish or use existing programs to make awards to institutions of higher education or nonprofit organizations (or consortia thereof) to provide traineeships to graduate students at institutions of higher education within the United States who are citizens of the United States and who choose or plan to pursue masters or doctoral degrees in quantum information science, engineering, and technology, or related fields, and by providing students with opportunities for research experiences in government or industry related to such students' quantum studies.

''(3) QUANTUM FELLOWSHIPS AND SCHOLARSHIPS.—

''(A) IN GENERAL.—The Director of the National Science Foundation may establish or

use existing programs to support fellowships and scholarships for students at institutions of higher education for the purpose of increasing quantum information science, engineering, and technology exposure for undergraduate and graduate STEM students and increasing post-graduation employment opportunities for STEM students.

''(B) REQUIREMENTS.—Eligible participants in the fellowship and scholarship program shall—

''(i) be enrolled in or have graduated from a STEM degree program at a domestic institution of higher education; and

''(ii) have taken at least one quantum-science or quantum-relevant course as part of their degree programs.

''(C) CONSIDERATIONS.—Eligible fellowships and scholarships may include temporary quantum-related positions at Federal or State agencies, National Laboratories, private sector entities, institutions of higher education, the quantum centers and institute established in sections 202, 302, 402, and 502, or other quan-

tum-relevant entities, as determined appropriate by the Director.

''(D) COMPETITIVE AWARDS.—Fellowships and scholarships shall be competitively awarded through a merit-review process. The Director of the National Science Foundation may prioritize fellowships that include an industry partner that provides financial assistance to the applicant for direct or indirect costs.

''(4) QUANTUM RESEARCH EXPERIENCES FOR UNDERGRADUATES.—The Director of the National Science Foundation shall seek to increase opportunities for quantum research for undergraduate students by encouraging proposals in quantum information science, engineering, and technology, through the research experiences for undergraduates pursuant to section 514 of the America COMPETES Reauthorization Act of 2010 (42 U.S.C. 1862p-6).

''(5) CO-OPERATIVE EDUCATION PROGRAMS.—The Director of the National Science Foundation may establish or use existing programs to support cooperative education programs between institutions of higher education and employers that increase opportunities for undergraduate students to acquire experiential learning and professional experiences in

quantum information sciences, engineering, and technology.

''(6) PARTNERSHIPS.—In carrying out the activities under this subsection, the Director of the National Science Foundation shall encourage awardees to partner with relevant Federal agencies, Federal laboratories, industry and other private sector organizations, and nonprofit organizations to facilitate the expansion of workforce pathways and hands-on learning experiences.'';

(5) in subsection (d)—

(A) in the subsection heading, by striking ''QISE'' and inserting ''QISET'';

(B) in paragraph (1)—

(i) by striking ''information science and engineering (referred to in this subsection as 'QISE')'' and inserting ''information science, engineering, and technology (referred to in this subsection as QISET)''; and

(ii) by inserting ''and career and technical education entities'' after ''colleges'';

(C) in paragraph (2)—

(i) in subparagraph (A), by striking ''QISE'' and inserting ''quantum information science, engineering, and technology'';

(ii) in subparagraph (D), by inserting '', engineering, and technology'' after ''science'';

(iii) in subparagraph (D), by inserting '', including materials relevant to emerging technologies'' before the period;

(iv) by redesignating subparagraphs (E) and (F) as subparagraphs (F) and (H), respectively;

(v) by inserting after subparagraph (D) the following new subparagraph:

''(E) Informal education methods to enhance experiences of students of all ages with quantum information science, engineering, and technology concepts and applications.'';

(vi) by inserting after subparagraph (F), as so redesignated, the following new subparagraph:

''(G) Methods to introduce into STEM curricula security and other potential societal dimensions associated with quantum information science, engineering, and technology.''; and

(vii) in subparagraph (H), as so redesignated, by inserting ", engineering, and technology" after "science";

(D) in paragraph (3), by striking "QISE" and inserting "quantum information science, engineering, and technology"; and

(E) by striking paragraph (4); and

(6) by adding at the end the following new subsections:

"(e) QUANTUM RESEARCH EXPERIENCES FOR TEACHERS.—The Director of the National Science Foundation shall seek to increase opportunities to engage educators, principals, or other school leaders of K-12 students in professional learning opportunities to enhance quantum information science, engineering, and technology knowledge, including by carrying out the following:

"(1) Providing hands-on training and research opportunities at Federal Laboratories, institutions of higher education, or in industry for such educators, principals, or other school leaders.

"(2) Developing best practices.

"(f) EXPANDING CAPACITY IN QUANTUM INFORMATION SCIENCE, ENGINEERING, AND TECHNOLOGY (QISET).—

''(1) IN GENERAL.—The Director of the National Science Foundation, in consultation with the heads of Federal agencies the Director considers appropriate, shall make awards on a competitive, merit-reviewed basis to eligible institutions of higher education or eligible nonprofit organizations (or consortia thereof) to increase research capacity, education and infrastructure capacity, and broaden participation in quantum information science, engineering, and technology and related disciplines, including by carrying out the following:

''(A) Supporting curriculum development in quantum information science, engineering, and technology as described in subsection (d).

''(B) Building upon the activities carried out under the Next Generation Quantum Leaders Pilot Program authorized under section 10661(f) of the Research and Development, Competition, and Innovation Act (Public Law 117–167; 42 U.S.C. 19261(f)).

''(C) Leveraging the readiness for the involvement of local research and education communities to secure talent pathways in quantum information science, engineering, and tech-

nology to satisfy the workforce needs of industry, government, and academia.

''(2) COLLABORATIONS.—The Director of the National Science Foundation shall—

''(A) require eligible institutions of higher educations or eligible nonprofit organizations to describe how such an institute or organization, as the case may be, plans to partner with one or more relevant private sector entities; and

''(B) may require such an institute or organization, as the case may be, to provide a letter of support from any such entities.

''(3) REQUIREMENTS.—To receive an award under this subsection, an eligible institution of higher education or eligible nonprofit organization, as the case may be, shall submit to the Director of the National Science Foundation an application that includes the following:

''(A) A plan to sustain proposed activities beyond the duration of the award.

''(B) Proposed quantum information science, engineering, and technology disciplines or focus areas such eligible institution or organization, as the case may be, is prepared to engage in to significantly build up its quantum in-

formation science, engineering, and technology research and education capacity.

''(C) A plan for education and workforce development, which may include K-12 and post-secondary education programs and activities, workforce training and career and technical education programs and activities, undergraduate, graduate, and postdoctoral education, and informal education programs and activities.

