Commanding Heights: Ensuring U.S. Leadership in the Critical and Emerging Technologies of the 21st Century.

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This paper is presented to the U.S. House of Representatives Select Committee on the Competition Between the United States and the Chinese Communist Party - as requested by majority Staff Director, Dave Hanke - on July 25, 2023, and addresses why the race to "Q-Day" is a must-win for the United States.

What is "Quantum"?

Quantum technologies, often referred to under the umbrella of 'Quantum Information Sciences' (QIS), leverage the principles of quantum physics to advance information processing, analysis, and transmission. Within QIS, we often think of three families of quantum technology, namely, quantum sensing[1], quantum communications[2], and quantum computing[3].

[1] **Quantum sensing** refers to the use of quantum mechanics to build extremely precise sensors. This is the application of quantum technology assessed to have the nearest-term operational potential.

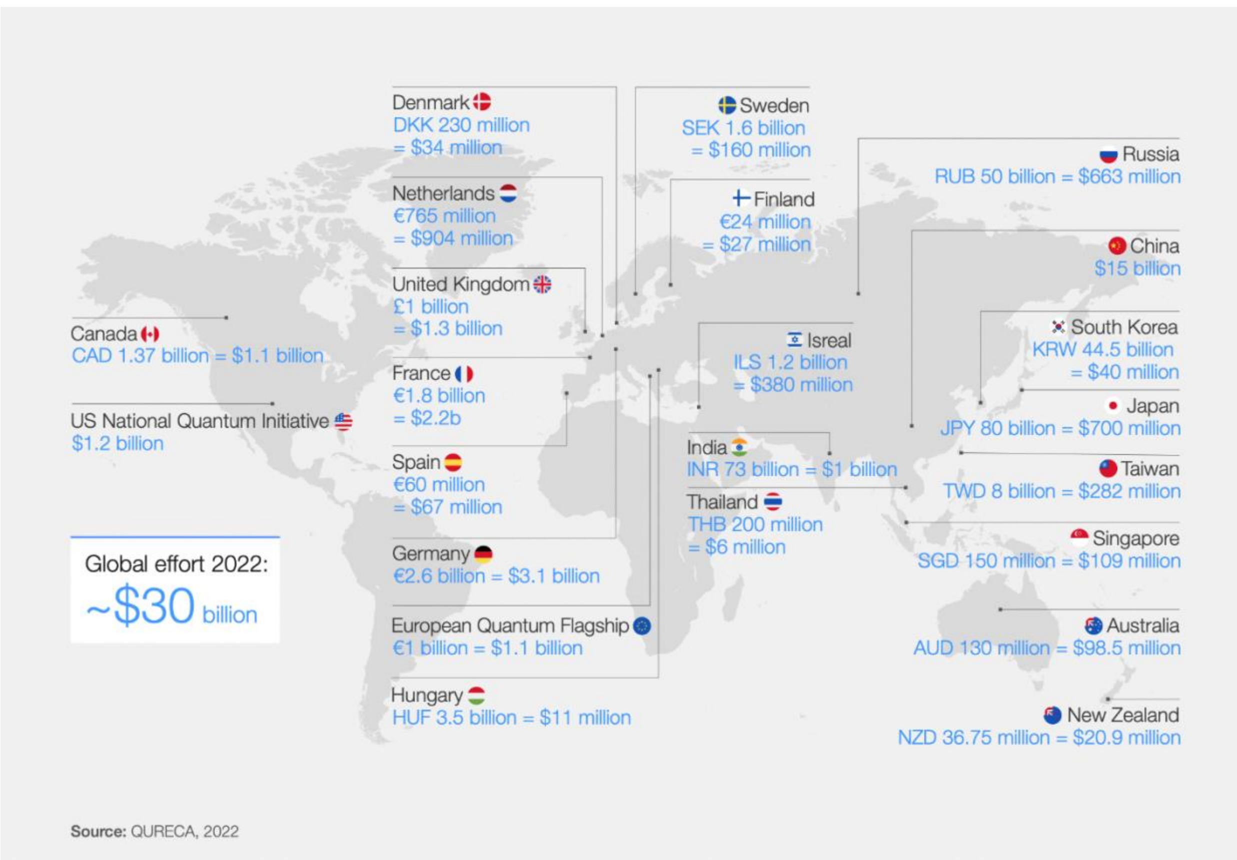
[2] **Quantum communication** takes advantage of the laws of quantum physics to protect data. The primary near-term application of quantum communication technology leverages a method known as quantum key distribution (QKD), where encrypted data are sent in the form of conventional bits (0s or 1s) over networks, while the keys to decrypt the information are both encoded and transmitted in a quantum state using quantum bits, or qubits. Longer-term applications include networking together quantum computers and sensors.

