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A SUGOSHA MEDIA PRESENTATION

DefInsights

COVER STORY

CBRN - SECURING MY CITY

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From the MD's Desk



Mrs. Shanti Kuber

Dear Friends and A&D Professionals,

After days of simmering tension, the world's worst fears came true when Russian President Vladimir Putin declared war on Ukraine in a televised address on 24 Feb 2022. He said the military action announced by him will seek to "demilitarize" Ukraine and came in response to threats from Ukraine. Moments after his announcement, large explosions were heard in different parts of Ukraine. Artillery attacks have also been reported at Ukraine's borders. A month on the war wages on, while there seems to be some glimmer of hope on resolving the matter through discussions.

India's biggest Defence exhibition DefExpo 2022 is currently on hold due to the current war situation and logistical issues being faced by FOEMs. India has been on a tricky position in terms of supporting Russia and Ukraine in the world forum. India did abstain from voting against Russia and the reasons for that are quite evident. Historically, Russia has been a strong defence support to India. Going forward as well, Russia is a critical country in terms of defence equipment to be supplied to Indian Armed Forces.

Several estimates have stressed on India's dependence on Russia for military hardware, which includes submarines, to fighter aircraft, to even a basic rifle. The Indian Army's imports from Russia can be divided broadly into the following categories — armoured and mechanised systems, artillery, and small arms. The Indian Navy's imports can be categorised into surface and submarines, besides fighters. When it comes to firepower, the Navy has the Kh-35 and P-20 anti-ship missiles, Klub anti-ship/land attack missiles and APR-3E torpedo from Russia. While the IAF has now diversified to French and Israeli systems, the majority of its equipment, including fighters and missiles, is of Russian origin. Topping the chart are the Sukhoi Su-30MKI fighters, which constitute about 14 of the 30 squadrons of the IAF. Then there are the MiG-29UPG and MiG-21 fighters from Russia that are in service with the force. The IAF also operates the IL-76 heavy transport aircraft besides the IL-78 tankers. India has also converted two IL-76 aircraft into Airborne Warning And Control Systems.

Industry

The US Air Force and Newspace Research & Technologies (India) are collaborating on Air Launched UAV. USAF Research lab Airforce Research Lab is working with NRT for Air launched drone, for which AFRL has established CRADA with NRT. CRADAs are valuable tools to partner with innovative small businesses both nationally and internationally.

The ground-breaking ceremony for a new facility of Helicopter Engines MRO Pvt Limited (HE-MRO), a Joint Venture of HAL and Safran was held at Sattari, 40 km from Panaji in Goa on Monday, March 14. During the ceremony, both partners signed a "Memorandum of Understanding" (MoU) to extend their cooperation and explore opportunities for new helicopter engines in civil and military markets, reflecting their commitment to the Indian Government's vision of "Atmanirbhar Bharat" towards achieving self-reliance in defence technologies and MRO. The facility will be operational by the end of 2023 with a capacity to repair 50 engines a year and a full-capacity goal of 150 engines in the coming years. India's Armed Forces are among the largest operators of Safran-designed helicopter engines with a fleet having

over 1,000 engines, including 250 TM333 and over 500 Shakti engines.

HSL Inks MoU with Eker Group (Norway) and Vaanmoto on 16 Mar 2022 to explore future business in the field of manufacturing high speed boats. These boats are high end boats with smart, flexible solutions with superior maneuverability which can be operated from shore upto max. speed of 75 knots. These high-end platforms can easily adopt the roles Search & Rescue, Surveillance, Anti- Submarine Warfare, Mine Countermeasures, Ambulance, fire, harbour control and close protection. Eker is a reputed Norwegian company which designs, constructs and sells ferries, leisure boats and professional boats, especially suitable for defence and law enforcement. Vaanmoto is an Indian private limited startup involved in the manufacture of parts and accessories for motor vehicles that includes engines, brakes, gearboxes, axles, wheels and suspension.

Contracts

Premier Explosives Limited has received orders worth Rs. 17.70 crore from Defence Research and Development Organisation (DRDO), which include Supply of Primary Explosives Plant on turnkey basis to HEMRL of DRDO for a total value of Rs4.50 crores and Fabrication and supply of R-III rocket motors (Propulsion system) to DRDL of DRDO for a total value of Rs13.20 crores.

The largest single VTOL Mini UAV defence contract globally has been awarded to ideaForge for its SWITCH UAV. As a part of this contract, ideaForge shall deliver 200 systems to augment the Indian Army's Surveillance capabilities. ideaForge won this contract against stiff competition from Israel, Russia, Ukraine, France, India & others. The SWITCH UAV was the only system that emerged successful from the rigorous testing and field trials that the Indian Army is well known for.

BRO and GRSE Ltd signed a MoU for fabrication, supply, erection and launching of 27 carriageway double lane galvanised modular bridges of 7.5 meters with Indian Road Congress (IRC) Load Class 70. The two-year contract, worth around Rs 60 crore, was inked by Director General BR Lt Gen Rajeev Chaudhry and Officiating CMD of GRSE Commodore P R Hari IN (Retd) in New Delhi on March 15, 2022.

The Cabinet Committee on Security (CCS) met under the Chairmanship of Prime Minister Shri Narendra Modi on 30 March 2022 in New Delhi. The CCS has approved procurement of 15 Light Combat Helicopter (LCH) Limited Series Production at the cost of Rs. 3,887 Cr along with Infrastructure sanctions worth Rs. 377 Cr. Light Combat Helicopter Limited Series Production (LSP) is an indigenously designed, developed and manufactured state of the art modern combat helicopter containing approx. 45% indigenous content by value which will progressively increase to more than 55% for SP Version.

The Ministry of Defence (MoD) of India and Bharat Electronics Limited, Hyderabad signed a Contract for Instrumented Electronic Warfare Range (IEWR) for the Indian Air Force, here today. The contract is a significant step towards enhancing the capabilities of IAF to prepare for future warfare. The overall cost of the contract is estimated to be ₹ 1109 Cr. The Ministry of Defence and Bharat Electronics Limited (BEL) concluded a Contract for supply of Advanced Electronic Warfare (EW) suite for Fighter aircraft of Indian Air Force. The contract was signed between MoD and M/s BEL, here today. The overall cost of the contract is estimated to be ₹ 1993 Cr.

Research

On Monday, March 7, an extended-range land-attack BrahMos supersonic cruise missile achieved precision hit, showcasing its pinpoint accuracy after it was fired without a warhead from the sea. The Defence officials informed that the missile was fired from the Andaman Sea recently at an uninhabited island in Andaman & Nicobar. Earlier on March 5, the Indian Navy successfully test-fired a long-range version of the BrahMos cruise missile. In November 2020, the Indian Army successfully test-fired the land-attack version of supersonic cruise missile BrahMos from Andaman and Nicobar Islands.

India's much-delayed project for indigenous artillery seems to be finally reaching its conclusion, with the towed

howitzer, Dhanush, clearing firing trials and the Advanced Towed Artillery Gun System (ATAGS) set to begin its last round of testing this month. The Army had, in 2018, placed an initial order for 114 of the 155mm x 45mm Dhanush, manufactured by Gun Carriage Factory (GCF) in Jabalpur — now known as Advanced Weapons and Equipment India (AWE) Limited.

L & T along with CVRDE are working together to develop the Light Tank prototype for which it has already started procuring armour steel and other systems and tools for the program. The tank will be fitted with a High Altitude Operable Powerpack (Engine+ Transmission) of 1000 hp and will be capable of firing multiple ammunition.

