BERNSTEIN
SOCIETE GENERALE GROUP

23 September 2026

U.S. IT Hardware

Quantum: The Next CHIPS Frontier



Mark C. Newman
+1 212 845 7822
mark.newman@bernsteinsg.com



Phoebe Sun
+1 917 344 8481
phoebe.sun@bernsteinsg.com



Arpad von Nemes
+1 917 344 8461
arpad.vonnemes@bernsteinsg.com



Viola Chen
+1 917 344 8614
viola.chen@bernsteinsg.com

*With Quantum World Congress kicking off today in Maryland, and with the US massive $2billion investment into Quantum through the CHIPS act, we summarize the global investment landscape into Quantum. For more see our **Quantum Deep Dive**.*

Quantum Computing has become a strategic priority globally across major nations, with cumulative public funding commitments of >$60B by 2026E, reflecting a geopolitical paradigm shift of governments moving away from treating quantum as an emerging scientific field, and instead viewing it increasingly as an important driver of national security and future economic progress.

In pursuit of their national Quantum interests, China and the US employ very different approaches to fund and support the Quantum ecosystem. Whereas the US is based on a hybrid model built on a combination of mostly private investment supported by public commitments meant to guide ecosystem development to align with national interests, China follows a centralization strategy, dominated by national funding directed towards state-linked organizations.

Over the last decade the US has increasingly shifted its support model for the Quantum ecosystem from funding scientific discovery and foundational research toward structured grants and procurement contracts with milestone-based covenants, culminating in the introduction of the May 2026 CHIPS minority investment mechanisms. This shift marks a transition away from generalized academic research support toward targeted, mission-oriented capital deployment. Alongside this transition, there has also been a clearer institutional separation with civilian agencies such as the DoE, DOC and NSF concentrated on resolving foundational scientific and infrastructure bottlenecks, while defense and intelligence agencies such as the DoD accelerated procurement-driven pathways for deployable quantum capabilities.

On May 21st, the DoC confirmed a federal commitment of $2B across a portfolio of quantum companies including two quantum foundries (Global Foundries and IBM) and 7 pure-play Quantum Computing companies. Administered through the CHIPS R&D Office, funds will be disbursed on a milestone-dependent schedule, incentivizing recipients to accelerate the development of domestic quantum fabrication infrastructure and progress toward utility-scale, fault-tolerant quantum systems across different modalities, thus diversifying technology risk.

The recent US Quantum investment bears many similarities with the 1965 push to accelerate Semiconductors, albeit with some differences. Much like the period since early 2025 with Quantum, 1965 represented an inflection point for silicon with commercial adoption still in its infancy. In both cases, geopolitical competition transformed an emerging technology from a largely scientific field into a national strategic priority and public sector support dramatically outpaced the scale of immediate commercial demand, reflecting strategic priorities rather than market economics. However, unlike in 1965, the mechanisms through which Washington supports quantum computing differ markedly from those employed during the semiconductor era, and most importantly, the ecosystem into which Quantum technology is being introduced is vastly more mature today than in 1965.

First Published: 23 Sep 2026 11:27 UTC Completion Date: 23 Sep 2026 11:27 UTC

INVESTMENT IMPLICATIONS

We rate Apple, Dell, SanDisk, Seagate, Western Digital OP; we rate HPE, HPQ, IBM, SMCI MP.

Table Of Contents

Quantum Computing is becoming a National Strategic Priority Globally 3
The US and China pursue different models to support the Quantum industry 5
The Evolution of US Quantum funding: from Research Grants to Procurement Contracts 7
US deploys $2 billion in quantum incentives via the CHIPS R&D Office 10
Echoes of 1965: Parallels to Washington's role in Commercializing Semiconductors 13

DETAILS

We thank Roshen Chatwal for his assistance and contribution.

QUANTUM COMPUTING IS BECOMING A NATIONAL STRATEGIC PRIORITY GLOBALLY

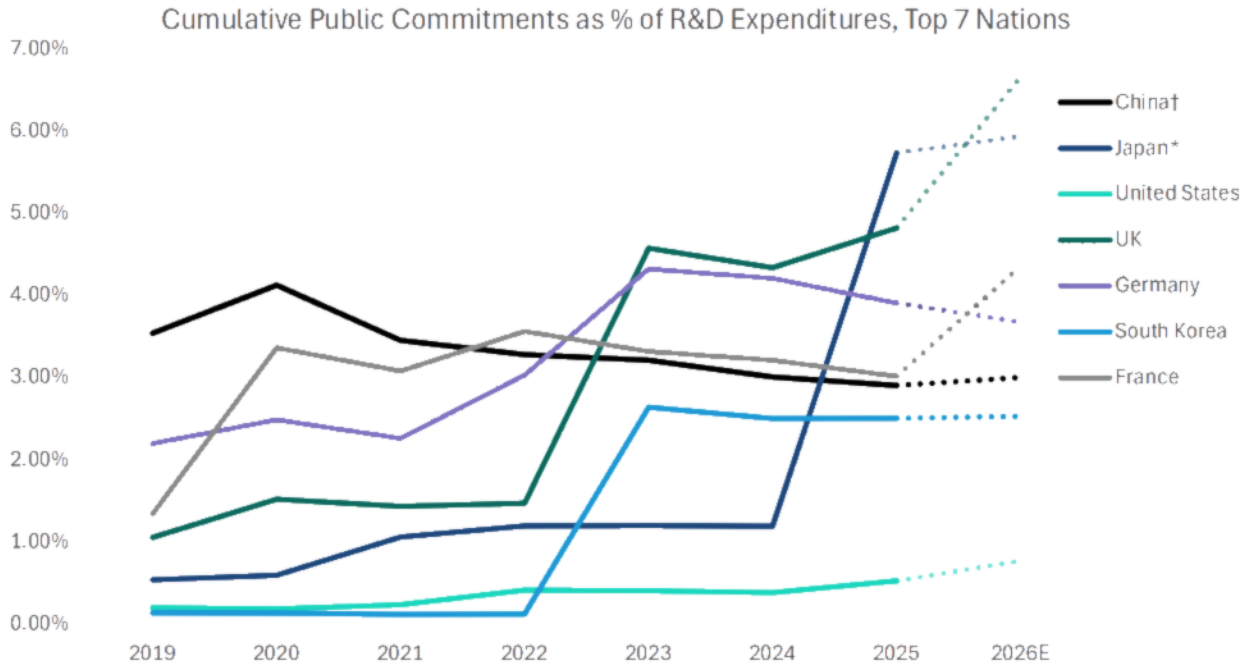
PUBLIC COMMITMENTS SURGE AS QUANTUM BECOMES STRATEGIC

Cumulative, global public commitments[1] directed toward quantum technologies have more than tripled since 2019, likely reaching over $60B in 2026E. This significant capital expansion reflects a geopolitical paradigm shift with governments moving away from treating quantum as an emerging scientific field, and instead viewing it increasingly as an important driver of national security and future economic progress. This priority shift is directly evidenced by Quantum's expanding, albeit volatile, share of national R&D expenditures across nearly all of largest developed countries (**Exhibit 1**). Alongside this shift, funding has evolved from research grants into more structured, program-oriented initiatives which are designed to hit progressive benchmarks on the path to quantum readiness, consolidating a large part of the funding around the industry's commercial front-runners.

