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The Quantum Race: U.S.-China Strategic Competition in Quantum Computing, Sensing, and Communications

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ABSTRACT

This article examines the intensifying strategic competition between the United States and China across three interrelated domains of quantum technology: quantum computing, quantum sensing, and quantum communications. Drawing on a qualitative comparative case-study methodology and engaging with theoretical frameworks of techno-nationalism, great-power competition, and military innovation, the article argues that quantum technologies have transcended their origins as instruments of scientific discovery and are now emerging as critical vectors of national power. Quantum capabilities hold the potential to compromise existing encryption architectures, transform battlefield intelligence and surveillance, revolutionise secure command-and-control communications, and render certain conventional deterrent postures strategically vulnerable. The article analyses the strategic investments, institutional ecosystems, and policy architectures through which both states are mobilising quantum capabilities, and it assesses the implications for military advantage, nuclear deterrence, and strategic stability. It concludes that the quantum race introduces new forms of uncertainty and instability into an already fraught great-power relationship, and that the absence of governance mechanisms or confidence-building measures in this domain represents a significant gap in international security architecture. The article contributes to the growing literature on emerging technology and strategic competition by offering a comprehensive comparative assessment of quantum power in the context of U.S.-China rivalry.

Keywords— Quantum technology; U.S.-China competition; strategic rivalry; techno-nationalism; quantum computing; quantum communications

Introduction

The history of international order is, in no small part, a history of technological advantage. From the steam engine to the nuclear bomb, those states that master transformative technologies first have generally been positioned to reshape the terms of geopolitical competition. At the beginning of the third decade of the twenty-first century, quantum technology has assumed precisely this character. Quantum computing, quantum sensing, and quantum communications are not merely the next

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chapter in the information revolution; they represent a potential discontinuity in the strategic landscape of comparable magnitude to the advent of nuclear weapons or the internet.

The United States and China have both identified quantum technologies as central to their long-term national security strategies. Washington has launched a National Quantum Initiative, incorporated quantum into its National Security Strategy, and designated quantum research as among the most sensitive areas of technological competition. Beijing, guided by successive iterations of the Made in China 2025 industrial strategy and the Fourteenth Five-Year Plan, has invested tens of billions of dollars in quantum research, established dedicated national laboratories, and integrated quantum technology into its military modernisation programme under the rubric of Civil-Military Fusion.[1]

Despite a rapidly growing body of policy literature, the scholarly field of Strategic Studies and International Relations has not yet produced a fully integrated analysis of quantum competition that encompasses all three technology domains and connects them systematically to questions of military advantage, deterrence stability, and great-power rivalry. This article seeks to fill that lacuna. Its central argument is that quantum technologies are now functioning as strategic instruments that could, within the coming decade, materially alter the balance of military intelligence, secure communications, encryption resilience, early warning capability, and nuclear deterrence between the United States and China. The quantum race is therefore not simply a technological or commercial competition; it is a strategic contest over the foundations of future power.[2]

The article proceeds as follows. Section two surveys the existing literature. Section three presents the theoretical framework. Section four explains the methodology. Section five offers the empirical analysis, structured around each quantum domain and its strategic implications. Section six provides discussion of the broader implications for stability, deterrence, and governance. Section seven concludes.

Literature Review

The academic literature on quantum technology and strategic competition has developed along two largely disconnected tracks. One body of scholarship, primarily in physics and computer science, addresses the technical properties of quantum systems and their prospective capabilities. A second body, located within Strategic Studies and International Relations, addresses the geopolitical dimensions of emerging technology competition in broader terms, without consistently focusing on quantum technologies as a distinct analytical category. This article situates itself at the intersection of these two literatures.

Within Strategic Studies, the relationship between technological innovation and military power has been theorised most extensively through the concept of the Revolution in Military Affairs (RMA), associated with scholars such as Eliot Cohen, Andrew Krepinevich, and, in its more sociological dimensions, Stephen Biddle.[3] The RMA framework draws attention to the way in which certain technological breakthroughs can fundamentally reorganise the conduct of warfare, rendering previously decisive capabilities obsolete. Quantum technologies exhibit characteristics

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consistent with RMA-level disruption: they may nullify existing cryptographic architectures, enable unprecedented surveillance and sensing precision, and provide militaries with decision-making advantages of considerable magnitude.

