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BHARAT ELECTRONICS
QUALITY. TECHNOLOGY. INNOVATION.

Export
Product
Booklet

INDEX:

A. LAND BASED SYSTEMS

1. RADARS

3D LOW LEVEL LIGHT WEIGHT RADAR

ASLESHA is a multifaceted ground based S-Band 3D Low Level Light Weight Surveillance Radar for deployment in diverse terrains like plains, deserts, mountain tops and high altitude regions. Aslesha detects and tracks heterogeneous air targets, including helicopters, fighters and UAVs at low and medium altitudes.

SALIENT FEATURES

- S-Band 3D surveillance for aerial targets at low and medium altitude.
- Detection and tracking of fighter aircraft, helicopters, slow moving micro-light aircraft and UAVs.
- Track while scan up to 100 targets.
- Full 3D capability using multi-beam technology.
- Distributed solid state TR module based semi active antenna with beam shape.
- Electronic tilting/ elevation scanning of stack of beam.

3D LOW LEVEL LIGHT WEIGHT RADAR

BATTLE FIELD SURVEILLANCE RADAR

Battlefield Surveillance Radar – Extended Range (BFSR-XR) is a man portable, battery powered state-of-the-art Pulse Doppler Surveillance Radar capable of automatically detecting and displaying a diversity of moving targets such as pedestrians, group of men, vehicles, tanks, low flying Helicopters, etc.

SALIENT FEATURES

- Light weight, man portable and fast deployment
- Operates 24 hours a day and under all weather conditions
- User-friendly menu driven interface based on Windows XP
- Instrumented range upto 30 km
- J-band Pulse Doppler Radar with Built In Test Equipment (BITE)
- Track while scan of up to 99 targets
- Low probability of intercept with low peak power
- High resolution, colored, north oriented radar picture displayed on portable PC

BATTLE FIELD SURVEILLANCE RADAR

WEAPON LOCATING RADAR

Weapon Locating Radar (WLR) has been primarily designed to locate hostile guns, mortars and rockets. WLR, in its secondary role, can track and observe the fall of shot from own weapons to provide corrections to own fire.

Detection, location and tracking of the requisite targets is handled by the advanced algorithms and State-of- the-art hardware. The ability to locate enemy weapons from its first round and transmit the data of the required target to the counter fire elements for retaliatory strike before the target is redeployed is the key feature of the radar.

SALIENT FEATURES

- Low Deployment and Decamp time
- Location of weapons in high density fire environment
- Electronically scanned Phased Array Antenna
- Adaptive Radar resource scheduling
- Coherent TWT based Transmitter
- Low Phase noise, multi channel source
- Highly sensitive three channel, gain and phase matched Receiver
- Programmable Digital Signal Processor using embedded technology with Clutter mapping

WEAPON LOCATING RADAR

COUNTER DRONE SYSTEM

The Counter Drone System is capable of performing real time search, detection, tracking and neutralization (Soft/ Hard Kill) of the flying drones (Micro/Small UAVs) in area of responsibility and will provide object details (Optical / Thermal) and RF spectrum display on GUI.

The detection of drone will be done with the help of Radars and RF based detection system. The identification of the target will be done with the help of EO sensor and COMINT (Communications Intelligence). The soft-kill will be executed by RF jamming & Anti GNSS technologies. Laser Directed Energy Weapon (DEW) system will perform the Hard Kill.

SALIENT FEATURES
- Counter Drone system comprises of the following systems
- RADAR System - Drone detection and tracking
- EO System - CCD, IR camera with LRF for detection and tracking of Drone target
- RF Counter Drone System- Drone communication channel RF Detection & Jamming, GPS Jamming / Spoofing System (Soft Kill)
- Laser Directed Energy Weapon System (Hard Kill)
- Command & Control Centre (C3) with Power Source for complete System
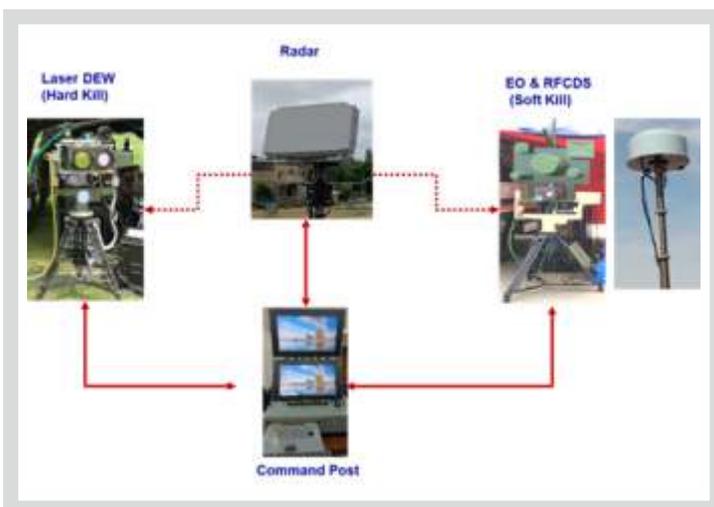
COUNTER DRONE SYSTEM

2. AIR DEFENCE SYSTEMS

2.1 AIR DEFENCE FIRE CONTROL RADAR

Air Defence Fire Control Radar (ADFCR) is a Ground Based Air Defence Radar system with X-band 3D Surveillance using Active Phased Array technology, TWT based Ka-band monopulse Tracking and Electro Optic sensors for passive tracking. It can control and command AD Guns for effective point defence against enemy Fighter Aircrafts, Helicopters and Unmanned Aerial Vehicles (UAV) at short/very-short ranges during day & night under all weather conditions and also in the presence of enemy jamming (ECM).

SALIENT FEATURES

- X Band Active Array Antenna based rotating three dimensional Search Radar
- Integrated IFF Mark XII (S)
- Ka Band Parabolic Reflector based Accurate Monopulse Single Target Tracking Radar
- TV & TI Camera for passive angular tracking and Laser Range Finder (LRF) for Radar Independent Ranging
- On-board Power Supply with UPS back up for Computers
- NBC Filtered, Air-Conditioned Commander's Cabin housing Radar Situation Display & HMI, Optical/Thermal Video Display, Weapon Control Unit and Radio/Data communication equipment.
- Remote Display for unmanned operation of ADFCR

AIR DEFENCE FIRE CONTROL RADAR

AKASH SURFACE TO AIR MISSILE SYSTEM

The AKASH Air Defence Missile System is a medium range, surface-to-air missile system which provides area air defence against multifarious air threats to mobile, semi mobile and static vulnerable forces and areas. The system has cutting edge features with cross country mobility.

The real time multi sensor data processing and threat evaluation enables simultaneous engagement of multiple targets from any direction.   The entire system is flexible, up scalable and can be operated in group and autonomous modes. It employs command guidance and relies on phased array guidance radar to guide the missile till intercept.

SALIENT FEATURES

- Large kill zone
- Simultaneous engagement of many targets with multiple missiles
- Missile Kill Range up to 25 Km
- Tracking of multiple targets in TWS mode by Multi Function Radar
- 80 km coverage by Multi Function Radar and 120 km coverage by Central Acquisition Radar
- 3D measurements of Range, Azimuth and Elevation by Central Acquisition Radar
- High level of automation, enabling effective operation
- High jamming immunity in severe ECM environment

AKASH SURFACE TO AIR MISSILE SYSTEM

3. TANK, GUNS AND WEAPONS UPGRADE

3.1 UPGRADED L-70 GUN

L-70 Gun Upgrade is a fusion of the latest technologies in the areas of electrical servo drives, Electro-Optical Fire Control System and Video tracking.

