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BEFORE THE
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UNITED STATES HOUSE OF REPRESENTATIVES
ON

ASSESSING U.S. LEADERSHIP IN QUANTUM SCIENCE AND TECHNOLOGY

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Chairman Babin, Ranking Member Lofgren, and esteemed Members of the Committee, I am honored to appear before you today to discuss quantum information science and technology and the transformative role that it plays across the Department of Energy's (DOE) portfolio. This area is deeply important to both the Department and our national prosperity. I am grateful and appreciative of this Committee's continued support for the advancement of this field, as well as science and technology broadly.

I am the Quantum Information Science Lead and Senior Technical Advisor for the Office of Science's Advanced Scientific Computing Research Program. I bring nearly two decades of experience as a practicing mathematician advancing quantum information science and technology at the United States Naval Research Laboratory. I also served for over three years as a Senior Policy Advisor in the National Quantum Coordination Office (NQCO) at the Office of Science and Technology Policy (OSTP).

DOE's work in quantum information science and technology spans the Office of Science programs, including the advancement of fundamental science, quantum computing, sensing, communications, and networking. The DOE brings the unique resources and team-science approach of the national laboratories to bear in the race to secure American dominance in quantum information science and technology. Our work across the field is enabled by our suite of user facilities and some of the most advanced technologies and computational abilities provided to the U.S. research, computing, and industrial ecosystem.

I look forward to speaking with this Committee today about the future of quantum science and technologies and their benefits for the American people.

DOE's Quantum Information Science and Technology Portfolio

The National Quantum Initiative Act of 2018 was a significant milestone for American leadership in quantum information science and technology. The legislation delivered a national strategy for the field, mobilized dedicated and sustained Departmental efforts, and launched several new center-scale flagship research and development activities. The DOE is honored to co-chair the National Science and Technology Council Subcommittees established by this legislation and later amendments, the Subcommittee on Quantum Information Science (SCQIS) and the Subcommittee on the Economic and National Security Implications of Quantum Information Science (ESIX). These subcommittees enable a whole-of-government approach to both the advancement and protection of quantum technologies.

Authorized by the National Quantum Initiative Act, the DOE established five multidisciplinary National Quantum Information Science Research Centers (the Centers). In November 2025, the Department renewed its commitment to the Centers to accelerate the advancement of quantum technologies over the next five years. Each Center is led by a national laboratory and collectively they bring together more than 50 academic institutions across 22 states and the District of Columbia, and more than 18 industry partners. They have been instrumental to workforce development, and, to date, have resulted in the hiring of over 300 scientists and more than 600 PhD students and postdocs, and have trained over 2,500 external personnel.

In the first five years, the DOE Centers laid the groundwork to deliver scientific breakthroughs across high-energy physics, materials science, computing and networking, and biosciences. They have developed open-source quantum control platforms, state-of-the-art quantum chips and simulators, qubits with record lifetimes, and the first quantum computation simulation validated by a neutron scattering experiment.

Looking ahead to the next five years, the Centers will tackle larger-scale, focused research efforts with a high potential to unlock new possibilities in both technological development and basic science.

In addition to the Centers, DOE's Office of Science advances quantum information science and technology through its core research programs, testbeds, and user facilities. The DOE's portfolio builds a foundation for the exploration of quantum information science and technology, while fostering breakthrough new ideas and cutting-edge research and development that pushes the vanguard of academic and commercial innovation. These programs collectively act as a powerful catalyst for the entire ecosystem and will address key roadblocks to quantum utility: enabling fault tolerance; unlocking scaling by miniaturizing and modularizing quantum systems via networks; developing new sensors; and enabling scientific impact by developing new algorithms and applications for real-world use-cases.

The Department's advancements in quantum information science and technology are a testament to decades of sustained support by Congress to the DOE and its sister agencies. These efforts have cultivated and explored scientific frontiers, built a community of scientific leaders for the Nation, and pushed the boundaries of technological development. The DOE supports fundamental and use-inspired research, derisks innovations with testbeds, and operationalizes these advancements within user facilities, making these quantum research tools available to the

American research community. This strategy covers a broad portfolio that combines single investigators, smaller teams, large centers, and enabling capabilities.