The more recent literature on great-power competition has developed a useful framework for analysing U.S.-China rivalry across economic, technological, and military dimensions. Graham Allison's work on the Thucydides Trap and Hal Brands's analyses of the China challenge both highlight the structural conditions under which rising powers challenge established ones, generating dynamics of threat perception and preventive action that complicate cooperative solutions.[4] This literature provides essential context for understanding why both states are investing in quantum technologies with a sense of strategic urgency.

The concept of techno-nationalism, developed by scholars including Richard Samuels and, more recently, applied to the digital economy by scholars such as Abraham Newman and Henry Farrell, offers a complementary lens.[5] Techno-nationalism captures the tendency of states to treat technological leadership as a constitutive element of national power and sovereignty, rather than merely a source of commercial competitive advantage. In this framework, quantum technology becomes a domain not of cooperative globalisation but of zero-sum competition, where dependence on a rival is treated as a strategic vulnerability.

More directly focused scholarship on quantum and security has expanded significantly since approximately 2019. Work by the RAND Corporation, the Center for Strategic and International Studies, and the IISS has begun to map the contours of quantum competition, with particular attention to the implications of cryptographically relevant quantum computers for cybersecurity and signals intelligence.[6] Elsa Kania and John Costello produced an important early analysis of China's quantum communications satellite programme and its military implications.[7] Jon Lindsay has offered a more sceptical assessment, arguing that the strategic impact of quantum computing has been systematically overstated.[8] Meanwhile, scholars working in arms control and nuclear security, including James Acton and Christopher Clary, have begun to examine how quantum sensing and computing may affect the vulnerability of nuclear second-strike capabilities, with significant implications for deterrence stability.

Despite these contributions, three gaps remain in the literature. First, most analyses address one quantum domain in isolation, rather than examining the synergies and trade-offs across computing, sensing, and communications as an integrated strategic system. Second, the comparative analysis of U.S. and Chinese institutional ecosystems for quantum development remains underdeveloped. Third, the governance implications of quantum competition have received limited attention relative to comparable discussions around artificial intelligence. This article addresses all three gaps.

Theoretical Framework

This article draws on three interrelated theoretical frameworks, each of which illuminates a different dimension of quantum strategic competition. Together, they provide an analytical architecture capable of capturing both the structural pressures driving competition and the specific mechanisms through which quantum technologies are reshaping strategic calculations.

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Great-Power Competition and Strategic Rivalry

The dominant structural condition shaping quantum competition is the intensification of U.S.-China strategic rivalry. Contemporary international relations scholarship has moved beyond treating this rivalry as merely a trade dispute or ideological contest. It reflects deeper dynamics identified by power-transition theory and structural realism: as China's aggregate power has grown, the distribution of capabilities in the international system has shifted, generating both offensive and defensive incentives for technological investment.[9] Quantum technologies are particularly salient in this context because they represent a class of general-purpose dual-use technologies whose military applications are inseparable from their civilian development. A state that achieves decisive advantage in quantum computing will simultaneously possess the capacity to break adversary communications, enhance intelligence collection, and potentially degrade the credibility of nuclear deterrent forces.

Military Innovation and Technological Competition

The military innovation literature, developed through empirical studies of how organisations adopt and integrate new technologies, offers a second analytical lens. Barry Posen's foundational work on military doctrine, and subsequent scholarship by Emily Goldman and Leslie Eliason, emphasise that military innovation is not automatic but is shaped by organisational culture, inter-service competition, and civil-military relations.[10] Applied to quantum technology, this framework generates important questions about whether the U.S. or Chinese defence establishments are better positioned to translate research advances into operational military capabilities. China's Civil-Military Fusion doctrine represents a deliberate institutional response to this challenge, mandating that civilian research institutions contribute to military programmes in ways that have no direct equivalent in the U.S. system, though the U.S. Defence Advanced Research Projects Agency (DARPA) and the national laboratories have historically served an analogous bridging function.