MoD

MoD accords in-principle approval to four projects under Make-I (Government Funded) & five under Make-II (industry-funded) categories of Defence Acquisition Procedure 2020. MoD has offered four projects to the Indian Industry for design & development under Make-I category of DAP 2020. The industry will be provided financial support for prototype development of these projects. The list of projects which were accorded AIP by Collegiate Committee of MoD is as follows:

- ⇒ Indian Air Force: Communication Equipment with Indian Security Protocols (Routers, Switches, Encryptors, VoIP Phones and their software)
- ⇒ Indian Air Force: Airborne Electro Optical pod with Ground Based System
- ⇒ Indian Air Force: Airborne Stand-off Jammer
- ⇒ Indian Army: Indian Light Tank

This is for the first time since the launch of industry-friendly DAP-2020 that Indian Industry has been involved in development of big ticket platforms such as Light tank and Communication Equipment with Indian security protocols. In addition, AIP has also been accorded to following five projects under industry-funded Make-II procedure:

- ⇒ Indian Air Force: Full Motion Simulator for Apache Helicopter
- ⇒ Indian Air Force: Full Motion Simulator for Chinook Helicopter
- ⇒ Indian Air Force: Wearable Robotic Equipment for Aircraft Maintenance
- ⇒ Indian Army: Integrated Surveillance and Targeting System for Mechanised Forces
- ⇒ Indian Army: Autonomous Combat Vehicle

The Ministry of Defence has also brought in some key changes to speed up private industry project plans. Some of these changes include reduction in contract signing deadline, simplification of contract signing committee, reducing number of trials, changes to user trials and PSQR documentation. MoD keeps its side of the promise, easy processes, minimum bureaucracy, faster contracts, planning 30 contracts before Dec 2022. Turn of the industry to respond?



SECURING MY CITY

CBRN Security for a Municipal Region

INTRODUCTION

Over the years, towns have grown larger into cities and metropolitan areas. They comprise residential areas, industries, corporate offices, large and small businesses and associated governance and administrative systems. The combination of these creates many toxic scenarios and polluted environments. Especially industries using a variety of chemicals, sewage treatment and waste disposal plants spew out toxicity in the urban environs. While much control and precautionary measures are invested in, we have seen major accidents in urban settings.

The horrors of Bhopal (1984) or Vizag (2020), the countless boiler accidents, firecracker industry fires and the tons of toxic wastes that abound in our cities are enough to raise public paranoia. A major CBRN accident or incident occurring in a city jurisdiction can wreak havoc and result in a multitude of casualties. Hundreds of helpless convulsing victims gasping for air surrounded by toxic gasses or vapours can seriously and rapidly overwhelm any response and healthcare mechanism. See the effects of COVID 19. The whole world got a terrible scare and even today many countries are battling the scourge of the pandemic. Wave after wave is having a devastating effect not just on the lives of people but on livelihood, business, and administrative capabilities.

Then there is the threat of a CBRN terrorist event. Deliberate sabotage of a research laboratory, or a toxic chemical plant or warehouse, causing a release in a crowded public place or high visibility event (an IPL match or festivals like Ganeshotsav or Diwali) brings to mind horrors seen in Douma, Syria or Halabja, Iraq. The ongoing Ukraine war has raised the spectre of nuclear weapons being used on cities and towns, aka Hiroshima and Nagasaki. There is even talk of Chemical, Biological and Radiological (CBR) threats and false flag attacks. It makes you ask the question, are Indian cities prepared for a mass toxic CBR incident? Or for that matter a Nuclear one?

While a nuclear war in the sub-continent may seem presently unlikely, the threat exists like a sword of Damocles. The chemical and biological threats are very real as seen from the various incidents increasing with uncanny rapidity. There is no doubt that we need to be prepared to prevent, and if required protect our cities from such Chemical, Biological, Radiological and Nuclear (CBRN) threats. It needs deliberate and comprehensive actions by many stakeholders to effectively secure our cities. I have endeavoured to discuss the various steps and measures that should be taken for just such an eventuality.

MEASURES TO SECURE THE CITY

Risk Analysis and Vulnerability Assessment (RAVA). The first step is to understand the types and magnitude of threats and risks. Each of the sub threats like chemical, biological or radiation need to be realistically analysed and assessed. Terrorist capabilities are ever-rising, and rapid and rampant industrialisation pose a myriad array of CBRN threats. These threats coupled with ill-planned urban infrastructural growth and overcrowding of cities lends to many risks and vulnerabilities.

⇒ **Risk Zoning.** Every city has an adjoining industrial area. Especially industries like pharma, plastics, paints, pesticides, and fertilizers. There would be many sewage plants and waste disposal areas. Some cities

		CONSIDER THE LIKELIHOOD OF A HAZARDOUS EVENT OCCURRING				
RISK ASSESSMENT MATRIX		Very unlikely to happen	Unlikely to happen	Possibly could happen	Likely to happen	Very likely to happen
CONSIDER THE SEVERITY OF INJURY/ILLNESS	Catastrophic (e.g fatal)	Moderate	Moderate	High	Critical	Critical
	Major (e.g Permanent Disability)	Low	Moderate	Moderate	High	Critical
	Moderate (e.g Hospitalisation/Short or Long Term Disability)	Low	Moderate	Moderate	Moderate	High
	Minor (e.g First Aid)	Very Low	Low	Moderate	Moderate	Moderate
	Superficial (e.g No Treatment Required)	Very Low	Very Low	Low	Low	Moderate

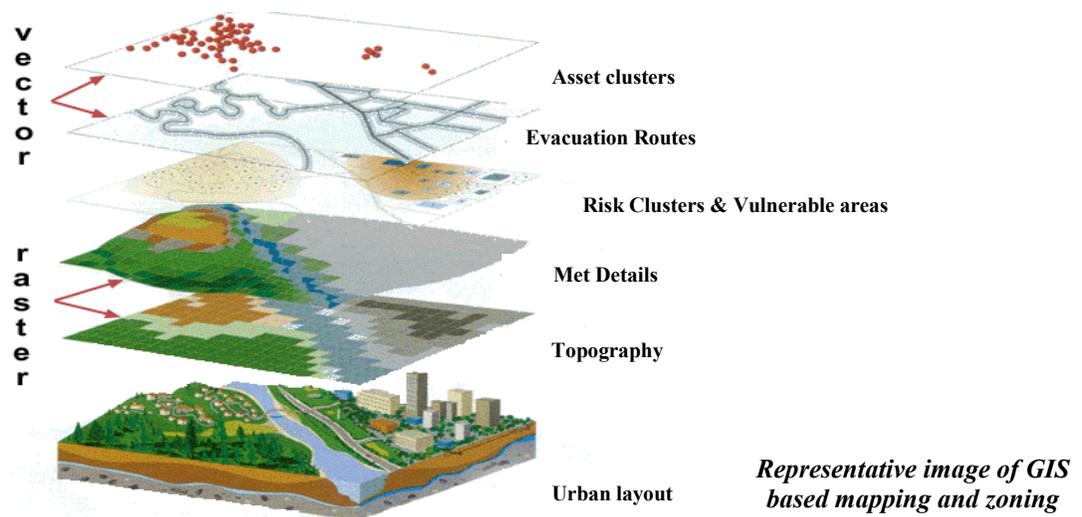
Risk matrix based on Impact and Likelihood: Credits SiteSafe, Australia

may have research labs handling toxic substances. There could even be a nuclear power plant in the vicinity. Ports and warehousing sectors (including container parks and large cargo transshipment facilities) may be storing tons of toxic chemicals or hazardous substances (remember Beirut, Lebanon or Tianjin, China). Risk Zoning is the technique of mapping risk areas, as given above, on a digitised map of the metropolitan region. GIS techniques (using vector and raster maps) are used to plot specific risk clusters on the map; they can be grouped based on localities, types, and levels of risks in clusters or zones. These zones should be numbered for easy reference. Additionally, risks should be graded based on type (chemical, biological, radiological, or explosive), impact (health, environment, business), severity, likelihood and kind of response. Such grading should take into consideration the Sendai Framework classification of manmade hazards.

