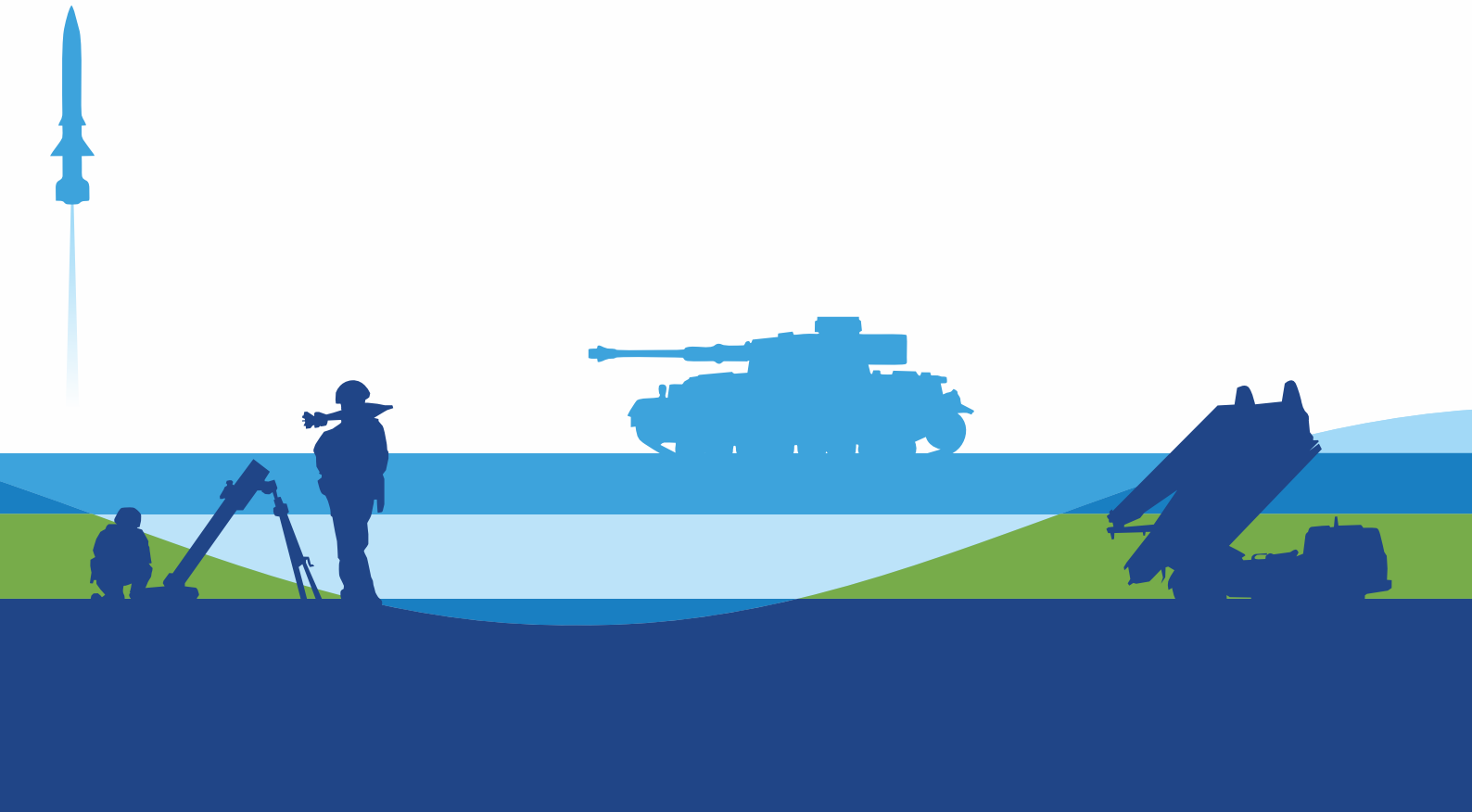
Azadi Ka Amrit Mahotsav

2023 AERO INDIA
The Runway to a Billion Opportunities

G20 भारत 2023 INDIA

# DRDO EXHIBITS


*. . . Realising the Vision of Atmanirbhar Bharat.*



# DEFENCE RESEARCH & DEVELOPMENT ORGANISATION

## Ministry of Defence, Government of India

## VISION

**Empowering the nation with state-of-the-art indigenous Defence technologies and systems.**

## MISSION

**Design, develop and lead to production of state-of-the-art sensors, weapon systems, platforms and allied equipment for our Defence Services.**

**Provide technological solutions to the Services to optimise combat effectiveness and to promote well-being of the troops.**

**Develop infrastructure and committed quality manpower and build strong indigenous technology base.**

डॉ जी. सतीश रेड्डी
FNAE, HFCSI, FRIN (London), FMACANUD (Russia), FAeSI, FRAeS (UK), FSSWR, FIET (UK), FIE, FAPAS, FIETE, AFAIAA (USA)
रक्षा मंत्री के वैज्ञानिक सलाहकार

Dr G. Satheesh Reddy
FNAE, HFCSI, FRIN (London), FMACANUD (Russia), FAeSI, FRAeS (UK), FSSWR, FIET (UK), FIE, FAPAS, FIETE, AFAIAA (USA)
Scientific Adviser to Raksha Mantri

सत्यमेव जयते

स्वच्छ भारत
एक कदम स्वच्छता की ओर

भारत सरकार
रक्षा मंत्रालय
साउथ ब्लाक
नई दिल्ली-110011

Government of India
Ministry of Defence
South Block
New Delhi-110011

## MESSAGE

I am happy to learn that Defence Research and Development Organization is exhibiting the indigenous technological developments in Aerospace as a part of Aero India 2023.

Recent developments in the field of Aerospace and Defence technologies have enhanced aerospace capability of Indian Defence. Continuous inflow of modern technology is essential to maintain superiority on the battle field. I am sure that DRDO will strive to continue with the exceptional technological progress in future to boost the combat capability of the Defence Forces. The academia, DRDO and the aerospace industry need to work together and priorities the future developments and challenges being faced in aerospace developments.

I am sanguine that the exhibition of the technological developments in Aerospace will further enhance collective understanding on future technologies and will take India closer towards its goal of attaining self-reliance in Aerospace and Defence Technologies. I extend my best wishes to the organizers of the Exhibition, whose efforts have immensely contributed in shaping the Aero India 2023.

With best wishes,

**Jai Hind**

**(Dr G Satheesh Reddy)**

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डॉ. समिर वी. कामत
Dr. Samir V. Kamat

सत्यमेव जयते
भारत सरकार
Government of India

सचिव, रक्षा अनुसंधान तथा विकास विभाग
एवं
अध्यक्ष, डीआरडीओ
Secretary, Department of Defence R&D
&
Chairman, DRDO

## MESSAGE

1. It gives me immense pleasure that Aero India Exhibition 2023 is being organized by Defence Research and Development Organisation from 13th to 17th February, 2023 at Bengaluru.

2. The displayed technological advancements in exhibition provides an ideal platform for all the participating professional, academicians, scientists and aerospace community to reconnoiter new horizons in the field of Aerospace and Defence. The interactions during the exhibition will bring in innovative thoughts and creative ideas, which will help in mapping out the future application in automation and mechanization. Defence Research and Development Organisation is marching towards "Atma Nirbhar Bharat" to keep the armed forces equipped with state-of the-art indigenous systems and create self-reliant ecosystem. I am confident that the exhibition will lead to collaborative partnership and introduction of new technologies in the field of indigenous defence production.

3. I wish the Aero India 2023 a grand success and my sincere appreciation to the organizing committee and participants of the exhibition.

Kamat

**(Dr. Samir V. Kamat)**

रक्षा मंत्रालय, रक्षा अनुसंधान तथा विकास विभाग, डीआरडीओ भवन, नई दिल्ली-110011
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डॉ. टेस्सी थॉमस
**Dr. Tessy Thomas**
विशिष्ट वैज्ञानिक
Distinguished Scientist
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Director General - Aeronautical Systems

सत्यमेव जयते

स्वच्छ भारत

एक कदम स्वच्छता की ओर

भारत सरकार, रक्षा मंत्रालय
Government of India - Ministry of Defence
रक्षा अनुसंधान तथा विकास संगठन
Defence Research & Development Organisation
एडीई कैम्पस
ADE Campus
न्यू तिप्पसन्द्रा पोस्ट, बेंगलूरु-560 075
New Thippasandra Post, Bengaluru - 560 075

## MESSAGE

I consider it a privilege to be associated with Aero India 2023 as the Chairperson of the Apex Committee for DRDO participation.

It is yet another opportunity for the DRDO to showcase the progress in latest indigenous developments and innovations in the aerospace technology through display of exhibits in Aero India 2023. The exhibition is a platform for both formal and informal interactions with various research and development organisations, government agencies, users and manufacturers. It also offers a common platform for exchanging and imparting contemporary knowledge and information in the field of aerospace technology. I am sure that, this is going to be an enriching experience for the scientists, engineers, academia and experts who have set aside their valuable time to be a part of this exhibition.

I commend the organisers of the exhibition for relentlessly working to make the event a grand success.

**Dr. Tessy Thomas**
**DS & DG(AERO)**

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AERONAUTICAL DEVELOPMENT AGENCY
(Ministry of Defence, Govt. of India)
P B No. 1718, Vimanapura Post, Bengaluru - 560 017, India.

**Dr Girish S Deodhare**
Distinguished Scientist
Director General

## MESSAGE

I am glad to learn that Aero India Exhibition 2023 is being organized by Defence Research and Development Organisation from 13th to 17th February, 2023 at Bengaluru.

There have been significant developments in the field of aerospace technology in the recent past. DRDO has done remarkably well in promotion advancement and diffusion of knowledge of aeronautical sciences and aircraft engineering in the country. The contribution of DRDO in particular for furtherance of technology is significant.

I commend the organisers of this exhibition for relentlessly working to make the event a grand success.

(GIRISH S DEODHARE)
February 8, 2023

डॉ के राजलक्ष्मी मेनन, उत्कृष्ट वैज्ञानिक
*Dr K Rajalakshmi Menon*
Outstanding Scientist
निदेशक / Director

भारत सरकार – रक्षा मंत्रालय
Government of India - Ministry of Defence
रक्षा अनुसंधान तथा विकास संगठन
Defence Research & Development Organisation
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## MESSAGE

I am extremely happy and delighted to note that Defence Research & Development Organization (DRDO) is organizing Aero India Exhibition 2023 from 13th to 17th February, 2023 at Bengaluru.

Indian aerospace industry today is on the threshold of entering into a new era assuming greater responsibility in making the nation self-reliant in the field of aerospace. This would not have been possible without the efforts of the scientists, professionals, engineers, academic institutions and the Indian industry partners who have taken up the challenge to keep pace with the international standards. The exhibition will provide an appropriate platform for exchange of ideas for collaborative approach in the field of aerospace technologies.

India's achievements in the field of Fighter Aircraft, Airborne Sensors, Light Combat Aircraft, Missiles, Advance Light Utility Helicopters, Indigenous Rocket and Satellite technologies, Propulsion systems etc. has been recognized throughout the world.

I am very happy that a compendium of DRDO exhibits is being released during the Aero India 2023 exhibition to show case the capability.

8th February 2023

(Dr K Rajalakshmi Menon)

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वै. दिलीप
उत्कृष्ट वैज्ञानिक एवं निदेशक

**Y. DILIP**
**Outstanding Scientist & Director**

भारत सरकार, रक्षा मंत्रालय,
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**Defence Research & Development Organisation,**
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**Post Box No 9302, C.V.Raman Nagar,**
**Bengaluru – 560 093**

## MESSAGE

I am very pleased to know that Aero India Exhibition 2023 is being organized by Defence Research and Development Organisation from 13th to 17th February, 2023 at Bengaluru.

DRDO has made significant contribution in the field of Aerospace in Defence. DRDO is supporting Indian armed forces with a wide range of strategic defence equipments and technologies. The Organisation is committed to make India self-reliant in defence weaponry and delivery systems by providing the country with an array of aerospace systems. Futuristic Defence & Aerospace technologies necessitate persistent efforts for improvement of existing systems and introduce new capabilities.

I extend my greetings and best wishes to the organizers and participants of the exhibition and wish the exhibition a grand success.

**(Y Dilip)**
**OS & Director**

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## Indoor Pavilion Tech Zone



## India Pavilion Display

## Flying Display at Aero Show

# Indoor Pavilion Tech Zone

## Combat Aircraft & UAVs

## Missiles & Strategic Systems

## Engine & Propulsion Systems



## Airborne Surveillance Systems

## Sensor, Electronic Warfare & Communication Systems

## Parachute & Drop Systems



## Naval Systems

## Microelectronics, AI / ML & Cyber

## Materials

## Land Systems & Munitions

## Life Support Systems



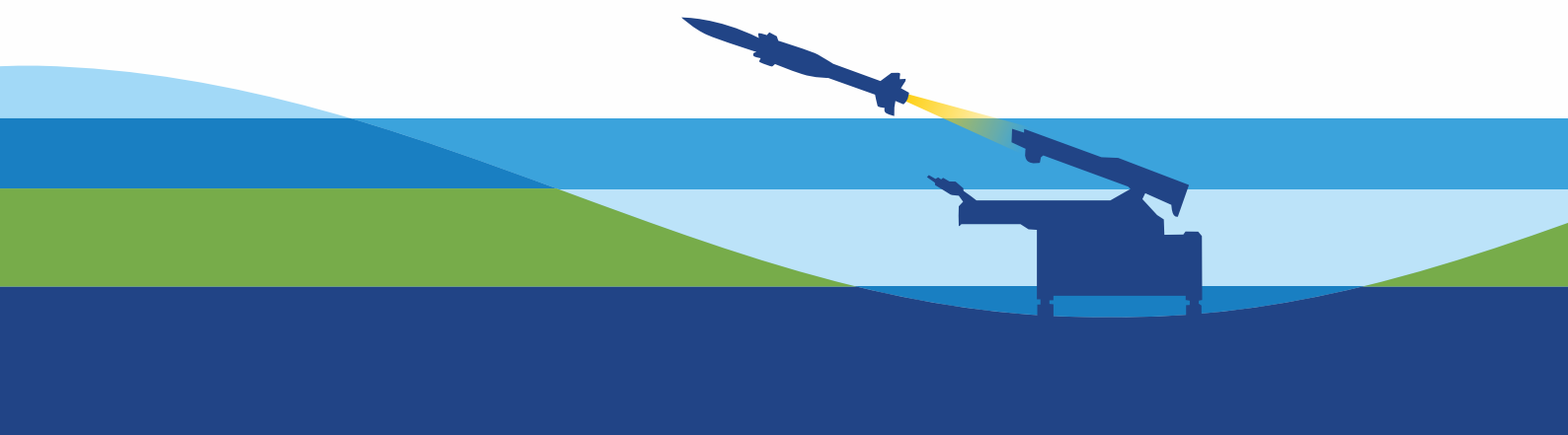
## Industry and Academia Outreach

## India Pavilion Display



## Flying Display at Aero Show

# Indoor Pavilion Tech Zone



# Combat Aircraft & UAVs

# Advanced Medium Combat Aircraft (AMCA)

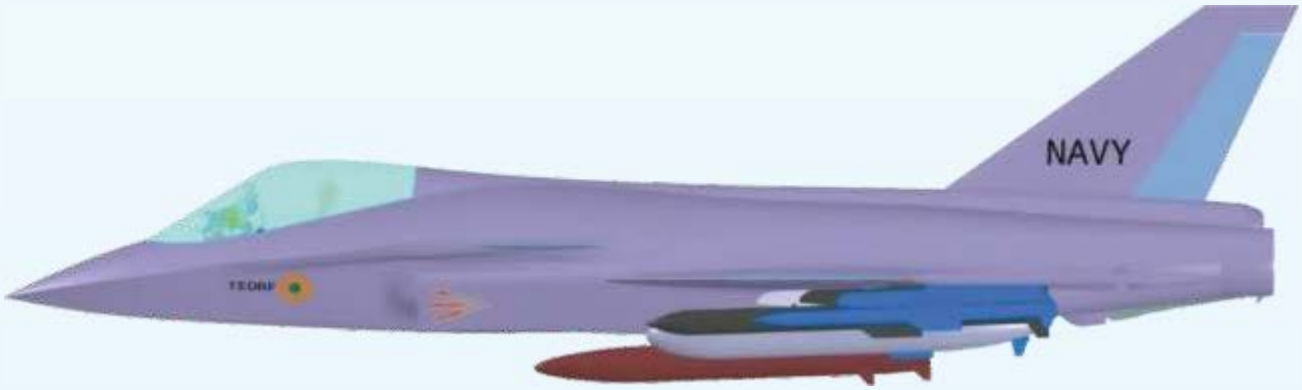
- 5th Generation, medium weight, multi-role twin engine stealth fighter airctaft
- Swing role capability

## LCA AF Mk-II

- State-of-the-art multi-role supersonic fighter aircraft having delta wing and close coupled canard
- Long range with inflight refuelling
- Fly-by-wire aircraft with carefree maneuverability
- Armed with beyond visual range Air-to-Air Missile and heavy stand-off Air-to-Ground weapons
- Equipped with Active Electronically Scanned Array (AESA) radar and Infra-Red Search and Track (IRST) Sensors, Missile Approach Warning System (MAWS), Counter Measures Dispensing System (CMDS), Electronic Warfare Suite

## Twin Engine Deck Based Fighter (TEDBF)

- Twin engine, single seat carrier borne fighter aircraft
- Operates with concept of Ski-jump Take Off But Arrested Recovery (STOBAR)



## LCA Navy Mk-I Trainer

- LCA Navy Mk1 is the country's first attempt towards development of a formidable air element for Navy. The aircraft will operate from an aircraft carrier using the concept of Ski-jump Take-off But Arrested Recovery (STOBAR). The aircraft takes off from a Ski-jump ramp in about 200 metres and is recovered on board in 90 metres, by engaging its arrester hook with the arresting gear wire on the carrier. LCA Navy, with its primary roles of Air Defence, and secondary roles of Anti-ship strike and Interception will complement other aircraft on Indian Navy aircraft carriers.

## LCA AF Mk-I

- India's signature in the sky
- Equipped with advanced digital fly-by-wire control system
- Multi-mode radar, compound delta wing with all glass cockpit
- Excellent maneuverability

## Stabilator Actuator

- System Pressure : 280 bar
- Type : Direct Drive Valve based
- Redundancy Mgmt. : Normal / Fail Op/ Fail Op / Fail Safe
- Bandwidth : 9 to 11 Hz
- No Load Rate : > 180 mm/sec
- Endurance : > 5 million cycles
- Operating Temperature : -54 °C to +135 °C
- Current Status : Under development

## Slat Actuators

- Technology : Electro Hydraulic Servo Valve
- Redundancy : Dual Electrical
- Force Capability : 2 Ton
- Service Life : > 3000 Hours
- Unit Cost / Weight : 30 lakhs / 4.7 kgs
- Operating Tempr : -54 °C to +135 °C
- Certified by : CEMILAC

## Aircraft Mounted Accessory Gearbox (AMAGB)

- Transmits Starter Drive from JFS to Engine
  Accessory Drive from Engine to following Accessories
  - Hydraulic pumps (2 Nos) : 60 kW @ 6000 rpm
  - Generator (1 No.) : 40 kW @ 7950 rpm
  - Jet Fuel starter (JFS) : 96 kW from 0 to 9700 rpm

## Power Take-Off Shaft (PTO Shaft)

- High power transmission capability (up to 250 hp)
- High speed of operation (up to 21,000 rpm)
- High precision, multi-plane dynamic balanced
- Ability to accommodate larger misalignments
- Higher Reliability
- Designed to negotiate higher critical speeds
- Light weight (as low as 1.6 kg)
- Back-lash free
- Lubrication free
- Corrosion proof to endure harsh environments

## 5 kW Generator

- Multi-stage brushless technology
- Light weight and high-power density
- Autonomous mode
- Embedded system based GCU
- Precise voltage regulation
- Built-in test and protection
- Compliance: MIL STD 704D, 461G

## Aerospace and Submarine Filters

- Filtration Rating : 3 Micron to 5mm
- Filtration Media : Glass fibre, SS mesh, wedge wire and poly- propylene
- Fluid Medium : Hydraulic oil, Lube oil, Fuel & Seawater
- Safety Devices : Unique By-Pass valve, Automatic shut-off valve, Clogging indicator

## Aircraft Bearings

- High Reliability 99% (L1 life)
- Wide operational temperature range -54° C to 150°C
- Made of M50 steel with VIM VAR process
- Manufactured by advanced technologies Viz,
- Cryogenic treatment at -193 C
- Vacuum Hardening at 10-2 mbar
- Machining to Dimensional and Geometric accuracy < 10 µm
- Super finishing of raceways, Ra 0.08 µm

## Landing Gear System

- Landing Gear MLG/NLG shock struts, wheel & brake system and hydraulic system were delivered & integrated in 1-Ton LG air frame.
- Drop & Strength Testing of MLG & NLG completed successfully.
- Antiskid Brake System has been designed, software developed, tested and implemented in 1-Ton LG.
- Brake system capability for holding full Engine thrust has been checked with NIKE & TRDD Engine at ATR, Chithradurga.
- Retractable LG system tested in Integrated Test Rig.
  Taxi trials of 1-Ton LG UAV carried out and Antiskid Brake System performance has been proved up to aircraft speed of 205 kmph to the satisfaction of ADE & Pilot with
- Twin NIKE Engine and TRDD Engine.
- Flight trial completed successfully.



