

LEGISLATION SUPPLEMENTING THE NATIONAL QUANTUM INITIATIVE ACT

Since its passage in December 2018, the National Quantum Initiative (NQI) Act (Public Law 115-368) has been amended and supplemented by various laws. In a separate document, the National Quantum Coordination Office (NQCO) has published the NQI Act with its amendments. In this document, the NQCO has collected excerpts of legislation that has supplemented the NQI Act, but that has not amended the NQI Act itself.

While this publication does not represent an official version of any Federal statute, substantial efforts have been made to ensure the accuracy of its contents. The official version of Federal law is found in the United States Statutes at Large and in the United States Code. The legal effect to be given to the Statutes at Large and the United States Code is established by statute (1 U.S.C. 112, 204).

NDAA 2019

[John S. McCain National Defense Authorization Act for Fiscal Year 2019](#)

Public Law 115-232

Enacted August 13, 2018

**With amendments through the National Defense Authorization Act for Fiscal Year 2020
(Public Law 116-92), enacted December 20, 2019**

SEC. 234. DEFENSE QUANTUM INFORMATION SCIENCE AND TECHNOLOGY RESEARCH AND DEVELOPMENT PROGRAM.

- (a) Establishment.--The Secretary of Defense shall carry out a quantum information science and technology research and development program.
- (b) Purposes.--The purposes of the program required by subsection (a) are as follows:
 - (1) To ensure global superiority of the United States in quantum information science necessary for meeting national security requirements.
 - (2) To coordinate all quantum information science and technology research and development within the Department of Defense and to provide for interagency cooperation and collaboration on quantum information science and technology research and development between the Department of Defense and other departments and agencies of the United States and appropriate ~~private sector entities~~ **private sector and international entities** that are involved in quantum information science and technology research and development.
 - (3) To develop and manage a portfolio of fundamental and applied quantum information science and technology and engineering research initiatives that is stable, consistent, and balanced across scientific disciplines.
 - (4) To accelerate the transition and deployment of technologies and concepts derived from quantum information science and technology research and development into the Armed Forces, and to establish policies, procedures, and standards for measuring the success of such efforts.
 - (5) To collect, synthesize, and disseminate critical information on quantum information science and technology research and development.

- (6) To establish and support appropriate research, innovation, and industrial base, including ~~facilities and infrastructure~~ facilities, workforce, and infrastructure, to support the needs of Department of Defense missions and systems related to quantum information science and technology.
- (c) Administration.--In carrying out the program required by subsection (a), the Secretary shall act through the Under Secretary of Defense for Research and Engineering, who shall supervise the planning, management, and coordination of the program. The Under Secretary, in consultation with the Secretaries of the military departments and the heads of participating Defense Agencies and other departments and agencies of the United States, shall--
- (1) prescribe a set of long-term challenges and a set of specific technical goals for the program, including--
- (A) optimization of analysis of national security data sets;
 - (B) development of defense related quantum computing algorithms;
 - (C) design of new materials and molecular functions;
 - (D) secure communications and cryptography, including development of quantum communications protocols;
 - (E) quantum sensing and metrology;
 - (F) development of mathematics relating to quantum enhancements to sensing, communications, and computing; and
 - (G) processing and manufacturing of low-cost, robust, and reliable quantum information science and technology-enabled devices and systems;
- (2) develop a coordinated and integrated research and investment plan for meeting the near-, mid-, and long-term challenges with definitive milestones while achieving the specific technical goals that builds upon the Department's increased investment in quantum information science and technology research and development, commercial sector and global investments, and other United States Government investments in the ~~quantum sciences~~; quantum information sciences, including through consultation with--
- (A) the National Quantum Coordination Office;
 - (B) the subcommittee on Quantum Information Science of the National Science and Technology Council;
 - (C) other organizations and elements of the Department of Defense;
 - (D) other Federal agencies; and
 - (E) appropriate private sector organizations;
- (3) in consultation with the entities listed in paragraph (2), develop plans for--
- (A) the development of the quantum information science and technology workforce;
 - (B) enhancing awareness of quantum information science and technology;
 - (C) reducing the risk of cybersecurity threats posed by quantum information science technology; and
 - (D) development of ethical guidelines for the use of quantum information science technology;
- (4) in consultation with the National Institute of Standards and Technology and other appropriate Federal entities, develop a quantum information science taxonomy and standards and requirements for quantum information technology;
- (5) support efforts to increase the technology readiness level of quantum information science technologies under development in the United States;
- (6) not later than 180 days after the date of the enactment of this Act, develop and continuously update guidance, including classification and data management plans for defense-related quantum information science and technology activities, and policies for