However, public funding can be lumpy, as evidenced by a compression in net new commitments between 2023–2024, followed by a sharp rebound thereafter (**Exhibit 2**). Sovereign commitments tend to come in "programmatic waves", unlike more consistent corporate budgets, especially as competing technologies vie for a limited budget. As an example, the cooling period observed between 2023–2024 coincides with a shift in attention to more near-term technologies such as Generative AI. Importantly, new public Quantum funding is increasingly milestone-dependent, requiring current initiatives to demonstrate tangible breakthroughs before triggering new state-sponsored waves of funding.

[1] Public Quantum commitments are defined as the total value of government, sovereign wealth fund, and university-announced funding directed toward quantum technologies. Although commitments do not necessarily translate into annual spending, they provide an available measure of long-term strategic intent and national priorities.

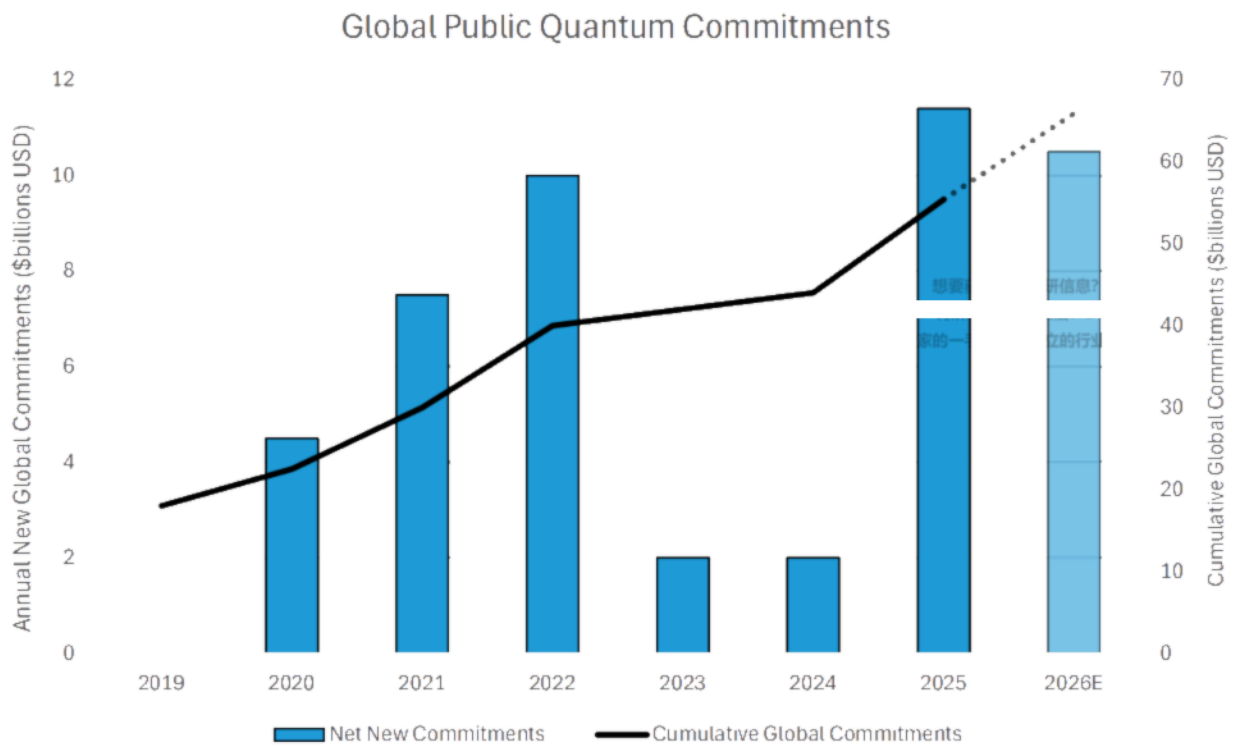
EXHIBIT 1: **Governments are prioritizing Quantum as a strategic technology and are spending an increasing share of national R&D expenditures on Quantum**



† China values may be conservative estimates due to limited public disclosure of quantum commitments.
* Japan values may be overstated since portions of its 2025 commitment include broader advanced computing initiatives in addition to quantum technologies.
Note: 2025–2026E R&D baselines assume 2024 OECD MSTI and China NBS R&D levels relative to GDP remain unchanged.

Source: OECD MSTI, China NBS, IMF, Bernstein estimates and analysis

EXHIBIT 2: **Public Quantum commitments expand through funding waves which can be lumpy**