- ⇒ **Vulnerability Zoning.** Critical infrastructures like water treatment plants, important Government buildings (like State assemblies, High Courts), Airports, Railway stations, Metro stations, important public places, tourist spots and markets all are vulnerable areas in a city. These need to be included as a layer in the vector mapping. Water bodies, their flow speed and direction should be mapped too. Toxicity in water bodies can lead to large areas of the city being vulnerable to contamination. Vulnerability will be dictated by the importance of the site, population density/footfall and impact of a hazard manifesting there. These should be mapped as a digital overlay/layer to the risk zoning map.
- ⇒ **Asset Assessment and Mapping.** To protect and respond to any CBRN threat, there is a need for careful creation and assessment of assets. These could be infrastructural or in terms of manpower. The Government already has the India Disaster Resource Network (IDRN), a web based platform, for managing the inventory of equipment, skilled human resources and critical supplies for emergency response. Primary focus of IDRN portal is to enable the decision makers to find answers on availability of equipment and human resources required to combat any emergency situation. This database will also enable them to assess the level of preparedness for specific disasters. However, the database needs to be updated for CBRN related assets. A realistic assessment of existing assets needs to be carried out. These should be also plotted as an overlay to the risk and vulnerability vector plots. Different stakeholder assets like police, fire brigades, civil defence and available paramilitary forces must be included. These should be clubbed in 'response' clusters on the plot. A study of the plots of risks and vulnerabilities

as compared to the asset cluster plot will throw up anomalies in asset deployments (if any), in terms of rapid response capability to the risk and vulnerable zones. Further, the type of assets and their imbalance in different asset clusters will also get highlighted.

- ⇒ **Meteorological Assessment.** The complete area under consideration should be analysed and mapped (raster mapping) for meteorological conditions. Wind speed and direction, ambient temperatures, ambient pressure, altitude, precipitation, and relative humidity assessments are important while analysing the likely spread of toxic contamination. Such parameters have effects on contamination spread and dispersion levels. Similarly, met conditions at varying times over a 24-hour cycle should also be mapped to analyse the temperature variations and inversion mechanics. This data can be sourced from the local met office, or the airport met department. Additionally, all critical infrastructure and high-risk facilities must have their own met sensors networked to the hazard mapping system.



Preventive Measures. After understanding and analysing risks and vulnerabilities, certain precautionary actions would go a long way in preventing and/or mitigating toxic risks from developing into disasters.

- ⇒ **Distancing of Risk Areas.** Town planners must keep in mind the risk areas (like factories, warehousing, waste management and sewage disposal) and locate these well away from residential areas and other vulnerable areas as discussed above. In addition, while deciding the location of such high-risk facilities, meteorological inputs must be considered so that any possible release or exposure of toxicity flows away from the town and not into it. It should also be ensured that a clear perimeter of at least half a kilometre around such high-risk areas is kept free of residential complexes, slums, and labour colonies. Where existing high-risk areas have got surrounded by residential localities, the industry and the Government should consider shifting these to a safer location or creating a buffer zone and adding enhanced safety measures to avoid any hazard.
- ⇒ **Strict Oversight and Audit.** All high-risk facilities are required to follow a strict safety protocol. Such oversight mechanisms are mandatory in all facilities. While the in-house Health, Safety and Environment (HSE) managers and their team would be responsible for ensuring the safety of workers, staff and equipment, the Government has instituted laws and regulations for occupational safety and mandated third

party safety and security audits. These if done diligently and as per the required schedule can minimise the risks and help maintain good safety standards. Global industrial/workplace safety best practices like regular third-party audits, oversight mechanisms and, Globally Harmonised Labelling System (GHS) need to be assiduously adopted.

- ⇒ Early Warning (EW). As part of the safety protocol at all high-risk facilities and at important vulnerable areas, suitable early-warning sensors need to be deployed. These sensors would detect toxic release or spread in real-time mode and trigger alarms. These alarms would be networked for necessary actions (simultaneously by multiple stakeholders) as explained in subsequent paragraphs. In addition to the alarms at high-risk facilities and critical infrastructures, the Municipal authorities need to institute a set of standard alarms or warnings over multiple media to pre-warn the citizen about an emerging threat.

Preparatory/precautionary actions. Post a detailed RAVA and instituting necessary preventive measures, there is a need to plan and prepare for a possible CBRN threat. The main aim of such actions is to limit casualties, prevent escalation of the threat and minimise its effects. Some key preparatory and precautionary activities are discussed below.

- ⇒ **Asset creation.** There is a need to create the right assets to be able to protect people and respond effectively to the emerging threat. The assets can be infrastructural, research and suitably equipped human resource.
- ◆ **Infrastructural Assets.** There is a need to create and improve certain key infrastructural assets. In most parts of western Europe, the metro train stations and tubes are well underground, enabling them to be used as temporary sheltering means in a CBRN attack. Similar sheltering measures need to be instituted in our cities. Other than such large underground shelters, strong overground facilities and buildings that can be used as temporary sheltering need to be studied and upgraded with sealing and clean air systems. In addition to these, residential societies and public facilities (malls, administrative and corporate infrastructures) which have secure underground parking can well be converted to provide such secure sheltering. All critical infrastructures need to create temporary stay-safe chambers or rooms with independent Heating, Ventilation and Air Conditioning (HVAC) systems (including CBRN filtration). Secure in-house power sources for any widespread power disruptions (could be due to power grid failures or EMP strikes by adversaries) need to be installed. Suitable evacuation routes and assets will need to be planned for shifting people to safer places once the situation permits. The Ukraine crisis has brought out many lessons in temporary sheltering of the citizens in heavy attack scenarios. For CBRN protection, sheltering facilities will need sensors, alarm systems, sealing mechanisms and CBRN filtration systems for clean and secure environments. Many Indian companies can provide such support. Notable are L&T Defence, Nucleonix Systems Pvt Ltd, Indesys Equipments Pvt Ltd, DH Ltd, Titagarh Wagons Ltd, Nikhtish Engineering Pvt Ltd, Suracsh Filters Pvt Ltd and a few others. The DRDO has been the support behind all these ventures especially in developing the technologies needed.
- ◆ **Research and Forensics.** State of the art research and forensic capabilities are a must for effective prevention and response to a CBRN incident. High containment and secure laboratories to analyse and develop antidotes, drugs and vaccines are needed. We have a few such high containment laboratories (including very renowned DRDO laboratories at Gwalior, Delhi, Jodhpur and Nagpur), but there is a need to increase footprint and enable all major cities (all A1 and A class or Tier 1 cities) with such analytical

facilities. Similarly, forensic laboratories to rapidly identify and analyse contamination in an interventional or response situation can be a huge asset in escalation prevention and minimising casualties. The current population of such forensic analysis assets are inadequate. For an effective response, there is a need to also create, at the Municipal level, mobile laboratory assets (field laboratories) for rapid deployment at the incident site. Such CBRN mobile laboratories, developed by the DRDO, have been used by the NDRF in the past.