- control of personnel participating on such activities to minimize the effects of loss of intellectual property in basic and applied ~~quantum science~~ quantum information science and information considered sensitive to the leadership of the United States in the field of quantum information science and technology; and
- (7) develop memoranda of agreement, joint funding agreements, and other cooperative arrangements necessary ~~for meeting the long term challenges and achieving the specific technical goals~~ for carrying out the program under subsection (a).
 - (d) Quantum Information Science Research Centers.--The Secretary of each military department may establish or designate a defense laboratory or establish activities to engage with appropriate public and private sector organizations, including academic organizations, to enhance and accelerate the research, development, and deployment of quantum information sciences and quantum information science-enabled technologies and systems. The Secretary of Defense shall ensure that not less than one such laboratory or center is established or designated.
 - (e) Report.--
 - (1) In general.--Not later than December 31, 2020, the Secretary shall submit to the congressional defense committees a report on the program, in both classified and unclassified format.
 - (2) Elements.--The report required by paragraph (1) shall include the following:
 - (A) A description of the knowledge-base of the Department with respect to quantum information sciences, plans to defend against quantum based attacks, and any plans of the Secretary to enhance such knowledge-base.
 - (B) A plan that describes how the Secretary intends to use quantum information sciences for military applications and to meet other needs of the Department, including a discussion of likely impacts of quantum information science and technology on military capabilities.
 - (C) An assessment of the efforts of foreign powers to use quantum information sciences for military applications and other purposes.
 - ~~(D) A description of activities undertaken consistent with this section, including funding for activities consistent with the section.~~
 - (D) A description of the activities carried out in accordance with this section, including, for each such activity--
 - (i) a roadmap for the activity;
 - (ii) a summary of the funding provided for the activity; and
 - (iii) an estimated timeline for the development and military deployment of quantum technologies supported through the activity.
 - (E) A description of the efforts of the Department of Defense to update classification and cybersecurity practices relating to quantum technology, including--
 - (i) security processes and requirements for engagement with allied countries; and
 - (ii) a plan for security-cleared government and contractor workforce development.
 - (F) Such other matters as the Secretary considers appropriate.

SEC. 247. REPORTS ON COMPARATIVE CAPABILITIES OF ADVERSARIES IN KEY TECHNOLOGY AREAS.

[The report authorized in this section includes quantum information science, highlighted below.]

(c) Technical Areas.--The Secretary shall ensure that the reports submitted under subsection (a) cover the following:

- (1) Hypersonics.
- (2) Artificial intelligence.
- (3) Quantum information science.
- (4) Directed energy weapons.
- (5) Such other emerging technical areas as the Secretary considers appropriate.

NDAA 2020

National Defense Authorization Act for Fiscal Year 2020

Public Law 116-92

Enacted December 20, 2019

SEC. 220. MODIFICATION OF DEFENSE QUANTUM INFORMATION SCIENCE AND TECHNOLOGY RESEARCH AND DEVELOPMENT PROGRAM.

[Amended Section 234 of NDA 2019, as shown in the previous section.]

SEC. 1741. IMPROVEMENTS TO MANUFACTURING USA PROGRAM.

[Section 34 of the National Institute of Standards and Technology Act (15 U.S.C. 278s) is amended to including the following, with quantum information science highlighted below.]