SALIENT FEATURES

- All electric drives to replace existing hydraulic drives.
- Integrated Fire Control System with Optronic Sight consisting of Eye Safe LRF, DLTV and TI.
- Autonomous ballistic computation on gun based on round to round basis.
- Silent operation of the gun with batteries.
- Interface with TC / FC Radars.

UPGRADED L-70 GUN

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SCHILKA UPGRADE

The Upgraded Schilka system is a ZSU 23 mm, 4 barrel, advanced all weather self-propelled Air Defence Weapon System primarily designed to protect mobile formations against aircraft and helicopters. The Upgraded Schilka provides drastic improvements in operational performances, accuracies and power consumption. It consists of state of the art 3D planar Active phased-array solid state Radar and Electro Optical Fire Control system that ensures Day and night capability for detection, acquisition and tracking of targets. The various phases of operation such as rapid acquisition of fast moving target, determination of the aiming point for the guns and ballistics of the projectiles, rapid laying of the guns on to the target and firing can be carried out when the vehicle is on the move or at halt.

SALIENT FEATURES

- State-of-art coherent, 3D planer Active Phased-array solid state search/track Radar.
- Electronic Beam Steering in Elevation.
- TWS search capability in circular and sector scans
- Single Target Tracking (STT) and Multi Target Tracking (MTT) Capability.
- Advanced ECCM capabilities.
- Cueing to target data received from external surveillance radar.
- Modern digital Fire Control Computer.

SCHILKA UPGRADE

3.3 ELECTRONIC UPGRADE OF BMP-II TANK

BMP-II has been in service for more than 30 years and hence upgrades are under way to enhance its extended life. The present sighting system is having only direct viewing optics with IR based nigh viewing facility, it is highly difficult during the nigh operation. The sighting systems are not independently stabilised and hence operator fatigue is more during its operation or during the engagement. The present fire control system is analog based and hence the engagement as well as firing accuracy is not up to the mark. Existing missile engagement through a separate day viewing sigh through which the Gunner alone could engage the potential target only In day time.

SALIENT FEATURES

- The upgrading of the BMP-II includes the following items:
- a. Gun Control system of BMP II.
- b. Fire Control system of BMP II
- c. Sighting System for the Armoured Fighting Vehicle
- d. NBC protection systems for AFVs
- f. Digital communication system for AFVs
  Fire detection and suppression systems for AFVs

ELECTRONIC UPGRADE OF BMP-II TANK

3.4 ADVANCED DRIVER NIGHT SIGHT

A-DNS comprises of an advanced uncooled Thermal Imager and a day camera having low light level imaging capability. It incorporates electronic image fusion of TI and Day camera. It provides tank driver the capability to drive tank in dark with headlights switched OFF. Driver can select TI or Day camera or Fused image (TI + Day Camera) on display.

SALIENT FEATURES:

- Form fit configuration for AFVs
- Fused mode allows viewing of thermal image and LED/Beacon lights in the same image during night enhanced visibility

ADVANCED DRIVER NIGHT SIGHT

3.5 NBC RECONNAISSANCE VEHICLE

Nuclear, Biological and Chemical (NBC) Recce Vehicle on a tracked vehicle is a NBC protected mobile platform for diagnosing the existence of nuclear, biological and chemical agent in the atmosphere during the NBC warfare in order to cordon the contaminated areas and protect the living beings. It carries out survey, detection, identification, monitoring and marking of the radiological and chemically contaminated areas. It is also equipped with sample collection device, which can collect the contaminated soil and liquid samples. It can also transmit data to command centre.

SALIENT FEATURES:

• Communication facility for data transmission to command centre
• Navigation facility to identify the location of contaminated zones in the map
• Portable Dose meter and Dose Rate meter for measurement of Dose received by crew
• 30 mm gun on the turret
• Software for predicting the Hazardous areas
• Data integration facility on Control Console
• On line transfer of recce data through telemetry

NBC RECONNAISSANCE VEHICLE

3.6 CHEMICAL AGENT MONITOR

Gas Chromatograph based electronic-nose vapour detector. It is capable of detection of Chemical Warfare Agents (CWA) down to few parts per billion concentration levels within a minute.It has high endurance and high efficiency.

SALIENT FEATURES:

- Targeted Compounds: Sarin, Soman, Tabun, VX, Lewisite (Nerve Agents), Sulphur Mustard (Blister Agent), Phosgene (Choking Agent), Hydrogen Cyanide (Blood Agent)
- Sensitivity: Nerve < 7 ppb, Blister <77 ppb, Blood < 20 ppm, Choking < 5 ppm
- Size: 30 x 10.5 x 12 cm^3
- Continuous operation: >8 hours
- Weight: 3.1kg with batteries

CHEMICAL AGENT MONITOR

3.7 CORNER SHOT SYSTEM

Corner Shot System is an ergonomically designed portable weapon system that enables user to see, aim and fire an armed target without exposing himself to any counterattack.

It provides a real time image of the target area, located around a corner to the user, with capability to aim and engage targets accurately during day and night.

To further enhance the capabilities of soldier and weapon during CQB / Night / Low light conditions Corner Shot System is equipped with in-built IR capabilities making it perfect for counter terrorism and urban combat operations.

SALIENT FEATURES

- Compact & Light weight
- Cross Hair Reticule
- Standard Picatiny
- Inbuilt IR Illuminator
- Combined Zeroing Mechanism
- Day/Night Mode Operation
- Accurate Laser Aiming Device
- Quick out of sight target acquisition

CORNER SHOT SYSTEM

3.8 MULTI PURPOSE REFLEX SIGHT (TRINETRA)

It is a compact, light-weight, Parallax free and rugged weapon sight for instant target acquisition, which can be easily integrated with weapons such as Assault Rifles (5.56mm and 7.62mm), Carbines like JVPC, etc. Trinetra is equipped with Laser Spot Designators, which make it an all-in-one versatile sight for all possible combat scenarios.

SALIENT FEATURES

- Faster Target Acquisition
- Facilitates Both Eyes Open Shooting
- Accurate Aiming with Precise Reticle
- Large Window for Easy / Quick operation
- Reticle Brightness adjustment
- In-built Invisible IR Laser Designator
- In-built LDR for Auto Intensity Control
- Combined Zeroing Mechanism
- Low Light / Night Operation Mode
- Ultra Compact & Lightest in its category

MULTI PURPOSE REFLEX SIGHT (TRINETRA)

ELECTRONIC FUZES

ARTILLERY FUZES

- Available in 3 variants (Percussion, Proximity and Time) suitable for 3 types of gun calibres namely 105MM (Mode-3), 130MM (Mode-2) and 155MM(Mode-1).
- Fuze Safety Distance: Min 100 meters from Muzzle End
- Shelf Life: Min 15 years under sheltered storage Safety: As per MIL-STD-1316 and STANAG 4187

Percussion Fuze

Proximity Fuze

Time Fuze

OPERATING

Percussion Fuze	Proximity Fuze	Time Fuze
Point Detonation Super Quick Point Detonation delay	Proximity Point Detonation Super Quick	Time Point Detonation Super Quick

B. NAVAL SYSTEMS:

4. RADARS & FIRE CONTROL SYSTEMS

4.1

ELECTRO OPTICS
FIRE CONTROL SYSTEM

The Electro Optical Fire Control System (EOFCS) is a compact, 2 axes stabilized, high performance system for control of short and medium range naval gun mounts.

