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NATIONAL QUANTUM INITIATIVE REAUTHORIZATION ACT

JULY 25, 2024.—Committed to the Committee of the Whole House on the State of the Union and ordered to be printed

Mr. LUCAS, from the Committee on Science, Space, and Technology, submitted the following

R E P O R T

[To accompany H.R. 6213]

The Committee on Science, Space, and Technology, to whom was referred the bill (H.R. 6213) to reauthorize the National Quantum Initiative Act, and for other purposes, having considered the same, reports favorably thereon with an amendment and recommends that the bill as amended do pass.

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The amendment is as follows:

Strike all after the enacting clause and insert the following:

SECTION 1. SHORT TITLE.

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

SEC. 2. DEFINITIONS.

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

(1) by redesignating paragraphs (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 (7), (9), (12), (13), (15), and (16), respectively;

(2) by inserting after paragraph (3) the following new paragraphs:

"(4) 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).

"(5) FOREIGN COUNTRY OF CONCERN.—The term 'foreign country of concern' means—

"(A) a country that is a covered nation (as such term is defined in section 4872(d) of title 10, United States Code); and

"(B) any country that the Secretary of Commerce, in consultation with the Secretary of Defense, the Secretary of State, and the Director of National Intelligence, determines to be engaged in conduct that is detrimental to the national security or foreign policy of the United States.

"(6) FOREIGN ENTITY OF CONCERN.—The term 'foreign entity of concern' means a foreign entity that is—

"(A) designated as a foreign terrorist organization by the Secretary of State under section 219(a) of the Immigration and Nationality Act (8 U.S.C. 1189(a));

"(B) included on the list of specially designated nationals and blocked persons maintained by the Office of Foreign Assets Control of the Department of the Treasury (commonly known as the 'SDN list');

"(C) owned by, controlled by, or subject to the jurisdiction or direction of a government of a foreign country that is a covered nation (as such term is defined in section 4872 of title 10, United States Code);

"(D) alleged by the Attorney General to have been involved in activities for which a conviction was obtained under—

"(i) chapter 37 of title 18, United States Code (commonly known as the 'Espionage Act');

"(ii) section 951 or 1030 of title 18, United States Code;

"(iii) chapter 90 of title 18, United States Code (commonly known as the 'Economic Espionage Act of 1996');

"(iv) the Arms Export Control Act (22 U.S.C. 2751 et seq.);

"(v) section 224, 225, 226, 227, or 236 of the Atomic Energy Act of 1954 (42 U.S.C. 2274, 2275, 2276, 2277, and 2284);

"(vi) the Export Control Reform Act of 2018 (50 U.S.C. 4801 et seq.); or

"(vii) the International Emergency Economic Powers Act (50 U.S.C. 1701 et seq.); or

"(E) determined by the Secretary of Commerce, in consultation with the Secretary of Defense and the Director of National Intelligence, to be engaged in unauthorized conduct that is detrimental to the national security or foreign policy of the United States.";

(3) in paragraph (7), as so redesignated, by striking "(a)" each place it appears;

(4) by inserting after paragraph (7), as so redesignated, the following new paragraph:

"(8) 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).";

(5) by inserting after paragraph (9), as so redesignated, the following new paragraphs:

"(10) 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.

"(11) 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, spin atoms, or spin electrons.";

(6) by amending paragraph (12), as so redesignated, to read as follows:

"(12) QUANTUM INFORMATION SCIENCE, TECHNOLOGY, AND ENGINEERING.—The term 'quantum information science, technology, and engineering' 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

(7) by inserting after paragraph (13), as so redesignated, the following new paragraph:

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

SEC. 3. 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 a domestic workforce pipeline 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 applications, to promote innovation and commercialization; and

"(G) to support technologies, including artificial intelligence, 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. 4. 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 inserting "and retain" after "to develop"; and

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

(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, and strategic allies"; and

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

SEC. 5. NATIONAL QUANTUM COORDINATION OFFICE.

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

(1) in subsection (a)(2)—

(A) in subparagraph (A)—

(i) by inserting "who shall be" before "appointed"; and

(ii) by inserting ", and who shall serve a four year term, subject to renewal" before the semicolon; and

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

"(B) staff comprised of employees detailed from the Federal departments and agencies specified in section 103(b).."; and

(2) in subsection (b)—

(A) in paragraph (3), by striking "science and technology" and inserting "science, engineering, and technology research and workforce";

(B) in paragraph (6), by striking "and" after the semicolon;

(C) in paragraph (7), by striking the period at the end and inserting ";"; and

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

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

(E) in paragraph (7), by inserting "nonprofit research organizations," after "universities,"; and

(F) by adding after paragraph (7), 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. 6. 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 those of our 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 "; and"; and

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

"(8) facilitate interagency partnership opportunities to advance quantum applications related to environment, advanced manufacturing, biotechnology, space, and other sectors.";

(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 subsection:

"(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 addressing such potential use cases, including lack of funding.".

SEC. 7. 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. universities, 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 "inter-

national 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 ";"; and

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

"(I) the domestic and international cooperation needs and goals of the Program, including 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)—

(A) by inserting "through December 31, 2030" after "thereafter"; and

(B) by adding at the end the following new sentence: "In the first such report required after the date of the enactment of this sentence, the Advisory Committee shall assess the advisability and feasibility of establishing a quantum communications corridor in which Federal laboratories, institutions of higher education, and other entities conducting quantum information science, engineering, and technology research are connected via quantum communication networks capable of rapidly and securely transmitting large quantities of information."; and

(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.".

SEC. 8. 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), 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)—

(i) by inserting "and engineering" after "quantum information science"; and

(ii) by inserting "any" before "export controls";

(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)—

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

(ii) 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, and technology; and

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

SEC. 9. 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, and the heads of other Federal agencies, as appropriate, shall develop and 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—

"(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; and

"(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 the relevant 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, and technology.

"(3) Efforts and plans to address risks to the national security and economic interests of the United States during development and 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 meet 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. 10. SUNSET.

Section 106(a) of the National Quantum Initiative Act (15 U.S.C. 8815(a)) is amended to read as follows:

"(a) IN GENERAL.—Except as provided in subsection (b), the authority to carry out sections 101, 102, 103, 104, and 105 shall terminate on December 30, 2030.".

SEC. 11. 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 quantum supporting technologies, such as artificial intelligence;".

(E) by redesignating paragraphs (5), (6), and (7) as paragraphs (8), (9), and (11), respectively;

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

"(5) shall carry out 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 "non-profit 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 the following new paragraph:

"(10) shall establish such infrastructure as is necessary to carry out title II; 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 meet 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 infor-

mation science, engineering, and technology, and communicate findings to Federal agencies and other domestic and international stakeholders;

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

"(E) to provide recommendations on how the National Institute of Standards and Technology, the Program, and other Federal agencies, as appropriate, can incorporate small and medium-sized businesses and startups into Federal quantum activities and promote the success of small and medium-sized startups.";

(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 than every five years," after "shall"; and

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

"(4) COORDINATION.—As appropriate, the consortium is encouraged to engage with Federal agencies that fund research, have a mission to transition or translate research results to practical quantum applications, or have a mission that could benefit from the development of quantum technologies, to inform and accelerate progress in such areas."; 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 promote, establish, and support international quantum information science, engineering, and technology research, metrology research, and standardization, as appropriate, to enhance international cooperation, meet 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 INSTITUTE.—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 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 deployment 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—

"(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 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; and

"(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 and after the date on which the Director of National Institute of Standards and Technology has issued standards relating to post-quantum cryptography, the Director 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 granting funds 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 cryptographic and remediate quantum-related vulnerabilities.

"(C) GUIDANCE.—The Director of the National Institute of Standards and Technology may develop, and periodically update, guidance, including relating to eligibility, application disclosure requirements, grant amount and duration, and any additional requirements regarding the award of grants under this paragraph.

"(D) CONSULTATION.—If the 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, and appropriate representatives of private sector entities, including nonprofit organizations, to share information regarding the grant program under this paragraph and guidance developed and updated under subparagraph (C).

"(e) FUNDING.—Of the funds authorized to be appropriated for the National Institute of Standards and Technology pursuant to section 10211 of the Research and Development, Competition, and Innovation Act (Public Law 117–167) for scientific and technical research and services laboratory activities, there is authorized to be appropriated to the Director of the National Institute of Standards and Technology to carry out this section up to $85,000,000 for each of fiscal years 2024 through 2027.".

SEC. 12. NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY QUANTUM 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 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 and operate 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 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, 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.

"(B) Quantum engineering.

"(b) REQUIREMENTS.—To the maximum extent practicable, centers developed, constructed, operated, or maintained 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 transfer.

"(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 an additional period 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.

"(e) FUNDING.—The Director of the National Institute of Standards and Technology shall allocate up to $18,000,000 for each center established under this section for each of fiscal years 2024 through 2028, subject to the availability of appropriations. Amounts made available to carry out this section shall be derived from amounts appropriated or otherwise made available to the National Institute of Standards and Technology.

"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. 13. 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 "; and"; and

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

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

(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 award grants 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 State or Federal 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 quantum-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 those relevant to emerging technologies, such as artificial intelligence, microelectronics, and nano technology" after "fields".

(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 security and other potential societal dimensions associated with quantum information science, engineering, and technology into STEM curricula."; 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—

"(1) providing hands-on training and research opportunities for such educators at Federal Laboratories, institutions of higher education, or in industry; and

"(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—

"(A) supporting curriculum development in quantum information science, engineering, and technology as described in section 301(d) of the National Quantum Initiative Act (15 U.S.C. 8841(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)); and

"(C) leveraging the readiness for the involvement of local research and education communities to secure a talent pipeline in quantum information science, engineering, and technology to meet the workforce needs of industry, government, and academia.

"(2) COLLABORATIONS.—A collaboration receiving an award under this subsection may include institutions of higher education, nonprofit organizations, and private sector entities.

"(3) 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.

"(4) REQUIREMENTS.—To receive an award under this subsection, an eligible institution 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 and focus areas the eligible institution is prepared to engage in to significantly build up its quantum information 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.

"(5) 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 disciplines and focus areas specified in paragraph (4)(B).

"(C) Bridge programs focused on preparing post-baccalaureate students for graduate programs in quantum information science, engineering, and technology.

"(D) To build research capacity and infrastructure at an eligible institution in disciplines and focus areas specified in paragraph (4)(B).

"(E) An assessment of capacity-building and research infrastructure needs identified in paragraph (4)(B).

"(F) Administrative research development support.

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

"(6) 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 applicant will support students from diverse backgrounds, including first-generation undergraduate students.

"(B) The geographic and institutional diversity of eligible applicants.

"(C) How the eligible applicant can leverage public-private partnerships and existing research partnerships with Federal agencies.

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

"(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, as appropriate, to enhance international cooperation and meet United States commitments, including as part of the terms and conditions of 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 national Quantum Information Strategy in accordance with Executive Order 14073 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) RESTRICTIONS.—

"(A) CONFUCIUS INSTITUTE.—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 COUNTRY OF CONCERN AND FOREIGN ENTITY OF CONCERN.—None of the funds made available under this section may be obligated or expended to promote, establish, or finance quantum research activities be-

tween a United States entity and a foreign country of concern or foreign entity of concern.

"(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 award grants 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 meet the materials, advanced materials development, high performance computing, heterogeneous computing, networking, software, data, clean room, and device needs of the scientific 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.

"(j) FUNDING.—Of the funds authorized to be appropriated to the National Science Foundation pursuant to section 10303 of the Research and Development, Competition, and Innovation Act (Public Law 117–167) for research and related activities, there is authorized to be appropriated to the Director of the National Science Foundation to carry out this section up to $141,000,000 for each of fiscal years 2024 through 2027.".

SEC. 14. 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"; and

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

(3) in subsection (d)(2)—

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

(B) in subparagraph (B), by inserting "health," after "chemistry,";

(C) in subparagraph (C), by inserting ", including how each participant will develop and implement outreach activities to increase the participation of women and other students from groups historically underrepresented in STEM" 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 of fair competition.";

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

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

(5) in subsection (f), by striking "2019 through 2023" and inserting "2024 through 2028".

SEC. 15. 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 to—

"(1) 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; and

"(2) 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 content 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 from groups historically underrepresented in STEM to pursue undergraduate and graduate studies in quantum information science, engineering, and 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 restrictions outlined in subsection (c) 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 as 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 women and other students from groups historically underrepresented in STEM.

"(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.

"(j) FUNDING.—The Director of the National Science Foundation shall allocate up to $10,000,000 for the Hub for each of fiscal years 2024 through 2028, subject to the availability of appropriations. Amounts made available to carry out this section shall be derived from amounts appropriated or otherwise made available to the National Science Foundation.

"SEC. 304. QUANTUM TESTBEDS.

"(a) IN GENERAL.—Not later than one year after the date of the enactment of this 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 from populations that are historically underrepresented in STEM, 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 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, 2030, 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 those authorized pursuant to section 10390 of the Research and Development, Competition, and Innovation Act (Public Law 117–167; 42 U.S.C. 10990), 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) FUNDING.—The Director of the National Science Foundation shall allocate up to $50,000,000 for the quantum testbeds under this section for each fiscal years 2024 through 2028, subject to the availability of appropriations. Amounts made available to carry out this section shall be derived from amounts appropriated or otherwise made available to the National Science Foundation.