(d) Manufacturing USA Institutes.--

- (1) In general.--For purposes of this section, a Manufacturing USA institute is an institute that--
 - (A) has been established by a person or group of persons to address challenges in advanced manufacturing and to assist manufacturers in retaining or expanding industrial production and jobs in the United States;
 - (B) has a predominant focus on a manufacturing process, novel material, enabling technology, supply chain integration methodology, or another relevant aspect of advanced manufacturing, such as nanotechnology applications, advanced ceramics, photonics and optics, composites, biobased and advanced materials, flexible hybrid technologies, tool development for microelectronics, food manufacturing, superconductors, advanced battery technologies, robotics, advanced sensors, quantum information science, supply chain water optimization, aeronautics and advanced materials, and graphene and graphene commercialization;
 - (C) has the potential--
 - (i) to improve the competitiveness of United States manufacturing, including key advanced manufacturing technologies such as nanotechnology, advanced ceramics, photonics and optics, composites, biobased and advanced materials, flexible hybrid technologies, tool development for microelectronics, food manufacturing, superconductors, advanced battery technologies, robotics, advanced sensors, quantum information science, supply chain water optimization, aeronautics and advanced materials, and graphene and graphene commercialization;
 - (ii) to accelerate non-Federal investment in advanced manufacturing production capacity in the United States; or
 - (iii) to enable the commercial application of new technologies or industry-wide manufacturing processes; and

- (D) includes active participation among representatives from multiple industrial entities, research universities, community colleges, and other entities as appropriate, which may include industry-led consortia, career and technical education schools, Federal laboratories, State, local, and Tribal governments, businesses, educational institutions, and nonprofit organizations.

NDA 2022

National Defense Authorization Act for Fiscal Year 2022

Public Law 117-81

Enacted December 27, 2021

SEC. 229. ACTIVITIES TO ACCELERATE DEVELOPMENT AND DEPLOYMENT OF DUAL-USE QUANTUM TECHNOLOGIES.

- (a) Activities Required.--The Secretary of Defense shall establish a set of activities--
- (1) to accelerate the development and deployment of dual-use quantum capabilities;
 - (2) to ensure the approach of the United States to investments of the Department of Defense in quantum information science research and development reflects an appropriate balance between scientific progress and the potential economic and security implications of such progress;
 - (3) to ensure that the Department of Defense is fully aware and has a technical understanding of the maturity and operational utility of new and emerging quantum technologies; and
 - (4) to ensure the Department of Defense consistently has access to the most advanced quantum capabilities available in the commercial sector to support research and modernization activities.
- (b) Assistance Program.--
- (1) Program required.--In carrying out subsection (a) and subject to the availability of appropriations for such purpose, the Secretary of Defense shall, acting through the Director of the Defense Advanced Research Projects Agency and in consultation with appropriate public and private sector organizations, establish a program under which the Secretary may award assistance to one or more organizations--
 - (A) to identify defense applications for which dual-use quantum technologies provide a clear advantage over competing technologies;
 - (B) to accelerate development of such quantum technologies; and
 - (C) to accelerate the deployment of dual-use quantum capabilities.
 - (2) Form of assistance.--Assistance awarded under the program required by paragraph (1) may consist of a grant, a contract, a cooperative agreement, other transaction, or such other form of assistance as the Secretary of Defense considers appropriate.
 - (3) Authorities and acquisition approaches.--The Secretary of Defense may use the following authorities and approaches for the program required by paragraph (1):
 - (A) Section 2374a of title 10, United States Code, relating to prizes for advanced technology achievements.
 - (B) Section 2373 of such title, relating to procurement for experimental purposes.
 - (C) Sections 2371 and 2371b of such title, relating to transactions other than contracts and grants and authority of the Department of Defense to carry out certain prototype projects, respectively.
 - (D) Section 2358 of such title, relating to research and development projects.

- (E) Section 879 of the National Defense Authorization Act for Fiscal Year 2017 (Public Law 114-328; 10 U.S.C. 2302 note), relating to defense pilot program for authority to acquire innovative commercial products, technologies, and services using general solicitation competitive procedures.
- (F) Requirement for milestone payments based on technical achievements.
- (G) Requirement for cost share from private sector participants in the program.
- (H) Commercial procurement authority under part 12 of the Federal Acquisition Regulation.
- (I) Such other authorities or approaches as the Secretary considers appropriate.
- (4) Policies and procedures.--The Secretary of Defense shall, in consultation with such experts from government and industry as the Secretary considers appropriate, establish policies and procedures to carry out the program required by paragraph (1).
- (c) Briefing and Report.--
 - (1) Briefing.--Not later than March 1, 2022, the Secretary of Defense shall provide to the congressional defense committees a briefing on the plan to carry out the activities required by subsection (a) and the program required by subsection (b).
 - (2) Report.--Not later than December 31, 2022, and not less frequently than once each year thereafter until December 31, 2026, the Secretary of Defense shall submit to the congressional defense committees a report on the activities carried out under subsection (a) and the program carried out under subsection (b).

