COMMITTEE ON
SCIENCE, SPACE
AND TECHNOLOGY
CHAIRMAN BRIAN BABIN

FULL COMMITTEE

HEARING CHARTER

"Assessing U.S. Leadership in Quantum Science and Technology"

Thursday, January 22, 2026
10:00 a.m.
2318 Rayburn House Office Building

PURPOSE

The purpose of this hearing is to evaluate the current state of quantum research, development, technology, and engineering in the United States. It will provide an opportunity to review the first seven years of the National Quantum Initiative Act (NQIA), examine the economic value and applications of quantum science, assess the national security importance of advancing quantum capabilities, and consider policy priorities for the next five years. The hearing will help inform legislation to reauthorize NQIA programs.

WITNESSES

- **Dr. James Kushmerick**, Director, Physical Measurement Laboratory, National Institute of Standards and Technology
- **Dr. Saul Gonzalez**, Deputy Directorate Head, Directorate for Mathematical and Physical Sciences, National Science Foundation
- **Dr. Mark Clampin**, Deputy Associate Administrator, Science Mission Directorate, National Aeronautics and Space Administration
- **Dr. Tanner Crowder**, Quantum Information Science Lead, Office of Science, Department of Energy

KEY QUESTIONS

- How has the state of quantum science advanced during the first seven years of the National Quantum Initiative Act?
- Which programs and activities authorized under the National Quantum Initiative Act have been most successful in advancing quantum science?
- What challenges have government, industry, and academia faced in implementing the National Quantum Initiative Act?
- Which areas or policies should Congress prioritize over the next five years of the National Quantum Initiative?

- What can Congress do to meet the workforce and educational needs of the quantum industry?
- Is the United States keeping pace with China in developing quantum capabilities?

BACKGROUND

Basics of Quantum Physics and Mechanics: Quantum theory is the theoretical basis of modern physics that explains the nature and behavior of matter and energy at the atomic and subatomic levels. The nature and behavior of matter and energy at subatomic levels may be referred to as quantum physics or quantum mechanics.

Quantum physics explains how atomic and subatomic particles, and the smallest packets of energy, such as photons, behave. Quantum mechanics provides an explanation for understanding what happens at these extremely small scales. Several key properties of quantum mechanics have enabled major technological breakthroughs:

- Superposition – the ability for subatomic particles to exist in one of two states, or both states simultaneously.
- Entanglement – the ability for subatomic particles that have been separated to instantaneously respond to each other.
- Uncertainty – the fact that we cannot know the precise location and state of a quantum particle at any time.

Research in quantum science has driven the development of technologies such as lasers, magnetic resonance imaging (MRI), superconducting magnets, light-emitting diodes, transistors, semiconductors/microprocessors, and electron microscopy. Quantum mechanics also holds the potential for significant advances in crucial areas like computing, precision measurement, cryptography, and secure communications.

Quantum Information Science (QIS): Quantum information science combines information theory and quantum physics to develop new and more powerful ways of processing, transmitting, and securing information.

QIS has a wide range of potential applications, some of which are already in use or in early to mid-stage testing, including satellite communications and highly sensitive sensing technologies. Other applications are expected to mature over the next five to ten years. These include quantum sensors capable of identifying underground oil and mineral deposits or detecting seismic signals from nuclear explosions that traditional devices may be unable to discern. New portable quantum navigation devices, some of which are already undergoing rigorous testing, could enable soldiers and weapons platforms to operate in environments where GPS signals are jammed or disabled.[1] QIS may also enable the development of communications systems that are resistant to both traditional and quantum-based cryptographic methods. China has already demonstrated secure quantum communications capabilities and is operating a quantum communications network

[1] Swayne, Matt, Boeing's Quantum-based Navigation System Takes Flight in Historic Test, August 9, 2024, available at https://thequantuminsider.com/2024/08/09/boeings-quantum-based-navigation-system-takes-flight-in-historic-test/

linking Beijing and South Africa, underscoring the strategic importance of U.S. leadership in this field.[2]

Quantum Computing: The basic architecture of modern computers has remained largely unchanged for more than 75 years. While advances in materials and computer science continue to push the envelope of classical computing speed and power, it has become increasingly clear that the physical limits of classic computing are within view. [3]

Quantum computing is in its pre-market stage, but as the technology matures, it promises significant improvements in computing speed and performance over conventional systems for certain critical classes of problems.

