

The National Quantum Initiative Program

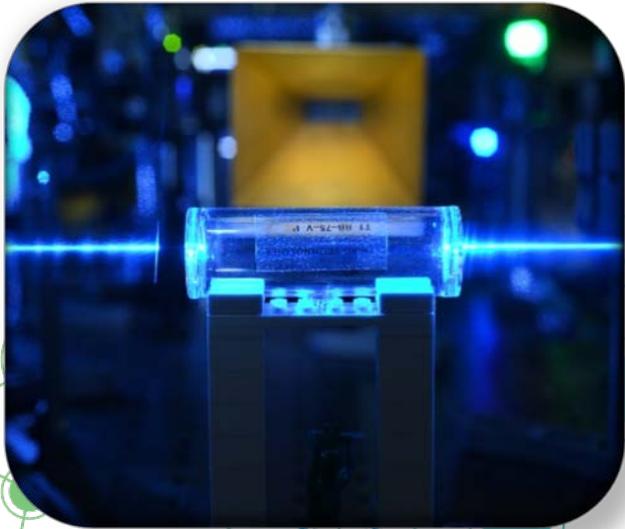
Dr. Alex Cronin,
Senior Quantum Coordinator
National Quantum Coordination Office
Office of Science and Technology Policy

[Whitehouse.gov/ostp](https://www.whitehouse.gov/ostp)
www.quantum.gov

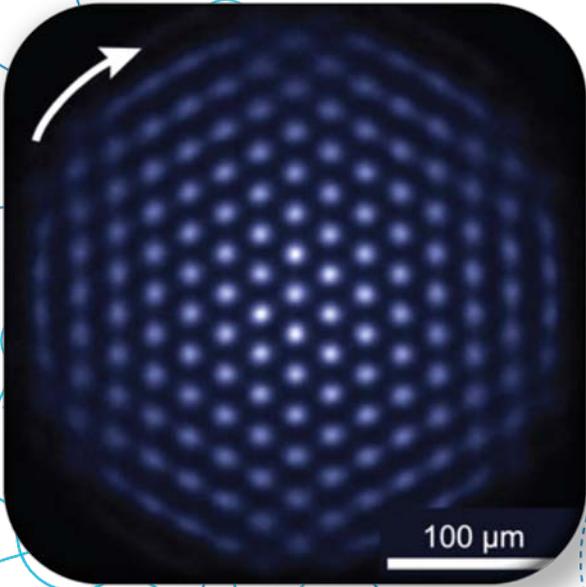
Presentation for DOE Isotope Program Workshop
January 12, 2021



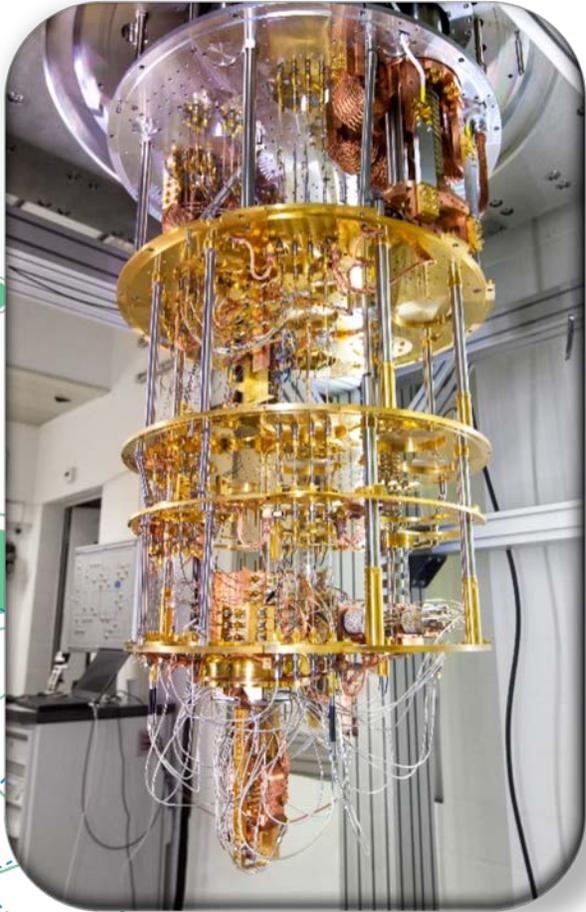
Quantum Information Science (QIS) will impact our future prosperity