"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. 16. DEPARTMENT OF ENERGY QUANTUM INFORMATION SCIENCE RESEARCH PROGRAM.

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

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

"(a) IN GENERAL.—The Secretary of Energy shall carry out a 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;

"(L) quantum biology;

"(M) superconductive and high-performance microelectronics; and

"(N) 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"; and

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

"(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

(3) by adding at the end the following:

"(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 conceptual plan to leverage capabilities and infrastructure from the exascale computing program, as the Secretary of Energy 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) Implement the plan developed under this section.

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

"(1) Educating—

"(A) the energy industry on near term and commercially available quantum technologies; and

"(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.

"(e) FUNDING.—Of the funds authorized to be appropriated for the Department of Energy's Office of Science pursuant to section 317 of the Department of Energy Research and Innovation Act, there is authorized to be appropriated to the Secretary to carry out the activities under this section up to $130,000,000 for each fiscal years 2024 through 2027.".

SEC. 17. 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 meet 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 meeting the device, hardware, software, and materials needs of the scientific community and the quantum supply chain.

"(d) FUNDING.—The Secretary of Energy shall allocate up to $25,000,000 for each of fiscal years 2024 through 2028 to carry out this section, subject to the availability of appropriations. Amounts made available to carry out this section shall be derived from amounts appropriated or otherwise made available to the Department of Energy's Office of Science.".

SEC. 18. 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, 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) in subsection (f)—
(A) by striking "$25,000,000" and inserting "$35,000,000"; and
(B) by striking "2019 through 2023" and inserting "2024 through 2028".

SEC. 19. 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), by inserting ", quantum sensors," after "quantum repeaters";
(iv) in subparagraph (G)—
(I) by inserting "data centers," 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 subparagraph:
"(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)(6), by inserting ", including small and medium-sized businesses and startups" before the semicolon; and
(4) in subsection (d), by striking "basic research" and inserting "research, development, and demonstration".

SEC. 20. DEPARTMENT OF ENERGY QUANTUM USER EXPANSION FOR SCIENCE AND TECHNOLOGY PROGRAM.

Section 404 of the 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 software 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) enables 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 (9), respectively;

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

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

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

(4) in subsection (e)—

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

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

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

"(6) $38,000,000 for fiscal year 2028.".

SEC. 21. QUANTUM INFORMATION SCIENCE TO ENHANCE THE RESILIENCE, SECURITY, AND EFFICIENCY OF THE ELECTRIC GRID.

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

"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 resilience, 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 to be appropriate, with members of relevant industries, National Laboratories, institutions of higher education, and other relevant institutions, including research institutions, as determined by the Secretary.".

(b) CLERICAL AMENDMENT.—The table of contents in section 1(b) of the National Quantum Initiative Act (Public Law 115–368; 132 Stat. 5092; 136 Stat. 1441) is amended by inserting after the item relating to section 404 the following:

"Sec. 405. Quantum information science to enhance the resilience and security of the electric grid.
"Sec. 406. Research security.".

SEC. 22. RESEARCH SECURITY.

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. 406. RESEARCH SECURITY.

"The activities authorized under title IV 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. 23. 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 research on quantum information science, engineering, and technology.

"(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 Government 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 identify resources required to support implementation of the strategy, including budgets, workforce, and infrastructure, describe cooperative efforts with other Federal Government agencies, and address areas of research and applications, including the following:

"(1) Quantum sensing.

"(2) Quantum networking.

"(3) Quantum communications, including quantum satellite communications.

"(4) Quantum computing.

"(5) Science, aeronautics, and exploration-related applications.

"(6) Any other area on quantum information, science, engineering, and technology the Administrator determines necessary.

"(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.—The institute under this section shall be 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 to be 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 Administration, and avoids unnecessary duplication of the existing activities of the National Aeronautics and Space 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 create and develop processes for the purpose of advancing space and aeronautics applications in quantum information science, engineering, 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. AUTHORIZATION OF APPROPRIATIONS.

"The Administrator of the National Aeronautics and Space Administration shall allocate up to $25,000,000 to carry out the activities authorized in sections 501 and 502 for each of fiscal years 2024 through 2028, subject to the availability of appropriations. Amounts made available to carry out sections 501 and 502 shall be derived from amounts appropriated or otherwise made available to the National Aeronautics and Space Administration.

"SEC. 504. 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. 24. 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. 25. CLERICAL AMENDMENTS.

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

(1) By inserting after the item relating to section 105 the following new item:

"Sec. 105A. International Quantum Cooperation Strategy.".

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

"Sec. 202. National Institute of Standards and Technology Quantum Centers.";

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

"Sec. 303. Quantum Reskilling, Education, and Workforce (QREW) Coordination Hub.
"Sec. 304. Quantum testbeds.".

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

"Sec. 401A. Department of Energy Quantum Instrumentation and Foundry Program.".

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

"TITLE V—NATIONAL AERONAUTICS AND SPACE ADMINISTRATION QUANTUM ACTIVITIES

"Sec. 501. Quantum information science, engineering, and technology research for space and aeronautics.
"Sec. 502. National Aeronautics and Space Administration quantum institute.
"Sec. 503. Authorization of appropriations.
"Sec. 504. Research security.".

PURPOSE AND SUMMARY

H.R. 6213 amends and extends programs created by the National Quantum Initiative Act (Public Law 115–368).

The bill modifies the goals and objectives of many quantum programs across agencies to ensure quantum information, science, technology, and engineering research can move beyond basic science and into use-inspired research, demonstration, and commercialization.

It also strengthens requirements for public-private partnerships between research agencies and the quantum industry. The bill authorizes the creation of new quantum research centers and institutes at the National Institute of Standards and Technology (NIST), the National Science Foundation (NSF), and the National Aeronautics and Space Administration (NASA) and bolsters support for the Department of Energy (DOE) centers. This includes a new workforce coordination hub to build and strengthen workforce pathways between universities, technical schools, and other institutions and the quantum industry.

The bill formally adds NASA as a quantum research agency under the National Quantum Initiative (NQI), bringing its unique capabilities, perspectives, and testing capacity into the quantum ecosystem.

The bill addresses competition from China in quantum information, science, technology, and engineering by requiring the White House Office of Science and Technology Policy to develop a strategy to establish new international partnerships with allies of the United States.

The bill authorizes the creation of Quantum Testbeds to support translational research for near-term and medium-term use cases and provide research and testing resources to support the development of new quantum capabilities across the private sector. It also authorizes the creation of a new Quantum Instrumentation and Foundry Program to develop domestic supply chains and provide resources, including devices, hardware, software, and materials, for the use of the quantum industry and research community.

The bill authorizes NSF to extend new traineeships, fellowships, scholarships, and other workforce-supporting programs to a broader population of STEM students with the potential to enter quantum information, science, technology, and engineering fields.

BACKGROUND AND NEED FOR LEGISLATION

The National Quantum Initiative Act (NQIA) was signed into law by President Trump on December 21, 2018, "to accelerate quantum research and development for the economic and national security of the United States." The NQIA authorized the National Institute

of Standards and Technology, the National Science Foundation, and the Department of Energy to strengthen quantum information science programs, centers, and consortia. The NQIA also called for a coordinated approach to quantum research and development efforts across the United States government, including the civilian, defense, and intelligence sectors by establishing the National Quantum Coordination Office within the White House Office of Science and Technology Policy (OSTP).

Quantum technologies have the potential to be transformative across the scientific, economic, and defense realms. For that reason, there is a global race among great powers to develop operational quantum platforms across a variety of applications. The United States has retained its lead in the theoretical physics that underpins quantum computing and related technologies, but adversarial nations have taken the lead in developing some quantum communications applications and are rapidly closing the gap in other areas.

Reauthorizing and updating NQIA's quantum programs is critical to ensuring that the United States' policies reflect the advances made in quantum information science, engineering, and technology since the passage of the original Act. A reauthorization is also necessary to ensure the quantum industry and ecosystem has access to a robust, educated workforce and the U.S. is partnering with allied nations to bolster quantum research and development to counter quantum advancements by our competitors.

LEGISLATIVE HISTORY

H.R. 6213 was introduced on November 3, 2023, by Committee on Science, Space, and Technology Chairman Lucas (R–OK) and is cosponsored by Ranking Member Lofgren (D–CA) and Representatives Collins (R–GA), Stevens (D–MI), Williams (R–NY), Bowman (D–NY), Babin (R–TX), Sorensen (D–IL), Obernolte (R–CA), Foushee (D–NC), Miller (R–OH), Ross (D–NC), Weber, (R–TX), Casten (D–IL), Baird (R–IL), Mullin (D–CA), Garcia (R–CA), Salinas (D–OR), Tenney (R–NY), Jackson (D–NC), Kean (R–NJ), Bonamici (D–OR), Wittman (R–VA), Feenstra (R–IA), Lee (D–PA), Caraveo (D–CO), Sykes (D–OH), Morelle (D–NY), Neguse (D–CO), Thanedar (D–MI), Thompson (R–PA), Delegate Norton (D–DC At Large), DelBene (D–WA), and Allred (D–TX).

SECTION-BY-SECTION

Section 1. Short title

This section states the short title of the bill.

Section 2. Definitions

This section adds engineering and technology to the understood definition of "Quantum Information Science" to make it the more inclusive phrase, "Quantum Information Science, Engineering, and Technology" (QISET). It also defines "STEM," "Foreign Country of Concern," "Quantum Applications," "Quantum Computing," "Foreign Entity of Concern," "Federal Laboratory," and "National Laboratory" consistent with their usein the CHIPS and Science Act and other laws.

Section 3. Purposes

This section adds the facilitation of cooperative research investments with allies of the United States, the development and retention of a quantum workforce, the development of quantum applications, the promotion of commercialization, and strengthening and securing the quantum supply chain as purposes of the Act. It also adds the use and consideration of technologies such as artificial intelligence as a purpose.

Section 4. National Quantum Initiative program

This section adds near, medium, and long-term demonstration activities as a component of the quantum ten-year plan. It also includes changes to ensure relevant quantum provisions of legislation outside the National Quantum Initiative Act are considered in interagency planning and coordination activities.

Section 5. National Quantum Coordination Office

This section establishes a four-year term of service for the Director of the National Quantum Coordination Office, subject to renewal. It also directs the office to track and promote workforce and supply chain policies that will benefit the U.S. in quantum.

Section 6. Subcommittee on Quantum Information Science

This section directs the Subcommittee on Quantum Information Science (QIS) to promote application development, demonstration, and commercialization. It formally adds the Department of Health and Human Services, Department of State, Department of Homeland Security, the National Oceanic and Atmospheric Administration, and the Department of Education to the QIS. It also directs the QIS to facilitate interagency partnerships to advance quantum applications in other advanced technology sectors. It includes a technical edit to the application of the Federal Advisory Committee Act (5 U.S.C. App.). It directs the QIS to conduct comparative benchmarking of Federal investments and research strategies. It directs the Subcommittee to identify potential use cases for quantum computing and authorizes it to develop on-ramp plans to enable such use cases. The section also adds a requirement that the QIS describe agency roles and responsibilities in its Report on Quantum Networking and Communications.

Section 7. National Quantum Initiative Advisory Committee

This section adds 'end users', including those from small and medium-sized businesses, to the National Quantum Initiative Advisory Committee and directs the advisory committee to assess other countries' quantum programs and progress relative to U.S. quantum programs. It also directs the advisory committee to assess the needs and goals of the Program, including infrastructure and supply chain needs. It also tasks the advisory committee with assessing how quantum technologies can enhance the advanced industrial economy and protect critical infrastructure. This section also directs the Committee to include in its next report an assessment of the advisability and feasibility of establishing a quantum communications corridor in the U.S.

Section 8. Subcommittee on the Economic and Security Implications of Quantum Information Science

This section adds the Department of Health and Human Services, Department of State, and the National Aeronautics and Space Administration to the Subcommittee on the Economic and Security Implications of Quantum Information Science. It directs the subcommittee to increase coordination between civilian, military, and intelligence quantum research entities and reduce unnecessary duplicative efforts, and also requires the subcommittee to recommend strategies for attracting and retaining students and scholars in quantum fields.

Section 9. International quantum cooperation strategy

This section directs the Director of the Office of Science and Technology Policy to develop a strategy to establish collaborative international partnerships with allies and partners of the United States, ensure U.S. participation in bilateral and multilateral quantum science efforts, protect the integrity and impartiality of international standards organizations, and ensure ethical application of QISET. The Director is required to brief Congress on the Strategy once it is finished.

Section 10. Sunset

This section extends the sunset of the Quantum Office through December 30, 2030.

Section 11. National Institute of Standards and Technology activities and quantum consortium

This section adds new activities for NIST to carry out under the Act, including: carrying out R&D and demonstration projects to facilitate the development and standardization of quantum applications; carrying out research to support measurement of comparative performance and progress of quantum technologies, including technology readiness assessments; promoting U.S. participation in international standards organizations related to quantum; and establishing infrastructure necessary to advance research programs.

