

## Breaching New Frontier-The National Quantum Mission (NQM)

By Uday Kumar Varma, IAS

Author is a former Secretary, Information and Broadcasting, GOI

*“Trying to understand the way nature works involves a most terrible test of human reasoning ability. It involves subtle trickery, beautiful tightropes of logic on which one has to walk in order not to make a mistake in predicting what will happen. The quantum mechanical and the relativity ideas are examples of this.”*

*-Richard P. Feynman*

Over four decades ago, the maverick Nobel Laureate Richard Feynman published a paper, ‘Stimulating Physics with Computers’ that shook the foundations of many scientific beliefs existing then. The paper was a follow up of a lecture he gave at the MIT, in which he famously observed, “Nature isn’t classical, dammit, and if you want to make a simulation of nature, you’d better make it quantum mechanical, and by golly it’s a wonderful problem because it doesn’t look so easy,”. He hinted at an entirely new way of looking at the classical computing, arguing, nature itself is not classical. Most were unclear and therefore sceptical about what he was talking about. Utilising the quantum mechanical properties of matter to develop more powerful computers was an idea too radical and much ahead of the times then.

But it was soon to become an idea whose time has come.

Forty years later, quantum computers have become a reality. Getting them to realise their full potential and perform tasks impossible or impractical for the conventional computers is one of the hottest areas of research today. That they are yet to do anything visibly meaningful, is merely an ephemeral apprehension.

Only six countries — the United States, Canada, Austria, Finland, China, and France — are currently working on it.

And when India joined this select club by launching a National Quantum Mission in 2020, the news did not receive the notice nor salience that it deserved, for it indeed was a quantum jump into a remarkably higher orbit of progress and growth. In a way, it was a tribute to stalwarts like C.V. Raman, Satyendra Bose and Meghnad Saha, whose contribution to Quantum Physics must remain the guideposts for the present generation of physicists and computer technologists.

### The Initiative

Presenting the union budget for 2020-21, Finance Minister Smt. Nirmala Sitharaman in her speech said, “the new economy is based on innovations that disrupt established business models. Artificial intelligence, Internet-of-Things (IoT), 3D printing, drones, DNA data storage, quantum computing, etc. are re-writing the world economic order.”

“Quantum technology is opening new frontiers in computing, communications, cyber security with wide-spread applications. It is expected that lots of commercial applications would emerge from theoretical constructs which are developing in this area. It is proposed to provide an outlay of 8000 crore over a period five years for the National Mission on Quantum Technologies and Applications,” she added.

Thus, was born the largest ever science mission, a 8000 crore National Mission on Quantum Technologies & Applications (NM-QTA) to be implemented over next five years by the Department of Science & Technology (DST).

The NQM is to focus on four key areas of quantum technology: quantum communication, quantum computing, quantum cryptography, and quantum sensors.

But things began to happen when on 19 April 2023 when the Union Cabinet approved Rs. 6003.65 crore, to be spent on scaling up scientific and industrial R&D, for accelerating Quantum Technology led economic growth and leverage India into a leading nation in the area. Over next 6 years, by 2030-31, the project aims to seed, nurture, and scale up scientific and industrial R&D and create a vibrant & innovative ecosystem in Quantum Technology (QT) to make India one of the leading nations in the development of Quantum Technologies & Applications (QTA).

### **The Vision**

The new mission targets developing intermediate scale quantum computers with 50-1000 physical qubits in 8 years in various platforms like superconducting and photonic technology. Satellite based secure quantum communications between ground stations over a range of 2000 kilometres within India, long distance secure quantum communications with other countries, inter-city quantum key distribution over 2000 km as well as multi-node Quantum network with quantum memories are among some of the deliverables of the Mission.

Further, the mission will help develop magnetometers with high sensitivity in atomic systems and Atomic Clocks for precision timing, communications, and navigation. It will also support design and synthesis of quantum materials such as superconductors, novel semiconductor structures and topological materials for fabrication of quantum devices. Single photon sources/detectors, entangled photon sources will also be developed for quantum communications, sensing, and metrological applications.

