TECHNOLOGY FOCUS
टैक्नोलॉजी फोकस
An In-house S&T Bulletin of DRDO
https://www.drdo.gov.in/technology-focus
Vol 32 | Issue 4 | July-August 2024 | ISSN No. 0971 - 4413

PRODUCTS AND TECHNOLOGIES FOR LOW INTENSITY CONFLICTS

Technology Focus focuses on the technological achievements in the organization covering the products, processes and technologies.

July-August 2024
Vol. 32 | Issue 4 | ISSN No. 0971-4413

Editor-in-Chief: Dr K Nageswara Rao
Assoc. Editor-in-Chief: Sudhanshu Bhushan
Editor: Dipti Arora
Design & Prepress: Raj Kumar, Raman
Printing: Rajesh Kr Singh

UGRAM

Readers may send their suggestions to

The Editor, Technology Focus
DESIDOC, Metcalfe House
Delhi-110 054
Telephone: 011-23902403, 23902472
Fax: 011-23819151; 011-23813465
E-mail: director.desidoc@gov.in;
techfocus.desidoc@gov.in
https://www.drdo.gov.in/technology-focus

Laboratory Correspondents

Agra	:	Shri SM Jain, ADRDE
Ahmednagar	:	Col Atul Apte, Shri RA Shaikh, VRDE
Ambernath	:	Dr Ganesh S. Dhole, NMRL
Bengaluru	:	Shri Satpal Singh Tomar, ADE
	:	Smt MR Bhuvaneswari, CABS
	:	Smt Faheema AGJ, CAIR
	:	Shri R Kamalakannan, CEMILAC
	:	Dr Sanchita Sil & Dr Sudhir S Kamble, DEBEL
	:	Dr V Senthil, GTRE
	:	Dr Sushant Chhatre, MTRDC
Chandigarh	:	Dr Pal Dinesh Kumar, TBRL
	:	Dr Anuja Kumari, DGRE
Chennai	:	Shri K Anbazhagan, CVRDE
Dehradun	:	Shri Abhai Mishra, DEAL
	:	Dr SK Mishra, IRDE
Delhi	:	Shri Sumit Kumar, CFEES
	:	Dr Dipti Prasad, DIPAS
	:	Shri Santosh Kumar Choudhury, DIPR
	:	Shri Navin Soni, INMAS
	:	Dr Rupesh Kumar Chaubey, SSPL
Gwalior	:	Dr AK Goel, DRDE
Haldwani	:	Dr Atul Grover & Dr Ranjit Singh, DIBER
Hyderabad	:	Shri ARC Murthy, DLRL
	:	Dr Manoj Kumar Jain, DMRL
Jodhpur	:	Shri DK Tripathi & Dr Yojana Janu, DL
Kanpur	:	Dr Mohit Katiyar, DMSRDE
Kochi	:	Smt Letha MM, NPOL
Leh	:	Dr Tsering Stobden, DIHAR
Mysuru	:	Dr M Palmurugan, DFRL
Pune	:	Dr Ganesh Shankar Dombe, HEMRL
	:	Shri AK Pandey, ARDE
	:	Dr Anoop Anand, R&DE(E)
Tezpur	:	Dr Sibnarayan Datta, DRL

अनीश दयाल सिंह, भा.पु.से.
Anish Dayal Singh , IPS

महानिदेशक
केन्द्रीय रिजर्व पुलिस बल
Director General
Central Reserve Police Force
Block-01, C.G.O. Complex, Lodhi Road
New Delhi-110003
Tel: 011-24360971, Fax: 011-24363192
Email : dg@crpf.gov.in

It gives me immense pleasure and happiness to know that DRDO is bringing out its inhouse magazine ***Technology Focus*** dedicated to highlighting the various products and technologies developed to aid in the conduct of ***Low Intensity Conflict Operations*** and maintenance of Internal Security. This issue is the first of a two part series and showcases the brilliant strides made by **DRDO** in aiding the infusion of indigenous technology and modernisation of the CAPFs.

The **CRPF** raised in 1939 has completed 85 glorious years in service of the Nation and has evolved into a niche organisation with nearly 250 Battalions deployed across the country, executing its mission by maintaining the Rule of Law, Public Order, Internal Security and safeguarding the Nation's Integrity while promoting Social Harmony and Development thereby upholding the supremacy of the Constitution.

The CRPF and DRDO are closely collaborating with each other under the ambit of the framework of DRDO-MHA Collaboration since 2012 and some critical products and technologies developed by DRDO have either been inducted or actively under process of induction into CRPF. The "***COPSYSS***" system developed by DIPR is successfully being used for the psychological profiling and screening of personnel deployed in VIP security duties. The ***Wheeled Armoured Platform*** **(WhAP)**developed by VRDE has been instrumental in saving lives of our troops in active LWE environment. Procurement of ARDE developed ***UBGL grenades with self destruction mechanism*** is at an advanced stage. DRDO products already in our inventory include ***Anti Terrorist Vehicle, Chilli Grenades, Mobike Ambulance- Rakshita, Multi Mode Hand Grenade, INSAS Rifle & Corner Shot Weapon System***. Other products/technologies under active consideration are ***Ground Penetration Radars for IED detection, Riot Protection Suit, Laser Dazzler, UGRAM Assault Rifle, Ergonomically designed Water Bottle etc***.

I take this opportunity to commend the excellent team at **DLIC,** working under the guidance of **DG (PC&SI), HQ DRDO** for their focus, dedication and unwavering commitment in realising the technology infusion thereby mitigating our myriad challenges in varied domains.

I wish DRDO the ***Best of Luck and Godspeed*** in their noble endeavour. I am sanguine that this collaboration will only touch greater heights in the days and years ahead.