The section also adds the acceleration of real-world uses of quantum systems to the goals of the Quantum Economic Development Consortium (QED–C) and directs the QED–C to identify enabling technologies and supply chains essential to the scientific and economic competitiveness of the U.S. quantum ecosystem. Other tasks added to the QED–C include: identifying supply-chain supporting technology to support quantum efforts; assessing, identifying, and expanding international research partnerships; and engaging with other Federal agencies to promote the use of quantum technologies.

The section also directs NIST to promote, establish, and support international quantum R&D, metrology research, and standardization activities to enhance U.S. participation in international standards and requires such activities align with the National Quantum Information Science Strategy. It includes guardrails that prohibit the obligation of funds to foreign entities of concern.

The section includes a subsection directing NIST to promote the voluntary development, adoption, and deployment of standards in post-quantum cryptography. It also authorizes NIST to establish a grant program through which the agency may provide technical as-

sistance to entities that are at a high risk of quantum cryptoanalytic attacks.

The section also authorizes, of the funds provided to NIST for scientific and technical research and services laboratory activities in the CHIPS and Science Act of 2022, up to $85 million each year until 2027, to carry out the activities in this section.

Section 12. NIST quantum centers

This section authorizes NIST to establish new, purpose driven quantum centers. Consistent with existing NSF and DOE centers, these new quantum centers (up to three) will accelerate R&D, deployment, and standardization activities at NIST and will prioritize quantum sensing and measurement and quantum engineering. The section authorizes up to $18 million for each fiscal year 2024 through 2028 to support the Centers.

Section 13. National Science Foundation Quantum Information Science research and education program

This section adds the requirement that National Science Foundation (NSF) pursue basic and use-inspired research of QIS and explore solutions to important challenges for the development and application of QIS to NSF's activities. It also directs NSF to provide infrastructure to support QISET research and activities.

It amends and enhances NSF's authorized workforce development activities by: adding fellowships and other models to existing traineeship activities at NSF; authorizing the NSF Director to establish fellowships and scholarships through a new program or existing programs to increase quantum science exposure for undergraduate and graduate STEM students; authorizing NSF to encourage proposals in quantum science as part of its Research Experiences for Undergraduates program; and directing NSF to encourage awardees to partner with industry, nonprofits, and Federal agencies to facilitate the expansion of workforce pathways.

The section includes an authorization for NSF to make competitive awards to eligible institutions of higher education to increase research capacity, education and infrastructure capacity, and broaden participation in QISET. It also authorizes faculty mid-career development awards for faculty to upgrade, develop, or acquire essential research instruments to start new research activities or expand existing activities in quantum.

The section also directs NSF to promote, establish, and support international quantum research, enhance international cooperation, and meet U.S. obligations or commitments in bilateral or multilateral quantum research agreements. NSF is directed to prioritize research with countries that have signed Quantum Cooperation Statements with the United States and restrict the use of funds for research activities at Confucius Institutes or with a foreign country of concern.

NSF is also authorized to make grants to eligible institutions of higher education to upgrade research facilities and improve access to research resources needed for QISET.

The section authorizes, of the funds provided to NSF for research and related activities in the CHIPS and Science Act of 2022, up to $141 million each year until 2027, to carry out the activities in this section.

Section 14. Multidisciplinary centers for quantum research and education

This section adds the requirement that center applicants describe how they will develop and implement activities to increase participation of women and other groups historically underrepresented groups from STEM fields (consistent with CHIPS and Science). It adds the requirement that center applicants describe how they will participate in international collaborations and build global research networks with allies and partners of the United States.

This section authorizes up to $100 million for each fiscal years 2024 through 2028 to support up to ten Centers.

Section 15. QREW coordination hub and quantum testbeds

This section authorizes NSF to establish a new Quantum Reskilling, Education, and Workforce (QREW) Coordination Hub. This hub will be focused on addressing cross-cutting workforce development challenges in QISET and facilitating the establishment of programs to disseminate quantum educational curricula. The hub must be established as a consortium that includes at least two community colleges, technical schools, nonprofit organizations, or private sector entities. The section specifically directs the hub to facilitate post-education employment opportunities for STEM graduates in the quantum industry through various activities. The hub shall coordinate with the QED–C to ensure robust stakeholder participation and build employment pipelines.

This section authorizes $10 million for each fiscal year 2024 through 2028 to carry out the section.

The section also authorizes NSF to establish new Quantum Testbeds for quantum technology application research and development. The testbeds are directed to support translational research for near-term and medium-term use cases and provide research and testing resources for likely use-cases. NSF is tasked with keeping a record of notable technology outcomes, establishing a process for identifying quantum technologies with significant utility potential for government use, and briefing Congress on testbed activities and outcomes. NSF must coordinate with the QED–C, National Laboratories, other NSF Centers, and quantum industry.

This section authorizes $50 million for each fiscal year 2024 through 2028 to carry out the section.

Section 16. Department of Energy Quantum Information Science research program

This section adds cooperative research with industry, National Laboratories, institutions of higher education, and others as a component of the Department of Energy's research program. It also adds quantum modeling or simulation and application development in a range of areas as authorized research activities. The section directs the Department to develop a ten-year strategic plan to guide Federal programs in designing, developing, and commercializing quantum-centric, high-performance computing systems.

The section authorizes, of the funds provided to Department of Energy's Office of Science in the CHIPS and Science Act of 2022, up to $130 million each year until fiscal year 2027, to carry out the activities in this section.

Section 17. DOE quantum instrumentation and foundry program

This section authorizes DOE to establish a quantum instrumentation and infrastructure program to meet technology challenges and infrastructure needs unique to quantum supply chains. It requires DOE to coordinate with academia and industry to support the program.

This section authorizes $25 million for each fiscal year 2024 through 2028 to carry out the section.

Section 18. National quantum information science research centers

This section makes technical edits to existing DOE centers and directs the centers to ensure collaborations are inclusive of the variety of viable quantum technologies and authorizes up to $175 million for each fiscal year 2024 through 2028 to support the Centers.

Section 19. Department of Energy quantum network infrastructure research and development program

This section directs DOE to leverage a diversity of quantum technologies and commercially available hardware and software, where applicable, adds coordination with the NASA Administrator, and strengthens DOE's authorization to develop quantum network and communications technology.

Section 20. Department of Energy Quantum User Expansion for Science and Technology program

This section adds the development of software and applications for near-term use to the QUEST Program. It also directs DOE to partner with users, the public sector, and the private sector to develop algorithms and other applications for cloud-based quantum computers and to develop training and education opportunities. The section adds NASA to the list of agencies DOE can partner with to carry out the QUEST Program, and it extends the authorization of the program for one year, authorizing $38 million for fiscal year 2028.

Section 21. Quantum Information Science to enhance the resilience, security, and efficiency of the electric grid

This section directs the Secretary of Energy to conduct research, development, and demonstration activities applying quantum technologies, including quantum computing, to enhance the electric grid. Such activities are authorized to take place in cooperation with other entities as deemed appropriate by the Secretary.

Section 22. Research security

Requires all activities in Title IV of the NQIA be conducted in a manner consistent with research security requirements as prescribed in Public Law 117–167.

Section 23. NASA quantum activities

This section formally authorizes NASA to carry out basic and applied research in quantum. It directs NASA to submit a strategy for its research activities and identify resources required to support implementation of the strategy.

The section also authorizes NASA to establish its own Quantum Institute focused on space and aeronautics applications of quantum

science. The NASA institute will meet requirements for existing NSF and DOE centers.

This section authorizes $25 million for each fiscal year 2024 through 2028 to carry out the section.

Section 24. National Science Foundation cryptography research

This section amends the Cyber Security Research and Development Act to include post-quantum cryptography in subsection (a)(1)(A) of section 4.

Section 25. Clerical amendments

COMMITTEE VIEWS

In general, it is the view of the committee that NSF should engage researchers with expertise across disciplines, including mathematics, computer science, environmental sciences, biological sciences, chemical sciences, materials science, and astronomical sciences, to expand the development of quantum technologies and explore quantum applications in other areas of scientific research.

Section 7 of H.R. 6213 directs the Quantum Advisory Committee to complete an assessment of the advisability and feasibility of establishing a quantum communications corridor in the United States. The Committee expects that such assessment shall be completed with the assumption that the corridor and relevant infrastructure would be constructed with components sourced domestically or from 19 U.S.C. 2501 compliant sources.

Additionally in Section 7, it is the view of this Committee that the President may act through the Department of Energy or other appropriate Federal agencies to stand up this federal advisory committee.

Throughout H.R. 6213, the Committee has struck "basic" from references to "basic research" and added references, authorizations, and directives for agencies to support the development and commercialization of quantum applications. It is the view of the Committee that these activities should not supplant continued support of fundamental research in quantum physics, quantum materials, quantum and nanoscale engineering, computational and information sciences, and other relevant fields. Continued investment in fundamental research contributes to a sustained innovation ecosystem and is beneficial to U.S. competitiveness. Further, it is the view of the committee that in carrying out commercialization activities, the government activities shall support, not supplant or duplicate, the development of commercially viable quantum technologies.

Sections 7, 9, and 11 of H.R. 6213 include language aimed at increasing participation at international standards organizations. The existing standards development system, involving many different types of standards development organizations producing primarily voluntary, consensus-based and industry-led technical standards, with appropriate support from the standards experts at NIST and other Federal agencies, is beneficial to U.S. competitiveness. Any effort to disrupt the current system or roles would be harmful. The Committee's intent is to reinforce and better resource the current system, not to disrupt or modify existing processes or roles.

With regard to Section 13 and adjustments to student traineeships, fellowships, and other models, the Committee's intent is to integrate these education and research activities into existing programs as practicable. It is the view of the committee that NSF should prioritize mentorship and experiential learning, informed by industry, as a part of fellowships, traineeships, and other awards offered to train the next generation of quantum-ready workers.

With regard to research infrastructure grants authorized in Section 13, NSF should consider a balanced portfolio of projects through existing infrastructure programs such as major research instrumentation, midscale research infrastructure, advanced computing programs, and major facilities as well as new programs dedicated to quantum research infrastructure.

With regard to Section 15 on the QREW Coordination Hub, NSF should incorporate multiple Directorates, including the Directorate for Technology, Innovation, and Partnerships, the Directorate for STEM Education, and relevant research Directorates, to broadly capture the education and workforce development pathways needed for a mature quantum industrial enterprise including K–12 education, higher education, and skilled technical workforce. NSF should consider how the quantum industry ecosystem may evolve different workforce needs as the technology matures and what pathways are likely to be needed, such as vocational, apprenticeship, and certification programs.

With regard to Section 23, the Committee's intent is for NASA to be the lead Federal agency on basic and applied research and development, in cooperation with other Federal government agencies, on quantum information science, engineering, and technology pertaining to civil space and aeronautics. With respect to authorization of appropriations, the Committee's intent is for NASA to determine the appropriate allocation of resources among basic research and applications related to quantum information science, engineering, and technology. Should the Administrator carry out a program to establish a NASA Quantum Institute, subject to the availability of appropriations, such institute should seek to establish NASA and U.S. leadership in the development of applications related to civil space and aeronautics.

The Committee expects agencies participating in the National Quantum Initiative to leverage the availability of commercially viable and prototyped technologies, including cloud access to quantum computing, where practicable, in carrying out quantum programs.

Related Committee Hearings

Pursuant to clause 3(c)(6) of rule XIII, the following hearing was used to develop or consider H.R. 6213.

On June 7, 2023, the Full Committee on Science, Space, and Technology held a hearing entitled *Advancing American Leadership in Quantum Technology*. Members and witnesses discussed the importance of and need to reauthorize the National Quantum Initiative Act and maintaining the leadership role of the United States in quantum technology.

Witnesses:

- Dr. Charles Tahan, Director, National Quantum Coordination Office, OSTP

- The Honorable Paul Dabbar, Former Under Secretary for Science, U.S. Department of Energy
- Dr. Eleanor G. Rieffel, Senior Researcher for Advanced Computing and Data Analytics, NASA/Ames Research Center
- Dr. Celia Merzbacher, Executive Director, Quantum Economic Development Consortium
- Dr. Emily Edwards, Executive Director, IQUIST, University of Illinois

COMMITTEE CONSIDERATION

On November 15, 2023, the Committee on Science, Space, and Technology met in open session to consider H.R. 6213.

Chairman Lucas offered a Manager's Amendment, which made minor technical and conforming changes to the text of the bill. The amendment was adopted by voice vote.

Representative Miller offered an amendment that directs federal agencies to consider how AI and machine learning could be used in quantum science and technology and how quantum tech might also feed into the advancement of AI. The amendment was adopted by voice vote.

Representative Sykes offered an amendment to prioritize quantum research and development in the healthcare space. The amendment was adopted by voice vote.

Representative Collins offered an amendment to include small and medium-sized businesses and startups into quantum programs. The amendment was adopted by voice vote.

Representative Garcia offered an amendment to direct the National Quantum Coordination Office to track and promote policies to support U.S. quantum efforts. It also directs the National Science and Technology Council to compare federal investments and research strategies with those made by other nations. The amendment was adopted by voice vote.