''(4) ACTIVITIES.—Awards under this subsection to support research and related activities may include the activities relating to the following:

''(A) Development or expansion of research programs in disciplines and focus areas specified in paragraph (4)(B).

''(B) Faculty recruitment and professional development in such disciplines and focus areas.

''(C) To build research capacity and infrastructure at an eligible institution in such disciplines and focus areas.

''(D) An assessment of capacity-building and research infrastructure needs identified in such paragraph.

''(E) Bridge programs focused on preparing post-baccalaureate students for graduate

programs in quantum information science, engineering, and technology.

''(F) Administrative research development support.

''(G) Other activities necessary to build research capacity in quantum information science, engineering, and technology.

''(5) ADDITIONAL CONSIDERATIONS.—In making awards under this subsection, the Director of the National Science Foundation may also consider the following:

''(A) The extent to which the eligible institution of higher education or eligible nonprofit organization, as the case may be, will support students from diverse backgrounds, including first-generation undergraduate students.

''(B) The geographic and institutional diversity of eligible institutions of higher education and eligible nonprofit organizations.

''(C) How the eligible institution of higher education or eligible nonprofit organization, as the case may be, can leverage public-private partnerships and existing research partnerships with Federal agencies.

''(6) DUPLICATION.—The Director of the National Science Foundation shall ensure awards made under this subsection are complementary to and not duplicative of existing programs.

''(7) ELIGIBLE INSTITUTION OF HIGHER EDUCATION DEFINED.—In this subsection, the term 'eligible institution of higher education' means an institution of higher education, that, according to the data published by the National Center for Science and Engineering Statistics, is not, on average, among the top 100 institutions in Federal research and development expenditures during the 3- year period prior to the year of the award.

''(g) FACULTY MID-CAREER DEVELOPMENT AWARDS.—The Director of the National Science Foundation may provide awards to support mid-career scientists and faculty to upgrade, develop, or acquire essential research instruments to start new research activities, or expand existing activities, focused on quantum information science, engineering and technology.

''(h) INTERNATIONAL RESEARCH ON QUANTUM INFORMATION SCIENCE, ENGINEERING, AND TECHNOLOGY.—

''(1) IN GENERAL.—The Director of the National Science Foundation, in coordination with the

Secretary of State and the Secretary of Commerce, shall support international quantum information science, engineering, and technology research collaboration, as appropriate, to enhance international cooperation and satisfy United States commitments, including pursuant to bilateral or multilateral quantum information science, engineering, and technology research agreements.

''(2) ALIGNMENT.—In carrying out this subsection, the Director of the National Science Foundation shall ensure alignment with the strategy for national quantum information science in accordance with Executive Order 14073 (87 Fed. Reg. 27909; relating to enhancing the National Quantum Advisory Committee) or successor strategies.

''(3) PRIORITY.—The Director shall prioritize research programs with countries that have signed a Quantum Cooperation Statement with the United States.

''(4) RESTRICTION.—None of the funds made available under this section may be obligated or expended to an institution of higher education that maintains a contract or agreement between such institution and a Confucius Institute or any successor of a Confucius Institute.

''(i) UPGRADING AND IMPROVING ACCESS TO QUANTUM RESEARCH RESOURCES.—

''(1) IN GENERAL.—In carrying out the activities described in this section, the Director of the National Science Foundation, in consultation with the heads of other Federal departments and agencies, as appropriate, shall make awards to institutions of higher education or eligible nonprofit organizations (or consortia thereof) to upgrade research facilities and improve access to research resources, such as equipment and instrumentation, that is needed for research and development in quantum information science, engineering, and technology.

''(2) PURPOSE.—Grants under paragraph (1) shall be used to facilitate quantum information science, engineering, and technology research and development, including by carrying out the following:

''(A) Upgrading or adding research resources to accelerate the development of quantum technologies, including capabilities focused on addressing the roadblocks to implementation, and satisfy the materials, advanced materials development, high performance computing, heterogeneous computing, networking, software, data, clean room, and device needs of the sci-

entific community and the quantum supply chain.

''(B) Enhancing access to equipment and instrumentation, including at partnering institutions, by facilitating information sharing, coordination, scheduling, education, and training, including activities that provide meaningful hands-on learning experiences for students, including at community and technical colleges.

''(C) Enabling professional staff to support the operation and improvement of research resources used for quantum information science, engineering, and technology.

''(3) REQUIREMENTS.—An institution of higher education or an eligible nonprofit organization (or a consortium thereof) and industry partners seeking funding under this subsection shall submit to the Director of the National Science Foundation an application at such time, in such manner, and containing such information as the Director may require.''.

SEC. 5014. MULTIDISCIPLINARY CENTERS FOR QUANTUM RESEARCH AND EDUCATION.

Section 302 of the National Quantum Initiative Act (15 U.S.C. 8842) is amended—

(1) in subsection (a), by striking ''5'' and inserting ''10'';

(2) in subsection (c)—

(A) in the matter preceding paragraph (1), by striking ''basic'';

(B) in paragraph (1), by striking ''science and engineering'' and inserting ''science, engineering, and technology, including by continuing to advance enabling fields, such as mathematics, materials science, fabrication science, and physics'';

(C) in paragraph (2), by striking ''and engineering'' and inserting '', engineering, and technology, including leveraging or expanding activities established pursuant to section 301(d)''; and

(D) in paragraph (3), by striking ''fostering innovation by bringing'' and inserting ''fostering domestic innovation and accelerating technology transfer by bringing''

(3) in subsection (d)(2)—

(A) in subparagraph (A), by inserting ''quantum information science, engineering, and technology'' after ''quantum science'';

(B) in subparagraph (B), by inserting ''health, ocean science,'' after ''chemistry,'';

(C) in subparagraph (C), by inserting '', including how each institution of higher education or an eligible nonprofit organization (or a consortium thereof), as the case may be, that is applying for a grant under this section will develop and implement outreach activities to increase the participation of students in STEM, including women and individuals from underrepresented groups (in accordance with section 526(a)(7) of the America COMPETES Reauthorization Act of 2010 (42 U.S.C. 1862p-14(a)(7)))'' before the semicolon;

(D) in subparagraph (D), by striking ''and'' after the semicolon;

(E) in subparagraph (E), by striking the period and inserting ''; and''; and

(F) by adding at the end the following new subparagraph:

''(F) how the Center will participate in international collaborations, as appropriate, to build a trusted global research network with allies and partners of the United States and other countries that share values with the

United States, including respect for international norms and a commitment to fair competition.'';

(4) in paragraph (2) of subsection (e), by striking ''on a competitive'' and inserting ''following a successful''.

(5) in subsection (f), by striking ''2019 through 2023'' and inserting ''2027''.