Quantum Sensors



Quantum Simulators



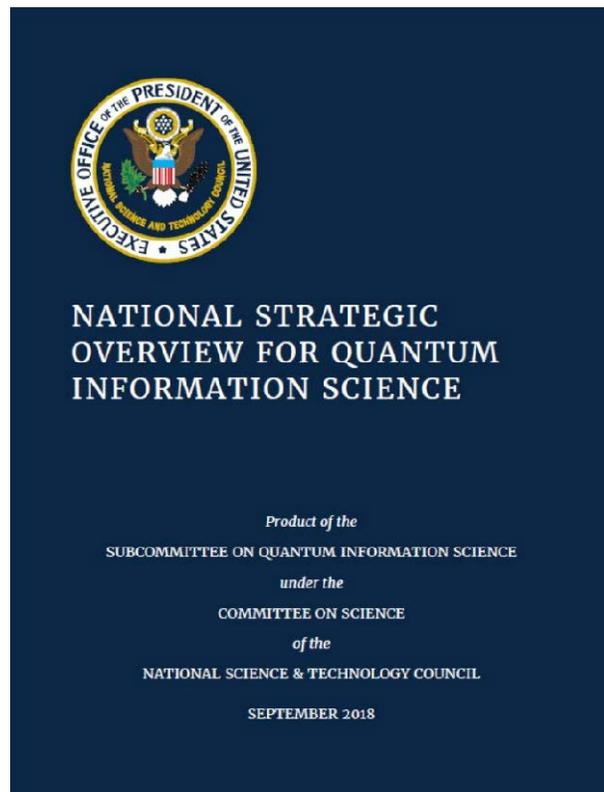
Quantum Computers

Quantum Networks

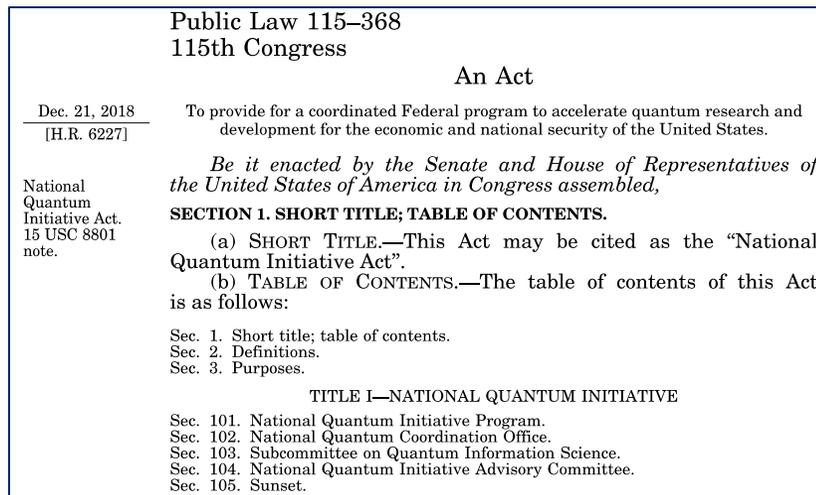


NSF, DOE, NIST, NSA, DOD, NASA, ODNI, DHS, STATE, NIH, USDA, USPTO, USDA, FBI

From Policy to Government Action



NSTC Strategic Policy, 2018