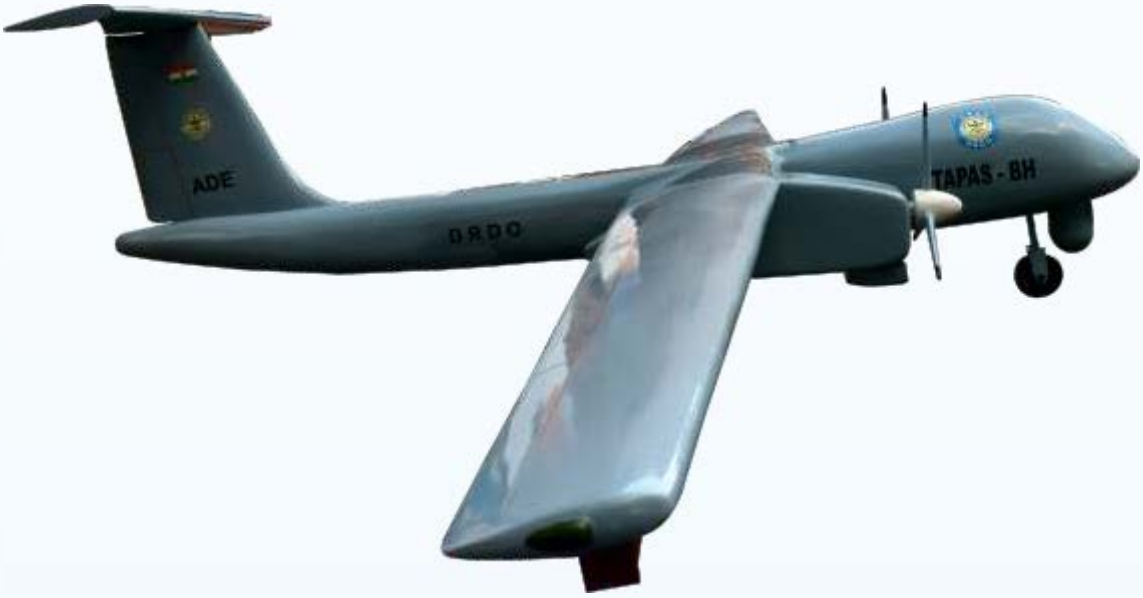
## Landing Gear System for TAPAS

- Retractable Nose Wheel Type Landing Gear System
- Hydro-gas Telescopic Shock Absorber Struts
- Steerable Nose Landing Gear
- Disc Brake to stop the aircraft within 300 meter distance
- Hydraulic system for Landing gear retraction & deployment
- Pneumatic for redundancy deployment & braking
- MIL-STD 1553B Bus based Controller with software DO 178B safety level A for landing gear operation and system health monitoring



## TAPAS BH MALE UAV System

- TAPAS is a Medium Altitude Long Endurance (MALE) UAV used for Intelligence, Surveillance, and Reconnaissance (ISR) missions. It has line of sight (LoS) range of 250 Km and Beyond Line of Sight (BLoS) up to 1000 Kms. It can operate at altitude up to 30000 ft with and endurance of 24 hours.




## ARCHER-NG Weaponised MALE UAV System

- Archer is a Short Range Weaponized UAV (SR-UAV). It is used to gather near real time, high quality imagery and signals intelligence and can destroy target of interest. It can operate at an altitude up to 22000 ft with and endurance of 12 hours and range of 220 Km with conventional and auto take-off landing.

## SR-UAV Weaponsied System

- Short Range Weaponized UAV (SR-UAV) it is used to gather near real time, high quality imagery and signals intelligence and can destroy target of interest. It can operate at an altitude up to 22000 ft with and endurance of 12 hours and range of 220 Km with conventional and auto take-off landing.

## ABHYAS

- ABHYAS is a cost effective High Speed Expendable Target System required by the tri- services for artillery practice. Air-to-Air combat and for battleship target practice. It has capability of autonomous flying from 20 m to 5 Km altitude with an endurance of more than 30 min.

# LCA FCS

- ADE is a center of excellence for design and development of integrated flight critical control system suite for combat aircrafts in the country. The Fly-by-Wire flight control system has been successfully flown on Light Combat Aircraft Tejas without any failure till date.

# Missiles & Strategic Systems

## NIRBHAY Cruise Missile

- Nirbhay is India's first subsonic cruise missile which can be launched from multiple platforms.
- It is capable of flying at low altitudes and carry conventional and strategic warheads to attack fixed or mobile land targets.


## AKASH

- SAM system for point & area defense of 27 km radius.
- Can be deployed in deserts, plains, medium & high altitude
- Configurable on prime mover – trailer or high mobility vehicles.

## Beyond Visual Range Air to Air Missile (ASTRA)

- ASTRA is a BVR (Beyond Visual Range Air to Air) class missile with proven flight range of 85+ km.
- The missile is configured with diameter of 178 mm and length of 3838 mm. Its launch mass is 170 kg.
- The missile can be fired using rail type launcher.
- It is equipped with mid-course inertial guidance system followed by terminal homing guidance.
- The mid-course guidance is carried out on the basis of target updates received via data link.
- The RF seeker provides large autonomous range for terminal phase.
- The missile is equipped with high accuracy proximity fuse and fragmented type warhead to ensure high kill probability.
- Integration of ASTRA missile with Su-30MKI has been carried out successfully.
- The missile system is platform independent and it can be integrated with other aircraft.

## Quick Reaction Surface to Air Missile (QRSAM)

- The Radars are four wall active array with capability of Search & Track on the move.
- Command & Control on the move.
- Radio & Satellite Communication on the move.
- Engagement of all Aerial Targets including low RCS targets.
- The Quick reaction time of weapon system for target engagement.

## New Generation Anti-Radiation Missile (NGARM)

- India's first indigenous Anti-Radiation Missile for SEAD Mission Role
- Suppression of Enemy Air Defences by targeting ground based Surveillance and Fire Control Radars
- Full mission range of 100 km demonstrated – range capability proven
- Captive performance evaluation of PHH and MMW seekers conducted –
- Detection and Tracking performance found satisfactory
- Project in an advanced stage of flight trial to demonstrate missions in full configuration
- Development-cum-Production Partner (DcPP) identified as a potential

## Long Range Surface - to - Air Missile (LRSAM)

- Air Defence Missile based weapon system to neutralize aerial targets up to a range of 70Km.
- System is operational with three Indian Armed Forces (Navy, Air Force & Army )
- Propulsion - Dual Pulse Solid Propellant Rocket Motor.
- Guidance - Midcourse INS with course correction with Radar data, and Terminal Active Seeker.
- Warhead - Pre-fragmented High Energy (23 kg).
- Targets - Aircraft, sub sonic and Supersonic Cruise Missile and Helicopters.
- Single Shot Kill Probability: 0.8

## Helicopter Lanched Anti -Tank Missile (HELINA)

- Lock-On-Before-Launch (LOBL)
- Fire & Forget' and 'Top Attack' Capability
- Day & Night Operation Capability
- Homing Guidance with Imaging Infra-Red (IIR) Seeker
- Warhead - HEAT
- Min - Max Range - (500 m, 7000 m)
- Platform - Advanced Light Helicopter (ALH)
- Operating Altitude - Sea Level to 6 km
- Launch Height - 10 m to 50 m above ground level

## NAG (Third Generation Anti-Tank Guided Missile)

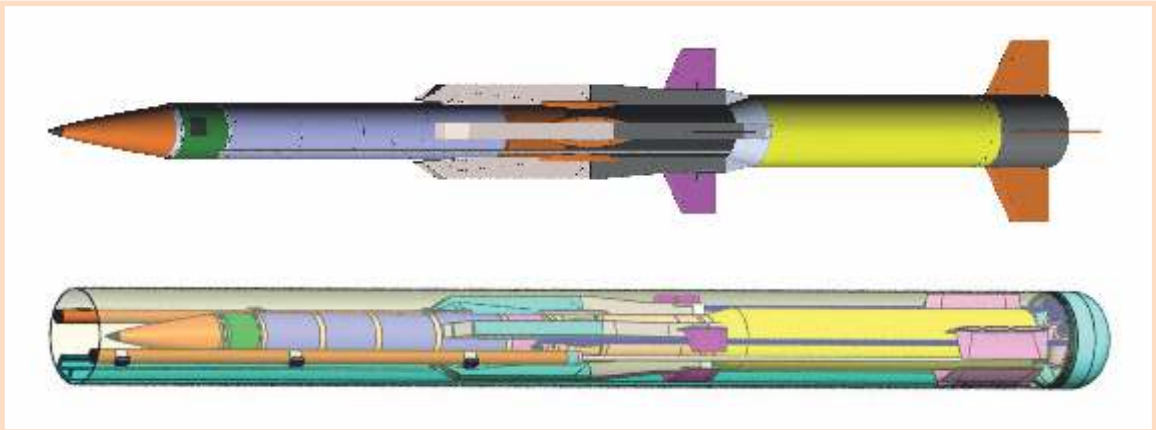
- Lock-On-Before-Launch (LOBL)
- Fire & Forget' and 'Top Attack' Capability
- Day & Night Operation Capability
- High Performance Homing Guidance with Imaging Infra-Red Seeker
- Potent Tandem Warhead –Effective Penetration in ERA Protected RHA of Enemy Tank
- Min - Max Range: (500mtr, 4000mtr)

## Man Portable Anti-Tank Guided Missile (MPATGM) Weapon System

- MPATGM is designed and developed as a 3rd Generation Fire-and-Forget missile for the Parachute, Parachute (Special Forces) and Infantry battalions of the Indian Army.
- It is intended to replace the MILAN system of France & Konkurs system of Russia in service with the Indian Army.


## Supersonic TARget (STAR)

- Anti-AWACS & Anti-Radiation Missiles to be launched from LCA Tejas.
- STAR-01 proved Catapult system and Canister configuration

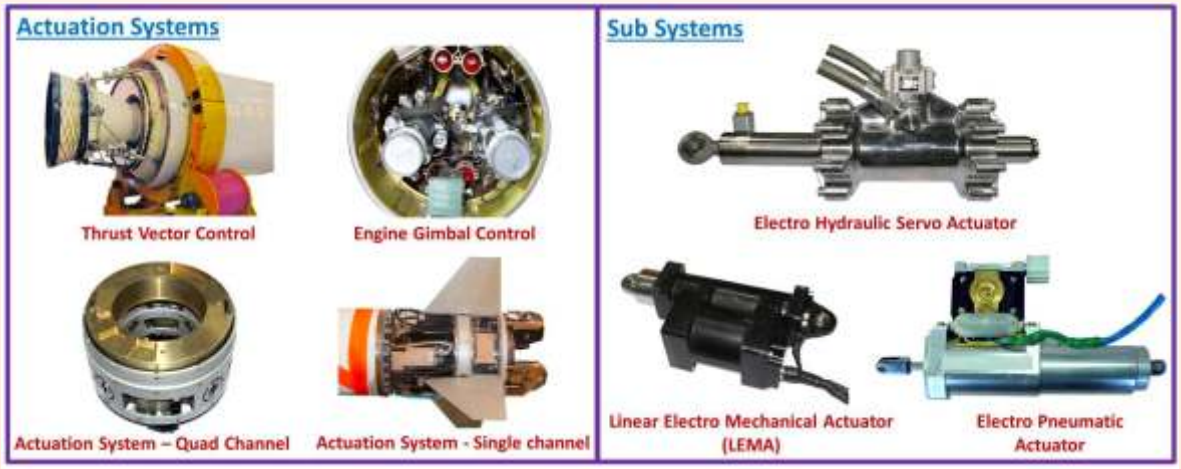


## Solid Fuel Ducted Ramjet (SFDR)

- Long Range Air to Air Missile (LRAAM) based Weapon System to meet Indian Air Force requirements to neutralize the air borne targets at ranges in between 50–340 Km.

## Actuation System

- Control Actuation System is used for deflecting the control surfaces/ thrust vector and thus generates side forces for aerospace vehicle to accelerate laterally or control the roll.
- Various types of actuation systems conventionally used for Aerospace applications are Electro Hydraulic, Electro Pneumatic and Electro Mechanical Actuation Systems.
- In electro mechanical actuation system, input electrical energy to the motor is converted into either linear or rotational motion of the system.
- Widely used due to faster response, higher reliability and better maintainability.

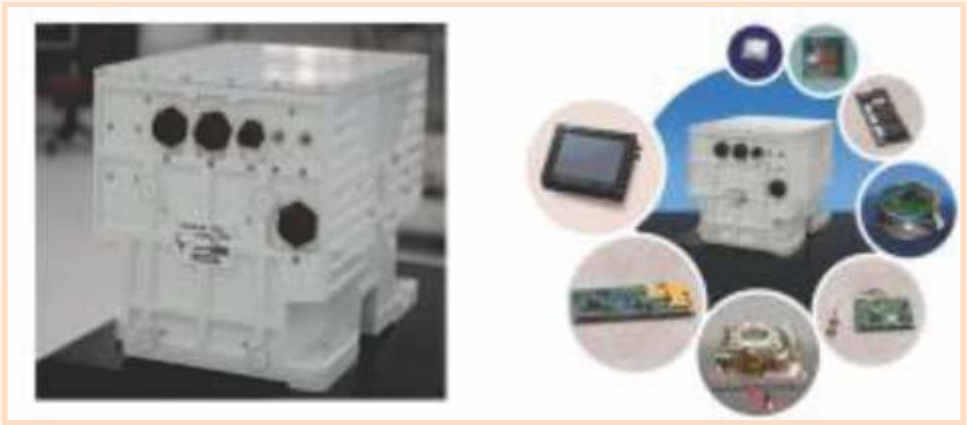


## Rotary Activator

- Rotary EMA (REMA) consists of BLDC motor, high reduction gear train, potentiometer and control electronics.
- Compact BLDC motor rotates at high speed and generates low torque.
- High reduction gear train is required to amplify the torque and rotate the fin at desired rate.
- The demands on the gear train are: high reduction, high efficiency, low inertia and low backlash with reliable operation.


## Inertial Navigation System for Ship Application

- INS-SA is an Inertial Navigation System providing proving position, true heading attitude, velocity and speed.
- Its high accuracy Inertial Measurement unit is based on Ring Laser Gyros and Accelerometers technology coupled with an embedded GPS-GLONASS Receiver and digital signal processor that runs an advanced Kalman Filter.

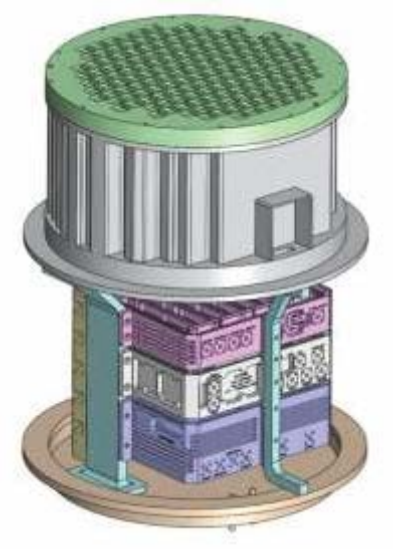


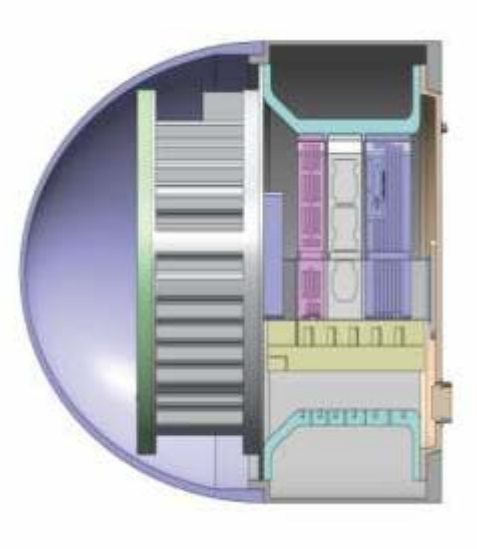
## Ku-Active Electronically Scanned Array (AESA) SEEKER

- Ku-Band AESA based seeker is strap down seeker designed on phased array principals.
- The seeker is capable of engaging fighter area crafts, sea skimming cruise missiles and hovering helicopters.
- It can also track multiple targets with high beam agility and provide superior isolations with reference to body disturbances.

## X-Active Electronically Scanned Array (AESA)

- X- Band AESA seeker is homing head of Anti-Ship missiles based on Phased Array Principles. Seeker is capable of search, acquire and track sea-surface targets and provide information for missile guidance. It has advanced ECCM features to operate and perform in dense ECM environment.





## Reaction Bonded Silicon Nitiride (CERAMIC) Radome

- The activity of design and development of Reaction Bonded Silicon Nitride (RBSN) radome was initiated st time in India to cater for the high temperature radomes for current and future missile applications at par with International radome development scenario. The targeted material properties of RBSN material including Electromagnetic properties, physical and mechanical properties were successfully achieved. CGCRI, Kolkata has successfully demonstrated & established the process of material processing, casting and sintering of RBSN radomes. 10 numbers of prototype radomes of 2 different sizes ( 0.5m & 1.0m height) have successfully fabricated with good Electromagnetic properties.

## E-Glass Polymide (COMPOSITE) Radome

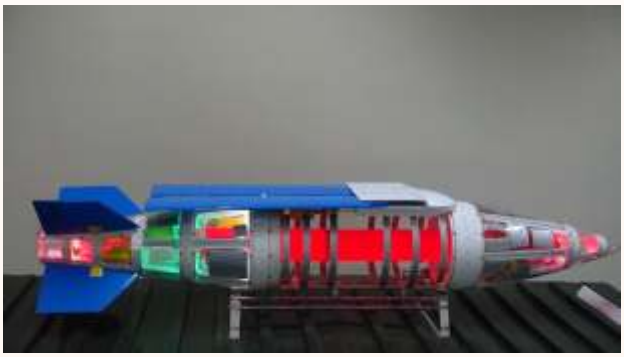
- The E-glass Polyimide radome has been successfully designed and fabricated indigenously with industry partner. The radome was developed for the Akash class of missiles with RF_Seeker – Akash Prime. The radome has successfully cleared all Qualification Tests. Radome was successfully flight tested during maiden flight of Akash-Prime in September 2021.

## The Electro Hydraulic Servo Valve (EHSV)

- The Electro Hydraulic Servo Valve (EHSV) is an essential part of a high speed & high accuracy servo hydraulic system. The EHSV has a major role in the performance of the servo hydraulic actuation system in terms of position & velocity control of the servo actuator. The EHSV is basically an electrically operated 4-way valve in which the output flow is proportional to input current. This design incorporates torque motor with flapper-nozzle as the first stage. The Body and sliding spool form the second and output stage. The pilot or first stage receives an electrical input, amplifies it, and controls the movement of the second stage. The double nozzle-flapper arrangement acts as a hydraulic amplifier, which converts motion at low-force level into motion at a high-force level. A cantilever feedback wire is fixed to the first stage armature and extends through a flapper and is engaged in a slot at the center of the spool.

# Long Range Glide Bomb (LRGB) - GOURAV & GAUTHAM

- Long Range Glide Bombs Gaurav and Gautham are designed and developed by DRDO.
- These bombs are Inertial Guided Bombs with good accuracy.
- They can be integrated with both Russian and Western aircrafts.

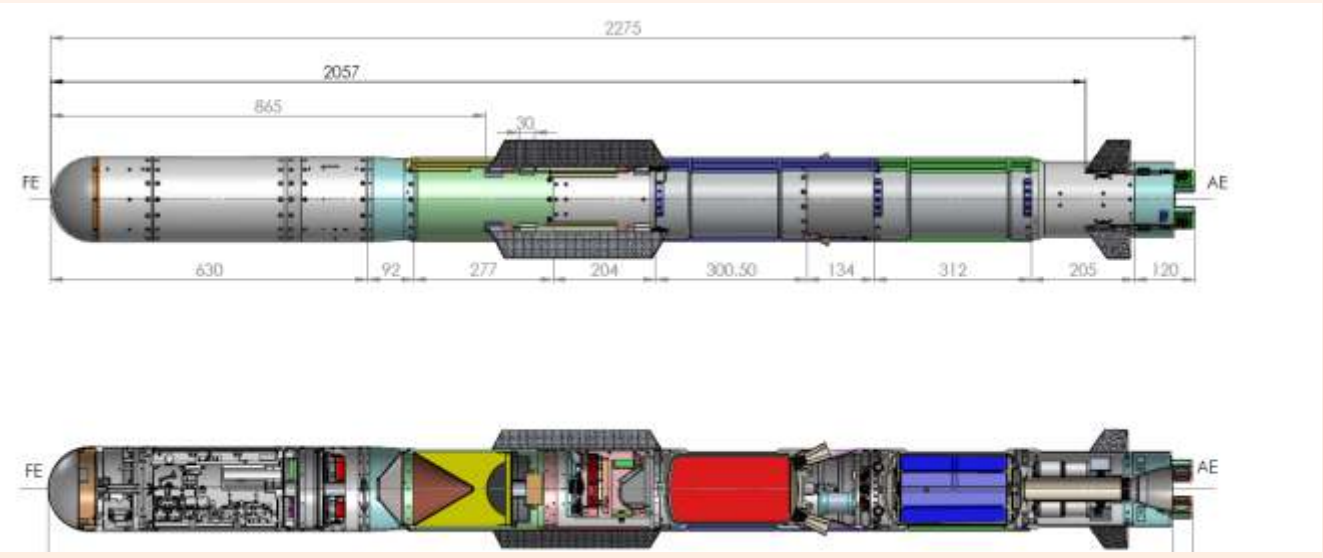


Gaurav

Gautham

# SANT Missile & Subsystems

- SANT Missile is an anti tank guided weapon with the capability of Lock on After Launch technology.
- The Missile operates with mid course pure navigation guidance and terminal homing through MMW seeker.
- The missile has been designed to be getting carried onto and fired from helicopters. Mi – 35 attack helicopters are the present platform of SANT missile.