Source: McKinsey QTM, QURECA, Bernstein estimates and analysis

THE US AND CHINA PURSUE DIFFERENT MODELS TO SUPPORT THE QUANTUM INDUSTRY

THE AMERICAN MODEL: PRIVATE CAPITAL, PUBLIC ACCELERATION

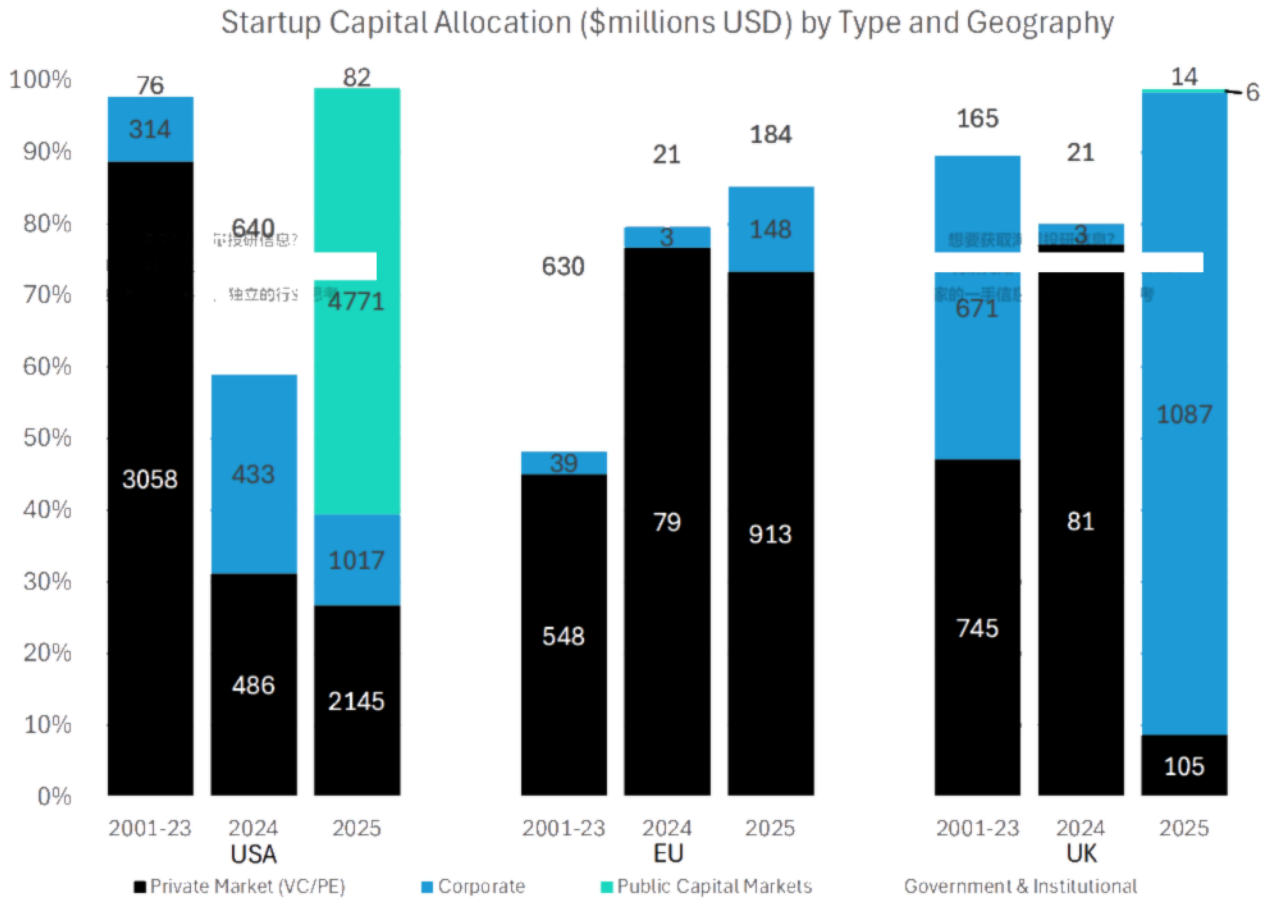
The US is aggressively closing its public Quantum Information Science (QIS) funding gap through its recent domestic funding programs, utilizing strategic partnerships with Japan and the UK as amplifiers. Legislative reauthorizations of National Quantum Initiative (NQI) Act funding, an expansion of Department of Defense (DOD) commercial procurement contracts, and targeted CHIPS Act allocations have nearly doubled cumulative US public spending levels since the beginning of 2025 and key allies have synchronized their capital deployments with the US. This is exemplified by a joint $500M commitment from both Japan and the US under the "Genesis Mission" to accelerate next-generation Quantum architectures alongside the US-UK Quantum Pact, the UK-Japan Frontier Technology Pact, and the US-Korea Technology Prosperity Deal. Alignment between Washington, London, and major APAC countries differs from, e.g. France and Germany which are deliberately building a parallel quantum value chain.

Recent public commitments are complementary to private commercial investment in American quantum companies (Exhibit 13) which are much larger than in other countries. Moreover, relative to international peers, US-headquartered Quantum startups tend to receive significantly less direct government capital due to the availability of deep private and public markets. As a result, most US-based Quantum companies have been largely decoupled from (financial) state dependency, with private venture markets historically providing the bulk of funding and increasingly even public capital markets providing ample capital despite the startup nature of these businesses, as evidenced by several listings, including those of Quantinuum, IonQ and D-Wave. **Importantly, we do not view the historic relative "lag" in US public commitment compared to smaller economies as a vulnerability for the domestic Quantum sector. Rather it is a reflection of deep, private and public capital pools with government funding serving as an additional accelerant.**

Achieving fault-tolerant computing and robust cryptography is the United States' major priority. Recent federal commitments are being funneled into domestic fabrication infrastructure and advanced hardware architectures to secure long-coherence processing supremacy. Adjacent, non-computing verticals like Quantum Communications (QComm) and Quantum

Sensing (QSense) currently receive very little public backing outside highly specialized military procurement.

EXHIBIT 3: **U.S. Quantum Startups Depend Less on Public Capital Than Global Peers**



Source: McKinsey QTM

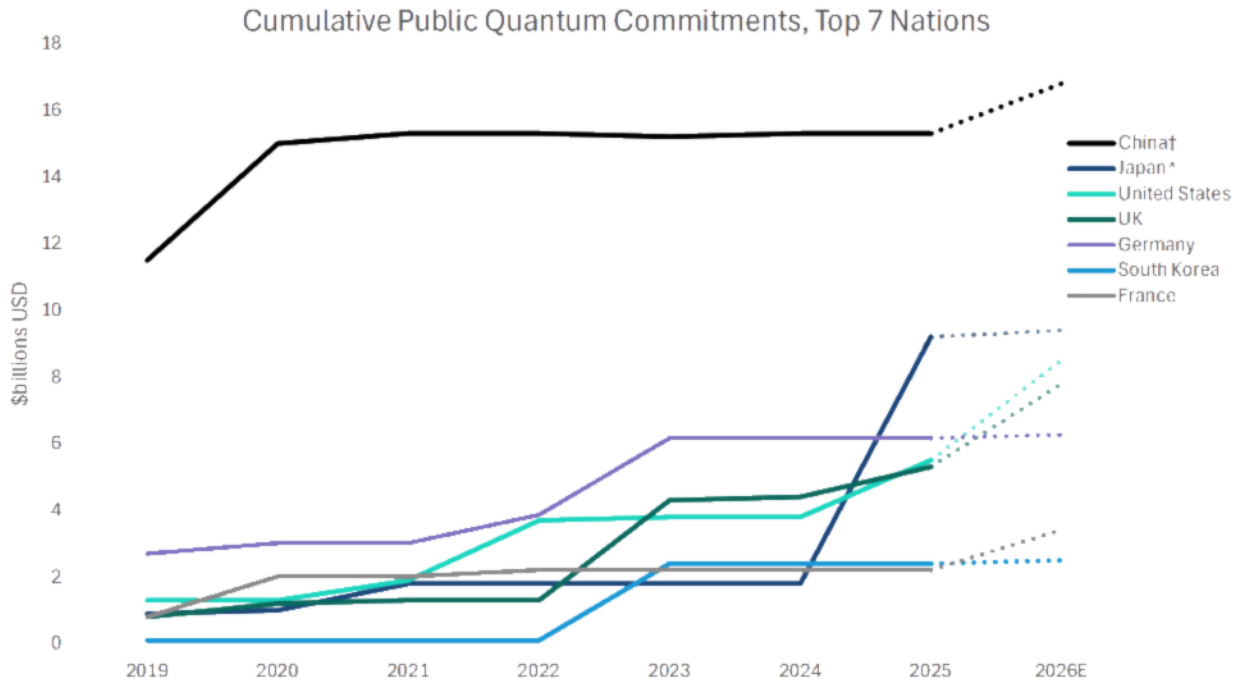
THE CHINESE MODEL: CENTRALIZATION

Chinese state commitments to quantum technologies have been the largest since at least 2019 (Exhibit 4), even by conservative estimates. Because China treats quantum programmatic data sensitively, these estimates primarily rely on proxy indicators, including patent volumes, mega-lab square footage, and reported headcounts as well as capital estimates in the 13th and 14th Five-Year Plans. However, newer initiatives, including the 15th Five-Year Plan and the $138bn National Venture Capital Guidance Fund announced in 2025signal a ramp-up in new commitments following a six-year "plateau."