The four chosen areas of quantum technology will receive focused attention by setting up four Thematic Hubs (T-Hubs) in top academic and National R&D institutes on the domains - Quantum Computing, Quantum Communication, Quantum Sensing & Metrology and Quantum Materials & Devices. The hubs which will focus on generation of new knowledge through basic and applied research as well as promote R&D in areas that are mandated to them.

### **And the Gains**

In practical terms, NQM can take the technology development eco-system in the country to a globally competitive level. The mission would greatly benefit communication, health, financial and energy sectors as well as drug design, and space applications. It will provide a huge boost to National priorities like digital India, Make in India, Skill India and Stand-up India, Start-up India, Self-reliant India, and Sustainable Development Goals (SDG). Seen in a broader and long-term perspective, the mission aims to establish India as a global hub for quantum computing and communication, and to foster innovation and entrepreneurship in this emerging field.

The implications of the NQM are significant, as quantum technology has the potential to revolutionize various fields such as healthcare, finance, defence, and cybersecurity. For example, quantum computing can help in the development of new drugs and materials, while quantum communication can enable secure communication channels that are resistant to hacking.

In terms of governance, the NQM can help in the development of new solutions for complex problems in areas such as logistics, transportation, and energy management.

The mission can also provide opportunities for collaboration between the government, academia, and industry, leading to the creation of new start-ups and job opportunities in the field of quantum technology. Furthermore, the NQM can help India become a global leader in the field of quantum technology, which can have strategic and geopolitical implications.

Six ministries — Department of Space, Department of Atomic Energy, Ministry of Electronics and Information Technology, Information, Department of Telecommunication, and Department of Science and Technology — will be involved in this mission.

### **What are quantum Technologies?**

Quantum Technology is based on the principles of Quantum mechanics developed in the early 20th century. It evolved as a practical application of the Quantum Theory that explained the nature of energy and matter on the atomic and subatomic level. It concerns the control and manipulation of quantum systems, with the goal of achieving information processing beyond the limits of the classical world.

These technologies use Quantum principles for engineering solutions to extremely complex problems in computing, communications, sensing, chemistry, cryptography, imaging, and meteorology. Using quantum superposition, a set of unbreakable codes or super-speedy information processing, quantum computers can mimic several classical computers working in parallel mechanics.

Unlike classical computers that use zeroes and ones (bits and bytes), quantum technology is atom-based. It uses quantum bits (qubits), which can be in a combination of zero and one simultaneously. Using quantum superposition, a set of unbreakable codes or super-speedy information processing, quantum computers can mimic several classical computers working in parallel. Quantum technology makes information processing faster, more authentic, more precise, more secure.

The prime factorization quantum algorithm, in turn, has important implications for security as it can be used to break RSA encryption, a popular method for secure communication.

### **Challenges**

Quantum technology may be a rapidly advancing field with the potential to revolutionize, inter alia, fields like computing, communication, and sensing, as never before, but formidable challenges exist and more are set to emerge as we determinedly begin to pursue it. These challenges include among others Hardware Development, Quantum Algorithm, Quantum Communication, and Error- correction.

Building and scaling up reliable and stable quantum systems is a major challenge. Quantum computers require a high degree of control over quantum states and maintaining coherence (the ability of quantum systems to retain information) is challenging due to environmental noise and decoherence.

Designing and optimizing quantum algorithms to solve practical problems efficiently is another significant challenge. While quantum computers have the potential to solve certain problems exponentially faster than classical computers, identifying suitable applications and developing quantum algorithms that outperform classical counterparts remains an active research area.

Quantum communication aims to secure information transmission using quantum phenomena such as entanglement and quantum key distribution. Ensuring the security and scalability of quantum communication networks is challenging due to the vulnerability of quantum systems to eavesdropping and loss of quantum states.

And lastly, Quantum systems are susceptible to errors due to various factors, such as noise, imperfect gates, and interactions with the environment.

Developing effective error correction techniques is crucial for scaling up quantum computers and achieving reliable computations.

An additional challenge will be to mobilise resources uninterruptedly and free of bureaucratic constraints. The technology, now, is too costly & cumbersome to get commercialised. For instance, qubits are kept in a chamber that chill them to near absolute zero temperature. Even giant tech companies have cautiously taken up quantum computing projects.