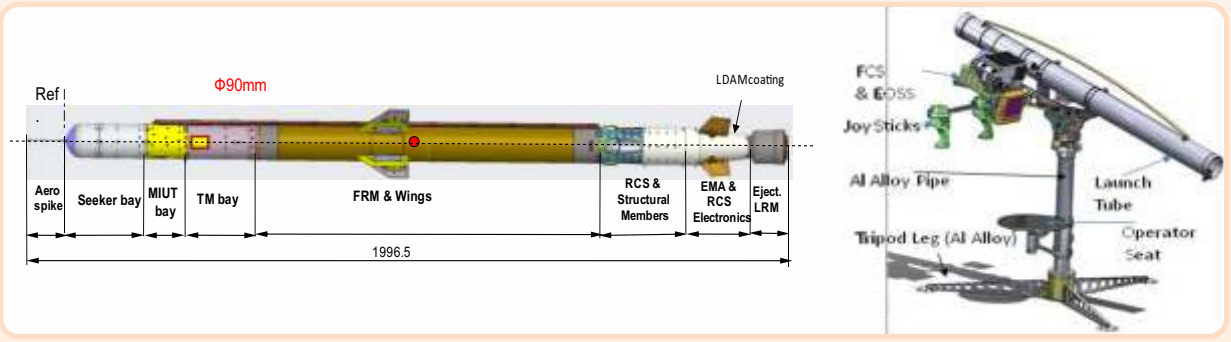


# PRALAY

- “PRALAY” is a Surface to Surface Missile (SSM) with a range of 150 to 400 km and has capability to strike different types of targets by carrying three types of warheads. It has a very good CEP allowing accurate targeting of C4I & Radar installations, airfields, oil refineries, ammunition dumps etc. The 'PRALAY' missiles are canisterized and can be made vertical for launching the missile from autonomous launcher. A typical 12x12 launcher accommodates 2 missiles and 8x8 launcher has 1 missile with Battery Command Centre vehicle as communication centre. Each missile from the 12x12 launcher can be programmed independently against the same or different targets. The missile has a RINGS 16/IAM navigation system and a seeker for terminal homing to achieve a Circular Error Probability (CEP) of better than 10 m. The missiles are controlled and guided from lift off phase to impact point. It has very fast reaction capability from mission command to launch (60s).In addition the launcher with the missile will be capable of being brought into action in already fire/launch condition within 10 minutes at launch location. PRALAY is an all- weather weapon system with day & night launch capability.


# Very Short Range Air Defense System (VSHORADS)

- Man Portable Very Short Range Air Defense System (VSHORADS) are lightweight anti-aircraft weapons. The Man Portable VSHORADS offers a low cost option for providing close Air Defense to vulnerable Areas (VAs) and Vulnerable Points (VPs) in all types of terrain including plains, semi-deserts, desert, mountains, high altitudes, marine and coastal areas. Such a versatile missile system offers lot of potential for employment besides the ground forces , with the heliborne and airborne Special Task Forces launched for special missions, assets located at inaccessible high altitudes / mountains areas. VSHORADS are usually the short-range component of a wider air defense system, providing the 'last-ditch' defense against attacking aircraft.



## Rail Track Rocket Sled (RTRS)

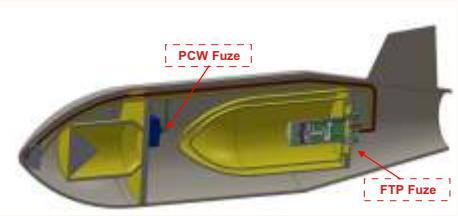
- Rail Track Rocket Sled (RTRS) facility has been instrumental in important National Programmes and development of various defence systems.
- The facility is being extensively utilized by DRDO and non-DRDO agencies for dynamic evaluation of components, systems & subsystems of aerospace, armaments and missiles during their developments stage.
- The Unit under test (UUT) is integrated on a specially designed vehicle called sled which slides on the rails during dynamic test. Solid rocket motors as propulsion system are used for achieving desired dynamic conditions.
- At RTRS, UUTs can be evaluated in impact, recovery and interception modes.
- Data acquired with various on-board systems, ground stations and telemetry are processed and analysed for performance evaluation.

## EASF Fuze for Post Impact Delay (PID) for Air Deliverable Bombs

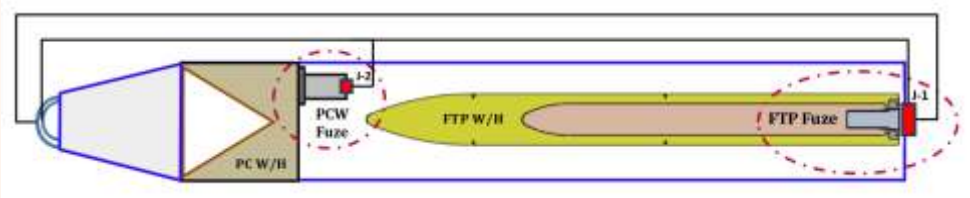
- TBRL has developed a 4th generation ESAD technology based electronic post impact delay fuze for air delivered bomb. EBW detonator based in-line explosive train is incorporated in the fuze to enhance the safety during storage, transportation and usage. The developed fuze is compatible with 2”fuze well and can be upscaled to 3” fuze well. PIDFuze is modular and fail safe.

# Long Range Glide Bomb (LRGB) Fuzing System

- Fuzing system for Hard Target (RCC-3m) Penetration Warhead is a combination of two Fuzes namely precursor charge warhead (PCW) fuze and Follow through projectile warhead (FTP) fuze.
- The PCW Fuze is located near precursor charge warhead and is capable of initiating two EBW detonators.
- This PCW Fuze acts as slave and get commands from the FTP Fuze for arming.
- The Fuzing command on impact is provided through an impact switch located at the nose of weapon system for optimum performance of the tandem warhead.
- FTP Fuzing system is programmable through RS-422 communication link from OBC (On Board Computer). Adequate safeties as per the bomb requirements for safe handling during storage, transportation and use are provided.

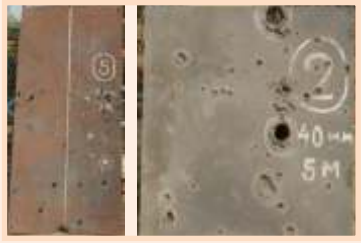


Placement of Fuzing system inside Bomb




# Naval Anti-Ship Missile – Short Range (NASM-SR) Warhead

- Omni-Directional Multi-EFP warhead system for Naval Anti-Ship Missile –Short Range (NASM-SR) Missile Requirement: Naval Anti-Ship Missile (Short- Range) (NASM-SR) is a helicopter launched air to surface weapon system which has been designed to meet the anti- surface warfare requirements of Indian Navy.



# Long Range Glide Bomb (LRGB) Warhead

- Tandem Warhead System for Long Range Glide Bomb (LRGB)
- Requirement: Long Range Glide Bomb (LRGB) is an air to surface weapon system that is launched from Su-30 MKI aircraft. It has been designed to meet the requirements of Indian Air Force to defeat hardened deep buried targets.


# Engine & Propulsion Systems

## Turbo-Charger for Combat Vehicle Diesel Engine Application

- Indigenous design for 1500 HP engines for Main Battle Tank (MBT) applications
- 600 HP engines for Infantry Combat Vehicle (ICV)
- High operating surge margin both at sea-level and high-altitude conditions

## Kaveri Derivative Engine

- Power Plant for Unmanned Aerial vehicles
- Non-afterburing turbofan engine
- Based on the Kaveri Engine architecture with specific indigenous modules

## Advanced Full Authority Digital Engine Controller (AFADEC)

- Controls the Kaveri Derivatve Engine by controlling the fuel flow, compressor, fan geometry positions and commands the ignition system
- Independent over speed protection mechanism

## High Speed Epicyclic Gearbox (HISPEL)

- Transmits 25 kW power.
- Steps up the output from commercially available electric motor to 1,10,000 rpm
- Provides the drive to test the performance of units/accessories fitted to small turbofan class of engines

## Fan with High Inlet Pressure Distortion Tolerance

- Improves matching of stages at part speeds and high surge margin
- 3D stacking to minimise losses and controlling secondary flow interaction

## Small Turbo Fan Engine (STFE)

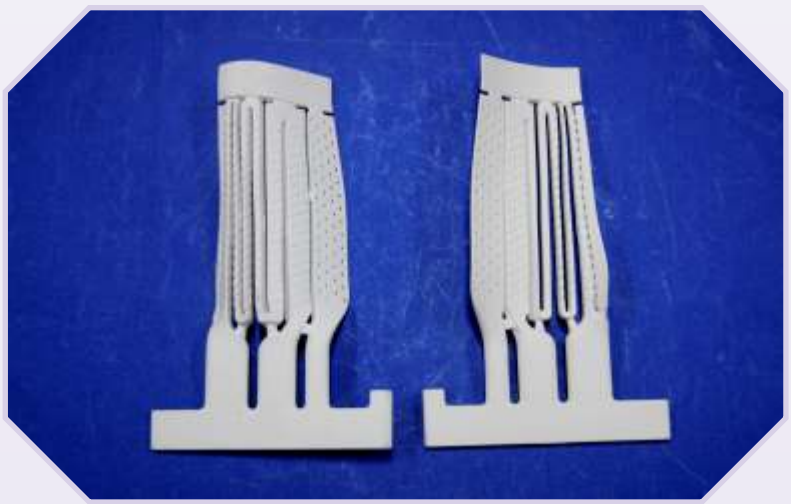
- STFE is a Twin spool, Low By-Pass Turbo Fan, Aero Gas Turbine Engine.
- It is a turbofan engine intended for use in unmanned air vehicle.
- The engine is controlled by Digital Engine Control Unit (DECU).

## Engine Fuel Control System (EFCS)

- Indigenous Engine Fuel Control System Comprising of Double Pump Fuel Metering Unit for supplying Metered Fuel flow at the required pressure to the Main Combustor and Variable Geometry Actuation System.

## Single Crystal Blades and Vanes

- Indigenous single crystal Blades and Vanes are designed and developed for high pressure turbine rotor blades and nozzle vanes.

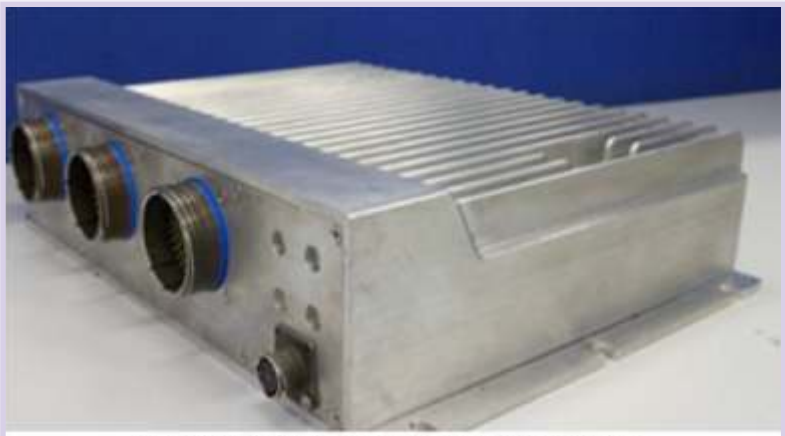


## 180 HP Diesel Engine for Rustom-II UAV

- 2178 cc Four stroke, inline four cylinder, common rail Direct Injection, Turbocharged Diesel engine fitted with constant speed Propeller.

## Full Authority Digital Engine Control (FADEC) System

- Single lever control through FADEC for the control of both throttle and propeller pitch with suitable redundancy management system.



Full Authority Digital Engine Control (FADEC) System

## 65 HP Rotary Engine for UAV Nishant

- Wankel-Type, Single Rotor Engine with Reduction Drive Gasoline Rotary engine.
- 345 cc High power to Weight ratio. The engine develops 65 bhp @ 8000 RPM and weight 32 kg.

## 55 HP Rotary Engine for UAV Panchi

- Wankel-Type, Single Rotor Engine with Reduction Drive Gasoline Rotary engine.
- 324 CC High power to Weight ratio. The engine develops 55 bhp @ 8000 RPM and weight only 28 kg.
- Water Cooled Housing, Air Cooled Rotor.

## Single Cylinder Reciprocating Engine for UAV

- 171 CC Lightweight Two-Stroke Single Cylinder Gasoline Air-cooled High power to Weight ratio.
- The engine develops 8.1 kW (11 bhp), Torque 14.7 N-m and weight only 7.5 kg.

Light Weight High Specific Power Single Cylinder Engine for RPV

## Twin Cylinder Reciprocating Engine for UAV

- 342 CC Lightweight Twin Cylinder Horizontally opposed two stroke air cooled gasoline Engine.
- High power to Weight ratio.
- The engine develops 15.5 kW(21 bhp), 27.5 N.m Torque and weight only 10.5 kg.

Light Weight High Specific Power Two Cylinder Engine for RPV

# Four Cylinder Reciprocating Engine for UAV

- 684 cc, Four Cylinder Horizontally opposed two stroke, air cooled gasoline Engine.
- High Power to Weight ratio.
- The engine develops 28kW(38 bhp), 54.0 N.mTorque and weight only 22 kg.

Light Weight High Specific Power Four Cylinder Engine for RPV

# Airborne Surveillance Systems

## Airborne Early Warning and Control (AEW&C) - Netra

- Two DRDO Developed AEW&C system inducted into the IAF
- Based on EMB 145 (I) Platform
- India is the fifth country in the World to develop this technology

## Airborne Early Warning and Control (AEW&C) Mk-II

- 06 AEW&C systems for the Indian Air Force based on A-321 Platform
- Long Endurance & Enhanced Coverage of operation
- Search, Detect, Track, Identify, Integrate Sensor Data, Communicate Air Situation Picture to Ground & Air Stations
- Threat Evaluation, Weapon Assignment & Intercept Control
- Intercept and Analysis of Communication Signals
- Controlling of Borders, Surveillance of Economic Zones

## Flight Test Bed (FTB) Aircraft

- DRDO Flight Test Bed for Airborne Systems Testing is based on A319 Aircraft. It comprises of generic External Modifications to mount large Avionics / Electronic Warfare Systems for flight Testing towards technology demonstration before offering it to user.
- It has provisions for breakthrough connectors for Electrical, Signal, etc.; Generic Internal Modification for Systems under Test; Electrical Power Distribution – provision for 28 V DC, 3 phase 115 V AC, Navigation Equipment for all Avionics Systems under Test, Operator Consoles and FTI racks for Instrumentation, etc.


## Medium Range Maritime Reconnaisance (MRMR) / Multi-Mission Maritime Aircraft (MMMA)

- AESA based Maritime Patrol Radar with Multichannel Adaptive Processing
- HPEC based Signal Processing Systems
- IFF with Mode S and Mode 4 Capability
- AI-Enabled Multi-Payload Day/Night EOIR System
- Pollution Surveillance Suite with Laser Fluoro Sensor
- Distributed Mission Management System
- Dual Display Multifunctional Tactical Console

## ISTAR Aircraft

- Manned airborne multi-role mission aircraft capable of performing ISR and targeting missions for Defence and Security forces.
- Hyper-converged Infrastructure (HCI) on enterprise-level hardware for airborne operation
- Long range high resolution SAR-GMTI system
- Multispectral (EO-IR) LOROP Sensor
- Geo-spatial intelligence processing and exploitation suite

## SIGINT COMJAM Aircraft (SCA)

- Manned Multi Mission Platform for Electronic Signal Warfare
- Long Range, High Endurance signal intelligence missions
- Real-time Electronic Order of Battle (E_ORBAT)
- Combined capability of SIGNIT and COMJAM
- AI Based Emitter definition creation and Emitter location Fix

## Identification Friend or Foe (IFF)

- Designed as per the regulations laid down in ICAO - Annex - 10 and STANAG 4193
- IFF MK XII(A) system, with E-scan and M-scan & Mode S level 2 capability
- ToT completed for total indigenization to two Indian Industries

IFF-INTERROGATOR

IFF-TRANSPONDER

COMBINED INTERROGATOR AND TRANSPONDER

O-Level Handheld Tester

## Lightning Test Facility (LTF)

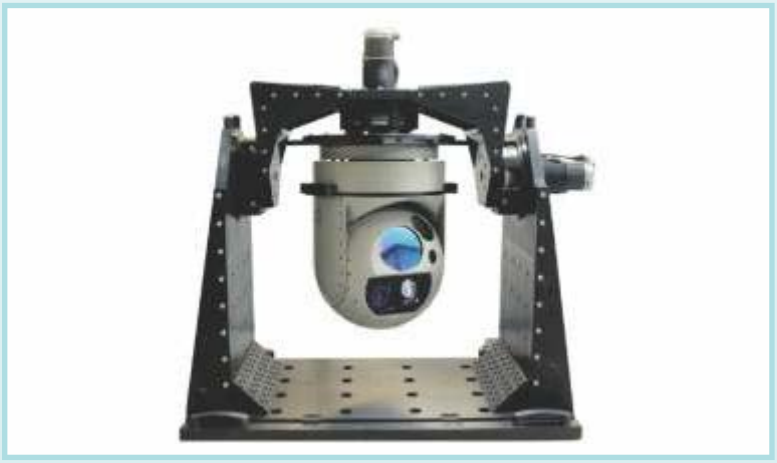
- The Lightning Test Facility is one of the unique facility in Asia with state-of-the-art technology that aids in designing and testing the Lightning protection schemes to ensure the lightning worthiness of aircraft.
- The facility is equipped for conducting all the High voltage, High current and Indirect Effect testing as per International Standards and Regulations. The facility have a provision to carry out test on actual aircraft or its part.

## Mission Systems Integration Rig (MSyIR)

- Mission Systems Integration Rig (MSyIR) facilitates the development, integration, testing and evaluation of mission avionics of airborne surveillance system prior to actual flight test in a controlled environment.
- It duplicates exact functional system architecture and design requirements; this helps in adopting the system architecture in the programmes such as AEW&C Mk-II, MMMA, RPSA etc.
- Equipped with Software models of sensors for Software in loop (SIL) simulation, Environment simulators, Hardware in loop (HIL) simulators and actual radiation testing.
- MOBILE RF MEASUREMENT POD(MRMP) installed on customized platform enhances the capability to test the system in Field situation.

## Electro Optic / Infra Red (EOIR)

- Electro Optic / Infra Red (EOIR) System for Maritime and Pollution Surveillance is an indigenously designed and developed product with ToT completed in line with Make in India regime.
- It has a 4 Axis stabilized Turret providing 360in Azimuth & Elevation with Stabilization Accuracy of better than 10 rad.
- It provides AI enabled automatic target recognition and video Tracking using IMU, Geo Pointing and Geo Referencing with Simultaneous display of 4 HD day and night videos including MWIR and SWIR.



## Active Antenna Array Unit (AAAU)

- The AAAU houses Front-End radiating interface of AESA based Primary Radar (PR) and PESA based Secondary Surveillance Radar(SSR) of AEW&C. Structral design of AAAU has been carried out as per FAR 25.
- Two radiating planar arrays which forms part of structural member are assembled back to back and mounted on top of the aircraft fuselage provide 120° coverage on either side of aircraft.
- It houses more than 100 LRUs that are designed to meet the electrical, structral and thermal requirements.
- AAAU plays a significant in the detection performance of both PR and SSR.

## Operator Workstation (OWS)

- The Operator Workstation (OWS) segment of C4I provides the interface to operators to interact with AEW&C system. It is ergonomically designed as per Mil-STD-1472F with inputs from the users. These OWS are reconfigurable and displays integrated Air Situation Picture (ASP) to operators on a 2D map in the background that enhances the situation awareness for the operator. It provides display of tactical data, tools to insert Operator's inputs to ASP and overall system serviceability.

# Ground Exploitation System (GES)

- Real Time Ground-to-Air and Air-to-Ground communication link for voice and data
- Interface between IACCS and AEW&C system
- Establishes communication with 3 nos of AEW&C system simultaneously over V/UHF, C- Band and SATCOM

# Sensor, Electronic Warfare & Communication Systems

## Passive Coherent Location Radar (PCLR)

- It detects and tracks targets by processing the reflections from targets due to illumination by FM broadcast emission.
- It uses low frequency of operation which is highly suitable for low observable target detection.
- The Radar is completely passive, covert, immune to Anti-Radiation Missile attack and jamming.
- The system works in multi-static configuration with multiple geographically separated receivers which makes it suitable for detecting emerging stealth threats.

## Hand Held Ground Penetrating Radar (HH-GPR)

- GPR System is used in detection of Anti-Tank Mines, Anti-Personnel Landmines (metallic and non-metallic) and Improvised Explosive Devices (IED) in a variety of Indian soils such as Sand, Red, Laterite, Black Cotton.