JAI HIND

(Signature) 2/7/24

डा. चन्द्रिका कौशिक
उत्कृष्ट वैज्ञानिक
एवं
महानिदेशक (पी सी एवं एस आई)
Dr. Chandrika Kaushik
OUTSTANDING SCIENTIST
&
DIRECTOR GENERAL (PC & SI)

सत्यमेव जयते

स्वच्छ भारत
एक कदम स्वच्छता की ओर

रक्षा मंत्रालय
MINISTRY OF DEFENCE
रक्षा अनुसंधान तथा विकास संगठन
DEFENCE RESEARCH & DEVELOPMENT ORGANISATION

Low Intensity Conflict (LIC) relates to conflict between regular army or law enforcement agencies and non-regular armed military which could include terrorist groups, guerrilla fighters, rioters, etc. This warfare also involves non state actors which are supported by adversaries. This has brought about a paradigm shift in National Security.

In India our security forces have been tackling this menace for several decades. With dramatic shift from conventional wars to non-conventional low intensity conflicts, which are fought in urban as well as rural areas within our own population, it is important that the security forces are adequately equipped to tackle this menace. The security forces should have capability to fight this high-grade security threat in any part of the country.

DRDO has been developing a wide spectrum of technologies for defence forces since its inception in 1958. In order to tackle growing LIC requirements, DRDO made a humble beginning by initiating LIC program in Jun 2012 for development of weapons and equipment for specific LIC roles. Regular interactions were held with security forces involved in LIC operations and the input were incorporated towards development of weapons and equipment.

A number of LIC related products/systems have already been inducted into the arsenal of the CAPFs/CPOS and the feedback on the performance of DRDO products/system is very encouraging. This issue of Technology Focus is dedicated to highlighting some of the LIC products/systems developed by our labs.

I am extremely delighted with the dedication and focus being demonstrated by the DLIC team and the DRDO labs in developing LIC products/systems which are fulfilling crucial operational requirements of the CAPFs/CPOS and exhort you all to continue the excellent work.

(Dr Chandrika Kaushik)
Outstanding Scientist &
Director General (PC&SI)

401, डी.आर.डी.ओ. भवन, राजाजी मार्ग, नई दिल्ली-110011, दूरभाष : (का) 23013220 फैक्स : 91-11-23017882
401, DRDO BHAWAN, RAJAJI MARG, NEW DELHI-110011 TELE.: (O) 23013220, FAX : 91-11-23017882

PRODUCTS AND TECHNOLOGIES FOR LOW INTENSITY CONFLICTS

Central Armed Police Forces (CAPFs) perform multi-dimensional role beginning from safeguarding of border, prevention of trans-border crimes, smuggling, and providing security to sensitive installation, person at security risk to maintaining law and order in area in the event of disturbance therein. In addition, they carry out counter insurgency operations, anti-naxal operations, internal security duties, VIP protection, lead intelligence agency, security to diplomatic mission abroad, UN peacekeeping operations, disaster management, civil action, nodal agency for UN police missions, etc. These personnel give a semblance of existence of government administration even in the remotest corner of the country. Their versatile experience is being utilised for the nation's advantage.

For discharging their duties they needed small arms and ammunitions not only for execution of their duties but also for their own safety. Need of the hour was to equip them with ammunition and weapons having effective range, wounding effect, lesser-weight, automatic operation, accuracy, consistency, and reliability. Directorate of Low Intensity Conflict (DLIC) role is to fulfil CAPFs requirement using DRDO developed technologies and products through interaction between user and concerned DRDO laboratories along with their development partners.

SMALL ARMS AND AMMUNITION

Corner Shot Weapon System

Corner Shot Weapon System (CSWS) enables the user to see, aim, and fire around the corner. This is a special-purpose weapon platform having day & night firing capability, which can be used in various LIC situations. It enhances the capabilities of 9 mm Pistols and 40 mm UBGL weapon and enable the user to aim the target without getting exposed against retaliatory firing. This system is designed and developed by Armament Research & Development Establishment (ARDE), Pune.

Salient Features:

- Foldable butt stock
- Hard anodised high strength Al alloy body
- High strength alloy steel-based mechanisms
- Universal picatinny rail for day/night camera
- Quick detachability for pistol
- Compliance as per JSS 5855-11:2009

Pistol Version

UBGL Version

5.56x30 mm Joint Venture Protective Carbine

Joint Venture Protective Carbine (JVPC) is a lightweight, compact, balanced, and unique caliber

weapon for use in close combat CI/CT operations. Its low recoil ensures its stabilised operation even during rapid firing. This system is designed and developed by ARDE, Pune.

Salient Features:

- Single hand firing ensures manoeuvrability in constrained space
- Provision of silencer for low noise attack
- Universal Mounting rail for mounting contemporary

5.56×45 mm CQB Carbine

5.56×45mm CQB Carbine is a lightweight, compact, effective weapon for use in close combat CI/CT operations. It has machined lower and upper bodies, rivets free design, fold-able butt, and cocking on the body to avoid heating. This system is designed and developed by ARDE.

Salient Features:

- Can fire three 5.56x45 mm ammunition (5.56 INSAS, 5.56 NATO & 5.56 Lethal)
- Configuration with latest AK and AR type Rifles/ Carbines
- Polymer magazine with metallic inserts suitable for AK type fitments weapons
- Non-detachable connecting pins
- Ergonomically designed pistol grip and hand guards

7.62×51 mm Light Machine Gun

7.62×51 mm Light Machine Gun is an automatic, bipod mounted weapon designed to fire bullets in quick succession from an ammunition belt, at a rate of 600-650 rounds per minute. It has integrated machined receiver and rivets free design, changeable barrel design, fixed butt with buffer and fold-able bi-pod. This system is designed and developed ARDE, Pune.

Salient Features:

- Commonality with Mag -58 weapon
- Safe, single shot and automatic mode
- Ammunition pouch
- Picatinny rail cover

Under Barrel Grenade Launcher

Under Barrel Grenade Launcher (UBGL) is a potential area weapon that can be attached with INSAS and AK-47 Rifles. It can fire different types of grenades based on requirement to give a devastating lethal effect up to 400 m range. This system is designed and developed by ARDE, Pune.