Several key areas of science and technology could be profoundly affected, including:

- Cryptography – Current methods of encrypting electronic information rely on mathematical complexity to overwhelm even the most powerful supercomputers. With sufficiently advanced quantum computers, it is believed that every bit of electronic information, from credit card transactions to national security secrets, could be decrypted instantly.[4] At the same time, quantum-based encryption techniques could enable communications that are effectively secure for the foreseeable future.
- Chemistry and physics research – By modeling the electronic structure of large and complex molecules, quantum computers could reduce reliance on time-consuming and expensive trial-and-error methods. This capability could accelerate the development of advanced materials for applications ranging from aeronautics to pharmaceuticals, making discovery faster and more cost-effective.[5]
- Complex data analytics – In many areas of data analysis, quantum computers could offer orders-of-magnitude speed advantages. Tasks such as analyzing and managing vast amounts of data in near real time could become feasible.[6]

Quantum computers are not expected to replace classical computers. Instead, their fundamentally different operating principles allow them to perform certain calculations that are impractical or impossible for classical computers.[7] Classical computers encode information in bits, which represent either a zero or a one. Quantum computers, by contrast, use "qubits," which can represent a zero, a one, or both simultaneously. This capability enables quantum computers to solve specific problems more efficiently.

The United States remains the global leader in quantum computing, due in large part to a robust

---

[2] Swayne, Matt. China Establishes Quantum-Secure Communication Links With South Africa, 14 March 2025, available at https://spacenews.com/china-is-developing-a-quantum-communications-satellite-network/
[3] Madasamy, Karthee. "As Tech Reaches Compute Limits, Quantum Computing Must Work ." *EE Times*, 7 Apr. 2025, www.eetimes.com/as-tech-reaches-compute-limits-quantum-computing-must-work/.
[4] Caltech Science Exchange, How Will Quantum Technologies Change Cryptography?, available at https://scienceexchange.caltech.edu/topics/quantum-science-explained/quantum-cryptography
[5] IEEE Spectrum, Quantum Computers Getting Smarter at Simulating Chemistry, available at https://spectrum.ieee.org/quantum-chemistry-largest
[6] MIT, Inspiring Quantum Data Analysts, available at https://hdsr.mitpress.mit.edu/pub/eyywouav/release/3
[7] Department of Energy, DOE Explains…Quantum Computing, available at https://www.energy.gov/science/doe-explainsquantum-computing

private-sector research and development community. The U.S. also hosts the most active quantum startup community, with dozens of companies advancing applications across a wide range of use cases.[8] This ecosystem has contributed to America's lead in quantum computing patent filings, although China continues to narrow that gap each year.[9]

Quantum Sensing: Quantum sensors use the fundamental properties of atoms and light to make extremely precise measurements.[10] In 2025, the Defense Advanced Research Projects Agency (DARPA) launched its Robust Quantum Sensors (RoQS) program to develop quantum sensors that can maintain high sensitivity while operating in real-world and challenging environments.[11] While additional work is needed to further develop and harden these sensors, they demonstrate how quantum technologies are already being deployed to support national defense and other critical missions.

Quantum sensing is also showing promise in the biomedical field. Because of their exceptional accuracy at very small scales, quantum sensors can detect subtle biological and physical signals.[12] These capabilities may enable more precise brain imaging, improved measurement at the cellular level, and new tools for advanced medical research and diagnostics.[13]

Quantum Networking and Communications: Quantum networks use the quantum properties of photons to encode and transmit information. These properties make quantum communication uniquely secure, as any attempt to intercept the signal can be detected.[14] Quantum networking may also enable communication across vast distances. Through entanglement, two quantum units can exhibit correlated behavior even when separated by large distances. To extend the reach of these networks, the Department of Energy and other partners are developing quantum network repeaters that use entanglement to support long-distance communication.[15]

THE GLOBAL RACE FOR QUANTUM LEADERSHIP

Summary: Quantum technologies are expected to be transformative across the scientific, economic, and defense domains. As a result, a global race is underway among major powers to develop operational quantum platforms for a variety of applications. While the United States

---

[8] Tracxn, Quantum Computing Startups in the United States, April 5, 2025, available at Top Companies in Superconducting Quantum Computer (Apr, 2025) - Tracxn

[9] QED-C, State of Quantum Industry Innovation – What Patents Tell Us, December 11, 2024, available at https://quantumconsortium.org/blog/state-of-quantum-industry-innovation-what-patents-tell-us/#:~:text=The%20U.S.%20patent%20office%20has,Japanese%20patent%20office%20is%20third.