- ◆ **Human Resource.** The key component in any preventive intervention or response to an emerging CBRN incident is the human resource. Response teams of suitably trained and equipped personnel are essential. Many stakeholders would be part of any intervention or response scenario. The Indian Armed Forces do maintain well trained and equipped CBRN Quick Reaction Teams for battlefield requirements, however they are not being considered here for civil response purposes. Apart from skilled CBRN responders of the NDRF (which shall always be at a premium due to low footprint, limited deployment and movement logistics), there is a need to maintain local teams at the municipal level. Firstly, all high-risk facilities must have on-site CBRN response teams. These could be part of the on-site security and staff manning such facilities. In addition, the security staff at all critical infrastructures and important public places, local police, fire brigades and Civil Defence personnel, all need to be adequately trained and equipped for immediate mitigation and escalation prevention. Basic awareness and mitigation training should also be imparted to private security staff in residential areas with local volunteers (preferably from within the Resident Welfare Associations [RWA], residential societies or resident committees) supplementing such assets. The importance of Civil Defence and local volunteers in saving lives has been demonstrated in the Ukraine crisis and in many instances in India too.
- ◆ **Training and Equipping.** Without optimal training and adequate equipment, no response can be successful. Especially in CBRN scenarios, standardised basic training needs to be instituted. Today, no single organisation provides such training needs. Further, other than guidelines issued by the NDMA, there are no standard textbooks or manuals for imparting training. It seeks the creation of a National CBRN Centre of Excellence to meet such needs. CBRN equipment is expensive, especially sensors and detectors. Hence correct operation, fitment and due maintenance must be inculcated in the personnel who are to use these.
- ◆ **Critical Equipment Production and Emergency Stocks.** COVID 19 hit us all in early 2020. Simple things like masks and sanitizers were considered gaities of rich people. As COVID 19 struck, suddenly there was a scramble for these items. Of course, there was a dearth of PPE, ventilators and even hospital beds. Critical medicines stocks were low and there was general panic. A similar situation was seen with Oxygen demand and supply during the second wave in 2021. Fly by night businesses began cashing in on locally made PPE, masks and sanitizers. Some entrepreneurs also resorted to flash imports. Quality was grossly ignored till the authorities published norms and standards. In a mass CBRN situation, there will be a short-term yet sudden need for such critical items in great numbers. The Government through the NDMA has planned and stocked Disaster Management stores in form of bricks at various locations for ease of rapid deployment and use. This system should be enhanced with CBRN related stocks in these bricks. Planned CBRN equipment stocks at select strategic locations

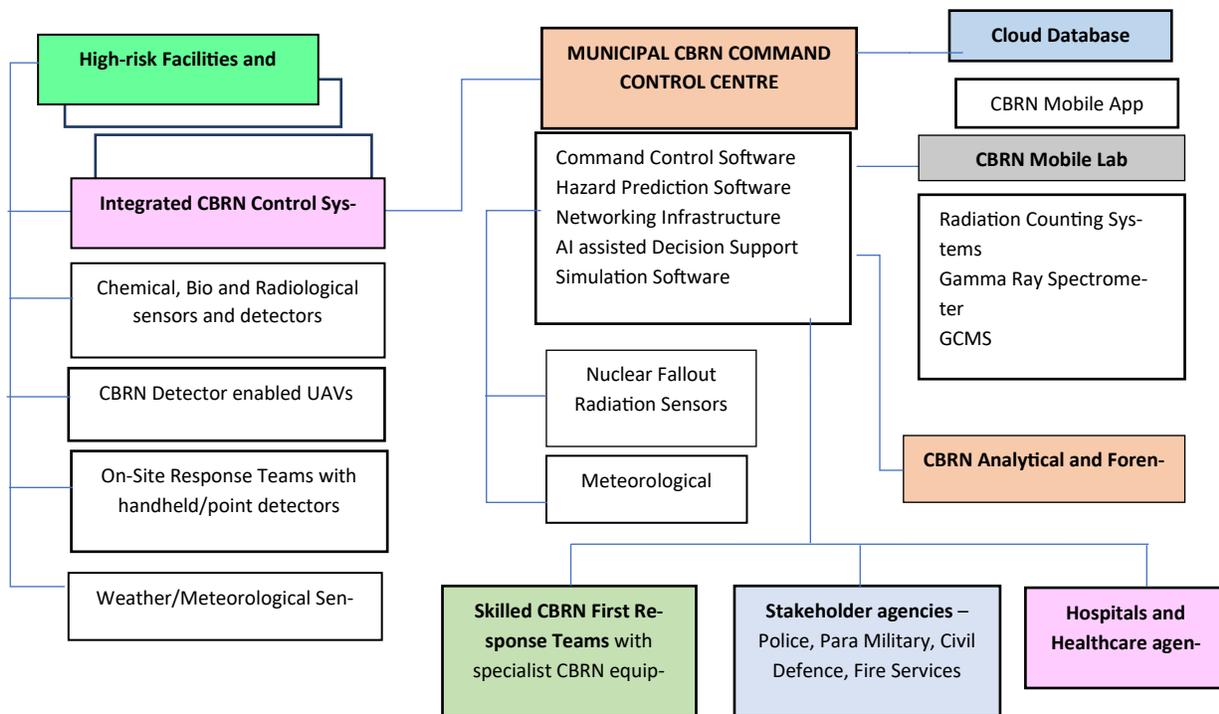
within easy access to various cities in each state and the capability to ramp up production in a crisis are needed. The Government should also aid research and development initiatives to constantly better the quality and effectiveness of critical equipment. Holding stocks is a costly affair. Due care should be taken to review stocks based on market availability and the residual life of these lifesaving items. Many Indian companies like Shiva Texyarn Ltd, Vijay Sabre Safety Pvt Ltd, Draeger India Pvt Ltd and Venus Safety and Health Pvt Ltd are already manufacturing state of the art CBRN grade PPE items.

- ◆ **Essential Drugs and Antidote Stocks.** As in the case of critical equipment, essential drugs and antidotes need to be stocked for critical CBRN situations. The need for such stocks shall be immediate and due consideration and planning must be undertaken for their rapid deployment in the affected areas. A periodic review with pharmaceutical companies must be undertaken to ensure optimal availability and production dynamics in case of emergent large-scale requirements. Public-private research partnerships to revise vaccine and antidote policies and aid in the development of newer and better vaccines (as seen in the cooperation between MOHFW, Bharat Biotech and Serum Institute) based on anticipated demand for emerging threats must be catered for.
- ◆ **Sensitizing Stakeholders and Populace on CBRN Threats and Their Mitigation.** The most important preparatory or precautionary action is to create and enhance awareness about CBRN threats and mitigation measures. Today, despite COVID 19 raging in the environment for two years, the level of awareness and understanding is very low. We need to get over the concept of “Jab Hoga, Dekha Jaayega”. We shall face grave consequences if we continue with our Ostrich like attitude of burying our heads in the sand. We need to organise awareness workshops for all possible stakeholders. Government agencies like home, police, hospitals and healthcare, municipal services (water, fire, emergency services, sewage, waste management, crematoria), paramilitary forces all need to be adequately sensitised and trained. Sensitizing citizen including students and workers is essential. Sensitisation using well-structured campaigns on social media, print/digital media and /or FM jingles can be considered. We also need to train School & College students in understanding the basics of CBRN risk mitigation. Due emphasis is needed for training and sensitizing the staff and workers of industries and logistics agencies (transportation, warehousing and bulk handling). Again, the need for a CBRN Centre of Excellence to standardise, coordinate and structure such workshops and training is felt.

Integrated Hazard Mapping and CBRN Control System. Keeping in mind the requirement of managing the multifarious CBRN detection and sensor deployments at high-risk facilities and critical infrastructures, there is a need to integrate these into a single command and control system. Already under the Smart City programs, some Indian cities have introduced an Integrated Command and Control Centre, aimed at bringing a range of municipal line departments on one management platform. We need to expand such initiatives to include an Integrated CBRN Control system. In fact, the Smart Cities program should cover all Tier 1 and Tier 2 cities.