## Through Wall Imaging Radar (TWIR)

- TWIR is a sensor used for detection and location of static and moving targets, especially human beings behind walls.
- The Radar can image in real time 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 different types of wall include concrete, reinforced concrete, brick, cement, wood, stone etc.


## Coastal Surveillance Radar (CSR)

- Coastal Surveillance Radar (CSR) is a part of the Integrated Coastal Surveillance System (ICSS) which comprises of chain of ground based microwave Radar, EO sensor, Electronic Support Measures (ESM) and optical sensors.
- Coastal Surveillance Radar (CSR) is a dual band Radar designed and capable of detecting small boats at sea that are likely to be a security threat, by providing 24x7 surveillance.

## Battle Field Surveillance Radar (BFSR-SR)

- 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.
- The Radar is a potential ground based e-sensor for Border surveillance of designated areas.

## 2D Low Level Light Weight Radar (Bharani)

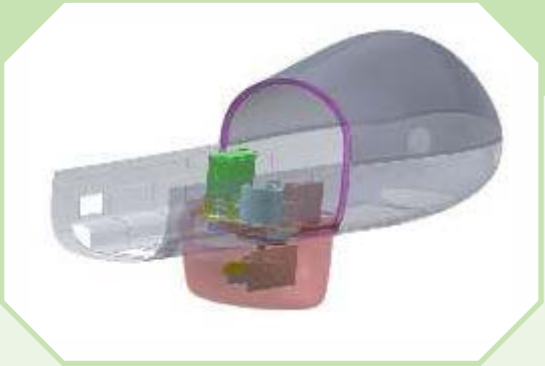
- 2D Low Level Light Weight Radar (2D LLLWR) is a light weight battery powered compact sensor which provides 2D surveillance in mountainous terrain against hostile aerial targets like UAVs, RPVs, helicopters and fixed wing aircraft flying at low and medium altitudes.
- The Radar can be transported by vehicles, animals, group of men or as helislung loads.
- It can be dismantled into packages to facilitate quick relocation and installation in mountainous terrain.
- It will act as an early warner to air defence weapon systems employed to provide protection to vulnerable areas or vulnerable points.

## 3D Low Level Light Weight Radar (ASLESHA )

- 3D Low Level Light Weight Radar is a multi-beam ground based 3D Surveillance Radar for deployment in diverse terrains like plains, deserts, mountain tops and high altitude regions.
- The Radar is engineered in multiple packages to enable easy transportability in mountainous terrain by vehicles, group of men or as an under-slung carriage by a helicopter.
- 3D surveillance for aerial targets at low and medium altitude.
- Detection and tracking of fighter aircraft, helicopters, slow moving micro-light aircraft and UAVs

## SWaP Optimized - Synthetic Aperture Radar (SAR)

- Synthetic Aperture Radar (SAR) is an all-weather, day/night capability imaging sensor which can provide ground imagery for both peace time information gathering and usage during conflict.
- It is capable of generating ground images of varying resolution.
- This radar operates in two imaging modes viz., Strip Map and Spotlight and also has GMTI capability.



## Active Electronically Scanned Array Radar (AESAR)

- AESA Radar is a multimode, solid-state active phased array fire control Radar with scalable architecture that can be adapted for various types of fighter class of aircraft. It is a fully electronically scanned agile beam Radar which uses Transmit / Receive module (TRM) technology.

- Radar has state of the art features including wide band RF front end, ultra low sidelobe antenna, frequency and waveform agility, multiple SLC channels for jammer suppression, Low Probability of Intercept and Non Co-operative Target Recognition.

- It is capable of tracking multiple targets with high accuracy suitable for missile firing with interleaved Air to Air, Air to Ground and Air to Sea modes for all terrain operation.

## Advanced Self Protection Jammer (ASPJ) Pod

- The Indigenous Advanced Self Protection Jammer (ASPJ) Pod is designed for installation on the Wing tip stations11 & 12 of Su-30 MKI Aircraft. The Podded jammer is configured in an LH & RH configuration and will always be installed as a set (one set consists of both LH & RH pods). The purpose of the system is to provide protection to the aircraft against ground based acquisition radars, fire control radars, anti-aircraft artillery and airborne multimode radars. Advanced Self-Protection Jammer Pod is a state of the art jammer system based on Active Phased Array (APA), ultra wide band DRFM and in-built cooling system

## 3.5 KW Air Cycle Machine

- Air Cycle Machine is basically a turbine and compressor coupled on a single shaft which is designed to be operated in Reverse Boot Strap Mode of operation.
- The purpose of the Air Cycle Machine is to generate cold air from hot ram air sourced from external ambient during flight.
- The cold air is generated by the machine by expansion of the air through the turbine. The cold air is supplied to an Air to Liquid Heat exchanger to remove the heat from the coolant which is circulated through electronics.
- The work generated by the turbine is used by the compressor to purge the hot air from the heat exchanger to the external ambient. The 3.5 KW ACM is state of the art machine designed for airborne application.

## Liquid Circulation Unit (LCU)

- The advanced EW systems generate large amount of heat and require liquid cooling for thermal management of electronics. The Liquid Circulation Unit (LCU) circulates Ethylene Glycol Water Mixture through the electronics and the hot coolant from the electronics is sent to heat exchanger where the liquid is cooled. The Liquid Circulation Unit mainly consist of Pump, accumulator, temperature and pressure sensors, pressure relief valve, filter and solenoid valves.
- The Liquid Circulation unit is designed as a Monoblock where all the interconnecting liquid paths are embedded inside the unit. The LCU is of compact form factor and weighs 10 Kg.
- The LCU is of ruggedized design and is suitable for application in external stores as well as internal to aircraft.

## Heat Exchanger

- The Phase change material based plate fin heat exchanger is a novel component being developed.
- The heat exchanger serves the purpose of providing a backup for a stipulated amount of time when the main cooling system is unable to deliver the required cooling.
- Hot liquid flows into the heat exchanger and exchanges heat with the Phase change material which gradually melts and changes phase from solid to liquid absorbing the latent heat. The molten material is solidified again and reused.

## Wide Band (WB) Receiver

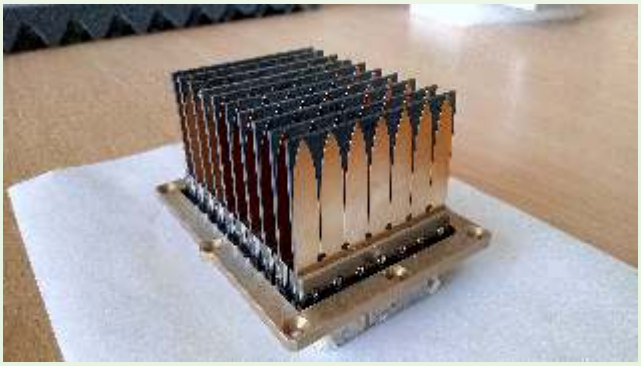
- Indigenous Wide band receiver is a new generation EW system which operates in a wide frequency range.
- It is a fully digital solution with powerful, real-time signal processing using complex and adaptive algorithms.
- High speed sampling, precision parametric estimation, sample storage provision and sophisticated interfaces including High Speed Gigabit Ethernet Link for threat data transfer are some of the unique features incorporated to meet future challenges
- High Instantaneous BW, capable of handling Multiple simultaneous threat signals

## ATRU

- Active Array plays an important role in modern electronic warfare system. Phased array based transmitter is an effective tool to engage and jam multiple targets with quick reaction time.

## VAAU

- Each VAAU covers 90Deg Field of View. Hence, 4 VAAUs are required to cover 360 deg in Azimuth.



## DHRUTI RWR System

- DHRUTI Digital RWR system provides versatile solution to a fighter platform offering very good sensitivity, selectivity and wideband instantaneous bandwidth at the same time for detecting all Radars in the Scenario.
- Digital Signal Processing techniques are exploited to replace complex RF and analog hardware. Built using fast response hardware, the dynamic Reception regime promises excellent probability of Intercept against variety of radars

## Unified Mission Computer (UMC)

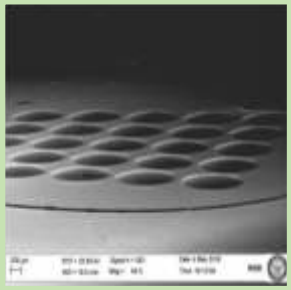
- UMC (Unified Mission Computer) is an avionics unified mission computer (UMC) with high performance and low power.
- UMC can integrate various weapons/sensors and avionics equipment onboard. It can provide necessary interfaces to the pilot for Navigation and Attack.
- UMC is 3/4th ATR conduction cooled system based on VPX standard. It is designed using an open architecture, consisting of Single Board Computer, IO modules and Internal Power Supply module with necessary protections and redundancy in-built.

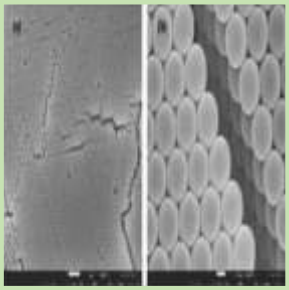
The primary Mission and Display functions of UMC are as follows:

1. Mission Functions
   a. Weapon Aiming Computations
   b. Navigation and Sensor Management
   c. Avionics Bus Control & Management
2. Display Functions
   a. OGL Symbol Generation
   b. Overlaying OGL symbols over the incoming video
   c. Video switching

## Micro-Optics & Nano-Photonics Technologies

- Micro-Optics technologies lead to miniaturized and light-weight optical systems, with added functionalities and unique characteristics, using Diffractive Optical Elements (DOEs), Holograms, Micro-lens and/or Micro-prism arrays.
- Nano-Photonics technologies are used to control the light-matter interactions that take place on wavelength and sub-wavelength scales.





## Hyper-Spectral Imaging Camera (HySIC) Payload

- IRDE is developing a Hyper-spectral Imaging Camera (HySIC) for space based applications.
- The development of HySIC will provide spatial resolution of 12 m from Low Earth Orbit and spectral resolution of 10-20 nm in Visible, Near Infra-Red (VNIR), and Short Wave Infra-Red (SWIR) wavebands.

## Athermal Laser Target Designator (ALTD)

- ALTD is a state-of-art laser target designator based on athermal technology.
- With 5 MW of laser peak power, ALTD facilitates ranging and designation of military targets (tank size) up to 8 km for precise terminal guidance of laser guided munition.
- This compact, light-weight instrument consumes low power and requires no warm-up time.
- It is also equipped withDMC and GPSwhich enables it to find own location (GPS co-ordinates) as well as target co-ordinates.

## CAMOP with Accessories

- The Compact Airborne Multi-sensor Optronic Payload provides a stabilized Line of Sight (LOS) to perform surveillance, reconnaissance, target detection and automatic target tracking from airborne platforms. This allows the LOS to be aimed and stabilized in required orientation, independent of platform altitude and motions. The payload assembly possesses light weight (<60kg) belly mount structure and houses all the EO sensors within a ball diameter of 450 mm.

## Laser Based End Game Fuze (LBEGF)

- Laser Based End Game Fuze (LBEGF) is a novel proximity fuze that detects the target around its axis by generating a forward looking optical cone.
- This provides information about the angular position and range of the target.
- Warhead detonation pulse is generated by this device based on the End Game Algorithm implemented on its End Game Processor.

## Laser Altimeter

- Laser Altimeter is a device that works over a range from 1m to 80m with 1m accuracy.
- It is used to map the topography of the earth surface and helps in discriminating the intended target from back ground.

## Multispectral Surveillance System (MSS)

- Multispectral Surveillance System (MSS) is a Visible-SWIR-MWIR observation channel based on broadband SWIR-MWIR detector, broadband optics, color day Camera and Eye-safe Laser Range Finder (ELRF).
- It provides day and night surveillance capability along with target ranging.

## Light-Weight Electro-Optical Payload (LEOP)

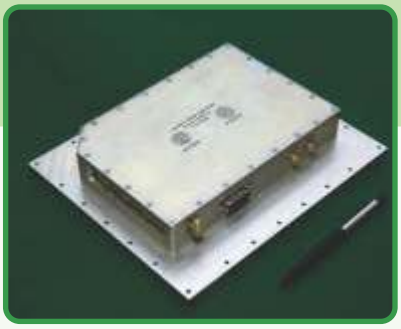
- LEOP for Helicopters and UAVsis a light weight modular two-axis gyro stabilized electro-optical payload consisting of the state-of-art sensors including Thermal Imager (TI), Short Wave Infra-Red (SWIR) camera, CCD camera and Eye-safe Laser Range Finder (ELRF). It is a light weight belly mounted structure.
- It provides a stabilized line of sight to perform surveillance, reconnaissance, target detection and automatic tracking from airborne platform.

## Advanced Driver Night Sight (A-DNS) with Fusion Tech for AFVs

- 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 the display, which makes it possible to view thermal image and small Beacon/LED lights in the same image during night.

## Power Amplifier at L-band and UHF – band frequencies

- GaN Based Design in UHF & L Band
- Harmonics (2nd / 3rd) ≤ -40 dBc
- PSAT = 100W
- IMD at 6 dB back off ≤ -18 dBc
- Spurious ≤ -80 dBc



## Software Defined Radio - Manpack (SDR-MP)

- V/UHF Manpack SDR
- Jam resistant frequency hopping
- Up to five hop MANET networking
- Up to 1 Mbps network throughput
- Interoperable with legacy radios through waveform porting

## Software Defined Radio - Handheld (SDR-HH)

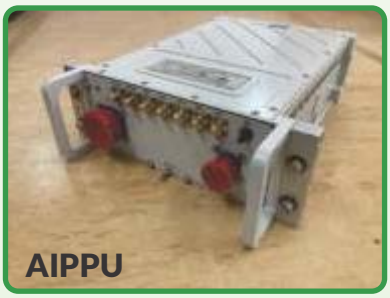
- SDR-Handheld (SDR-HH) in UHF band
- FM & Digital secure voice
- Secure authentication based access

## Advanced Quad Diversity Modem

- C Band Quad Diversity Modem
- Modem waveforms like OFDM, SCFDE, LDPC and Maximum Ratio Combining (MRC)
- Future upgradable

## SWaP Optimized Data Links for TAPAS UAV

- Secure & anti-jam Uplink
- Multiplexed payload and TM downlink
- C-band LOS communication
- Ku-band SATCOM link.
- Remote Video Terminal with Soldiers for situational awareness
- Ship-Borne Data Terminal for Maritime surveillance


AIPPU

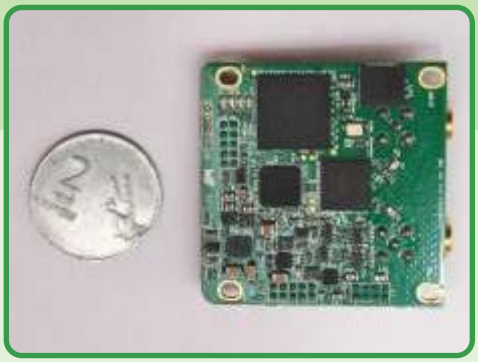

SSPA


CAPS

## Satcom terminals for GSAT-6

**S Band RF Modem**

- Compact size of 50*50 mm
- Full Duplex operation
- Direct RF Frequency conversion architecture



**Handheld Satcom Terminal (HST)**

- Battery operated terminal for GSAT6
- Secure voice/data services within satellite footprint
- Voice & Data (2.4 Kbps)

## Akash NG Microwave Power Module (MPM)

- This MPM (MPS5054A) is a high-efficiency 300W Ku-band compact Microwave Power Module (MPM) based super-component, comprising a solid-state power amplifier and a power booster travelling-wave tube (TWT) powered by an electronic power conditioner (EPC), all integrated into a compact conduction cooled chassis.
- A built-in micro-controller controls and monitors the functions of various modules of the super component.

## EW-POD Microwave Power Module (MPM)

- This C-X-Ku band MPM (MCS 3548) is a high-efficiency, compact gain-phase matched, 100W RF output Microwave Power Module (MPM) comprising a solid-state power amplifier, MMIC based gain equaliser, electronic power conditioner (EPC) and a power booster travelling-wave tube (TWT), all integrated into a compact chassis. The MPM is designed for conduction-cooled operation.

## Space Traveling Wave Tube Amplifier (TWTA)

- The TWTA (MPS 5054S) for aerospace application is designed for operating in the Ku-Band, delivering 300W over a narrow bandwidth in pulsed mode. The unit is operating with a conduction-cooled baseplate on a 28V DC bus.
- A short-length TWT and an SSPA shares the gain in almost equal proportions for ensuring low-noise RF output.

## Brahmos Microwave Power Module (MPM)

- The Microwave Power Module (MPS4053) is operating in a narrow bandwidth at X-band frequency with 200W RF Output. The MPM contain a short-length TWT and an SSPA in a cascaded mode, sharing the gain.
- A compact electronic power conditioner (EPC) powers the MPM which is designed to operate over a short period with natural cooling

## S-band Coupled - Cavity TWT

- The S-band coupled-cavity TWT (MPC 2081) consists of non-intercepting gridded gun, PPM focusing, single stage depressed collector and liquid cooling. It is a high gain, high power, high efficiency CCTWT suitable for surveillance radar applications.

## Multiple Beam Klystron (MBK) Transmitter

- The MBK based transmitter (MPS5055K) is a Multiple Beam Klystron (MBK) based transmitter.
- This transmitter provides minimum 250 W of RF Powerin the Ku-band over 150 MHz bandwidth and capable of operating without cooling up to 40 seconds.
- It is a high gain, high efficiency, compact lightweight transmitter suitable for missile applications.

# Parachute & Drop Systems

## Military Combat Parachute System

High performance parachute with enhanced glide ratio and payload capacity in terms of following performance parameters:

- Glide Ratio (>4:1)
- Better controls response
- Smooth opening
- User friendly Control/Guidance and Navigation System
- Improved Life support system & Communication

## Brake Parachute

Brake parachutes are used to reduce the speed of aircraft after landing prior to application of frictional wheel brake. Brake parachute has advantages over friction wheel brakes which provide efficient braking at very high landing speed where friction wheeled brakes are not very effective. In addition to this it provides an additional safety to the aircraft during emergency like aborted takeoff or malfunctioning of brakes or landing at short and/or wet runways.

## Inflatable Structure (Radome)

Air supported inflatable Radome of 80 feet diameter has been developed indigenously by ADRDE with an objective to serve as a shelter to provide controlled environment for effective and continuous functioning of expensive electronic and strategic systems for civil and military application. Inflatable Radome system comprises of Radome envelope with airlock tunnel, air blower units, electrical control system, air conditioning units and emergency generator.

## Aerostat System

- Indigenously developed aerostat system for size 3500 $m^3$ with 300 kg payload capacity and endurance 14 days at height of 1000m AMSL.
- Payload integrated
  - LREO, MREO
  - IFF
  - ADS-B
  - DF
  - GSM Mobile Monitoring
  - V/UHF Monitoring
  - MW Monitoring

## FIAM for Torpedo

- The Torpedo air stabilizer ensures a predictable air trajectory and water entry without structural damage.
- Parachute technology reduces decent speed of torpedo relative to speed of launching helicopter.

## P-16 Heavy Drop System

- Heavy drop System-16T has been developed with an objective of creating indigenous capability of paradrop store of 16 Ton weight class i.e. BMP – II. System compromises of Platform & Parachute.

# Aircraft Arrestor Barrier System

- The Aircraft Arrester Barrier System is used to engage a fighter aircraft to halt its forward momentum in the event of aborted take-off or landing over run with minimal damage to aircraft or injury to the crew.
- It enables a safe and reliable arresting solution for fighter aircraft during take-off and landing over-runs.

# Naval Systems

## Low Frequency Dunking Sonar (LFDS)-X

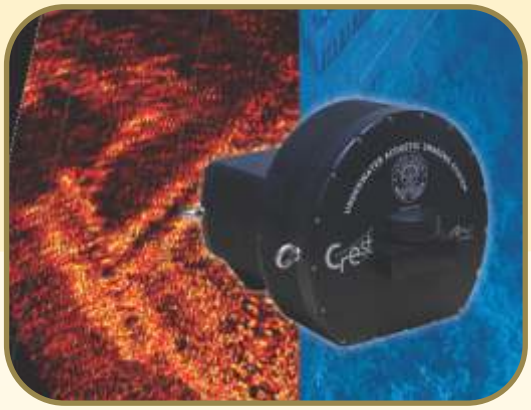
- LFDS is an airborne sonar system which can be deployed from rotary wing platforms, for effectively acting as force multiplier for naval ships. It provides the advantages of lower frequency combined with higher source level for range advantage in littoral Anti-Submarine Warfare (ASW). It enables the deployment of sensors to deeper depths for detection of deep dived submarines. It is an integrated system capable of simultaneously processing inputs from sonobuoys and dunking sonar.

## Directional Sonobuoy

- The Directional Sonobuoy is an Airborne SONAR system, which an expendable type passive sensor is called DIFAR Sonar (DIFAR - Directional Finding and Acoustic Ranging sensor). It is mainly used for Anti-Submarine Warfare (ASW) operations by the Naval Forces to determine targets of interest to take appropriate counter measures.


## CHITR-M1

- CHITR-M1 is a wide-band high-frequency imaging sonar which gives excellent image quality and good object detection ranges. It's a compact system designed for dual use purposes. Military applications include Autonomous Underwater Vehicle (AUV) navigation, marine mine detection, ship hull inspection and harbour security.



