

A journey from sanctions to embrace

After initial isolation, India harmonised relations and signed the US deal

Lalit Mansingh was secretary (west) in the external affairs ministry in May 1998 when India conducted five nuclear tests on May 11 and 13, 1998, at the Pokhran range in Rajasthan. The first three detonations took place simultaneously at 3.45pm on May 11. These included a 45 kT thermonuclear device, a 15kt fission device and a 0.2 kt sub-kiloton (which is less than a kiloton) device. The two nuclear devices detonated simultaneously on May 13 were also in the sub-kiloton range, 0.5 kT and 0.3 kT. The test happened months after then foreign secretary K Raghunath told his US counterpart that India did not have any intention of testing a nuclear device. “The test was a secret, known only to five people; that certainly did not include me or even the foreign secretary,” Mansingh recalled. The test opened floodgates of trouble for India: sanctions, economic and military, and interactional isolation. “It was certainly the biggest challenge Indian foreign policy establishment faced in a long, long time,” said Mansingh, who later became the foreign secretary as well as the country’s envoy to the US. The immediate challenge was to mitigate international opposition and eventually bridge the trust gap with the US. Immediately after the tests, the US suspended foreign secretary-level talks; over the following two years, it put more than 200 Indian entities under the sanctions list. The list included not only the facilities of the Department of Atomic Energy (DAE) and the Defence Research and Development Organisation (DRDO), and entities of Department of Space, but also a clutch of private sector firms that had worked for them.

The now fabled discussions between Strobe Talbot, then US secretary of state, and then foreign minister Jaswant Singh followed — they were held in seven countries, 10 cities, and included 14 rounds of talks.

For Americans and the West, India was gatecrashing the nuclear club. With Pakistan seeking nuclear



parity, the Americans feared South Asia would become a nuclear flashpoint. A great deal of the Talbot-Singh conversation covered this ground. “I hope my regard for the way Jaswant advanced his nation’s interests and sought, as he put it, to harmonise US-India relations speaks for itself...” Talbot wrote in his book *Engaging India: Diplomacy, Democracy and the Bomb*. “These talks provided the basis for the next stage of India-US relationship, and eventually paved the way for the India-US nuclear deal,” says Mansingh. The nuclear deal, pursued by the Manmohan Singh-George Bush Jr administrations, resulted in India getting a seat at the nuclear high table for all practical

purposes without signing the Non-Proliferation Treaty. The framework for this agreement was a July 18, 2005, joint statement by then Indian PM Manmohan Singh and then US President George W Bush. This led to India putting some of its reactors under the Indiaspecific International Atomic Energy (IAEA) safeguards, and getting a waiver from the Nuclear Suppliers Group, the elite club of countries that deals with trade in nuclear technology and fissile materials. The NSG waiver on September 2008 lifted an over three-decade, US-led world embargo on civilian nuclear cooperation with India that was brought upon India after it first tested a nuclear device in 1974 and in 1998. The waiver earned India the right to trade for civilian nuclear fuel and technology.

It was expected to give a boost to nuclear power in India’s energy basket. Back at the time, India’s 22 nuclear plants were operating at under 40% capacity. India subsequently started signing deals with foreign

countries to start nuclear parks in the country. It signed agreements with Russia, France and the US. Except with the Russians, the other plans ran into a host of issues ranging from land acquisition to liability.

The share of nuclear power in the total electricity generated in the country in 2016-17 was a mere 3.05%. According to the data from Department of Atomic Energy, the present installed nuclear capacity is 6,780 MW and it will reach 13,480 MW by the year 2024 with the completion of projects under construction. In June 2017, the Government accorded administrative approval and financial sanction for 12 more reactors with a total capacity of 9,000 MW that are scheduled to be completed progressively by 2031. Together with the capacity being implemented by BHAVINI, the total nuclear power capacity will reach 22,480 MW by the year 2031. “But we all hoped the nuclear power production in the country would see a quantum jump because of the deal. That didn’t happen”, said Mansingh.

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Drdo is taking new challenges in AI and Robotics that will act as force multipliers’

BW Business world’s Manish Kumar Jha catches up with DRDO Chairman and Secretary, Department of Defence R&D, S. Christopher, for an exclusive interview

By Manish Kumar Jha

The Defence Research & Development Organization (DRDO) is an apogee among institutions under the— and brickbats for time and cost overruns. BW Business world’s Manish Kumar Jha catches up government’s Department of Defence Research and Development. It has since 1958, been indigenously developing military technology, weapons and equipment for the Indian Armed Forces. It has received both bouquets for India’s home-grown missiles technology (Agni-V, NAG and the long-range LRSAM), rocket systems (Pinaka) and platforms with DRDO Chairman and Secretary, Department of Defence R&D, S. Christopher, for an exclusive interview.

Next generation technology is going to influence warfare in the future. Please tell us about these new developments

War is serious business, as it tends to drain the economy, development and social fabric of any nation involved. Future wars would be short, swift, accurate and gain an upper hand during bargaining. That brings us to the importance of technology in futuristic wars affecting military doctrine and strategy. New dimensions of threat are posing radically new questions, demanding fundamentally new answers, buttressed by unconventional mindsets and integration of methods that facilitate both. The DRDO has identified specific technologies for low level of readiness and high strategic value, where scientific investigations are urgently required in laboratories, through modeling and simulation.