Representative Bowman offered an amendment to ensure the Department of Education's inclusion in the development of our quantum strategy and to broaden quantum research and infrastructure development opportunities. The amendment was adopted by voice vote.

Representative Stevens offered an amendment to include advanced manufacturing in eligible use cases for quantum activities. The amendment was adopted by voice vote.

Representatives Ross and Obernolte offered an amendment to direct the Subcommittee on Quantum Information Science to identify potential use cases for quantum computing that could advance the missions of federal agencies and add energy efficiency and energy technologies to the list of fields for DOE research. The amendment was adopted by voice vote.

Representative Baird offered an amendment directing the Quantum Advisory Committee to study the feasibility and advisability of constructing of a national quantum communications corridor. The amendment was adopted by voice vote.

Representatives Jackson and Tenney offered an amendment to include the Post Quantum Cybersecurity Standards Act in the reauthorization. This language would advance the rapid deployment of post quantum cybersecurity standards across the economy of the

United States and support cryptography research in the U.S. The amendment was adopted by voice vote.

Representative Sykes offered an amendment to accelerate the development of domestic supply chain and supply chain supporting technologies and reduce supply chain vulnerabilities. The amendment was adopted by voice vote.

Representative Crawford offered an amendment to add a new section under each subtitle requiring all authorized activities by agencies be conducted consistent with the research security requirements enacted in the Chips and Science Act (P.L. 117–167). The amendment was adopted by voice vote.

Representative Sorensen offered an amendment to support cooperative education programs between institutions of higher education and employers. The amendment was adopted by voice vote.

Representative Baird offered an amendment that adds language to section 13 of the bill to authorize Research Experiences for Teachers (RET) in quantum-related fields. The amendment was adopted by voice vote.

Representative Bice offered an amendment to authorize activities at NSF to provide awards to support mid-career scientists and faculty to begin new or expand existing research activities that are focused on quantum information science, engineering, and technology. The amendment was adopted by voice vote.

Representatives Kean and McClellan offered an amendment to include the Expand QISET Act (H.R. 6384) in the reauthorization. This bill codifies the Expand QISET program, which expands capacity in quantum information science, engineering, and technology. The amendment was adopted by voice vote.

Representatives Salinas and Baird offered an amendment that directs NSF to award grants to upgrade quantum research equipment and instrumentation, and to improve coordination to expand access and build the quantum workforce. The amendment was adopted by voice vote.

Representatives Obernolte and Stevens offered an amendment to strengthen quantum testbeds activities at the National Science Foundation and ensure they are established quickly, in a fiscally sustainable way, and with the needs of the quantum industry in mind. The amendment was adopted by voice vote.

Representatives Babin and Ross offered an amendment to require the Secretary of Energy to conduct research on how quantum information science, technology, and engineering can enhance the resilience and security of the electric grid. The amendment was adopted by voice vote.

On November 29, 2023, the Committee on Science, Space, and Technology reconvened to consider H.R. 6213.

Chairman Lucas moved that Committee favorably report the bill, H.R. 6213, as amended, to the House of Representatives with the recommendation that the bill be approved. The motion was agreed to by a vote of 36–0.

ROLL CALL VOTES

Clause 3(b) of rule XIII requires the Committee to list the record votes on the motion to report legislation and amendments thereto. The following reflects the record votes taken during the Committee consideration:

House Committee on Science, Space, and Technology
118th Congress
Full Committee Markup

Bill # HR 6213
Motion to report HR 6213 to the House, as amended

Majority	Aye	No	Present
Frank Lucas, Oklahoma	1		
Bill Posey, Florida	1		
Randy Weber, Texas	1		
Brian Babin, Texas	1		
Jim Baird, Indiana	1		
Daniel Webster, Florida	1		
Mike Garcia, California	1		
Stephanie Bice, Oklahoma	1		
Jay Obernolte, California	1		
Chuck Fleischmann, Tennessee	1		
Darrell Issa, California	1		
Rick Crawford, Arkansas			
Claudia Tenney, New York	1		
Ryan Zinke, Montana	1		
Scott Franklin, Florida	1		
Dale Strong, Alabama	1		
Max Miller, Ohio	1		
Rich McCormick, Georgia	1		
Mike Collins, Georgia	1		
Brandon Williams, New York	1		
Tom Kean, New Jersey	1		
Minority	**Aye**	**No**	**Present**
Zoe Lofgren, California	1		
Suzanne Bonamici, Oregon	1		
Haley Stevens, Michigan	1		
Jamaal Bowman, New York	1		
Deborah Ross, New Carolina	1		
Eric Sorensen, Illinois	1		
Andrea Salinas, Oregon	1		
Val Foushee, North Carolina	1		
Kevin Mullin, California	1		
Jeff Jackson, North Carolina	1		
Emilia Sykes, Ohio			
Maxwell Frost, Florida			
Yadira Caraveo, Colorado	1		
Summer Lee, Pennsylvania	1		
Jennifer McClellan, Virgina	1		
Ted Lieu, California	1		
Sean Casten, Illinois	1		
Paul Tonko	1		
Total	36	0	

Date: 11/29/23

Result?	Agreed To: [X] Not Agreed To: [ ] Withdrawn: [ ]		
Voice Vote	*Ayes*	*Nays*	*Present*
	36	*0*	

Application of Law to the Legislative Branch

The Committee finds that H.R. 6213 does not relate to the terms and conditions of employment or access to public services or accommodations within the meaning of section 102(b)(3) of the Congressional Accountability Act (Public Law 104–1).

Statement of Oversight Findings and Recommendations of the Committee

In compliance with clause 3(c)(1) of rule XIII and clause (2)(b)(1) of rule X, the Committee's oversight findings and recommendations are reflected in the descriptive portions of this report.

Statement of General Performance Goals and Objectives

Pursuant to clause (3)(c)(4) of rule XIII, the goal of H.R. 6213 is to modify the goals and objectives of many quantum programs across agencies to ensure quantum information, science, technology, and engineering research can move beyond basic science and into use-inspired research, demonstration, and commercialization.

Duplication of Federal Programs

Pursuant to clause 3(c)(5) of rule XIII, the Committee finds that no provision of H.R. 6213 establishes or reauthorizes a program of the Federal Government known to be duplicative of another Federal program, including any program that was included in a report to Congress pursuant to section 21 of Public Law 111–139 or identified in the most recent Catalog of Federal Domestic Assistance.

Federal Advisory Committee Act

The Committee finds that the legislation does not establish or authorize the establishment of an advisory committee within the definition of section 5(b) of the Federal Advisory Committee Act.

Unfunded Mandate Statement

The Committee adopts as its own the estimate of Federal mandates prepared by the Director of the Congressional Budget Office pursuant to section 423 of the Unfunded Mandates Reform Act. At the time this report was filed, the estimate was not yet available.

Earmark Identification

Pursuant to clauses 9(e), 9(f), and 9(g) of rule XXI, the Committee finds that H.R. 6213 does not include any congressional earmarks, limited tax benefits, or limited tariff benefits.

Committee Cost Estimate

Pursuant to clause 3(d)(1) of rule XIII, the Committee adopts as its own the cost estimate prepared by the Director of the Congressional Budget Office pursuant to section 402 of the Congressional Budget Act of 1974. At the time this report was filed, the estimate was not available.

NEW BUDGET AUTHORITY, ENTITLEMENT AUTHORITY, AND TAX EXPENDITURES

Pursuant to clause 3(c)(2) of rule XIII, the Committee finds that H.R. 6213 would result in no new or increased budget authority, entitlement authority, or tax expenditures or revenues.

CONGRESSIONAL BUDGET OFFICE COST ESTIMATE

Pursuant to clause 3(c)(3) of rule XIII, at the time this report was filed, the cost estimate prepared by the Director of the Congressional Budget Office pursuant to section 402 of the Congressional Budget Act of 1974 was not available.

CHANGES IN EXISTING LAW MADE BY THE BILL, AS REPORTED

In compliance with clause 3(e) of rule XIII of the Rules of the House of Representatives, changes in existing law made by the bill, as reported, are shown as follows (existing law proposed to be omitted is enclosed in black brackets, new matter is printed in italics, and existing law in which no change is proposed is shown in roman):

NATIONAL QUANTUM INITIATIVE ACT

SECTION 1. SHORT TITLE; TABLE OF CONTENTS.

(a) SHORT TITLE.—This Act may be cited as the "National Quantum Initiative Act".

(b) TABLE OF CONTENTS.—The table of contents of this Act is as follows:

Sec. 1. Short title; table of contents.

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TITLE I—NATIONAL QUANTUM INITIATIVE

Sec. 101. National Quantum Initiative Program.

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Sec. 105A. International Quantum Cooperation Strategy.

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TITLE II—NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY QUANTUM ACTIVITIES

Sec. 201. National Institute of Standards and Technology activities and quantum consortium.

Sec. 202. National Institute of Standards and Technology Quantum Centers.

TITLE III—NATIONAL SCIENCE FOUNDATION QUANTUM ACTIVITIES

* * * * * * *

Sec. 303. Quantum Reskilling, Education, and Workforce (QREW) Coordination Hub.

Sec. 304. Quantum testbeds.

TITLE IV—DEPARTMENT OF ENERGY QUANTUM ACTIVITIES

Sec. 401. Quantum Information Science Research program.

Sec. 401A. Department of Energy Quantum Instrumentation and Foundry Program.

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Sec. 405. Quantum information science to enhance the resilience and security of the electric grid.

Sec. 406. Research security.

TITLE V—NATIONAL AERONAUTICS AND SPACE ADMINISTRATION QUANTUM ACTIVITIES

Sec. 501. Quantum information science, engineering, and technology research for space and aeronautics.
Sec. 502. National Aeronautics and Space Administration quantum institute.
Sec. 503. Authorization of appropriations.
Sec. 504. Research security.

SEC. 2. DEFINITIONS.

In this Act:

(1) ADVISORY COMMITTEE.—The term "Advisory Committee" means the National Quantum Initiative Advisory Committee established under section 104(a).

(2) APPROPRIATE COMMITTEES OF CONGRESS.—The term "appropriate committees of Congress" means—

(A) the Committee on Commerce, Science, and Transportation of the Senate;

(B) the Committee on Energy and Natural Resources of the Senate; and

(C) the Committee on Science, Space, and Technology of the House of Representatives.

(3) COORDINATION OFFICE.—The term "Coordination Office" means the National Quantum Coordination Office established under section 102(a).

(4) 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).

(5) FOREIGN COUNTRY OF CONCERN.—The term "foreign country of concern" means—

(A) a country that is a covered nation (as such term is defined in section 4872(d) of title 10, United States Code); and

(B) any country that the Secretary of Commerce, in consultation with the Secretary of Defense, the Secretary of State, and the Director of National Intelligence, determines to be engaged in conduct that is detrimental to the national security or foreign policy of the United States.

(6) FOREIGN ENTITY OF CONCERN.—The term "foreign entity of concern" means a foreign entity that is—

(A) designated as a foreign terrorist organization by the Secretary of State under section 219(a) of the Immigration and Nationality Act (8 U.S.C. 1189(a));

(B) included on the list of specially designated nationals and blocked persons maintained by the Office of Foreign Assets Control of the Department of the Treasury (commonly known as the "SDN list");

(C) owned by, controlled by, or subject to the jurisdiction or direction of a government of a foreign country that is a covered nation (as such term is defined in section 4872 of title 10, United States Code);

(D) alleged by the Attorney General to have been involved in activities for which a conviction was obtained under—

(i) chapter 37 of title 18, United States Code (commonly known as the "Espionage Act");

(ii) section 951 or 1030 of title 18, United States Code;

(iii) chapter 90 of title 18, United States Code (commonly known as the "Economic Espionage Act of 1996");

(iv) the Arms Export Control Act (22 U.S.C. 2751 et seq.);

(v) section 224, 225, 226, 227, or 236 of the Atomic Energy Act of 1954 (42 U.S.C. 2274, 2275, 2276, 2277, and 2284);

(vi) the Export Control Reform Act of 2018 (50 U.S.C. 4801 et seq.); or

(vii) the International Emergency Economic Powers Act (50 U.S.C. 1701 et seq.); or

(E) determined by the Secretary of Commerce, in consultation with the Secretary of Defense and the Director of National Intelligence, to be engaged in unauthorized conduct that is detrimental to the national security or foreign policy of the United States.

[(4)**]** *(7)* INSTITUTION OF HIGHER EDUCATION.—The term "institution of higher education" has the meaning given the term in section 101**[**(a)**]** of the Higher Education Act of 1965 (20 U.S.C. 1001**[**(a)**]**).

(8) 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).

[(5)**]** *(9)* PROGRAM.—The term "Program" means the National Quantum Initiative Program implemented under section 101(a).

(10) 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.

(11) 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, spin atoms, or spin electrons.

[(6) QUANTUM INFORMATION SCIENCE.—The term "quantum information science" means the use of the laws of quantum physics for the storage, transmission, manipulation, computing, or measurement of information.**]**

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

[(7)**]** *(13)* QUANTUM NETWORK INFRASTRUCTURE.—The term "quantum network infrastructure" means any facility, expertise, or capability that is necessary to enable the development and deployment of scalable and diverse quantum network technologies.