[10] Nature, Quantum sensors will start a revolution — if we deploy them right, May 24, 2023, available at https://www.nature.com/articles/d41586-023-01663-0#:~:text=Quantum%20sensors%20exploit%20the%20fundamental,for%20making%20a%20quantum%20computer.

[11] Defense Advanced Research Projects Agency (DARPA), Taking quantum sensors out of the lab and into defense platforms, available at https://www.darpa.mil/news/2025/quantum-sensors-defense-platforms

[12] Aslam, N., Zhou, H., Urbach, E.K. *et al.* Quantum sensors for biomedical applications, February 3, 2023, available at https://www.nature.com/articles/s42254-023-00558-3#citeas

[13] Id.

[14] Department of Energy, DOE Explains…Quantum Networks, available at https://www.energy.gov/science/doe-explainsquantum-networks

[15] Id.

maintains its global leadership in theoretical physics that underpins quantum computing and related technologies, adversarial nations such as China have taken the lead in developing quantum applications and advancing the programming expertise needed to operationalize them.[16] China's government investment in applied quantum science is estimated to be double that of the European Union and triple that of the United States government.[17] However, in 2023, private investment in quantum startups in the U.S. was roughly ten times greater than in China.[18]

China: The Chinese Communist Party (CCP) has identified quantum capabilities as one of several mission-critical technologies for its economic and national security. In 2016, China launched a large-scale quantum initiative aimed at surpassing the United States by 2030. Under its 14th Five-Year Plan, China announced plans to invest an estimated $15.3 billion in quantum research and development activities.[19] Since then, China has claimed major breakthroughs in quantum capabilities, including the unveiling of the Zuchongzhi-3, a 105-qubit superconducting quantum processor that reportedly operates ten to fifteen times faster than the world's most powerful classical computer,[20] and Hanyuan No. 1, China's first atomic quantum computer for commercial use.[21] China has also made claims regarding advances in defense-related quantum applications that have not been independently verified or peer-reviewed. Still, the increasing frequency of such claims underscores the CCP's interest in gaining a competitive advantage over its challengers.

Russia: Russia established its National Quantum Laboratory under Rosatom[22] and has integrated quantum technologies into its strategic technology roadmaps. The country has developed and tested a 72-qubit atom-based quantum computing prototype and aims to scale toward hundreds of high-fidelity qubits by 2030.[23] Despite early progress, international sanctions and the resource demands of the war in Ukraine have likely hindered Russia's quantum advancements.[24] The conflict has also disrupted global supply chains, including access to critical resources such as helium.[25]

---

[16] Swayne, Matt, Report: China is Challenging U.S. Leadership in Quantum, September 9, 2024, available at https://thequantuminsider.com/2024/09/09/report-china-is-challenging-u-s-leadership-in-quantum/

[17] Ivezic, Marvin, China's Quantum Computing and Quantum Technology Initiatives, December 30, 2024, available at https://postquantum.com/quantum-computing/china-quantum/

[18] Omaar, Hodan and Makaryan, Martin, How Innovative is China in Quantum?, September 9, 2024, The Information Technology and Innovation Foundation, available at https://itif.org/publications/2024/09/09/how-innovative-is-china-in-quantum/

[19] Mateusz Masiowski et al., "Quantum Computing Funding Remains Strong, But Talent Gap Raises Concern," McKinsey Digital, June 2022, https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/quantum-computing-funding-remains-strong-but-talent-gap-raises-concern

[20] Romero, Romero. Quantum Singularity Ahead? China's Zuchongzhi-3 Reshapes Quantum Race, Forbes, 10 March 2025, available at https://www.forbes.com/sites/luisromero/2025/03/10/quantum-singularity-ahead-chinas-zuchongzhi-3-reshapes-quantum-race/

[21] Swayne, Matt, Chinese Report Neutral-Atom Quantum Computer Enters Commercial Use, December 1, 2025, available at: https://thequantuminsider.com/2025/11/02/chinese-report-neutral-atom-quantum-computer-enters-commercial-use/

[22] Swayne, Matt, Russia sets up National Quantum Lab, January 28, 2022, available at https://thequantuminsider.com/2022/01/28/russia-sets-up-national-quantum-lab/

[23] Ur Rehman, Mohib, Russian Researchers Test 72-Qubit Atom-Based Quantum Computer, December 27, 2025, available at: https://thequantuminsider.com/2025/12/27/russia-72-qubit-neutral-atom-quantum-computer/

