



IMPLEMENTATION OF NATIONAL QUANTUM INITIATIVE CRITICAL TO LONG-TERM SECURITY, COMPETITIVENESS OF U.S.

NATIONAL QUANTUM INITIATIVE (NQI)

The National Photonics Initiative is calling for a National Quantum Initiative (NQI) to accelerate the development of commercially available quantum-based technologies to facilitate growth in the U.S. economy and keep pace with accelerating international competition. The NQI will also bridge significant workforce gaps in the United States that exist between the world's leading quantum researchers and industrial engineers, and catalyze a new sector in the science, technology, engineering and math (STEM) workforce. The specific operational goals of the NQI are to:

- Engage and produce a world-leading industrial quantum technology workforce;
- Engineer, industrialize and automate quantum technology, including quantum computers, communications systems and sensors;
- Provide access to the emerging quantum computer systems;
- Develop conventional technology and intellectual property needed to support and enable quantum technology;
- Produce quantum software and new applications of quantum technology; and
- Continue the fundamental research needed to support these NQI goals and those that arise from the capabilities of quantum technologies.

QUANTUM TECHNOLOGIES

Quantum technologies – based on fundamental particles of nature such as individual atoms and photons – hold great promise to become the computers, networks and sensors of tomorrow. Quantum information science is based on exploiting subtle aspects of quantum physics, such as “quantum superposition” and “entanglement,” for valuable, real-world technologies. These technologies can:

- handle computationally complex problems;
- provide communication security; and
- enhance navigation, imaging and other sensing technologies in ways that are impossible using binary-based computer systems.

INTERNATIONAL INVESTMENT

The United States has yet to capitalize on the available opportunities – such as those in the field of cybersecurity – to move promising quantum technology from the laboratory to the marketplace. Meanwhile, other nations are investing heavily in quantum-based technology.

- China is aggressive in its commitment to quantum; the Chinese government recently launched a satellite devoted to quantum communication protocols.

- In Europe, entities have recently established large, focused, academic/industrial thrusts, including the UK Quantum Hub Network (\$400 million over five years), the Netherlands QuTech Initiative (\$150 million/10 years) and the European Union (EU) Flagship Quantum Program (\$1.3 billion/10 years).
- Major initiatives are also underway in Australia and Canada.

IMPLEMENTATION PLAN

In a white paper released in June 2017, titled *A Call for a National Quantum Initiative*, and in a subsequent action plan and testimony before the U.S. House Science, Space and Technology Committee in October 2017, the NPI has called for an investment in three to six new facilities called **Quantum Innovation Laboratories (QILabs)**, along with a **Quantum Research Network (QRNet)** and a **Quantum Computing Access Program (QCAP)**.

- The **QILabs** will serve as proving grounds and testbeds for quantum technologies, and will follow the proven model of academia, government and industrial scientists and engineers working collaboratively on shared objectives at central facilities across the U.S., each with its own distinct and focused research and development mission.
- The **QRNet** program will support fundamental research of quantum technology by funding individual efforts to investigate and collaborate with QILab technologies, combine different quantum technology for hybrid quantum systems, and uncover promising quantum systems for future quantum bit realization and quantum technology development.
- The **QCAP** will support the activities of the QILab and QRNet programs by providing access to the most advanced American quantum computing systems and simulators.

QILabs/QRNet/QCAP will be administered and funded in a coordinated fashion by an appropriate grouping of programs within NSF, NIST and DOE, to be decided jointly by those agencies, and informally advised by quantum technology experts selected by NSF, NIST, DOE, and the DOD and Intelligence agencies, accounting for recommendations by industry. These agencies will coordinate their existing programs in underlying quantum science and technology with the QILabs. The QILab and QRNet performers will be selected by the above agencies based on existing solicitation and evaluation procedures. Each QILab will be led by a scientific and administrative director, who will coordinate the operation of the QILab with the above agencies.

ABOUT THE NPI

The National Photonics Initiative (NPI) is a collaborative alliance among industry, academia and government to raise awareness of photonics and the impact of photonics on our everyday lives; increase cooperation and coordination among U.S. industry, government and academia to advance photonics-driven fields; and drive U.S. funding and investment in areas of photonics critical to maintaining U.S. economic competitiveness and national security. The initiative is being led by top scientific societies, including the American Physical Society (APS), the IEEE Photonics Society, the Laser Institute of America (LIA), The Optical Society (OSA) and SPIE, the International Society for Optics and Photonics (SPIE).

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