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

[(8)] *(15)* SUBCOMMITTEE ON ECONOMIC AND SECURITY IMPLICATIONS.—The term "Subcommittee on Economic and Security Implications" means the Subcommittee on the Economic and Security Implications of Quantum Information Science established under section 105(a).

[(8)] *(16)* SUBCOMMITTEE ON QUANTUM INFORMATION SCIENCE.—The term "Subcommittee on Quantum Information Science" means the Subcommittee on Quantum Information Science of the National Science and Technology Council established under section 103(a).

SEC. 3. PURPOSES.

The purpose of this Act is to ensure the continued leadership of the United States in quantum information [science and its technology applications] *science, engineering, and technology* by—

(1) supporting research, development, demonstration, and application of quantum information [science and technology] *science, engineering, and technology*—

[(A) to expand the number of researchers, educators, and students with training in quantum information science and technology to develop a workforce pipeline;]

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

(B) to promote the development and inclusion of multidisciplinary curriculum and research opportunities for quantum information [science at the] *science, engineering, and technology at the primary, secondary,* undergraduate, graduate, and postdoctoral level;

(C) to address [basic] research knowledge gaps, including computational research gaps;

(D) to promote the further development of facilities and centers available for quantum information [science and technology] *science, engineering, and technology* research, testing and education; [and]

(E) to stimulate research on and promote more rapid development of quantum-based technologies;

(F) to support development of quantum applications, including quantum-hybrid applications, to promote innovation and commercialization; and

(G) to support technologies, including artificial intelligence, 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.

(2) improving the interagency planning and coordination of Federal research and development of quantum information [science and technology] *science, engineering, and technology*;

(3) maximizing the effectiveness of the Federal Government's quantum information [science and technology] *science, engi-*

neering, and technology research, development, and demonstration programs;

(4) promoting collaboration among the Federal Government, Federal laboratories, *National Laboratories,* industry, and universities; [and]

(5) promoting the development of international *partnerships, research collaborations, and* standards for quantum information [science and technology security] *science, engineering, and technology*—

(A) to facilitate technology innovation*, social benefit,* and private sector commercialization; [and]

(B) to meet economic and national security goals[.]*; and*

(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

(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.

TITLE I—NATIONAL QUANTUM INITIATIVE

SEC. 101. NATIONAL QUANTUM INITIATIVE PROGRAM.

(a) IN GENERAL.—The President shall implement a National Quantum Initiative Program.

(b) REQUIREMENTS.—In carrying out the Program, the President, acting through Federal agencies, councils, working groups, subcommittees, and the Coordination Office, as the President considers appropriate, shall—

(1) establish the goals, priorities, and metrics for a 10-year plan to accelerate [development] *research development, and near- and medium-term, and long-term demonstration* of quantum [information science and technology] applications *in diverse sectors* in the United States;

(2) invest in [fundamental] Federal quantum information [science and technology] *science, engineering, and technology* research, development, demonstration, *infrastructure,* and other activities to achieve the goals established under paragraph (1);

(3) invest in activities to develop *and retain* a quantum information [science and technology] *science, engineering, and technology* workforce pipeline;

[(4) provide for interagency planning and coordination of Federal quantum information science and technology research, development, demonstration, standards engagement, and other activities under the Program;]

(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 Na-

tional 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;

(5) partner with [industry and universities] *industry, universities, and strategic allies* to leverage knowledge and resources*, including human resources*; and

(6) leverage existing Federal investments efficiently to advance Program goals and priorities established under paragraph (1).

SEC. 102. NATIONAL QUANTUM COORDINATION OFFICE.

(a) ESTABLISHMENT.—

(1) IN GENERAL.—The President shall establish a National Quantum Coordination Office.

(2) ADMINISTRATION.—The Coordination Office shall have—

(A) a Director *who shall be* appointed by the Director of the Office of Science and Technology Policy, in consultation with the Secretary of Commerce, the Director of the National Science Foundation, and the Secretary of Energy*, and who shall serve a four year term, subject to renewal*; and

[(B) staff comprised of employees detailed from the Federal departments and agencies described in section 103(b).]

(B) staff comprised of employees detailed from the Federal departments and agencies specified in section 103(b).

(b) RESPONSIBILITIES.—The Coordination Office shall—

(1) provide technical and administrative support to—

(A) the Subcommitteeon Quantum Information Science;

(B) the Advisory Committee; and

(C) the Subcommittee on Economic and Security Implications;

(2) oversee interagency coordination of the Program, including by encouraging and supporting joint agency solicitation and selection of applications for funding of activities under the Program;

(3) serve as the point of contact on Federal civilian quantum information [science and technology] *science, engineering, and technology research and workforce* activities for Federal departments and agencies, industry, universities professional societies, State governments, and such other persons as the Coordination Office considers appropriate to exchange technical and programmatic information;

[(4) ensure coordination among the collaborative ventures or consortia established under section 201(a), Multidisciplinary Centers for Quantum Research and Education established under section 302(a), and the National Quantum Information Science Research Centers established under section 402(a);]

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

(5) conduct public outreach, including the dissemination of findings and recommendations of the Advisory Committee, as appropriate;

(6) promote access to and early application of the technologies, innovations, and expertise derived from Program activities to agency missions and systems across the Federal Government, and to industry, including startup companies; [and]

(7) promote access, through appropriate Federal Government agencies, and an open and competitive merit-reviewed process, to existing quantum computing and communication systems developed by industry, universities, *nonprofit research organizations,* and Federal laboratories to the general user community in pursuit of discovery of the new applications of such systems[.]*;*

(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.

(c) FUNDING.—Funds necessary to carry out the activities of the Coordination Office shall be made available each fiscal year by the Federal departments and agencies described in section 103(b), as determined by the Director of the Office of Science and Technology Policy.

SEC. 103. SUBCOMMITTEE ON QUANTUM INFORMATION SCIENCE.

(a) ESTABLISHMENT.—The President shall establish, through the National Science and Technology Council, the Subcommittee on Quantum Information Science.

(b) MEMBERSHIP.—The Subcommittee shall include a representative of—

(1) the National Institute of Standards and Technology;
(2) the National Science Foundation;
(3) the Department of Energy;
(4) the National Aeronautics and Space Administration;
(5) the Department of Defense;
(6) the Office of the Director of National Intelligence;
(7) the Office of Management and Budget;
(8) the Office of Science and Technology Policy; [and]
(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
[(9)] *(14)* such other Federal department or agency as the President considers appropriate.

(c) CHAIRPERSONS.—The Subcommittee shall be jointly chaired by the Director of the National Institute of Standards and Technology, the Director of the National Science Foundation, and the Secretary of Energy.

(d) RESPONSIBILITIES.—The Subcommittee shall—

(1) coordinate [the quantum information science and technology research] *quantum information science, engineering, and technology research and quantum application development, demonstration, and commercialization*, information sharing about international standards development and use, and education activities and programs of the Federal agencies;

(2) establish goals and priorities of the Program, based on identified knowledge and workforce gaps and other national needs;

(3) assess and recommend Federal infrastructure needs to support the Program;

(4) assess the status, development, and diversity of the United States quantum information science*, engineering, and technology* workforce;

(5) assess the global outlook for quantum information science*, engineering, and technology* research and development efforts *and conduct comparative benchmarking of Federal investments and research strategies relative to those of our strategic partners and other countries*;

(6) evaluate opportunities for international cooperation with strategic allies on research and development in quantum information [science and technology] *science, engineering, and technology*; [and]

(7) propose a coordinated interagency budget for the Program to the Office of Management and Budget to ensure the maintenance of a balanced quantum information science*, engineering and technology* research portfolio and an appropriate level of research effort[.]*; and*

(8) facilitate interagency partnership opportunities to advance quantum applications related to environment, advanced manufacturing, biotechnology, space, and other sectors.

(e) STRATEGIC PLANS.—In order to guide the activities of the Program and meet the goals, priorities, and anticipated outcomes of the Federal departments and agencies described in subsection (b), the Subcommittee shall—

(1) not later than 1 year after the date of enactment of this Act, develop a 5-year strategic plan;

(2) not later than 6 years after the date of enactment of this Act, develop a subsequent 5-year strategic plan; and

(3) periodically update each plan, as necessary.

(f) SUBMITTAL TO CONGRESS.—The chairpersons of the Subcommittee shall submit to the President, the Advisory Committee, and the appropriate committees of Congress each strategic plan developed under subsection (e) and any updates thereto.

(g) ANNUAL PROGRAM BUDGET REPORT.—

(1) IN GENERAL.—Each year, concurrent with the annual budget request submitted by the President to Congress under section 1105 of title 31, United States Code, the chairpersons of the Subcommittee shall submit to the appropriate committees of Congress and such other committees of Congress as the chairpersons deem appropriate a report on the budget for the Program.

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

(A) The budget of the Program for the current fiscal year, for each Federal department and agency described in subsection (b).

(B) The budget proposed for the Program for the next fiscal year, for each Federal department and agency described in subsection (b).

(C) An analysis of the progress made toward achieving the goals and priorities established under subsection (d)(2).

(h) REPORT ON QUANTUM NETWORKING AND COMMUNICATIONS.—

(1) IN GENERAL.—Not later than January 1, 2026, the Quantum Networking Working Group within the Subcommittee on Quantum Information Science of the National Science and Technology Council, in coordination with the Subcommittee on the Economic and Security Implications of Quantum Information Science, shall submit to the appropriate committees of Congress a report detailing a plan for the advancement of quantum networking and communications technology in the United States, building on the report entitled *A Strategic Vision for America's Quantum Networks and A Coordinated Approach for Quantum Networking Research*.

(2) REQUIREMENTS.—The report under paragraph (1) shall include the following:

(A) An update to the report entitled *Coordinated Approach to Quantum Networking Research Report* focusing on a framework for interagency collaboration regarding the advancement of quantum networking and communications research*, including a description of agency roles and responsibilities*.

(B) A plan for Federal Government partnership with the private sector and interagency collaboration regarding engagement in international standards for quantum networking and communications technology, including a list of Federal priorities for standards relating to such networking and technology.

(C) A proposal for the protection of national security interests relating to the advancement of quantum networking and communications technology.

(D) An assessment of the relative position of the United States with respect to other countries in the global race to develop, demonstrate, and utilize quantum networking and communications technology.

(E) Recommendations to Congress for legislative action relating to the matters considered under subparagraphs (A), (B), (C), and (D).

(F) Such other matters as the Quantum Network Working Group considers necessary to advance the security of communications and network infrastructure, remain at the forefront of scientific discovery in the quantum information science domain, and transition quantum information science research into the emerging quantum technology economy.

(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 addressing such potential use cases, including lack of funding.

SEC. 104. NATIONAL QUANTUM INITIATIVE ADVISORY COMMITTEE.

(a) IN GENERAL.—The President shall establish a National Quantum Initiative Advisory Committee.

[(b) QUALIFICATIONS.—The Advisory Committee shall consist of members, appointed by the President, who are representative of industry, universities, and Federal laboratories and are qualified to provide advice and information on quantum information science and technology research, development, demonstrations, standards, education, technology transfer, commercial application, or national security and economic concerns.]

(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. universities, 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.

(c) MEMBERSHIP CONSIDERATION.—In selecting the members of the Advisory Committee, the President may seek and give consideration to recommendations from the Congress, industry, the scientific community (including the National Academy of Sciences, scientific professional societies, and universities), the defense community, and other appropriate organizations.

(d) DUTIES.—

(1) IN GENERAL.—The Advisory Committee shall advise the President, the Subcommittee on Quantum Information Science, and the Subcommittee on Economic and Security Implications and make recommendations for the President to consider when reviewing and revising the Program.

(2) INDEPENDENT ASSESSMENTS.—The Advisory Committee shall conduct periodic, independent assessments of—

(A) any trends or developments in quantum information [science and technology] *science, engineering, and technology*;

(B) the progress made in implementing the Program;

(C) the management, coordination, implementation, and activities of the Program;

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

[(D)] *(E)* whether the Program activities and the goals and priorities established under section 103(d)(2) are helping [to] *promote innovation, foster a robust United States quantum industry, and* maintain United States leadership in quantum information [science and technology] *science, engineering, and technology*;

[(E)] *(F)* whether a need exists to revise the Program*, including to address any gaps that may exist*;

[(F)] *(G)* whether opportunities exist for international cooperation with strategic allies on research and development in, and the development of [open standards for, quantum information science and technology; and] *international standards in open and transparent standardization systems for quantum information science, engineering, and technology;*

[(G)] *(H)* whether national security, societal, economic, legal, *educational, environmental, health,* and workforce concerns are adequately addressed by the Program[.]*;*

(I) the domestic and international cooperation needs and goals of the Program, including 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))).