Techno-Nationalism and Strategic Autonomy

The third framework is techno-nationalism, understood here as the strategic prioritisation of indigenous technological development in domains deemed critical to national security and sovereignty.[11] For both Washington and Beijing, quantum technology has acquired a techno-nationalist character that goes beyond rational cost-benefit calculation. American export controls on quantum-related hardware and software, and Chinese commitments to domestic semiconductor and quantum component supply chains, reflect a shared logic in which technological self-sufficiency is treated as a precondition of strategic autonomy. This framework also illuminates the role of institutional design: both states have built dedicated quantum agencies, national laboratories, and industrial policy instruments premised on the assumption that market mechanisms alone will not deliver the required pace of development.

Together, these three frameworks suggest that quantum competition is driven by structural factors (great-power rivalry), organisational dynamics (military innovation), and ideational commitments (techno-nationalism) that are mutually reinforcing. Quantum technologies are simultaneously a cause of intensified competition and a product of it.

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Research Methodology

This article employs a qualitative comparative case-study methodology. The two principal cases are the United States and China, selected on the grounds of theoretical relevance: they are the two states most deeply invested in quantum research and development, and they represent the principal axis of great-power strategic competition. The case-study approach allows for process tracing of how each state has translated technological capabilities into strategic policy, and it permits structured comparison of the institutional, doctrinal, and investment dimensions of quantum strategy.

Data for the analysis are drawn from four categories of primary sources. First, official policy documents, including the U.S. National Quantum Initiative Act, the National Security Strategy, the Department of Defense's quantum research roadmaps, and Chinese Five-Year Plans, Made in China 2025 documentation, and official statements by the Ministry of Science and Technology and the People's Liberation Army (PLA). Second, government-affiliated research reports produced by institutions such as RAND, CSIS, CNAS, the IISS, RUSI, and SIPRI. Third, peer-reviewed academic literature from journals including the Journal of Strategic Studies, International Security, Security Studies, and Science and Global Security. Fourth, technical reports and white papers from national laboratories including Oak Ridge, Argonne, and the Chinese Academy of Sciences.[12]

The analytical method is qualitative document analysis combined with comparative strategic assessment. Documents are analysed for the stated strategic priorities of each state, the institutional mechanisms through which those priorities are pursued, and the military applications that are explicitly or implicitly targeted. The comparative assessment evaluates each state across five dimensions: investment scale, institutional architecture, technological progress, military integration, and international engagement.

The study acknowledges several limitations. Chinese-language primary sources are consulted principally through translations and analyses produced by specialist research institutions; direct textual analysis of classified documents is not possible for either case. The rapidly evolving nature of quantum research means that some empirical claims will require updating as new capabilities emerge. Finally, the dual-use character of quantum technologies makes it difficult to distinguish precisely between civilian and military applications in the available evidence base. These limitations are inherent to the subject matter rather than methodological choices, and they are common to the broader literature on emerging technology and security.

Empirical Analysis

Quantum Computing: Strategic Implications of Cryptographic Disruption

Quantum computing exploits the principles of superposition and entanglement to process information in ways that are exponentially more efficient than classical computing for specific problem classes. The most strategically significant of these is the factorisation of large prime numbers, which underlies the RSA and elliptic-curve cryptographic systems that currently protect the communications of governments, militaries, financial institutions, and critical infrastructure providers worldwide. A

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sufficiently powerful, fault-tolerant quantum computer running Shor's algorithm could, in principle, render all currently deployed asymmetric encryption obsolete, exposing decades of encrypted communications to retrospective decryption.[13]

The United States has invested substantially in quantum computing through both public and private channels. The National Quantum Initiative Act, signed in 2018, committed $1.275 billion over five years to quantum research, with significant allocations to the National Institute of Standards and Technology (NIST), the Department of Energy, and the National Science Foundation.[14] American technology corporations, most notably IBM, Google, and IonQ, have made rapid progress in increasing qubit counts and reducing error rates. In 2019, Google claimed to have achieved quantum supremacy on a specific computational task, a claim that, while contested, illustrated the pace of progress.[15] In the national security domain, the National Security Agency has been preparing for the post-quantum cryptographic transition since at least 2015, and NIST completed its first round of post-quantum cryptographic standard selections in 2022, providing the basis for a planned transition of federal communications systems.