SALIENT FEATURES

- High Pointing and Tracking Accuracy
- 2 axes Gyro Stabilized
- Control of medium & short range guns
- Engagement using sighting device or Electro Optic Director (EOD)
- Integrated ballistic computer
- Manual target acquisition
- Operation in integrated mode with a Combat Management System or in stand-alone mode
- Day & night operation
- Modular Design
- Fast sensor exchange
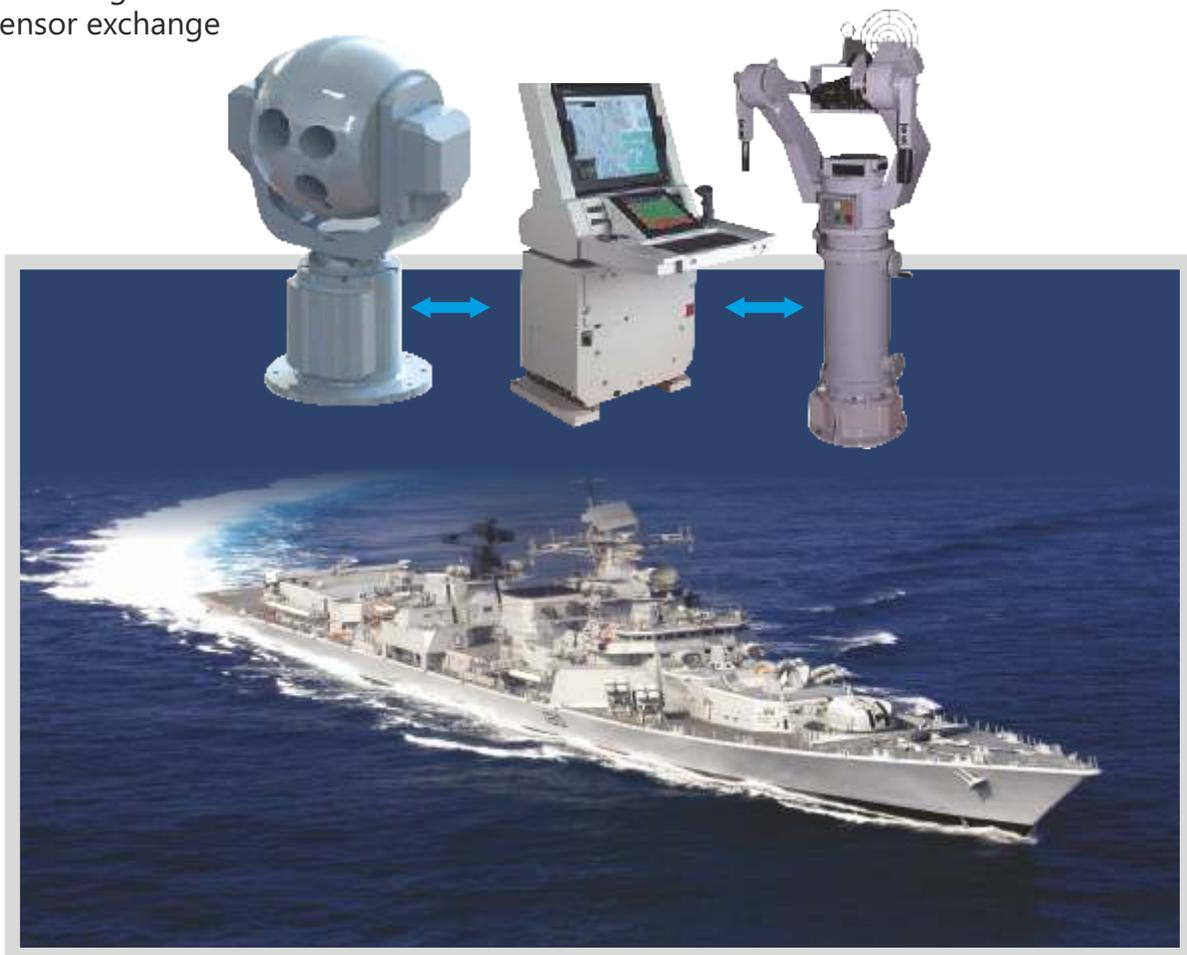
ELECTRO OPTICS FIRE CONTROL SYSTEM

LYNX FIRE CONTROL SYSTEM

State of the art, Quick Reaction, Multi Sensor & Compact Naval Gun Fire Control System Designed to acquire, track and engage both AIR, SU & NGS Targets.CONFIGURED with X band Radar as Fully Coherent & Mono Pulse Tracker as Main Fire Channel 01 x Medium Range GM (SRGM,AK176, A190, SRGM-UG) 02 / 04 x Short Range GM (AK 630) LYNX U2 Is Classified into 'Five Functional Blocks

- TRACKER
- WEAPON
- ENGAGEMENT CONTROL SYSTEM
- SIGHT CONTROL
- SUPPORT SYSTEMS

SALIENT FEATURES

- Accurate Target Tracking of Both Air & Surface Targets
- Tract Data Generation for Weapon Control & Aiming
- Target Engagement with Medium & Short Range Gun Mounts with "TRACKER" & "MANUAL" mode of control

LYNX FIRE CONTROL SYSTEM

BHARAT ELECTRONICS

Composite Communication System (CCS) Mk IV is an IP based new generation Voice, Data and Video Integrated communication system, designed primarily to provide connectivity between remote users and radio equipment for accessing, monitoring and controlling along with other services like intercom, Automatic Message Handling System (AMHS), FAX, Non Operational Computer Resources (NOCR) Net, Video conferencing and IP Surveillance onboard warships. CCS MK IV is designed to ride on the Ethernet (IP) backbone being installed on future naval ships. The physical connectivity with the IP backbone (1Gbps) is through Ethernet (CAT6) cable at 100Mbps. The system is highly flexible and can be configured for all classes of ships and submarines.

SALIENT FEATURES
- Control & Monitoring Subsystem (CMS)
- MF Subsystem
- HF Subsystem
- VHF / UHF Subsystem
- RATT Subsystem
- Audio Subsystem
- Data subsystem
- Video Subsystem

COMPOSITE COMMUNICATION SYSTEM

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3D Surveillance Radar is a ship borne Radar. The radar has advanced technologies like digital receiver, programmable signal processor providing high resolution, accuracy, response and information availability. The radar can auto track up to 150 targets including tracking with IFF.The radar simultaneously forms multiple beams in reception which are used for estimating height. The radar has excellent ECCM features. The antenna of the radar is hydraulically stabilized. The radar incorporates interfaces with Ships Household Data (Gyro, Log, GPS etc) with Combat Management Systems (CMS) onboard.

SALIENT FEATURES:

- Medium range 3D surveillance
- Range - 210 km
- Integrated IFF with co-mounted antenna
- Clutter/Weather/ECM video maps
- Jamming analysis and presentation
- COTS hardware for maintainability and cost effective surveillance solution

3D SURVEILLANCE RADAR

Modern Radar systems are required to provide fast and effective response to present day threats characterized by high speeds and high manoeuvrability. The First Defence Layer in a combat system being the long range air surveillance Radar whose main task is "early detection" of the vital, potential threats.

BEL Radar RAWL-02 MK II A is long range air surveillance radar designed for use on-board large and medium Naval Ships for air warning and target detection.

The Radar RAWL-02 MK II A provides a detection volume space up to 190 Kms in range and height coverage up to 40,000 ft. The operational frequency band of the Radar RAWL -02 MK-IA is L band. The application of this band together with the use of Solid State Transmitter with optimum duty ratio guarantees long range surveillance and better probability of detection.