In the future, Artificial Intelligence (AI), cyber elements, smart materials, smart ammunition, Soldier as a System, Military Robotics and Unmanned Systems, Network Centric, surveillance, long-range accurate weapons and systems, mobile launch pads and stealth technology will incapacitate the enemy, even before a full-scale war begins. They would also play a pivotal role in safeguarding our own assets. The aim would be to create an effect, without sending a soldier to a hostile land. Joint initiatives are on between the DRDO and academia at various Centres of Excellence for multi-institutional collaborative and directed research under technology verticals, like Directed Energy



Technologies, Secure System and Cognition, Unmanned Systems and Robotics Technologies, Quantum Computing, Photonics, Plasmonics and Smart and Intelligent materials. These areas have been identified based

on the requirements of future defence systems and where further scientific investigations are required to enhance indigenous capabilities.

The DRDO has earmarked Rs 18,000 crore for research and development (R&D) in the current year? Is it enough for your ongoing and next generation research?

Research and Development is a continuous process which also involves creating infrastructure for strategic projects apart from the cost involved in R&D. Investment in R&D is vital for the Make in India initiative. The Rs 18,000 crore allocated in this financial year will set things rolling, of which nearly 25 per cent - 30 per cent will go into newer projects, such as stealth technology for unmanned combat aerial vehicle (UCAV) and next generation critical technologies for Advanced Medium Combat Aircraft (AMCA), Next Gen integrated EW system, indigenous technology for cruise missile etc. We have a proposal to develop BrahMos next generation missiles. Funds have never hindered progress.

Where do we stand in the landscape of global research now when the Defence Production Policy 2018 envisions India as a global leader, especially in AI?

Modernisation of our Armed Forces is an on-going process and information technology plays a very crucial role in the process. In this context, keeping the roles of Artificial Intelligence, Robotics, and Drones as vital, the DRDO has carried out a number of Army-specific projects. The Artillery Command Control and Communication System (ACCCS) called Project 'Shakti', developed in the 1990's, has the third generation version that is now being deployed. The DRDO's Centre for AI and Robotics (CAIR) has developed robots for various kinds of inspection for aerospace manufacturing and nuclear reactor maintenance. Another DRDO laboratory Aeronautical Development Establishment, Bengaluru has developed the 'Nishant' and 'Rustom' variants of the UAVs for defence applications. A high performance computing facility is being set up in Hyderabad. Through these initiatives, the DRDO hopes to deliver critical AI and robotics technologies required for network-centric warfare capability and superiority of information of our Armed Forces. The DRDO is taking new challenges in AI and robotics that would act as force multipliers for our Armed Forces. We can confidently say that we are on par with many developed nations of the world and are catching up with the most advanced ones.

What is the objective of the proposed Innovation for Defence Excellence (iDEX)?

The iDEX has been recently launched by the Prime Minister at DefExpo 2018, Chennai. The main objective of iDEX is to develop an ecosystem to foster innovation and technology development in defence and aerospace by involving industries including MSMEs, startups, individual innovators, R&D institutes and academia and provide them grants or funding and other support for R&D. The iDEX will enable funding, guidance, handholding, users' engagement and facilitation.

The DRDO is slated to show cutting-edge technological platform and benchmark for UCAV Ghatak and SWiFT. Could you elaborate ?

Unmanned Combat Air Vehicles (UCAV) are envisaged for complex missions where several types of aircraft and ground and Naval Forces may be present. The UCAV (Project GHATAK) around modified KAVERI dry engine and stealth technology is being taken up on a fast track. The objective of SWiFT (Stealth wing Flying Testbed) is to develop a flying wing test bed to demonstrate capabilities and technologies for future UCAV. The Government of India is in the process of bringing out a new Defence Production Policy 2018 which encourages participation of private industries in R&D and production. It also encourages MSMEs, which may utilise DRDO test facilities.

<http://businessworld.in/article/-DRDO-Is-Taking-New-Challenges-In-AI-And-Robotics-That-Will-Act-As-Force-Multipliers-/09-05-2018-148714/>

A big bang explosion in Arms business

The laboratories around the world are abuzz with swarming drones, robotics, AI and the Internet of Battle Things. Are we in step?

By Manish Kumar Jha

In October 2016, the Department of Defence, the Strategic Capabilities Office, partnering with Naval Air Systems Command, successfully demonstrated one of the world's largest micro-drone swarms at China Lake, California. The test was a significant milestone in defence preparedness and was documented on Sunday's CBS News programme '60 Minutes'. It showcased 103 Perdix drones launched from three F/A-18 Super Hornets. The micro-drones demonstrated advanced swarm behaviours, such as collective decision-making, adaptive formation flying and self-healing.