But the one challenge that dominates all others is not technological. It is ethical and professional. With several black sheep infiltrating our scientific establishments, and with the increasing temptations to compromise their integrity and probity, their knowledge and commitment, a steadfast adherence to national interest becomes supremely crucial.

Both US and China have already taken significant steps in this area. While US has created a statutory framework for sustained work in this field, China has already made some breakthroughs including the world's first quantum satellite, Micius, to enable secure quantum communication. Clearly, India will have to very closely monitor the progress and must single-mindedly pursue the goals to maintain a competitive edge and retain a leadership position.

### **The Future**

The range of quantum technologies is expected to be one of the major technology disruptions that will change entire paradigm of computation, communication, and encryption. It is perceived that the countries who achieve an edge in this emerging field will have a greater advantage in garnering multi-fold economic growth and dominant leadership role.

It is also the opportune moment to provide the space for many start-up companies to take off. The Mission draws upon the existing deep strengths within academic institutions across India to support interdisciplinary research projects in key verticals involving quantum technology, while simultaneously developing key foundational strengths in important core areas.

Implementation of the mission would help develop and bring quantum computers, secured communications through fibre and free space, quantum encryption and cryptanalysis and associated technologies within reach in the country and help address India specific national and regional issues.

The mission will help prepare next generation skilled manpower, boost translational research, and encourage entrepreneurship and start-up ecosystem. By promoting advanced research in quantum science and technology, technology development and higher education in science, technology and engineering disciplines India can be brought at par with other advanced countries and can derive multitudes of direct and indirect benefits.

With a solid research base and workforce founded on significant and reliable government support, it can lead to the creation of innovative applications by industries, thereby stimulating economic growth and job creation, which will feed back into a growing quantum-based economy. The government's financial and organizational support will also ensure that both public and private sectors will benefit. It will establish standards to be applied to all research and help stimulate a pipeline to support research and applications well into the future.

### **A Moment of Reckoning**

For a country whose leaders and people are overly obsessed with politics, this quiet but determined march to hitherto unexplored frontier of disruptive technologies is nothing short of a revolution. It will secure our communications and financial transactions and arm us with a distinct competitive edge. It will drive societal progress, generate employment, foster economic growth, and improve the overall quality of life of common man. It will ensure a sustained strategy to be at the forefront, the leader of a technological world order.

Quantum technology landscape is highly dynamic. An enlightened and visionary leadership of India is one advantage that makes the prospects eminently promising. The scientific community has a rare and unprecedented opportunity to prove the depth and reach of their capabilities and commitment.

India must shine in this path-breaking initiative.

---

## Beijing's Powerplay

**By Srikanth Kondapalli**

Author is Dean of School of International Studies and Professor in Chinese studies at Jawaharlal Nehru University.

*China refuses to vacate an estimated 60,000 to 70,000 troops from Depsang Plains and Demchok, and thus continues to obstruct Indian patrols.*

Despite tremendous pressure from major powers, India is steering the G20 and Shanghai Cooperation Organisation (SCO) meetings with its own flavour of speaking for the Global South, humanitarian assistance and disaster relief (HADR), food security, climate change, and other issues.

The SCO meeting in New Delhi on Friday saw the defence ministers of China, India, Russia, Kazakhstan, Uzbekistan, Tajikistan and Kyrgyzstan take part. Iran and Belarus joined as observers and Pakistan's defence representative attended the meeting virtually. This was preceded by informal bilateral meetings amongst them the previous day, including between India's Defence Minister Rajnath Singh and his Chinese counterpart Li Shangfu.

The SCO defence ministerial mechanism is aimed at military cooperation among member-states, addressing regional security issues such as border disputes and arms control, pursuing counter-terrorism measures and enhancing cyber security cooperation.

Given that SCO mandate and in the face of the Ukraine war and China's violation of agreements with India in the border areas – manifesting most worryingly in such incidents as the conflict in Galwan in June 2020 and intrusions at Yangtse, Tawang, in December last, India, as the host, has to work out a way to obtain some substantial outcomes and ensure the success of its presidency of the SCO.