# Microelectronics
# AI / ML & Cyber

## Joule Thomson Cryocooler

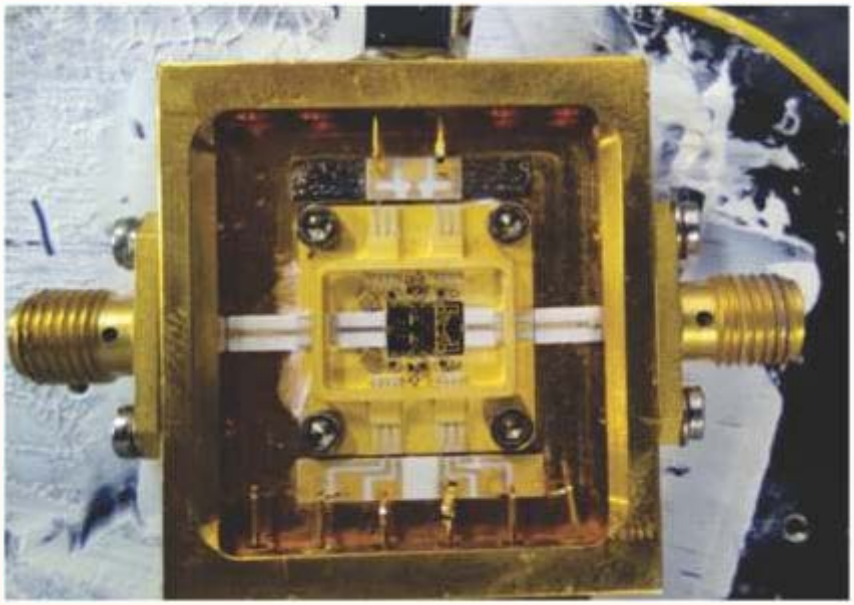
- A JT cryo-cooler is fundamentally a counter flow heat exchanger and a nozzle which produces refrigeration based on the Joule Thomson principle of isenthalpic expansion of a refrigerant (High purity Nitrogen or Argon) from a high pressure and temperature to a lower pressure and temperature. Cryo-coolers are often rated by their available refrigeration capacity measured in watts, at a particular temperature, at which the refrigeration is available, for example 1W at 80K. A JT cooler works on an open cycle.

## Acoustic Emission Sensors and Hydrophone

- Snow avalanche and land slide monitoring / prediction, NDT Structural health monitoring, Inspections of Defence and Aerospace vehicles / system

## GaN MMICs and RF Module

- SSPL has successfully demonstrated GaN technology at C-band, X-band and is presently working towards the development of Ku band applications. Using external foundry, various Power amplifiers, Low noise amplifiers and switches in frequency bands starting from S-band to Ku-band have been designed and demonstrated.



## INDIGIS

- INDIGIS is a suite of GIS components developed by Centre for Artificial Intelligence and Robotics (CAIR) to meet the specific GIS requirements of a collaborative defense environment. This can be customized to build military GIS applications to facilitate operation planning, execution and monitoring. It offers a common platform for display, analysis and decision support involving spatio-temporal data.

## Geo Pointing and Geo Location

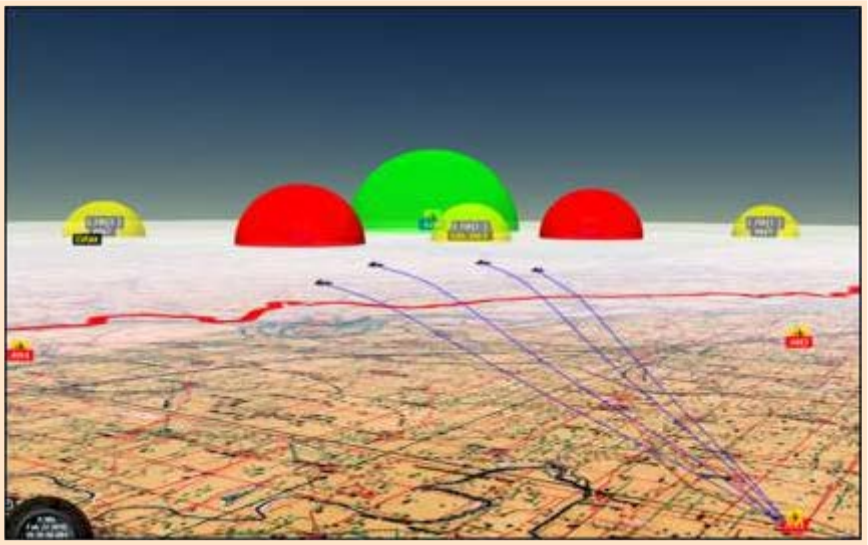
- For reconnaissance, surveillance, target detection & automatic target tracking from airborne platforms, imaging sensors are fitted in the belly of the airborne platform that provide the video/updateto the operator. CAIR has developed a solution for Geo Pointing (9GP) and Geo Location (GL) that is deployed this aerial platform. The actuating parameters of the gimbal have to be computed to "look" at the targets of interest for GP. In the GL scenario, the problem is to compute the location of a target that is being currently "pointed"/tracked by the sensors. Electro Optic Sensor System after integration with the GIS software has undergone successful trials. Currently technology is available as proprietary firmware embedded in sensors and functionally equivalent software is not available in the commercial or military systems.

## Air Warfare Simulation System

- AWSS simulates air warfare scenarios between two or more opposing forces. This application software can be configured for meeting the training requirements of the users and as well as for operational analysis at the tactical and operational levels of warfare for decision making and formulating strategies.

## Air Defence Simulation System

- ADSS evaluates the effectiveness of various deployment patterns of Ground Based Air Defence Weapon Systems (GBADWS) deployed to protect critical assets against Enemy Air Threats.



## Tactical Simulation System for Combat Aircraft

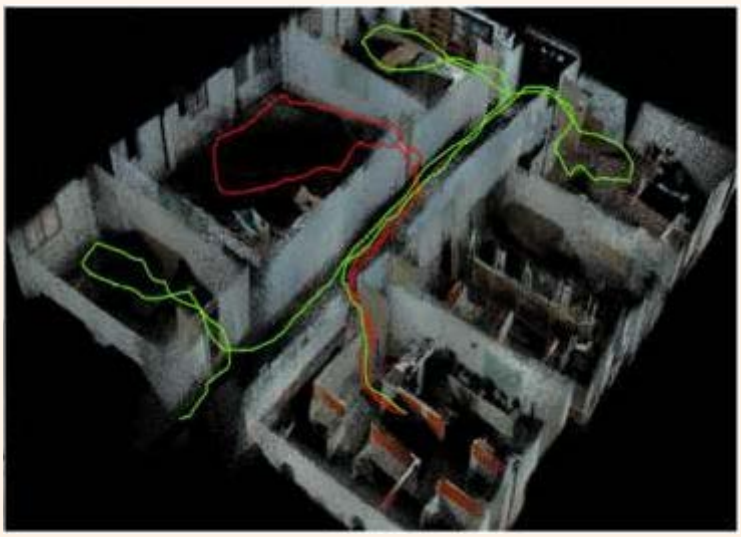
- A tactical Simulation System for Combat Aircraft is an important subsystem of any full mission simulator. It helps in providing a context of warfare and create war scenarios in which training for the pilot is provided. Air, Ground and Sea entities can be deployed to depict the scenario. It integrates constructive and virtual simulation for imparting scenario based training to pilots

## Air Direction and Helicopter Control Simulator

- The software system would enable simulation based training of Air Direction Officers of Indian Navy for Air Direction and Helicopter Control. It would enable simulation of combat scenarios for Fixed Wing Aircrafts and deck landing scenarios for Helicopters. The simulator would have the capability to train 15 Air Direction officers together on same or different missions. The system would enable seamless transition of trainees from simulator to actual system on board ships.

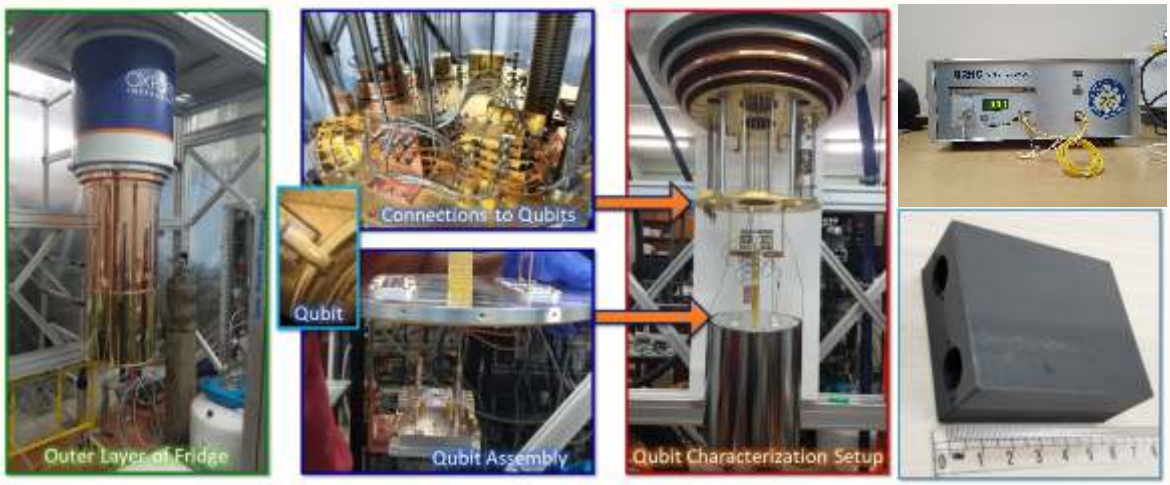
## Internet of Battle Field Things: SMART HELMET

- The "Smart Helmet" is capable of building a 3D map of any unknown indoor environment in real time. Multiple soldiers wearing this Smart Helmet can be tracked accurately with respect to a prebuilt 3D map. The tracking takes place based only on the images captured by the optical camera, hence is best suited for combat/search & rescue operations in No-GPS/Low-GPS environments

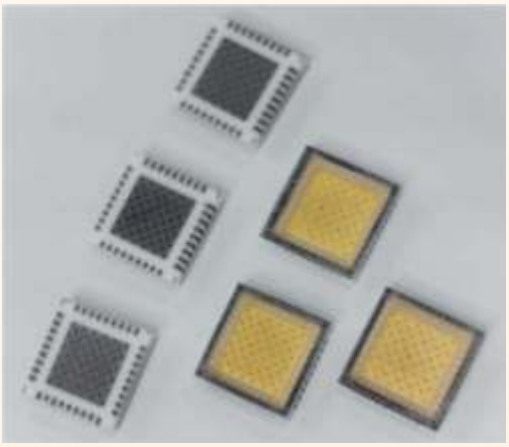
## Quantum Random Number Generator (QRNG)

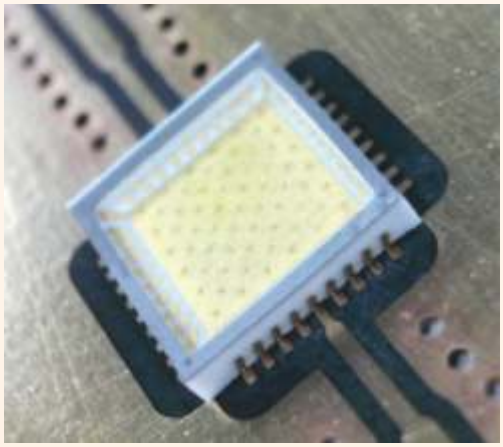
- DYSL-QT has developed Quantum Random Number Generator (QRNG) which is an opto-electronic system which uses principles of quantum mechanics to generate true randomness. The system detectsrandom quantum events and converts them into a stream of binary bits. The approach followed in the design uses the path superposition property of single photons in the fiber optic medium to generate random numbers.




## Ceramic (LTCC) RF QFN Package

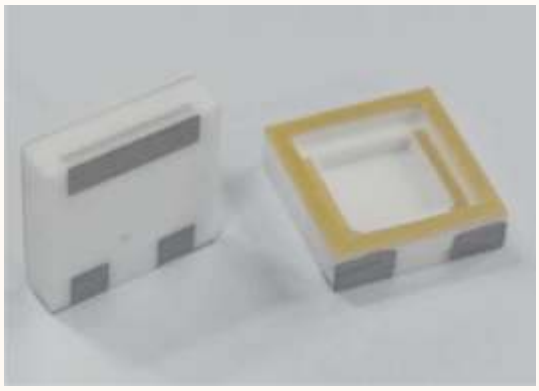
- Ceramic (LTCC) RF QFN Package is a Low Temperature Co-fired Ceramic RF QFN Package for application from DC to 40 GHz. It is High-density surface mountable package with RoHS compiled . Its other features are solder pads with castellation, hermetic package and Grounded Seal Ring.

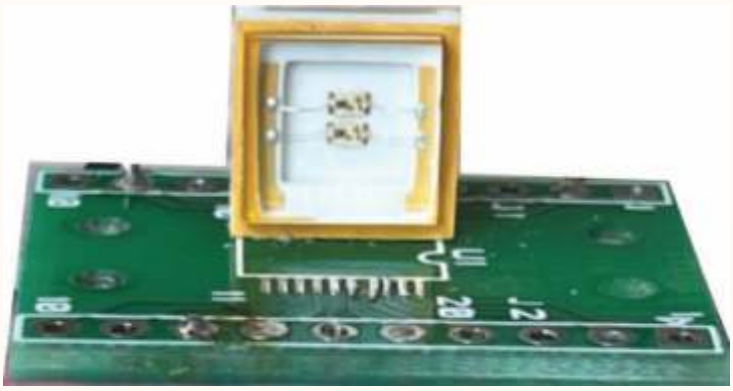




## Customized LTCC Packages Mounted

- Customized LTCC Packages are constructed with multiple layer to achieve a miniature size with high repeatability, It can be Horizontally or Vertically mounted with side castellation.
- Its other features are Hermetic package, High-density surface mountable package, ROHS compiled, Close thermal-expansion matching provides superior mechanical elasticity and less mechanical stress with silicon MEMS chips.





## MEMS Accelerometer based PIDS

- MEMS Accelerometer based Perimeter Intrusion Detection System (PIDS) is a device or sensor that detects the presence of an intruder attempting to breach the physical perimeter of a property, building, or other secured area.
- A PIDS is typically deployed as part of an overall security system and is often found in high-security environments such as correctional facilities, airports, military bases and nuclear plants.

## Mechanical Pressure Switch

- Mechanical Pressure Switch is a field settable mechanical pressure switch with an adjustable switching range of 6 to 10 bar g. It does not require electrical power to operate and can be adjusted to the desired switching point by a simple procedure. It can be configured to operate in either Normally Open or Normally Closed state. Pigtail connector is provided in the Switch but can be customised based on customer requirement. Each sensor is tested and calibrated under the required conditions. Sensor is screened through stern environmental tests as per applicable standards.

## MEMS Naval Pressure Transducer

- MEMS Naval Pressure Transducer is used for Naval Applications. It is a MEMS based pressure sensor MIL qualified, OIL field, compact & rugged Pressure Transducer. Its accuracy is better than 1 % and operating temperature range is - 40°C to +70°C. All pressure components exposed to pressure are made of SS 316L. Hermeticity is ensured by leak free e-beam welding at all joints.

## MEMS High Temperature Pressure Transducer

- MEMS High Temperature Pressure Transducer is used in applications where the media temperature exceeds the temperature limit of standard Pressure Transducers.
- It is a MEMS based pressure sensor with high guage factor. It is MIL qualified, OIL field, compact & rugged Pressure Transducer. Its accuracy is better than 0.50 % and operating temperature range is -40°C to +300°C.
- All pressure components exposed to pressure are made of SS 316L. Hermeticity is ensured by leak free e-beam welding at all joints.

## MEMS Weldable Pressure Transducer

- MEMS Weldable Pressure Transducer can be welded at the required point of use location. It is a MEMS based pressure sensor with high guage factor. It is MIL qualified, OIL field, compact & rugged Pressure Transducer. Its accuracy is better than 1% and operating temperature range is - 40°C to +125°C. All pressure components exposed to pressure are made of SS 316L. Hermeticity is ensured by leak free e-beam welding at all joints.

## MEMS Pressure Transducer with Digital Display

- MEMS Pressure Transducer with Digital Display is a MEMS based pressure sensor with Embedded Driver/Controller and display size is 2.44 cm with Interface modes: I2C/IIC. It is compact & rugged Pressure Transducer. Its operating temperature range is - 40°C to +70°C. All pressure components exposed to pressure are made of SS 316L. Hermeticity is ensured by leak free e-beam welding at all joints.

## Pressure Transducer with Digital Readout

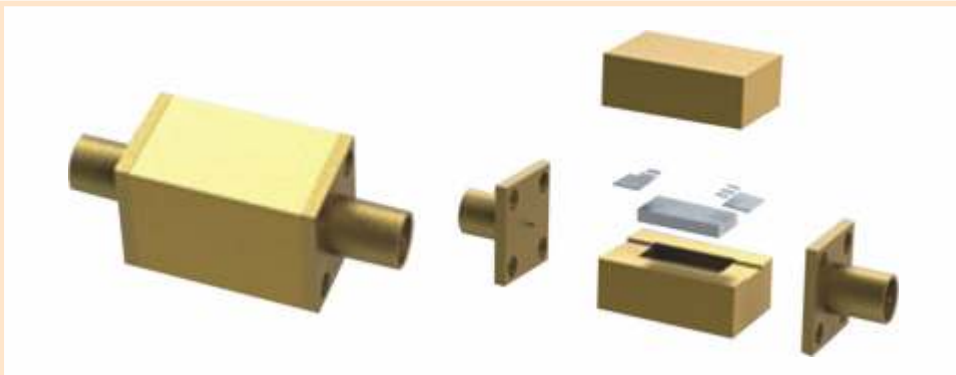
- MEMS Pressure Transducer with Digital Output is a MEMS based pressure sensor uses smart sensor technology plug and play. Sensor Calibration coefficients are stored in the sensor. It uses low current drain output format RS-422. It is MIL qualified, OIL field, compact & rugged Pressure Transducer. Its accuracy is better than 0.50 % and operating temperature range is - 40°C to +120°C. All pressure components exposed to pressure are made of SS 316L. Hermeticity is ensured by leak free e-beam welding at all joints.

## Piezoelectric Accelerometer

- Piezoelectric Accelerometer is a compact vibration sensor which employs a piezoelectric film for sensing vibrations over a wide frequency range. It uses a spring mass system to generate a force proportional to the vibration which produces a deformation in the sensing element and a corresponding mV output is produced.
- Rugged packaging of the sensor makes it capable of high shock survivability.
- Pigtail connector is provided with ultra-low noise cable but can be customised based on customer requirement.
- Each sensor is tested and calibrated under the required conditions.
- Sensor is screened through stern environmental tests as per applicable standards.

## LTCC based Band Pass Filter

- LTCC Band Pass Filter is constructed with 12 layers in order to achieve a miniature size and high repeatability of performance, these units offer low insertion loss and good rejection. It allows excellent solder ability and easy visual inspection capability. LTCC construction Provides a rugged package that is well suited for tough environments including high humidity and high temperature extremes.

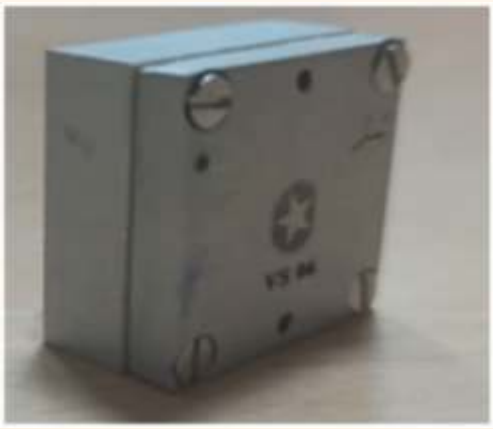


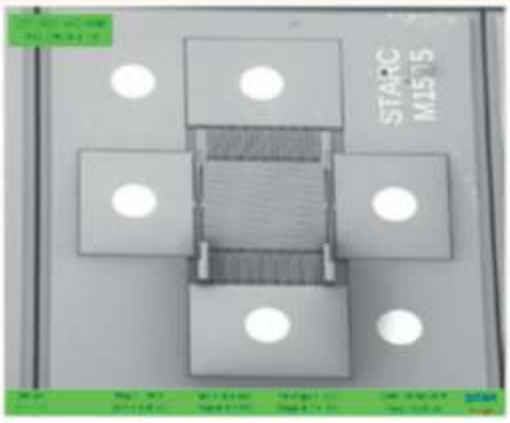
## Infrasonic MIC for Snow-Avalanche Detection

- Infrasonic Mic is a specialized microphone which is capable of measuring infra sound i.e. frequencies less than 20 Hz. The Microphones use a moving diaphragm to pick up audio where sound waves cause the surface to vibrate. This specialized mic find their application in detection of snow avalanche.


## Micro Electro Mechanical System (MEMS) Vibration Sensor

- A vibration sensor is a device that measures the amplitude and frequency of vibration in a given system, machine, or piece of equipment. Those measurements can be used to detect imbalances or other issues in the asset and predict future breakdowns. The devices are fabricated using Silicon on Insulator Technology in MEMS, where movement of the Proof mass is used to determine the vibration.