SEC. 5015. QUANTUM RESKILLING, EDUCATION, AND WORKFORCE (QREW) COORDINATION HUB.

Title III of the National Quantum Initiative Act (15 U.S.C. 8841 et seq.) is amended by adding at the end the following new sections:

''SEC. 303. QUANTUM RESKILLING, EDUCATION, AND WORKFORCE (QREW) COORDINATION HUB.

''(a) IN GENERAL.—The Director of the National Science Foundation, in consultation with the Director of the National Institute of Standards and Technology, the Secretary of Energy, and the heads of other relevant Federal departments and agencies, as appropriate, shall make an award to a consortium led by an institution of higher education or an eligible nonprofit organization to establish a Quantum Reskilling, Education, and Workforce Coordination Hub (in this section referred to as the 'Hub').

''(b) CONSORTIUM.—The Hub established pursuant to subsection (a) shall include not fewer than four institutions of higher education, including not fewer than two community colleges, and may include career and technical schools, nonprofit organizations, and private sector entities.

''(c) PURPOSE.—The purpose of this Hub shall be the following:

''(1) To identify and address cross-cutting workforce development challenges in quantum information science, engineering, and technology, and the quantum industry, by serving as a national and regional clearinghouse.

''(2) To facilitate the establishment of programs to disseminate to institutions of higher education and career and technical education entities model curricula, best practices, and instructional materials.

''(d) ACTIVITIES.—The activities of the Hub may include the following:

''(1) Testing, implementing, scaling, disseminating, and standardizing materials, methods, best practices, and other outputs developed through activities under this Act.

''(2) Increasing the integration of quantum information science, engineering, and technology con-

tent into STEM curricula at all education levels, including career and technical education programs.

''(3) Providing opportunities for STEM degree students to provide feedback on quantum information science, engineering, and technology curricula.

''(4) Facilitating post-education employment opportunities and workforce pathways for STEM degree recipients in quantum-related industries, including by facilitating opportunities for internships, externships, fellowships, and other such activities as determined by the Director, including through the establishment of a publicly accessible online portal.

''(5) Coordinating with quantum industry and nonprofit entities and small and medium-sized businesses and startups to inform and enhance the quality and availability of quantum education in STEM degree programs, including through the promotion of post-graduation opportunities for STEM students outside the classroom to increase exposure to quantum industries.

''(6) Supporting activities and programs to enhance the recruitment of students in STEM, including women and individuals from underrepresented groups (in accordance with section 526(a)(7) of the America COMPETES Reauthorization Act of 2010

(42 U.S.C. 1862p-14(a)(7))), to pursue undergraduate and graduate studies in quantum information science, engineering, or technology.

''(7) Developing, testing, implementing, and coordinating career development programs and strategies for pre-university and university educators for the purpose of increasing the number of quantum-informed educators at all levels of education, including by carrying out the following:

''(A) Hosting career development workshops.

''(B) Developing in-house and distance learning career development tools for public use.

''(C) Facilitating access to related quantum technology, tools, and resources.

''(D) Developing training, research, and professional development programs, including innovative pre-service and in-service programs.

''(E) Facilitating relationships with State and local entities to increase awareness of and promote quantum-related career development activities at the Hub.

''(8) Establishing a framework for performing ongoing regular data collection and analysis for the

quantum workforce to report on trends, and perform other activities that expand the understanding of the current and future needs of the quantum industry, and education capacity or readiness of the quantum workforce. Such activities shall complement or align with, as relevant, authorized quantum and STEM workforce studies under section 10661(d) of the Research and Development, Competition, and Innovation Act (42 U.S.C. 19261(d)).

''(9) Facilitating public education and outreach activities to enhance the understanding and awareness of quantum information science, engineering, and technology to a boarder community to satisfy broader impact requirements of award applications.

''(10) Encouraging coordination on quantum education in the broader STEM community.

''(e) QREW QUANTUM FELLOWSHIP PROGRAM.—Subject to the restriction specified in subsection (h)(4) of section 301, the Hub may support education or policy fellowships for students at entities participating in the consortium under subsection (a) or at other research centers established pursuant to this Act at the National Science Foundation, the National Institute of Standards and Technology, the Department of Energy, or the National

Aeronautics and Space Administration, for the purpose of supporting the activities described in subsection (d).

''(f) INDUSTRY COORDINATION.—The Hub shall collaborate with the Quantum Consortium established in section 201(b) or other industry consortia to identify, publish, facilitate, or enable quantum-related education and workforce development opportunities described in subsections (c) and (d).

''(g) APPLICATION.—A consortium seeking funding under this section shall submit to the Director of the National Science Foundation an application at such time, in such manner, and containing such information as the Director may require. Each application shall include a description of how the consortium shall carry out the following:

''(1) Contribute to the success of the Hub and fulfill the purposes of the Hub.

''(2) Include industry participation in fulfilling the purposes of the Hub.

''(3) Collaborate with other members of the consortium to share expertise in integrating quantum information science, engineering, and technology into existing STEM programs and other relevant fields and disciplines.

''(4) Support long-term and short-term workforce development in the quantum field.

''(5) Develop and implement outreach activities to increase the participation of students in STEM, including women and individuals from underrepresented groups (in accordance with section 526(a)(7) of the America COMPETES Reauthorization Act of 2010 (42 U.S.C. 1862p-14(a)(7))).

''(h) SELECTION AND DURATION.—

''(1) IN GENERAL.—The Hub established under this section is authorized to carry out activities for a period of 5 years.

''(2) REAPPLICATION.—An awardee may reapply for an additional, subsequent period of 5 years following a successful, merit-based review.

''(3) TERMINATION.—Consistent with the authorities of the National Science Foundation, the Director of the National Science Foundation may terminate the Hub if it is underperforming during the performance period.

''(i) COORDINATION.—The Hub shall coordinate with other research centers established under this Act at the National Science Foundation, the National Institute of Standards and Technology, the Department of Energy, the National Aeronautics and Space Administration, and

other relevant Federal agencies, as appropriate, on activities and resources.

"SEC. 304. QUANTUM TESTBEDS.

"(a) IN GENERAL.—Not later than one year after the date of the enactment of the National Quantum Initiative Reauthorization Act, the Director of the National Science Foundation, in coordination with the Director of the National Institute of Standards and Technology, the Secretary of Energy, and the heads of other Federal agencies, as determined appropriate by the Director of the National Science Foundation, shall make awards on a competitive, merit-reviewed basis to institutions of higher education, nonprofit organizations, federally funded research and development centers, or consortia thereof, to establish not more than five testbeds for quantum applications research and development.

