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118TH CONGRESS
1ST SESSION

H. R. 6213

To reauthorize the National Quantum Initiative Act, and for other purposes.

IN THE HOUSE OF REPRESENTATIVES

NOVEMBER 3, 2023

Mr. LUCAS (for himself, Ms. LOFGREN, Mr. COLLINS, Ms. STEVENS, Mr. WILLIAMS of New York, Mr. BOWMAN, Mr. BABIN, Mr. SORENSEN, Mr. OBERNOLTE, Mrs. FOUSHEE, Mr. MILLER of Ohio, and Ms. ROSS) introduced the following bill; which was referred to the Committee on Science, Space, and Technology

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A BILL

To reauthorize the National Quantum Initiative Act, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

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;

(F) in subparagraph (E), by inserting ''and'' after the semicolon; and

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

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

tions, to promote innovation and commercialization.'';

(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), 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 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''; and

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

(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''; and

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

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

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

(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 '', technology, and engineering'' 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, biotechnology, space, and other sectors.'';

and

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

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, 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 "international standards in open and transparent standardization systems for quantum information science, engineering, and technology;";

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

(i) by inserting "educational," after "legal,"; and

(ii) by striking the period and inserting "; and"; 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), by inserting ''through December 31, 2030'' after ''thereafter''; 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 (3), by inserting '', or supply chains'' after ''investments'';

(C) in paragraph (5)—

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

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

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

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

(F) in paragraph (8)—

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

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

(G) 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 of the national security and economic interest 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 104a 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 (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, and sensing technologies and quantum applications;''.

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

(E) 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, technology, and engineering;'';

(F) in paragraph (7), as so redesignated, by striking ''infrastructure'' and inserting '', communications, sensing, and computing''; and

(G) in paragraph (8), as so redesignated—

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

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

(H) by inserting after paragraph (8) the following the following new paragraph:

''(9) shall establish such infrastructure as is necessary to advance the research program described in this section; 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 gencies, as appropriate, can address the gaps in the necessary research identified in subparagraph (B) 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 re-

search and industrial competitiveness in quantum information science, engineering, and technology, and communicate findings to Federal agencies and other domestic and international stakeholders; and

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

(C) in paragraph (3)—

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

(ii) by inserting ''periodically, but not less 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 Secretary of Commerce, in coordination with the Secretary of State and the Director of the National Science Foundation, and acting through the Director of the National Institute of Standards and Technology, 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 obligations or 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) 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 section:

''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 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 Stand-

ards 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.

''(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 in and prioritize the following topics in 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 infor-

mation science community, to create and 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) COLLABORATIONS.—A collaboration that receives an award under this section may include multiple types of research institutions, private sector entities, Federal laboratories, and nonprofit organizations.

''(d) COORDINATION.—The Director of the National Institute of Standards and Technology shall ensure awardees coordinate, 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.

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

''(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.

''(f) FUNDING.—The Director of the National Institute of Standards and Technology shall allocate up to $18,000,000 for each Center supporter 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. 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 basic and use inspired 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 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 businesses, universities, Multidisciplinary Centers for Quantum Research and Education as established in section 402, 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 appli-

cant for direct or indirect costs as estimated by the fellowship sponsor.

''(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 2021 (42 U.S.C. 1862p–6).

''(5) PARTNERSHIPS.—In carrying out the activities under this section, 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 sub-

section as 'QISE')'' and inserting ''information science, engineering, and technology''; 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) by redesignating subparagraphs (E) and (F) as subparagraphs (F) and (H), respectively;

(iv) 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.'';

(v) 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

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

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

(II) by inserting ''of the Research and Development, Competition, and Innovation Act (42 U.S.C. 19261(d))'' after ''section 10661 of the Research and Development, Competition, and Innovation Act'';

(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) 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 promote, establish, and support international quantum information science, engineering, and technology research, as appropriate, to enhance international cooperation and meet United States obligations or 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 or successor strategies.

''(3) PRIORITY.—The Directors shall prioritize research programs with countries that have signed 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.