## Low Temperature Co-fired Ceramic (LTCC) based Cooling Channels

- Low Temperature Co-fired Ceramic (LTCC) based Cooling Channel offers for electronic packaging, it also enables the fabrication of micro fluidic elements like channels and embedded cavities. Hence, LTCC facilitate the realization of complex and integrated micro fluid system. However, for many power applications it is necessary to have a short thermal path between the power semiconductor and the heat sink. A coolant is pumped through the channel in order to cool down the device. Thermal vias are added in the ceramic and the fluidic channel to optimize the heat transfer to the coolant.

## Micro Electro Mechanical System (MEMS) Accelerometer

- MEMS Accelerometer measures the physical acceleration experienced by an Object. It is single axis capacitive type MEMS accelerometer designed for Low g (up to 2g). Its resolution is 10mg.


## Micro Electro Mechanical System (MEMS) g-Switch

- MEMS based g-Switch is an acceleration threshold switch with an independent angled latching mechanism. It is designed to operate in critical applications wherein power cannot be applied. This device realised on Silicon on Insulator (SoI) Technology, Proof Mass and spring structure with extended symmetrical fins on either side for latching at a certain value of acceleration.
- It is very small and lightweight but fast in response. Contact acceleration threshold is 1500g & 3000g. It can be packaged in LTCC packages also.

## Micro Electro Mechanical System (MEMS) Pressure Load Switch

- Pressure Load Switch is a passive micro switch, does not require power for operation and designed to close at a threshold actuation load. It has very low contact Resistance in closed condition and Offers a large actuation area required for mine application. It is MIL qualified and made of Stainless Steel 316L material. It is also resistant to temperature and vibration.


## Micro Electro Mechanical System (MEMS) based Temperature Sensor

- MEMS Temperature Sensor is usable over a wide temperature range with excellent stability, accuracy and repeatability. It does not require special cables or cold junction compensation. It is suitable for pressurized fluid temperature measurement. Its rugged outer body made of Stainless Steel 316L material. Weather Proof and can also be used in chemical environments.

# Materials

## Tungsten Heavy Alloy - FSAPDS

- DMRL has developed tungsten heavy alloys which are used as the core rods in kinetic energy penetrators and established the technology for Fin Stabilised Armour Piercing Discarding Sabot (FSAPDS) anti-tank ammunition.
- Version: 120 mm Mark-II Penetrators
- Dimensions: Penetrator Rod: 30 mm dia x 510 mm
- Weight: Approx 8 kg
- Depth of penetration: 500 mm in RHA steel target
- DMRL was also responsible for setting up a manufacturing plant Heavy Alloy Penetrator Project (HAPP) under Ordnance Factory Board at Tiruchirapalli to produce these penetrators in large scale, using DMRL technology.

## Silica Radome for Astra Missile

- DMRL has developed Silica Radome technology indigenously in view of its current and future requirement in large numbers for target seeking missiles. The salient features are:
- Raw material available indigenously, Low manufacturing cost, Consistent properties, Good machinability, High component yield
- The technology based on cold Isostatic Pressing (CIP) and sintering has been established for the first time in the country
- DMRL developed Radomes have been successfully integrated with Astra Missile
- The technology for silica Radomes has been transferred to (i) M/s MIDHANI (ii) M/s CEL and (iii) M/s BEL for large scale production

## Titanium Sponge in Acrylic Box

- DMRL has developed a state-of-the-art technology for Titanium sponge production from indigenous raw material ($TiCl_4$) with quality of the sponge meeting international specifications.
- First commercial plant (KMML) for Ti sponge production has been setup in the country based on technology developed at DMRL.
- The plant was inaugurated in 2011 and subsequently production commenced.
- The plant is producing Titanium sponge in 3.5 - 4.0 MT batches.
- Titanium sponge produced at KMML is certified for aero and naval applications including submarine construction.
  Self-reliance with respect to Titanium metal for critical applications.
  India is 7th nation in the world producing aeronautical grade Titanium sponge.

## Titanium Alloy – Drop Link for Tejas

- Ti-10V-2Fe-3Al (Ti-1023) alloy is a high strength Titanium alloy which has the lowest flow stresses at forging temperature amongst many commercially used Titanium alloys and therefore used as closed die forged components in many aircrafts.
- The alloy can replace Ni-Cr-Mo steel forged parts in aircraft structures resulting in considerable weight savings.
- ADA has identified about 15 components presently made of Ni-Cr-Mo steel to be replaced by this alloy.
- Drop Link is a part of the landing gear of fighter aircraft Tejas Mark-II, manufactured at Hindustan Aeronautics Limited (HAL), Bengaluru with DMRL technology.

## Titanium Alloy – Compressor Disc for Adour Engine

- DMRL has successfully developed indigenous isothermal forging technology for manufacturing critical components of Adour engine for Jaguar fighter aircraft.
- Established technology to produce all the five stages of high-pressure compressor (HPC) disc out of difficult-to-deform titanium alloy using its unique 2000 MT isothermal forge press.
- With this development, India has joined the league of limited global engine developers to have the manufacturing capabilities of such critical aero engine components.
- To meet the bulk production requirements, DMRL technology was transferred to M/s MIDHANI.
- Using the isothermal forge press facility available at DMRL, Hyderabad, bulk quantity (200 numbers) of HPC disc forgings pertaining to various compressor stages have been jointly (DMRL & MIDHANI) produced and successfully supplied to HAL (E), Bengaluru for fitment into Adour Engine that powers the Jaguar/Hawk Aircrafts.

## DS & SX Blades and Vanes for Aero Engines

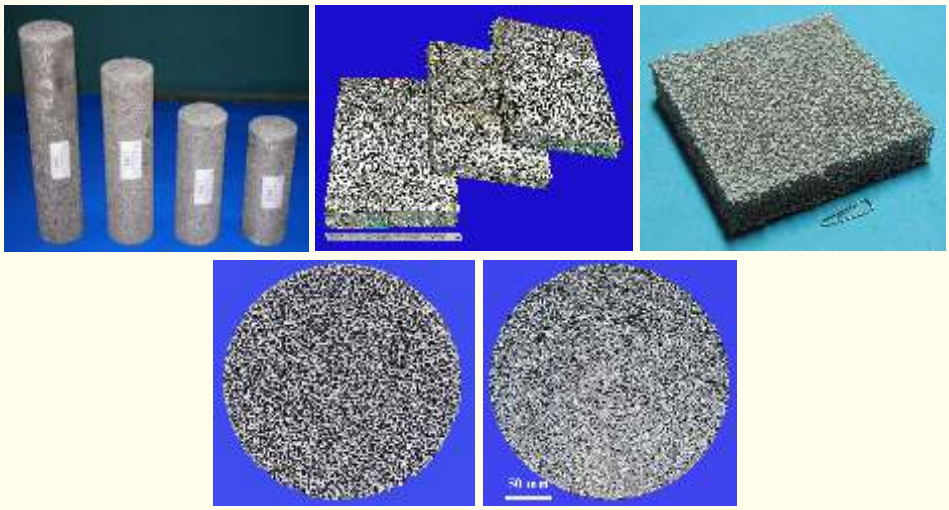
- DMRL has developed vacuum investment casting process to produce state-of-the-art Directionally Solidified (DS) and Single Crystal (SX) blades and vanes for aero gas turbine engines.
- DS High Pressure Turbine (HPT) Blades and Vanes are columnar grained hollow castings with thin walled aerofoils between two shrouds
- These are cast in vacuum induction melting and casting furnace using Ni- base superalloys
- SX High Pressure Turbine (HPT) Blades and Vanes are produced by using orthogonal grain selector from advanced Ni-base single crystal alloy
- Ceramic silica cores are used to get hollow cast components
- These components result in high efficiency, high thrust and low specific fuel consumption

## Rare Earth Permanent Magnets

- In high performance applications, rare earth permanent magnets are preferred over conventional magnets. DMRL has established process technologies for making three different classes of rare earth magnets:
- SmCo5, Sm2Co17 and Nd-Fe-B
- Different shapes and sizes of rare earth magnets for defence and aerospace applications have been made, assembled in the devices and tested

## Metal Foams

- Metal foams are ultra light weight materials which can absorb impact and blast energy efficiently. DMRL has developed Al, Ni and Ni-Cr-Mo superalloy foams
- Properties: High porosity (> 90 %), Low thermal conductivity, High specific surface area, High permeability, High damping capacity, High specific strength, High Specific stiffness (as sandwich panel)
- Open cell Ni foam (30 ppi, 0.5 g/cc) developed by DMRL has been successfully used as secondary wick (Liquid acquisition baffle in Loop Heat Pipe) on GSAT-19 Satellite launched in June 2017



## Cu-Ti Non-Sparking Tools

- DMRL has developed a Cu-4.5Ti alloy for manufacturing non-sparking tools as a substitute to toxic and expensive Cu-Be alloys. The alloy possesses good conductivity and strength.
- Typical non-sparking tools developed are: Scrapers, Knifes, White Bits, Hacksaw Blades, Spatula, Hexagonal Chisels
- The main advantages are: Tools are non-toxic, Lower cost as Ti ores are in abundance

## Radar Absorbing Structure

- Glass-epoxy composite based broadband radar absorbing structural composite using Frequency Selective Surfaces (FSS)
- Developed in the form of laminates at the thickness of 3.6 mm
- Excellent mechanical properties and environmental stability
- Minimum reflection loss of 10 dB (90% electromagnetic absorption) in 8-18 GHz frequency region

## Multispectral Personnel Camouflage Equipment (MSPCE)

- 3D Structured Multi Spectral Camouflage System for camouflaging of military objects in visual, NIR, thermal and microwave frequency regions.
- Two layers, 3 dimensional structure
- Camouflage efficacy observed in visual (380-780 nm), NIR (780-1500 nm), thermal (3-5 & 8-12 µm) & MW (8-18 GHz)
- Light weight structure (~ 350 gsm) & low water absorption < 10%
- Withstand pressure of high wind velocity 60-70 km/h
- Fire retardant and self extinguishableQuick deployment and removal


## Coolants DAFC-30 and DAFC-50

- These fluids are used as coolants in vehicles/radars.
- They are non reactive towards rubber parts in the system.
- Besides, they are also non corrosive towards metallic parts of the system.
- DAFC-50 can function in extreme low temperature regions (-30 0C).

## HOTS Oil & Fuel JP-10

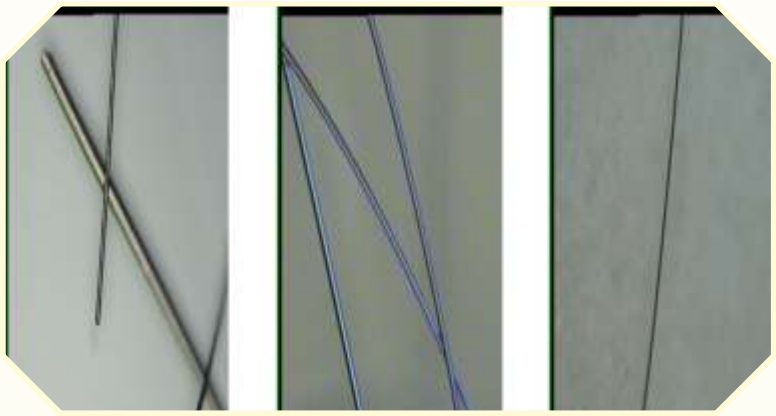
- HOTS oil as per Russian standard for small Turbo Fan Engine
- The high density fuel JP-10 is a liquid hydrocarbon fuel chemically known as Exo-Tetrahydrodicyclopentadiene synthesized over mesoporous supported nickel nanocatalyst (Ni/MCM-41) using starting material Dicyclopentadiene


## Closed Cell SiC Foam for High Temperature Application

- Ceramic (SiC) foam offers a unique combination of properties such as low density, high specific surface area and high stiffness to weight ratio, high specific strength, high thermal shock resistance and low thermal & electrical conductivity.

## Silicon Carbide Fiber

- Developed Process to prepare SiC fiber
- Fabrication of single/multi hole 100 gm capacity spinneret
- Drawing from 300 m diameter, stretching of precursor materials fiber below ~50 μmdia and winding
- Stabilization of precursor fibers by controlled exposure to air atmosphere
- Pyrolysis of PCS fibers up to ~1300°C to get SiC ceramic fiber
- Characterization and property evaluation



## Water Filtration Cartridge

- It has a unique feature of air droppable characteristics which enables mass scale supply of drinkable water during natural calamities

## Thermal Insulation and Impact Shock Absorbing Materials for FDR

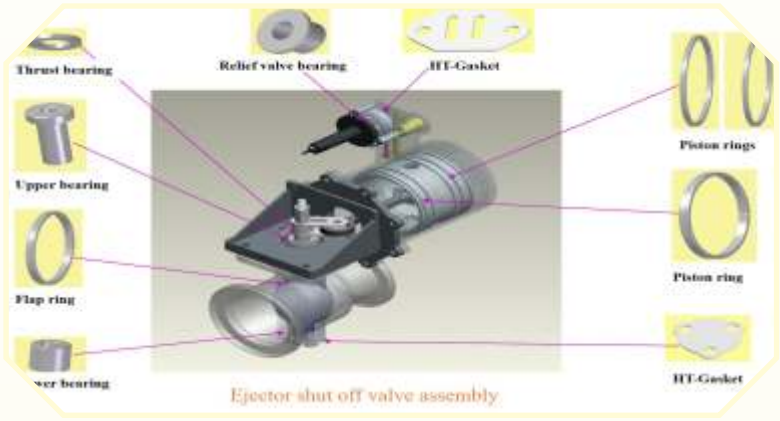
- AN-32 Air Flight Data Recorder (FDR) module has magnetic tape storage media.
  This was replaced with state-of-the-art Solid State Flash disk in the indigenized configuration.
  The thermal insulation block of micro porous silica insulation and was designed and developed by DMSRDE Kanpur using micro porous silica insulation.
  - Extremely low thermal conductivity : 0.021 to 0.041 W/m.K
  - Thermal stability:upto 11000C
  - Specific heat: 900 J/kg.K at 200 OC
  - Low density: 0.25 to 0.45 gm/cm3
  - Resistance to compression: 8.2 kg/cm2
  - Organic content: 1 – 2%


## Lightning Insulator Tubes for LCA

- Material: Poly ether ether ketone (PEEK)
- Properties: High thermal stability(250oC), very good mechanical properties, very low moisture absorption, excellent chemical resistant and fire retardant with dielectric strength (190 kvcm-1)
- Process: Injection moulding & Machining

## Carbo-Graphite Seals for HT Sealing System of Ejector Shut off Valve Assembly (LCA)

- Graphite filler dispersed in carbon matrix with Silica & silicates of Al, Mg & Ca as reinforcing fillers and P salts as additives.
- Carbo-graphite material is an advanced carbon composite having high strength, wear resistance, natural lubricity and thermal shock resistance properties.




## Light Weight Ceramic Composite Armour Panels for Advanced Light Helicopter (ALH)

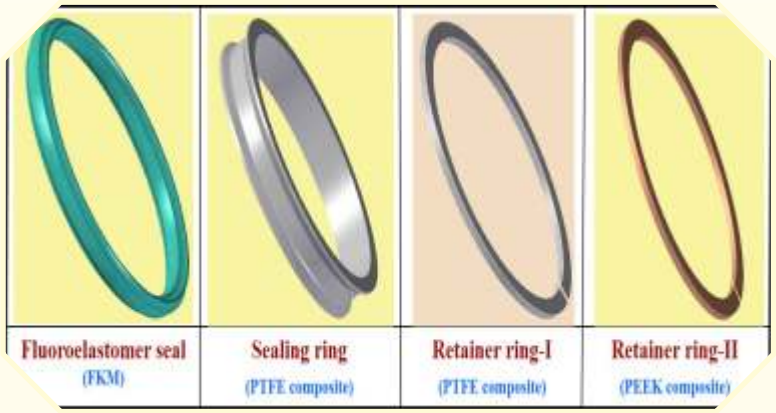
- As per requirement of RWR&DC Hindustan Aeronautics Ltd. (Helicopter Division) Bangalore, composite armour panels have been designed and developed by DMSRDE, Kanpur for Advanced Light Helicopter (Army Variant) which provide protection to aircrews and critical parts of helicopter against 12.7 mm API bullet hits

## NBC Shielding Pads for Combat Vehicles

- Nuclear shielding pads for T-90, T-72 and ICVs; BMP-2 & 2K under modernization programme of NBC protection system
  - 118 types shielding pads developed against INR and fallout radiations
  - It has very good vibration damping characteristics and crack growth resistance
  - Resistant to chemical and biological warfare agents
  - Resistant to environmental weathering
  - Improved fastening system to avoid head injury to crews
  - Shelf life is 14 years (from date of manufacturing)

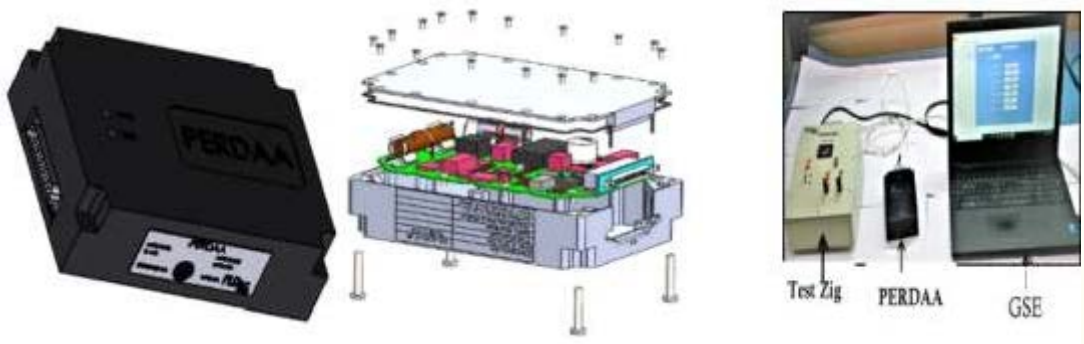
## Seals for Dynamic Piston Assembly

- Dynamic seals for dynamic & guide piston assembly and static seals (i.e. retainer packings, scraper seal &'O' ring) based on high performance fluoroelastomer compounds and advanced thermoplastic composite materials



## Personal Dosimeter for Aerospace Applications (PERDAA)

- The Personal Dosimeter for Aerospace Application (PERDAA) is developed for Gamma radiation detection for Crew Module of Gaganyaan Mission. PERDAA is a Radiation sensor unit for monitoring of Gamma radiation dose rate and total dose. It is interfaced to Mission Computer in the Crew Module. GM sensors and passive semiconductor sensor are being used for Gamma and neutron dose measurement respectively.

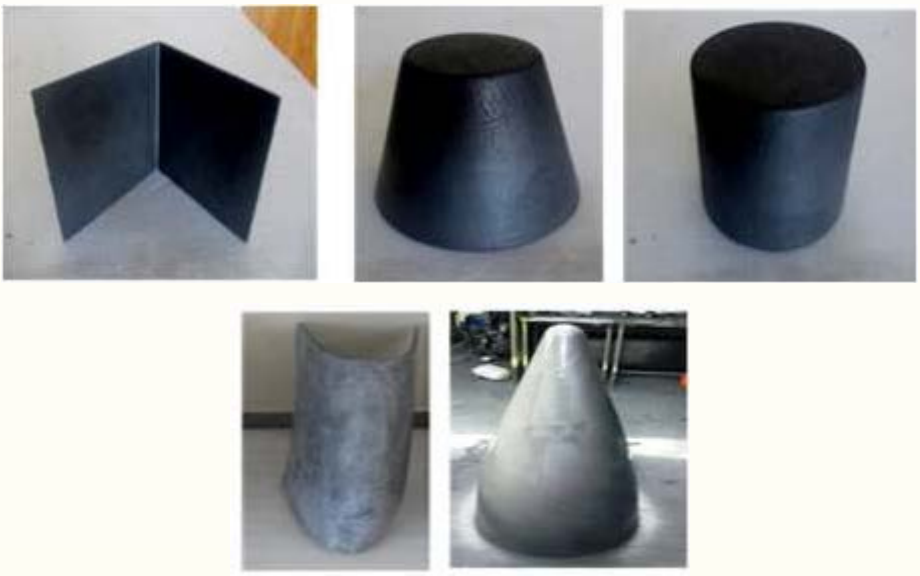



## Emergency Sea Water Purification Kit (ESWPK)

- Sea Water Purification Kit is capable to convert 500 ml Sea water into drinkable water with in short period of 30 minutes. Kit is capable to remove colour, odour, turbidity, high TDS and microbial contaminants from sea water. It is light weight, foldable, simple to operate, compact and no need of electricity.

## X-Band Radar Absorbing Paint Curved Specimen

- Defence Laboratory, Jodhpur has developed Radar Absorbing Paint System for airborne strategic objects such as glider bomb, manned fighter, surveillance aircraft and unmanned aerial vehicles to reduce Radar Cross Section (RCS) of objects. The application of the paint on to selective locations decreases detectability of objects tracked by enemy radars and increases the survivability of the objects.



## Chaff Cartridge-118/I

- Chaff Catridge-118/I is a passive electronic counter-measure to protect Aircrafts from RF seeker missiles in the microwave frequency range.
- It is a non-metallic rectangular container filled with millions of chaff fibers of different cut off lengths.
- DLJ has designed and developed advanced chaff cartridge having efficient chaff material and innovative payload design

## 26 mm Chaff Cartridge

- 26mm chaff cartridge is a passive electronic counter-measure to protect Aircrafts from RF seeker missiles in the microwave frequency range.
- It is a cylindrical container filled with lakhs of chaff fibers of different cut off lengths.