[3] **Quantum computing** uses quantum mechanics principles to perform operations on data much faster and with much more efficient processing power than is possible with conventional computing. Whereas in conventional computing, bits can only exist in one of two physical states: 0 or 1 meaning that calculations have to be performed sequentially, in quantum computing, qubits can exist in a "superposition" of *both states simultaneously (0 and 1)* which means that multiple calculations can be performed simultaneously. Think of this like a light switch. In conventional computing, the light is either off or on. With quantum computing, the light switch can be thought of as on a dimmer. Additionally, qubits can become "entangled" with each other, meaning that the state of one qubit affects the state of another, even if they are far apart. This allows for the creation of quantum circuits that can perform complex calculations that would be impossible with conventional computing.

Though our understanding of the field of QIS is ever evolving, the technology will almost certainly transform nearly every major industry from aerospace to pharmaceuticals to finance and intelligence collection and processing.

Advances in quantum computing in particular, are increasingly projected to offer a "once-in-a-generation [technological] paradigm shift,"[i] revolutionizing our approaches to drug discovery, simulations, large-scale optimization modeling, encryption protocols, and instantaneous communication, to name a few.

As is the case with many critical emerging technologies, most leading industrial nations have publicly committed to focus on, and demonstrated robust public and private investment in, quantum technology development. In fact, last year, the World Economic Forum highlighted that planned public investment in quantum computing, alone, had topped $30 Billion, with over 50 percent of that investment coming from China.[ii] By way of comparison, the United States invested $1.2 billion during the same period.



Why Should We Care?

The Defense Advanced Research Projects Agency (DARPA) anticipates that quantum computing will have profound impacts on society and national security once we have built what the agency refers to as *utility-scale quantum computers*. These large-scale, commercially and cryptographically relevant quantum computers have not yet been fully developed but are expected to come online within the decade. It is increasingly clear that the race to "Q-Day"[4] – a national security and global position-defining race which, in many policy circles, has become emblematic of U.S.-China competition – is well underway.

Quantum computers exist today, but they are small and not yet fault-tolerant, or error corrected. In plain English: the quantum computers of today are not any more useful than supercomputers. But, as the technology continues to develop at a rapid pace, in a matter of a few short years the first utility-scale quantum computers will become a reality.

The Chinese Communist Party (CCP) itself describes the international security system and global strategic stability as being undermined by the United States through "engage[ment] in technological and institutional innovation in pursuit of absolute military superiority."[iii] The CCP cites such technologies as artificial intelligence and quantum information, or "new and high-tech military technologies based on IT" as enablers of the "prevailing trend to develop long-range precision, intelligent, stealthy or unmanned weaponry and equipment" and drivers of the evolution of "informationized warfare" and ultimately, "intelligent warfare."[iv] Such proclamations as "China's military security is confronted by risks from technology surprise and growing technological generation gap. Greater efforts have to be invested in military modernization to meet national security demands"[v] reinforce China's massive public and private investments in such technologies as quantum computing and underscore its long-stated aspiration to lead the global quantum revolution.[vi]

The bottom line is that whichever country leads in quantum computing and technologies, will have an asymmetric advantage in all aspects of information infrastructure – public and private – both in terms of its own defenses, via designing and enacting new encryption protocols, and in terms of its ability to threaten, decrypt, or disable adversary infrastructure.[vii] Further, with a projected $1 Trillion dollar global market by 2035[viii], the first nation to commercialize quantum computing will "have an upper hand in establishing market dominance, developing quantum governance models, and pursuing novel quantum applications."[ix]

[4] "Q-Day" is the colloquial term industry experts use to describe the day when utility-scale quantum computers are able to factorize the large prime numbers that underlie our public encryption systems, securing our personal and corporate bank accounts, financial markets, and vital infrastructure.