Chinese quantum technology funding is becoming increasingly nationalized. This trend is evidenced by disengagement from major technology incumbents like Alibaba and Baidu, which shut down their quantum research divisions in late 2023 and early 2024, respectively, and transferred assets to state-linked institutions. R&D efforts are instead being consolidated into centralized hubs like Hefei's "Quantum Avenue," with over 30 companies in a city with nearly 100 industry players. This shift likely reflects the government's push to streamline research and fast-track technologies that directly serve state interests.

Public capital moved early into physical infrastructure. By 2021, China had deployed a secure Quantum Key Distribution (QKD) communication network integrating 700 fiber and 2 ground-to-satellite links, connecting over 150 users across a combined 4,600 kilometers. That same year, Chinese entities accounted for roughly 53.8% of total quantum technology patents filed over the previous two decades, while Quantum Information Science rapidly expanded across the curricula of standard colleges and universities.

EXHIBIT 4: **Chinese Public Quantum Commitments have been the largest since at least 2019**



† China values represent conservative estimates due to limited public disclosure.
* Japan values may be overstated since portions of its 2025 commitment include broader advanced computing initiatives in addition to quantum technologies.

Source: McKinsey QTM, Bernstein estimates and analysis

THE EVOLUTION OF US QUANTUM FUNDING: FROM RESEARCH GRANTS TO PROCUREMENT CONTRACTS

The 2018 passage of the National Quantum Initiative Act (NQI) marked the beginning of the modern era of federal quantum funding. Since then, disbursements have evolved from pure research grants supporting scientific discovery to increasingly structured grants and contracts with milestone-based covenants, culminating in the introduction of the May 2026 CHIPS minority investment mechanisms.

2018: RESEARCH-FIRST FOUNDATIONS

The 2018 NQI Act approached fault-tolerant quantum computing as a scientific challenge decades away from commercialization, prioritizing Quantum Information Science (QIS) competency over the scaling of manufacturing infrastructure. The Act authorized $1.275B (**Exhibit 5**) over a 5-year window in non-dilutive QIS research support: up to $625M for the Department of Energy (DOE), $400M for the DOC via the National Institute of Standards and Technology (NIST), and $250M for the National Science Foundation (NSF). Prior to the NQI, federal Quantum funding followed a bottom-up model, characterized by fragmented $1–5M SBIR and STTR awards distributed across hundreds of academic labs, university consortia, and early-stage experimental systems. The NQI Act marked a shift toward a more centralized, top-down funding model that enabled multi-agency programs and larger institutional awards.

2019-24 APPROPRIATIONS: BUILDING THE NATIONAL QUANTUM ECOSYSTEM

Federal Quantum funding expanded significantly beyond the levels initially authorized under the 2018 NQI Act as agencies scaled and coordinated a national quantum ecosystem (**Exhibit 5**). The Department of Defense (DOD) and NASA emerged as major participants as well, supporting QIS research while also entering early-stage commercial and procurement relationships. Because federal agency budget reporting does not consistently distinguish between research grants and procurement contracts, we estimate agency-level funding composition by applying grant-versus-contract award shares derived

from USASpending.gov data.

- **DOE:** allocated approximately **$1.4B on large scale research support infrastructure**, including the establishment of 5 National Quantum Information Science Research Centers (NQISRCs). These centers focus on scaling quantum hardware and developing early application pathways.
- **NSF:** allocated approximately **$1.5B toward early-stage innovation and workforce development**, including the creation of multi-institutional Quantum Leap Institutes and broad funding of university-based QIS research.
- **DOC:** allocated approximately **$275M to metrology and standards development**, including the creation of the Quantum Economic Development Consortium and early post-quantum cryptography initiatives to support industry coordination.
- **DOD:** allocated approximately **$1.7B toward developing deployable quantum capabilities** across computing, sensing, navigation, and timing systems. Notably, DOD functioned as an early market creator, with an estimated 36% of its funding directed through procurement-oriented contracts rather than pure research support.
- **NASA:** allocated approximately **$60M toward applying QIS in space and extreme environments**, including free-space quantum communication and Cold Atom Lab-based sensing experiments aboard the ISS. Unlike civilian science agencies, NASA played a disproportionately application-focused role, with an estimated 88% of funding distributed through procurement-oriented contracts with photonics and space hardware developers.

2025-26 COMMITMENT: PROCUREMENT-LED FUNDING BECOMES MORE DOMINANT

We think Washington's timeline for fault-tolerant quantum computing is compressing, with a once multi-decade horizon increasingly focused on a target window within the next 10 years. This shift is partially supported by Google's December 2024 Willow chip breakthrough, which first demonstrated that scaling physical qubit counts can reduce error rates and extend coherence times. Beyond any single technical milestone, a few developments signal a broader structural shift in federal quantum strategy:

- **Legislative Acceleration**: The progression of the NQI Reauthorization Act in December 2024, proposing a $2.7B budget ceiling over a five-year lifecycle, reflects a heightened sense of urgency among federal policymakers.
- **Funding Model Evolution**: In advance of the equity-linked capital introduced through the May 2026 CHIPS commitments, federal agencies expanded programs awarding industry-leading universities and companies through non-dilutive vehicles.

Together, these shifts mark a transition away from generalized academic research support toward targeted, mission-oriented capital deployment (**Exhibit 6**). Crucially, this period also introduced a clearer institutional separation: civilian agencies concentrated on resolving foundational scientific and infrastructure bottlenecks, while defense and intelligence agencies accelerated procurement-driven pathways for deployable quantum capabilities.

RESEARCH SUPPORT: CIVILIAN AGENCIES TARGETING BOTTLENECKS

Civilian agency funding during this period has remained predominantly grant-based and focused on resolving critical bottlenecks in materials science, fabrication infrastructure, and quantum software. Total committed funding across major programs has reached at least $1.15B so far over 2025-26.