SEC. 511. MODIFICATION OF GRANT PROGRAM SUPPORTING SCIENCE, TECHNOLOGY, ENGINEERING, AND MATH EDUCATION IN THE JUNIOR RESERVE OFFICERS' TRAINING CORPS TO INCLUDE QUANTUM INFORMATION SCIENCES.

[The amended grant program now includes **quantum information sciences**, highlighted below.]

Section 2036(g)(2) of title 10, United States Code, is amended--

- (1) by redesignating subparagraphs (J) through (M) as subparagraphs (K) through (N), respectively; and
- (2) by inserting after subparagraph (I) the following new subparagraph:
“(J) **quantum information sciences**.”.

SEC. 6606. ESTABLISHMENT OF SUBCOMMITTEE ON THE ECONOMIC AND SECURITY IMPLICATIONS OF QUANTUM INFORMATION SCIENCE.

[Amended the NQI Act to establish the Subcommittee on the Economic and Security Implications of Quantum Information Science.]

SEC. 1251. COMPARATIVE ANALYSES AND REPORTS ON EFFORTS BY THE UNITED STATES AND THE PEOPLE'S REPUBLIC OF CHINA TO ADVANCE CRITICAL MODERNIZATION TECHNOLOGY WITH RESPECT TO MILITARY APPLICATIONS.

[The assessment authorized in this section includes **quantum science**, highlighted below.]

- (2) Comparative analysis assessments.--
 - (A) In general.--The Under Secretary, in coordination with the Director of the Office of Net Assessment, shall conduct a comparative analysis assessment of the efforts of the United States Government and the Government of the People's Republic of China to

develop and deploy critical modernization technology with respect to military applications in each of the following areas of critical modernization technology:

- (i) Directed energy systems.
- (ii) Hypersonics.
- (iii) Emerging biotechnologies.
- (iv) Quantum science.
- (v) Cyberspace capabilities.

CHIPS and Science Act of 2022

[Supreme Court Security Funding Act of 2022](#)

Public Law 117-167

Enacted August 9, 2022

SEC. 10102. BASIC ENERGY SCIENCES PROGRAM.

[Section 303 of the Department of Energy Research and Innovation Act (42 U.S.C. 18641) is amended to include the following, with **quantum information science** highlighted.]

(10)Nanoscale science research center recapitalization project.--

- (A) In general.--The Secretary shall provide for the recapitalization of the Nanoscale Science Research Centers, to include the upgrade of equipment at each Center supported by the Office of Science on the date of enactment of the Research and Development, Competition, and Innovation Act, to accelerate advances in the various fields of science including nanoscience, materials, chemistry, biology, and **quantum information science**.
- (B) Funding.--Out of funds authorized to be appropriated under subsection (j), there are authorized to be appropriated to the Secretary to carry out the recapitalization under this paragraph--
 - (i) \$25,000,000 for fiscal year 2023; and
 - (ii) \$25,000,000 for fiscal year 2024.

SEC. 10104. ADVANCED SCIENTIFIC COMPUTING RESEARCH PROGRAM.

[Section 304 of the Department of Energy Research and Innovation Act (42 U.S.C. 18642) is amended to include the following, with quantum-relevant terms highlighted.]

(e) Advanced Computing Program.--

- (1) In general.--The Secretary shall establish a program to develop and implement a strategy for achieving computing systems with capabilities beyond exascale computing systems. In establishing this program, the Secretary shall--
 - (A) maintain foundational research programs in mathematical, computational, and computer sciences focused on new and emerging computing needs within the mission of the Department, including post-Moore's law computing architectures, novel approaches to modeling and simulation, artificial intelligence and scientific machine learning, **quantum computing**, edge computing, extreme heterogeneity, including potential **quantum accelerators**, and distributed high-performance computing;
 - (B) retain best practices and maintain support for essential hardware, applications, and software elements of the Exascale Computing Program that are necessary for sustaining the vitality of a long-term capable software ecosystem for exascale and beyond; and

- (C) develop a Department-wide strategy for balancing on-premises and cloud-based computing and scientific data management.
- (2) Report.--Not later than 1 year 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 report on the development and implementation of the strategy described in paragraph (1).

[...]