The nation that wins in the global race to Q-Day, which would entail finalizing development of a large (utility-scale) fault-tolerant, error corrected quantum computer capable of running Shor's algorithm,[5] will be poised to fundamentally alter the global security and economic landscape.

Now imagine for a moment, a future, wherein China is that nation. The only certainty in such a future is that the balance of power – across multiple axes – shifts markedly. But here is what it could look like:

National Security Implications: First and foremost is the threat to encryption. China would be able to crack most of our existing cryptographic systems, which protect everything from classified government information to our personal bank accounts. In addition to the obvious and dangerous exposure of highly sensitive information, broken encryption would likely lead to a huge and sustained loss of trust in government and industry security measures and result in significant financial losses and potential civil unrest as the population grappled with the realities of the technology and the limitations of our existing safeguards.

Economic Implications: Economically, control of this breakthrough technology puts China at the helm of what could be the next technological revolution. Dominance in quantum computing could mean a competitive edge across major industries – both those where we have proven quantum algorithms that will transform automotives, pharmaceuticals, and finance, and those adjacent industries where the still ill-understood magnitude of the technology will create new products, services, and potentially entirely new industries. Further, Western tech giants, that have made decades-long, substantial investments in quantum research, might see their positions threatened, leading to market volatility.

Technological Implications: Further, there is a real risk, though likely longer-term in nature, that a quantum advantage could supercharge China's lead in AI, potentially amplifying China's capabilities in surveillance, both domestically and internationally, further widening the gulf between the two nations on issues of data privacy and cybersecurity. Other countries, seeing such a leap might be more inclined to form technology partnerships with China, potentially isolating the U.S. or forcing the country to take a defensive position to protect our own industrial base.

Geopolitical Implications: A dominant China in quantum computing could ultimately redefine the power dynamics between our nations, increasing China's leverage in international relations,

[5] Factoring large numbers is incredibly complicated, and so, factoring is the basis for many of our current encryption schemes or protocols. In 1994, Peter Shor, the Morss Professor of Applied Mathematics at MIT, developed a quantum algorithm that calculates the prime factors of a large number, vastly more efficiently than a conventional computer is able to. However, the algorithm's success depends on a large-scale quantum computer able to run it.

through the widespread export of its technology—and with it, potentially, its political values—to other nations, altering global norms and the global order.

China's Commitment to Quantum Primacy

At the turn of the century, it was widely accepted that the United States was far out in front, leading the globe in quantum technology development and applications. In the last few years, however, the incredible disparity in government funding for quantum research and technology development between the U.S. and China, combined with China's acutely defined and meticulously executed, long-term science and technology strategy, has positioned China to overtake the U.S. in the race to Q-Day.[x] We should not be surprised. The CCP has been signaling its desire and intent to become a technological superpower for decades. In fact, it "stems [back] to the exploitation of China's weaknesses by foreign powers possessing superior military technology during the 'century of humiliation'... and form[s] the basis for what is now known as China's 'techno-nationalism," a concept that now underpins China's development and innovation strategies.[xi]

In 1998, China's quantum research program kicked off in earnest with a consortium of Chinese universities and research institutes, forming amongst the Chinese Academy of Sciences' Institute of Physics, USTC, and Shanxi University. Fifteen years later, that research became foundational to China's desire to reinforce the security underpinning its communications as the country gained unparalleled insights into the U.S.' quantum program and intelligence capabilities during the Snowden leaks. USTC Scientist Jian-Wei Pan leveraged those 15 years of research to great effect in his pursuit of a quantum communications capability (and ultimately, advantage). He is now widely considered the "founder" or "godfather" of China's quantum science program.[xii]

Over the last decade, China's quantum-related national spending and policy focuses have included creation of the National Laboratory for Quantum Science, the worlds' largest quantum research facility to date; the launch of a quantum-enabled satellite called Micius; announcement of the world's first integrated quantum communication network from over 700 optical fibers with two ground-to-satellite links using QKD; roughly $15B in committed public funding for quantum research and technology development; state-owned venture capital funds such as Shenzhen Capital investing hundreds of millions of dollars in at least 30 Chinese quantum startups and scale-ups (not including those contained within Universities); and roughly 85,000 quantum-related patents granted to Chinese scientists.[xiii]