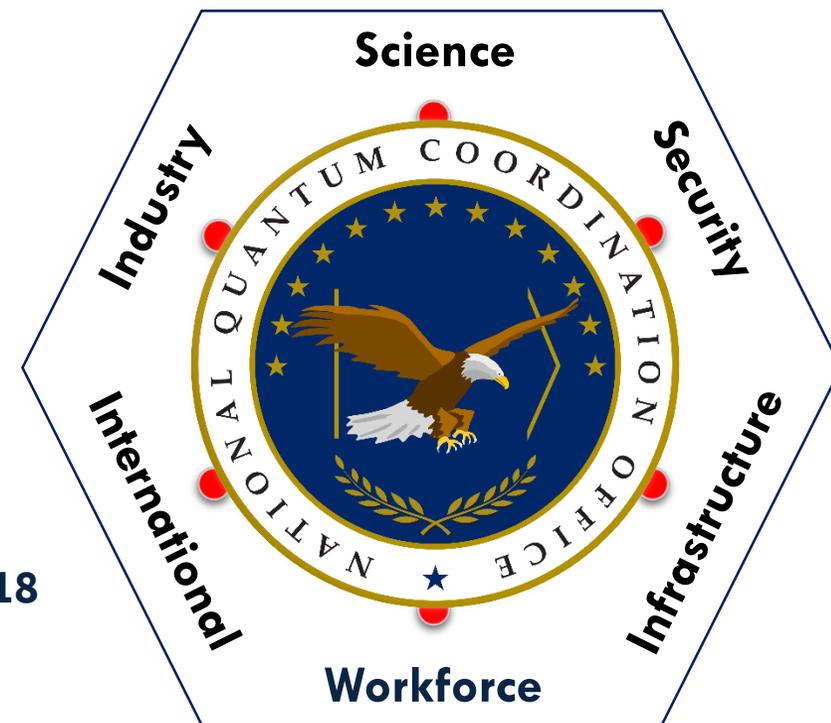


National Quantum Initiative Act, Dec 2018

- National QIS Research Centers
- Quantum Consortium (QED-C)
- National Quantum Coordination Office
- NQI Advisory Committee (NQIAC)

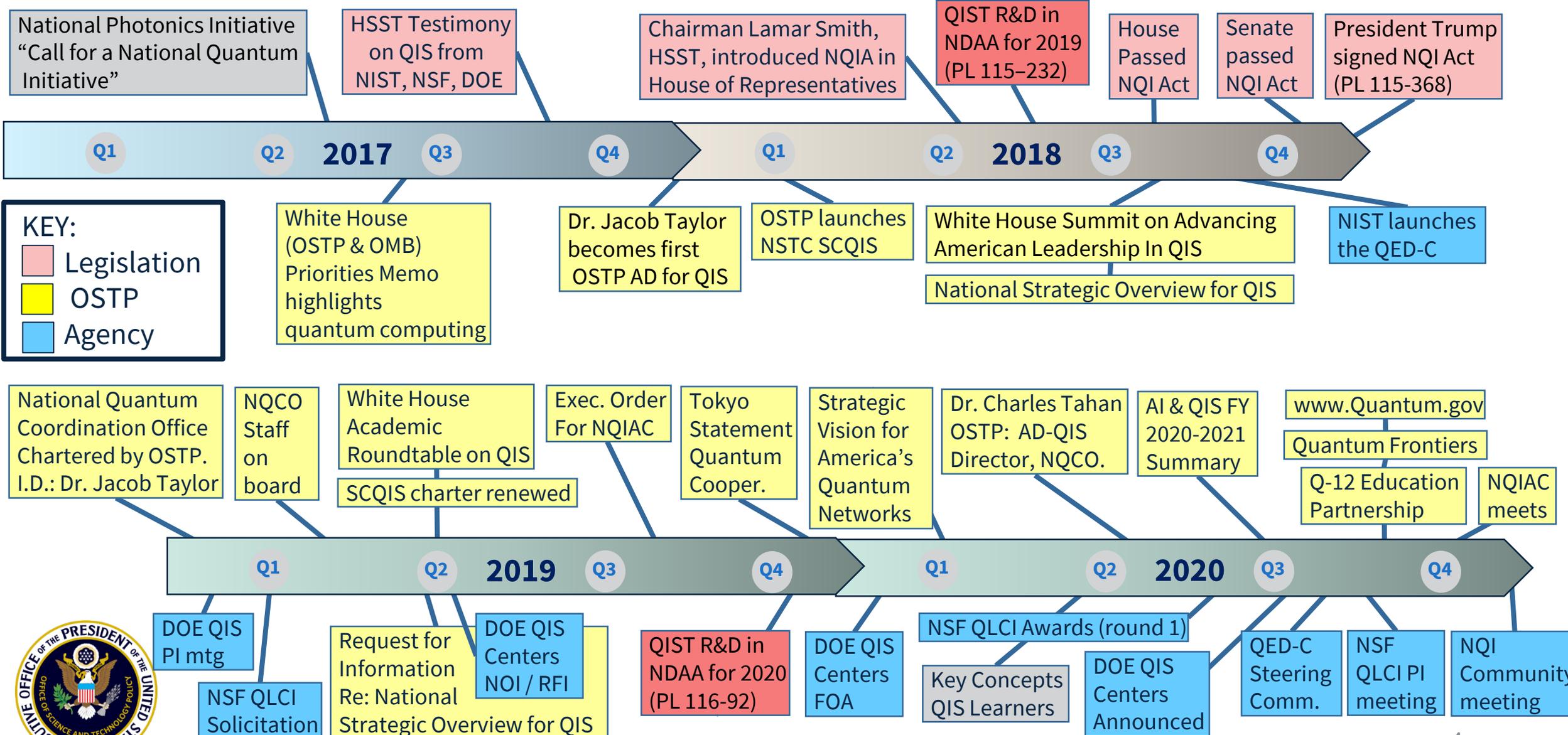
National Defense Authorization Act, 2019