- (j) Computational Science Graduate Fellowship.--
 - (1) In general.--The Secretary shall support the Computational Science Graduate Fellowship program in order to facilitate collaboration between graduate students and researchers at the National Laboratories, and contribute to the development of a diverse and inclusive computational workforce to help advance research in all areas of computational science relevant to the mission of the Department, including quantum computing.
 - (2) Funding.--Of the funds authorized to be appropriated for the Advanced Scientific Computing Research Program, there are authorized to be appropriated to the Secretary for carrying out activities under this subsection--
 - (A) \$15,750,000 for fiscal year 2023;
 - (B) \$16,537,500 for fiscal year 2024;
 - (C) \$17,364,375 for fiscal year 2025;
 - (D) \$18,232,594 for fiscal year 2026; and
 - (E) \$19,144,223 for fiscal year 2027.
- (k) Authorization of Appropriations.--Out of funds authorized to be appropriated for the Office of Science in a fiscal year, there are authorized to be appropriated to the Secretary to carry out the activities described in this section--
 - (1) \$1,126,950,000 for fiscal year 2023;
 - (2) \$1,194,109,500 for fiscal year 2024;
 - (3) \$1,265,275,695 for fiscal year 2025;
 - (4) \$1,340,687,843 for fiscal year 2026; and
 - (5) \$1,420,599,500 for fiscal year 2027."

[This Section also amended the NQI Act to include the Department of Energy Quantum Network Infrastructure Research and Development Program and the Department of Energy Quantum User Expansion for Science and Technology (QUEST) Program.]

SEC. 10230. ADVANCED COMMUNICATIONS RESEARCH.

[The National Institute of Standards and Technology Act (15 U.S.C. 271 et seq.) is amended to include quantum communications, highlighted below.]

- (a) Advanced Communications Research.--
 - (1) In general.--The Director, in consultation with the Assistant Secretary for Communications and Information, the Director of the National Science Foundation, and heads of other Federal agencies, as appropriate, shall carry out a program of measurement research for advanced communications technologies.
 - (2) Research areas.--Research areas may include--
 - (A) radio frequency emissions and interference, including technologies and techniques to mitigate such emissions and interference;

- (B) advanced antenna arrays and artificial intelligence systems capable of operating advanced antenna arrays;
- (C) artificial intelligence systems to enable internet of things networks, immersive technology, and other advanced communications technologies;
- (D) network sensing and monitoring technologies;
- (E) technologies to enable spectrum flexibility and agility;
- (F) optical and quantum communications technologies;
- (G) security of advanced communications systems;
- (H) public safety communications;
- (I) resilient internet of things applications for advanced manufacturing; and
- (J) other research areas determined necessary by the Director.

SEC. 10316. FEDERAL CYBER SCHOLARSHIP-FOR-SERVICE PROGRAM.

[The amended scholarship program now includes quantum computing, highlighted below.]

- (a) Sense of Congress.--It is the sense of Congress that--
 - (1) since cybersecurity risks are constant in the growing digital world, it is critical that the United States stay ahead of malicious cyber activity with a workforce that can safeguard our innovation, research, and work environments; and
 - (2) Federal investments in the Federal Cyber Scholarship-for-Service Program at the National Science Foundation play a critical role in preparing and sustaining a strong, talented, and much-needed national cybersecurity workforce and should be strengthened.
- (b) In General.--Section 302(b)(1) of the Cybersecurity Enhancement Act of 2014 (15 U.S.C. 7442(b)(1)) is amended by striking the semicolon at the end and inserting the following ``and cybersecurity-related aspects of other related fields as appropriate, including artificial intelligence, quantum computing and aerospace;''.

SEC. 10318. MICROELECTRONICS WORKFORCE DEVELOPMENT ACTIVITIES.

[Activities to develop the microelectronics workforce should be coordinated with the activities carried out under the National Quantum Initiative Act, highlighted below.]