SALIENT FEATURES:

- Long range air warning
- High gain Antenna with low side lobes
- Two selectable antenna rotation speeds
- Solid State Transmitter (Power Amplifier based)
- Low noise receiver
- High ECM resistance
- Staggered mode of operation
- Sector transmission mode
- Clutter suppression
- Optimized digital pulse compression
- 3 pulse Canceller and FFT
- CFAR and correlation
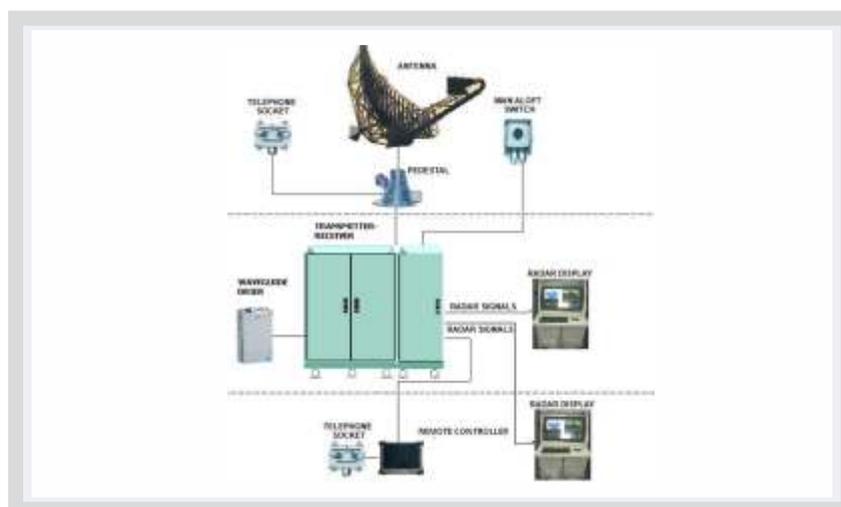
2D LONG RANGE SURVEILLANCE RADAR

5. SONARS

5.1 HULL MOUNTED SONAR X2

Hull Mounted Sonar for Surface Ships is the Sonar for frigates and destroyers class of ships. The system configuration has a modular system architecture and open standard interfaces, so that variants of the system for each class of naval ship can be configured from the same basic building blocks, without having to start from scratch. The system is supplied with associated auxiliary equipment like (i) NACS, the Nearfield Acoustic Characterisation System for calibration of transducers, (ii) Sonar domes, and (iii) Directing Gears for the transducer array.

SALIENT FEATURES:

• Range: 20-30 kms

• Simultaneous detection of 4 targets

• Reduced hardware volume

• Software based design and scalable signal conditioning

• Common wideband acoustic transducer array catering to multiple requirements of active sonar and passive sonar

HMS–X OPERATOR CONSOLE　　　　　**HMS–X ARRAY ONBOARD A DESTROYER CLASS SHIP**

5.2 SUBMARINE SONAR SUITE (SMS-X)

Submarine Sonar Suite is a compendium of multiple sensors for passive detection which collates different characteristics of the same target and provides target data through information fusion. The constituent sonars in the suite include passive sonar, active sonar, intercept sonar, obstacle avoidance sonar and underwater telephony. It is designed for EKM class of submarines.

SALIENT FEATURES:

- Easily scalable to suit submarine platforms with varying levels of displacement capacity
- Contact Motion Analysis
- Automatic Torpedo Detection
- End-to-End redundancy for passive sonar systems and improved values of MTBF (Mean Time Before failure)
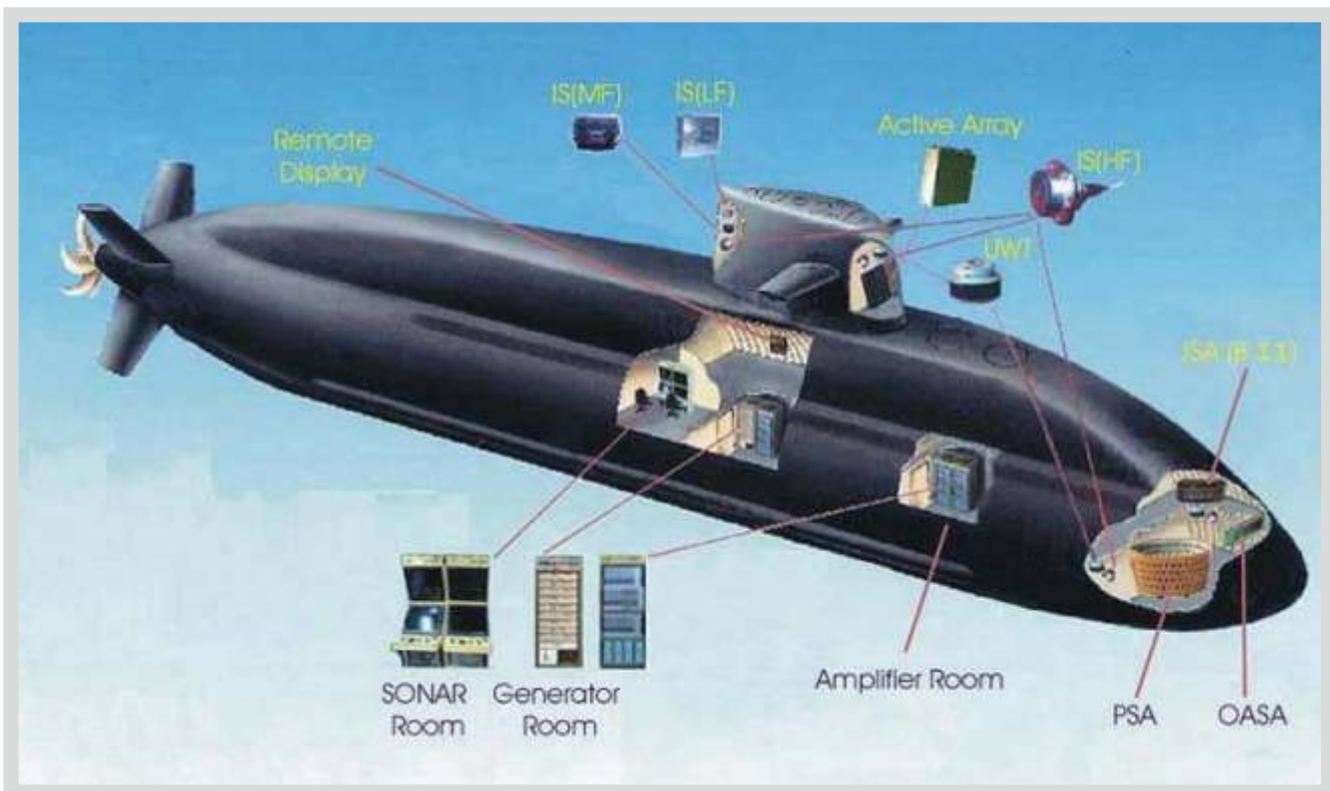
SUBMARINE SONAR SUITE (SMS-X)

5.3 ADVANCED TORPEDO DEFENCE SYSTEM FOR SHIPS WITH EXPENDABLE DECOYS

Advanced Torpedo Defence System for Ships is a fully integrated system having both torpedo detection and countermeasure capability. The system comprises of two sonars namely a hull mounted sonar and a towed array sonar for passive detection. It is a complete package involving sensors and decoys for defence against vintage as well as modern torpedoes. Acoustic decoying is effected using two types of decoys namely the towed and expendable decoys. The decoys work automatically and choose the appropriate mode of working depending on the incoming signature from the torpedo. The data from the sonar is processed in the Fire Control System (FCS).

SALIENT FEATURES:

- Acoustic decoying of the torpedo
- Classification & localisation of torpedo along with target motion parameters
- Intelligent soft kill decoy systems with multi-mode operational capability
- ECS for escape parameters
- Hydraulically operated winch system

ADVANCED TORPEDO DEFENCE SYSTEM FOR SHIPS WITH EXPENDABLE DECOYS

5.4 ADVANCED LIGHT TOWED ARRAY SONAR (ALTAS-X)

ALTAS-X is variable depth, active cum passive towed array ship sonar system for detection, localization and classification of submarines and torpedoes. It provides early warning of torpedo attack. It consists of a linear towed receiver array and vertical towed projector. It is deployed into the sea with the help of robotic handling gears, on-board electronics and system software for signal processing, display & recording of sonar information.