China's quantum computing programme is characterised by massive state investment, coordinated industrial policy, and a willingness to accept short-term duplication in pursuit of long-term technological self-sufficiency. Chinese researchers at the University of Science and Technology of China (USTC) have produced several internationally notable results, including demonstrations of photonic quantum advantage.[16] Beijing has embedded quantum computing as a priority technology in the Fourteenth Five-Year Plan and has funded dedicated national quantum laboratories, including the Anhui Quantum Computing Engineering Research Centre. Chinese state-linked enterprises, including Alibaba's Quantum Laboratory and Baidu's quantum computing division, have developed proprietary quantum hardware and software platforms. Importantly, Civil-Military Fusion directives require that civilian research institutions share relevant findings with PLA-affiliated bodies, creating a structural mechanism for translating commercial quantum advances into military applications.

From a strategic standpoint, the most significant near-term implication of quantum computing competition concerns the cryptographic transition. The state that first deploys a cryptographically relevant quantum computer will possess an extraordinary intelligence windfall, having the ability to decrypt adversary government, military, and diplomatic communications. Both states are engaged in what intelligence analysts term "harvest now, decrypt later" operations, storing large volumes of encrypted adversary communications in anticipation of future quantum decryption capability.[17] This dynamic has already begun to reshape signals intelligence competition and will intensify regardless of whether a fault-tolerant quantum computer is achieved in five years or twenty.

Quantum Sensing: Intelligence, Navigation, and Anti-Submarine Warfare

Quantum sensing exploits quantum-mechanical phenomena to achieve measurement precision that vastly exceeds classical limits. Quantum gravimeters, magnetometers, accelerometers, and clocks have a range of military applications that are, in some respects, more near-term and operationally immediate than quantum computing. Three applications merit particular attention: navigation, submarine detection, and early

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warning.

Quantum inertial navigation systems (QINS) exploit the exquisite sensitivity of atom interferometry to measure acceleration and rotation with unprecedented precision.[18] A QINS-equipped military platform could navigate with high accuracy without relying on GPS, which is vulnerable to jamming, spoofing, and, in a conflict scenario, deliberate degradation by an adversary. Both the U.S. Defense Advanced Research Projects Agency and the PLA General Armaments Department have funded QINS research, recognising its potential to render contested electromagnetic environments less strategically debilitating for precision-guided munitions and long-range strike systems.

Quantum sensing's implications for anti-submarine warfare (ASW) are among the most strategically sensitive in this article's scope. Nuclear-armed submarines derive their deterrent value from their ability to remain undetected, providing an assured second-strike capability that underwrites strategic stability between nuclear powers. Quantum gravimeters and magnetometers, in principle, could detect the gravitational and magnetic anomalies associated with submarines at significantly greater depths and ranges than current systems.[19] If quantum ASW sensing were to mature into operational deployability, it could fundamentally undermine the survivability of submarine-based nuclear forces, eroding second-strike assurance and potentially incentivising first-strike calculations in a crisis. China's significant investment in ballistic missile submarine (SSBN) capability, and American reliance on the sea-based leg of its nuclear triad, mean that quantum ASW sensing is a shared vulnerability with enormous deterrence implications.

China has invested specifically in quantum sensing for ASW purposes. Reports from SIPRI and the IISS suggest that the PLA Navy has been exploring quantum magnetometry for submarine detection as part of its broader undersea warfare research programme.[20] The United States, through the Office of Naval Research and DARPA, has similarly funded quantum sensing programmes with ASW applications. The mutual vulnerability this creates is under-acknowledged in arms control and strategic stability discussions.

Quantum Communications: The Quantum Internet and Strategic Secure Communications

Quantum communications exploit the phenomenon of quantum entanglement to distribute cryptographic keys in a manner that is, in principle, physically secure against interception: any attempt to measure a quantum state necessarily disturbs it, alerting communicating parties to eavesdropping. This principle, instantiated in Quantum Key Distribution (QKD) protocols, represents a potential solution to the cryptographic vulnerability created by the prospect of quantum computing.