[24] Beating China in the Race for Quantum Supremacy | The Heritage Foundation

[25] Swayne, Matt. "How Will the Ukraine–Russia Crisis Affect Quantum?" The Quantum Insider, March 10, 2022,

Europe: In 2018, the European Union (EU) launched Quantum Flagship, a 10-year research initiative with an approximate $1.06 billion budget.[26] This program funds research in quantum computing, simulation, communications, basic quantum physics, quantum metrology, and quantum sensing, and includes efforts to modernize communications networks through quantum key distribution cryptography.[27] In December 2023, the EU released the European Declaration on Quantum Technologies, outlining objectives such as aligning European, national, and regional research and development programs, accelerating the transition of quantum innovations from the laboratory to commercial applications, and establishing quantum infrastructure to support research, testing, and deployment across Europe.[28] In July 2025, the European Commission released a strategy aimed at making Europe a global leader in quantum technology by 2030.[29] The Commission is also expected to release a quantum act proposal in 2026.

LEGISLATIVE HISTORY AND THE GOVERNMENT'S ROLE IN QUANTUM SCIENCE

National Quantum Initiative Act: The National Quantum Initiative Act[30] (NQIA) was signed into law by President Trump on December 21, 2018, to "accelerate quantum research and development for the economic and national security of the United States." The NQIA authorizes the National Institute of Standards and Technology (NIST), the National Science Foundation (NSF), and the Department of Energy (DOE) to strengthen QIS Programs, Centers, and Consortia. The NQIA also called for a coordinated approach to QIS research and development (R&D) across the United States Government, including the civilian, defense, and intelligence sectors.

To support this coordination, the NQIA assigns responsibilities to the National Science and Technology Council (NSTC) Subcommittee on Quantum Information Science (SCQIS), the NSTC Subcommittee on the Economic and Security Implications of Quantum Science (ESIX), the National Quantum Coordination Office (NQCO), and the National Quantum Initiative Advisory Committee (NQIAC).

In the 117th Congress, bipartisan leaders of the House Committee on Science, Space, and Technology introduced H.R. 6213, the National Quantum Initiative Reauthorization Act.[31] The reauthorization bill was favorably reported out of the Full Committee on November 29, 2023, but was not considered on the House floor. The Committee intends to advance a reauthorization bill

---

https://thequantuminsider.com/2022/03/10/how-will-the-ukraine-russia-crisis-affect-quantum/

[26] Quantum Flagship, Introduction to the Quantum Flagship, available at https://qt.eu/about-quantum-flagship/

[27] News release, "The Launch of the Quantum Flagship," Quantum Flagship, October 29, 2018, https://qt.eu/about-quantum-flagship/newsroom/quantum-flagship-launch-press-release/

[28] European Quantum Act | European Declaration on Quantum Technologies, available at https://www.european-quantum-act.com/European_Declaration_on_Quantum_Technologies.html?utm_source=chatgpt.com

[29] Directorate-General for Communication, The EU's plan to become a global leader in quantum by 2030, July 2, 2025, available at: https://commission.europa.eu/news-and-media/news/eus-plan-become-global-leader-quantum-2030-2025-07-02_en

[30] Public Law 115-368, National Quantum Initiative Act, available at https://www.european-quantum-act.com/European_Declaration_on_Quantum_Technologies.html?utm_source=chatgpt.com https://www.congress.gov/115/plaws/publ368/PLAW-115publ368.pdf

[31] https://www.congress.gov/bill/118th-congress/house-bill/6213

this Congress.

NDAA and Defense Legislation in Quantum: QIS technologies have both commercial and defense applications, and Congress has authorized additional QIS R&D through defense legislation. Civilian, defense, and intelligence agencies have a long history of investment in QIS and a shared interest in future discoveries and technology development. The National Defense Authorization Acts (NDAAs) for Fiscal Years 2019, 2020, 2024, and 2026 direct the Department of Defense (DOD) to carry out and support quantum information science and technology research and development. [32,33,34,35] These provisions authorize DOD to increase the technology readiness level of QIS technologies developed in the United States, support the development of a quantum workforce, and enhance awareness of QIS and technology.[36] The NDAA for Fiscal Year 2026 also directs DOD to develop and submit to Congress a Quantum Readiness Strategy and a report assessing the readiness of DOD cryptographic systems to adopt quantum-resistant cryptographic algorithms and practices.