- ⇒ **The System Architecture.** The Integrated CBRN Control system is a digitised platform wherein all CBRN sensors and detectors (early warning) are networked to a control station. Each high-risk facility and critical infrastructure should have such a control station. A scaled-up version should be integrated with the Integrated Municipal Command and Control Centre. The high-risk facility or critical infrastructure

control station receives real-time inputs of any releases, spills, or contamination spreads in their areas. The inputs (including meteorological) are plotted on digitised maps and a hazard prediction map is generated. Based on the areas affected or likely to be affected, automated warnings are relayed to the nearest response asset as per the mapping discussed above. Hazard mapping, situational reports and warnings are also relayed to the Integrated Municipal Command and Control Centre for alerting neighbouring localities and response assets. Associated stakeholders like the fire department, hospitals, police, forensics and others also get these warnings. Artificial Intelligence (AI) enabled Decision Support module of the Integrated CBRN Control Centre gives suggested protection and mitigation measures to response teams and assists in directing forensics for early analysis. It also gives predicted figures needing hospital care and helps in the immediate planning of equipment and antidote/drug requirements. Nucleonix Systems, Hyderabad has developed an Integrated CBRN Control System.



Representative System Diagram of the Integrated CBRN Command and Control architecture

⇒ **Sensor deployment.** There is a need to deploy a select range of CBRN detectors and sensors. These need to be identified based on location, type of threat envisaged, usage (fixed, roving or handheld) and optimal coverage. Stand-alone detectors can be deployed at key locations within and on the periphery of the facilities. A coverage modelling based on spread dynamics of likely threat releases can be developed for each location to optimally deploy such detectors. In addition, autonomous or partially controlled roving sensors and detectors can be planned for larger venues covering open grounds and clustered risk facilities. Such autonomous roving systems can be unmanned aerial vehicles (UAVs or drones) or unmanned ground vehicles (UGVs or robotic systems) with an onboard array of CBRN detection devices. Highly critical infrastructures may even have roof or mast mounted Stand-Off detectors capable of detecting approaching chemical threats from up to five kilometres. For pinpoint

identification of the release/hotspots, handheld systems can be used by the response teams. There are some Indian manufacturers like Indesys Systems, Nucleonix Systems, L&T Bangalore who are producing CBRN detectors and sensors. In addition, many start-ups are making drones and robotic vehicles for multiple applications.

- ⇒ **Alarm mechanism.** The Integrated CBRN Control System will have an alarm mechanism included. The alarms would be audio-visual indicators with coding to indicate the type of hazard. The alarms can be transmitted not just to the facility-based control centre but also the main centre at the Municipal control room.
- ⇒ **Alert and warning messages.** The Integrated CBRN Control Centre can generate automated user-specific alerts and warning messages. These would be updated as the situation unfolds and transmitted automatically to the concerned recipients.
 - ◆ Stakeholders. Various stakeholders who would need to be alerted would receive regular situational updates and alerts. These messages would be specific and contain hazard details, contamination spread predictions, actions at hand, mitigation measures and suggested further actions. Stakeholders can use these inputs to initiate precautionary and protective actions for as yet unaffected areas.
 - ◆ Public. Cautionary messages can also be generated by the Integrated CBRN Control System for the common public. These can be suitably integrated to be transmitted via social media, television and radio broadcasts. AI-generated Do's and Don'ts for mitigating the effects of the hazard can also be included for the specific type of hazard in these cautionary messages.



*Representative image of an Integrated CBRNe Command and Control Centre.
With permission of M/s Nucleonix Systems, Hyderabad.*

⇒ **Enhancing protection.** Certain aspects of mass protective measures have been discussed under asset creation above. In addition, some measures that could be undertaken to enhance protection levels are discussed below.

- ◆ **Escalation Prevention and Containment.** Rapid escalation prevention and containment of the toxic release is of utmost importance. All high-risk facilities and critical infrastructures management must cater for mechanisms and drills for the same. Necessary immediate assistance equipment and stores should be stocked at all high-risk facilities and critical infrastructures. Staff and workers must be trained for all possible contingencies and prepare for the same.
- ◆ **Collective Protection.** Every high-risk facility and critical infrastructure must cater for onsite protection for the staff and workers. Key installations may plan underground bunkers/holding rooms for the security of VIP and critical assets. For general public, underground assets like parking spaces, metro stations and tunnels or basement areas in Malls, hospitals and any other public infrastructure can be suitably modified for use. Due attention to the sheltering capacity, duration of stay and connected logistics must be given. Protected evacuation means need to be planned for various contingencies. First-aid measures should be catered for. Members of the staff who have a proclivity for nursing or first aid should be suitably trained. Similar selection and training are needed at residential societies. Volunteer members from resident committees can be trained. Where localities exist with no resident committees, local Ward offices must be tasked to do the needful. Signposting of essential helplines and nearest shelter details. During COVID 19, the Government had earmarked and converted some railway coaches as Covid hospitals. Similar plans should be developed at Municipal levels to convert a few metro coaches or air-conditioned busses suitable augmented with CBRN sealing and filtration means.
- ◆ **Individual Protection.** As mentioned earlier, all stakeholder teams who may form part of response or intervention in CBRN incidents need to be suitably kitted out for optimal protection. CBRN suits, masks and Self-Contained Breathing Apparatus (SCBA) sets need to be provided. There is a need to also stock a minimum number of kits (PPE and respirators) at all high-risk facilities and critical infrastructures, based on anticipated usage. The administration should widely distribute (if required, through residential societies and ward offices) a booklet/handbook on CBRN Emergencies, which should include dos and don'ts for the common public. Simple protective and mitigative actions must be included in such booklets/handbooks. For wider distribution, ward offices, schools and colleges and public places like malls and cinema halls can be used. Basic contents can be displayed at public places, malls and residential societies.
- ◆ **Decontamination.** It is very essential to decontaminate even suspected items, body parts and equipment to avoid secondary contamination and save lives. In any CBRN incident which entails mass contamination, the Administration would set up centres for decontamination. Large vehicle wash centres can be quickly converted to effective decontamination stations.

- ◆ **Mass Decontamination.** A CBRN incident would affect a large number of people. In such instances, mass decontamination of the affected or even suspected of contamination would be required. There are procedures and drills to set up such mass decontamination centres at selected locations. These would need a huge supply of water and an open area which can accommodate the number of people to be decontaminated. Normally a shower washdown with clean water and a decontamination solution is the norm. It needs to be understood that all belongings on the person like watches, phones, jewellery, documents and clothing may need to be discarded and either incinerated or separately decontaminated. Therefore, a fresh set of clothing may need to be provided to those undergoing decontamination. Decontamination logistics are intensive and need to be planned with care. It is also recommended that all high-risk facilities and critical infrastructures maintain an on-site decontamination centre suitably located after threat appreciation. Necessary logistics for such a decontamination centre should be the responsibility of the high-risk facility and critical infrastructure. Open areas, public parks and vacant plots can be earmarked for decontamination areas.
- ◆ **Individual Decontamination Kits.** As with the protective kits, a similar number of personal decontamination kits should be catered for at all high-risk facilities and critical infrastructures. These are small easy to use decontamination pads with powder substances. Such personal decontamination kits are also needed by all stakeholder response and intervention teams. Sanitiser sprays and gels can also be included for decontamination of personnel and equipment.