ALTAS-X has low frequency spectrum of the radiated noise, low losses of propagation and capability to operate at different depths to make best use of the prevailing hydrological conditions.

SALIENT FEATURES:

- Capable of operations in shallow and deep waters
- Advanced adaptive beam forming techniques for detection and tracking of silent submarines
- Automatic depth keeping and bottom avoidance functions
- Minimal effect of selfnoise of the platform

| OPERATOR CONSOLE | WINCH & HANDLING SYSTEM | TOW BODY DEPLOYMENT |

IAC MOD 'C' FIRE CONTROL SYSTEM FOR TORPEDO & ROCKETS

Integrated ASW Complex MOD 'C' (IAC MOD 'C')

IAC MOD'C' is a modular and fault tolerant fire control system with open system architecture and multiple redundancy for all crucial modules / sub systems of the system. It is capable to compute Contact Motion analysis (CMA) for active & passive SONAR targets and RADAR targets using state of the art tracking algorithms.

SALIENT FEATURES:

- Designation of multiple targets to attack
- Capable to generate Fire Control solution for all tracked targets within 10 sec
- Generates recommendations on own ship Course and speed to attain the weapon release point at the earliest
- Displays tracks from on-board Sonar systems and track data of on-board radars

CONSOLE 1
(ASW Console)

WDC 1
(For ASW Rocket launcher)

WDC 2
(For Russian Torpedo Tube Launcher)

IAC MOD 'C' FIRE CONTROL SYSTEM FOR TORPEDO & ROCKETS

C. AIRBORNE SYSTEMS

RADAR WARNING RECEIVERS

Radar Warning Receivers (RWR) is part of ESM system operating in the frequency range of 1 to 18 GHz. It intercepts, detects and identifies all types of ground and air borne emitters (Pulse, CW, ICW, Pulse Doppler, PRF agile, Frequency agile) and presents them on Multifunction Displays with the help of alphanumeric/special colour symbols and audio.

SALIENT FEATURES

- Futuristic design towards realisation of multi-spectral warners.
- Compact size, light weight, less no. of LRUs.
- High sensitivity.
- High direction finding accuracy.
- State of the art Digital Signal Processing (DSP) based architecture for faster processing & higher pulse density handling ; software intensive.
- Man /machine interface: Situation display & control of RWR operation trough function keys on MFD. Separate RWR ON/ OFF switch in the cockpit.

RADAR WARNING RECEIVERS

D. C4I SYSTEMS

7.1 COASTAL RADAR SYSTEM

Coastal Radar System is designed to be the control centre of the platform which shall integrate information from its own data sources and collect information from other paltforms using a communication suite, to provide the command team a single point information amalgamation for situational awareness, tactical and mission planning and threat assessment.

SALIENT FEATURES

- Establishes Wide Area Network among Naval Units (Aircrafts, Ships, Submarines, and Shore Establishments etc.) over radio circuits, SATCOM etc. for exchange of tactical data to achieve a common operational picture across platforms
- Tactical data handling & Message Handling
- Supports data rates up to 9600 bps
- Provides balanced analog PTT/Mic/Spk signals for interface with V/UHF and HF radios on-board

COASTAL RADAR SYSTEM

7.2 COMBAT MANAGEMENT SYSTEM (CMS)

CMS automates tactical data handling from the ship's sensors and provide a Decision support system to the command. It gathers data from ships / helicopters / aircrafts in the fleet through data link to collate, process, integrate and present a comprehensive tactical picture of the area of operation and also acquires, stores, processes, integrates, correlates & displays tactical data (both raw & processed) from various sensors in real time.

SALIENT FEATURES

- Continuous Identification & Classification of air, surface & sub-surface targets, carry out threat assessment & automatically advise the command on their engagement
- Can advise the Command on course of action when activated by events occurring in the equipments that are integrated
- Designates sub-surface, surface and air targets to the fire control system
- Monitors the execution of weapon firing and display the status of weapons communication etc. after firing

COMBAT MANAGEMENT SYSTEM (CMS)

7.3 BORDER SURVEILLANCE SYSTEM (BOSS)

Border Surveillance System (BOSS) provides all weather surveillance for day/night monitoring of Border areas. It consists of Battle Field Surveillance Radar (BFSR) and Electro-Optical (EO) sensors (Day/ night cameras, eye-safe LRF and geo location sensors) mounted on the Pan-Tilt platform powered with renewable energy source.

SALIENT FEATURES:

- Automatic Motion detection
- Remote operation capability :20 km (wired & wireless)
- On-site recording (14 Days)
- Networkable
- Equipped with Hybrid power source (15 days backup)

BORDER SURVEILLANCE SYSTEM (BOSS)

E. COMMUNICATION SYSTEMS

SOFTWARE DEFINE RADIO HANDHELD

UHF Handheld Transceiver is developed to meet the required short range ground to ground, ground to ship and ship to ship communication needs with protection against Electronic Counter Measures (ECM). The radio is provided with high-grade crypto frequency hopping.

SALIENT FEATURES:

- Frequency range   :   108-155.975 MHz and 225-399.975 MHz
- Channels   :   Up to 8920 channels at 25 KHz spacing
- Preset channels   :   40 in FF/Secure/ECCM mode
- Operating mode   :   Simplex
- Type of emission   :   AM, FM, FSK
- Mode of operation   :   Clear/ Secure/ Frequency Hopping (UHF Band)
- Frequency stability   :   ±5 ppm
- Hop rate   :   100 hop/sec
- Synchronisation   :   Master/Salve (TOD Held by Stable clock)
- Data rate   :   Up to 8Kbps Sync in (FF/FH) mode

SOFTWARE DEFINE RADIO HANDHELD

SOFTWARE DEFINE RADIO MANPACK

BEL SDR Manpack radio is a Next Generation, Multi-band, High data rate, IP radio with Mobile Ad hoc Networking (MANET) functionality. The radio works in wide frequency band in V/UHF range of 30 - 512MHz. The radio works in Frequency Hopping (FH) and Fixed Frequency (FF) modes with built-in-high-grade digital secrecy in voice and data modes. The radio is built around latest state of the art hardware using DSP and FPGA. The radio is designed as 10W man pack transceiver and has in-built MANET feature supporting up to 32 nodes and 5 Hops. The network is self-forming and self-healing and support network throughput up to 1Mbps.

SALIENT FEATURES:

- State of the art software intensive IP radio
- Frequency Range : 30 MHz to 512 MHz
- IP based Mobile Adhoc Networking (MANET) upto 32 nodes
- Self configuring, Self healing network
- Frequency Hopping: 500 Hops / second
- Data rate: upto 1Mbps network throughput
- Plug In secrecy module with built in encryption
- Waveform loading through Front Panel
- Robust connectivity in tactical battle field co nditions
- Simultaneous voice & Data services
- Selective / Group Calling

SOFTWARE DEFINE RADIO MANPACK

8.3 SOFTWARE DEFINE RADIO – NAVAL COMMUNICATION

SDR-NC is a Multi-mode, Multi Band shipborne Software Defined Radio (SDR) for Naval Communication in 3 to 512 MHz RF band. The SDR has high assurance security architecture and high level software operating environment in line with Software Communication Architecture (SCA) standard. The radio has accessories for remote control operations and security management.