Quantum Coordinating Bodies: The National Quantum Initiative is implemented through multiple federal agencies, and the NQIA, as amended, calls for interagency coordination through the National Science and Technology Council Subcommittee on Quantum Information Science and the NSTC Subcommittee on the Economic and Security Implications of Quantum Science.

The NQIA also established the National Quantum Initiative Advisory Committee (NQIAC) to provide independent assessments and recommendations regarding the National Quantum Initiative. The NQIAC consists of 15 members from government, academia, and industry appointed by the President.[37] In September 2024, the NQIAC released a report presenting findings and recommendations to promote U.S. leadership in quantum networking for national security and economic growth.[38] The report included the following recommendations:

- Continue supporting fundamental research in quantum networking, its applications, and enabling technologies.
- Encourage the definition, development and use of metrics to measure progress on quantum networking technologies and their applications.
- Support the development of a coordination model to describe the functional layers of quantum networks.
- Allocate federal funding for quantum networking testbeds when such testbeds are appropriately sized and timed.

---

[32] Public Law 115-232, John S. McCain National Defense Authorization Act for Fiscal Year 2019, available at https://www.congress.gov/115/bills/hr5515/BILLS-115hr5515enr.pdf
[33] Public Law 116-92, National Defense Authorization Act for Fiscal Year 2020, available at https://www.congress.gov/116/plaws/publ92/PLAW-116publ92.pdf
[34] Public Law 118-31, National Defense Authorization Act for Fiscal Year 2024, available at https://www.congress.gov/118/plaws/publ31/PLAW-118publ31.pdf
[35] Public Law 119-60, National Defense Authorization Act for Fiscal Year 2026, available at https://www.congress.gov/bill/119th-congress/senate-bill/1071/text
[36] Supra note 33.
[37] National Quantum Initiative Advisory Committee, available at https://www.quantum.gov/about/nqiac/
[38] National Quantum Initiative Advisory Committee, Quantum Networking: Findings and Recommendations for Growing American Leadership, available at https://www.quantum.gov/wp-content/uploads/2024/09/NQIAC-Report-Quantum-Networking.pdf

- Support and facilitate industry participation in quantum networking testbeds.
- Prioritize new funding and mechanisms to promote collaboration with international allies and like-minded partners for quantum networking R&D.
- Leverage quantum networking testbeds to support training and development of a skilled quantum workforce.

Finally, the NQIA established the National Quantum Coordination Office to oversee the interagency coordination of the National Quantum Initiative, manage day-to-day coordination activities, and provide technical and administrative support to relevant committees.[39]

<u>National Institute of Standards and Technology (NIST):</u> The Fiscal Year 2026 budget request for QIS at NIST is approximately $60 million. NIST is one of the world's leaders in quantum information research. Its expertise in measurement science, quantum physics, and information technology has contributed to major discoveries and breakthroughs since the field's emergence in the mid-1990s. NIST researchers developed the first component of a quantum computer, known as a quantum logic gate, and have created many of the world's leading single-photon detectors and transmitters for sending and receiving quantum data. NIST has also developed quantum logic clocks, which have the potential to provide the world's most precise timekeeping and enable new discoveries in physics, including the detection of dark matter. In addition, NIST is actively developing post-quantum encryption algorithms.

Some of the most fundamental quantum research in the world is conducted through partnerships between NIST and leading universities, including the Joint Institute for Laboratory Astrophysics (JILA),[40] the Joint Quantum Institute (JQI),[41] and the Joint Center for Quantum Information and Computer Science (QuICS).[42] Scientists in these institutes leverage combined resources to advance research in the control of atoms and molecules and the development of ultrafast lasers capable of manipulating states of matter. Research conducted through these partnerships continues to address emerging measurement challenges, including the development of the world's best atomic clocks and lasers.

An emerging research focus at NIST is understanding how quantum-based technologies could transform security, computing, and communications, as well as developing the measurement tools and standards needed to support these advances. In August 2024, NIST published its first set of post-quantum cryptography standards.[43] These standards are designed to protect electronic information from future quantum-enabled attacks, securing data ranging from confidential communications to e-commerce transactions. NIST is also developing technology-based approaches to help integrate quantum computing capabilities into real-world applications.[44]