"(b) PURPOSES.—The quantum testbeds established under subsection (a) shall focus on advancing research and development for near-term and medium-term quantum application use cases by providing accessible research resources to academia and industry for developing and testing such use cases, including through proof-of-concept testing, demonstrations, pilot projects, and prototyping.

"(c) APPLICATION PROPOSALS.—An applicant for an award under this section shall submit to the Director a

proposal at such time, in such manner, and containing such information as the Director may reasonably require. The proposal shall, at a minimum, describe the following:

''(1) How the applicant will assemble a workforce, including women and individuals from underrepresented groups (in accordance with section 526(a)(7) of the America COMPETES Reauthorization Act of 2010 (42 U.S.C. 1862p-14(a)(7))), with the skills needed to operate a quantum testbed.

''(2) How the applicant will ensure broad access to a quantum testbed, including for start-ups and small businesses.

''(3) How the applicant will securely research and develop software that is interoperable, portable, and cross-modal, including with respect to benchmarking and reproducibility.

''(4) How a quantum testbed will operate after Federal funding has ended.

''(d) PRIORITIZATION.—The Director of the National Science Foundation shall prioritize the following:

''(1) Applicants that ensure not less than 25 percent of the cost for a testbed awarded under this section is provided by private or non-Federal entities, including in-kind contributions.

''(2) Awards for consortia that include quantum industry participation.

''(e) ROLES AND RESPONSIBILITIES.—The Director of the National Science Foundation shall be responsible for the following:

''(1) Maintaining a record of notable outcomes from each quantum testbed established under this section.

''(2) Partnering with other Federal agencies to enable opportunities for quantum testbed outcomes to be appropriately taken up by such agencies in alignment with the missions of such agencies.

''(3) Not later than one year after the date of the enactment of this section and every two years thereafter until December 31, 2032, briefing the appropriate committees of Congress on the status of such quantum testbeds and providing recommendations for improving such quantum testbeds.

''(f) COORDINATION.—In establishing quantum testbeds under this section, the Director of the National Science Foundation shall ensure coordination with other testbeds and other quantum facilities hosting Federal quantum technology and infrastructure supported by the National Science Foundation, including testbeds authorized pursuant to section 10390 of the Research and Devel-

opment, Competition, and Innovation Act (Public Law 117–167; 42 U.S.C. 19110), or by other Federal agencies as determined appropriate by the Director, to avoid duplication and maximize use of Federal resources.

''(g) STAKEHOLDER COLLABORATION.—In carrying out this section, the Director of the National Science Foundation shall collaborate with the Quantum Consortium established pursuant to section 201(b) to accomplish the purposes of the quantum testbeds program described in subsection (b) and ensure there is strong collaboration with industry stakeholders. The Director may also engage with National Laboratories, federally funded research and development centers, industry, and other members of the United States quantum ecosystem.

''(h) GEOGRAPHIC DIVERSITY.—The Director shall ensure regional and geographic diversity in issuing awards under this section.

''(i) PUBLICATION.—An entity that establishes a testbed under subsection (a) is encouraged to publish non5 proprietary software artifacts and benchmark results from such testbed if such publication would not compromise the security of such software or such testbed.

''SEC. 305. RESEARCH SECURITY.

''The activities authorized under title III shall be applied in a manner consistent with subtitle D of title VI

of the Research and Development, Competition, and Innovation Act (enacted as division B of Public Law 117–167; 42 U.S.C. 19231 et seq.).''.

SEC. 5016. DEPARTMENT OF ENERGY QUANTUM INFORMATION SCIENCE RESEARCH PROGRAM.

Section 401 of the National Quantum Initiative Act (15 U.S.C. 8851) is amended—

(1) in subsection (a), by striking ''basic research program on quantum information science'' and inserting ''research, development, and demonstration program on quantum information science, engineering, and technology'';

(2) in subsection (b)—

(A) in paragraph (1), by inserting '', engineering, and technology'' after ''science'';

(B) by redesignating paragraphs (3), (4), and (5) as paragraphs (5), (6), and (7), respectively;

(C) by inserting after paragraph (2) the following new paragraphs:

''(3) operate National Quantum Information Science Research Centers to accelerate and scale up scientific and technical breakthroughs in quantum information science, engineering, and technology, and maintain state-of-the-art infrastructure for

quantum researchers and industry partners, in accordance with section 402;

''(4) conduct cooperative research with industry, National Laboratories, institutions of higher education, and other research institutions to facilitate the development and demonstration of quantum information science, engineering, and technology, including in the fields of—

''(A) quantum information theory;

''(B) quantum physics;

''(C) quantum computational science, including hardware and software, including artificial intelligence, machine learning and data science;

''(D) quantum data storage, including hardware and software for energy efficient data centers;

''(E) applied mathematics and algorithm development;

''(F) quantum communications and networking, including hardware and software for quantum communications and networking;

''(G) quantum sensing and detection;

''(H) materials science and engineering;

''(I) quantum modeling and simulation, including molecular modeling;

''(J) near- and long-term application development in a range of areas as determined by the Secretary, such as materials discovery, advanced manufacturing, cybersecurity, energy efficiency and energy technologies, energy storage and electric grid management;

''(K) quantum chemistry and chemical sciences;

''(L) quantum biology; and

''(M) quantum security technologies;'';

(D) by amending paragraph (5), as so redesignated, to read as follows:

''(5) provide research experiences and training for additional undergraduate and graduate students in quantum information science, engineering, and technology, including in the fields specified in paragraph (4);'';

(E) in paragraph (6), as so redesignated—

(i) in subparagraph (E), by striking ''and'' after the semicolon;

(ii) by redesignating subparagraph (F) as subparagraph (J); and

(iii) by inserting after subparagraph (E) the following new subparagraphs:

''(F) the Office of Electricity;

''(G) the Office of Cybersecurity, Energy Security, and Emergency Response;

''(H) the Office of Fossil Energy and Carbon Management;

''(I) the Office of Technology Transitions; and'';

(F) in paragraph (7), as so redesignated, by striking the period and inserting '' and other relevant efforts as defined by the Secretary of Energy;''; and

(G) by adding at the end the following new paragraphs:

''(8) leverage the collective body of knowledge and data, including experience and resources from existing Federal research activities and commercially-available quantum computing hardware and software to the extent practicable; and

''(9) support, in collaboration with the Secretary of Commerce and Director of the National Science Foundation, regional innovation initiatives in quantum information science, engineering, and technology, including quantum industry and non-

profit entities and small and medium-sized businesses and startups.''; and

(3) by adding at the end the following new subsections:

''(c) QUANTUM HIGH PERFORMANCE COMPUTING STRATEGIC PLAN.—Not later than one year after the date of the enactment of this subsection, the Secretary of Energy shall submit to Congress a report containing a 10-year strategic plan to guide Federal programs in designing, expanding, commercializing, and procuring hybrid, high performance computing systems featuring the ability to integrate a diverse set of resources, including artificial intelligence and machine learning, accelerated by quantum supercomputers to enable the Department of Energy's computing facilities to continuously advance computing resources. Such strategic plan shall include the following:

''(1) A plan to leverage capabilities and infrastructure from the exascale computing program, as the Secretary determines necessary.

