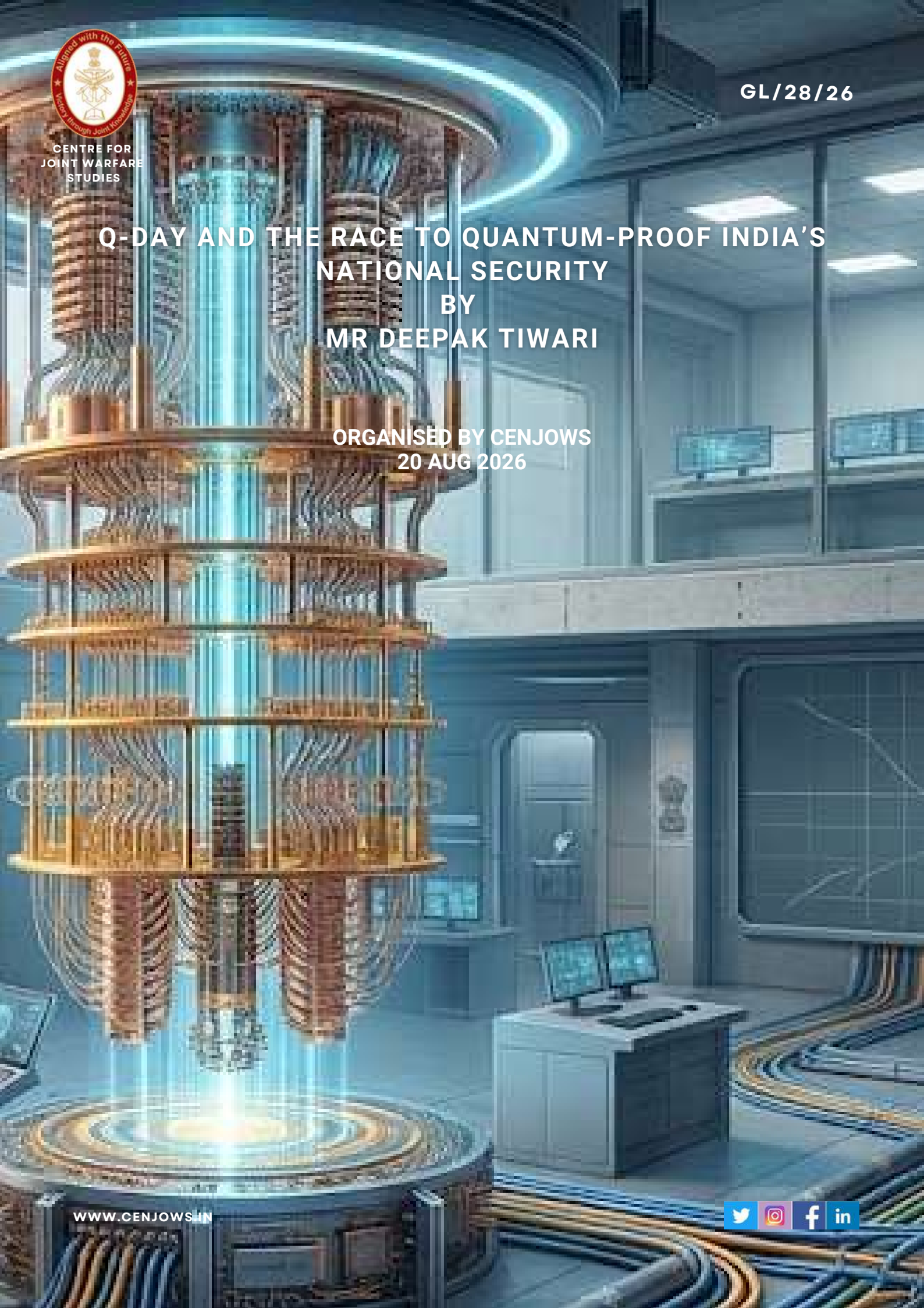

CENTRE FOR JOINT WARFARE STUDIES

GL/28/26

Q-DAY AND THE RACE TO QUANTUM-PROOF INDIA'S NATIONAL SECURITY

BY

MR DEEPAK TIWARI

ORGANISED BY CENJOWS
20 AUG 2026

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ORGANISED BY CENJOWS ON 20 AUG 2026

The presentation introduced quantum computing principles, contrasting superposition, entanglement, and decoherence with classical computing limitations. The transformative potential of quantum technologies was detailed across four verticals—computing, sensing, communication, and simulation—emphasizing strategic and military applications. Global investment disparities were noted, highlighting India's modest budget relative to the US and China. Achieving quantum advantage was underscored as vital for information superiority. The session concluded with a call for indigenous R&D and cross-sector collaboration.

Detailed Summary

Introduction to Quantum Technologies The session underscored quantum literacy as essential for strategic and policy discourse. Thomas Kuhn's concept of paradigm shifts was cited to illustrate major scientific transitions. The shift from classical to quantum computing was presented as a foundational transformation.

Limitations of Classical Computers Classical architectures were characterized by determinism and sequential processing, limiting dynamic multitasking. Complex problems like route optimization and molecular modelling face severe classical memory bottlenecks. Data centre thermal dissipation was cited as evidence of classical computing inefficiencies.

Fundamentals of Quantum Computing Superposition allows qubits to occupy multiple states simultaneously, multiplying data capacity. Entanglement enables instantaneous correlation between particles, supporting secure communications. Quantum interference manipulates probability amplitudes to enhance correct computational pathways. Decoherence was identified as a critical barrier, requiring near-absolute-zero operating conditions.

Quantum Computing Technologies and Companies Google and IBM utilize superconducting loops, while IonQ uses trapped ions. Intel pursues silicon quantum dots, and Microsoft investigates topological qubits. India’s startup IQOR is developing superconducting quantum computers with government support.

Quantum Computing Terminology and Components Quantum gates execute operations on qubits analogously to classical logic gates. Algorithms like Shor’s and Grover’s are designed specifically to harness quantum processing advantages. QPUs serve as quantum processors, requiring high-precision materials such as pure gold.

Four Verticals of Quantum Technologies Quantum computing delivers high-precision solutions to complex mathematical challenges. Quantum sensing provides ultra-precise detection, enhancing battlespace transparency. Quantum communication enables secure encryption via quantum key distribution. Quantum simulation models molecular interactions, accelerating defence material and pharmaceutical development.

Quantum Advantage, Supremacy, and Threats Quantum advantage entails solving practical problems superior to classical systems. Quantum supremacy represents executing calculations unfeasible for classical supercomputers. Q-Day denotes the risk of quantum systems breaking current RSA and AES encryption. Adopting post-quantum cryptography standards is critical to avoid foreign cryptographic dependencies.

Strategic and Military Implications Quantum computing can optimize military logistics and tactical deployment strategies. Quantum communication ensures hardened, interception-resistant command channels. Quantum sensing offers operational clarity and comprehensive battlefield visibility. Achieving quantum advantage first confers decisive decision-to-action superiority in conflicts.

Global Quantum Technology Investments and India's Position China’s $15 billion quantum investment significantly outpaces India's $60 million mission budget. Substantial state funding was noted across the US, UK, France, Canada, and Switzerland. Strengthened collaboration among government, academia, and industry was urged for India.

Challenges and Future Outlook Extreme qubit fragility requires costly cryogenic environments and specialized engineering talent. A unilateral breakthrough could grant an unassailable geopolitical and technological advantage. Accelerating indigenous quantum development is vital to ensure India's national security.