- **DOE National QIS Research:** Committed an additional **$625M** in 2025 over a 5-year lifecycle directly to the 5 NQISRCs. The funding focuses on **designing hardware-agnostic quantum software,** quantum memory storage, and integration with classical high-performance computing systems.
- **DOE Energy Frontier Research Centers:** Committed **$352M** in early 2026 over a 4-year lifecycle to academic groups to isolate and **solve fundamental materials constraints at the atomic level.** Specific targets include synthesizing topological insulators and next-gen superconducting materials to reduce variance in superconducting qubits.
- **NSF National Quantum and Nanotechnology Infrastructure:** Committed **$100M** in early 2026 over a 5-year lifecycle to support open-access cleanrooms and nano-fabrication facilities across up to 16 universities. These will **reduce**

capital intensity barriers for early-stage quantum companies and university spin-offs demanding specialized lithography and cryogenic equipment to test chip prototypes.

- **DOE Advanced Scientific Computing Research:** Committed **$65M** in mid-2026 over a 5-year lifecycle through 38 awards across 10 academic and lab-led software projects targeting development of **cloud middleware, error-correction algorithms, and compilation toolchains** for noisy mid-scale quantum hardware.

PROCUREMENT CONTRACTS: DEFENSE-LED MARKET FORMATION

In contrast, federal contracting activity during this period has been dominated by defense and intelligence agencies, which deployed fixed-price, milestone-dependent agreements to procure early Quantum capabilities from commercial vendors. The total value of goods and services being provisioned in unclassified federal Quantum contracts has reached **over $500M** so far over 2025-26.

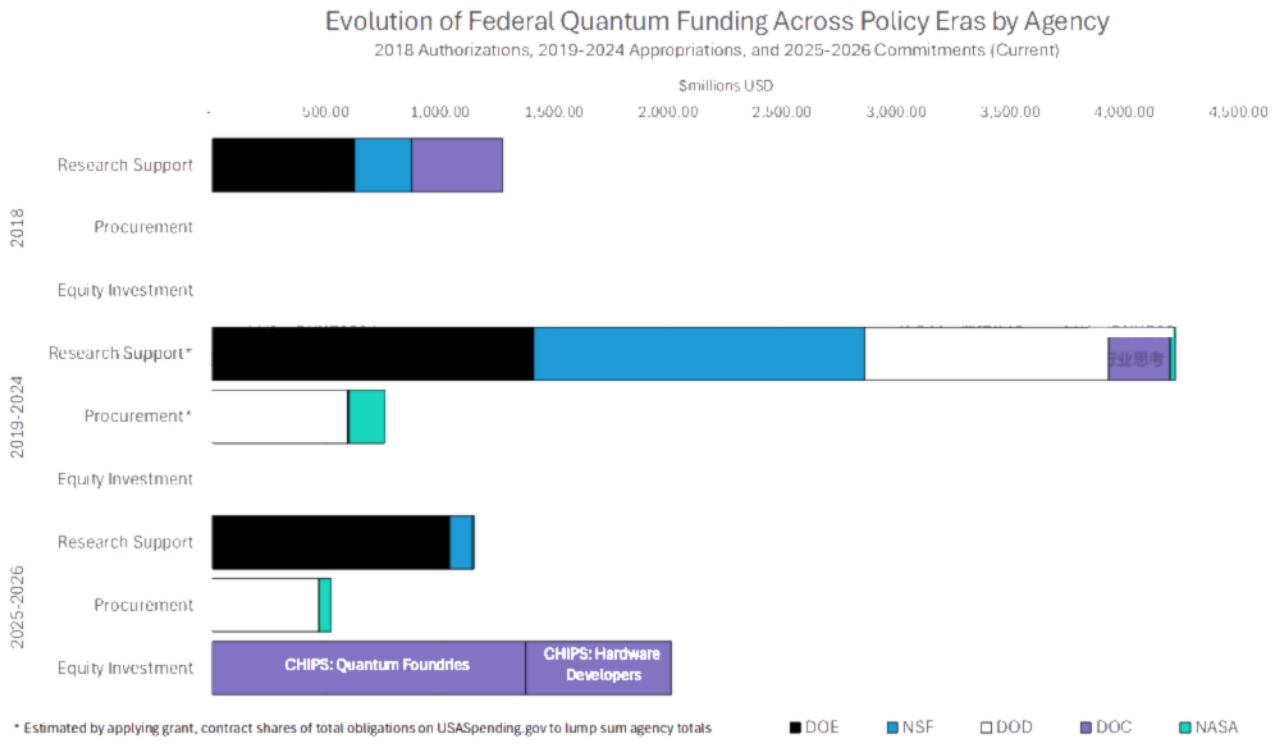
- **DOD DARPA Quantum Benchmarking Initiative:** Committed to signing over **$250M** in contracts in early 2026 towards accelerating the timeline for **verifying whether commercial quantum computing approaches can achieve utility-scale operation by 2033**. DARPA previously advanced 11 companies in late 2025 to Stage B of the program, signing an estimated **$125M** in contracts with awards maxing out at $15M per company. Stage B is the hard engineering filter that forces the companies prototype next-generation components, and develop auditability to prepare for strict government benchmark testing in Stage C.

- **DOD DARPA Independent Verification and Validation Contract:** Awarded **$34.8M** in early 2026 to the University of Maryland Applied Research Laboratory for Intelligence and Security. This laboratory will **develop the independent technical audit team** responsible for supporting the Capital Quantum Benchmark Hub in Stage C testing protocols, hardware benches, and verification software used to audit the 11 players currently in stage B of the Quantum Benchmarking Initiative.

- **DOD DIU Transition of Quantum Sensing:** Awarded **$59.5M** in contracts in late 2025. These commercial acquisition agreements, managed through the Defense Innovation Unit, will provide the government with **quantum sensing technologies including atomic clocks (Exhibit 7) and magnetometers** for testing on military vehicles in GPS-denied locations. These agreements included strict manufacturing covenants (e.g., size, weight, power, and cost), with failure to meet thresholds triggering contract termination clauses.

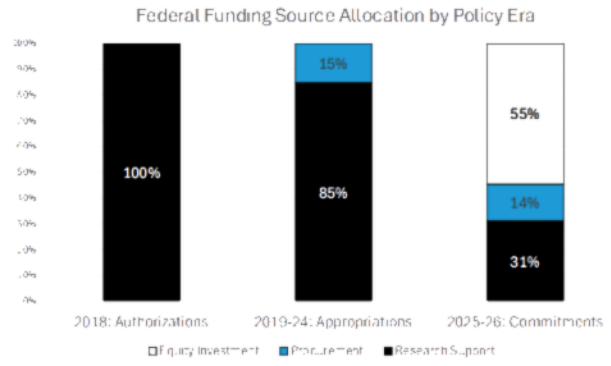
- **NASA allocated approximately $60M** over 2025-2026 toward applied QIS in space and extreme environments, maintaining an estimated procurement-heavy split consistent with prior periods. Notably, NASA's position within the federal Quantum stack is expanding following a **June 2026 executive order requiring the agency to deliver a comprehensive space strategy within 120 days.** This mandate signals NASA's institutional move from an application-layer player to a potential system-level integrator of space-based quantum communication and sensing infrastructure.