Salient Features:

- An add-on attachment to increase fire-power of the INSAS and AK-47
- Beta-light source for firing in low-light conditions

- Low recoil enables shoulder firing
- HEDP round can be used for door breaching
- High specific strength material for construction

40 mm Grenades

40x46 mm Under Barrel Grenade with self-Distraction Mechanism

Four variants of grenades for UBGL and Multiple Grenade Launcher (MGL) weapon systems have been developed. The grenades are designed to have advanced feature of self-destruction capability which ensures no unexploded ordnance in the field after the operation. This system is designed and developed by ARDE, Pune.

Salient Features:

- HEAP: Produces lethal fragments for anti-personnel effect
- HEDP: Serves dual-purpose of anti-personnel effect as well as armour penetration
- RP: Scatters burning particles and emits smoke for temporary camouflage
- TM: Emits orange coloured smoke for a prolonged duration for marking purposes

5.56x45 mm INSAS Rifle-IC

5.56 x 45 mm INSAS-IC is an upgraded version of INSAS 1B Rifle. It has machined body in place of riveted body, one piece nylon folding butt and detachable folding grip. It can fire in single shot and three round burst mode. This system is designed and developed by ARDE.

Salient Features:

- Direct gas tapping
- Introduction of auto mode of firing in place of TRB
- Hand guard and body cover with Picatinny rails
- Use of MIM route in place of Machining for Extractor and Retainer

Multi-mode Hand Grenade

Multi-mode Hand Grenade (MMHG) light in weight, modular in design and can be used in two modes, i.e. offensive mode and defensive mode depending upon the tactical requirement of users. The two modes can be changed easily from one to another by removing/applying fragmenting sleeve. This system is designed and developed by Terminal Ballistics Research Laboratory (TBRL), Chandigarh.

Salient Features:

- Uniform fragmentation pattern
- Additional safety for thrower
- Less safety distance
- Maintenance free
- Minimum 95% reliability
- Shelf-life of 15 years

NON-LETHAL/LESS LETHAL WEAPONS

Non-lethal weapons are used in policing and combat situations to limit the escalation of conflict where employment of lethal force is prohibited or undesirable, where rules of engagement require minimum causalities or where policy restricts the use of conventional force. The rationale for less-lethal weaponry is not only to effectively replace firearms but also to reduce the number of injuries inflicted during other instances of use of force by law enforcement officials. These weapons may be categorised under category of self-defence as they provide an effective means of self-defence without the risk of causing permanent harm or death.

Police and public administration are responsible to manage the protest and ensure peace and security. However, at times these protests become violent and unruly and may lead to loss of life and public property. In such cases, it is the duty for CAPFs and police forces to do crowd control, riot control using non-lethal weapons only. Such type of devices can also be used to address counter militancy/insurgency operations and dealing with left wing extremism. India is a country having many occasion for large gatherings where in even smallest of rumours can cause major chaos. Stone pelting incidents cause casualties to not only civilians but security forces also. It is a standard instruction for forces dealing with such incidences to use force only when it is absolutely necessary so there is huge demand of such weapons by agencies dealing with them.

There are numerous technology alternatives which have been deployed by countries having non-lethal capabilities used to debilitate individual, to deny personnel access to an area and to clear facilities.

Short Range Laser Dazzler

Short Range Laser Dazzler is a non-lethal anti-personnel laser device producing an intense laser radiation. The device illuminates a spot of 50 cm diameter to cover the face of target. The intense bright radiation causes credible glare in target eyes leading to immediate temporary vision capability degradation. This system is designed and developed by (IRDE), Dehradun

Salient Features:

- Configured to pistol
- Safety lock with unique key-in code
- Adjustable Laser spot size
- Lightweight (1.2 Kg)
- Operation mode-flickering

Tripod Mounted Laser Dazzler

Tripod Mounted Laser Dazzler is a non-lethal anti-personnel weapon system for crowd control applications. The system illuminates a large swath (typically 8m x 3m) at target to cover a large section of crowd with a set of mirrors oscillating at fast repetition rate. The intense bright radiation causes credible glare in target eyes leading to immediate but temporary vision capability degradation. This system is designed and developed by IRDE, Dehradun.

Salient Features:

- Configurable to any user specific platform
- User selectable range and scanning frequencies
- Pan and tilt mechanism using hydraulic head

Vehicle Mounted Laser Dazzler

Vehicle Mounted Laser Dazzler a non-lethal system meant for crowd control applications. The laser beam illuminates a large swath (typically 8 mx3 m) at target to cover large section of crowd. The system can also be effectively used for area denial applications as it is highly effective against oncoming rouge vehicles. Although, the system has been configured on a light armoured platform (MARKSMAN) which provides safety to the crew, it can be configured to any user specific platform. This system is designed and developed by IRDE, Dehradun.

Salient Features:

- Integrated two-axis PTU for wider coverage
- Configurable to any user-specific platform
- Integrated camera for post-operation analysis
- HMI Interface at co-driver seat

Chilli Grenade

Non-lethal Chilli Grenade, an indigenous product, has been formulated using oleoresin extracted from Bhut Jolokia, highly suitable for application in (LIC) areas as well as for riot control and mob-dispersal. Grenades are highly useful for peacekeeping purposes and combating terrorism. The product has been designed and developed by Defence Research Laboratory (DRL), Tejpur.

Salient Features:

- Effective for use in hostage crisis management and mob-dispersal

Less-Lethal Plastic Bullets

The plastic bullets are non-lethal crowd/mob control and practice ammunition. These non-poisonous bullets do not expand after penetration and cause only superficial injuries at 50 m and above

range. Ammunition can be tailored for effective requirement just by reducing the charge. These bullets can be used by in-service weapons without any modifications. This is designed and developed by Terminal Ballistics Research Laboratory (TBRL), Chandigarh.

Salient Features:

- Induces similar sound effect as that of ball ammunition
- Recoil of the rifle is much less
- Ammunition available in four calibers, i.e .303", 7.62 mm, AK-47 & 9 mm
- Shelf life: 5 years

OR Grenades

Oleoresin (OR-Chili extract)-based grenades are simple to operate, users-friendly and extremely useful for flushing out terrorists from their hideout. These grenades can be thrown by hand on to the hideouts /agitated mob and are easily dispersed as smoke (aerosol) from pyrotechnic mixture. The body of the grenades, made of plastic, melts immediately after burst, thus difficult to throw them back. The product has been designed & developed by Defence Research & Development Establishment (DRDE), Gwalior.