---

[39] National Quantum Initiative, available at https://www.quantum.gov/about/
[40] Joint Institute for Laboratory Astrophysics, available at https://jila.colorado.edu/
[41] Joint Quantum Institute, available at https://jqi.umd.edu/
[42] Joint Center for Quantum Information and Computer Science, available at https://quics.umd.edu/
[43] National Institute of Standards and Technology, NIST Releases First 3 Finalized Post-Quantum Encryption Standards, available at https://www.nist.gov/news-events/news/2024/08/nist-releases-first-3-finalized-post-quantum-encryption-standards
[44] National Institute of Standards and Technology, Quantum Information Science, available at https://www.nist.gov/quantum-information-science

Quantum Economic Development Consortium (QED-C): NIST founded and supports the QED-C, which was authorized under the National Quantum Initiative Act. QED-C is intended to expand U.S. leadership in global quantum research and development and support the growth of the domestic quantum industry across computing, communications, and sensing. The consortium is operated by SRI International, an independent nonprofit research organization headquartered in Menlo Park, California.[45] Membership in QED-C is open to corporations, academic and research institutions, and quantum industry support organizations across the supply chain.[46] QED-C convenes both government and private-sector stakeholders to:

- Identify workforce needs critical to the development of quantum technologies;
- Improve public-private coordination;
- Identify solutions to gaps in research and infrastructure;
- Highlight use cases and grand challenges to accelerate development; and
- Promote the sharing of intellectual property, efficient supply chains, technology forecasting, and quantum literacy.

QED-C members collaborate on precompetitive R&D activities, such as device design and prototyping, to increase efficiency through shared resources. These collaborations help leverage private investment alongside government funding and provide broader access to quantum engineering capabilities needed to create, test, and validate emerging quantum technologies and processes.

National Science Foundation (NSF): The Fiscal Year 2026 budget request for QIS at NSF is approximately $231 million.[47] NSF has a long history of investing in research that has helped lay the groundwork for quantum-based technologies expected to advance rapidly in the coming years. Decades of sustained NSF investments have supported the foundational science behind quantum sensing, computing, and communications,[48] and remain a central component of the NQI.[49] Since the enactment of the NQIA, NSF has prioritized partnerships that link academia, industry, government, philanthropy, private investors, and civil society. This approach emphasizes the development of proof-of-concept devices, tools, systems, and applications that enable information processing, transmission, and measurement in ways that exceed the capabilities of classical technologies.[50] Recent NSF investments have been informed by analyses and recommendations contained in NSTC reports, including:

---

[45] National Institute of Standards and Technology, NIST Launches Consortium to Support Development of Quantum Industry, available at https://www.nist.gov/news-events/news/2018/09/nist-launches-consortium-support-development-quantum-industry
[46]QED-C, available at https://quantumconsortium.org/membership/
[47] National Sciene Foundation, FY 2026 Budget Request to Congress, available at https://nsf-gov-resources.nsf.gov/files/00-NSF-FY26-CJ-Entire-Rollup.pdf?VersionId=GBeE5YPXWyPwtuB7WdVZjCSw3mrvAypu
[48] National Science Foundation, Quantum Information Science, available at https://www.nsf.gov/focus-areas/quantum
[49] National Science Foundation, *FY 2025 Budget Request to Congress,* March 11, 2024, available at https://nsf-gov-resources.nsf.gov/files/00_NSF_FY25_CJ_Entire%20Rollup_web.pdf?VersionId=cbkdqD_UMweHEIsZwPjtVgcQRwMccgvu
[50] *Id.*

- *National Strategic Overview for QIS*[51]
- *Quantum Frontiers Report*[52]
- *A Coordinated Approach to Quantum Networking Research*[53]
- *The Role of International Talent in Quantum Information Science*[54]
- *QIST Workforce Development National Strategic Plan*[55]
- *Bringing Quantum Sensors to Fruition*[56]

In 2020, NSF funded the first of its Quantum Leap Challenge Institutes (QLCI), supporting large-scale interdisciplinary research projects focused on challenges at the frontiers of quantum information science and technology.[57] These institutes coordinate research across disciplines and institutions while providing education, training, and workforce development. For example, the QLCI for Robust Quantum Simulation, hosted by the University of Maryland at College Park, combines expertise in computer science, engineering, and physics to develop the methods and tools for large-scale quantum simulators.[58] The QLCI for Hybrid Quantum Architectures and Networks at the University of Illinois Urbana-Champaign focuses on developing robust, interconnected networks of quantum processors and includes three quantum testbeds working collaboratively to develop hybrid quantum processing and networking technologies.[59] Since 2020, NSF has awarded over $245 million through the QLCI initiative.[60]