- (a) Creating Helpful Initiatives to Produce Personnel in Needed Growth Industries.--
 - (1) In general.--The Director shall make awards to institutions of higher education, non-profit organizations, or consortia thereof, for research, development, and related activities to advance innovative approaches to developing, improving, and expanding evidence-based education and workforce development activities and learning experiences at all levels of education in fields and disciplines related to microelectronics.
 - [...]
- (b) National Network for Microelectronics Education.--
 - (1) <> In general.--The Director, in coordination with the Secretary of Commerce, shall on a competitive, merit-reviewed basis, make awards to institutions of higher education and non-profit organizations (or consortia of such institutions and organizations) to establish partnerships to enhance and broaden participation in microelectronics education.
 - [...]
 - (7) Coordination across foundation programs.--In carrying out the activities under this section, the Director shall ensure awardees coordinate with, and avoid unnecessary duplication of,

the activities carried out under this Section with the activities of the 21st Century Nanotechnology Research and Development Act (Public Law 108-153), the National Quantum Initiative Act (Public Law 115-368), and Division E of the William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021, and other related programs, as appropriate.

[...]

SEC. 10387. CHALLENGES AND FOCUS AREAS.

[Quantum information science and technology (highlighted below) is set as an initial key technology focus area for the new NSF Directorate for Technology, Innovation, and Partnerships (TIP).]

- (c) Initial List of Key Technology Focus Areas.--The initial list of key technology focus areas are the following:
- (1) Artificial intelligence, machine learning, autonomy, and related advances.
 - (2) High performance computing, semiconductors, and advanced computer hardware and software.
 - (3) Quantum information science and technology.
 - (4) Robotics, automation, and advanced manufacturing.
 - (5) Natural and anthropogenic disaster prevention or mitigation.
 - (6) Advanced communications technology and immersive technology.
 - (7) Biotechnology, medical technology, genomics, and synthetic biology.
 - (8) Data storage, data management, distributed ledger technologies, and cybersecurity, including biometrics.
 - (9) Advanced energy and industrial efficiency technologies, such as batteries and advanced nuclear technologies, including but not limited to for the purposes of electric generation (consistent with section 15 of the National Science Foundation Act of 1950 (42 U.S.C. 1874)).
 - (10) Advanced materials science, including composites 2D materials, other next-generation materials, and related manufacturing technologies.

SEC. 10661. QUANTUM NETWORKING AND COMMUNICATIONS.

[In subsection (b), amended the NQI Act to task the Quantum Networking Working Group to produce “a report detailing a plan for the advancement of quantum networking and communications technology.” In subsection (c), amended the NQI Act to task NIST with carrying out quantum networking and communications research and standardization. In subsection (d), tasked NSF with the following:]

- (d) Quantum Information Science Workforce Evaluation and Acceleration.--
- (1) In general.--Not later than 180 days after the date of the enactment of this Act, the Director shall enter into an agreement with the National Academies of Sciences, Engineering, and Medicine to conduct a study to evaluate and make recommendations for the quantum information science workforce. The study shall--
 - (A) characterize the quantum information science workforce, including by--
 - (i) describing what constitutes a quantum information science qualified worker across sectors, including academia, the Federal Government, and industry; and
 - (ii) describing the size and makeup of the quantum information science workforce, including an assessment of current and future trends;

- (B) identify near- and long-term quantum information science workforce needs across government, academia, and industry sectors, including identifying the cross-disciplinary academic degrees or academic courses necessary to--
 - (i) prepare students for multiple career pathways in quantum information sciences and related fields;
 - (ii) ensure the United States is competitive in the field of quantum information science while preserving national security; and
 - (iii) support the development of quantum applications;
 - (C) assess the state of quantum information science education and skills training at all education levels and identify gaps in meeting current and future workforce needs, including with respect to--
 - (i) elementary, middle, and high-school student access to foundational courses, age-appropriate quantum concepts, and hands-on learning opportunities;
 - (ii) elementary, middle, and high-school teacher professional development and access to resources, materials, lesson plans, modules, and curricula;
 - (iii) career pivot and skills training opportunities, including professional certificates and internships; and
 - (iv) higher education curricula, laboratory experiences in academia, the Federal Government, and industry settings, and cross-discipline degree programs aligned with workforce needs; and
 - (D) make recommendations for developing a diverse, flexible, and sustainable quantum information science workforce that meets the evolving needs of academia, the Federal Government, and industry.
- (2) Report.--Not later than two years after the date of the enactment of this Act, the National Academies of Science, Engineering, and Medicine shall submit to Congress and the Director a report containing the results of the study conducted pursuant to paragraph (1).