''(2) A plan to minimize disruptions to the advanced scientific computing workforce.

''(3) A consideration of a diversity of quantum computing modalities.

''(4) A plan to integrate cloud access of commercially available quantum hardware and software

to complement on-premises high performance computing systems and resources consistent with the QUEST program under section 404.

''(5) A description of how the Secretary will implement the plan developed under this section.

''(d) INDUSTRY OUTREACH.—In carrying out the program under subsection (a) the Secretary of Energy shall engage with the quantum technology industry and promote commercialization of applications of quantum technology relevant to the Department of Energy's activities by carrying out the following:

''(1) Educating the following:

''(A) The energy industry on near term and commercially available quantum technologies.

''(B) The quantum industry on potential energy applications.

''(2) Accelerating the advancements of United States quantum computing, communications, networking, sensing, and security capabilities to protect and optimize the energy sector.

''(3) Advancing relevant domestic supply chains, manufacturing capabilities, and associated simulations or modeling capabilities.

''(4) Facilitating commercialization of quantum technologies from National Laboratories and engaging with the Quantum Consortium established pursuant to section 201(b) and other organizations, as applicable, to transition component technologies to help facilitate, as appropriate, the development of a quantum supply chain.

''(5) Where appropriate, promoting participation by small and medium-sized businesses and startups.''.

SEC. 5017. DOE QUANTUM INSTRUMENTATION AND FOUNDRY PROGRAM.

Title IV of the National Quantum Initiative Act (15 U.S.C. 8851 et seq.) is amended by inserting after section 401 the following new section:

''SEC. 401A. DEPARTMENT OF ENERGY QUANTUM INSTRUMENTATION AND FOUNDRY PROGRAM.

''(a) IN GENERAL.—The Secretary of Energy shall establish a quantum instrumentation and infrastructure foundry program to carry out the following:

''(1) Maintain United States leadership in quantum information science, engineering, and technology.

''(2) Develop domestic quantum supply chains.

''(3) Provide resources for the broader scientific community.

''(4) Support activities carried out under sections 401, 403, and 404.

''(b) PROGRAM COMPONENTS.—In carrying out the program under subsection (a), the Secretary of Energy shall design, build, develop, purchase, and commercialize specialized equipment, laboratory infrastructure, and state-of-the-art instrumentation to advance quantum engineering research and the development of quantum component technologies at a scale sufficient to satisfy the needs of the scientific community and enable commercialization of quantum technology.

''(c) QUANTUM FOUNDRIES.—In carrying out the program under subsection (a), and in coordination partnership with institutions of higher education and industry, the Secretary of Energy shall support the development of quantum foundries focused on satisfying the device, hardware, software, and materials needs of the scientific community and the quantum supply chain.''.

SEC. 5018. NATIONAL QUANTUM INFORMATION SCIENCE RESEARCH CENTERS.

Section 402 of the National Quantum Initiative Act (15 U.S.C. 8852) is amended—

(1) in subsection (a)—

(A) in paragraph (1)—

(i) by striking ''basic'';

(ii) by striking ''science and technology'' and inserting ''science, engineering, and technology, to expand capacity for the domestic quantum workforce,''; and

(iii) by striking ''section 401'' and inserting ''sections 401, 403, and 404''; and

(B) in paragraph (2)(C), by inserting ''that may include one or more commercial entities'' after ''collaborations'';

(2) in subsection (b), by inserting '', and should be inclusive of the variety of viable quantum technologies, where appropriate'' before the period;

(3) in subsection (c),

(A) by striking ''basic''; and

(B) by inserting '', engineering, and technology, accelerating quantum workforce development,'' after ''science'';

(4) in subsection (d)(1)—

(A) in subparagraph (C), by striking ''and'' after the semicolon;

(B) by redesignating subparagraph (D) as subparagraph (E); and

(C) by inserting after subparagraph (C) the following new subparagraph:

''(D) the Office of Technology Transitions; and'';

(5) in subsection (e), by amending paragraph (2) to read as follows:

''(2) RENEWAL.—Each Center under this section may be renewed for an additional period of 5 years following a successful, merit-based review and approval by the Director.''; and

(6) by striking subsection (f).

SEC. 5019. DEPARTMENT OF ENERGY QUANTUM NETWORK INFRASTRUCTURE RESEARCH AND DEVELOPMENT PROGRAM.

Section 403 of the National Quantum Initiative Act (15 U.S.C. 8853) is amended—

(1) in subsection (a)—

(A) in paragraph (4)—

(i) by inserting '', including'' after ''networking''; and

(ii) by striking ''and'' after the semicolon;

(B) in paragraph (5), by striking the period and inserting a semicolon; and

(C) by adding at the end the following new paragraphs:

''(6) where applicable, leverage a diversity of modalities and commercially-available quantum hardware and software; and

''(7) develop education and training pathways related to quantum network infrastructure investments, aligned with existing programmatic investments by the Department of Energy.''; and

(2) in subsection (b)—

(A) in paragraph (1)—

(i) by redesignating subparagraphs (C) and (D) as subparagraphs (D) and (E), respectively; and

(ii) by inserting after subparagraph (B) the following new subparagraph:

''(C) the Administrator of the National Aeronautics and Space Administration;'';

(B) in paragraph (2)—

(i) in subparagraph (A), by inserting ''ground-to-space and'' after ''channels,'';

(ii) in subparagraph (E), by striking ''photon-based'' and inserting ''all applicable modalities of'';

(iii) in subparagraph (F)—

(I) by striking ''large scale'' and inserting ''large-scale''; and

(II) by inserting '', quantum sensors,'' after ''quantum repeaters'';

(iv) in subparagraph (G)—

(I) by inserting ''data centers, quantum sensors'' after ''repeaters,''; and

(II) by striking ''and'' after the semicolon;

(v) in subparagraph (H)—

(I) by striking ''the quantum technology stack'' and inserting ''quantum technology modality stacks''; and

(II) by striking ''National Laboratories in'' and inserting ''National Laboratories such as''; and

(vi) by adding at the end the following new subparagraphs:

''(I) development of quantum network and entanglement distribution protocols or applications, including development of network stack protocols and protocols enabling integration with existing technologies or infrastructure; and

''(J) development of high efficiency room-temperature photon detectors for quantum photonic applications, including quantum networking and communications;'';

(C) in paragraph (4)—

(i) by striking ''basic''; and

(ii) by striking ''material'' and inserting ''materials''; and

(D) in paragraph (5), by striking ''fundamental'';

(3) in subsection (c)—

(A) in paragraph (6), by inserting '', including small and medium-sized businesses and startups'' before the semicolon;

(B) in paragraph (7), by striking ''and'' at the end;

(C) by redesignating paragraph (8) as (9); and

(D) by inserting after paragraph (7) the following new paragraph:

''(8) nonprofit organizations; and''; and

(4) in subsection (d), by striking ''basic research'' and inserting ''research, development, and demonstration''.