Salient Features:

- Causes severe coughing, lachrymation,
- Irritation of eyes and nose and suffocation

CR-based Grenade

The active component of CR-based grenade is CR, which is one of the peripheral sensory irritants, commonly used as a riot control agent. It is more potent and less-toxic than the presently used riot control agents, namely, chloroacetophenone (CN) or -chlorobenzylenemalononitrile (CS). Immediately after the exposure to the vapours or aerosol of the tear gas compound, there will be an irritation and burning sensation (itching sensation) in the eyes, nose throat, mouth and all the exposed parts of the body. The product has been designed and developed by DRDE, Gwalior.

Salient Features:

- Totally safe, simple to operate, user-friendly
- Irritation and burning sensation in exposed parts
- Made of plastic body, melts easily, throwback difficult

IED/CW DETECTION AND MANAGEMENT

India has been facing substantial threats to its internal security from Improvised Explosive Devices (IEDs). The IEDs have become a primary means of terrorising people, causing destruction to public properties and disrupting development activities. Ill minded organisations have resorted to terror through the use of IED in urban and semi-urban area. These hostile elements frequently adopt new tactics, techniques and procedures thereby unbalancing the security forces and extensively use real time human intelligence to thwart and frustrate any counter IED operation undertaken by security forces. It is need of the hour to impart security organisations with suitable equipment through leveraging of technology establishing efficient and intelligence apparatus.

Almost all the central police forces are dealing with IED detection and management. National Security Guard (NSG) is highly specialised contingency force dealing with handling the IED menace. The National Bomb Data Centre has been established at NSG HQ Manesar, Haryana. The BSF have counter IED teams locating at border outposts in the threatened sector to take care of any possible IED incidents. The CRPFs carry out the operations in the 'Red Corridor', UT J&K, and Northeast. It has established institutes of IED Management at Telegaon, Maharashtra wherein they impart training and carry out post incident analysis and maintains nationwide data of IED incidents. All the states in India have dedicated bomb squad/teams which are trained by Army/NSG/CRPF but need of the hour is to equip them with latest equipment to deal with them. The equipment related to explosive detection, demolition devices, remotely operated vehicle are as:

Explosive Detection Kit

The Explosive Detection Kit (EDK) is an innovative product designed for the detection and identification of suspect materials, trace explosive residues and IED constituents accurately at site. The EDK is simple, sensitive, simple, and precise. Explosives are identified on the principle of Colorimetry. The colour generated on reaction between an explosive and the chemical reagent is used for identification of explosive. It can identify about eight common explosives like RDX, HMX, TNT, PETN, CE, etc. The kit is available in three variants; the drop, disposable and spray type to meet specific requirements. The product has been designed & developed by High Energy Materials Research Laboratory (HEMRL), Pune.

Salient Features:

- Useful in laboratory and field conditions
- Minimum false alarms
- Result within 3 minutes

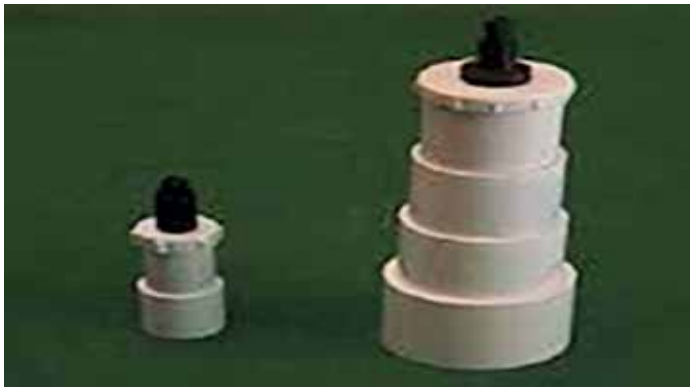


Advanced Demolition Devices

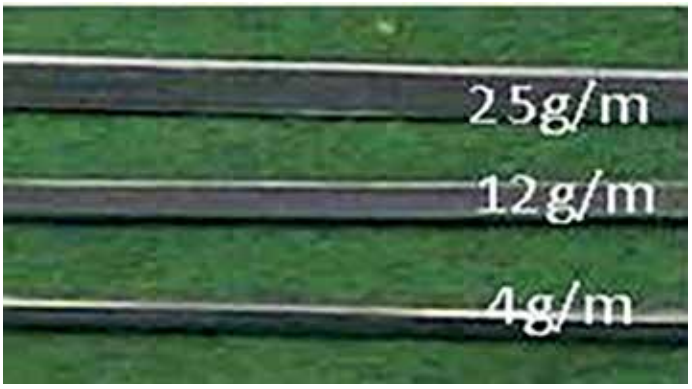
Advanced Demolition Devices (ADDs) are employed to meet the tactical requirements both in offensive and defensive operations for varied engineering tasks. The ADDs are lightweight with enhanced power and improved efficiency to provide greater flexibility of deployment. ADDs encompass 12 devices of which 7 devices are suitable for LIC applications such as controlled operations like room intervention, breaching of walls, breaking of locks/ hatch/lock mechanism, drilling of hole in concrete roofs, cutting of thin metal sheet erections, in-situ demolition of IEDs/mines/UXOs, etc. The device has been designed and developed by High Energy Materials Research Laboratory (HEMRL), Pune.

Modular Charge 20

Sheet Explosive



Shape Charge 30 and 60



Flexible Linear Shape Charge

Light-weight Explosive Identification System—Pre-emptor MK-II

The Pre-emptor Mk-II is a hand-held bulk explosive identifier for identification of explosives and their precursors. It is based on the Raman scattering effect and hence offers high level of selectivity. Although a bulk detector, it has reasonably high level of sensitivity (~10 mg). The system consists of DPSS laser, customized optics, spectrograph coupled with CCD, processor and related electronics. It also comprises of real time identification software based on customised algorithm. It is completely a user-friendly system. This system is designed and developed by Instruments Research & Development Establishment (IRDE), Dehradun.