EXHIBIT 5: **Quantum Funding mix and magnitude by Policy Era**



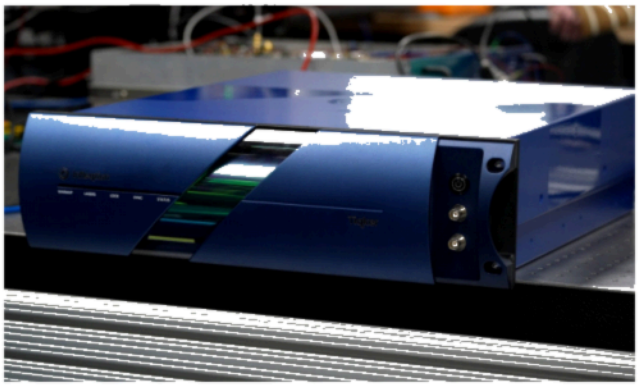
Source: NQI Act, NQI FY2025 Budget Supplement Report, federal agency releases, USASpending.gov, Bernstein estimates and analysis

EXHIBIT 6: **Federal Quantum Capital Has Shifted from Research Support to Commercialization**



Source: Bernstein estimates and analysis

EXHIBIT 7: **Tiqker Optical Atomic Clock Illustrates Real-World Quantum Sensing Deployment**



Source: Infleqtion

US DEPLOYS $2 BILLION IN QUANTUM INCENTIVES VIA THE CHIPS R&D OFFICE

On May 21, the U.S. Department of Commerce (DOC) confirmed a federal commitment of $2B across a portfolio of quantum companies including two quantum foundry companies (Global Foundries and IBM) and 7 Quantum Computing companies (Exhibit 8). Administered through the CHIPS R&D Office, funds will be disbursed on a milestone-dependent schedule, incentivizing recipients to accelerate the development of domestic quantum fabrication infrastructure and progress toward utility-scale, fault-tolerant quantum systems.

All letters of intent grant the U.S. government non-controlling minority equity stakes, introducing a novel federal funding mechanism for the quantum sector. Historically, federal support has primarily relied on non-dilutive research grants and defense-oriented contracts. These CHIPS commitments mark a shift toward direct capital participation with potential financial

returns to taxpayers. The agreements also incorporate national security and compliance covenants aligned with the CHIPS and Science Act's objectives of strengthening domestic supply chains and maintaining technological competitiveness.

The portfolio spans both incumbent foundries and pure-play quantum computing hardware developers. On the manufacturing side, the focus is on superconducting qubit fabrication with broader readiness to support multiple modalities and chip architectures, whereas the investments in pure-play firms, follows a diversified portfolio approach with the inclusion of companies across superconducting, neutral atom, trapped ion, silicon spin, and photonic modalities. This signals that the government is not committing to a single technological pathway at this point, but is instead underwriting parallel approaches to maximize the probability of achieving commercial quantum advantage. This is coherent with the evolving rankings and application-specific advantages of different modalities we learned about in our call with a former technology manager in the industry and described in our analysis of winners and losers in the quantum future.

EXHIBIT 8: **CHIPS Quantum Incentives: Recipients, Allocations, and Engineering Priorities**

Category	Company	Modality	CHIPS Funding ($millions USD)	Engineering Initivatives
Quantum Foundries	IBM	Dual-Modality Quantum Foundry: Superconducting & Silicon Spin (Anderon)	1,000	▪ Build 300mm wafer line ▪ Automate superconducting chip fabrication ▪ Manufacture high-density physical interconnects
	GlobalFoundries	Multi-Modality Foundry (QTS)	375	▪ Mass-produce cryogenic CMOS subsystems ▪ Develop 3D heterogeneous interconnects ▪ Scale open manufacturing pipelines
Quantum Computing Hardware Developers	Atom Computing	Neutral-Atom	100	▪ Improve classical computer integration ▪ Parallelize validation testbeds ▪ Streamline supply chain partnerships
	Infleqtion	Neutral-Atom	100	▪ Standardize large-scale system integration ▪ Build high-powered optical systems ▪ Design next-gen readout systems
	Quantinuum	Trapped-Ion	100	▪ Fix fault-tolerant manufacturing bottlenecks ▪ Develop low-loss integrated photonics ▪ Partner on optical components
	D-Wave	Superconducting: Annealing & Gate	100	▪ Optimize dielectric coherence materials ▪ Minimize interface error rates ▪ Deploy high-density advanced packaging
	Rigetti	Superconducting: Gate	Up to 100	▪ Scale annealing fabrication methods ▪ Integrate microwave-to-optical transducers ▪ Optimize high-density dilution refrigerators
	PsiQuantum	Photonic	100	▪ Improve Barium Titanate switches ▪ Mass-produce single-photon detectors ▪ Optimize ultra-low-loss packaging
	Diraq	Silicon Spin	Up to 38	▪ Scale silicon spin processors ▪ Develop quantum logic units ▪ Build out large qubit arrays

Source: DOC, Company reports

QUANTUM FOUNDRIES: ACCELERATING US QUANTUM MANUFACTURING INFRASTRUCTURE

IBM and GlobalFoundries are slated to receive a combined $1.375bn, representing 68% of incentives. The concentration of capital in two foundries located just 25 miles apart reflects a federal priority to establish a geographically concentrated, domestically controlled fabrication base for advanced quantum wafers. Given the economic and defense implications of quantum computing, establishing an onshore foundry base for commercially viable, fault-tolerant systems is a major priority, likely drawing lessons from relinquishing conventional semiconductor manufacturing capacity to Asia, the strategic importance of which in hindsight has been severally underestimated.

IBM as the largest recipient is co-investing pari passu alongside $1bn from the DOC to launch **Anderon**, the country's first dedicated quantum foundry. The project will center on a **tenant production line** at IBM's Albany NanoTech Complex (**Exhibit 9**). The facility is designed to support large-scale production of 300mm quantum wafers with the ability to expand high-volume fabrication capabilities for superconducting qubits and, more recently, silicon spin qubit architectures following IBM's planned HRL acquisition. Planned output also includes critical interconnect technologies such as superconducting wiring, bump interconnects, and through-silicon vias (TSVs) to support a broad ecosystem of industry clients. Anderon is strategically positioned to reduce reliance on foreign supply chains while using IBM's existing strengths in scalable quantum

wafer processes.