At the SCO meeting, Rajnath Singh proposed HADR, in which India has demonstrated capability since the 2004-5 tsunami rescue and relief operations, as part of its agenda, in addition to defence capacity-building through training and co-manufacturing and co-development of items, food security and climate change mitigation and adaptation.

Counter-terrorism issues were also raised, with a caveat that countries that promote terrorism should be penalised. The SCO states conduct "Peace Mission" counter-terrorism exercises, but these remain ineffective, mainly because of the prevailing double-standards.

Another intractable SCO defence ministerial agenda item is border stability. Clearly, as Rajnath Singh told Gen Li, China's "violation of existing agreements [1993, 1996, 2005, 2013, 2021 and others] has eroded the entire basis of bilateral relations". Despite 18 corps commander-level meetings till last week, China refuses to implement the February 2021 defence ministerial agreement on "disengagement and de-escalation at all friction points" and thus violates the spirit of SCO as such.

**[Read complete article on website deccanherald.com](https://www.deccanherald.com)**

---

# Sudan Crisis

By Lt Gen V A Bhat

Gen Bhat served as the Director-General of Quality Assurance (DGQA) at the Department of Defence Production (Ministry of Defence) affairs.

Fighting in Sudan suddenly erupted in the middle of April 2023 leading to many deaths and citizens of this country fleeing its border to safer havens. The fighting represents the latest crisis in the North African country. (Map attached) Sudan is a very big country of Africa with Egypt to its north, Libya to its northwest, Chad to its Central west; the Central African Republic in the south of Sudan and then Ethiopia. The country is rich in mineral resources like oil, gold, copper and limestone among others. This is a new development in a nation, which has contended with numerous coups and periods of civil strife since becoming independent in 1956. In February 1953, the United Kingdom and Egypt concluded an agreement providing for Sudanese self-government and self-determination. South Sudan gained independence in 2011 after a referendum in which its people voted overwhelmingly to secede from Sudan. Independence was the culmination of a long-armed struggle waged by South Sudanese starting in the mid-1950, mainly Christians and animist by faith. This time, the fighting involves the Sudanese Armed Forces (SAF) and Rapid Support Forces (RSF). In a coup in 2019 the Sudanese Army led by Gen Abdel-Fattah Burhan and Mohammed Hamdan Dagalo, popularly known as Hemdeti, commander of RSF joined hands to overthrow the Sudanese strong man the President Omar al-Bashir in 2019.

After this coup it appeared the two individuals who had joined hands to depose Basheer had popular support of the citizens of Sudan. There was an announcement of forming a Transitional Council to govern Sudan finally leading to elections ushering in Democracy. The western World welcomed this news which will finally lead to a democratically elected government. Unfortunately, Gen Abdel Fattah al-Burhan dissolved the Transitional Sovereignty Council in 2021 and dashed hopes of Democracy in Sudan. Former president and military leader Omar al-Bashir presided over the War in Darfur from 2003. Matters escalated on February 26, 2003, when a newly-formed group calling itself the Darfur Liberation Front (DLF) – later renamed the Sudan Liberation Movement publicly claimed an attack on Golo, the main town in the district of Jebel Marra.



This rebel group and the Justice and Equality Movement (JEM) launched a rebellion to protest the Sudanese government's disregard for the western region and its non-Arab population and seek power-sharing within the Arab-ruled Sudanese state. The response of President Omar's government was ruthless. He equipped and supported Arab militias known as Janjaweed to fight the rebels in Darfur. Referring to themselves as Popular Defence Forces, they worked alongside Sudanese government forces to systematically kill the African Fur, Masalit, and Zaghawa ethnic groups, from which the members of the rebel groups were drawn. The Commander of this Janjaweed was Mohammed Dagalo later renamed RSF. The militias, however, also terrorized the civilians in the region and prevented international aid organizations from delivering much-needed food and medical supplies. Despite a 2004 cease-fire and the presence of African Union (AU) troops that followed, by 2007 the conflict and resulting humanitarian crisis had left hundreds of thousands of people dead and more than two million displaced, internally as well as externally, as they were forced to flee from the fighting.