Salient Features:

- Identifies explosive materials in real-time
- No sample preparation required
- Can identify the materials from a distance of 30 cm
- Database is upgradable as and when required

Confined Space Remotely Operated Vehicle

The Confined Space Remotely Operated Vehicle (CSROV) has been designed to traverse through confined spaces within train compartments and aircraft, reach onto the berth or the cabin baggage space and extract any suspected object. The CSROV can also assess the threat by using an on-board X-Ray scanner and thereafter defuse using a water jet disrupter. The CSROV can be deployed remotely from a distance of 200 m and is driven from a backpack-based user-friendly and high resolution Master Control Station (MCS). Daksh Mini is equipped with a six-swiveling manipulator arm with high resolution camera. The potential users of this system are Airport Authority of India, Railways, Paramilitary Forces, Services, and State Polices. This system is designed & developed by Research & Development Estt (Engrs) (R&DE (E)), Pune.

Salient Features:

- Stair-climbing and slope-negotiation capability
- Multiple switchable cameras on-board
- User-friendly hand-held master control station

IED Containment Vessel

A one-time use, cost-effective, lightweight IED containment vessel, developed for safe detonation of explosives by law-enforcement agencies in crowded public areas. The containment vessel can successfully detonate 6 kg IED within it. The vessel is carried on a crane mounted trolley for easy transportation and deployment. This system is designed & developed by (R&DE (E)), Pune.

Salient Feature:

- Contain up to 6 kg IED

Remotely Operated Vehicle–Daksh

A state-of-the-art Remotely Operated Vehicle (ROV) 'Daksh', capable of being remotely controlled over a range of 500 m line-of-sight. In an urban environment, 'Daksh' can be deployed within buildings and can climb stairs for detection, handling and diffusing (IEDs) and other suspected hazardous material. It has an on-board mounting system for shotgun and can be used for blasting door locks as well as breaking the windshield or side glass panes of likely car bombs. The ROV and Master Control System (MCS) are transported to the site in a specially designed carrier vehicle. The ROV is having an additional feature of real-time CBRNe detection capability with on-board CBRNe instrumentation. The system is designed & developed by R&DE (E).

Salient Features:

- Manipulator arm with six degrees of freedom
- Multiple switchable cameras on-board
- Cameras on motorized pan-tilt platform
- Endurance of 3 h

E-Nasika

E-Nasika (CAM & ACADA) system is capable of detecting Chemical Warfare (CW) agents in chemical war scenario. The developed system is capable of detecting the CW agents in ppb level; the system is lightweight, Hand-held, and battery operated. It can also sense the presence of various hazardous chemicals (TICs and TIMs) at low concentration (ppb) with least false alarm and quick response times. The system has been designed and developed by Solid State Physics Laboratory (SSPL), Delhi.

Salient Features:

- Compound detection
- Wide compound library
- Low false alarms
- System internationally certified at TNO, Netherlands

ACADA CAM

Hand-held Device for Trace Explosive Detection and Identification–OPX-Revilator

OPX-Revilator is an embedded controller-based hand-held device useful in detection and identification of explosives in pre and post blast scenarios in the pure form, in compositions and also as traces with contaminants.

The device works on the principle of Colorimetry and Computer Vision technology. The suspect sample for the test is collected directly or by swabbing and its solution prepared with the Revilator reagents. The device identifies more than 20 types of explosives. The user friendly in- built algorithm guides user at every step of operation to obtain name of explosive on the LCD display screen of the device within three minutes. The system has been designed and developed by High Energy Materials Research Laboratory (HEMRL), Pune.

Salient Features:

- Identification of explosive in solid and liquid state
- Time taken for identification: < 3 minutes
- Battery operated, with 6 h backup
- Extendable library for identification of more explosives

SURVEILLANCE AND RECONNAISSANCE

Surveillance is systematic observation to collect whatever data is available; it is the monitoring of the activities on ground. It has many applications from the operational and strategic to the tactical level while reconnaissance is specific mission performed to obtain specific data. Reconnaissance is the military term for exploring beyond the area occupied by friendly forces to gain vital information about enemy forces or features of the environment for later analysis and/or dissemination. The data provided by Surveillance Reconnaissance system provides early waning of enemy threats enables forces to increase its effectiveness, co-ordination, and lethality. Today's security environment requires continuous monitoring of ground situation. In lack of technological resources, it is challenging and tedious task to do surveillance of vulnerable areas against unwanted intrusions and to perform CI/CT operation by forces as they are too faced with asymmetric warfare such as drug trafficking, terrorism, biological warfare, etc.

Some of the system being used by Armed Forces based on the DRDO developed technologies are Laser Fence System for safeguarding vulnerable area against unwanted intrusions, Low-Cost Surveillance System (LCSS) for speedy and effectiveness engagement of targets by the soldiers, Weapon Locating and Tracking System (WLTS) for live tracking and monitoring of weapons, Surveillance Remotely Operated Vehicle (SROV) for counter terrorist applications, Surveillance using Multilayer Intelligent Tracking Response Analysis (SUMITRA) for protection and safe-guarding key/vital installation and various surveillance radars for ground surface targets, detection of anti-tank and anti-personnel mines, scanning and detection of buried objects on roads and tracks, detection and location of static and moving targets especially human beings behind wall. In addition, products counter drone system for real time search, tracking and neutralisation system against drones of different category, autonomous surface vehicle for underwater objects, face recognition system to identify a person in disguise are names of some of the system are either under rigorous user trials or already induced by CAPFs.

Laser Fence System

Laser Fence System (LFS) safeguards vulnerable areas against unwanted intrusions. The system offers two-tier security and capable of 24/7 operation. The LFS can be integrated with multiple sensors to provide a comprehensive security to military assets, strategic zones and LOC/border areas. The system has been designed and developed by Instrument (IRDE), Dehradun.