GlobalFoundries (GF) will deploy its $375mn allocation to launch Quantum Technology Solutions (QTS), an onshore foundry initiative, building on its existing FDX cryogenic CMOS platform. QTS is designed to **support fabrication across multiple quantum computing modalities**, extending beyond superconducting-focused approaches. We think the relative $625mn funding gap between GF and IBM reflects IBM's scale, its matched co-investment, and alignment with superconducting architectures that are currently favored for early national security and commercial applications. GF plans on expanding its Fab 8 facility (**Exhibit 10**) to enable high-volume production of cryogenic CMOS subsystems and the development of a universal 3D heterogeneous integration platform for connecting distinct quantum processor components. The initiative also aims to establish open manufacturing pipelines to serve a wide range of customers, including quantum startups and major incumbents such as Google, Nvidia, and Microsoft. In this context, QTS provides critical flexibility and scalability for a multi-modality quantum ecosystem, complementing IBM's more focused technology approach.

EXHIBIT 9: **IBM NanoTech Complex in Albany, NY**



Source: Forbes

EXHIBIT 10: **GlobalFoundries Fab 8 Complex in Malta, NY**



Source: Forbes

QUANTUM COMPUTING PURE-PLAYS: DIVERSIFICATION OF MODALITIES AND ADDRESSING KEY HARDWARE BOTTLENECKS

The remaining $638mn of DOC incentives will be distributed among 7 pure-play quantum companies spanning the major hardware modalities. Rather than funding a single technological pathway, these investments both diversify modalities and address three of the industry's most significant scaling bottlenecks: optical control systems (**Exhibit 11**) for neutral-atom and trapped-ion architectures, scalable high-density packaging and cryogenic cooling systems (**Exhibit 12**) for superconducting circuits, and advanced semiconductor fabrication for photonic and silicon-spin approaches (**Exhibit 13**).

Optical Control Systems

Atom Computing develops quantum systems based on neutral-atom architectures and was among the first to demonstrate sustained quantum error correction at scale, surpassing the 1,000-qubit threshold. The company plans to deploy its $100M allocation to improve system performance and classical integration, parallelize testbeds to accelerate validation cycles, and strengthen supply chain partnerships to address scalability bottlenecks.

Infleqtion develops both quantum computing and sensing platforms using neutral-atom systems, including the U.K.'s first operational 100-qubit quantum computer and early deployments of quantum navigation and atomic clock systems. Its $100M allocation will fund the development of large-scale system architectures, higher-powered optical control systems, and next-generation readout and error correction technologies.

Quantinuum develops trapped-ion quantum computers and associated software platforms, and has demonstrated early fault-tolerant logical qubit operations. The company will use its $100M allocation to address manufacturing bottlenecks, develop low-loss integrated photonics, and expand the optical control infrastructure required to scale trapped-ion systems.

Cryogenic Infrastructure & Superconducting Platforms

D-Wave develops annealing-based superconducting quantum computers, with processors exceeding 5,000 interconnected qubits, and has recently expanded its platform roadmap to include gate-based superconducting architectures.

The company has recently expanded its roadmap to include gate-model superconducting quantum computing through its dual-platform strategy and the acquisition of Quantum Circuits. The company's $100M allocation will support materials optimization, the reduction of interface-induced errors, and processor scaling through advanced packaging and high-density integration.

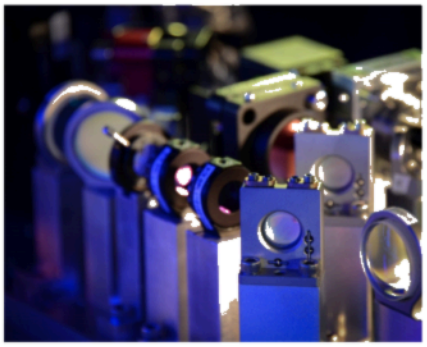
Rigetti develops gate-model superconducting quantum computers, utilizing multi-chip architectures incorporating over 100 qubits. With up to $100M in CHIPS incentives, the company plans to scale fabrication techniques to reduce qubit variability, integrate cryogenic transduction systems to mitigate thermal leakage, and optimize dilution refrigeration systems for high-density, chiplet-based architectures.

Advanced semiconductor fabrication for photonic and silicon-spin approaches

PsiQuantum develops photonic quantum systems and has demonstrated integration of high-performance single-photon detectors on standard semiconductor platforms. Its $100M allocation will support improvements in the manufacturability of photonic components, scaling production of heat-resilient single-photon detectors, and optimization of low-loss photonic packaging.

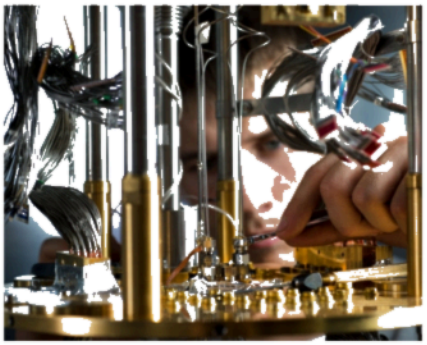
Diraq develops silicon spin quantum processors and has demonstrated high-fidelity qubit operations within commercial semiconductor fabrication environments. The company will use its up to $38M allocation to strengthen domestic supply chains, refine silicon-based manufacturing processes, and optimize architectures targeting a sub-dollar cost per physical qubit. The smaller allocation reflects the modality's ability to leverage existing CMOS semiconductor infrastructure rather than requiring dedicated quantum foundries or highly specialized fabrication lines.

EXHIBIT 11: **Optical Control Systems for Atomic Architectures**



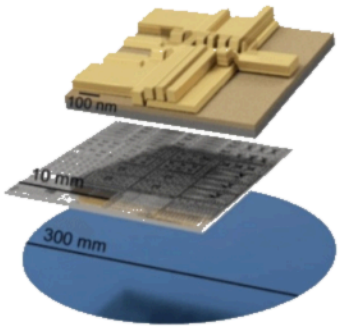
Source: Atom Computing

EXHIBIT 12: **Advanced Packaging and Cryogenics for Superconducting Circuits**



Source: D-Wave

EXHIBIT 13: **On-Chip Fabrication for Photonic and Silicon Spin Approaches**



Source: Stuyck et al., Nature (2025)

ECHOES OF 1965: PARALLELS TO WASHINGTON'S ROLE IN COMMERCIALIZING SEMICONDUCTORS

The federal push into quantum computing in 2026 bears a striking resemblance to Washington's role in commercializing the integrated circuit during the mid-1960s, particularly in its geopolitical motivations, funding intensity, and market-forming ambitions (Exhibit 14). The invention of the integrated circuit (IC) in the late 1950s fundamentally transformed the structure of computing, compressing electronic architectures onto a single chip and laying the foundation for the modern digital economy. Examining the IC funding and market landscape in 1965 provides a useful blueprint for understanding how national security priorities can influence frontier technology markets. Much like the period since early 2025, 1965 represented a technical and economic inflection point for silicon: Gordon Moore's scaling thesis articulated a credible path toward long-term economic viability, while aggressive federal defense and aerospace procurement bridged the gap between laboratory physics and commercial adoption.