⇒ **Medical Management.** CBRN incidents can lead to hundreds of casualties. Many victims may need critical care and careful yet immediate management. Key issues required to be addressed would include:

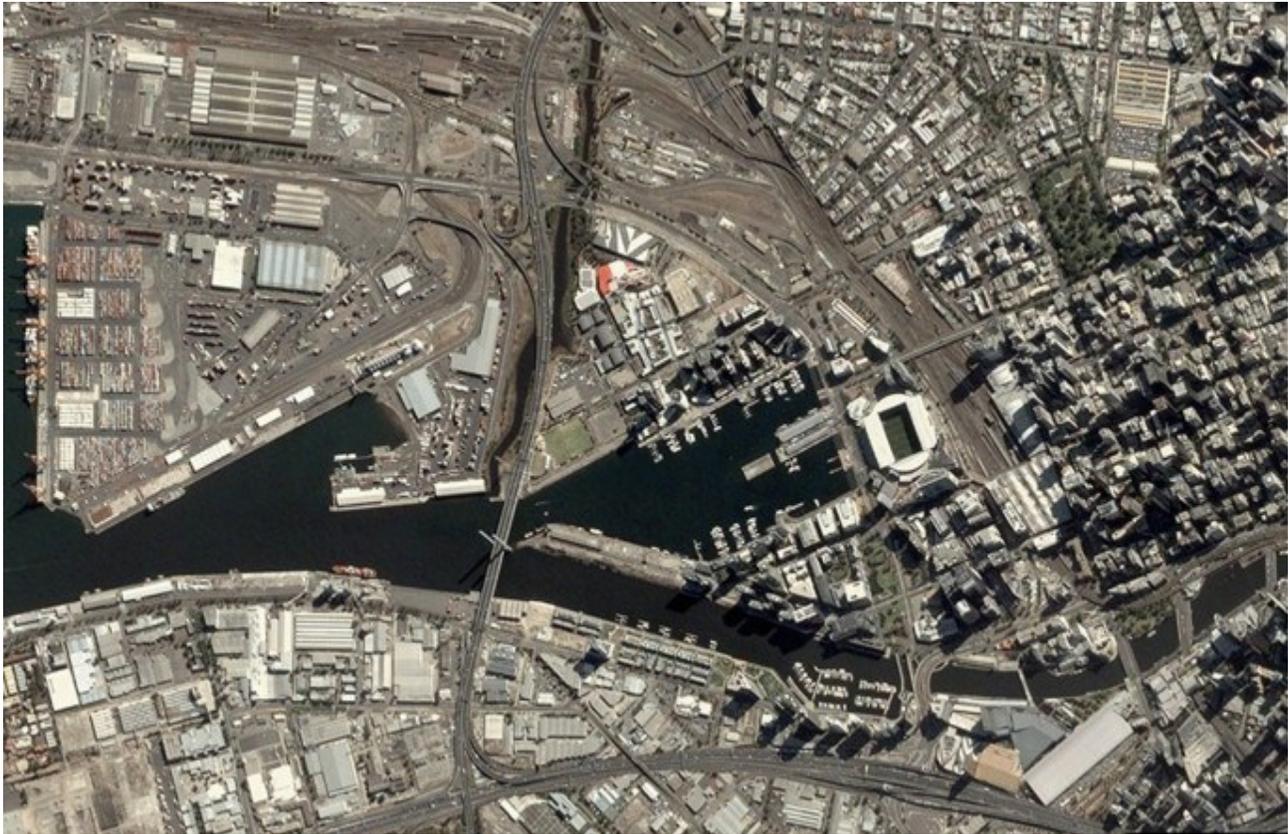
- ◆ **Triage.** This is the procedure to identify the victims requiring prioritised care. Doctors and paramedics are trained to conduct triage in mass casualty situations in the field. All hospitals and clinics need to prepare for such incidents and cater for adequate Triage equipment. Suitable training if required may be imparted under the Continuing Medical Education (CME) programs.
- ◆ **Evacuations.** Detailed planning is required for the evacuation of victims from the incident sites. An adequate pool of available ambulances needs to be maintained as a database with the Municipal Corporation. A dedicated communication plan to requisition ambulances with paramedic staff must be worked out. A well thought out private-public coordination for such ambulance and staff provisioning must be instituted. Such drills must be practised. Municipal planners must also work out routes of evacuation (including alternate ones) from all high-risk facilities and critical infrastructures.
- ◆ **Hospital Preparedness.** Careful planning and preparation are needed to enable hospitals and clinics to manage CBRN casualties. As most medical colleges do not include the management of CBRN casualties as a subject, such training should be included in the CME for all. Hospitals would be called upon to deploy field medical aid centres near the incident site(s). Tents, field operation and treatment facilities, equipment like resuscitators and CBRN casualty pods are required to be

catered for. Doctors and paramedics must practice rapid deployment of such field facilities and hospitals must train the support staff for the same. Every city has a medical helpline. For example, 101. Such facilities should have the capacity to switch to a CBRN mode on the requirement. Necessary additional supplies and modification kits should be provisioned.

- ◆ Mass Crematoria. As the fatal casualties would be toxic and contaminated, there may be a need for the contained disposal of these cases. As such, special crematoria may be earmarked for such procedures. In some countries, mobile container-based crematoria are provisioned for onsite disposal.
- ⇒ Control Agency and Incident Command. CBRN situations need multi-agency response and interventions. You cannot have all stakeholders operating in their own way without coordination. There is also the need for centralised command for effective operations. It is necessary to have a central control agency under the Municipal administration. This agency should coordinate all preventive and preparatory actions including planning and follow-on tasks. Further, for onsite operational effectiveness, an Incident Command Centre is needed to be set up. NDMA has laid down detailed guidelines on establishing such Incident Command Centres.
- ⇒ Guidelines and SOPs. For the smooth and seamless functioning of all the stakeholders in a CBRN situation, there is a need for setting guidelines and Standard Operating Procedures (SOPs). The Municipal agency made responsible for CBRN incident management should be tasked with developing and disseminating such guidelines and SOPs amongst all stakeholder agencies.
- ⇒ TTE and Mock drills. For effective operationalisation of intervention and response plans, there is a need for practice. Especially as there are many stakeholder agencies involved. Based on the guidelines and SOPs, regular Tabletop Exercises (TTE) must be conducted based on different CBRN contingencies which are possible. The author is a CBRN resource person and has experience in conducting such TTE. Once the plans are discussed and played through in TTEs, finalised contingency plans need to be developed. Such plans need validation on the ground. For this, mock drills are a must. It should be ensured that all relevant stakeholders participate in such mock drills. Due diligence and realism, within safety and security limits, should be built in to suitably train the personnel.
- ⇒ Review mechanism. No plans and situations are permanent. Threats are constantly evolving. So is the technology and newer equipment. It is, therefore, necessary to review the plans and training procedures periodically. Guidelines and SOPs may need revision. Such reviews are essential to maintain optimal capabilities to prevent and if required effectively respond to a CBRN incident.

CONCLUSION

Smart cities need to be smart secure too. Industrialisation and uncontrolled urban development have created an ever-growing range of CBRN threats. Municipal authorities, the various stakeholder agencies and the public at large need to be sensitised and prepared to prevent such threats. At the same time, due precautionary measures and mitigating procedures need to be comprehensively instituted to save lives and prevent escalation of CBRN incidents. It calls for a structured program cooperative initiative duly



by experts in the field. Relevant books by CBRN resource persons like **“Toxic Portents – CBRN Incident Management in India”**, By Col Ram Athavale, PhD, ISBN 10: 9388161823 / ISBN 13: 9789388161824, Published by Vij Books India Pvt Ltd, 2/19, 2nd Floor, Ansari Rd, Daryaganj, New Delhi 110002 and, **“Biological Disasters: The City Beautiful (Un)Prepared”**, By Col Gaurav Bhatia, PhD, ISBN: 978-93-87839-71-7; Published by Satyam Law International, New Delhi-110002, India are a good source of additional information on the subject. This paper is an appeal to Municipal, District and State authorities to take note and enable our cities. Let us make our cities CBRN secure.