(e) REPORTS.—Not later than 180 days after the date of enactment of this Act, and at least biennially thereafter *through December 31, 2030*, the Advisory Committee shall submit to the President, the appropriate committees of Congress, and such other committees of Congress as the Advisory Committee deems appropriate a report on the findings of the independent assessment under subsection (d), including any recommendations for improvements to the Program. *In the first such report required after the date of the enactment of this sentence, the Advisory Committee shall assess the advisability and feasibility of establishing a quantum communications corridor in which Federal laboratories, institutions of higher education, and other entities conducting quantum information science, engineering, and technology research are connected via quantum communication networks capable of rapidly and securely transmitting large quantities of information.*

(f) TRAVEL EXPENSES OF NON-FEDERAL MEMBERS.—Non-Federal members of the Advisory Committee, while attending meetings of the Advisory Committee or while otherwise serving at the request of the head of the Advisory Committee away from their homes or regular places of business, may be allowed travel expenses, including per diem in lieu of subsistence, as authorized by section 5703 of title 5, United States Code, for individuals in the Government serving without pay. Nothing in this subsection shall be construed to prohibit members of the Advisory Committee who are officers or employees of the United States from being allowed travel expenses, including per diem in lieu of subsistence, in accordance with existing law.

[(g) FACA EXEMPTION.—The Advisory Committee shall be exempt from section 14 of the Federal Advisory Committee Act (5 U.S.C. App.).]

(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.

SEC. 105. SUBCOMMITTEE ON THE ECONOMIC AND SECURITY IMPLICATIONS OF QUANTUM INFORMATION SCIENCE.

(a) ESTABLISHMENT.—The President shall establish, through the National Science and Technology Council, the Subcommittee on the Economic and Security Implications of Quantum Information Science.

(b) MEMBERSHIP.—The Subcommittee shall include a representative of—

(1) the Department of Energy;
(2) the Department of Defense;
(3) the Department of Commerce;
(4) the Department of Homeland Security;
(5) the Office of the Director of National Intelligence;
(6) the Office of Management and Budget;
(7) the Office of Science and Technology Policy;
(8) the Department of Justice;
(9) the National Science Foundation;
(10) the National Institute of Standards and Technology; [and]
(11) the Department of Health and Human Services;
(12) the Department of State;
(13) the National Aeronautics and Space Administration; and
[(11)] *(14)* such other Federal department or agency as the President considers appropriate.

(c) RESPONSIBILITIES.—The Subcommittee shall—

(1) in coordination with the Director of the Office and Management and Budget, the Director of the National Quantum Coordination Office, and the Subcommittee on Quantum Information Science, track investments of the Federal Government in quantum [information science] *information science, engineering, and technology* research and development;

(2) review and assess any economic or security implications of such investments *or to supply chains*;

(3) review and assess any counterintelligence risks or other foreign threats to such investments *or supply chains*;

(4) recommend goals and priorities for the Federal Government and make recommendations to Federal departments and agencies and the Director of the National Quantum Coordination Office to address any counterintelligence risks or other foreign threats identified as a result of an assessment under paragraph (3);

(5) assess the export of technology associated with quantum information science *and engineering* and recommend to the Secretary of Commerce and the Secretary of State *any* export controls necessary to protect the economic and security interests of the United States as a result of such assessment;

(6) recommend to Federal departments and agencies investment strategies in quantum [information science] *information science, engineering, and technology* that advance the economic and security interest of the United States;

(7) recommend to the Director of National Intelligence and the Secretary of Energy appropriate protections to address counterintelligence risks or other foreign threats identified as a result of the assessment under paragraph (3); [and]

(8) in coordination with the Subcommittee on Quantum Information Science, ensure the approach of the United States to investments of the Federal Government in quantum information science research and development reflects a balance between scientific progress and the potential economic and security implications of such progress[.]*;*

(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, and technology; and

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

(d) TECHNICAL AND ADMINISTRATIVE SUPPORT.—

(1) IN GENERAL.—The Secretary of Energy, the Director of National Intelligence, and the Director of the National Quantum Coordination Office may provide to the Subcommittee personnel, equipment, facilities, and such other technical and administrative support as may be necessary for the Subcommittee to carry out the responsibilities of the Subcommittee under this section.

(2) SUPPORT RELATED TO CLASSIFIED INFORMATION.—The Director of the Office of Science and Technology Policy and the Director of National Intelligence shall provide to the Subcommittee technical and administrative support related to the responsibilities of the Subcommittee that involve classified information, including support related to sensitive compartmented information facilities and the storage of classified information.

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, and the heads of other Federal agencies, as appropriate, shall develop and 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—

(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; and

(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 the relevant 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, and technology.

(3) Efforts and plans to address risks to the national security and economic interests of the United States during development and 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 meet 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. 106. SUNSET.

[(a) IN GENERAL.—Except as provided in subsection (b), the authority to carry out sections 101, 102, 103, 104, and 105 shall terminate on the date that is 11 years after the date of enactment of this Act.]

(a) IN GENERAL.—Except as provided in subsection (b), the authority to carry out sections 101, 102, 103, 104, and 105 shall terminate on December 30, 2030.

(b) EXTENSION.—The President may continue the activities under such sections if the President determines that such activities are necessary to meet national economic or national security needs.

TITLE II—NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY QUANTUM ACTIVITIES

SEC. 201. NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY ACTIVITIES AND QUANTUM CONSORTIUM.

(a) NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY ACTIVITIES.—As part of the Program, the Director of the National Institute of Standards and Technology—

(1) shall continue to support and expand [basic and applied] quantum information [science and technology] *science, engineering, and technology* research and development of measurement and standards infrastructure necessary to advance commercial development of quantum applications;

(2) shall use the existing programs of the National Institute of Standards and Technology, in collaboration with other Federal departments and agencies, as appropriate, to *attract, educate, and* train scientists in quantum information [science and technology] *science, engineering, and technology* to increase participation in the quantum fields;

[(3) shall carry out research to facilitate the development and standardization of quantum cryptography and post-quantum classical cryptography;

[(4) shall carry out research to facilitate the development and standardization of quantum networking, communications, and sensing technologies and applications;]

(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;

(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 applica-

tions, including quantum supporting technologies, such as artificial intelligence;

(5) shall carry out 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;

[(5)**]** *(8)* for quantum technologies determined by the Director of the National Institute of Standards and Technology to be at a readiness level sufficient for standardization, shall provide technical review and assistance to such other Federal agencies as the Director considers appropriate for the development of quantum networking **[**infrastructure**]***, communications, sensing, and computing* standards;

[(6)**]** *(9)* shall establish or expand collaborative ventures or consortia with other public or private sector entities, including industry, universities, *non-profit research organizations,* and Federal laboratories for the purpose of advancing the field of quantum information science **[**and engineering; and**]***, engineering, technology and expanding the domestic STEM workforce;*

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

[(7)**]** *(11)* may enter into and perform such contracts, including cooperative research and development arrangements and grants and cooperative agreements or other transactions, as may be necessary in the conduct of the work of the National Institute of Standards and Technology and on such terms as the Director considers appropriate, in furtherance of the purposes of this Act.

(b) QUANTUM CONSORTIUM.—

(1) IN GENERAL.—Not later than 1 year after the date of enactment of this Act, the Director of the National Institute of Standards and Technology shall convene a consortium of stakeholders to identify the **[**future**]** *research* measurement, standards, cybersecurity, and other appropriate needs for supporting the development of a robust quantum information **[**science and technology**]** *science, engineering, and technology* industry in the United States.

(2) GOALS.—The goals of the consortium shall be—

[(A) to assess the current research on the needs identified in paragraph (1);

[(B) to identify any gaps in the research necessary to meet the needs identified in paragraph (1); and

[(C) to provide recommendations on how the National Institute of Standards and Technology and the Program can address the gaps in the necessary research identified in subparagraph (B).**]**

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

(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 meet 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;

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

(E) to provide recommendations on how the National Institute of Standards and Technology, the Program, and other Federal agencies, as appropriate, can incorporate small and medium-sized businesses and startups into Federal quantum activities and promote the success of small and medium-sized startups.

(3) REPORT TO CONGRESS.—[Not later than 2 years after the date of enactment of this Act, the] *The* Director of the National Institute of Standards and Technology shall *periodically, but not less than every five years,* 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 summarizing the findings of the consortium.

(4) COORDINATION.—As appropriate, the consortium is encouraged to engage with Federal agencies that fund research, have a mission to transition or translate research results to practical quantum applications, or have a mission that could benefit from the development of quantum technologies, to inform and accelerate progress in such areas.

[(c) FUNDING.—The Director of the National Institute of Standards and Technology shall allocate up to $80,000,000 to carry out the activities under this section for each of fiscal years 2019 through 2023, subject to the availability of appropriations. Amounts made available to carry out this section shall be derived from amounts appropriated or otherwise made available to the National Institute of Standards and Technology.]

(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 promote, establish, and support international quantum information science, engineering, and technology research, metrology research, and standardization, as appropriate, to enhance international cooperation, meet United States commitments, and support United States engagement in international stand-

ards 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 INSTITUTE.—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 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 deployment 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—

(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 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; and

(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 and after the date on which the Director of National Institute of Standards and Technology has issued standards relating to post-quantum cryptography, the Director 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 granting funds 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 cryptographic and remediate quantum-related vulnerabilities.

(C) GUIDANCE.—The Director of the National Institute of Standards and Technology may develop, and periodically update, guidance, including relating to eligibility, application disclosure requirements, grant amount and duration, and any additional requirements regarding the award of grants under this paragraph.

(D) CONSULTATION.—If the 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, and appropriate representatives of private sector entities, including nonprofit organizations, to share information regarding the grant program under this paragraph and guidance developed and updated under subparagraph (C).

(e) FUNDING.—Of the funds authorized to be appropriated for the National Institute of Standards and Technology pursuant to section 10211 of the Research and Development, Competition, and Innovation Act (Public Law 117–167) for scientific and technical research and services laboratory activities, there is authorized to be appropriated to the Director of the National Institute of Standards and Technology to carry out this section up to $85,000,000 for each of fiscal years 2024 through 2027.

SEC. 202. NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY QUANTUM 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 and operate 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 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, 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.

(B) Quantum engineering.

(b) REQUIREMENTS.—To the maximum extent practicable, centers developed, constructed, operated, or maintained 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 transfer.

(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 an additional period 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.

(e) FUNDING.—The Director of the National Institute of Standards and Technology shall allocate up to $18,000,000 for each center established under this section for each of fiscal years 2024 through 2028, subject to the availability of appropriations. Amounts made available to carry out this section shall be derived from amounts appropriated or otherwise made available to the National Institute of Standards and Technology.

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.).

TITLE III—NATIONAL SCIENCE FOUNDATION QUANTUM ACTIVITIES

SEC. 301. QUANTUM INFORMATION SCIENCE, *ENGINEERING, AND TECHNOLOGY* RESEARCH AND EDUCATION PROGRAM.

(a) IN GENERAL.—The Director of the National Science Foundation shall carry out a [basic] research and education program on quantum information [science and engineering] *science, engineering, and technology*, including the competitive award of grants to institutions of higher education or eligible nonprofit organizations (or consortia thereof).

(b) PROGRAM COMPONENTS.—

(1) IN GENERAL.—In carrying out the program under subsection (a), the Director of the National Science Foundation shall carry out activities that—

(A) support [basic] interdisciplinary quantum information [science and engineering] *science, engineering, and technology* research; and

(B) support [human resources] *education and workforce* development in all aspects of quantum information [science and engineering] *science, engineering, and technology*.

(2) REQUIREMENTS.—The activities described in paragraph (1) shall include—

(A) using the existing programs of the National Science Foundation, in collaboration with other Federal departments and agencies, as appropriate—

(i) to improve the teaching and learning of quantum information [science and engineering] *science, engineering, and technology* at the *K–12, vocational,* undergraduate, graduate, and postgraduate levels; [and]

(ii) to increase participation in the quantum fields, including by individuals identified in sections 33 and 34 of the Science and Engineering Equal Opportunities Act (42 U.S.C. 1885a, 1885b); *and*

(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;

(B) formulating goals for quantum information [science and engineering] *science, engineering, and technology* research and education activities to be supported by the National Science Foundation;

(C) leveraging the collective body of knowledge from existing quantum information [science and engineering] *science, engineering, and technology* research and education activities;

(D) coordinating research efforts funded through existing programs across the directorates of the National Science Foundation; [and]

(E) engaging with other Federal departments and agencies, research communities, and potential users of information produced under this section[.]*; and*

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

[(c) GRADUATE TRAINEESHIPS.—The Director of the National Science Foundation may establish a program 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 to pursue masters or doctoral degrees in quantum information science.]

(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 award grants 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 State or Federal 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 quantum-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.

(d) INCORPORATING **[**QISE**]** *QISET* INTO STEM CURRICULUM.—

(1) IN GENERAL.—The Director of the National Science Foundation shall, through programs carried out or supported by the National Science Foundation, seek to increase the integration of quantum **[**information science and engineering (referred to in this subsection as "QISE")**]** *information science, engineering, and technology (referred to in this subsection as QISET)* into the STEM curriculum at all education levels, including community colleges *and career and technical education entities*, as considered appropriate by the Director.

(2) CURRICULUM INTEGRATION.—The curriculum integration under paragraph (1) may include the following:

(A) Methods to conceptualize **[**QISE**]** *quantum information science, engineering, and technology* for elementary, middle, and high school curricula.

(B) Methods for strengthening foundational mathematics and science curricula.

(C) Methods for integrating students who are underserved or historically underrepresented groups in STEM.