- Defense QIST R&D Program



- NSTC Subcommittee on QIS
- Subcommittee on Economic and Security Implications (ESIX)
- Interagency Working Groups
- Policy Recommendations

Establishing and Implementing the NQI



KEY:

- Legislation
- OSTP
- Agency



The US has a federal approach to science funding

US Quantum Information Science Ecosystem

Pillars of Federal QIS Ecosystem

End Users:

NIH, DHS, USDA, DOI, DOD, ODNI

Enabling and Support: **STATE, USPTO, FBI**

CIVILIAN

DEFENSE

INTEL

**NSF
DOE
NIST
NASA**

**DARPA
ARO
AFOSR
ONR
ARL
NRL
AFRL
OSD/R&E**

**IARPA
LPS**

FEDERAL QIS R&D FUNDING AGENCIES

**USG Coordination/Oversight
(Congress, SCQIS, ESIX, OSTP/NQCO, NQIAC)**

INDUSTRY

ACADEMIA, FFRDCs

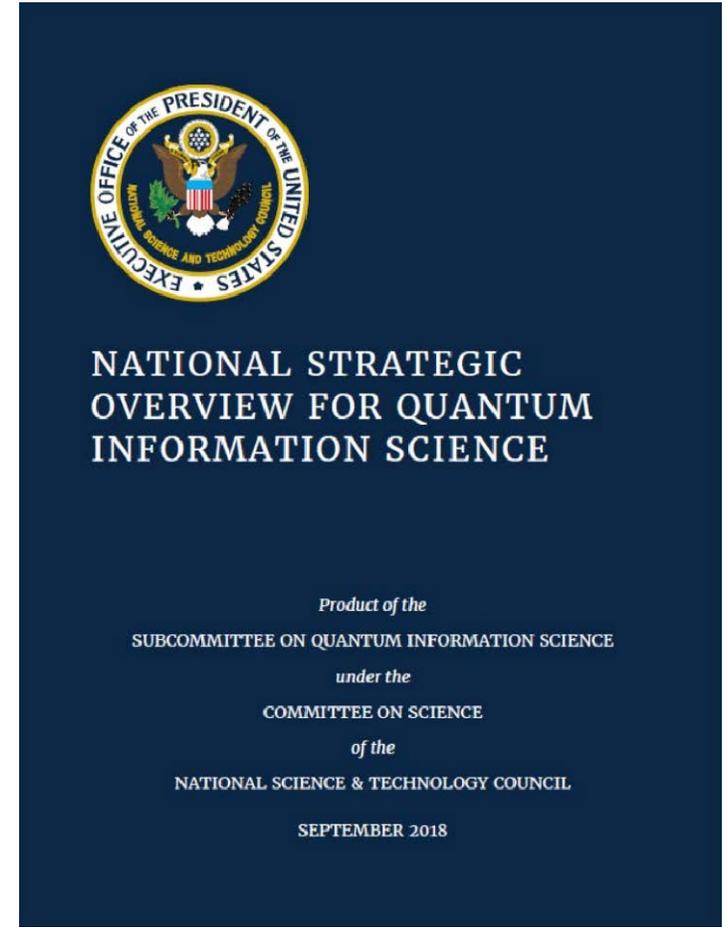


NSF, DOE, NIST, NSA, DOD, NASA, ODNI, DHS, STATE, NIH, USDA, FBI, EOP

National Strategy for QIS

First product of the Subcommittee on QIS recommended six policy thrusts:

1. Choose a science-first approach
2. Create a quantum-capable workforce
3. Nurture nascent quantum industry
4. Provide key infrastructure for QISE
5. Maintain security and economic growth
6. Continue to develop international collaboration and cooperation



Available at : www.quantum.gov

The Quantum Frontiers Report

- Synthesizes feedback from a Request for Information (RFI) on National Strategic Overview, and multiple QISE Workshops held by Federal agencies
- The technical challenges can be found here:

1. Expanding Opportunities for Quantum Technologies to Benefit Society
2. Building the Discipline of Quantum Engineering
3. Targeting Materials Science for Quantum Technologies
4. Exploring Quantum Mechanics through Quantum Simulations
5. Harnessing Quantum Information Technology for Precision Measurement
6. Generating and Distributing Quantum Entanglement for New Applications
7. Characterizing and Mitigating Quantum Errors
8. Understanding the Universe through Quantum Information



QUANTUM FRONTIERS
REPORT ON COMMUNITY INPUT TO THE NATION'S
STRATEGY FOR QUANTUM INFORMATION SCIENCE

Product of

THE WHITE HOUSE

NATIONAL QUANTUM COORDINATION OFFICE

October 2020



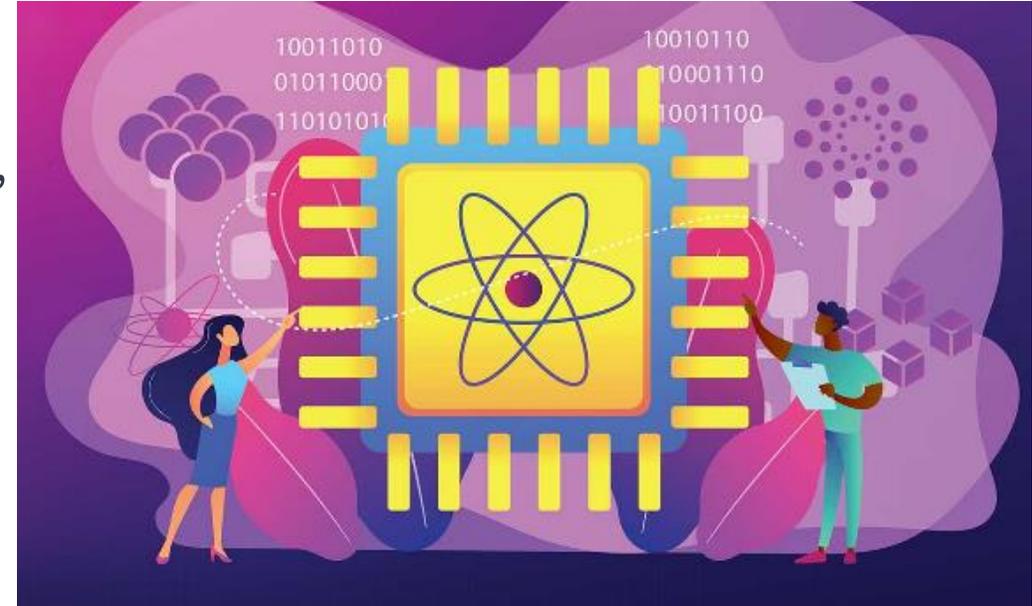
*The Quantum Frontiers Report highlights areas where technical challenges can be found to advance various missions and practical objectives in QIST. Also see: **A Strategic Vision for America's Quantum Networks***

Released in October 2020
www.quantum.gov

Creating a Quantum-Capable Workforce

Create convergent, trans-sector approaches for diverse workforce ◊ Use and enhance existing programs ◊ Encourage academia to consider quantum science and engineering as its own discipline ◊ Address education in the area of quantum science at an early stage ◊ Reach out to broader audiences with novel or unconventional approaches ◊ Encourage the QIS community to track and estimate the future workforce needs of quantum industry

- White House Academic Roundtable on QIS (2019)
- NSTC SCQIS Workforce Working Group
 - (Co-Chairs NSF and LPS)
- NSF: internal WG, EHR Directorate, Q2Work program, Convergence Accelerators, and more
- ESIX Workforce and Talent WG
 - Government Requirements Survey
- QED-C Workforce Surveys
- Q-12 Partnership for Education



QIS Concepts & the Q-12 Education Partnership



- ~25 leaders identified key QIS concepts for future learners
- 9 concepts posted May '20

NSF Key Concepts Workshop

NQCO
SCQIS Workforce Working Group



National Q-12 Education Partnership

Growing the Quantum Workforce.