SEC. 5020. DEPARTMENT OF ENERGY QUANTUM USER EXPANSION FOR SCIENCE AND TECHNOLOGY PROGRAM.

Section 404 of the National Quantum Initiative Act (15 U.S.C. 8854) is amended—

(1) in subsection (a)—

(A) in the matter preceding paragraph (1), by striking ''and quantum computing clouds'' and inserting '', software, and cloud-based quantum computers'';

(B) in paragraph (3), by striking ''and'' after the semicolon;

(C) in paragraph (4), by striking the period and inserting a semicolon; and

(D) by adding at the end the following new paragraphs:

''(5) to enable development of interoperable, secure, and scalable software for cloud-based, hybrid, and other appropriate environments, and applications, including estimation of resources needed to scale applications; and

''(6) to develop near-term quantum applications to solve public and private sector problems.'';

(2) in subsection (b)—

(A) in paragraph (4), by striking ''and'' after the semicolon;

(B) in paragraph (5), by striking the period and inserting a semicolon; and

(C) by at the end the following new paragraphs:

''(6) enable users to develop algorithms, software tools, simulators, and applications for quantum systems using cloud-based quantum computers; and

''(7) partner with appropriate public and private sector entities to develop training and education opportunities on prototype and early-state devices.'';

(3) in subsection (c)—

(A) by redesignating paragraphs (4), (5), (6), (7), and (8) as paragraphs (5), (6), (7), (8), and (10), respectively;

(B) by inserting after paragraph (3) the following new paragraph:

''(4) the National Oceanic and Atmospheric Administration;'';

(C) in paragraph (7), as so redesignated, by inserting '', including small- and medium-sized businesses and startups'' before the semicolon;

(D) in paragraph (8), as so redesignated, by striking ''and'' after the semicolon; and

(E) by inserting after paragraph (8), as so redesignated the following new paragraph:

''(9) nonprofit organizations; and''; and

(4) in subsection (d)—

(A) in the heading, by striking ''SECURITY'' and inserting ''INTERAGENCY FUNCTIONS''; and

(B) by striking ''ensure'' sand inserting ''carry out the following:

''(1) Align such activities, including with respect to the benchmarking of software referred to in paragraph (5) of subsection (a), such that such activities are not duplicated across the Department of Energy, the Foundation, and the Institute.

''(2) Ensure''.

SEC. 5021. QUANTUM INFORMATION SCIENCE TO ENHANCE THE RESILIENCE, SECURITY, AND EFFICIENCY OF THE ELECTRIC GRID.

Title IV of the National Quantum Initiative Act (15 U.S.C. 8851 et seq.) is amended by adding at the end the following new section:

"SEC. 405. QUANTUM INFORMATION SCIENCE TO ENHANCE THE RESILIENCE AND SECURITY OF THE ELECTRIC GRID.

"(a) IN GENERAL.—The Secretary of Energy (referred to in this section as the 'Secretary') shall conduct research, development, and demonstration activities focused on the use of quantum information science, engineering, and technology, including through quantum applications and quantum computing, to enhance the resilience, security, and efficiency of the electric grid in the United States.

"(b) RESEARCH AREAS.—In carrying out subsection (a), the Secretary may conduct research in the following areas:

"(1) Fault detection and prediction.

"(2) Grid security and safety, including through post-quantum cryptography.

"(3) Integrated grid planning.

"(4) Grid optimization.

"(5) Enhanced modeling.

"(6) Energy storage.

"(7) Energy market optimization.

"(8) Any other area in which, in the determination of the Secretary, quantum information science, engineering, and technology can enhance the resil-

ience, security, and efficiency of the electric grid in the United States.

''(c) COOPERATION.—To the extent practicable, the Secretary shall conduct research, development, and demonstration activities under subsection (a) in cooperation, including through partnerships, as the Secretary determines appropriate, with members of relevant industries, National Laboratories, institutions of higher education, nonprofit organizations, and other relevant institutions, including research institutions, as determined by the Secretary.''.

SEC. 5022. RESEARCH SECURITY.

Title IV of the National Quantum Initiative Act (15 U.S.C. 8851 et seq.), as amended by section 5021, is further amended by adding at the end the following new section:

''SEC. 406. RESEARCH SECURITY.

''The activities authorized under this title shall be applied in a manner consistent with subtitle D of title VI of the Research and Development, Competition, and Innovation Act (enacted as division B of Public Law 117–167; 42 U.S.C. 19231 et seq.).''.

SEC. 5023. PUBLIC-PRIVATE PARTNERSHIP FOR QUANTUM APPLICATION DEVELOPMENT ACCELERATION.

Title IV of the National Quantum Initiative Act (15 U.S.C. 8851 et seq.), as amended by sections 5021 and 5022, is further amended by adding at the end the following new section:

"SEC. 407. PUBLIC-PRIVATE PARTNERSHIP FOR QUANTUM APPLICATION DEVELOPMENT ACCELERATION.

''(a) ESTABLISHMENT OF COLLABORATIVE VENTURE FOR QUANTUM APPLICATION DEVELOPMENT ACCELERATION.—The Secretary of Commerce, in coordination with the Director of the National Institute of Standards and Technology, may establish or expand an existing collaborative venture or consortia with other public sector entities or private sector entities for the purpose of identifying and developing near-term use cases of quantum technologies.

''(b) ENGAGEMENT.—In carrying out subsection (a), the Secretary may, acting through the Director of the National Institute of Standards and Technology—

''(1) coordinate activities with the Federal agencies that are members of the Subcommittee on Quantum Information Science or the Subcommittee on the Economic and Security Implications of Quantum Science; and

''(2) engage with—

''(A) the Quantum Economic Development Consortium;

''(B) the National Laboratories (as such term is defined in section 2 of the Energy Policy Act of 2005 (42 U.S.C. 15801));

''(C) federally funded research and development centers; and

''(D) other members of the United States quantum computing and quantum information ecosystem.