(D) Age-appropriate materials that apply the principles of quantum information science*, engineering, and technology* in STEM fields*, including those relevant to emerging technologies, such as artificial intelligence, microelectronics, and nano technology*.

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

[(E)] *(F)* Recommendations for the standardization of key concepts, definitions, and curriculum criteria across government, academia, and industry.

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

[(F)] *(H)* Materials that specifically address the findings and outcomes of the study to evaluate and make recommendations for the quantum information science*, engineering, and technology* workforce pursuant to subsection (d) of section 10661 of the Research and Development, Competition, and Innovation Act and strategies to account for the skills and workforce needs identified through such study.

(3) COORDINATION.—In carrying out this subsection, the Director shall coordinate with relevant Federal agencies, and consult with nongovernmental entities with expertise in [QISE] *quantum information science, engineering, and technology*, as appropriate, which may include institutions eligible to participate in the Established Program to Stimulate Competitive Research (EPSCoR).

[(4) DEFINITION.—In this subsection, the term "STEM" means the academic and professional disciplines of science, technology, engineering, and mathematics, including computer science.]

(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—

(1) providing hands-on training and research opportunities for such educators at Federal Laboratories, institutions of higher education, or in industry; and

(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—

(A) supporting curriculum development in quantum information science, engineering, and technology as described in section 301(d) of the National Quantum Initiative Act (15 U.S.C. 8841(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)); and

(C) leveraging the readiness for the involvement of local research and education communities to secure a talent pipeline in quantum information science, engineering, and technology to meet the workforce needs of industry, government, and academia.

(2) COLLABORATIONS.—A collaboration receiving an award under this subsection may include institutions of higher education, nonprofit organizations, and private sector entities.

(3) 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.

(4) REQUIREMENTS.—To receive an award under this subsection, an eligible institution 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 and focus areas the eligible institution is prepared to engage in to significantly build up its quantum information 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.

(5) 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 disciplines and focus areas specified in paragraph (4)(B).

(C) Bridge programs focused on preparing post-baccalaureate students for graduate programs in quantum information science, engineering, and technology.

(D) To build research capacity and infrastructure at an eligible institution in disciplines and focus areas specified in paragraph (4)(B).

(E) An assessment of capacity-building and research infrastructure needs identified in paragraph (4)(B).

(F) Administrative research development support.

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

(6) 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 applicant will support students from diverse backgrounds, including first-generation undergraduate students.

(B) The geographic and institutional diversity of eligible applicants.

(C) How the eligible applicant can leverage public-private partnerships and existing research partnerships with Federal agencies.

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

(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, as appropriate, to enhance international cooperation and meet United States commitments, including as part of the terms and conditions of 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 national Quantum Information Strategy in accordance with Executive Order 14073 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) RESTRICTIONS.—

(A) CONFUCIUS INSTITUTE.—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 COUNTRY OF CONCERN AND FOREIGN ENTITY 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.

(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 award grants 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 meet the materials, advanced materials development, high performance computing, heterogeneous computing, networking, software, data, clean room, and device needs of the scientific 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.

(j) FUNDING.—Of the funds authorized to be appropriated to the National Science Foundation pursuant to section 10303 of the Research and Development, Competition, and Innovation Act (Public Law 117–167) for research and related activities, there is authorized to be appropriated to the Director of the National Science Foundation to carry out this section up to $141,000,000 for each of fiscal years 2024 through 2027.

SEC. 302. MULTIDISCIPLINARY CENTERS FOR QUANTUM RESEARCH AND EDUCATION.

(a) IN GENERAL.—The Director of the National Science Foundation, in consultation with other Federal departments and agencies, as appropriate, shall award grants to institutions of higher education or eligible nonprofit organizations (or consortia thereof) to establish at least 2, but not more than **[**5**]** *10*, Multidisciplinary Centers for Quantum Research and Education (referred to in this section as "Centers").

(b) COLLABORATIONS.—A collaboration receiving an award under this subsection may include institutions of higher education, nonprofit organizations, and private sector entities.

(c) PURPOSE.—The purpose of the Centers shall be to conduct **[**basic**]** research and education activities in support of the goals and priorities established under section 103(d)(2), including by—

(1) continuing to advance quantum information **[**science and engineering**]** *science, engineering, and technology*;

(2) supporting curriculum and workforce development in quantum information science **[**and engineering**]**, *engineering,*

and technology, including leveraging or expanding activities established pursuant to section 301(d); and

(3) fostering innovation by bringing industry perspectives to quantum research and workforce development, including by leveraging industry knowledge and resources.

(d) REQUIREMENTS.—

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

(2) APPLICATIONS.—Each application under paragraph (1) shall include a description of—

(A) how the Center will work with other research institutions and industry partners to leverage expertise in [quantum science] *quantum information science, engineering, and technology*, education and curriculum development, and technology transfer;

(B) how the Center will promote active collaboration among researchers in multiple disciplines involved in quantum research, including physics, engineering, mathematics, computer science, chemistry, *health,* and material science;

(C) how the Center will support long-term and short-term workforce development in the quantum field*, including how each participant will develop and implement outreach activities to increase the participation of women and other students from groups historically underrepresented in STEM*;

(D) how the Center can support an innovation ecosystem to work with industry to translate Center research into applications; [and]

(E) a long-term plan to become self-sustaining after the expiration of funding under this section[.]*; and*

(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 of fair competition.

(e) SELECTION AND DURATION.—

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

[(2) REAPPLICATION.—An awardee may reapply for additional, subsequent periods of 5 years on a competitive, merit-reviewed basis.]

(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 an underperforming Center for cause during the performance period.

(f) FUNDING.—The Director of the National Science Foundation shall allocate up to $10,000,000 for each Center established under this section for each of fiscal years [2019 through 2023] *2024 through 2028*, subject to the availability of appropriations. Amounts made available to carry out this section shall be derived from amounts appropriated or otherwise made available to the National Science Foundation.

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 to—

(1) 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; and

(2) 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 content 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 from groups historically underrepresented in STEM to pursue undergraduate and graduate studies in quantum information science, engineering, and 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 restrictions outlined in subsection (c) 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 as 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 in-

clude 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 women and other students from groups historically underrepresented in STEM.

(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.

(j) FUNDING.—The Director of the National Science Foundation shall allocate up to $10,000,000 for the Hub for each of fiscal years 2024 through 2028, subject to the availability of appropriations. Amounts made available to carry out this section shall be derived from amounts appropriated or otherwise made available to the National Science Foundation.

SEC. 304. QUANTUM TESTBEDS.

(a) IN GENERAL.—Not later than one year after the date of the enactment of this 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 from populations that are historically underrepresented in STEM, 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 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, 2030, 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 those authorized pursuant to section 10390 of the Research and Development, Competition, and Innovation Act (Public Law 117–167; 42 U.S.C. 10990), 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) FUNDING.—The Director of the National Science Foundation shall allocate up to $50,000,000 for the quantum testbeds under this

section for each fiscal years 2024 through 2028, subject to the availability of appropriations. Amounts made available to carry out this section shall be derived from amounts appropriated or otherwise made available to the National Science Foundation.

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.).

TITLE IV—DEPARTMENT OF ENERGY QUANTUM ACTIVITIES

SEC. 401. QUANTUM INFORMATION SCIENCE RESEARCH PROGRAM.

[(a) IN GENERAL.—The Secretary of Energy shall carry out a basic research program on quantum information science.**]**

(a) IN GENERAL.—The Secretary of Energy shall carry out a research, development, and demonstration program on quantum information science, engineering, and technology.

(b) PROGRAM COMPONENTS.—In carrying out the program under subsection (a), the Secretary of Energy shall—

(1) formulate goals for quantum information science*, engineering, and technology* research to be supported by the Department of Energy;

(2) leverage the collective body of knowledge from existing quantum information science research;

[[(3)**]** *(5)* provide research experiences and training for additional undergraduate and graduate students in quantum information science, including in the fields of—

[(A) quantum information theory;

[(B) quantum physics;

[(C) quantum computational science;

[(D) applied mathematics and algorithm development;

[(E) quantum networking;

[(F) quantum sensing and detection; and

[(G) materials science and engineering;**]**

(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;

(L) quantum biology;

(M) superconductive and high-performance microelectronics; and

(N) quantum security technologies;

(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);

[(4)**]** *(6)* coordinate research efforts funded through existing programs across the Department of Energy, including—

(A) the Nanoscale Science Research Centers;

(B) the Energy Frontier Research Centers;

(C) the Energy Innovation Hubs;

(D) the National Laboratories;

(E) the Advanced Research Projects Agency; **[**and**]**

(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) the National Quantum Information Science Research Centers; and

[(5)**]** *(7)* coordinate with other Federal departments and agencies, research communities, and potential users of information produced under this section**[**.**]** *and other relevant efforts as defined by the Secretary of Energy; and*

(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.

(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 conceptual plan to leverage capabilities and infrastructure from the exascale computing program, as the Secretary of Energy 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) Implement the plan developed under this section.

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

(1) Educating—

(A) the energy industry on near term and commercially available quantum technologies; and

(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.

(e) FUNDING.—Of the funds authorized to be appropriated for the Department of Energy's Office of Science pursuant to section 317 of the Department of Energy Research and Innovation Act, there is authorized to be appropriated to the Secretary to carry out the activities under this section up to $130,000,000 for each fiscal years 2024 through 2027.

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 meet 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 meeting the device, hardware, software, and materials needs of the scientific community and the quantum supply chain.

(d) FUNDING.—The Secretary of Energy shall allocate up to $25,000,000 for each of fiscal years 2024 through 2028 to carry out this section, subject to the availability of appropriations. Amounts made available to carry out this section shall be derived from amounts appropriated or otherwise made available to the Department of Energy's Office of Science.

SEC. 402. NATIONAL QUANTUM INFORMATION SCIENCE RESEARCH CENTERS.

(a) ESTABLISHMENT.—

(1) IN GENERAL.—The Secretary of Energy, acting through the Director of the Office of Science (referred to in this section as the "Director"), shall ensure that the Office of Science carries out a program, in consultation with other Federal departments and agencies, as appropriate, to establish and operate at least 2, but not more than 5, National Quantum Information Science Research Centers (referred to in this section as "Centers") to conduct [basic] research to accelerate scientific breakthroughs in quantum information [science and technology] *science, engineering, and technology, expand capacity for the domestic quantum workforce,* and to support research conducted under [section 401] *sections 401, 403, and 404*.

(2) REQUIREMENTS.—

(A) COMPETITIVE, MERIT-REVIEWED PROCESS.—The Centers shall be established through a competitive, merit-reviewed process.

(B) APPLICATIONS.—An eligible applicant under this subsection shall submit to the Director an application at such time, in such manner, and containing such information as the Director determines to be appropriate.

(C) ELIGIBLE APPLICANTS.—The Director shall consider applications from National Laboratories, institutions of higher education, research centers, multi-institutional collaborations *that may include one or more commercial entities*, and any other entity that the Secretary of Energy determines to be appropriate.

(b) COLLABORATIONS.—A collaboration that receives an award under this section may include multiple types of research institutions and private sector entities*, and should be inclusive of the variety of viable quantum technologies, where appropriate*.

(c) REQUIREMENTS.—To the maximum extent practicable, the Centers developed, constructed, operated, or maintained under this section shall serve the needs of the Department of Energy, industry, the academic community, and other relevant entities to create

and develop processes for the purpose of advancing [basic] research in quantum information science*, engineering, and technology, accelerating quantum workforce development,* and improving the competitiveness of the United States.

(d) COORDINATION.—The Secretary of Energy shall ensure the coordination, and avoid unnecessary duplication, of the activities of each Center with the activities of—

(1) other research entities of the Department of Energy, including—

(A) the Nanoscale Science Research Centers;

(B) the Energy Frontier Research Centers;

(C) the Energy Innovation Hubs; [and]

(D) the Office of Technology Transitions; and

[(D)] *(E)* the National Laboratories;

(2) institutions of higher education; and

(3) industry.

(e) DURATION.—

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

[(2) REAPPLICATION.—An awardee may reapply for additional, subsequent periods of 5 years. The Director shall approve or disapprove of each reapplication on a competitive, merit-reviewed basis.]

(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.

(3) TERMINATION.—Consistent with the authorities of the Department of Energy, the Secretary of Energy may terminate an underperforming Center for cause during the performance period.

(f) FUNDING.—The Secretary of Energy shall allocate up to [$25,000,000] *$35,000,000* for each Center established under this section for each of fiscal years [2019 through 2023] *2024 through 2028*, subject to the availability of appropriations. Amounts made available to carry out this section shall be derived from amounts appropriated or otherwise made available to the Department of Energy.

SEC. 403. DEPARTMENT OF ENERGY QUANTUM NETWORK INFRASTRUCTURE RESEARCH AND DEVELOPMENT PROGRAM.

(a) IN GENERAL.—The Secretary of Energy (referred to in this section as the "Secretary") shall carry out a research, development, and demonstration program to accelerate innovation in quantum network infrastructure in order to—

(1) facilitate the advancement of distributed quantum computing systems through the internet and intranet;

(2) improve the precision of measurements of scientific phenomena and physical imaging technologies;

(3) develop secure national quantum communications technologies and strategies;

(4) demonstrate quantum networking*, including* utilizing the Department of Energy's Energy Sciences Network User Facility; [and]

(5) advance the relevant domestic supply chains, manufacturing capabilities, and associated simulations or modeling capabilities[.]*;*

(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.