Despite known “institutional impediments to interdisciplinary cooperation and challenges in complex engineering that is required”[xiv] for true quantum primacy, China’s quantum-related accomplishments – announced and observed/verified – to include its new ‘megaprojects’ in quantum computing and communications under its 13th Five-Year Plan (2016-2020), continue to reinforce the nation’s long-signaled desire to become a true “science and technology superpower…contest[ing] traditional American leadership in innovation in ways that may have far-reaching implications for today’s great power rivalry.”[xv]

U.S. Countermeasures

In December 2018, the 115th Congress passed, and the President signed into law, an incredibly significant piece of legislation and a key pillar of the U.S.’ ability to counter the possibility of Chinese quantum primacy: the National Quantum Initiative Act (NQIA) “to accelerate quantum research and development for the economic and national security of the United States.”[xvi]

The Act, which has since been amended by subsequent National Defense Authorization Acts and by the CHIPS and Science Act of 2022, seeks to ensure a coordinated federal approach amongst key agencies and departments to the development, guidance, and funding of QIS programs and quantum systems and application development. Further, it aims to more closely tie federally funded research and development to academic and private sector quantum initiatives to foster a stronger quantum ecosystem. In furtherance of the NQIA the U.S. appropriated nearly $1.3B in federally funded quantum R&D over the future years defense program.

The challenge with respect to the NQIA and its intent is one of timing. Much like our approach to the adoption, development, and proliferation of AI within the federal government, wherein the strategy was sound but failed in execution due to timing, my fear is the same will be true for the NQIA and our well-intentioned approach to quantum technology. The ‘let 100 flowers bloom’ strategy that the federal government seems to repeatedly adopt for emerging technology development and procurement presumes that we have enough time to let the notoriously slow technology scouting, testing and evaluation, and procurement processes play out. That strategy also assumes the labs’ will successfully mature their respective technologies sufficiently quickly for operational purposes, and that multi-billion-dollar investments from private industry will continue in perpetuity, either through internal R&D investments or – more realistically in the case of quantum computing – through private capital.[xvii]

The vibrant quantum ecosystem in the United States is intact today but despite the 100+ quantum startups that call America home, despite the most quantum-related patents filed in any country, despite the extraordinary amount of private capital that has been invested in U.S. quantum companies, the race to Q-Day is both critical for us to win and is unquestionably ours to lose.[xviii]

Where Do We Go from Here? Recommendations for Committee Consideration

The U.S. government is exceptionally well-positioned to drive our quantum ecosystem further and faster, by expanding efforts to buy down risk, making some big bets, meaningfully investing in innovation incubation, and helping to reduce friction points that might slow private sector progress. An increased focus on transitioning quantum-related research and engineering experiments and prototypes into American company-made products would also yield positive domestic outcomes.

There are countless opportunities and initiatives – many of which have been robustly researched and proposed by leading think tanks,[6] private sector analytics and global advisory firms, and senior national security and technology practitioners – that could help secure the U.S.' position in the global race to Q-Day. Below is a compilation of previously published recommendations that I believe are most critical to pursue in the next 24 months:

Resourcing Recommendations:

1. **Increase public funding.**
    a. **According to McKinsey & Company, China has committed $15.3 billion in public funds for quantum computing, eight times more than the U.S. and more than double that of European Union governments.** China has stated that they cannot lose the next generation of computing leadership and fall behind, as they did in semiconductors. Given these stakes, we need bold action by the U.S. government to close the investment gap in the form of primary research, research grants to private partners, building and purchasing quantum computing platforms for applications research, and deployment of strategic capital to fund long, deep-technology development cycles.[xix]

[6] Of note, the Australian Strategic Policy Institute's Critical Emerging Technologies Tracker and associated report is summarized at Appendix A.

b. **Increase federally-funded R&D to 2% of GDP through a revived Endless Frontiers Act** which would provide ~$400 billion for basic research in the named emerging and critical technologies as well as strengthen our world-class academic institutions (up from ~$80 billion R&D dedicated to national security fields and $80 billion for health-related fields).[xx]