In 2024, NSF selected eleven pilot projects to help bridge scientific gaps between current quantum technological capabilities and those needed to fully harness quantum properties for practical applications. Together, these projects support the National Quantum Virtual Laboratory initiative, which seeks to accelerate quantum technology development by providing researchers with access to specialized resources nationwide.[61] This effort aligns directly with NQI priorities to broaden access and build domestic research capacity. Each pilot project received $1 million

---

[51] National Science and Technology Council, National Strategic Overview for Quantum Information Science, available at https://www.quantum.gov/wp-content/uploads/2020/10/2018_NSTC_National_Strategic_Overview_QIS.pdf
[52] National Quantum Coordination Office, Quantum Frontiers: Report on Community Input to the Nation's strategy for quantum information science, available at https://www.quantum.gov/wp-content/uploads/2020/10/QuantumFrontiers.pdf
[53] National Science and Technology Council, A Coordinated Approach to Quantum Networking Research, available at https://www.quantum.gov/wp-content/uploads/2021/01/A-Coordinated-Approach-to-Quantum-Networking.pdf
[54] National Science and Technology Council, The Role of International Talent in Quantum Information Science, available at https://www.quantum.gov/wp-content/uploads/2021/10/2021_NSTC_ESIX_INTL_TALENT_QIS.pdf
[55] National Science and Technology Council, Quantum Information Science and Technology Workforce Development Strategic Plan, available at https://www.quantum.gov/wp-content/uploads/2022/02/QIST-Natl-Workforce-Plan.pdf
[56] National Science and Technology Council, Bringing Quantum Sensors to Fruition, available at https://www.quantum.gov/wp-content/uploads/2022/03/BringingQuantumSensorstoFruition.pdf
[57] National Science Foundation, NSF Quantum Leap Challenge Institutes, available at https://www.nsf.gov/mps/osi/quantum-leap-challenge-institutes
[58] Institute for Robust Quantum Simulation, available at https://rqs.umd.edu/about
[59] Hybrid Quantum Architectures and Networks, available at https://hqan.illinois.edu/
[60] National Science Foundation, Quantum Leap Challenge Institutes (QLCI) Active Awards, available at https://www.nsf.gov/awards/award_visualization.jsp?org=NSF&pims_id=505634&ProgEleCode=105Y00&from=fund#showAwardDollars=true
[61] National Science Foundation, Final 6 pilot projects selected for NSF National Quantum Virtual Laboratory, December 16, 2024, available at https://www.nsf.gov/news/final-6-pilot-projects-selected-nsf-national-quantum-virtual

for one year to support real-world testing environments for quantum technologies.

National Space and Aeronautics Administration (NASA): The Fiscal Year 2026 budget request for QIS at NASA is approximately $36 million.[62]Although NASA is not a formal member of the NQI, the agency participates in advisory committees and has made targeted investments in quantum research, development, and technology. NASA established the Quantum Science and Technology Laboratories at the Jet Propulsion Laboratory to advance research in quantum-enabled technologies and precision instruments. NASA's quantum research activities include laser cooling and trapping of atomic particles, ultracold atom physics, nonlinear and quantum optics, frequency control, and precision measurement.[63] Key focus areas include high-performance atomic clocks, atom interferometer sensors, microresonator devices, laser interferometers, and their applications for fundamental physics measurements in space.

NASA also operates the Quantum Artificial Intelligence Laboratory (QuAIL) within its Intelligent Systems Division.[64] QuAIL is the agency's center for evaluating how quantum computing could address complex computational challenges in the future. The laboratory explores whether quantum algorithms and systems could enhance optimization and machine learning capabilities across NASA's aeronautics, Earth science, space science, and exploration missions.

Department of Energy (DOE): The Fiscal Year 2026 budget request for QIS at DOE is $340 million.[65] DOE's Office of Science supports robust QIS research and development across its core program areas. Office of Science activities related to QIS include:

- Advanced Scientific Computing Research (ASCR): Advancing quantum computing through the development of new algorithms and support for quantum testbeds.
- Basic Energy Sciences (BES): Leveraging the BES Nanoscale Science Research Centers to advance materials and chemistry research addressing key QIS challenges, including quantum coherence.
- High Energy Physics (HEP): Evaluating quantum sensors and related opportunities for new areas of HEP research.
- Nuclear Physics (NP): Exploring quantum chromodynamics, nuclei, nuclear astrophysics, and fundamental nuclear symmetries.
- Fusion Energy Sciences (FES): Developing quantum sensors capable of monitoring fusion plasmas and providing new data for fusion research.
- Biological and Environmental Research (BER): Supporting QIS applications in bioimaging.
- Isotope Research and Production.