The Gulf War in 1990 had brought to light a new dimension in warfare where smart weapon technology and "intelligent" weapon systems were used extensively. These weapons performed effectively against designated targets and reduced human casualty. This stealth and precision of modern warfare is going to define the 'future of defence'. And almost three decades later, the laboratories around the world are abuzz with swarming drones, robotics, artificial intelligence and the Internet of Battle Things. As the Director General of the Society of Indian Defence Manufacturers (SIDM) Lt. Gen. (Retd) Subrata Saha points out, "We are talking about the precision weapon systems here and the emphasis is more on stealth to achieve more with less and your robust ISR (Intelligence, Surveillance and Reconnaissance) mechanism that defines the future of defence technology per se. And that is going to drive the business of defence with the most critical and necessary components that would also have an outreach and application beyond defence." How ready are we?

According to a report by the International Data Corporation (IDC), the global spending on robotics and related services will more than double by 2020, growing from \$91.5 billion in 2016 to more than \$188 billion then. Defence will absorb the major chunk of unmanned aerial vehicles (UAVs,) for accuracy in military operation. Not just a few advance militaries, but a cluster of nations are in the race for the drone. The reason is simple. Even though drones do not exactly come cheap, they still cost less than the life of a soldier. Automation has myriad applications in warfare, be it to manoeuvre missiles or to reconnaissance over enemy territory with an UAV. Military UAVs are getting increasingly sophisticated, outfitted with low-level autonomy that allows the drones to navigate their way through space without human intervention. China has declared research on artificial intelligence (AI) as a national priority and some striking AI capabilities are being integrated in the military with scale and range.



The Chinese do realize that the nature of warfare will undergo a fundamental change with unmanned platforms and autonomous systems. India's Defence Research and Development Organisation (DRDO) have taken a leaf out of China's book, by taking advantage of the home-grown information technology (IT) industry. It has set aside Rs 1500 crore for research on UAVs projects for application across the Army, Navy and Air Force. The DRDO plans to spend Rs 18,000 crore in the current fiscal on both existing and futuristic projects. In February the DRDO carried out test flights of its Rustom 2 drone, a

medium-altitude long-endurance unmanned aerial vehicle at Chalakere in Karnataka's Chitradurga district. Rustom 2 is being developed on the lines of predator drones of the United States to carry out surveillance and reconnaissance (ISR) for the Armed Forces with an endurance of 24 hours.

Future of Defence

The DRDO has of late come up with noteworthy and startling new-age technologies in its 'Future of defence' project. The integration of AI and related technologies are being liberally integrated in the next generation Unmanned Combat Aircraft (UCAV) Ghatak and iSWIFT (Stealth Wing Flying Testbed). Besides, Cyber warfare will assume a far greater importance, and cyber adversaries will have to be tackled with AI. Internet of Intelligent Battle Things is the emerging reality of warfare. A variety of networked intelligent systems – things – will continue to proliferate on the battlefield, where they will operate with varying degrees of autonomy. Intelligent things will not be a rarity, but ubiquitous on the future battlefield, says Alexander Kott of the U.S. Army Research Laboratory in a widely acclaimed research paper.

Thus, military can have many applications similar to the commercial ones derived from the Internet of Things (IoT). Be it in critical infrastructure, industrial control, or consumer durables, IoT systems are similar in data collection, distribution, feedback and analytical technologies. In a report titled, 'Internet of Things (IoT) in Aerospace & Defence Market Forecast 2017-2027,' the global agency, Vg-Defence estimated the global IoT market in the aerospace and defence sectors to be \$22.6 billion in 2017. In the spheres of aerospace and defence, IoT devices connect aircraft, systems and people to the Internet to help improve production processes, management efforts and help enhance productivity. The report projects IoT sales in aerospace and defence for the next ten years, taking into account the businesses of the world's leading defence contractors, like BAE Systems, Boeing Co., General Dynamics, Lockheed Martin and Northrop Grumman Corp. At the moment developing military capabilities with futuristic, next generation technologies seems to be the sole compulsion of the DRDO. A convergence must occur between the military, industry and academia, though, for a competitive tempo in next generation defence R&D.

<http://businessworld.in/article/A-Big-Bang-Explosion-In-Arms-Business/09-05-2018-148663/>



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Indian Army likely to order another batch of Akash surface-to-air missiles

The Indian Army is likely to order another batch of home-grown Akash, medium-range surface-to-air missiles from Defense Research Development Organization (DRDO). "The defence forces were fully satisfied with the performance of Akash system and that they were also intending to enhance its performance, Lt. Gen Parminder Singh S Jaggi, Director General, Army Air Defense was quoted as saying by The Hindu Tuesday. "We are happy with the Akash system. It is a watershed as far as indigenous systems are concerned. The biggest advantage is it is a home grown system," Jaggi said.

"The first user trial by AAD crew was fully successful. Akash has been validated as it has been conceptualised," he added. The Army is likely to order more Akash regiments as it is in the process of replacing its legacy systems in service. More regiments were ordered. There could be additional enhancements in the system as well as in the performance, he said. In December last year, DRDO test-fired the Akash missile with an indigenous radio frequency seeker against a mobile target. This missile is being inducted into Army as Short Range Surface to Air Missile (SRSAM).

http://www.defenseworld.net/news/22489/Indian_Army_Likely_to_Order_another_Batch_of_Akash_Surface_to_Air_Missiles