China has achieved a globally significant lead in operational quantum communications infrastructure. The Micius satellite, launched in 2016 by the Chinese Academy of Sciences, demonstrated intercontinental QKD between Beijing and Vienna, representing the first satellite-based quantum communications experiment of its kind.[21] China has also constructed a 2,000-kilometre ground-based QKD network connecting Beijing, Jinan, Hefei, and Shanghai, used for high-security government and financial communications. The strategic rationale for this investment is transparent: if China can

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Volume 4, Issue 3 (2026)

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http://amresearchreview.com/index.php/Journal/about

build a national quantum communications network before the advent of cryptographically relevant quantum computers, it will be immune to the decryption threat that those computers pose. Beijing's quantum communications programme is therefore both an offensive hedge (protecting Chinese communications from future U.S. quantum computing) and a defensive infrastructure (building the institutional and technical basis for a global quantum communications architecture that China could shape and potentially lead).

The United States has been more cautious in its investment in operational QKD infrastructure, in part because the NSA and NIST have historically been sceptical of QKD as a near-term solution compared with post-quantum cryptographic algorithms, which are software-based and can be deployed across existing communications infrastructure.[22] However, the Department of Energy's quantum internet development programme, and research at the Argonne, Brookhaven, and Oak Ridge National Laboratories, reflects a growing recognition that quantum communications infrastructure will be strategically important regardless of which approach prevails. The Chicago quantum metropolitan network and the Stony Brook-Brookhaven quantum communications link represent early operational demonstrations of a nascent U.S. quantum internet architecture.

For military command and control, the implications of quantum communications are profound. Secure command-and-control communications are the central nervous system of nuclear deterrence: if an adversary can intercept or disrupt communications between political leadership and nuclear forces, the credibility of deterrence is undermined. Both the United States and China are investing in quantum-secured command-and-control communications as a priority application, though the details are necessarily classified.

Space-Based Quantum Systems and the Orbit Dimension

The intersection of quantum technology and outer space represents one of the most consequential and least analysed dimensions of quantum competition. China's Micius satellite has already demonstrated the feasibility of space-based QKD, and Beijing has announced plans for a constellation of quantum communication satellites that would provide global coverage by the mid-2030s.[23] Such a constellation would give China a global quantum-secured communications network independent of terrestrial cable infrastructure, which is vulnerable to physical interdiction and signals intelligence collection at submarine repeater stations.

The United States has responded with its own space-based quantum research, though at a less advanced stage of operational deployment. The National Aeronautics and Space Administration and the Air Force Research Laboratory have both funded quantum communication experiments in the space domain, and the intelligence community has recognised space-based quantum systems as a priority area for competitive analysis.[24] The strategic stakes are considerable: the state that first deploys a global quantum-secured satellite communications network will possess a communications infrastructure that is, at least in current understanding, impervious to interception, providing military and intelligence advantages of enormous value in a conflict or crisis scenario.

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There is also an important asymmetry to note. China's quantum communications satellite programme is directly integrated with its national security infrastructure, reflecting Civil-Military Fusion principles. In the United States, space-based quantum development is distributed across civilian and military agencies with less explicit integration, potentially slowing the translation of research advances into operationally deployed capabilities.

Cybersecurity, Encryption, and the Post-Quantum Transition

The cybersecurity implications of quantum computing are perhaps the most immediately consequential dimension of the quantum race, given that virtually all digital communications and data storage currently rely on cryptographic systems that a sufficiently powerful quantum computer could compromise. Both states have initiated post-quantum cryptographic transitions, but the pace, comprehensiveness, and strategic logic of these transitions differ.

NIST's post-quantum cryptography standardisation programme, which selected four candidate algorithms in 2022 and published its first finalised standards in 2024, represents the most significant multilateral effort to address the quantum cryptographic threat.[25] The U.S. government has mandated a transition timeline for federal agencies, and American technology companies have begun implementing post-quantum algorithms in commercial products. However, the transition is complex, expensive, and incomplete: legacy systems embedded in critical infrastructure, defence networks, and financial systems may retain quantum-vulnerable cryptography for years or decades, creating a prolonged window of vulnerability.