''(c) DEFINITION.—In this section, the term 'near-term use case' means—

''(1) in the case of an application that includes the development of quantum computing hardware, an application that can be developed and deployed in less than three years; or

''(2) in the case of an application that includes quantum technologies, including quantum communication, sensing, algorithm development for hybrid applications, supply chain innovation, or demonstrations of computational advantage, where new quantum computer hardware would not need to be developed and deployed in less than 18 months.''.

SEC. 5024. NATIONAL AERONAUTICS AND SPACE ADMINISTRATION QUANTUM ACTIVITIES.

The National Quantum Initiative Act is amended by adding at the end the following new title:

"TITLE V—NATIONAL AERONAUTICS AND SPACE ADMINISTRATION QUANTUM ACTIVITIES

"SEC. 501. QUANTUM INFORMATION SCIENCE, ENGINEERING, AND TECHNOLOGY RESEARCH FOR SPACE AND AERONAUTICS.

''(a) IN GENERAL.—The Administrator of the National Aeronautics and Space Administration is authorized to carry out the following:

''(1) Carry out research on quantum information science, engineering, and technology.

''(2) Designate an individual responsible for coordinating quantum activities across the agency.

''(b) COOPERATION.—In carrying out subsection (a), the Administrator of the National Aeronautics and Space Administration—

''(1) shall consider cooperative arrangements with the Department of Energy and other Federal departments and agencies, as practicable, on areas of shared benefit; and

''(2) may enter into memoranda of understanding or memoranda of agreement to establish such cooperative arrangements.

''(c) STRATEGY.—Not later than 180 days after the date of the enactment of this title, the Administrator of the National Aeronautics and Space Administration shall submit to the appropriate committees of Congress a strategy for National Aeronautics and Space Administration research on quantum information science, engineering, and technology. The strategy shall—

''(1) identify priority areas of quantum science, engineering, and technologies, such as quantum sensing, that have the highest potential to transform and improve NASA's missions, research, and development activities;

''(2) identify opportunities for novel ways to investigate, explore, and advance measurements of the Earth, the solar system, and the universe;

''(3) identify resources required to support implementation of the strategy, including budgets, workforce, and infrastructure; and

''(4) describe cooperative efforts with other Federal departments and agencies, and address areas of research and applications, including—

''(A) quantum sensing;

"(B) quantum networking;

"(C) quantum communications, including quantum satellite communications;

"(D) quantum computing; and

"(E) science, aeronautics, and exploration-related applications.

"(d) CONSULTATION.—In developing the strategy described in subsection (c), the Administrator may seek input from relevant external stakeholders, including institutions of higher education, industry, and nonprofit research organizations.

"SEC. 502. NATIONAL AERONAUTICS AND SPACE ADMINISTRATION QUANTUM INSTITUTE.

"(a) IN GENERAL.—Subject to the availability of appropriations, the Administrator of the National Aeronautics and Space Administration, in consultation with the heads of other Federal departments and agencies, as appropriate, may carry out a program to establish an institute focused on space and aeronautics applications of quantum information science, engineering, and technology.

"(b) INSTITUTE DETAILS.—

"(1) COMPETITIVE, MERIT-REVIEWED PROCESS.—If the institute under this section is estab-

lished, the institute shall be so established through a competitive, merit-reviewed process.

''(2) APPLICATIONS.—An eligible applicant under this section shall submit to the Administrator of the National Aeronautics and Space Administration an application at such time, in such manner, and containing such information as the Administrator determines to be appropriate.

''(3) ELIGIBLE APPLICANTS.—When administering the process described in paragraph (1), the Administrator of the National Aeronautics and Space Administration shall consider applications from institutions of higher education, research centers, multi-institutional collaborations, and any other entity that the Administrator determines appropriate.

''(4) COLLABORATIONS.—A collaboration that receives an award under this section may include multiple types of research institutions, private sector entities, and nonprofit organizations.

''(5) COORDINATION.—The Administrator of the National Aeronautics and Space Administration shall ensure an awardee under this section coordinates the activities carried out under this section with the National Aeronautics and Space Adminis-

tration, and avoids unnecessary duplication of existing activities of the Administration, other activities carried out under this Act, and other related programs, as appropriate.

''(6) COMMERCIAL TECHNOLOGY.—The institute under this section may leverage commercially-available hardware and software to carry out the activities described in subsection (c).

''(c) INSTITUTE ACTIVITIES.—The institute under this section may carry out activities that—

''(1) support research focused on developing space and aeronautics applications for quantum information science, engineering, and technology, including as related to the results of the strategy under section 501(c); and

''(2) support quantum information science, engineering, and technology education and public outreach.

''(d) INSTITUTE REQUIREMENTS.—To the maximum extent practicable, the institute under this section shall serve the needs of the National Aeronautics and Space Administration for the benefit of the broader United States quantum information science community, to establish processes for the purpose of advancing space and aeronautics applications in quantum information science, engi-

neering, and technology, and improving the competitiveness of the United States.

''(e) INSTITUTE SELECTION AND DURATION.—

''(1) IN GENERAL.—Subject to the availability of appropriations, the institute under this section may carry out activities for a period of 5 years.

''(2) REAPPLICATION.—Subject to the availability of appropriations, an awardee may reapply for an additional, subsequent period of 5 years following a successful, merit-based review.

''(3) TERMINATION.—Consistent with the authorities of the National Aeronautics and Space Administration, the Administrator of the National Aeronautics and Space Administration may terminate the institute for cause during the performance period.

''SEC. 503. RESEARCH SECURITY.

''The activities authorized under title V shall be applied in a manner consistent with subtitle D of title VI of the Research and Development, Competition, and Innovation Act (enacted as division B of Public Law 117–167; 42 U.S.C. 19231 et seq.).''.

SEC. 5025. NATIONAL SCIENCE FOUNDATION CRYPTOGRAPHY RESEARCH.

Subsection (a)(1)(A) of section 4 of the Cyber Security Research and Development Act (15 U.S.C. 7403) is amended by inserting ", including post-quantum cryptography (as such term is defined in section 3 of the Quantum Computing Cybersecurity Preparedness Act (6 U.S.C. 1526 note; Public Law 117–260))" before the semicolon.

SEC. 5026. REPORTS ON MITIGATING THE CYBERSECURITY AND NATIONAL SECURITY RISKS POSED BY CERTAIN QUANTUM COMPUTERS.

(a) INITIAL REPORT.—Not later than one year after the date of the enactment of this Act, the Subcommittee on the Economic and Security Implications of Quantum Information Science established under section 105 of the National Quantum Initiative Act (15 U.S.C. 8814a) shall carry out the following:

(1) Conduct an assessment of each of the following:

(A) The capabilities and progress of the United States, relative to other countries, with respect to the following:

(i) Developing a cryptographically-relevant quantum computer.