## 50 mm Chaff Cartridge

- 50mm chaff cartridge is a passive electronic counter-measure to protect Aircrafts from RF seeker missiles in the microwave frequency range.
- It is a cylindrical container filled with millions of chaff fibers of different cut off lengths.

# Virtual Reality based Chaff Application Training Console (ViRAT)

- Airborne Chaffis an important strategic countermeasure device used worldwide to protect Military Aircrafts and Ships from enemy radar and RF seeker missiles. Defence Laboratory has successfully developed indigenous airborne chaff material. Defence Laboratory, Jodhpur has established a 'Virtual Reality based Airborne Chaff Simulator' for the simulation of real time warfare scenarios by firing chaff cartridges for deceiving the incoming hostile RF seeker missiles and safeguarding the Fighter Aircrafts.

# Land Systems & Munitions

## Aircraft Store Release and Ejection Mechanism (ASREM)

- Suspension and release of aircraft stores during various flight conditions
- Designed for store up to 125 kg
- Reconfigurable for higher weight stores

## Quick Release Mechanism (QRM)

- Aircraft store launcher for internal weapon bay
- Suspension and release of aircraft stores
- Payload capacity up to 190 kg

## Control Stick

- Aircraft motion is controlled by Pilot through Pilot stick which provides the longitudinal control (pitch movement) and lateral control (Roll movement) of the aircraft which is fitted near the pilot seat. The pilot controls pitch angle of aircraft with forward and aft movement of the pilot stick and Roll motions of the aircraft with left and right movement of the pilot stick. These commands given to the aircraft through quadruple LVDT output to DFCC (Digital Flight Control Computer) to control surfaces. This is a passive control stick.



## Rudder Pedal

- Rudder pedal facilitates the directional control to the aircraft about its vertical axis
- Provide the pitch and roll control of the aircraft and is fitted near the pilot seat


## Confined Space ROV (CSROV) with MCS

- Designed to traverse through confined spaces within train compartments and aircrafts
- Reach onto the berth or the cabin baggage space and extract any suspected object
- Assess the threat by using on-board X-ray scanner and defuses it by using a water jet disrupter
- Remotely deployable from a range of 200m LOS
- Driven from a backpack based Master Control Station (MCS)

## Surveillance ROV (SROV)

- Remotely operated vehicle equipped for multi-role capability
- Real time video transmission from a range of 200m
- One-man portable design
- Traverse through urban and cross-country terrain and climb stairs
- Equipped with day and night vision cameras

## SUMITRA

- Augmenting the existing perimeter security apparatus with enhanced sensors, automated alarm generation and better situational awareness to reduce operator fatigue and false alarms
- Further augmented with fully automated real-time intruder tracking using Unmanned Aerial Vehicles (UAVs)

Mission Command & Control Centre

Intruder tracking UAV

## Modular Bridging System

- Mechanically launched single span mobile bridging system
- Used to traverse a trench/river gap in the path of the moving platoon/regiment.
- Designed to support crossing over of tracked and wheeled vehicles up to MLC 70 load class
- Deployable across gaps of varying lengths as required from 14m to 46m in steps of 6.5m
- Provides a safe 4m roadway passage for traffic across gaps and trenches with transportation width of 3.5m

## Sarvatra Bridging System

- Individual spans of 15m each, a class 70 bridge upto a span of 75m can be constructed using 5 spans
- Being class 70, the system is capable for most of service vehicles including MBT Arjun
- Each span of the bridge can be deployed mechanically in less than 20 minutes
- Spans are connected through telescopic piers which can vary in height from 2.5m to 6m

## QRSAM Launcher

The QRSAM Weapon System is a Quick Reaction Missile System capable of Surveillance, Target Acquisition, Tracking while on the move and fire on short halts for an Area Air Defence being developed by DRDO.

- All Round Missile Firing Capability in elevation from 10 to 60° and Azimuth 360 °
- Quick Deployment and Launching of the Canisterised Missiles from uneven grounds
- All Weather Condition and Day Night Operation
- High Slewing & Tracking Rates with precise positioning
- Automatic High Speed Deployment System
- Cross Country Mobility & Transportation by Air, Rail Road & Ship
- Multi-axis closed loop servo control
- Multiple High Speed Actuator Synchronization
- System Ruggedisation&Integration

## Akash NG

- The AKASH-NG (AKNG) Weapon System is being developed by DRDO for Indian Air Force. The weapon system is capable of engaging multiple targets (10 targets) simultaneously with 360° coverage in azimuth. AKASH-NG MLS is a trailer mounted system hauled by 6x4 Prime Mover for launching AKASH-NG missile. The MLS houses the up to six (6) Canisterised Missiles (CMs), platform levelling system, Elevation and Azimuth system, Launcher and Missile electronics, Communication and other necessary equipment. A single trailer carries the entire Launcher System including its captive Power Supply System housed on an Underframe.
  The key launcher operations and functions including missile launch is controlled by CCU which communicates with MLS through a wired / wireless communication system at a distance up to 2 km away from the MLS
  - Electrically Synchronized twin roller screw
  - Indigenous 128 Channel Slip Ring with max power of 40kW
  - Embossed type easy to manufacture canister
  - 20° to 70° Elevation and all 360° azimuth firing
  - Slant Range upto 30 Km
  - Altitude 30m to 14 Km

## Trawl Assembly for T-72 / T-90 Tanks

- Create Assault/ Vehicle Safe Lane (VSL) through minefields
- One set of trawls will be mounted on one T-72/T-90 tank
- The trawl assembly creates VSL of 5.39 m by using 4 trawl tanks in tandem
- Deployment in plains, semi-desert and desert terrain
- Able to withstand blast of A/T mines

## High Payload Multi Copter (Untethered Payload 5 Kg)

- Untethered Multi-copter Payload 5kg is a high payload multi-copter with on-board Li-ion battery bank. Advantage of Untethered multi-copter is that it has high payload capacity and endurance of 30min. This Untethered multi-copter can carry out autonomous missions with waypoint navigation up to 5km. It has feature of payload release. So it can travel to designated location in auto mode and release payload and return to home location

## 250 Kg Pre-fragmented Bomb

- The bomb is similar to Russian OFAB 250-270 bomb in terms of shape and inertial properties. The bomb primarily consists of two sub-assemblies - Bomb body and Preformed Fragmentation (PF) Module. The PF module has total 12000 steel balls of 12mm diameter embedded between FRP in three layers. The bomb has twin suspension i.e. 250 mm and 14" for carrying it on Russian as well as NATO origin aircrafts. The fragments are lethal up to a distance of 35m against 8m thick RHA plate capable of producing min. 1 perforation per square meter

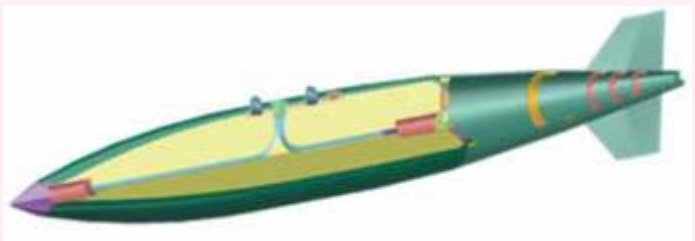
## 450 Kg High Speed Low Drag (HSLD) Bomb

- 450 kg High Speed Low Drag Bomb is a natural fragmenting Bomb.
- The bomb has twin suspension i.e. 250 mm and 14" for carrying it on Russian as well as NATO origin aircrafts.
- Two types of tail units, Retarder Tail Unit (RTU) for high speed low level bombing and Ballistic Tail Unit (BTU) for high speed high altitude bombing have been developed for the bomb to be used in different tactical roles.
- The HE filling of the bomb is Dentex for achieving maximum blast and fragmentation effect for inflicting maximum damage to the target.


450 kg HSLD Bomb

## 500 Kg General Purpose Bomb

- ARDE has designed and developed 500 kg GP Bomb which has the physical parameters and mass properties of the bomb similar to that of Mk-83 bomb so that the bomb can be directly fitted with LGB kits available with Air Force to utilize the limited concrete penetration capabilities of the bomb.



## 500 Kg Pre-fragmented Bomb

- The 500 kg PF Bomb has external profile, physical properties and ballistics matching with that of FAB-500 M-62 Bomb. The Bomb is designed to have provision for carrying on aircrafts of Russian origin as well as western origins. The bomb meets the lethality criteria of Perforation in 10 mm thick RHA plate at 50 m radius from the point of burst.

## AAKASH Missile Warhead

- AKASH missile warhead is a Preformed Fragmentation (PF) warhead weighing 55 kg developed for Surface-to-Air Missile AKASH to neutralize aerial targets such as combat aircrafts, helicopters, cruise missiles and UAVs etc. It consists of around 10000 TA Fragments and approximately 20 kg explosive filling. The fragments are capable of perforating 8 mm thick steel plate up to a distance of 50 m from the point of burst. An electromechanical Safety Arming & detonation mechanism is provided to keep the warhead safe during handling & transport and detonates the warhead in proximity of the target.

## 1000 lbs Thermobaric Bomb

- Thermobaric bombs use advanced fuel rich explosive filling capable of sustained terminal effects with enhanced lethality. TB bombs are capable to defeat soft and medium hard targets in open / confined environments with high impulse blast (TNT equivalent of 1.6) and thermal output. TB bombs are capable to generate higher blast impulse (> 30%) and long duration thermal effects (>1600oC, > 400ms) compared to conventional HE bombs. The bombs are adaptable to NATO and Russian aircrafts. The TB composition with enhanced performance parameters are developed as one to one replacement of existing bombs which uses TNT based conventional filling.

## IC-50mm M.S.Flare

- IR guided missiles pose the major threat to military aircraft. To counteract these threats pyrotechnic infrared(IR) decoy flares were required to be develop indigenously for Indian Air Force and Navy. The impulse cartridge (IC) is required to be develop for the ignition of SFU igniter cup and ejection of IR flare from the container. Impulse cartridge is an electro explosive device. On functioning, it produces sufficient gas pressure in a confined volume and ejects the flare out of container with ejection velocity between 25-50 m/s and simultaneously ignites composition of safety and functioning unit (SFU).

## Impulse Cartridge (IC) - 218

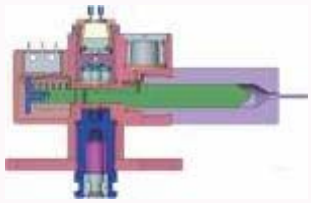
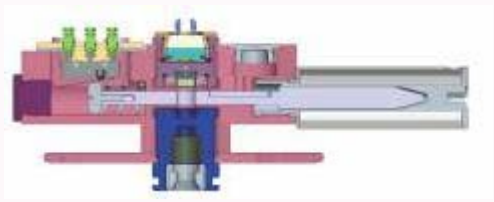
- IR guided missile pose the major threat to military Aircrafts. To counteract these threats pyrotechnic infrared (IR) decoy flares were required to be developed indigenously for Indian, Air Force and Navy. The impulse cartridge (IC) is required to be develop for the ignition of SFU igniter cup and ejection of IR flare from the container. Impulse cartridge is an electro explosive device. On functioning, it produces sufficient gas pressure in a confined volume and ejects the flare out of container with ejection velocity between 25-50 m/s and simultaneously ignites composition of safety and functioning unit (SFU).

## EVP - 19

- HEMRL has developed the Pyrocartridges (PC) for the missile Brag Mos under the programme PJ-10. EVP-19 Pyrocartridge is a single shot device which on receiving the electrical pulse gets initiate and generate the flame hot gases and particles. This output is used for initiation of explosive train (Igniter and Propellant or doing the Mechanical work. Depending on charge mass of Pyrotechnic composition, EVP-19 Pyrocartridges are divided into three variants namely Red, Blue and Green. All three are dimensionally same and can be interchangeable. On the basis of the coloured mentioned in their name , EVP-19 ( Red, Blue and Green) is painted with Red, Blue and Green respectively on the Hexagon of body for visual identification mark.

## 1A/1W Detonator for LRSAM

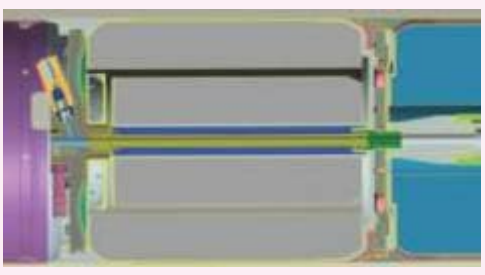
- 1A/1W Detonator is developed by HEMRL for initiation of igniter of LRSAM via Through Bulk head Initiator (TBI). The detonator initiates the donor charge of TBI which on detonation transmits a shock impulse through the metallic barrier and initiates the acceptor charge. The flash/shock of acceptor charge initiates the igniter which in turn initiates the propellant charge. The detonator and the TBI are kept separated by a safe and arm device "Ignition Safe and Arm Unit" (ISA #1 or ISA#2) in which detonator and TBI are housed.

## 1A/1W Explosive Bolt for LRSAM

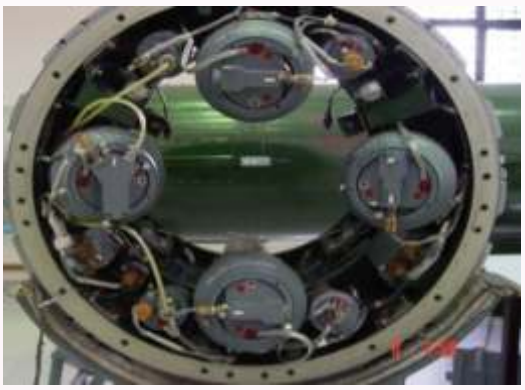
- Long Range Surface to Air Missile (LRSAM) Propulsion system requires a Jet Vane based Thrust Vector Control (TVC) system for its initial maneuver. TVC system is assembled to the motor casing, by means of Interface Plate and separation sub unit called V-Band Assembly, which in turn is held together by two explosive bolts. The TVC is required to be operative for initial 4 seconds from the launch instant and ejected immediately after its mission is over. Upon initiation, the Explosive bolts shear at the notch region and separate the V-Band assembly facilitating the release of TVC system (as it is free to move in axial direction in this condition) under the action of drag force. HEMRL has developed a new squib composition which can withstand the current of 1A for five minutes for explosive bolt.





## PDO-1-4

HEMRL has developed the Pyrocartridges (PC) for the missile BrahMos under the programme PJ-10. The Pyrocartridge is basically an Electro Explosive device which are designed to produce a explosive output in the form of flame, hot gases, hot particles etc. by converting the chemical energy. The electrical stimulus causes an exothermic reaction in the device. This output is used for initiation of explosive train (igniter & propellant) or during the mechanical work. Depending on charge mass of Pyrotechnic composition Pyrocartridges have four variants namely PDO-I, PDO-II, PDO-III and PDO-IV. All these four are dimensionally same and can be interchangeable except screw.



## Pyro Igniter for STFE

HEMRL has developed the Pyro Igniter (PI) for small Turbo Fan Engine (STFE) for Nirbhay missile. The Pyro Igniter consists of electro explosive device (EED) and main charge as igniter. EEDs are designed to produce an explosive output in the form of flame, hot gases, hot particles etc. by converting the chemical energy. The electrical stimulus causes an exothermic reaction in the device. This output is used for ignition of explosive train (Initiator, booster, igniter, etc.) or doing the mechanical work. In case of pyro igniter, once EED functions it gives a flash to the booster which in turn ignites the main charge. Booster and main charge are pyrotechnic compositions. The main charge gives output in the form of flame of sufficient temperature, length and duration. A total of 2 Nos of PI are used on one STFE.

## Impulse Cartridge (IC) - 118

The chaff is a passive electronic counter measure, deployed to either confuse hostile radar system or act as a decoy against radar homing missile. Chaff consists of large number of fine reflecting elements cut off to resonant length to act as resonating dipoles, packed in disposable cartridge. The Impulse Cartridge is an Electro Explosive Device which on receiving the electrical impulse functions and generates the high pressure, high volume gases. These gases eject the chaff material with an ejection velocity sufficient to form rapid blooming of the chaff. Chaff cloud formed has RCS (Radar cross section) sufficient to confuse ground based missile radar system. The EED (IC-118/I) contains bridges squib plug pressed in base of cartridge body, squib charge, booster charge and propellant.


## Explosive Detection Kit (EDK)

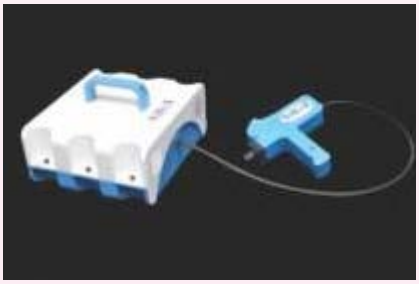
The Explosive Detection Kit is an innovative product designed and developed by HEMRL, for the detection and identification of suspect materials, trace explosive residues and IED constituents accurately at site. Explosives are identified by the principle of Colorimetry. It uses reagents that trigger coloured products to identify common explosives like RDX, TNT, PETN, CE, AN etc. from different classes like Nitramines, Nitro aromatics, Nitrate esters and Inorganic nitrates. It can be utilised in laboratory conditions and field conditions, both in the Pre blast and Post blast scenarios. It provides results within three minutes with minimum false alarms and is highly cost-effective.


## OPX- Revilator Explosive Detector

HEMRL has designed and developed OPX-Revilator, an Optronic Trace Explosive Detector based on the principle of Colorimetry and Computer Vision Technology. OPX-Revilator is an embedded controller based portable explosive detection device used for the identification of pure explosives, explosive compositions and trace explosives in mixtures with contaminants. It can detect and identify 20 explosives and compositions from different classes like RDX, TNT, PETN, Ammonium nitrate, NTO, FOX-7, CL-20, Cyclotol, LTPE etc. These explosives can be identified even in the presence of contaminants like sand, mud, salt, sugar, diesel etc. The name of the identified explosive constituent/s is displayed on the LCD screen within three minutes. The device is compact (185 mm X 126 mm X 75 mm), handheld (weight ~ 510 g) and battery operated. The inbuilt Algorithm guides the user at every step of operation in the laboratory or on the field.


## RAIDER- X Explosive Detector

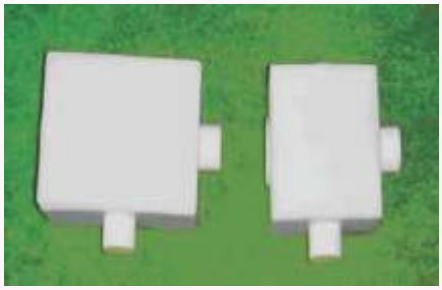
Raider-X is a Raman Spectroscopy based Explosive Detection and Identification Device developed by HEMRL in association with IISc, Bangalore. This state-of-the-art device is capable of detecting explosives from a stand-off distance of half a metre even in the concealed condition in translucent materials of about 3 mm thickness. This portable detector equipped with a flexible, point and shoot probe can be utilized for identification of 14 pure explosives and 2 binary explosive compositions configured in its database. The explosives identified include TNT, RDX, Ammonium Nitrate, CL-20, AP, FOX-7, NTO, TATB, HNS, RDX/TNT, HMX/TNT etc. An in-built Artificial Intelligence based algorithm for data analysis and explosive identification displays the name of the explosive constituent/s on the screen within a minute. The flexible library database can be configured for new explosives and is extendable for identification of narcotics, contraband, toxic and hazardous chemicals.



## Advanced Demolition Devices

ADDs encompass following types of devices:
1. Modular charge 350 g and 220 g – 2 devices
2. Shaped charges 30mm, 60mm, 90mm and 145 mm – 4 devices
3. Flexible Linear Shaped charge, FLSC 4 g/m, 12 g/m and 25 g/m – 3 devices

These devices are efficient, light in weight and provide greater flexibility of employment. ADDs have been developed to replace the existing demolition devices currently in use by Indian Army. Demolition devices are employed to meet the tactical requirements both in offensive and defensive operations for varied engineer tasks. Depending on the ground conditions, the devices can be adapted to meet their operational requirements. ADDs have been accepted for induction into services and regular production is in progress under ToT at M/s MIL.



## BrahMos Warhead

- Brahmos is a supersonic cruise missile with a range of 300km (Flight time 300 s) and carried a warhead of about 200 kg. Anti-Ship PCB warhead for Brahmos missile is indigenously developed by Programme PJ-10. HEMRL has developed the novel high explosive HEMEX which is a HMX based explosive. HEMEX formulation has been developed by HEMRL, based on the requirement given in terms of shock sensitivity, VoD, filling density and TNT equivalent. HEMRL has also developed the procedure and infrastructure required for filling the warhead casing and preparation of booster pellet during the development phase. Vacuum casting method has been adopted for filling the warhead with HEMEX composition to achieve desired density.

## Canopy Severance System

- Canopy Severance System (CSS) is an emergency escape aid system used for rescue of pilot in the shortest possible time. It consists of two independent sub-systems namely-
  1) Ground Egress System (GES)
  2) In-flight Egress System (IES)
- GES is used during emergency when the aircraft is on ground. It can be operated either by pilot himself or the ground crew. On operation, the canopy is cut along its periphery and then it is removed to facilitate the exit of the pilot.
- In-flight Egress System (IES) is used during flight. It is operated by the pilot by pulling the handle of ejection seat. On its operation, canopy is cut over the head of pilot which facilitates him to eject out easily through the canopy


## IR Decoy Flare for CMDS

- Infra red (IR) guided missiles pose major threat to military aircrafts. For aerial intercept missions, IR guided missiles have been developed around the world. Military as well as civilian aircrafts/helicopters are prone to attack by ground to air and air to air IR guided missiles.
  IR flare for CMDS is used to decoy the incoming IR guided missiles and thus save the aircraft/ helicopter.