SALIENT FEATURES:

- Re-Configurable and upgradable through Software
- SCA 2.2.2
- Integrated secure speech and ECCM enabled data communication integrated HMI

SOFTWARE DEFINE RADIO – NAVAL COMMUNICATION

SOFTWARE DEFINE RADIO – TACTICAL

SDR-TAC provides Ship-to-Coast, Ship-to-Air and Ship-to-Ship communication and network-centric applications in both narrowband and wideband communication in V/UHF and L-Band. The Radio system provides four channel capability. TAC is a 19" rack-mount enclosure designed for rugged and reliable operations to withstand extreme environmental conditions of temperature, humidity, shock and vibration.

SALIENT FEATURES:

- RF bands: 30-512 MHz (V/UHF), 960-1240 MHz (L Band)
- Simultaneous four channel operation
- Mode of Operation: Fixed Freq. & Freq. Hopping
- Integrated secure speech and ECCM enabled Mobile Adhoc Networking (MANET) waveforms
- Data Rate :64 Kbps to 6 Mbps

SOFTWARE DEFINE RADIO – TACTICAL

8.5 QUAD DIVERSITY TROPOSCATTER MODEM

Quad diversity Tropo-scatter modem provides communication beyond the horizon by using a radio path through the troposphere. The Tropo channel has severe frequency selective fading with time variant deep fades due to varying weather conditions. OFDM based Quad Diversity Modem combats Long/short term fading behavior of Tropo Channel.

SALIENT FEATURES:

- Frequency: 1.7-2.1 GHz
- Data Rate: Upto 21 Mbps
- Data Interface: L2 Gigabit Ethernet
- Monitoring & Control: SNMP

QUAD DIVERSITY TROPOSCATTER MODEM

HIGH DATA RATE VLF COMMUNICATION SYSTEM

HD-VLF Communication System provides secure transmission and reception of data at 800 bps. It comprises of HD-VLF Modulator and HD-VLF Receiver, HD-VLF Modulator has the capability to broadcast secure VLF data in interface with high power VLF transmitter, HD-VLF Receivers are capable of receiving VLF and HF broadcast data.

SALIENT FEATURES:

- Frequency Band - 10 kHz to 30 MHz
- User Throughput - up to 800 bps (VLF)
- VLF Modulation - GMSK, MSK, CW, OOK
- HF Modulation - CW, AM, DSB, USB, LSB, ISB
- Online secrecy

HIGH DATA RATE VLF COMMUNICATION SYSTEM

8.7 COMBAT NET RADIO MK-II FOR ARMOURED FIGHTING VEHICLE

CNR MK-II is a Next Generation tactical radio with software configurable features. The radio is designed primarily for tank and Armored Vehicle role. The radio works in frequency VHF band in range of 30 - 88MHz. The radio works in Frequency Hopping (FH) and Fixed Frequency (FF) modes with built-in-high-grade digital secrecy in voice and data modes. The radio is built around latest state of the art hardware using DSP and FPGA. The radio is backward compatible with legacy STARS-V MK II radio in Clear, Secureand Frequency Hopping modes of operation. The radio has ECCM feature with hop rate of 250 hops per second. Radio has capability of data communication with maximum data rate of 19.2 Kbps

SALIENT FEATURES:

- • State of the art software intensive design
- • Frequency Range : 30 MHz to 88 MHz
- • Ethernet and RS232 Interface
- • Selective and group calling facility
- • Frequency Hopping: 250 Hops / second.
- • Data rate: up to 19.2 kbps
- • Built in encryption

COMBAT NET RADIO MK-II FOR ARMOURED FIGHTING VEHICLE

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DATA RADIO – DPWCS

Data Radio-DPWCS is a UHF transreceiver in 400-470 MHz frequency band for data communication link between two nodes. That radio has high power (10W) transmitter and two receivers operated in Diversity Reception mode. The diversity reception helps in improved data connection wherein there is signal fading due to reflections. The radio offers ethernet connection for NMS operation. The radio provides data integrity in adverse conditions.

SALIENT FEATURES

- Frequency Band 400 – 470 MHz
- Data Rate – 50 kbps max
- Type of Emission - GFSK, DSSS
- Mode of Communication – Half Duplex
- Data Interface – Serial/Ethernet
- Diversity – Space Diversity Reception
- Operating Voltage – 11.8 V to 30V
- Deployment- Railways (Inside Loco)

DATA RADIO – DPWCS

8.9 SECURE DIGITAL MOBILE RADIO

The Secure Digital Mobile Radio a 25W digital protocol radio with built in encryption for high end secrecy requirement. The encryption card is fitted inside the radio and customized algorithnm is ported on encryption card to provide high grade end to end secracy .It is capable of providing line of sight (LOS) communication in clear and secure mode with short data messages. The Vehicle mounted radio operated radio is compatable with legacy radios in clear FM mode and other DMR radios in digital mode. The Radio communication protocol complies ETSI standard for DMR protocol.

SALIENT FEATURES

- DMR (Direct/Repeater)
- Analog 12.5 KHz/25KHz
- AES Encryption, Custom Encryption (SAG gradable)
- DMR Individual Call, DMR Group Call, DMR Broadcast Call
- SMS
- DMR Remote Monitor/ DMR Radio Check
- DMR Radio Enable/Disable
- DMR Call Alert/ Caller ID Display
- DMR Repeater/ Talk Around Support

SECURE DIGITAL MOBILE RADIO

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The Secure Digital Mobile Radio (DMR) is multi digital protocol radio with built in encryption card for high end secrecy requirements. It is capable of providing line of sight (LOS) communication in clear and secure mode along with short data messages. The battery operated radio is compatible with legacy radio in clear FM mode and other DMR radios in digital mode and complies ETSI standard for DMR protocol.

SALIENT FEATURES

- DMR (Direct/Repeater)
- Analog 12.5 KHz
- Dual Capacity Direct Mode
- AES/Built In Graded Encryption
- DMR Group Call
- DMR Individual Call
- DMR Emergency call , DMR Broadcast Call
- DMR SDS
- DMR Radio Check and DMR Radio Enable/Disable
- DMR Call Alert
- DMR Repeater / Talk Around Support
- DMR Late Entry
- ANALOG RX/TX Squelch Mode : Carrier
- Emergency Alarm and Lone Worker
- Mandown Feature and Low battery alert / Battery Strength Indicator
- Caller ID Display
- GPS

DIGITAL MOBILE RADIO-HAND HELD

HIGH CAPACITY RADIO RELAY

The High Capacity Radio Relay equipment provides reliable and secure tactical communication links in the hostile Electronic Warfare (EW) environment. It is a full duplex communication equipment, designed to operate through line-of-sight radio path, for military use. The equipment operates in the frequency range of 4.4 - 5 GHz. User data rates of 2/8/34/100 Mbps are supported by the equipment. Various kind of data interfaces are provided viz. IP interface, E1 as per ITU – G.703, E3 as per ITU – G.703. The radio is provided with an ngineering Order Wire (EOW) service. The equipment is modular in construction for the ease of maintenance and repair.

SALIENT FEATURES:

- High Capacity upto 100Mbps
- In-built IP and TDM multiplexer
- Frequency Hopping 1000hops/sec
- PTP and PTMP role
- Auto power control
- Auto frequency evasion
- High gain directional antenna
- BITE facility
- FEC and Interleaving
- Management: EMS/ NMS
- IDU&ODU architecture separable upto 2Km
- EOW – Selective/Broadcast

INDOOR UNIT   OUTDOOR UNIT

HIGH CAPACITY RADIO RELAY

HF-SOFTWARE DEFINED RADIO

HF-SDR radio is an advanced and flexible 20 W HF/SSB radio set for short and medium range communication The radio is built on open frame architecture in compliance with SCA 4.1. This radio is based on SDR technology with inter-operability and wave-form portability.