On July 31, 2007, the United Nations Security Council authorized a joint UN-AU peacekeeping mission (UNAMID) to replace the AU mission, although UNAMID troop deployment did not begin until 2008. The Pro government forces were alleged to have perpetrated a genocide and war crimes which led to hundreds of thousands dead. In 2013, Bashir transformed the Janjaweed (RSF) into a semi-organised paramilitary force and gave their leaders military ranks before deploying them to crush a rebellion in South Darfur and then dispatching many to fight in the war in Yemen, and later Libya. Various peacemaking efforts did not yield much results till a comprise treaty was signed between Gen Abdel Fattah al-Burhan in 2019 after the President Basheer was overthrown. Mohammed Dagalo the leader of the RSF, was born in 1974 and is practically uneducated. He joined his uncle in camel trading business. He joined the Janjaweed (RSF) when men attacked his trade envoy, killed 60 members of his family and looted his camels. He was noticed by President Basheer and soon was promoted Commander. This Janjaweed was renamed Rapid Security Forces and this force was utilised by Basheer in crushing any opposition to his regime in Sudan and/or in the neighbouring areas.

Dagalo was promoted Lieutenant General and was given free rein as he seized lucrative gold mines in Darfur belonging to a rival tribal leader. He multiplied his fortune many times over. His RSF is now a battle-hardened organisation and is alleged to have killed and raped many civilians after Basheer was overthrown. This convenient alliance to share power by the two, namely the regular Sudanese Army led by Gen Burhan and Lt Gen Mohammed Dagalo lasted for about four years. Things began to look ugly, and relations strained, when the integration of the RSF with the regular army came up. The RSF wanted integration with the regular Army in a span of over 10 years, but the regular army wanted to do it within two years. Other contested issues included the status given to RSF officers in the future hierarchy, and whether RSF forces should be under the command of the army chief – currently Al Burhan rather than the RSF Chief Dagalo. They have also clashed over authority over sectors of Sudan's economy that are controlled by the two factions. As a sign of their rift, Dagalo expressed regret over the October 2021 coup.

The RSF has 100000 troops well equipped but lacks Air Support which is controlled by the regular Army. In April the RSF forces attacked a large number of bases held by the regular Sudanese Army including the residence of the President Gen Al Burhan. SAF retaliated with Air Strikes and counter Attacks. All roads leading to the Capital Khartoum are now closed and under RSF. The countries air space was closed, and internet services suspended. There have been announcements of ceasefire to help evacuate its distressed residents. Rampant violations of the Ceasefire have been reported as the terms of reference for cease fire between the two warring factions are not defined. The picture on the ground is not clear although there are efforts by Saudi Arabia to broker peace between the two factions. Fighting could be heard in south Khartoum on Sunday 07 May as envoys from Sudan's warring parties were in Saudi Arabia for talks that international mediators hope will bring an end to a three-week old conflict that has killed hundreds and triggered an exodus.

The U.S.-Saudi initiative is the first serious attempt to end fighting between the army and the paramilitary Rapid Support Forces (RSF) that has turned parts of the Sudanese capital Khartoum into war zones and derailed an internationally backed plan to usher in civilian rule following years of unrest. Some international observers are of the opinion that this war between the SAF and RSF will only finish when one side defeats the other comprehensively. Meanwhile the worlds eyes are riveted on Saudi Arabia to get the two sides to agree to stop the fighting and settle issues peacefully, in the interest of the countries neighbouring Sudan in particular and world in general.

---

## **Kaladan Waterway India's Strategic Stamp In Myanmar**

**By Dr Seshadri Chari**

Author is a Secretary General of the Forum for Integrated National Security (FINS). Dr Chari writes on foreign policy, strategy, and security affairs.

In a significant boost to strategic, diplomatic and economic engagement between India and Myanmar, the waterway section of the ambitious Rs 3,200 crore Kaladan Multimodal Transit Transport Project, KMTTP, is all set to become operational this week. After a trial run of rice shipment to Bangladesh, a shipload of cement from Kolkata to Sittwe port in Myanmar will be the first official cargo after Naypyidaw gave necessary permission for regular commercial operations from the port completed by the Shipping Ministry's Inland Waterways Authority of India in 2018.