[In subsection (e), amended the NQI Act to task NSF with integrating quantum information science and engineering into the STEM curriculum at all education levels. In subsection (f), tasked NSF with the following:]

- (f) Quantum Education Pilot Program.--
 - (1) In general.--Not later than one year after the date of the enactment of this Act, the Director, building on the National Science Foundation's role in the National Q-12 Education Partnership and programs such as Q2Work Program, shall make awards to institutions of higher education, non-profit organizations, or consortia thereof to carry out a pilot program, to be known as the "Next Generation Quantum Leaders Pilot Program" (in this subsection referred to as the "Program"), for the education and training of the next generation of students and teachers in the fundamental principles of quantum mechanics.
 - (2) Requirements.--
 - (A) In general.--In carrying out the Program, the Director shall--
 - (i) encourage awardees to coordinate with educational service agencies (as such term "educational service agency" is defined in section 602(5) of the Individuals with Disabilities Education Improvement Act of 2004 (20 U.S.C. 1401(5))), associations that support STEM educators or local educational agencies, and partnerships through the Q-12 Education Partnership, to encourage elementary schools, middle schools, and secondary schools, and State educational agencies to participate in the Program;

- (ii) require that awardees partner with elementary schools, middle schools, or secondary schools, or consortia thereof, and State educational agencies, to carry out activities under the Program;
- (B) Use of funds.--In carrying out the Program, the Director shall make competitive, merit-reviewed awards to--
 - (i) support testing, evaluation, dissemination, and implementation of age-appropriate quantum information sciences curricula and resources, including the integration of quantum information science and engineering into the STEM curriculum pursuant to subsection (d) of section 301 of the National Quantum Initiative Act
 - (i) (15 U.S.C. 8841), as added by subsection (e);
 - (ii) support opportunities for informal education on quantum concepts, including informal hands-on learning opportunities;
 - (iii) support opportunities for students to further explore quantum information science education and related careers;
 - (iv) develop and implement training, research, and professional development programs for teachers, including innovative pre-service and in-service programs, in quantum information science and related fields; and
 - (v) carry out such other activities as the Director determines appropriate.
- (C) Distribution.--In carrying out the Program and to the extent practicable, the Director shall ensure there is a wide, equitable distribution of Program participants across diverse geographic areas and that the Program includes a diverse representation of students, including students from groups historically underrepresented in STEM.
- (3) Consultation.--The Director shall carry out the Program in consultation with the QIS Workforce Working Group of the Subcommittee on Quantum Information Science of the National Science and Technology Council and the Advancing Informal STEM Learning Program.
- (4) Reporting.--Not later than four years after the date of the enactment of this section, the Director shall submit to Congress a report that includes the following:
 - (A) An assessment, that includes feedback from a wide range of stakeholders in academia, K-12 education, and the private sector, of the effectiveness of the Program in scaling up implementation of effective quantum education and training innovations.
 - (B) If determined to be effective, a plan for integrating the Program into existing programs, including the feasibility and advisability of expanding the scope of the Program to include additional technology areas, grade levels, and educational institutions beyond those originally selected to participate in the Program.
- (5) Authorization of appropriations.--There are authorized to be appropriated to the Director \$8,000,000 for each of fiscal years 2023 through 2026 to carry out this section.
- (6) Termination.--This subsection shall terminate on the date that is four years after the date of the enactment of this Act.

SEC. 10731. MICROELECTRONICS RESEARCH FOR ENERGY INNOVATION.

[The Department of Energy is tasked with creating a microelectronics research program, including Microelectronics Science Research Centers, that should coordinate with the **National Quantum Information Science Research Centers**, highlighted below.]

- (1) Coordination.--The Secretary shall--

- (A) establish a coordinating network to coordinate cross-cutting research and foster communication and collaboration among the Centers; and
- (B) ensure coordination, and avoid unnecessary duplication, of the activities of each Center with the activities of--
 - (i) other research entities of the Department, including--
 - (I) the Nanoscale Science Research Centers;
 - (II) the National Quantum Information Science Research Centers;
 - (III) the Energy Frontier Research Centers;
 - (IV) the Energy Innovation Hubs;
 - (V) the National Laboratories; and
 - (VI) other offices of the Department;
 - (ii) the National Semiconductor Technology Center established under section 9906(c)(1) of the William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021 (15 U.S.C. 4656(c)(1));
 - (iii) institutions of higher education;
 - (iv) industry; and
 - (v) relevant research activities carried out by other Federal agencies.