Salient Features:

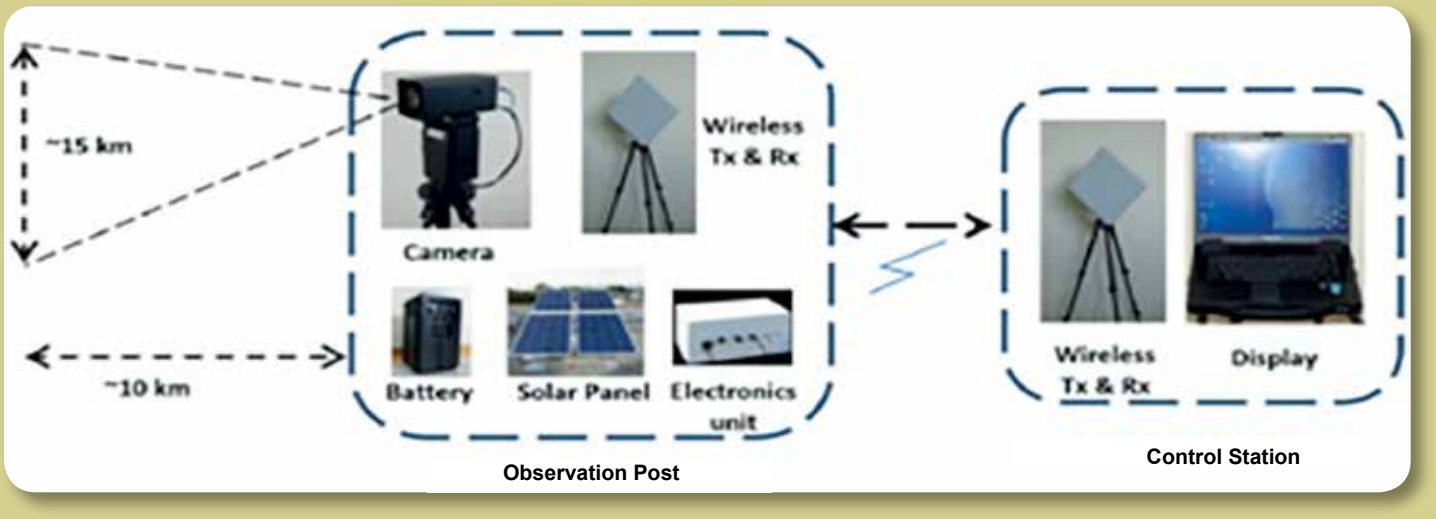
- Continuous invisible Laser fence
- Two-tier security
- Event triggered video transmission and recording
- Distributed/wireless hooter (up to 500 m)
- Local/remote connectivity
- Day-night operability
- Highly-reliable
- Network-compliant

Low Cost Surveillance System

Low Cost Surveillance System (LCSS) consists of day camera and Pan-Tilt Unit (PTU). It is used for day surveillance and speedy and effective engagement of targets by the soldier. The equipment transmits video and data over wireless (10 km LOS). It is powered with renewable energy source. The system has been designed and developed by IRDE, Dehradun.

Salient Features:

- Remote operation capability
- Network-able
- Provision to feed video over fibre-optic



Weapon Locating and Tracking System

Weapon, especially small arms, may miss from the inventory due to theft, robbery and can be snatched by enemy in the battlefield. The weapon may fall into wrong hands, which can be used for illegal activities like terrorism, insurgency, and rebelliousness. The Weapon Tracking System (WTS) enables the live tracking and monitoring of the weapon. The WTS can also be used for the purpose of inventory management. The system has been designed and developed by ARDE, Pune.

Salient Features:

- Weapon compatibility: INSAS, AK-47
- Compatible with GPS and IRNSS
- Remotely change location data refresh rate
- Geo-fencing
- Powered by Li-ion rechargeable battery
- Wireless inductive charger
- Environmental tests: JSS 5855-11:2009 compliance

Surveillance Remotely Operated Vehicle

Surveillance Remotely Operated Vehicle (SROV) is a portable and remotely operated tracked vehicle capable of silent surveillance at day and night and for real time video transmission. The system is useful for Indian Army and other security agencies involved in counter terrorist applications. The system can be deployed across cross-country areas and confined spaces, within culverts, etc. for surveillance. The SROV has been designed to be one man portable on his backpack and be deployed using a hand-held (MCS) with an operator console. The system can traverse through urban and cross-country terrain. It is capable of climbing stairs and is equipped with cameras with day and night vision capability. This system is designed and developed by (R&DE (E)), Pune.

Salient Features:

- Built-in aiming device
- Stair-climbing capability
- Hand-held MCS

Surveillance Using Multi-layer Intelligent Tracking Response Analysis

Surveillance Using Multi-layer Intelligent Tracking Response Analysis (SUMITRA) is an integrated multi-layer intelligent perimeter surveillance system for protection and safe-guarding key/vital installations. Intrusions/activities detected from multiple sensors are fused together, analysed by the AI-based decision support engine and thereafter alarms are raised. It is further augmented with fully automated intruder tracking UAVs so that the whereabouts of the intruder are not lost till human QRT arrives. This system has been designed and developed by R&DE (E), Pune.

Salient Features:

- Intelligent intrusion detection
- Classification and recognition
- AI-based decision support
- Identification of Friend or Foe
- Zone prioritisation
- Summarisation and post analytics
- Distributed architecture
- Scalable and modular design
- Indigenous software solution

Battle Field Surveillance Radar-Short Range

Battle Field Surveillance Radar-Short Range (BFSR-SR) is a man-portable, battery-operated surveillance radar. The Radar has been developed for deployment in the forward areas with the capabilities to detect, track, and classify variety of moving ground surface targets. BFSR-SR is a reliable sensor for day and night operations in all weather conditions. This system has been designed and developed by LRDE, Bengaluru.

Salient Features:

- Pulse Doppler Radar
- Low-probability of intercept
- Digitally coded waveforms with choice of RF channels
- Presentation of ground clutter map/geographical map in PPI format
- Ability to detect, track and classify
  - ♦ Crawling man
  - ♦ Single/group of walking men
  - ♦ Moving light and combat vehicles
  - ♦ Low flying helicopters
- Audio alarm of new target detection over fenced area
- Weight: <3 kg

Hand-held Ground Penetration Radar

Ground Penetration Radar (GPR) system is used in detection of anti-tank mines, anti personnel land-mines (metallic and non- metallic) and (IED) in a variety of Indian soils such as sand, red, laterite, black cotton. Hand-held GPR is configured on a 1.6 mt collapsible wand. Hand-held GPR system is extremely useful for army and paramilitary forces, respectively in jungle area where very narrow path ways exist. The system has been designed and developed by LRDE, Bengaluru.