The Kaladan project proposed about two decades ago began with the Detailed Project Report (DPR) prepared by RITES in 2003 and the subsequent signing of the 2008 agreement between India and Myanmar. The project envisaged four important stages – Kolkata to Sittwe waterway, Sittwe to Paletwa inland (River Kaladan) waterway, Paletwa to India-Myanmar border post in Myanmar and finally linking the road to Lawngtlai in Mizoram as part of the project's last leg.

India unveiled the Look East Policy under the then government led by P V Narasimha Rao in early 90s with a view to ensure economic development of India's Northeast and build a bridge between the region and the rest of East Asia. The Look East Policy, India's outreach towards East Asia and the economic development of the region were interlinked. India's trade with East and South Asia was no doubt being conducted through Indian Ocean and overland routes like by air. But it was necessary to strengthen land connectivity and integrate the economic development on the Northeast with that of Bangladesh and Myanmar. Such linkages would also increase India's strategic footprints in East Asia and more importantly in our immediate neighbourhood.

### **Where India lost time**

Soon after Independence, both India and China had a policy of deeper engagement with countries in the immediate neighbourhood and with East and South Asia. While a democratic India had to maintain a balance between regional geopolitics and the global expectations towards support to democracy movement, China had no such compulsions. China has been one of the few countries, and the only major power to have provided unwavering support to successive regimes in Myanmar when the Western world and even the UNSC imposed sanctions on the country.

**[Read complete article on website theprint.in](#)**

---

**Disclaimer: The opinions expressed in this publication are those of the authors. They do not purport to reflect the opinions or views of the FINS or its members.**



## **Nation is Indebted to:**

**Prof Ashab Ali**

**A great scholar of Veda's**



In 1977, a young, clean-shaven man, attired in an immaculate dhoti and kurta, joined the department of Sanskrit in Deen Dayal Upadhyaya University in Gorakhpur as an assistant lecturer (on an ad hoc basis) to teach the Vedas.

He was Ashab Ali, from a small town, Maharajganj, 30 Kms away from Gorakhpur.

After a Haj pilgrimage in 1997, Ali started sporting a beard and his attire changed to a kurta-pyjama with a skull cap. That did nothing to diminish his popularity with his fellow teachers and students, though. He continued to work till 2010 and was even the head of the department for some time.

Prof Ashab Ali doesn't remember any discrimination or misbehaviour by fellow teachers or students in a department dominated for years by Brahmins and Thakurs. "Surely they accepted me for my knowledge", says Prof Ali.

Ashab Ali topped both his BA and MA exams in Sanskrit in 1969 and 1971. He then completed a PhD on a comparative study of Vedic and Islamic myths under the then head of department, Atul Chandra Banerjee, who also played a key role in his appointment.

Prof Ali retired as head of department (HoD) in 2010, the only Muslim professor to hold the highest departmental post. He says, "Despite being a Muslim, I continued to excel in Sanskrit and went on to become the head of a department of Sanskrit, (which was full of Brahmins and Thakur's) in Deen Dayal Upadhyay University Gorakhpur in the year 2010."

Prof Ali recalls, how a group of Hindu students laid siege to Prof Banerjee's office to protest against the preference given to two Hindu teachers over him when it came to promotion to a regular teacher position in 1979. They ensured his appointment as a regular teacher. His heads of department, for their part, made sure classes didn't clash with his prayers.

Commenting on Prof Ali, the former head of the department Prof Murli Manohar Pathak said: "He was so hard working that during his days of studies in the university he would come by a cycle, pedalling over 30 km daily from neighbouring Maharajganj, his home. He was a gentleman, And a scholar of unapparelled repute."

He expired about two years back during Covid 19 pandemic.

We in India are certainly proud of such great scholar.

Write to us at:

**[bulletin@finsindia.org](mailto:bulletin@finsindia.org)**

**OFFICE :4, Belle View, Lakhamsi Nappu  
Road, Dadar (East), MUMBAI - 400014  
Phone 022 24127274**

**EDITORIAL BOARD**

**Shri. Milind Bondale  
Col Ravindra Tripathi**