(ii) Adopting security and preparedness measures, including post-quantum

cryptography, to mitigate the cybersecurity and national security risks posed by such computer.

(B) The progress of private sector entities and public sector entities in the United States toward adopting such measures, including the progress toward implementing the guidance under section 4 of the Quantum Computing Cybersecurity Preparedness Act (6 U.S.C. 1526).

(2) Identify the sectors of the economy most vulnerable to such risks.

(3) Based upon such assessments and such identification, develop a plan to mitigate such risks, including by carrying out the following:

(A) Facilitating collaboration between agencies and departments of the Federal Government.

(B) Facilitating the exchange of information between such private sector entities and public sector entities.

(C) Forming partnerships between the Federal Government and such private sector entities.

(D) Identifying such measures that such private sector entities and public sector entities may adopt.

(E) Supporting such exchange and the adoption of such measures, including by identifying actions, including piloting projects, providing technical assistance, and publishing cyber hygiene guidance for such private sector entities, that such agencies and departments may carry out to support such exchange and adoption.

(4) Develop guidelines for determining whether a quantum computer is a cryptographically-relevant quantum computer.

(5) Submit to the appropriate committees of Congress a report in classified or unclassified form, as appropriate, that includes information relating to the following:

(A) The assessments conducted under paragraph (1).

(B) The sectors identified under paragraph (2).

(C) The plan developed under paragraph (3).

(D) The guidelines developed under paragraph (4).

(E) Recommendations for the following:

(i) A timetable to implement such plan.

(ii) Policies to implement such plan that require legislation.

(iii) Policies to implement such plan that do not require legislation.

(b) SUBSEQUENT REPORTS.—Not later than one year after the report under subsection (a) is submitted and annually thereafter for four years, the Subcommittee referred to in such subsection shall submit to Congress a report in classified or unclassified form, as appropriate, that includes information relating to the progress of private sector entities and public sector entities in the United States toward adopting the measures described in such subsection.

(c) DEFINITIONS.—In this section:

(1) APPROPRIATE COMMITTEES OF CONGRESS.—The term ''appropriate committees of Congress'' has the meaning given such term in section 2 of the National Quantum Initiative Act (15 U.S.C. 8801).

(2) CLASSICAL COMPUTER; POST-QUANTUM CRYPTOGRAPHY; QUANTUM COMPUTER.—The terms ''classical computer'', ''post-quantum cryptography'', and ''quantum computer'' have the meanings given such terms in section 3 of the Quantum Computing Cybersecurity Preparedness Act (6 U.S.C. 1526 note).

(3) CRYPTOGRAPHICALLY-RELEVANT QUANTUM COMPUTER.—The term ''cryptographically-relevant quantum computer'' means a quantum computer with the ability to compromise a cryptographic system that a classical computer is unable to compromise.

SEC. 5027. STUDIES RELATING TO NATIONAL QUANTUM INITIATIVE PROGRAM.

(a) INDEPENDENT STUDY ON PROGRESS MADE BY NATIONAL QUANTUM INITIATIVE PROGRAM.—

(1) AGREEMENT.—The Director of the Office of Science and Technology Policy shall seek to enter into an agreement with the National Academies of Sciences, Engineering, and Medicine (in this subsection the ''National Academies'') to carry out the independent study under paragraph (2).

(2) INDEPENDENT STUDY.—Under an agreement between the Director of the Office of Science

and Technology Policy and the National Academies under this subsection, the National Academies shall carry out an independent study to assess the progress made by the National Quantum Initiative Program in achieving the purposes set forth under section 3 of the National Quantum Initiative Act (15 U.S.C. 8802) and the goals of the Program, including with respect to sensing, communications, computing, and workforce development for near-term development and quantum applications.

(b) STUDY ON IMPEDIMENTS TO COLLABORATION UNDER NATIONAL QUANTUM INITIATIVE PROGRAM.—

(1) STUDY AND REPORT.—Not later than 180 days after the date of the enactment of this Act, the consortium convened by the Director of the National Institute of Standards and Technology pursuant to section 201(b)(1) of the National Quantum Initiative Act (15 U.S.C. 8831(b)(1)) shall—

(A) conduct a study—

(i) on the impediments to collaboration under the National Quantum Initiative Program implemented pursuant to section 101(a) of such Act (15 U.S.C. 8811(a)) between Multidisciplinary Centers for Quantum Research and Education es-

tablished under section 302(a) of such Act (15 U.S.C. 8842(a)), National Quantum Information Science Research Centers established and operated pursuant to section 402(a)(1) of such Act (15 U.S.C. 8852(a)(1)), industry, and academia; and

(ii) to develop recommendations for legislative action to eliminate or mitigate such impediments; and

(B) submit to the Committee on Commerce, Science, and Transportation of the Senate and the Committee on Science, Space, and Technology of the House of Representatives a report on the findings of the consortium with respect to the study conducted pursuant to subparagraph (A).

(2) CONTENTS.—The report submitted under paragraph (1)(B) shall include the following:

(A) An overview of the current state of research being conducted under the National Quantum Initiative Program.

(B) A breakdown of the funding under the Program for near-term quantum applications development, disaggregated by different quantum technologies, including computing (anneal-

ing and gate-model with the different types of qubit technologies), sensing, communication, and networking.

(C) Identification of potential risks in the research funded under the Program.

SEC. 5028. REAUTHORIZATION OF NEXT GENERATION QUANTUM LEADERS PILOT PROGRAM OF THE NATIONAL SCIENCE FOUNDATION.

Paragraph (6) of section 10661(f) of the Research and Development, Competition, and Innovation Act (Public Law 117–167; relating to the Next Generation Quantum Leaders Pilot Program of the National Science Foundation for the education and training of the next generation of students and teachers in the fundamental principles of quantum mechanics) is amended by striking ''four years'' and inserting ''eight years''.

SEC. 5029. CLERICAL AMENDMENTS.

The table of contents in section 1(b) of the National Quantum Initiative Act is amended as follows:

(1) By striking the items relating to sections 105 and 106 and inserting the following new items:

''Sec. 105. Subcommittee on the Economic and Security Implications of Quantum Information Science.
''Sec. 105A. International Quantum Cooperation Strategy.
''Sec. 106. Sunset.''.

(2) By inserting after the item relating to section 201 the following new items:

(3) By inserting after the item relating to section 302 the following new items:

(4) By inserting after the item relating to section 401 the following new item:

(5) By inserting after the item relating to section 404 the following new items:

(6) By adding at the end the following new items:

''TITLE V—NATIONAL AERONAUTICS AND SPACE ADMINISTRATION QUANTUM ACTIVITIES

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