China's approach to the post-quantum cryptographic transition is shaped by a dual imperative: protecting Chinese communications from U.S. quantum computing while also positioning itself to exploit quantum-vulnerable adversary communications for as long as possible. Beijing has developed indigenous post-quantum algorithms through Chinese academic and state research institutions, but has been less transparent about its transition timeline and implementation status.

The cybersecurity competition also has an offensive dimension. Both states' intelligence agencies are engaged in efforts to collect quantum-relevant research through cyber espionage. U.S. intelligence has documented extensive Chinese cyber operations targeting quantum research institutions, national laboratories, and defence contractors.[26] The theft of quantum research could potentially accelerate a competitor's timeline to cryptographically relevant quantum computing, compressing the window available for the adversary to complete a post-quantum cryptographic transition. This creates a strategic incentive for cyber operations that is independent of, and reinforcing to, the direct investment in quantum research.

Nuclear Deterrence and Strategic Stability

The implications of quantum technologies for nuclear deterrence and strategic stability deserve separate treatment, given their potential magnitude. Strategic stability, in the classical formulation associated with scholars such as Glenn Snyder and Albert Wohlstetter, rests on the mutual assurance of second-strike capability: each state must be confident that, regardless of a first strike, sufficient retaliatory forces will survive to

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Print ISSN 3007-3189
http://amresearchreview.com/index.php/Journal/about

inflict unacceptable damage on the aggressor.[27] Quantum technologies threaten this stability through several distinct pathways.

First, quantum sensing advances in ASW could, as noted above, erode the survivability of submarine-based nuclear forces. China's SSBN programme, still maturing and dependent on limited patrol areas, is particularly vulnerable to advances in quantum-enabled ASW. Conversely, U.S. reliance on SSBN-launched Trident missiles as the most survivable leg of its nuclear triad would be threatened if Chinese quantum ASW sensing achieves operational maturity. The mutual character of this vulnerability creates a bilateral deterrence stability problem that has not received adequate attention in arms control discussions.

Second, quantum computing's potential to break encrypted communications could compromise the authentication and command-and-control systems that connect political leadership to nuclear forces. If an adversary could intercept and decrypt nuclear command-and-control communications, it could potentially generate false orders, delay genuine ones, or simply use the intelligence to inform a disarming first strike. Both states' investment in quantum-secured command-and-control reflects awareness of this vulnerability.

Third, the intelligence advantages generated by quantum sensing, particularly in early warning and surveillance, could create pressures toward launch-on-warning postures and shorter decision timescales, reducing the role of political deliberation in crisis management. James Acton has argued that emerging technologies, broadly defined, are already compressing nuclear decision timescales in ways that heighten crisis instability.[28] Quantum sensing represents a specific and particularly concerning instance of this broader dynamic.

Discussion

The foregoing analysis reveals several overarching patterns and implications that merit discussion beyond the domain-specific empirical findings.

The Structural Logic of Quantum Arms Racing

Quantum competition exhibits the hallmark features of a technological arms race: mutual investment driven by the fear of relative disadvantage, uncertainty about the adversary's capabilities, and structural incentives that impede cooperative solutions. The "harvest now, decrypt later" dynamic is particularly illustrative. Both states are already engaged in intelligence operations premised on the assumption that quantum computing will eventually enable retrospective decryption. This creates an investment imperative that is largely insensitive to near-term uncertainty about when, or whether, cryptographically relevant quantum computing will be achieved. The arms race logic is therefore already operative, even before the technology reaches its strategic potential.

China's asymmetric advantages in quantum communications infrastructure and the United States's lead in certain aspects of quantum computing create a situation of mutual vulnerability that differs from classic arms race models. Neither state enjoys a clear, across-the-board lead; both face distinct strategic risks from the other's specific capabilities. This configuration creates incentives for continued investment across all quantum domains rather than specialisation, potentially driving overall investment

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http://amresearchreview.com/index.php/Journal/about

levels higher than either state would choose in isolation.