In both cases, geopolitical competition transformed an emerging technology from a largely scientific field into a national strategic priority. Just as the early semiconductor industry was propelled by Cold War guidance mandates for the Minuteman ICBM and Apollo programs, which together purchased about 60% of the early domestic microchip supply, the modern quantum race for fault-tolerant computing and post-quantum cryptography has similarly elevated quantum technologies from a research frontier to a strategic national asset.

In both periods, public sector support dramatically outpaced the scale of immediate commercial demand, reflecting strategic priorities rather than market economics. In 1965, ICs drew 0.63% of the single-year DOD and NASA electronics procurement pools ($56.9M of approximately $9M) while accounting for only 0.25% of the global electronics and vacuum-tube market ($79M of approximately $31M). In 2026, we estimate that U.S. public commitments to Quantum technologies will total approximately $3B, exceeding the estimated annual size of the global quantum computing market itself (~$2B).

While the strategic rationale remains familiar, the mechanisms through which Washington supports quantum computing differ markedly from those employed during the semiconductor era. While the 1965 model relied on procurement to guarantee demand and drive down component costs, the current model deploys capital in venture-style fashion. Importantly, by pairing targeted R&D funding with non-controlling minority equity stakes in incumbent foundries and emerging quantum hardware developers, the government is not replacing private capital; it is guiding it toward strategically important capabilities, including domestic manufacturing, supply-chain resilience, and fault-tolerant computing infrastructure, that private markets may otherwise underinvest in relative to their national security value. Viewed through this historical lens, **the May 2026 CHIPS commitments are less a technology subsidy than an attempt to ensure that quantum computing does not follow the semiconductor industry's trajectory, where domestic technological leadership ultimately became decoupled from manufacturing leadership.** By pairing investment in quantum developers with investment in domestic fabrication capacity, Washington is seeking to recreate the market-forming conditions that transformed the IC from a laboratory breakthrough into the foundation of the modern economy.

The most consequential difference between quantum computing and the early semiconductor industry may be the maturity of the ecosystem into which the technology is being introduced. The state-backed procurement mandates of the 1960s enabled rapid industrial scale-up, driving a sustained decline in IC costs that ultimately unlocked the consumer computing era and generated trillions of dollars in economic value over the following decades. If quantum computing follows a similar trajectory, the infrastructure now being assembled through federal incentives could accelerate the transition from laboratory breakthroughs to commercial deployment. Unlike the semiconductor industry of the 1960s, however, quantum technology is emerging into an environment already defined by hyperscaler cloud platforms, mature enterprise software ecosystems, and globally integrated digital markets. As a result, successful quantum applications could scale through existing cloud and software distribution channels far more rapidly than semiconductor technologies could during the 1960s, potentially shortening the interval between technical breakthrough and broad commercial adoption.

人在草木间

EXHIBIT 14: **Two Computing Revolutions, Two Government Playbooks**

	Integrated Circuits (1965)	Quantum Computing (2026)
Strategic Driver	Cold War military and space competition accelerated integrated circuit adoption	Competition for leadership in fault-tolerant computing, post-quantum cryptography, and quantum-enabled national-security capabilities
Government's Market-Forming Role	DOD and NASA procurement created guaranteed demand for an emerging technology	Federal R&D funding, procurement contracts, and equity-linked incentives are building domestic capacity before broad commercial demand exists
Federal Support vs. Market Size	$56.9mn of DOD/NASA procurement versus a ~$79mn annual integrated circuit market	~$3bn of U.S. public commitments versus a ~$2bn annual quantum computing market
Primary Policy Mechanism	Procurement-led commercialization	Venture-style capital deployment combined with targeted industrial policy
Core Objective	Bridge the gap between laboratory innovation and commercial production	Scale quantum capabilities while preserving U.S. manufacturing leadership
Principal Bottleneck	Manufacturing scale, yields, and component cost reduction	Fault tolerance, manufacturing scalability, and quantum supply-chain development
Technology Ecosystem	Immature computing ecosystem requiring new markets, customers, and applications	Existing cloud, software, AI, and enterprise infrastructure capable of accelerating commercialization
Key Risk Washington Seeks to Avoid	N/A (industry was still being established)	Repeating the semiconductor experience, where technological leadership became decoupled from manufacturing leadership
Long-Term Actual / Potential Implication	Foundation of the modern computing industry	Potentially accelerated transition from technical breakthrough to widespread commercial deployment

Source: Bernstein estimates and analysis

BERNSTEIN TICKER TABLE

Ticker	Rating	Cur	22 Sep 2026 Closing Price	Price Target	TTM Rel. Perf.	Cur	Adjusted EPS 2026A	2027E	2028E	Adjusted P/E (x) 2026A	2027E	2028E
AAPL (Apple)	O	USD	339.75	370.00	17.5%	USD	7.46	8.85	10.03	45.5	38.4	33.9
DELL (Dell)	O	USD	548.92	650.00	292.6%	USD	10.35	25.88	29.63	53.1	21.2	18.5
HPE (HPE)	M	USD	61.03	62.00	131.1%	USD	1.96	3.84	4.59	31.1	15.9	13.3
HPQ (HPQ)	M	USD	32.04	32.00	(3.7)%	USD	3.12	3.29	3.54	10.3	9.7	9.1
IBM (IBM)	M	USD	231.38	230.00	(31.0)%	USD	11.58	12.23	13.40	20.0	18.9	17.3
SNDK (SanDisk)	O	USD	1,887.04	3,000.00	1657.5%	USD	70.08	238.36	272.09	26.9	7.9	6.9
STX (Seagate)	O	USD	919.84	1,350.00	287.2%	USD	15.53	40.61	64.40	59.2	22.7	14.3
SMCI (SMCI)	M	USD	41.54	42.00	(27.6)%	USD	3.56	3.99	3.53	11.7	10.4	11.8
WDC (Western Digital)	O	USD	464.60	770.00	305.4%	USD	10.19	23.39	36.58	45.6	19.9	12.7
SPX			7,764.64									

O - Outperform, M - Market-Perform, U - Underperform, NR - Not Rated, CS - Coverage Suspended

DELL estimate is Reported EPS; AAPL, HPE, HPQ, IBM base year is 2025;

Source: Bloomberg, Bernstein estimates and analysis.