Q2WORK

New NSF Programs

- Q2Work, 2 teacher conferences on quantum (Summer 2020)
- Convergence Accelerators for QIS Education
- QIS outreach embedded in centers and programs

Q-12 Education Partnership

- Announced August 2020
- 13 initial members: industry, professional societies, and academia
- Commits to expanding access to K-12 quantum learning tools
- Will work with the community to nurture a diverse and innovative quantum workforce

<http://q12education.org/>



Engaging with Quantum Industry

Foster the formation of a U.S. Quantum Consortium ◊ Increase investment via partnerships between industry, academia, and Government to accelerate pre-competitive research ◊ Maintain awareness of how the quantum revolution may effect agency mission spaces

The Quantum Economic Development Consortium (QED-C)

- Industry consortium of stakeholders that aims to enable and grow the U.S. quantum industry.
- QED-C was established with support from the National Institute of Standards and Technology (**NIST**) as legislated by the NQI Act. (NIST and DOE sit on steering committee.)
- The mission of QED-C is to enable and grow a robust commercial quantum-based industry and associated supply chain in the United States.

NQCO

- “Industry Liaison” position created and staffed to execute NQI Act requirements



Nov 2019 QED-C Cryogenic Workshop, Montana

2020: QED-C steering committee signs Partnership Agreement and is recognized as the US Quantum Industry Consortium (per the NQI)



Providing Critical Infrastructure

Encourage necessary investments ◊ increase access to facilities ◊ Establish end-user testbed facilities along with training and engagement ◊ Leverage existing infrastructure, including manufacturing facilities

NQI: 3 NSF Quantum Leap Challenge Institutes

- More in 2021
- Plus other quantum centers

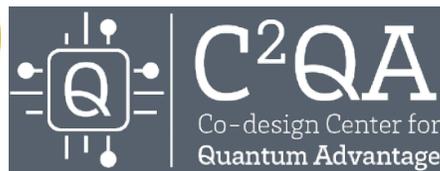
NQI: 5 DOE QIS Research Centers

- Plus existing user facilities and infrastructure

NDAA 2020: new DOD QIS Research Center(s)

- Naval Research Lab
- AFRL Innovare Center
- LPS Qubit Collaboratory

ARO/LPS Qubits for Computing Foundry RFI



Providing Critical Infrastructure

Encourage necessary investments ◊ increase access to facilities ◊ Establish end-user testbed facilities along with training and engagement ◊ Leverage existing infrastructure, including manufacturing facilities