Governance Gaps and the Need for Confidence-Building Measures

Perhaps the most important policy-relevant finding of this article is the near-total absence of governance mechanisms or confidence-building measures specific to quantum technologies. Unlike nuclear weapons, which generated an elaborate architecture of arms control treaties, verification regimes, and crisis communication mechanisms, or even artificial intelligence, where a nascent international governance discussion has emerged, quantum technologies have attracted almost no formal bilateral or multilateral governance attention.

This absence is significant for two reasons. First, quantum technologies present a classic security dilemma in the domain of communications security: any state that achieves quantum communications superiority will be tempted to exploit it for intelligence advantage before the adversary completes a post-quantum cryptographic transition. The incentive to exploit rather than signal is particularly acute because the vulnerability is temporary and asymmetric. Second, the dual-use character of quantum sensing creates an insuperable verification problem: the same quantum gravimeter that enables precision navigation also enables ASW sensing, and no arms control regime has successfully prohibited sensors rather than weapons.[29]

Nevertheless, there are governance options short of formal arms control that merit serious exploration. Bilateral U.S.-China discussions on quantum standards, analogous to the technical standardisation dialogues that characterised Cold War-era arms control in embryonic form, could build familiarity and reduce the risk of misperception. The joint development of post-quantum cryptographic standards, building on NIST's work, could be proposed as a domain of limited technical cooperation that serves both states' interests in cryptographic stability. Track 1.5 and Track 2 dialogues specifically focused on quantum technology and strategic stability, involving scientists as well as strategists, could provide a forum for building shared understanding of capabilities and limitations without compromising national security.

Techno-Nationalism and the Risk of Fragmentation

Both states' techno-nationalist approaches to quantum technology risk producing a fragmented global quantum ecosystem in which incompatible standards, supply chains, and communications infrastructures impede the scientific cooperation that has historically accelerated quantum research. The practical implications of this fragmentation are already visible in U.S. export controls on quantum computing components, Chinese restrictions on foreign participation in quantum research programmes, and the partial decoupling of U.S. and Chinese quantum science communities that has accompanied broader geopolitical deterioration.

Paradoxically, techno-nationalism in quantum may retard the pace of progress in both states relative to what could be achieved through unrestricted scientific collaboration, while simultaneously increasing the strategic stakes attached to whatever advantages are achieved. This dynamic is familiar from the history of nuclear weapons research but is playing out in a globalised innovation ecosystem that is far more difficult to segment than the Manhattan Project era research environment.

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Conclusion

This article has argued that quantum technologies have acquired a strategic character that places them at the centre of U.S.-China great-power competition. Quantum computing threatens to render existing cryptographic architectures obsolete, creating an intelligence windfall for whichever state achieves a cryptographically relevant quantum computer first. Quantum sensing introduces new capabilities for intelligence collection, precision navigation, and, most consequentially, anti-submarine warfare, with direct implications for the survivability of nuclear second-strike forces. Quantum communications offer the prospect of physically secure command-and-control communications that could, in the long term, provide decisive military advantage in a crisis or conflict scenario.

The United States and China are pursuing these technologies through distinct but parallel institutional architectures. The United States draws on a combination of federal investment, national laboratories, and a robust commercial quantum sector. China relies on massive state investment, Civil-Military Fusion integration, and a coordinated industrial policy framework. Each approach has distinct strengths and vulnerabilities, and neither state currently holds an unambiguous across-the-board lead in all quantum domains.

The article has identified three principal contributions to the existing literature. First, it provides an integrated analysis of all three quantum technology domains, demonstrating that their strategic implications are synergistic rather than additive. Second, it applies a multi-framework theoretical approach, drawing on great-power competition theory, military innovation scholarship, and techno-nationalism, to explain both the structural pressures driving quantum competition and the institutional mechanisms through which it is organised. Third, it identifies the governance gap as among the most significant and under-addressed features of the quantum strategic landscape.

The quantum race is not yet decided, and its ultimate strategic consequences remain genuinely uncertain. What is certain is that the decisions made by both states in the coming decade regarding investment, institutional design, military integration, and international engagement will shape the quantum strategic landscape for a generation. The absence of governance mechanisms specifically addressing quantum technologies is a structural deficiency in the current international security architecture that scholars, strategists, and policymakers would be well advised to address before the technology matures sufficiently to generate the crises that governance is designed to prevent.

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