A robust and world-class domestic workforce is central to the success of DOE's quantum information science and technology portfolio. The DOE national laboratories and facilities serve as a nexus for workforce development. Through training events, DOE facilities engage directly with thousands of researchers and students annually. The quantum capabilities developed by our national laboratories deliver new technologies for the U.S. and provide hands-on training for highly skilled technicians, early career researchers, and senior scientists.

A New Paradigm for Scientific Discovery

These quantum information science investments are yielding the desired results as evidenced by the growth of a vibrant quantum industry in the United States. As a result, the quantum technology space is embarking on a new chapter, one that, in addition to supporting fundamental research and development, can deliver capabilities such as quantum-centric supercomputers that will provide a paradigm shift for exploring new scientific frontiers. Delivering these novel capabilities involves substantial infrastructure and technical expertise from quantum information scientists and engineers, as well as the domain scientists that will use this new technology.

The DOE and its vast network of national laboratories are well positioned to support the development of these novel quantum computing, sensing, communications, and networking technologies. The DOE national laboratories have multi-disciplinary experts that excel in balancing open science, proprietary research and development, and national security research missions. The national laboratories also have significant expertise in bringing first-of-a-kind systems online, maintaining these systems, and developing a broad user community. In addition, the DOE national laboratories have flexible and unique large-scale infrastructure, such as x-ray sources, supercomputers, purpose-built quantum information science and technology laboratory space, and cryoplants that create a fertile environment for new efforts.

DOE recently launched the Genesis Science and Security platform to unleash a new age of AI- and quantum-accelerated innovation and discovery, solving the most challenging problems of this century. DOE's quantum information science and technology vision integrates with the Genesis Science and Security platform, designed to connect the world's fastest supercomputers, AI systems, and next-generation quantum computers with the most powerful and precise scientific instruments and data. Quantum information systems will leverage new AI models to aid in error correction, accelerate the discovery of new quantum algorithms, and integrate outputs of quantum computers and sensors directly into the discovery workflow. Conversely, AI models can be trained with new data from quantum computers and other quantum information systems. Scaling AI supercomputers, AI models, and quantum computers together will allow for their co-optimization and co-development, and for the exploration of new computational and scientific paradigms. The resulting capabilities, talent, and infrastructure will serve as a competitive differentiator, a stabilizing force, and an incubator for U.S. industry across all scales.

Quantum Computing

Scientific computing is at an inflection point, where the products of exploration, nurtured through sustained support by this Committee, DOE, interagency partners, academia, and the private sector, are accelerating America's computing capability. Novel developments in high-performance computing architectures, artificial intelligence models, and quantum information technologies have launched a new frontier for scientific discovery—developments that will be harnessed and accelerated by the Genesis Mission, defining the next phase of quantum-computing research and development.

The first fault-tolerant quantum computers, those that protect fragile qubits from errors caused by external noise, will serve as novel scientific instruments, unlocking unprecedented opportunities for scientific discovery. Eventually, these computers may not only tackle portions of today's high-performance computing workloads but redefine scientific boundaries in applications such as those across materials science, quantum chemistry, and high-energy physics, among many others.

To realize this future, we must improve and deploy new quantum computing platforms, while exploring architectural diversity to mitigate risk and to hedge against the failure of any single platform. Contemporaneous efforts in algorithms and applications will bridge the gap between projected hardware capabilities and the current requirements for scientific computing. Open-source software stacks developed by DOE labs will enable community-wide progress, portability of algorithms and applications, and a more competitive, innovative enterprise.

A whole-of-government approach, with support from DOE and the National Laboratories, to responsibly scale quantum computing technologies for scientific discovery would position America to lead in the convergence of quantum computing, AI, and high-performance computing. It would catalyze industrial efforts by setting clear requirements and strategic guideposts to align the sector, stimulate competition, and establish a robust supply chain. Like the Exascale Computing Initiative, a DOE-led initiative to build the first exascale computer, a quantum initiative can set industrial milestones and forge public-private partnerships to demonstrate the first generation of error-corrected quantum-centric supercomputers that can deliver scientific utility. Such initiatives can be accomplished through competitive program calls, advanced market commitments, and prize challenges.