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Col Athavale has been a Key Adviser to the Government of India (MoD and MHA) on CBRN Security. He has been a Key CBRN Expert for the EU CBRN Risk Mitigation Centres of Excellence initiative in Eastern and Central Africa. A Visiting Faculty at select Indian and overseas universities, prolific writer and a speaker in international seminars and conferences on CBRN subjects, he holds a PhD in CBRN Security and Incident Management. He has authored a pioneering book titled “Toxic Portents” on ‘CBRN Incident Management in India’. Presently he is a freelance CBRN Security and Risk Mitigation Consultant based at Pune, India. His personal website <https://chebiran.com> has more details.

INDUSTRY BUZZ

Ministry of Defence identifies 18 major platforms for industry led Design and Development

In a significant boost to Prime Minister Shri Narendra Modi's vision on 'Aatmanirbhar Bharat Abhiyan', and in sync with the announcement in the Union Budget 2022-23 that allocated 25% of Defence R & D Budget for industry led R & D, 18 major platforms have been identified by the Ministry of Defence for industry led Design & Development under various routes. The list is as follows:

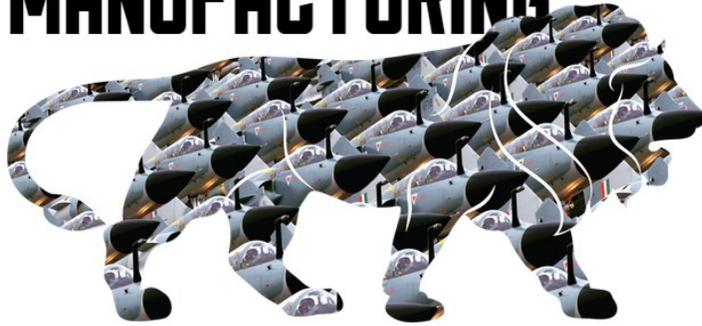
Make-I

1. Hypersonic Glide Vehicle
2. Directed Energy Weapons (300 KW and more) [High Powered Electromagnetic Devices and High Powered Laser Devices]
3. Naval Ship Borne Unmanned Aerial System (NSUAS)
4. Light Weight Tank
5. Self-Healing Mine Fields
6. Unmanned Autonomous AI Based Land Robot
7. 127 mm Naval Gun
8. 127 mm Guided Projectile
9. Electric Propulsion (Engines) for Ships
10. Standoff Airborne Jammer
11. Li-ion Cells/ Li-Sulphur Cells [Portable High Capacity Energy Systems replacing the Conventional Hydrocarbons]
12. Communication System (AFNET System Switches, routers, Encryptors& VOIP phones)
13. Electro Optical (EO) Pod (with subsequent upgrade to EO/IR) with high resolution sensing
14. 'Plug and Play' Housing/ Infrastructure for soldiers posted at extreme altitudes.

Under the Defence Acquisition Procedure 2020, 'Make' Category aims to achieve self-reliance by involving greater participation of Indian industry. Projects involving design and development of equipment, systems, major platforms or upgrades thereof by the industry can be taken up under this category. For Projects under Make-I sub-category, Ministry of Defence will provide financial support up to 70% of total cost of prototype development.

INDUSTRY BUZZ

DEFENCE MANUFACTURING



Special Purpose Vehicle (SPV) Model

Under SPV model, private industry will be encouraged to take up design and development of military platforms and equipment in collaboration with the Defence Research and Development Organisation (DRDO) and other organizations. Following two platforms have been identified under this category.

15. Long Range Unmanned Aerial Vehicles (UAVs) [High Altitude Long Endurance (HALE)]

16. Indian Multi Role Helicopter (IMRH)

iDEX

Projects of Start-ups, MSMEs etc. involving high-end innovation would be pursued under the iDEX category and the following platform has been selected under this category.

17. Low Orbit Pseudo Satellites

Make-II

Under Make-II, which is funded by industry with assured procurement, following platform has been listed.

18. Anti-jamming Systems for Multiple Platforms

Out of 18 major platforms mentioned above, following four platforms have been already accorded Approval-In-Principle (AIP) under Make-I category on 03 March 2022:

1. Communication System (AFNET System Switches, routers, Encryptors& VOIP phones)
2. EO Pod (with subsequent upgrade to EO/IR) with high resolution sensing
3. Standoff Airborne Jammer
4. Light Weight Tanks

The indigenous development of these projects will help harness the design capabilities of domestic defence industry and position India as a design leader in these technologies.

Defence Acquisition Procedure 2020 Primer

Part 08 – ACQUISITION PROCEDURES FOR ‘BUY’ AND ‘BUY AND MAKE’ SCHEMES - Chapter II



By Sohil Patel

We continue the acquisition process from Part 7 at the SQR stage.

SQR Formulation

The SQRs would be drafted by the concerned User directorate at SHQ. In addition to obtaining the required inputs from RFI analysis, SHQ will seek information from Defence Attaches, internet, defence journals/magazines/exhibitions, previously contracted cases in such category and any other relevant and credible information source. A ‘Comparative Analysis of Specifications’ of similar products available in the World and domestic market will be carried out and draft SQRs will be prepared.

Format of SQRs

The SQRs, as far as possible, would follow a standardized format as under :-

- (a) Introduction & Operational Philosophy/Proposed Employment of equipment/system/platform.
- (b) Essential Parameters-A.
 - (i) Operational Parameters. Unambiguous, non-negotiable, essential functional requirements laid down by the Services, which clearly define basic profile of an equipment/system, specifying minimum acceptable performance requirements thereby defining ‘Core Capabilities’ of the equipment/system would be termed as Operational Parameters.
 - (ii) Technical Parameters. Based on the Operational Parameters, scientific and technical characteristics required in the system to achieve these operational capabilities would be drawn out after due analysis of contemporary and developing technology in the field.
 - (iii) Maintainability & Ergonomic Parameters. These parameters will primarily relate to aspects like maintenance, crew comfort, storage of equipment, packing material etc.
- (c) Essential Parameters-B.
- (d) Enhanced Performance Parameters

Formulation of Joint Service Quality Requirements (JSQRs).

In cases where other Services also intend to procure similar equipment in the next three years, the lead Service will process the JSQRs through the Integrated Staff Equipment Policy Committee (ISEPC). Conversion of SQR to JSQRs will not be mandatory in cases where the other Service) accept the SQRs. Also, in cases where quantities required by other Service(s) is 20% or less as compared to the lead service, joint

procurement case would be progressed on the lead Service SQRs itself. In cases, where a Service opts to join an ongoing procurement case of other service at the time of seeking AoN, with no change in the SQRs, the case would be progressed on the lead service SQRs, and the same SQRs would be subsequently converted into JSQRs, for future procurements.

Approval of SQRs/JSQRs

SQRs (except Shipbuilding cases) will be fielded for approval of the respective Staff Equipment Policy Committees (SEPC) within six months of the receipt of RFI responses. SHQ should satisfy that the stipulations mentioned in the DAP have been followed while recommending the SQRs for the approval of the respective Staff Equipment Committees. SEPCs will be authorised to consult Subject Matter Experts as deemed necessary while finalising SQRs. In cases of JSQRs, the same would be approved by the ISEPC. A copy of the approved SQR/JSQR along with the 'Comparative Analysis of Specifications' of similar products available in the World and domestic market as per Paragraph 15 above would be submitted along with the 'Statement of Case' (SoC) for seeking AoN.