NQI: 3 NSF Quantum Leap Challenge Institutes

- More in 2021
- Plus other quantum centers

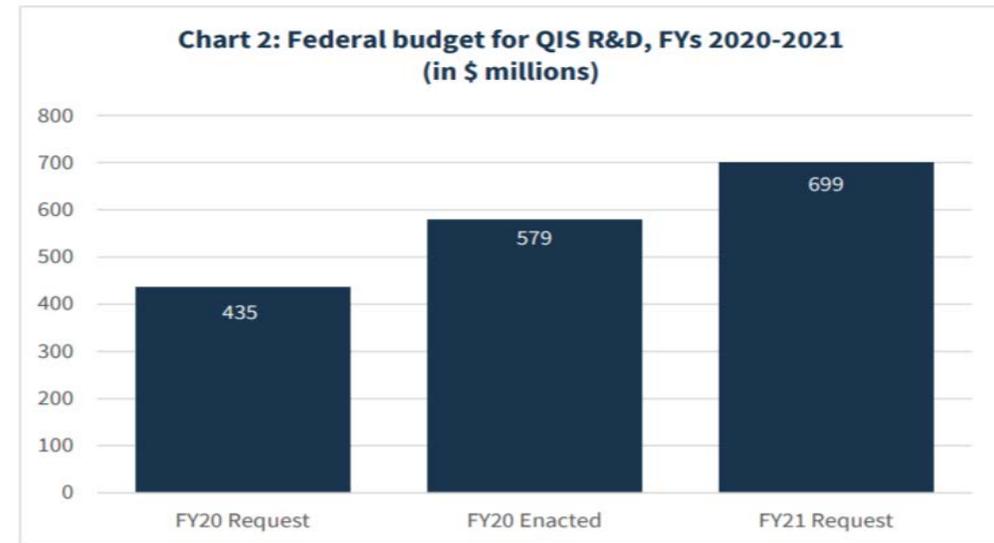
NQI: 5 DOE QIS Research Centers

- Plus existing user facilities and infrastructure

NDAA 2020: new DOD QIS Research Center(s)

- Naval Research Lab
- AFRL Innovare Center
- LPS Qubit Collaboratory

ARO/LPS Qubits for Computing Foundry RFI



Preliminary budget data in OSTP Report aggregates data from NIST, NSF, DOE and DOD



Maintaining National Security and Economic Growth

Maintain an understanding of the security implications QIS ◊ Promote mechanisms for all Government agencies to stay abreast of the defense and security implications and help balance the benefits of economic growth with new risks ◊ Ensure consistent application of existing control mechanisms to provide the largest amount of information possible to American universities and industry

ESIX – Subcommittee on the Economic and Security Implications of Quantum Science

- Co-Chaired by DOD, NSA, DOE, OSTP
- Established to ensure that economic and security implications of QIS are understood across the agencies.
- Provides a national security perspective to QIS related research.
- Coordinates with NSTC subcommittees, such as the SCQIS, to ensure that the economic and national security implications of basic research and development in QIS, along with derived technologies are fully understood.



Dr. Droege meier introduces OSTP Joint Committees on the Research Enterprise (JCORE) Subcommittees, Nov 2019

ESIX Working Group on Talent and Research Security created (July 2020)



Continuing to Develop International Collaboration and Cooperation

Increase international cooperation with like-minded industry and Government partners ◊ Ensure the US continues to attract and retain the best talent, and has access to international resources ◊ Identify and understand the evolving international QIS landscape from both technical and policy perspectives.

- International partnerships are critical to bringing together the wide range of skills, expertise, and ingenuity to accelerate the research and development around QIST
- Good-faith cooperation based on the shared values of freedom of inquiry, merit-based competition, openness and transparency, accountability, and reciprocity.
- Follow-on actions: industry and science dialogues, ...



[U.S.-Tokyo Statement on Quantum Cooperation](#)

US-Australia Joint Commission Meeting highlights Quantum Information Science
US-Australia Industry Dialogue
US-UK QIS Dialogue

...



Tracking/Reporting



- Annual reports on US QIS Activities (Supplement to President's Budget)
 - Budget
 - Technical Highlights
 - Progress toward strategic thrusts
 - Coordination activities and initiatives
- Strategic Plan and Policy Thrust Strategies
 - Seek feedback from NQIAC: *What is missing in the national strategy?*
 - *Where do we want to be 5-years into the NQI?*
- Tracking progress toward policy recommendations
 - Seek feedback from NQIAC: *Suggestions for useful tracking mechanisms toward key goals (workforce, etc.).*

[Track USG activities at quantum.gov](https://www.quantum.gov)

The **National Quantum Coordination Office** (NQCO)'s charge, as legislated by the National Quantum Initiative (NQI) Act of 2018, is to:

- provide technical and administrative support to the National Quantum Initiative and NQIAC;
- oversee interagency coordination;
- serve as the point of contact on Federal civilian quantum information science and technology activities;
- ensure coordination among the QIS Research Centers; to conduct public outreach;
- promote access to and early application of the output of the National Quantum Initiative; and
- promote access to quantum computing and communications systems.

SCQIS, NQCO, ESIX are deliberately taking an all-of-government, all-of-nation approach to QISE R&D
(broader than strict NQI Act requirements)



The National Quantum Initiative Program

Dr. Alex Cronin,
Senior Quantum Coordinator
National Quantum Coordination Office
Office of Science and Technology Policy

[Whitehouse.gov/ostp](https://www.whitehouse.gov/ostp)
www.quantum.gov