Salient Features:

Types of Targets	Anti-personnel Mine Anti-tank Mines
Types of Soil	Red Soil, Laterite Soil, Red-Yellow Soil, Red-Loamy Soil and Black Cotton Soil
Detection Capability	Real-time Detection Online Audio Signature (Headphones) Visual Indication (LED)
Power Source	Rechargeable Li-ion Batteries
Weight	Less than 5 Kg
Technology	Ultra Wide Brand Radar

Vehicle Mounted Ground Penetration Radar

Vehicle Mounted Ground Penetration Radar (VMGPR) is used for scanning and detecting

buried objects on roads and tracks that are used by patrolling parties of paramilitary forces and Services. Antenna array is mounted in front of the vehicle and the electronics consisting of waveform generator, Receiver, Signal-Processor (SP), Radar Controller (RC) and Image & Data processing (IDP) cards are housed in a Central Unit. A rugged laptop is used for control and GUI. The GUI offers Radar images in 2D as well as 3D. The system has been designed and developed by LRDE, Bengaluru.

Salient Features:

Types of Target	Anti Tank Mines IED/UXO
Depth of Detection	ATM: 1 m IED/UXO: 2 m
Types of Soil	Red Soil, Laterite Soil, Red-Yellow Soil, Red-Loamy Soil and Black Cotton Soil
Vehicle Speed	5-15 Km/hr
Depth Resolution	2 cm
Cross Range Resolution	5 cm
Inline Resolution	5 cm
Power Source	Rechargeable Li-Ion Batteries
Weight	Less than 80 Kg
Technology	Ultra Wide Band Radar

Hand-held Through Wall Imaging Radar

Hand-held Through Wall Imaging Radar is a sensor used for detection and location of static and moving targets, especially human beings behind walls. The Radar can image in realtime the scenario behind wall, identify the number of people and their location behind walls, study their activity patterns and thus help in identifying a hostage scenario behind the wall. The Hand-held TWIR is a 2D lightweight, portable, battery-operated system configured to detect targets. The product has been designed and developed by LRDE, Bengaluru.

Salient Features:

Penetrable walls	Concrete, Reinforced Concrete, Brick, Cement, Wood and Stone
Display	LCD Panel indicating target position
Doppler	Heart beat, Breathing detection
Imaging	2D
Dimen-sions	38 (L) x 46 (B) x 25 cm (D), approx.
Weight	6 kg + 1.3 Kg Battery
Power Supply	12 V Rechargeable batteries/mains Power
Wireless Video	Built-in wireless video transmitter with upto 15 m range
Env. Spec	To meet the IP67, MIL-STD-810F
Types of Targets	Stationary and moving human, static objects

Tripod Mounted Through Wall Imaging Radar

Tripod Mounted Through Wall Imaging Radar (TMTWIR) is a sensor used for the detection and location of static and moving targets, especially human beings behind walls. Imaging the scenario behind wall, tracking the path of the moving targets and presenting fine Doppler information like heart beat and breathing of a person are the important functions of this radar.

The tripod mounted TWIR is a portable battery operated system mainly used for getting a 3D view of the scenario behind the wall. The product has been designed and developed by LRDE, Bengaluru.

Salient Features:

- Penetrable Walls : Concrete, reinforced concrete, brick, cement, wood and stone
- Display : LCD Panel indicating target position
- Dimensions : 60 (L) x 40 (B) x 25 cm (D) Approx.
- Weight : 15 kg
- Power Supply : 12 V Rechargeable batteries
- Wireless Video : Built-in wireless video transmitter upto 20 m range
- Env. Spec. : To meet the IP65, MIL-STD-810F

D4-Counter Drone System

Counter Drone System as a multi sensor detection and neutralisation system against drones of different category. The System is capable of real-time search, tracking and neutralisation by way of soft/hard kill. The detection and identification is done using Radars, EO-sensors, and COMINT. The soft kill is carried out by RF jamming and anti-GNSS technologies. Laser-Directed Energy Weapon is used for the hard kill. The complete system is integrated to a single command and control center. The system is configured in two options:

- System with soft-kill option, consisting of Radar, EO-Tracking system, RF Detection and Jamming System
- System with Soft-kill+Hard kill option, consisting of Radar, EO Tracking system, RF Detection & Jamming System and Laser-based weapon system

Vehicle Mounted Configurations Counter Drone System can be configured as static installation or vehicle mounted system. Two approaches for vehicle configuration has been worked out. Approach I: Two vehicle configuration • Radar, soft kill and command & control center on one vehicle • Hard kill system on second vehicle. Approach II: Single vehicle configuration single 4x4 vehicle consisting Radar, soft kill and hard kill systems along with command & control center and integrated power system. The system has been designed and developed by LRDE, Bengaluru

Salient Features:

- Multi-sensor technology for target detection and confirmation up to 5 km range
- Efficient target neutralisation- 3 km (Jamming), 1 km (Destruction)
- Drone classification and identification
- Single power supply for whole system with AC mains option
- Comprehensive and user-friendly GUI
- Capable of jamming multiple frequency bands

Autonomous Surface Vehicle

The Autonomous Surface Vehicle (ASV) is an electrically powered catamaran surface vehicle for autonomous surveillance of underwater objects and bathymetric survey. The platform is designed as a Catamaran since it is more stable while traversing in water. The ASV is an autonomous boat which can be remotely controlled as well as programmed to follow a pre-defined path. It can be used to collect bathymetric data for analysis. The platform is powered by electrical thrusters/out board motors with capability of carrying a payload of 200 kg. The platform if equipped with cameras to aid in navigation over an area. It has a range of 2 km with an endurance of 6 h and can be used to scan a pre-defined area. The real-time data as well as video is relayed back to the ground control station. The system has been designed & developed by (R&DE (E)), Pune.