2. **Diversify investment across quantum computing modalities.** Since the NQI was established five years ago, a new wave of technologies, such as neutral atoms and photonics, have moved to the forefront of the field with the potential to scale more quickly. These modalities are not supported by current NQI funding because they were not established when funds were distributed. Public funding and support, including the renewed NQI, should be distributed across a broader set of quantum computing modalities to support new technological evolutions and increase our chances of maintaining global leadership. We have seen investment in newer modalities by individual government agencies, such as DARPA through its Underexplored Systems for Utility-Scale Quantum Computing (US2QC) program. These programs are essential for emerging modalities.[xxi]

3. **Government as partner and customer**. It is critical that the U.S. government be an early adopter and customer of quantum computing systems and/or services and help build the user base by incentivizing agencies and researchers to explore and adopt quantum computation. Purchase of quantum computing time or systems would multiply the effects of funding. Revenue and the U.S. government stamp of approval attract further venture investment in quantum computing companies and feedback into the research ecosystem, giving the technology further boosts in applications development and as an ecosystem. We are seeing increased efforts in this area with agencies like the U.S. Department of Energy, the National Science Foundation, and others issuing more quantum-related funding calls or incorporating quantum technologies into broader funding opportunities.[xxii]

4. **Critical Technology Industry Fund.** Create a Critical Technology Industry Fund (CTIF), which would provide incentives to companies in emerging and critical technology industries “and be matched by state and local governments, for building or expanding R&D and advanced production facilities in the United States. This would be similar to the incentives program in the Creating Helpful Incentives to Produce Semiconductors (CHIPS) Act, but it would be applied to a broader set of advanced industries. U.S.-headquartered firms, as well as firms

from allied nations, would qualify for incentives. Ideally, Congress would provide at least $25 billion per year, to be matched dollar-for-dollar by state and local governments. To ensure that the investments are widely distributed geographically, there could be limits on how much each state could receive in matching funds for their incentives, based on their share of the U.S. population. This program should be run by the Department of Commerce...These kinds of capital-focused incentives are critical because U.S. capital markets today reward firms that take an asset-light strategy. In other words, firms are pressured by Wall Street to shed capital assets to boost returns on net assets. All too often, the firms that keep or grow capital assets are foreign. We see this in the semiconductor industry where the United States leads in the fabless sector of the market, but lags in the capital-intensive fab sector. Absent a serious overhaul of the U.S. equity markets, providing incentives to invest in assets such as buildings, machinery, and equipment will be needed to restore U.S. production in capital-heavy advanced industries.[xxiii]

Talent Recommendations:

5. **Ensure critical talent can stay in the United States.**
    a. **Experienced PhD-level quantum physicists are rare but essential to carrying the quantum computing industry forward.** Many of these PhDs are currently being trained in U.S. universities and companies but struggle with visa and immigration challenges even as their talents and skills benefit our national and economic security. Favorable U.S. export control and immigration policies to retain scarce talent are required. These experts drive American innovation and their visa status should not be at risk.[xxiv]

    b. **Existing frameworks and minilaterals, including but certainly not limited to the Quad and AUKUS, should be leveraged to establish reciprocal technology visa programs among member countries.** Such new visa arrangements should enable easy movement and provide work rights for both early-career and established researchers. For individuals seeking research training, the visa should provide reciprocal recognition of enrolment at the destination university along with a guaranteed period of work rights following successful completion of the training. It is critical that the program supports young researchers to ensure that the best and the brightest are attracted and retained. Visa recipients should be provided with preferential pathways to permanent residency or citizenship at the conclusion of their studies to help reverse the brain drain.[xxv]

c. **Critical technology scholarships for both students and technologists.** Governments should immediately increase funding for specialized PhD scholarships and provide compelling financial incentives for technology companies to run large trainee programs. Each country could tailor such incentives to the technologies they want to specialize in over the coming decades and distribute them via relevant agencies, including education, training and/or science departments. Citizenship eligibility requirements should be considered at the policy design stage, and it may be appropriate for a greater weighting to be given to a country's own citizens to build up greater domestic capability, in addition to those participating in friend-shoring and partnership grant programs (such as in technology visa schemes).[xxvi]

Policy Recommendations:

6. **Prioritize quantum computing in regional tech ecosystems across the country.** Workforce development, job creation, and cross-organization collaborations are required to build a sustainable quantum computing industry in the U.S. that can outpace our global rivals. Regional ecosystems consisting of co-located universities, research labs, and companies are a well-proven strategy to foster a virtuous cycle of innovation. These communities for quantum innovation have already emerged in the U.S. but will require ongoing funding and support from all levels of government to compete in the global economy.[xxvii]

7. **National security considerations in antitrust interventions.** Require the FTC and Department of Justice to explicitly consider national security when ruling on antitrust interventions so we do not inadvertently harm critical technology industries or provide a scale advantage in competing for global markets to an adversary such as the PRC.[xxviii]

8. **Flexible budgeting and procurement tools.** Provide the Defense Department more flexibility in budgeting such as colorless, multi-year funding for adopting critical and emerging technologies; eliminate the need for requirements prior to acquisition of commercial items and encourage the use of Other Transaction Authority to emphasize speed and flexibility for these purchases just as Congress created in 1958 to respond to the Sputnik launch.[xxix]

9. **Create a new China Technology Centre.** The Five-Eyes (FVEY) partners plus Japan should build a new dedicated China technology collection and analysis centre. This new analytical centre should be built from scratch and involve the creation of new teams and structures,

not cobbled together from bits of existing or potential initiatives across countries. All countries involved in this initiative would make significant contributions to rapidly develop new reporting lines on selected China technology topics. That reporting would inform a range of decision-makers and urgently fill any gaps that might currently exist. Such an initiative would be successful only if it's created to pool resources, maximise information sharing and promote innovation in selected critical technology areas. Secondments between countries involved in the initiative would boost trust, sharing and skills transfer and the position of head of this initiative could rotate amongst major contributors. Beyond the initial small group of countries, selected countries could be potentially invited to participate in the centre (such as India and South Korea) once up and running.[xxx]

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Appendix A.
Australian Strategic Policy Institute Critical Technology Tracker

ASPI's Critical Technology Tracker

Appendix 1.2: One-page visual snapshot

Table 6: Lead country and technology monopoly risk.

Technology	Lead country	Technology monopoly risk
Advanced materials and manufacturing		
1. Nanoscale materials and manufacturing	China	high
2. Coatings	China	high
3. Smart materials	China	medium
4. Advanced composite materials	China	medium
5. Novel metamaterials	China	medium
6. High-specification machining processes	China	medium
7. Advanced explosives and energetic materials	China	medium
8. Critical minerals extraction and processing	China	low
9. Advanced magnets and superconductors	China	low
10. Advanced protection	China	low
11. Continuous flow chemical synthesis	China	low
12. Additive manufacturing (incl. 3D printing)	China	low
Artificial intelligence, computing and communications		
13. Advanced radiofrequency communications (incl. 5G and 6G)	China	high
14. Advanced optical communications	China	medium
15. Artificial intelligence (AI) algorithms and hardware accelerators	China	medium
16. Distributed ledgers	China	medium
17. Advanced data analytics	China	medium
18. Machine learning (incl. neural networks and deep learning)	China	low
19. Protective cybersecurity technologies	China	low
20. High performance computing	USA	low
21. Advanced integrated circuit design and fabrication	USA	low
22. Natural language processing (incl. speech and text recognition and analysis)	USA	low
Energy and environment		
23. Hydrogen and ammonia for power	China	high
24. Supercapacitors	China	high
25. Electric batteries	China	high
26. Photovoltaics	China	medium
27. Nuclear waste management and recycling	China	medium
28. Directed energy technologies	China	medium
29. Biofuels	China	low
30. Nuclear energy	China	low
Quantum		
31. Quantum computing	USA	medium
32. Post-quantum cryptography	China	low
33. Quantum communications (incl. quantum key distribution)	China	low
34. Quantum sensors	China	low
Biotechnology, gene technology and vaccines		
35. Synthetic biology	China	high
36. Biological manufacturing	China	medium
37. Vaccines and medical countermeasures	USA	medium
Sensing, timing and navigation		
38. Photonic sensors	China	high
Defence, space, robotics and transportation		
39. Advanced aircraft engines (incl. hypersonics)	China	medium
40. Drones, swarming and collaborative robots	China	medium
41. Small satellites	USA	low
42. Autonomous systems operation technology	China	low
43. Advanced robotics	China	low
44. Space launch systems	USA	low