Amendment to SQR Parameters

There may be situations wherein SQRs need to be amended post accord of AoN, till issue of RFP. In case the requirement is to amend Operational and Technical parameters of SQR, the approval for same would be accorded by AoN according authority. However, for amendment of Maintainability and Ergonomic parameters of SQR, the approval may be accorded by Staff Equipment Policy Committee (SEPC)/ Integrated Staff Equipment Policy Committee (ISEPC). No amendment to SQRs will be carried out after issue of RFP without approval of DAC.

Quality standards such as JSS/other relevant standards will be mentioned in the SQRs. Based on the operating conditions stipulated in the SQRs by the User, selection and sequence of tests for checking compliance to the standards shall be formulated by QA agencies. SQRs should contain specific and verifiable parameters for the capabilities sought. Generic terms such as 'all weather capability', 'state-of-the-art', etc., are not to be included.

Acceptance of Necessity (AoN)

AoN based on SQRs/JSQRs will be obtained by SHQ within one year of their approval by the respective SEPC /ISEPC. Extension for obtaining AoN till upto six months after the stipulated one year may be granted by respective CISC/VCOAS/VCNS/DCAS/DGICG and a further extension of six months by DG (Acquisition). In order to seek AoN, the SHQ will carry out detailed internal consultations and prepare a draft Statement of Case (SoC) as per format at Appendix B, assisted by guidelines at Appendix C. The draft SoC would be approved by the Head of the respective User/Plans Directorate/equivalent of the Services.

Processing of AoN : Non Delegated Power Cases

Copies of the draft SoC would be forwarded to DDP, DRDO, Acquisition Wing (with additional copies for the concerned JS & AMs, ADG Acquisition Technical and FM) and HQ IDS. Quantity vetting would be carried out by FMs as per SOP promulgated by MoD (Finance). The finalised SoC, duly considering all comments received, will be fielded in the Defence Procurement Board (DPB) by the concerned SHQ. AoN for all cases more than INR 300 crores and upto INR 500 crores will be accorded by the DPB. In cases beyond INR 500 crores, DPB will recommend categorisation, based on the proposal of the SHQ and refer these to the Defence Acquisition Council (DAC) for accord of AoN.

Business Opportunities : Mar 2022

SL NO	TENDER TITLE	SUBMISSION CLOSING DATE	ORGANISATION/ AGENCY	TENDER ID	ENQUIRY TYPE
1	PROCUREMENT OF 03 LINES OF THD 1955 RADAR SPARES	21-04-2022 11:00	IAF	2022_IAF_515738_1	Single
2	Design and Development of Front end Electronics System of Front Looking Sonar	26-04-2022 10:30	DDRD	2022_DRDO_515667_1	Single
3	VALVE PNEUMATIC 3/2 HAND LEVER OPERATED DETENT PRESSURE RANG -E 0 TO 6 BAR	18-04-2022 14:00	DoDP	2022_DoDP_653656_1	Open
4	REPLACEMENT OF EXISTING MTU DA WITH CUMMINS 1 MW DA IN SHIP	07-04-2022 10:00	NAVY	2022_NAVY_515716_1	Single
5	EKM SUBMARINE SPARES	09-04-2022 12:00	NAVY	2022_NAVY_515695_1	Single
6	EKM SUBMARINE SPARES	09-04-2022 12:00	NAVY	2022_NAVY_515695_1	Single
7	FABRICATION ASSEMBLY AND TESTING OF FLOW CONTROL ELECTRO MECHANICAL ACTUATOR WITHOUT QT	12-04-2022 10:00	DDRD	2022_DRDO_515703_1	Open
8	CNC ROUTER and AERIAL VEHICLE MOUNTING COMPONENTS	11-04-2022 10:00	DDRD	2022_DRDO_515625_1	Limited
9	SPARES OF TURBO ALTERNATOR 750KW FD BLOWER ALLEN TYPE AND MAIN CIRCULATING PUMP	22-04-2022 12:00	NAVY	2022_NAVY_515594_1	Single
10	TURBO ALTERNATOR 750KW FD BLOWER ALLEN TYPE AND MAIN CIRCULATING PUMP	22-04-2022 11:00	NAVY	2022_NAVY_515591_1	Single
11	TEST JIG FOR WCS SIMULATOR	05-04-2022 10:00	DDRD	2022_DRDO_515552_1	Single
12	Supply of Micro Electric Detona-	20-04-2022	DDRD	2022_DRDO_515545_1	Single
13	Online Invitation of Bids for Aircraft Weighing System (150 Ton)	26-04-2022 10:00	DDRD	2022_DRDO_515561_1	Open
14	REPAIR OF AVIATION HEADSET	06-04-2022 10:00	IAF	2022_IAF_515506_1	Open
15	INDIGENOUS DEVELOPMENT OF PULLER MECHANICAL OUTER SPOOL OF M-53 AERO ENGINE.	18-04-2022 11:00	IAF	2022_IAF_515480_1	Open

Business Opportunities : Mar 2022

SL NO	TENDER TITLE	SUBMISSION CLOSING DATE	ORGANISATION/ AGENCY	TENDER ID	ENQUIRY TYPE
16	INDIGENOUS DEVELOPMENT OF SCREW ASSORTMENT OF M-53 AERO ENGINE	18-04-2022 11:00	IAF	2022_IAF_515508_1	Open
17	INDIGENOUS DEVELOPMENT OF SPRING OF M-53 AERO ENGINE.	18-04-2022 11:00	IAF	2022_IAF_515486_1	Open
18	Annual Maintenance Contract of Fifty One CCTV Cameras at INS Kalinga for One Year	18-04-2022 15:00	NAVY	2022_NAVY_515410_1	Limited
19	INDIGENOUS DEVELOPMENT OF KEY SOCKET HEAD SCREW (ECCENTRIC BUSH WRENCH) OF MIRAGE-2000 AIRCRAFT.	16-04-2022 11:00	IAF	2022_IAF_515240_1	Open
20	Annual Maintenance Contract of Fifty One CCTV Cameras at INS Kalinga for One Year	18-04-2022 15:00	NAVY	2022_NAVY_515336_1	Limited
21	REPAIR OF WEAPON SYSTEM TEST KIT PT NO. GES-05420-803	14-04-2022 11:00	NAVY	2022_NAVY_515224_1	Limited
22	Procurement of VUC-201 spares	18-04-2022 10:30	IAF	2022_IAF_515198_1	Open
23	Repair of DG Set 90 KVA	06-04-2022 10:00	IAF	2022_IAF_515193_1	Open
24	DESIGN AND DEVELOPMENT OF LRU ,SPARES AND MATERIALS USED IN SU30MKI AIRCRAFT AGAINST MAKE -II	28-04-2022 13:00	DPSU	EOI-HAL-NK/AURDC/DI/4501/71A/2022/94	EOI
25	Inquiry Seeking Expression of Interest towards hiring of Project Management Consultancy for Naval Dockyards	08-04-2022 17:00	NAVY	2022_NAVY_514537_1	Open
26	INVITATION OF BIDS FOR REPAIR/RECLAMATION OF AERO ENGINE PARTS (26 LINES) OF TV3 117MT AERO ENGINE	18-04-2022 14:00	IAF	2022_IAF_652956_1	Open
27	PROC OF CUMMINS DG SET SPARES	02-04-2022 11:00	IAF	2022_IAF_515172_1	Single
28	PROC OF KOEL DG SET SPARES	02-04-2022 11:00	IAF	2022_IAF_515173_1	Single
29	PROCUREMENT OF SPARES OF T-90,T-72,BMP-II/IIK/AAT/CMT	13-04-2022 09:55	ARMY	2022_ARMY_515060_1	Open
30	PROCUREMENT OF SPARES FOR MIRAGE AIRCRAFT	04-05-2022 11:00	IAF	2022_IAF_680289_1	Single

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