(b) PROGRAM.—In carrying out this section, the Secretary shall—

(1) coordinate with—

(A) the Director of the National Science Foundation;

(B) the Director of the National Institute of Standards and Technology;

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

[(C)] *(D)* the Chair of the Subcommittee on Quantum Information Science of the National Science and Technology Council established under section 103(a); and

[(D)] *(E)* the Chair of the Subcommittee on the Economic and Security Implications of Quantum Science;

(2) conduct cooperative research with industry, National Laboratories, institutions of higher education, and other research institutions to facilitate new quantum infrastructure methods and technologies, including—

(A) quantum-limited detectors, ultra-low loss optical channels, *ground-to-space and* space-to-ground connections, and classical networking and cybersecurity protocols;

(B) entanglement and hyper-entangled state sources and transmission, control, and measurement of quantum states;

(C) quantum interconnects that allow short range local connections between quantum processors;

(D) transducers for quantum sources and signals between optical wavelength regimes, including telecommunications regimes and quantum computer-relevant domains, including microwaves;

(E) development of quantum memory buffers and small-scale quantum computers that are compatible with [photon-based] *all applicable modalities of* quantum bits in the optical or telecommunications wavelengths;

(F) long-range entanglement distribution, including allowing entanglement-based protocols between small- and large scale quantum processors, at the terrestrial and space-based level using quantum repeaters*, quantum sensors,* and optical or laser communications;

(G) quantum routers, multiplexers, repeaters, *data centers,* and related technologies necessary to create secure long-distance quantum communication; [and]

(H) integration of systems across [the quantum technology stack] *quantum technology modality stacks* into traditional computing networks, including the development of remote controlled, high-performance, and reliable implementations of key quantum network components by leveraging the expertise, infrastructure and supplemental investments at the [National Laboratories in] *National Laboratories such as* the Energy Sciences Network User Facility;

(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;

(3) engage with the Quantum Economic Development Consortium and other organizations, as applicable, to transition component technologies to help facilitate as appropriate the development of a quantum supply chain for quantum network technologies;

(4) advance [basic] research in advanced scientific computing, particle and nuclear physics, and [material] *materials* science to enhance the understanding, prediction, and manipulation of materials, processes, and physical phenomena relevant to quantum network infrastructure;

(5) develop experimental tools and testbeds in collaboration with the Energy Sciences Network User Facility necessary to support cross-cutting [fundamental] research and development activities with diverse stakeholders from industry, National Laboratories, and institutions of higher education; and

(6) consider quantum network infrastructure applications that span the Department of Energy's missions in energy, environment, and national security.

(c) LEVERAGING.—In carrying out this section, the Secretary shall leverage resources, infrastructure, and expertise across the Department of Energy and from—

(1) the National Institute of Standards and Technology;

(2) the National Science Foundation;

(3) the National Aeronautics and Space Administration;

(4) other relevant Federal agencies;

(5) the National Laboratories;

(6) industry stakeholders*, including small and medium-sized businesses and startups*;

(7) institutions of higher education; and

(8) the National Quantum Information Science Research Centers.

(d) RESEARCH PLAN.—Not later than 180 days after the date of enactment of the Research and Development, Competition, and Innovation Act, the Secretary shall submit to the Committee on Science, Space, and Technology of the House of Representatives and the Committee on Energy and Natural Resources of the Senate a 4-year research plan that identifies and prioritizes [basic research] *research, development, and demonstration* needs relating to quantum network infrastructure.

(e) STANDARD OF REVIEW.—The Secretary shall review activities carried out under this section to determine the achievement of technical milestones.

(f) FUNDING.—Of the funds authorized to be appropriated for the Department of Energy's Office of Science, there is authorized to be appropriated to the Secretary to carry out the activities under this section $100,000,000 for each of fiscal years 2023 through 2027.

SEC. 404. DEPARTMENT OF ENERGY QUANTUM USER EXPANSION FOR SCIENCE AND TECHNOLOGY PROGRAM.

(a) IN GENERAL.—The Secretary of Energy (referred to in this section as the "Secretary") shall establish and carry out a program, to be known as the "Quantum User Expansion for Science and Technology program" or "QUEST program", to encourage and facilitate access to United States quantum computing hardware [and quantum computing clouds], *software, and cloud-based quantum computers* for research purposes—

(1) to enhance the United States quantum research enterprise;

(2) to educate the future quantum computing workforce;

(3) to accelerate the advancement of United States quantum computing capabilities; [and]

(4) to advance the relevant domestic supply chains, manufacturing processes, and associated simulations or modeling capabilities[.]*;*

(5) to enable development of software 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.

(b) PROGRAM.—In carrying out this section, the Secretary shall—

(1) coordinate with—

(A) the Director of the National Science Foundation;

(B) the Director of the National Institute of Standards and Technology;

(C) the Chair of the Subcommittee on Quantum Information Science of the National Science and Technology Council established under section 103(a); and

(D) the Chair of the Subcommittee on the Economic and Security Implications of Quantum Science;

(2) provide researchers based within the United States with access to, and use of, United States quantum computing resources through a competitive, merit-reviewed process;

(3) consider applications from the National Laboratories, multi-institutional collaborations, institutions of higher education, industry stakeholders, and any other entities that the Secretary determines are appropriate to provide national leadership on quantum computing related issues;

(4) coordinate with private sector stakeholders, the user community, and interagency partners on program development and best management practices; [and]

(5) to the extent practicable, balance user access to commercial prototypes available for use across a broad class of applications and Federal research prototypes that enable benchmarking a wider variety of early-stage devices[.]*;*

(c) LEVERAGING.—In carrying out this section, the Secretary shall leverage resources and expertise across the Department of Energy and from—

(1) the National Institute of Standards and Technology;

(2) the National Science Foundation;

(3) the National Aeronautics and Space Administration;

(4) the National Oceanic and Atmospheric Administration;

[(4)] *(5)* other relevant Federal agencies;

[(5)] *(6)* the National Laboratories;

[(6)] *(7)* industry stakeholders*, including small and medium-sized businesses and startups*;

[(7)] *(8)* institutions of higher education; and

[(8)] *(9)* the National Quantum Information Science Research Centers.

(d) SECURITY.—In carrying out the activities authorized by this section, the Secretary, in consultation with the Director of the National Science Foundation and the Director of the National Institute of Standards and Technology, shall ensure proper security controls are in place to protect sensitive information, as appropriate.

(e) FUNDING.—Of the funds authorized to be appropriated for the Department of Energy's Office of Science, there are authorized to be appropriated to the Secretary to carry out the activities under this section—

(1) $30,000,000 for fiscal year 2023;

(2) $31,500,000 for fiscal year 2024;

(3) $33,075,000 for fiscal year 2025;

(4) $34,728,750 for fiscal year 2026; [and]

(5) $36,465,188 for fiscal year 2027[.]*; and*

(6) $38,000,000 for fiscal year 2028.

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 resilience, 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 to be appropriate, with members of relevant industries, National Laboratories, institutions of higher education, and other relevant institutions, including research institutions, as determined by the Secretary.

SEC. 406. RESEARCH SECURITY

The activities authorized under title IV shall be applied in a manner consistent with subtitle D of title VI of the Research and Devel-

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

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CYBER SECURITY RESEARCH AND DEVELOPMENT ACT

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SEC. 4. NATIONAL SCIENCE FOUNDATION RESEARCH.

(a) COMPUTER AND NETWORK SECURITY RESEARCH GRANTS.—

(1) IN GENERAL.—The Director shall award grants for basic research on innovative approaches to the structure of computer and network hardware and software that are aimed at enhancing computer security. Research areas may include—

(A) authentication, cryptography, and other secure data communications technology*, 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))*;

(B) computer forensics and intrusion detection;

(C) reliability of computer and network applications, middleware, operating systems, control systems, and communications infrastructure;

(D) privacy and confidentiality;

(E) network security architecture, including tools for security administration and analysis;

(F) emerging threats;

(G) vulnerability assessments and techniques for quantifying risk;

(H) remote access and wireless security;

(I) enhancement of law enforcement ability to detect, investigate, and prosecute cyber-crimes, including those that involve piracy of intellectual property;

(J) secure fundamental protocols that are integral to inter-network communications and data exchange;

(K) secure software engineering and software assurance, including—

(i) programming languages and systems that include fundamental security features;

(ii) portable or reusable code that remains secure when deployed in various environments;

(iii) verification and validation technologies to ensure that requirements and specifications have been implemented; and

(iv) models for comparison and metrics to assure that required standards have been met;

(L) holistic system security that—

(i) addresses the building of secure systems from trusted and untrusted components;

(ii) proactively reduces vulnerabilities;

(iii) addresses insider threats; and

(iv) supports privacy in conjunction with improved security;

(M) monitoring and detection;

(N) mitigation and rapid recovery methods;

(O) security of wireless networks and mobile devices;

(P) security of cloud infrastructure and services;

(Q) security of election-dedicated voting system software and hardware; and

(R) role of the human factor in cybersecurity and the interplay of computers and humans and the physical world.

(2) MERIT REVIEW; COMPETITION.—Grants shall be awarded under this section on a merit-reviewed competitive basis.

(3) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to the National Science Foundation to carry out this subsection—

(A) $35,000,000 for fiscal year 2003;

(B) $40,000,000 for fiscal year 2004;

(C) $46,000,000 for fiscal year 2005;

(D) $52,000,000 for fiscal year 2006; and

(E) $60,000,000 for fiscal year 2007.

(b) COMPUTER AND NETWORK SECURITY RESEARCH CENTERS.—

(1) IN GENERAL.—The Director shall award multiyear grants, subject to the availability of appropriations, to institutions of higher education, nonprofit research institutions, or consortia thereof to establish multidisciplinary Centers for Computer and Network Security Research. Institutions of higher education, nonprofit research institutions, or consortia thereof receiving such grants may partner with 1 or more government laboratories or for-profit institutions, or other institutions of higher education or nonprofit research institutions.

(2) MERIT REVIEW; COMPETITION.—Grants shall be awarded under this subsection on a merit-reviewed competitive basis.

(3) PURPOSE.—The purpose of the Centers shall be to generate innovative approaches to computer and network security by conducting cutting-edge, multidisciplinary research in computer and network security, including improving the security and resiliency of information technology, reducing cyber vulnerabilities, and anticipating and mitigating consequences of cyber attacks on critical infrastructure, by conducting research in the areas described in subsection (a)(1).

(4) APPLICATIONS.—An institution of higher education, nonprofit research institution, or consortia thereof seeking funding under this subsection shall submit an application to the Director at such time, in such manner, and containing such information as the Director may require. The application shall include, at a minimum, a description of—

(A) the research projects that will be undertaken by the Center and the contributions of each of the participating entities;

(B) how the Center will promote active collaboration among scientists and engineers from different disciplines, such as computer scientists, engineers, mathematicians, and social science researchers;

(C) how the Center will contribute to increasing the number and quality of computer and network security researchers and other professionals, including individuals from groups historically underrepresented in these fields; and

(D) how the Center will disseminate research results quickly and widely to improve cyber security in information technology networks, products, and services.

(5) CRITERIA.—In evaluating the applications submitted under paragraph (4), the Director shall consider, at a minimum—

(A) the ability of the applicant to generate innovative approaches to computer and network security and effectively carry out the research program;

(B) the experience of the applicant in conducting research on computer and network security and the capacity of the applicant to foster new multidisciplinary collaborations;

(C) the capacity of the applicant to attract and provide adequate support for a diverse group of undergraduate and graduate students and postdoctoral fellows to pursue computer and network security research;

(D) the extent to which the applicant will partner with government laboratories, for-profit entities, other institutions of higher education, or nonprofit research institutions, and the role the partners will play in the research undertaken by the Center;

(E) the demonstrated capability of the applicant to conduct high performance computation integral to complex computer and network security research, through on-site or off-site computing;

(F) the applicant's affiliation with private sector entities involved with industrial research described in subsection (a)(1);

(G) the capability of the applicant to conduct research in a secure environment;

(H) the applicant's affiliation with existing research programs of the Federal Government;

(I) the applicant's experience managing public-private partnerships to transition new technologies into a commercial setting or the government user community;

(J) the capability of the applicant to conduct interdisciplinary cybersecurity research, basic and applied, such as in law, economics, or behavioral sciences; and

(K) the capability of the applicant to conduct research in areas such as systems security, wireless security, networking and protocols, formal methods and networking and information technology, nanotechnology, or industrial control systems.

(6) ANNUAL MEETING.—The Director shall convene an annual meeting of the Centers in order to foster collaboration and communication between Center participants.

(7) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated for the National Science Foundation to carry out this subsection—

(A) $12,000,000 for fiscal year 2003;

(B) $24,000,000 for fiscal year 2004;

(C) $36,000,000 for fiscal year 2005;

(D) $36,000,000 for fiscal year 2006; and

(E) $36,000,000 for fiscal year 2007.

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