Appendix B.
Jacqueline Tame Biography

Jacqueline is the inaugural Director of Government Affairs at PsiQuantum – a company building the world's first useful fault tolerant, error corrected quantum computer. Prior to her role at PsiQuantum, Jacqueline was the VP, Innovation at Landus – a multibillion-dollar agricultural coop in Iowa. Before joining Landus, Jacqueline served as the Acting Deputy Director and inaugural Chief Performance Officer of the Department of Defense's (DoD) Joint Artificial Intelligence Center (JAIC). In this capacity, she oversaw day-to-day operations for the 200+ person, $250M Center; led engagements with the White House, Congress, and other key stakeholders and investors to raise awareness of DoD AI programs and secure policy priorities in support of JAIC offerings; advised DoD AI leadership on the federal budget environment and legislative actions; worked to position the JAIC for maximum exposure to key members of Congress, relevant Commissions, and industry leadership; translated DoD's AI objectives into targeted advocacy campaigns with traditional and non-traditional partners to ensure consistent messaging and sustained financial investment; led execution of key campaigns; and designed DoD's inaugural AI performance framework, marrying statutory and policy-driven roles, responsibilities, and functions with customer-defined indicators of success to generate repeatable, outcome-based performance data.

Jacqueline began her career at the Central Intelligence Agency, leading a team of futures analysts to inform strategic acquisition and investment planning. She then transitioned to the Office of the Director of National Intelligence, where she supported the development of IC priorities and publication of the Community's planning and programming guidance and led IC and DoD-wide policy reviews to inform the IC's Capability Requirements and Major Systems Acquisition processes. Finally, Jacqueline served at the Defense Intelligence Agency (DIA), first as a Counterterrorism Mission Manager, then as Senior Policy Advisor to the Chief Performance Officer and Deputy Director. In 2015, while attending the Naval War College, Jacqueline was the only civilian selected to serve for a year as a Director Fellow on the Chief of Naval Operations' Strategic Studies Group. She returned to DIA as Chief of Customer Engagement, where she focused on DIA's support to the Combatant Commands.

Following a decade of service in the executive branch, Jacqueline joined the House Permanent Select Committee on Intelligence where she served as the DIA monitor. During her tenure, she led a 14-month long review of DIA's roles and missions, created a roadmap for defense intelligence reform, and codified findings and legislative recommendations in a Committee report and the FY19 National Defense Authorization Act. In late 2018, Jacqueline returned to the executive branch to lead the implementation of several of the defense intelligence reforms she had identified and recommended as a Hill staffer.

As the Senior Advisor for Strategic Assessment and Integration for the Under Secretary of Defense for Intelligence and Security, Jacqueline designed a comprehensive framework to assess defense intelligence and security component health and readiness; advised the Under Secretary on institutionalizing and measuring the performance of a modern, Enterprise business model for defense intelligence; and designed, secured funding for, and oversaw the development of GAMECHANGER – DoD's first, AI-enabled policy/legal analytics platform to automate the discovery and mapping of DoD authorities, roles, missions, responsibilities, and component interdependencies, decreasing DoD policy and legal query times and analyses from months to seconds.

Jacqueline holds a Bachelor of Arts degree in French with a minor in classical vocal performance and a Master of Public Affairs degree from the University of Texas at Austin, as well as a Masters in National Security and Strategic Studies from the U.S. Naval War College's College of Naval Warfare. She is passionate about growing and promoting women leaders, having founded Command After Next – a small group dedicated to the mentorship, professional development, education, and championship of women in national security. She serves as a partner with the Silicon Valley Defense Group, an Advisory Board member with Modern Intelligence, Groq, and the Common Mission Project, a venture advisor for Starburst Ventures, and a senior advisor to the Chief Digital and AI Officer at DoD, Globally, and Schmidt Futures. A hot yoga enthusiast who legitimately can be found reading policy and Congressional Research Service reports at night before bed, Jacqueline lives with her husband Jonathan, daughter Charlotte, and rescue pups, Dax and Penny in Arlington, VA.