''(f) 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)—

(A) by striking ''in consultation with other Federal departments and agencies,''; and

(B) 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 and engineering, 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 (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;

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

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

(E) 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)—

(A) by striking ''established'' and inserting ''supported''; and

(B) 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 addind 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 Consortium 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 informa-

tion 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 and maintenance of a publicly accessible online portal.

''(5) Coordinating with quantum industry and nonprofit entities 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 pipeline. 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 aware-

ness 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)(2) of section 401, the Hub may establish and administer a program to 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)(4).

''(f) INDUSTRY COORDINATION.—The Hub shall collaborate with the Quantum Economic Development Consortium established in section 301 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 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, and the National Aeronautics and Space Administration, and other relevant Federal agencies, as appropriate, on activities and resources.

''(j) FUNDING.—

''(1) IN GENERAL.—The Director of the National Science Foundation shall allocate up to $10,000,000 for the Hub for each of fiscal years 2024–2028, subject to the availability of appropriations.

''(2) SOURCE.—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.—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, or consortia thereof, to establish and operate 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 histori-

cally 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) 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 success of such quantum testbeds and providing recommendations for improving such quantum testbeds.

''(e) 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.

''(f) STAKEHOLDER COLLABORATION.—In carrying out this section, the Director of the National Science Foundation shall collaborate with the Quantum Economic Development Consortium established pursuant to section 301 to accomplish the purposes of the quantum testbeds program described in paragraph (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.

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

''(h) FUNDING.—

''(1) IN GENERAL.—The Director of the National Science Foundation shall allocate up to $50,000,000 for the establishment and operation of quantum testbeds under this section for each fiscal years 2024 through 2028, subject to the availability of appropriations.

''(2) SOURCE.—Amounts made available to carry out this section shall be derived from amounts appropriated or otherwise made available to the National Science Foundation.''.

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 202;

''(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) applied mathematics and algorithm development;

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

''(F) quantum sensing and detection;

''(G) materials science and engineering;

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

''(I) near- and long-term application development in a range of areas as determined by the Secretary, such as materials discovery, cybersecurity, energy storage and electric grid management. financial modeling, energy storage, traffic optimization, and improved weather climate forecasting;

''(J) quantum chemistry;

''(K) quantum biology;

''(L) superconductive and high-performance microelectronics; and

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

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

''(5) provide research experiences and training for additional undergraduate and graduate students

in quantum information science, engineering, and technology, including in the fields specified in paragraph (4);'';

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

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

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

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

''(F) the Office of Electricity;

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

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

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

(F) in paragraph (7), as so redesignated, by striking the period and inserting ''and other relevant efforts as defined by the Secretary of Energy; and''; 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 section 404 of the CHIPS and Science Act.

''(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 the United States quantum computing, communications, and 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 the Department of Energy national labs and engaging 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.

''(e) FUNDING.—Of the funds authorized to be appropriated for the Department of Energy's Office of Science in section 10102(a)(4) of the Research and Development, Competition, and Innovation Act (Public Law 117–167), 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 an instrumentation and infrastructure 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 develop, design, build, 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 the heading, by striking ''ESTABLISHMENT'' and inserting ''**REAUTHORIZATION**'';

(B) in paragraph (1)—

(i) by striking ''establish'' and inserting ''maintain'';

(ii) by striking ''basic'';

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

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

(C) 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), 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 established 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 invest-

ments, 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''; and

(3) 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'';

(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) and paragraphs (5), (6), (7), (8), and (9), respectively; and

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

''(4) the National Oceanic and Atmospheric Administration;''; 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. 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 basic and applied 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 basic and applied 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 establish and operate 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.—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 with, and avoids unnecessary duplication of, the activities carried out under this section with 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 basic and applied 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 for each of fiscal years 2024 through 2028 to carry out this title, subject to the availability of appropriations. Amounts made available to carry out this title shall be derived from amounts appropriated or otherwise made available to the National Aeronautics and Space Administration.''.

SEC. 22. 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:

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

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

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