Face recognition System Under Disguise

Face Recognition System under Disguise (FRSD) is used to identify anti-social elements with or without disguise in the low-resolution surveillance camera feeds. The algorithm has been trained in such a way that the face recognition system is robust to several disguises like face-masks, beard, moustache, wigs, sunglasses, head-scarves, monkey-caps, hats, etc.

Apart from the disguises, the system is also robust to different lighting conditions, shadows on face, crowd occlusions, etc.

The system can be deployed at restricted/secure zones for the purpose of live video surveillance. It can also be deployed at public places to recognise anti-social elements. The algorithm can also be used by security agencies for robust face search across large repositories.

The system is designed to ensure scalability across multiple GPUs and servers. In addition, the system is optimised to ensure maximum utilisation of GPUs and thus can support multiple surveillance cameras on a single GPU. The system comes with a flexible video analytics suite with number of additional surveillance applications like people counting, loiter detection, vehicle collision detection, geo-fencing and fire detection. More use cases can be built as per the requirement. This system has been designed and developed by (R&DE (E)), Pune.

Salient Features:

- Flexible architecture to add more potential video analytics use-cases
- A scalable system, across multiple GPUs and servers

MOBILITY SUPPORT

The array of duties performed by armed forces requires a variety of specialised means, i.e. mobility support. Mobility support mainly depends upon environment of operations and it should have all the possible means to fulfill the desired objectives. Our country has very diversified physiographic regions and in every region security personnel has to perform their duties.

To fulfill specific requirements of mobility support, some systems developed on DRDO developed technologies are Wheeled Armoured Personnel Carrier (WAPC) an amphibious vehicle incorporated with high power engines, double floor mine protection and modular add-on composite armour for ballistic protection and suitable for integration of different caliber/type of armaments, Anti-Terrorist vehicles (ATV) for urban warfare having compact size with all round ballistic protection. Other ones are a lightweight infantry floating bridge to bridge wet gaps of 100 m with pathway of 0.85 m and lightweight mountain footbridge of total length 34.5 m capable of withstanding weather condition prevailing in even glacial regions. These are some of the system which are either already inducted or are in the process of induction by CAPFs.

Wheeled Armoured Platform

Wheeled Armoured Platform (WhAP) 8x8 is a wheeled armoured personnel carrier indigenously developed by the DRDO. The vehicle platform is modular and has been designed based on common platform for family of vehicles. The vehicle is state-of-the-art and matches the capabilities of contemporary wheeled armoured vehicles in-service worldwide. The vehicle is amphibious and incorporated with features such as high power engine, fully automatic transmission, hydrogas suspension, double floor mine protection and modular add-on composite armour for ballistic protection.

The vehicle design/configuration is suitable for integration of different caliber/type of armaments such as 30 mm manned turret, 30 mm RCWS, 7.62/12.7 mm RCWS and Anti-tank Guided missiles. The firing trials have been conducted with 30mm upgraded in-service turret and 7.62 mm RCWS. The system has been designed and developed by Vehicle Research & Development Establishment (VRDE), Ahmednagar.

Salient Features:

- Modularity of platform to suit variety of battlefield or urban warfare roles
- CTIS and wheels with run flat inserts
- Amphibious with Hydro jets upto 24.5 ton GVW
- Double floor V-type mine protection with shock resistant seats and foot pads

Anti-Terrorist Vehicle

Urban warfare needs an agile, compact, and highly maneuverable armoured envelope adequately protected with troop carrying capacity of 2-5 persons in hostile environment especially in the hotel corridors, small lanes and constrained spaces of hide outs, etc. For this purpose, three different kinds of armoured vehicles namely wheeled, tracked, and electric (battery-operated) vehicles have been successfully realised. The Anti Terrorist Vehicle (ATV) has been designed and developed by VRDE, Ahmednagar.

Salient Features:

- Compact size with all round ballistic protection
- Protected against STANAG 4569, level I
- Emergency exit hatch on roof-top provided
- Pivot turning capability for better manoeuvrability
- Provided with camera and PA system

Infantry Floating Foot Bridge

A lightweight infantry floating foot bridge is developed for water current upto 1.5 knot to bridge wet gaps up to 100 m with a pathway of 0.85 m width and finds important applications in disaster management. The bridge is made of high-strength aluminum alloy and Polyurethane Foam (PUF). Each section of the bridge, weighing 55 kg, can be carried by two persons. To launch the bridge a SWR is fixed/ attached across the gap, then one by one bridge modules are attached with the SWR using sling and pushed forward towards the other bank. In this way a bridge upto 100 m long can be constructed. . The system has been designed and developed by R&DE (E), Pune.

Salient Features:

- Harness for easy portability
- Quick and easy joining of modules through ball and socket
- Transportable using in service 2.5/5/7.5 T vehicles and also heli-portable
- OBM attachment possible
- Launching in multiple spans

Mountain Foot Bridge

A lightweight mountain footbridge of total length 34.5 m has been developed to bridge clear gaps up to 32 m with a pathway of 0.8 m. It is also capable of withstanding weather conditions prevailing in glacial regions. It includes a man-portable launching system that facilitates the bridge to be launched from near-bank without any access to the far-bank. To launch the bridge, a lightweight nose is first launched from near-bank in cantilever mode. After that nose is lowered across the gap, bridge panels are attached to the nose and pushed across the gap. The system has been designed & developed by R&DE (E), Pune.

Salient Features:

- Each panel of the bridge portable by one man
- Harness provided for transportation of components
- Made of high-strength aluminium alloy
- AA6061 T6 components

Editors are thankful to Shri Sangita Rao Achary Addanki, Director DLIC and his team, Vishal Veer Singh, Sc 'F'; Avinash Chandra Verma, Sc 'E'; Col Sunil G Nayak; Babit Kumar Rajput, TO 'B'; Nirbhay Kumar, TO 'A'; and Directors of DRDO laboratories, viz. ARDE, IRDE, DRL,TBRL, DRDE, HEMRL, R&DE(E), SSPL,LRDE, DYSL-AI, and VRDE., for preparing the write-up for this issue of *Technology Focus*.