Under the NQIA, DOE was directed to establish up to five National QIS Research Centers with unique missions and capabilities to help maintain U.S. leadership in QIS.

[62] National Aeronautics and Space Administration, FY 2026 Budget Technical Supplement, available at fy-2026-budget-technical-supplement-002.pdf

[63] NASA Jet Propulsion Lab, Science and Research and NASA JPL, available at https://scienceandtechnology.jpl.nasa.gov/quantum-sciences-and-technology-laboratories

[64] NASA Quantum Artificial Intelligence Laboratory (QuAIL), available at https://www.nasa.gov/content/nasa-quantum-artificial-intelligence-laboratory-quail

[65] Department of Energy, FY 2026 Congressional Justification, available at https://www.energy.gov/media/346281

Q-NEXT: Next Generation Quantum Science and Engineering: Based at Argonne National Laboratory, Q-NEXT focuses on quantum communications and the reliable control, storage, and transmission of quantum information over long distances. This work supports the development of more complex quantum networks.[66]

C^2QA: Co-design Center for Quantum Advantage: Located at Brookhaven National Laboratory, C^2QA conducts basic physics research to improve the accuracy and efficiency of quantum computers. By simultaneously advancing materials and software, the center seeks to accelerate quantum computer development.[67]

SQMS: Superconducting Quantum Materials and Systems Center: Situated at Fermi National Accelerator Laboratory, SQMS develops and tests quantum devices to improve system performance. The center leverages Fermi's expertise in high-energy physics and superconducting radio-frequency cavities to increase understanding of quantum systems.[68]

QSA: Quantum Systems Accelerator: Based at Lawrence Berkeley National Laboratory, QSA develops algorithms to optimize quantum systems. This research on basic quantum systems will accelerate technology development and support future commercialization.[69]

QSC: The Quantum Science Center: Located at Oak Ridge National Laboratory, QSC addresses challenges related to the control and stability of quantum states. The center also emphasizes workforce development and building a skilled pipeline to support the growing quantum field.[70]

The Genesis Mission: On November 24, 2025, President Donald Trump signed Executive Order 14363, "Launching the Genesis Mission."[71] The Genesis Mission aims to develop an integrated platform connecting leading supercomputers, experimental facilities, AI systems, and unique datasets across major scientific domains. The initiative seeks to double the productivity and impact of American research and innovation within a decade, with QSI identified as a priority area.[72]

Office of Artificial Intelligence and Quantum (AIQ): The Office of Artificial Intelligence and Quantum was announced as part of DOE's November 2025 reorganization. The office is responsible for coordinating and advancing AI and quantum research conducted by the Department and across the National Laboratories.

Department of Defense (DOD): DOD supports basic research, defined as the systematic study

[66] Q-NEXT, available at https://q-next.org/about/
[67] Brookhaven National Laboratory, Co-design Center for Quantum Advantage, available at https://www.bnl.gov/quantumcenter/
[68] Fermi National Accelerator Laboratory, SQMS Center, available at https://sqmscenter.fnal.gov/
[69] Lawrence Berkeley National Laboratory, Quantum Systems Accelerator, available at https://crd.lbl.gov/centers/qsa/
[70] Quantum Science Center, available at https://www.qscience.org/
[71] "Fact Sheet: President Donald J. Trump Unveils the Genesis Mission to Accelerate AI for Scientific Discovery." *The White House*, 24 Nov. 2025, www.whitehouse.gov/fact-sheets/2025/11/fact-sheet-president-donald-j-trump-unveils-the-genesis-missionto-accelerate-ai-for-scientific-discovery/.
[72] "Genesis Mission." *U.S. Department of Energy*, 30 Oct. 2025, genesis.energy.gov/.
[72] Id.

directed toward greater knowledge or understanding of fundamental phenomena without specific applications in mind. DOD has invested in fundamental QIS research for more than three decades and continues to support basic QIS R&D through multiple offices, agencies, and laboratories. These include the Office of the Under Secretary of Defense for Research and Engineering (OUSD(R&E)), the Defense Advanced Research Projects Agency (DARPA), the Air Force Research Laboratory (AFRL), the Air Force Office of Scientific Research (AFOSR), the Army Research Laboratory (ARL), the Army Research Office (ARO), the Naval Research Laboratory (NRL), and the Office of Naval Research (ONR).