Radio provides a complete solution to communication requirements in the crowded HF band, even under the electronic warfare (EW) conditions expected on the modern battlefield. The radio offers secure transmission in voice and data communication. Communication reliability and quality is improved by means of automatic frequency management and automatic link establishment (3G-ALE). The radio can be used with wide range antennas, including lightweight foldable whip for portable operation, man portable NVIS antennas, dipole, long wire and many other broadband antennas for static operation.

SALIENT FEATURES:

Radio architecture	:	SDR in line with SCA 4.1
Frequency Range	:	1.5MHz to 30MHz
Modes of Operation	:	Clear, Secure, FH
Frequency Management	:	Single, Dual, 2G/3G-ALE
Digital Voice	:	600/1200/2400 bps TWELP
Power Output	:	5W/10W/20W selectable
Configurable Bandwidth	:	Up to 24 Khz
Spectrum Scanning	:	Complete band scanning with master channel facility
GPS Facility	:	In-built GPS for synchronization and location

polling with IRNSS and GAGAN

HF-SDR

F. ELECTRO OPTICS & LASER SYSTEMS

9.1 LASER RANGE FINDER EYE SAFE (LRF-312)

Laser Range Finder Eye safe Class-1 (LRF-312) is a lightweight LRF designed to measure the distance of target up to 20 Km range accurately and Azimuth / Elevation instantaneously.

SALIENT FEATURES:

- Class -1 Eye safe
- Light Weight
- Simple to Operate
- Built-in Sighting Telescope with magnification
- Operates with Customized Battery Pack or 8x AA size Battery cells
- Remote readout, Remote Triggering through RS422 / RS232 selectable Serial Interface
- Built-in Compass and Inclinometer (Optional)
- Meets Military Specifications

LASER RANGE FINDER EYE SAFE (LRF-312)

9.2 MINI LRF

Mini Eye safe Laser Range Finder, MLRF is a compact and light weight equipment, which enables the user to measure distances to non-cooperative targets. It can easily be integrated with Day or Night Sights.

SALIENT FEATURES:

- Compact design
- Simple to Operate
- Ranging operation (1 PPS)
- Built - in -Test facility
- RS 422 interface
- Meets Military Specs

MINI LRF

9.3 LIGHT WEIGHT LASER TARGET DESIGNATOR

Light weight Laser Target Designator (LLTD) is used for ranging & illuminating enemy target with high repetition rate laser, so that Laser guided ammunition such as Laser guided missiles and bombs can receive the scattered laser radiation from target and home on it.

SALIENT FEATURES:

- Light Weight
- Simple to Operate
- Battery Powered
- Built in Sighting Telescope With magnification
- Remote Readout, Remote Triggering through RS 422 Serial Interface
- Meets Military Specifications

LIGHT WEIGHT LASER TARGET DESIGNATOR

9.4

THERMAL SIGHT FOR ASSAULT RIFLE UNCOOLED

Uncooled Thermal Weapon Sight for Assault Rifle is an Uncooled TI based System which is compact and lightweight monocular using Gen-III Uncooled Thermal imagery principle. Uncooled Sight for Assault Rifle is a state of the art thermal weapon sight required for use of ground forces for surveillance, observation and fire fighting during night The Uncooled Thermal Weapon Sight is rugged with exterior powder coating and composite non-breakable material. It is completely passive and silent in operation.

SALIENT FEATURES:

- Compact, light weight, rugged and ergonomic design.
- 3rd Gen Uncooled amorphous Silicon detector
- Equipment is portable and provides adequate flexibility to move easily.
- Allows the user to look comfortably through the eye over extended periods of time.
- Electronically generated reticule for accurate aiming of target.

THERMAL SIGHT FOR ASSAULT RIFLE UNCOOLED

9.5 MULTI-FUNCTION HAND HELD THERMAL IMAGER

Multi-function Hand Held Thermal Imager   is a cooled TI based integrated day/night sight with in-built eye safe Laser Range Finder, Digital Magnetic Compass, Colour CCD and GPS. This equipment is capable of giving range, azimuth & elevation and also coordinates of the target. This is highly useful to Army and Navy for effective engagement of targets.

SALIENT FEATURES:

- Compact and ergonomic design
- High performance, MWIR, 3rd Gen, Indium Antimonide detector
- In-built Class-1, Eye safe LRF
- Integral day sight, colour CCD camera, digital magnetic compass and GPS
- Binocular design with inter-ocular and inter-pupillary distance adjustments
- Display of range, azimuth, elevation, coordinates and other data

MULTI–FUNCTION HAND HELD THERMAL IMAGER

9.6

HAND HELD THERMAL IMAGE BINOCULAR (UNCOOLED)

Uncooled HHTI (BINOCULAR) is an advanced night vision system, which is compact and lightweight and uses Uncooled Thermal imagery principle. The Uncooled HHTI (BINOCULAR) is rugged with exterior powder coating and composite non-breakable material. It is completely passive and silent in operation.The uncooled Thermal Imager having a detector system with OLED Display having minimum resolution 640x480.

SALIENT FEATURES:

- Compact, light weight, rugged and ergonomic design.
- 3rd Gen Uncooled detector
- Binocular design with inter-ocular and inter-pupillary distance adjustments
- Equipment is portable and provides adequate flexibility to move easily.
- Allows the user to look comfortably through the binocular eye piece over extended periods of time.
- Capability to produce real time video
- Low Battery Indication
- In built system for marking range

HAND HELD THERMAL IMAGE BINOCULAR (UNCOOLED)

9.7 PASSIVE NIGHT VISION SYSTEMS

9.7.1 PASSIVE NIGHT SIGHT FOR INSAS RIFLE/LMG

Advanced passive night sight is a weapon sight system designed to be mounted on different assault ifles / INSAS Rifle / LMG. Its innovative design enables users to lower the distance between the weapon and sight. LOS resulting more comfortable aiming position. An illuminated Red Cross reticule with switchable brightness levels maintains reticule definition, allowing fire control for target engagement.

SALIENT FEATURES:

- Strain free viewing
- II Tube with built in bright source protection, reverse polarity protection & Automatic Brightness control (ABC)
- Light weight, compact and rugged

PASSIVE NIGHT SIGHT FOR INSAS RIFLE/LMG

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PASSIVE NIGHT SIGHT FOR ROCKET LAUNCHER

Advanced passive night sight is a weapon sight system designed to be mounted on different Rocket launchers. Its innovative design enables users to lower the distance between the weapon and sight. LOS resulting more comfortable aiming position. An illuminated Red Cross reticule with switchable brightness levels maintains reticule definition, allowing fire control for target engagement.

SALIENT FEATURES:
- Strain free viewing
- II Tube with built in bright source protection, reverse polarity protection & Automatic Brightness control (ABC)
- Light weight, compact and rugged

PASSIVE NIGHT SIGHT FOR ROCKET LAUNCHER

9.7.3

PASSIVE NIGHT VISION BINOCULAR

Passive Night Vision Binocular is a lightweight, durable, water proof and compact night vision device. It is a single tube full field binocular system. It is fitted with XD-4 High Performance Tube and adjustable eyepiece. It is an ideal device for surveillance, patrolling and reconnaissance in the night.

SALIENT FEATURES:

- Full field viewing
- Compact and ergonomic
- II Tube with built in bright source protection, reverse polarity protection & Automatic Gain Control (AGC)
- Hermetical sealing
- Inter-ocular and Dioptric adjustment
- Infra Red Illuminator
- Low battery Indicator
- Bright light cut off facility while exposing high light.
- Water resistant at 1meter deep for 30 minutes.

