6. Military Quantum Mission Policy Framework – S & T

The Chief of Defence Staff (CDS), formally released the Military Quantum Mission (MQM) Policy Framework. The framework emphasizes Civil-Military Fusion through dedicated governing bodies with members from across government sectors.

Military Quantum Mission (MQM)- Conceptual Overview

The Military Quantum Mission (MQM) Policy Framework provides a time-bound, mission-mode roadmap for integrating quantum technologies into India's defence ecosystem.

It recognises that quantum technologies are force multipliers, capable of altering-

1. Command and control
2. Intelligence dominance
3. Stealth and counter-stealth balance
4. Cyber and information warfare

MQM seeks to ensure technological overmatch rather than incremental parity in future warfare.

Strategic Rationale- Why MQM is a Necessity, not a Choice

Changing Nature of Warfare

Modern warfare is increasingly

1. Data-centric
2. Network-centric
3. Speed-centric

Classical computing and encryption systems are approaching strategic obsolescence in high-intensity conflicts.

Quantum as a Disruptive Military Domain

Quantum technologies create asymmetric advantages, similar to-

1. Nuclear weapons (20th century)
2. Cyber warfare (early 21st century)

Nations that lag risk permanent strategic vulnerability.

Four Foundational Pillars of the MQM

Quantum Communication

Based on Quantum Key Distribution (QKD)

1. Uses principles of quantum mechanics (no-cloning theorem).
2. Any interception attempt disturbs the quantum state, instantly alerting users.

Military relevance- Secure communication between-

1. Command headquarters
2. Missile forces
3. Naval task groups
4. Strategic assets

Addresses threats like

1. Cyber espionage
2. Long-term decryption of classified military data

Quantum Computing

Quantum computers process information using qubits, enabling-

1. Massive parallelism
2. Exponential speed-ups for specific problems

Defence applications-

1. Real-time battlefield simulations
2. Cryptanalysis of adversary communications

Optimisation of- Logistics, Supply chains, Troop deployments

3. Strategic impact- Faster and more accurate decision-making superiority

Quantum Sensing and Metrology- Quantum sensors detect extremely small physical variations.

Key military applications

1. Quantum Gravimetry- Detection of submarines via minute gravitational anomalies
2. Quantum Magnetometers-Silent detection without active emissions
3. GPS-independent PNT systems-Critical in GPS-jammed or denied environments

Advantage-

1. Makes stealth platforms increasingly detectable
2. Enhances survivability in electronic warfare zones

Quantum Materials and Devices

Focus on indigenous development of

1. Superconducting circuits
2. Topological insulators
3. Ultra-stable lasers

These materials are foundational for

1. Quantum sensors
2. Quantum processors
3. Advanced counter-stealth platforms

Strategic importance-

1. Reduces dependence on foreign Original Equipment Manufacturers (OEMs)
2. Strengthens defence industrial base

Scientific Foundations- Quantum Computing Essentials

Difference from Classical Computing

Classical computing- Uses bits (0 or 1)

Quantum computing- Uses qubits (0, 1, or both simultaneously)

Core Quantum Principles

Superposition- Enables parallel computation

Entanglement- Creates instant correlations across distances

Quantum Interference- Amplifies correct solutions while cancelling incorrect ones

Combined effect- Enables problem-solving beyond classical limits, especially in cryptography and optimisation.

Linkage with the National Quantum Mission (NQM)- The National Quantum Mission was launched in 2023 under the Department of Science and Technology.

Outlay-

1. ₹6,000 crore (2023–2031)

Key goals-

2. Develop 50–1,000 qubit quantum computers
3. Establish 2,000 km quantum-secure communication networks
4. Build national quantum research ecosystems

MQM acts as the defence vertical of NQM, translating civilian breakthroughs into military-grade applications.

Key Threat Drivers Necessitating MQM

"Harvest Now, Decrypt Later" (HNDL)- Adversaries are storing encrypted military data today. Future quantum computers may decrypt it retrospectively.

MQM prioritises-

1. Post-Quantum Cryptography (PQC)
2. Long-term protection of state secrets

Counter-Stealth Imperative

Quantum radar and sensing threaten-

1. Stealth aircraft
2. Silent submarines

India must avoid being on the defensive side of the detection curve.

GPS-Denied Warfare

Modern battlefields face-

1. GPS spoofing
2. Satellite denial

Quantum PNT systems ensure-

1. Operational continuity
2. Precision strike capability

OODA Loop Compression-

Faster Observe–Orient–Decide–Act cycles decide victory.

Quantum computing enables- Near-real-time fusion of satellite, drone, and ISR data.

Global Military Quantum Landscape

United States- Pentagon's "Quantum & Battlefield Information Dominance" (2025)

China- PLA Quantum Cyber Warfare Programme (2026) and Operational quantum-secured satellite links

European Union- Quantum Sensing Space & Defence Roadmap (2026)

NATO- First-ever Quantum Strategy (2024)

United Kingdom- National Quantum Technologies Programme (NQTP) and MoD Quantum Roadmap (2023–2033)

India- Risks a regional quantum asymmetry without MQM.

Strategic Significance of MQM

Technological Sovereignty

Promotes Atmanirbharta in critical defence technologies. Reduces exposure to supply-chain coercion.

Achieving Jointness

Ensures-

1. Interoperable quantum protocols
2. Seamless Army–Navy–Air Force integration

Essential for Integrated Theatre Commands.

Civil–Military Fusion

Encourages collaboration among-

1. DRDO
2. Academia
3. Start-ups

Accelerates innovation cycles.

Long-Term Strategic Deterrence

PQC and quantum-secure systems protect-

1. Nuclear command and control
2. Strategic communications
3. Intelligence networks

Implementation Challenges

Technological Constraints

Quantum systems require-

1. Cryogenic cooling
2. Extreme environmental stability

Battlefield ruggedisation is complex.

Quantum Skill Gap

Acute shortage of-

1. Quantum physicists
2. Quantum engineers

Military-specific training pipelines needed.

Long Gestation Periods

1. High R&D costs
2. Uncertain timelines for operational deployment
3. Requires sustained political commitment.

Way Forward

Phased Induction

1. Start with short-range QKD
2. Progress to satellite-based quantum networks

Indigenous Supply Chains- Manufacture dilution refrigerators, lasers, vacuum systems domestically

Quantum Testbeds- Dedicated defence testing ranges for real-world validation

Dedicated Quantum Cadre- Specialised military-scientific workforce

Conclusion

The Military Quantum Mission Policy Framework acknowledges that future wars will be decided by quantum superiority, not just manpower or firepower.

By integrating

1. Quantum communication
2. Computing
3. Sensing
4. Materials

Through a Tri-Service, Atmanirbhar, and civil–military fusion approach, India positions itself as a front-rank power in the Second Quantum Revolution, ensuring credible deterrence and strategic autonomy in the 21st century.

Source- https-//www.pib.gov.in/PressReleseDetailm.aspx?PRID=2217374&reg=3&lang=1