Quantum Sensing

Quantum sensors present an exciting new frontier, offering near-term and transformative opportunities to augment DOE's mission space through improved accuracy, sensitivity, and precision, compared to their classical counterparts. Quantum sensing harnesses the exquisite sensitivity of quantum systems to make precise measurements of physical quantities, such as magnetic fields, temperature, acceleration, and gravity, that surpass classical limits. Quantum sensing and imaging have the potential to revolutionize how we probe physical and biological systems and enable entirely new technologies, such as interaction-free measurements in quantum electron microscopy, and can provide nanoscale resolution capable of detecting single neurons firing. Atomic interferometers can detect gravitational fields with unprecedented accuracy with applications that range from high-precision measurements of fundamental physical constants to terrestrial subsurface sensing and precision, navigation, and timekeeping. Quantum-enabled, long baseline interferometry offers the opportunity for better and more efficient resolution of distant celestial objects. Quantum magnetometers based on diamonds are generally unaffected by high-temperature and irradiation, making them excellent candidates to study fusion and operate in high-radiation environments.

Quantum sensing and imaging platforms are at varying stages of technological readiness. For example, atomic clocks and atom interferometers are being commercialized and providing technological solutions today, while other platforms are at more nascent stages of development and need further exploration to utilize their capabilities. Testbeds and demonstrators can pull together the DOE's community of experts to derisk the space and aid in the evaluation, advancement, and commercialization of viable candidate platforms. These testbeds would also provide valuable new sources of data for the Genesis Mission to build new models for classical AI and develop new quantum algorithms for signal processing. Enhancing the utility of scientific equipment and facilities, such as accelerators and imaging technologies, will also expedite the production of world-leading scientific instruments.

Quantum Communication and Networking

Quantum communication and networking will provide a foundation to integrate quantum computers and sensors into larger constellations of technologies. Quantum networks will establish and distribute quantum information, such as superposition and entanglement, between heterogeneous quantum technologies. At small to medium scales, they will distribute quantum computation across multiple chips or computing platforms. At larger scales, they will integrate geographically distributed quantum systems, such as sensors or computers. Distributed quantum computing would connect multiple processors to form a more powerful, unified quantum computing system, capable of tackling more complex problems, while networked quantum sensors will increase resolution and enable precision that far exceeds that of a single sensor or sensors connected classically.

Quantum networks that can enable distributed quantum information processing beyond single systems will require advancements in hardware and software development. These advancements include accelerating the development of high-fidelity and robust interconnects, new networking protocols, algorithms, and architectures, and world class toolkits to characterize and integrate hardware. The DOE's classical networking resources, such as ESnet, and quantum expertise provide a backbone to drive these developments and scale quantum technologies.

Conclusion

Quantum information science and technology hold great potential to unlock a new era in American innovation and economic competitiveness, offering the promise to solve some of the world's most pressing challenges, including groundbreaking energy innovation, advanced chemistry simulations, and medical breakthroughs. Advances across this field will impact DOE's entire mission space of scientific discovery, energy dominance, and national security.

Maturing quantum technologies into fully functional scientific instruments for America will require careful handoffs between Federal agencies, scientists, engineers, manufacturers, and industrial performers. This effort will explore new scientific discoveries, public-private partnerships, and a robust supply chain.

The National Quantum Initiative Act recognized the great potential of quantum technologies to impact our national and economic competitiveness through new research and development programs, building and enabling our talent pipeline, and facilitating technological innovation. The U.S. Government, and DOE in particular, can capitalize on decades of investment and innovation, including those efforts initiated by the National Quantum Initiative Act. Its reauthorization can usher the U.S. into the next chapter of quantum information science and technology, ensuring that we maintain leadership and once again maximize the impact of the American scientific enterprise. This vision integrates with the ambitious goals of the Genesis Mission: to dramatically accelerate scientific discovery and to significantly increase the productivity and impact of research and development in America.

Chairman Babin, Ranking Member Lofgren, and esteemed Members of the Committee, thank you again for the opportunity to testify before you today. I look forward to our discussion and answering your questions.