PASSIVE NIGHT VISION BINOCULAR

9.7.4 PASSIVE NIGHT VISION GOGGLES

Advanced Passive Night Vision Goggle is a lightweight, durable, water resistant and compact night vision device. It is a single tube full field binocular system. It is fitted with High performance Autogated XD4 II Tube and adjustable eyepiece. It is an ideal device for surveillance, patrolling and reconnaissance in the night.

SALIENT FEATURES:

- Full field viewing
- Compact and ergonomic
- Autogated II Tube with built in bright source protection, reverse polarity protection & Automatic Brightness control (ABC)
- Hermetical sealing with nitrogen filling and   water resistant
- Inter-ocular and Dioptric adjustment
- Infra Red Illuminator for map reading
- Low battery Indicator
- Bright light cut off facility
- Operates on 1.5V AA size batteries

PASSIVE NIGHT VISION GOGGLE

PASSIVE NIGHT VISION MONOCULAR

Night Vision Monocular is light weight device capable of being used as a hand held viewer, face & helmet mounted for night patrolling and surveillance and night firing. It is easily used as a hand held viewer, face & helmet mounted. It is provided with an Infrared Laser Illuminator for use in totally dark environment for recognition of ranges of 125 mtrs or better.

SALIENT FEATURES:

- Strain free viewing
- Military Grade II Tube with built in bright source protection, reverse polarity protection & Automatic Brightness control (ABC).
- Works with Commercially available Primary/ rechargeable btys.
- Battery will run at least 8 hrs.

PASSIVE NIGHT VISION MONOCULAR

G. SOFTWARE AND SIMULATORS

10.1 SOFTWARE SOLUTIONS

Software hubs of BEL, located at Bengaluru and Ghaziabad (CMMI Level 5 Certified) offer complete Software Solutions for Defence, Paramilitary, smart city & e-governance domains. The software solutions of BEL are characterized by high level of customization, integration with legacy systems use of state of art technologies & industry standard practices.

MAJOR SOFTWARE MODULES INCLUDE:

BEL e-Sammelan Tool (BEST) for virtual meetings.
* Attendance and Access Control
* Video Management and Video Analytics
* Smart City Platform
* BEL Public Key Infrastructure Solution (BESafe)
* GIS for Military Applications
* Network Management System (NMS)
* Secure Tactical Radio System (STARS) Visualizer for Defence
* Debrief Display
* Weapon / Ballistics Control Module
* Threat Computation Module
* Multi-Sensor Tracking and Fusion
* Planning of Radio Frequency in Adverse Situation (PORAS)
* **AI BASED SOLUTIONS**
* Adversary Network Analysis Tool (ANANT)
* Face Recognition System
* Social Media Analysis

SOFTWARE SOLUTIONS

10.2 SOFTWARE SERVICES

BEL's Software Division setup in 1996 at Bengaluru primary for application software development of in house software intensive projects, has grown into self-sufficient SBU offering Software Development & Quality Assurance services. BEL is Cyber Emergency Response Team (CERT-IN) empaneled as an IT Security organization comprising Vulnerability Assessment and Penetration Testing (VAPT) and Security Compliance Audits. BEL's Software Center has also got design house approval from Centre for Military Airworthiness & Certification (CEMILAC) for performing Independent Verification and Validation (IV&V):

- IV&V (Independent Verification & Validation)
- VAPT (Vulnerability Assessment & Penetration Testing)
- IT Security Audits based on ISO 27001
- Software Quality Assurance
- Custom Software Development
- Cyber Security Solutions

SOFTWARE SERVICES

H. ENERGY STORAGE DEVICES

11.1 PRIMARY AND SECONDARY BATTERIES

- State of the art infrastructure for Design, Development and Manufacturing of MIL-Grade battery packs of Li-Ion, NiCd, NiMH, LISO2, LiSOCl2, LiMnO2, LTC chemistries complying with IEC61951, IEC 61960, COAL603, COAL624, CQAL6140 etc. for Defence.
- More Than three decades of experience in Development and Manufacturing.
- Indigenous power packs for NATO equipments.

⚡ RECHARGEABLE BATTERIES

Li-ion Batteries
Voltage: 3.6 V to 30 V
Capacity: 1.5 Ah to 100 Ah
Operating Temp: -20°C to +60°C

Ni-MH Batteries
Voltage: 1.2 V to 12 V
Capacity: 3.5 Ah to 10 Ah
Operating Temp: -20°C to +55°C

Ni-Cd Batteries
Voltage: 1.2 V to 24 V
Capacity: 1 Ah to 15 Ah
Operating Temp: -30°C to +65°C

⚡ NON-RECHARGEABLE BATTERIES

Li-SO$_2$ Batteries
Voltage: 3V to 30 V
Capacity: 7 Ah to 80 Ah
Operating Temp: -40°C to +70°C

Li-MnO$_2$ Batteries
Voltage: 3V to 30 V
Capacity: 10 Ah to 450 Ah
Operating Temp: -30°C to +65°C

LTC (Lithium Thionyl Chloride) Batteries
Voltage: 3.6 V to 30 V
Capacity: 1 Ah to 300 Ah
Operating Temp: -30°C to +65°C

Applications
- Portable Communication Sets, Surveillance equipments, Field Radars, etc.

Applications
- Portable Communication Sets, Surveillance equipments, Field Radars, Emergency Rescue Systems and Under water equipments

K. OFFSET AND CONTRACT MANUFACTURING

Shelters & mast Systems are designed and manufactured using state-of- the-art techniques and technologies to protect electronic equipment and other systems from severe climatic conditions, shield them against Electromagnetic Interference (EMI) and also to meet High Mobility and Rapid Deployment requirements of modem militaries around the world.

SALIENT FEATURES:

|		
ISO 1161-1980F	-	Top comer fittings
MIL STD 907/ASTM1925	-	Engineering and design criteria for shelters
MIL STD 285	-	Attenuation measurement
MIL STD 810D	-	Environmental test

MASTS AND SHELTER SOLUTIONS

12.2 ELECTRONICS SYSTEM DESIGN & MANUFACTURING (ESDM)

BEL Complete range of manufacturing and test facilities for PCB assembly, Cable Assembly, Precision Fabrication, Composites, Electro-mechanical Assembly, Super Components, Prototyping, Conformal - Coating, Burn-in and Thermal Cycling BEL is capable of any Built To Print (BTP) & Bulit To Specs (BTS) electronics systems design & manufacturing.

SALIENT FEATURES:

- Surface Mount Technology Assembly
- High mix high volume
- Low mix Low volume
- Wave soldering
- Leaded component insertion line
- X-ray and AOI Inspection
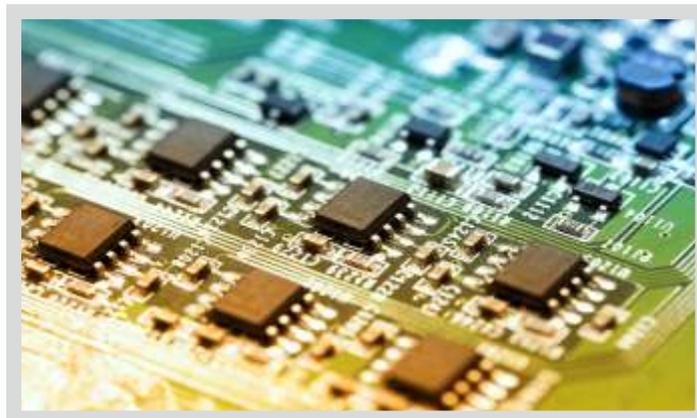
ELECTRONIC MANUFACTURING SERVICES

International Marketing Division
BHARAT ELECTRONICS LIMITED
(A Govt. of India Enterprise, Ministry of Defence)
Email: imd@bel.co.in
Website: www.bel-india.in

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