## IR Decoy Flare 50 mm

- The 50 mm MTV Flares are used to save the fighter, transport and helicopters from IR guided missiles (both surface to air and air to air threats).
- 50 mm IR Flare, on produces very intense IR radiations in the desired waveband for more than 5s duration.
- The flare is compatible with APP-50 UV Mk I 30 (Russia) CMDS.
- Incorporated with a Safety and Functioning (SFU) unit, to ensure ignition of pellet only after ejection.


## Multi Spectral IR Flare

- Infra red (IR) guided missiles pose major threat to military aircrafts.
- Advanced IR guided missiles with spectral discrimination technique use IR intensity ratio of two IR wavebands as well as IR intensity in each waveband to differentiate between a Flare and Aircraft.
- Intensity ratio for MTV flare is ~ 1.3 while for an aircraft is < 0.5.
- Multispectral Ø50mm and 2"x1"x8" IR flares are being developed.
- Passive countermeasure for protection of aircraft from advanced IR guided missiles using spectral discrimination.

## IR Flare Type-II for PTA Lakshya-II

- PTA Lakshya is surface/ship launched high subsonic reusable aerial target system with under wing expendable tow bodies which act as sub-targets on which infra-red flares are mounted. Four IR flares can be fitted to each IR tow target.
- HEMRL has developed an Infrared flare type – II for PTA (Lakshya).
- This flare is a source of dual band infrared radiation as well as visual radiation


## 26 mm Infrared Decoy Flare

- 26mm IRF is used for self-protection of Russian Transport, Helicopters and MIG-29 aircraft for defeating IR homing anti-aircraft missile.
- Presently these flares are being imported. Due to recurring requirement of IAF, there is a need to indigenise these cartridges to save FE and develop the self-reliance.
- Project Performa received from IAF & project taken by HEMRL for development of 26 mm IR Flare.

## 118-Chaff Cartridge

- Chaff is an expendable countermeasure and is deployed to either confuse hostile radar system or act as a decoy against radar homing missile, depending upon tactical situation.
- As a self protection device against surface based and missile mounted tracking radars, chaff is best used in conjunction with an evasive manoeuvre.
- Chaff cut length is optimized to provide a radar return signal from 2-18 Ghz.

## 81 mm Anti Thermal-Anti Laser Smoke Grenade

- HEMRL has designed and developed 81 mm Anti Thermal-Anti Laser smoke grenade for Indian Army for use with T-72, T-90, MBT Arjun and BMP-2.
- The grenade instantaneously generates smoke screen to defeat Thermal Imaging (TI) Sights and Laser equipment of enemy modern Tanks.
- This grenade will replace existing inventory (3D6 Russian grenade) held with Indian Army which is not capable to defeat TI and LRF effectively.
- Development has been completed.

# Life Support Systems

# Integrated Life Support System (ILSS) for LCA

- On-Board Oxygen Generating System (OBOGS) Centric Integrated Life Support System provides enhanced physiology protection to aircrew of combat aircrafts. OBOGS preplaces Liquid Oxygen System (LOX) and generates oxygen enriched breathing gas by utilizing conditioned bleed air from the aircraft engine and separating its components using molecular sieve Pressure Swing Adsorption (PSA). The ILSS consists of 11 subsystems integrated together to provide desired protection. Use of OBOGS technology in fighter aircraft eliminates the logistic tail associated with liquid oxygen system, improves safety, reduces aircraft turn-around time, extends mission duration and significantly lowers operational cost.


# Helicopter Oxygen System (HOS) Mk-I

Provides oxygen enriched breathing gas on demand to the helicopter pilot with appropriate O2 concentration which varies with altitude Consists of high pressure light weight composite cylinders of 2L (WC) and 200 bar working pressure

- Chest mounted demand dilution oxygen regulator
- Meets JSSG 2010 and DEF STD 970 for oxygen concentration with altitude and flow requirement
- Work satisfactorily upto 30000 ft altitude
- Caters for 40lpm average and 120lpm peak flow
- Provides endurance of 2 hrs
- Flexible oxygen compatible hose with dolls eye flow indicator

## Helicopter Oxygen System (Mk-II)

Provides oxygen enriched breathing gas on demand to the helicopter crew of ALH, LCH and MI-17
Consists of high pressure light weight composite cylinders of 2L, 3.8L, 10.6L (WC) and 200 bar working pressure

- Panel mounted demand dilution oxygen regulator
- Meets JSSG 2010 and DEF STD 970 for oxygen concentration with altitude and flow requirement
- Work satisfactorily upto 30000 ft altitude
- Caters for 40lpm average and 120lpm peak flow
- Provides endurance of 3 hrs
- Flexible oxygen compatible hose
- Electronic Flow Indicator




## Combat Free Fall (CFF) Oxygen System

- Oxygen system and protective equipment to protect combat free fall paratroopers against decompression sickness, hypoxia, hypothermia during bailout. The breathing system supplies oxygen on demand for enhanced breathing time and can support breathing of 6-8 paratroopers for approximately one hour during pre-breathing of 100% O2.
- The system has in-built Automatic control of oxygen concentration in breathing gas with respect to altitude and hands free communication through the Helmet –Mask-Radio set combination.
- The Oxygen system provides breathing gas to paratrooper for more than 50 minutes during descent from 30,000 ft altitude to ground. Inner and outer jump suit for protection from extreme low temperature. Specially designed boots for protection from leg injuries and landing shock

## Medical Oxygen Plant (MOP)

The MOP generates oxygen on site directly from the atmosphere by using zeolites molecular sieves and pressure swing adsorption (PSA) technique. The oxygen generated by the MOP can supplied to wards of hospitals and it can also be deployed for filling medical oxygen cylinders.

## Three Bed On Board Oxygen Generating System (TBOGS)

The TBOGS is designed to generate oxygen enriched air insitu in fighter aircraft using zeolite molecular sieves and pressure swing adsorption technology. The oxygen enriched gas of variable upto 93% (Max) purity is provided to the pilot for breathing meeting the requirements in all flight scenarios for cabin altitude less than 20000 ft.

## On Board Inert Gas Generating System (OBIGGS)

The OBIGGS is designed to generate nitrogen enriched air insitu in fighter aircraft using hollow fibre membrane. The nitrogen enriched gas of purity 98±2% at 300 LPM is used to pressurize the ullage space generated on consumption of fuel in the tank. This reduces the risk of fire due to fuel vapours and as quantity of oxygen is kept below inflammable levels. (<9% O2 Concentration)

## Helmet and Masks (Su-30, Mi-17 & Pilatus)

- Manufactured out of aramid & other high performance fibres
- Protection against Impact & Penetration tests as per DEF-05-102
- Polycarbonate Visors meets various Optical parameters as per MIL_DTL-43511D
- Provision to mount NVG (GEN2 & GEN3)
- Low breathing resistance as per Mil-V-27296C & MIL-M-87163A
- Fitted with Flame retardant fabric laminated hose
- Bayonet anchoring mechanism to secure Mask with Helmet
- Compatible R/T to the aircraft

# Aircrew Protective Clothing (with Mannequin)

Flame Retardant personal protective clothing for fighter aircraft and aircrew is intended to provide protection to the aircrew in case of unforeseen fire hazards. The protective clothing encompasses FR Overalls, FR Gloves, FR G Suits, FR Life Jackets, FR Survival Jackets and also Leg garter restraint. The complete ensemble is intended to meet specific requirements and acts as an important life saving equipment. The ensemble is essentially made out of inherently flame retardant meta aramid fabric with comfort finish to meet wicking and moisture vapor transmission properties (FR Overalls). Anti-g suit is another important lifesaving equipment of overall ensemble of fighter aircraft pilot which is designed to enhance the +Gz tolerance of fighter pilots by 1 to 1.5G. The suit is designed to meet stringent endurance cycle.

# Industry and Academia Outreach

## AVPSM Module (Developed Under TDF)

AVPSM Module (Avionics video processing & Switching module) is a Video Processing and Switching Module for Analog to Digital Conversion on SMFD at high bandwidth, low latency as per ARINC-818 Standard Protocol.

## 40 TPH Composite Submersible Pump (Developed Under TDF)

40 TPH Submersible Pump is for on-board Naval Ships for pumping of Sea Water from Various Sections of Ships.

## 125 TPH Composite Recirculation Pump (Developed Under TDF)

125 TPH Recirculation Pump is for on-board Naval Ships for pumping of re-circulation of Sea Water for cooling of various machineries.

## JT Cooler (Developed Under TDF)

JT Coolers are critical for missile seeker applications.

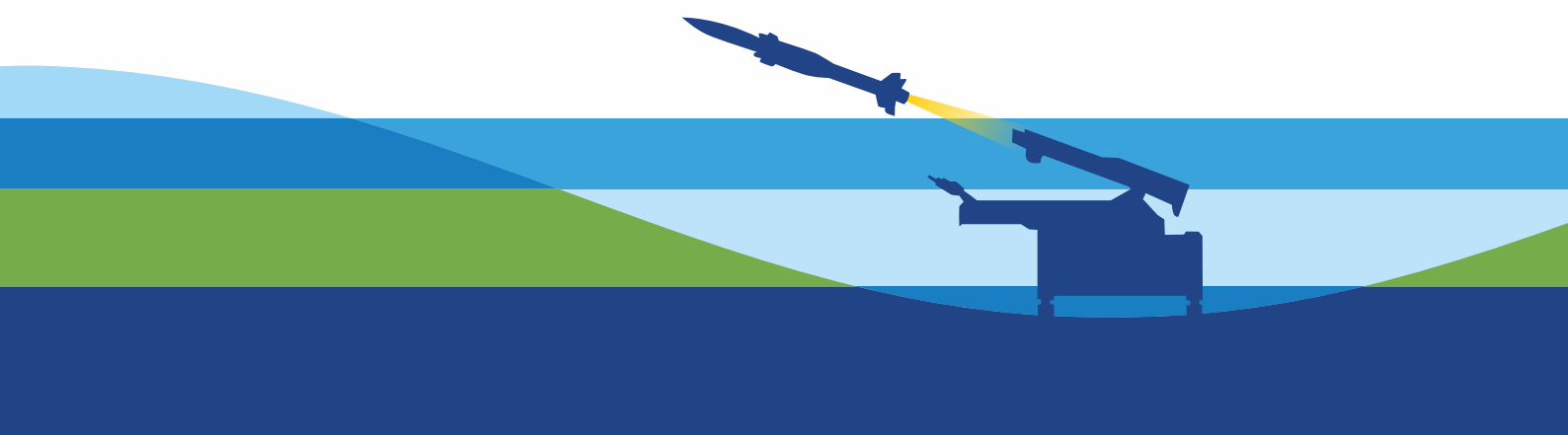
## Prussian Blue Drug under GMP Facility (Developed Under TDF)

Prussian Blue Drug formulation and its API for decontamination of Cesium & Thallium poisoning in any nuclear emergency


## Health & Usage Monitoring System (Developed Under TDF)

Health & Usage Monitoring System is a solution, indigeniously developed under TDF, uses Machine Learning techniques to improve the serviceability of Mig-29K which provides Indian Navy an ability to centrally store the flight data, automate preventive turn around checks and data analytic for defect investigation with state of art ML algorithm for prediction of defects to improve serviceability of Mig 29K aircraft.

# India Pavilion Display



# Airborne Early Warning and Control (AEW&C) MK-II

- 06 AEW&C systems for the Indian Air Force, based on A-321 Platform
- Long Endurance & Enhanced Coverage of operation
- Search, Detect, Track, Identify, Integrate Sensor Data, Communicate Air Situation Picture to Ground & Air Stations
- Threat Evaluation, Weapon Assignment & Intercept Control
- Intercept and Analysis of Communication Signals
- Controlling of Borders, Surveillance of Economic Zones

## Major Technologies

- Total Indigenously developed Mission System
- AESA based Primary Radar (PR) with long range
- AESA based Identification Friend or Foe (IFF), with Mk XII (A) capability
- Net centric operation through high data rate LOS and SATCOM, SDR Data links (DL)
- Electronic Support Measures (ESM)
- Self Protection Suite (SPS) with Missile Approach & Warning System, Radar Warning Receiver & Counter Measures Dispensing System
- Tactical Mission Computer
- Real-time display of the Integrated Tactical Air Situation Picture
- Advanced Multi Sensor Data Fusion, for enhanced Air Situational awareness, which aids in faster and reliable decisions
- Integration with IACCS
- Guidance & Recovery
- Enhanced Situational Awareness

- 12 Nos. Reconfigurable Dual Display Operator Console
- AIS & ADSB IN capability
- NAVIC Compatibility
- High Data Record & Replay capability

# ARCHER

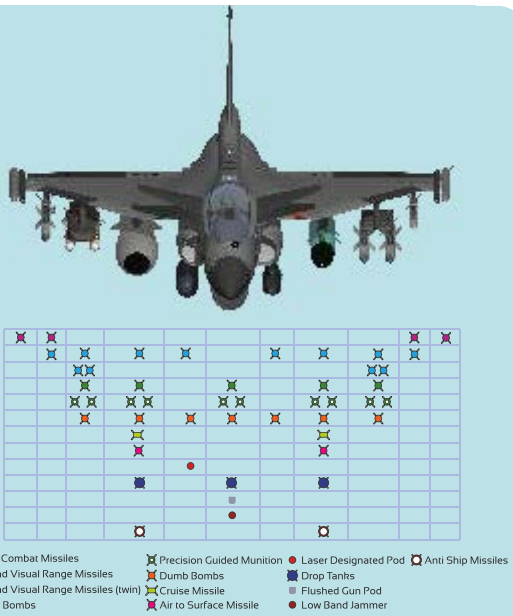
- ARCHER-NG is an indigenously developed Weaponized Medium Altitude Long Endurance (MALE) UAV used for Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) and Strike missions. It has Line of Sight (LoS) range of 250 kms and Beyond Line of Sight (BLoS) up to 1000 kms.

- It can operate at altitude up to 30000 ft with an endurance of 18+ hours

# LCA AF Mk2

**Salient Features:**

- Tailless, Compound Delta wing and Close Coupled CANARD
- Long range and endurance
- On-Board Oxygen Generation System (OBOGS)
- Enhanced mission and point performance.
- Quick turn around and role change
- High Payload Carrying capacity with heavy stand – off weapons
- Advanced Sensors like AESA Radar and IRST
- Internal Electronic Warfare Suite with RWR, Jammer & MAWS
- Network Centric Warfare Capabilities
- Multi Sensor Data Fusion
- Modern Cockpit with smart Large Area Display (LAD) Smart Head Up Display (SHUD) and Side Control Stick
- Fly-by-Wire Flight Controls with Upgraded Digital Flight Control Computer




Specification:

Performance
- Ceiling : 50000ft.
- 'g' Limits : +8/-3.2g

Dimensions
- Length : 14.65 m
- Span : 8.5 m

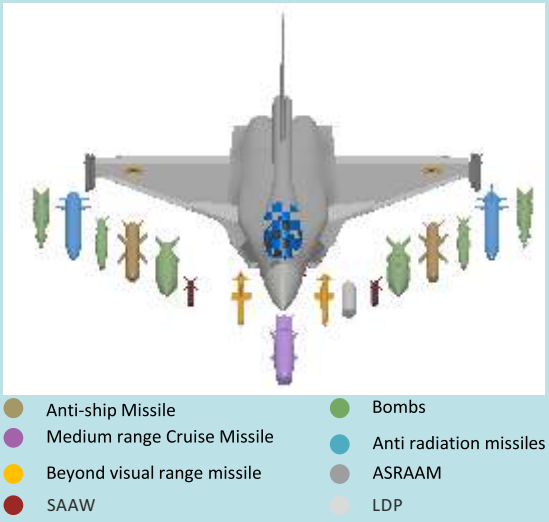
Weight
- Max. All Up Weight : 17.5T
- Payload : 6.5T

Power plant : GE-F414-INS6

# Twin Engine Deck Based Fighter (TEDBF)

**Salient Features:**

- Wing folding arrangement for Carrier spotting
- Automatic Carrier Landing System for high precision landing on-board carrier
- Man Un-Manned teaming for net-centric operations
- Buddy Refueling pod integration for Tanker role
- Active Fuel transfer system for better CG control
- On-Deck alignment system




Specification:

Performance
- Ceiling : 55000ft.
- 'g' Limits : +8/-3 g
- Max Speed : 1.8 Mach

Dimensions
- Length : 17 m
- Span : 11.6 m
- Height: 5.6 m

Weight
- Max. All Up Weight : 26T
- External Stores : 7.5T

Power plant : 2 x 90 kN Thrust Class Engine

# Advanced Medium Combat Aircraft (AMCA)

Salient Features:

- Diverter-less Supersonic Intake (DSI) with serpentine duct
- All moving Horizontal tails and twin canted vertical tails with Composite and Radar Absorbing Structures
- Internal Weapon Bay (IWB) with BVR missiles and precision guided bombs. Inserted Fuel Tanks for extended range in lieu of weapons
- FSS Radome and Conformal apertures
- Internal Electronic Warfare Suite consisting of Radar Warning Receivers (RWR), SPJ, interferometer and MAWS
- Extended detection range sensors (AESA Radar and IRST)
- Smart Cockpit LAD, Smart sleek wave guide base HUD, advanced HMDS, 3D audio warnings and pilot voice commands
- Network Centric Capability, multi sensor data fusion and electronic pilot for autonomous missions
- Retractable Air-to-Air Refueling Probe
- Maintenance friendly aircraft with ease of access and interchangeability


**Specification:**

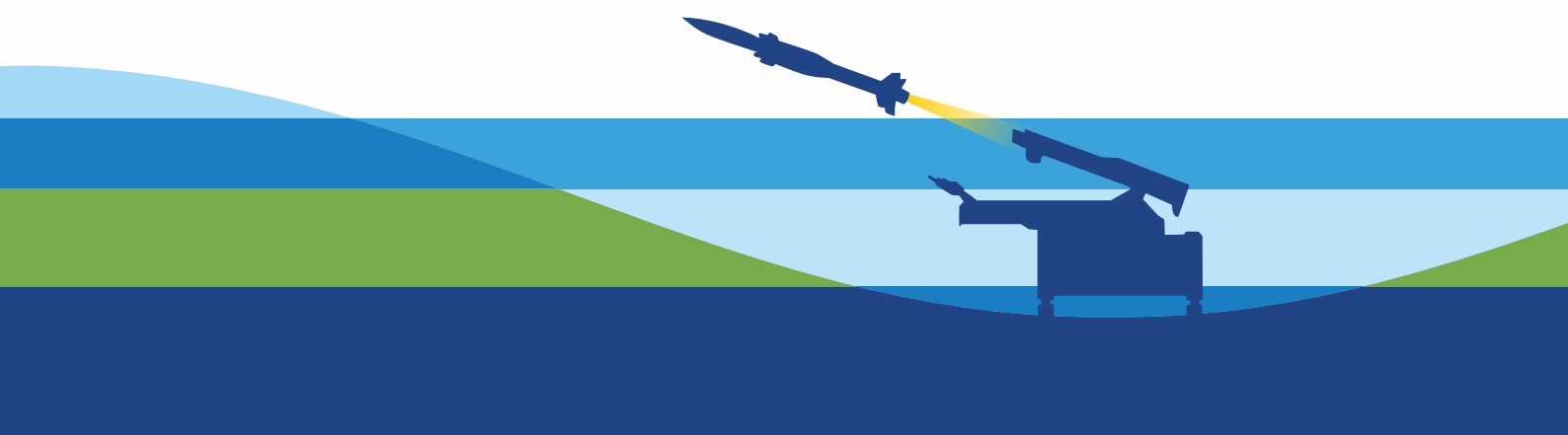
**Performance**
- Ceiling : 60000ft.
- 'g' Limits : 8 g
- Max Speed : 1.8 Mach

**Dimensions**
- Length : 18 m
- Span : 11 m
- Height : 4.4 m

**Weight**
- Max. All Up Weight : 25T
- External Stores : 5T
- Internal Stores : 1.5T

**Power plant :**
2 x 90 kN Thrust Class Engine

# Flying Display at Aero Show



# AEW&C

- Two DRDO Developed AEW&C system inducted into the IAF
- Based on EMB 145 (I) Platform
- Fifth country in the World to develop this technology

## Major Technologies

- Suite of surveillance sensors, SIGINT, communications and computing systems -C4ISR
- Net-centric Operations
- Active Electronically Scanned Antenna based Primary Radar
- AAAU designed with high power transmit capability and ultra-low side lobe level in the receive mode
- Integrated antenna aperture for both primary and secondary surveillance system
- High power airborne IFF MK XII(S) interrogator
- LOS and SATCOM Data links
- Tactical Mission Computer, with Command & Control and Tactical Management capability
- Multi Sensor Data Fusion to enables a better situation awareness in order to have faster and more reliable decisions and significantly enhancing mission effectiveness
- Intercept Control and Battle Management (IC&BM) acts as a decision aid
- Ergonomically designed Reconfigurable Operator Console
- Real-time situational awareness through display of integrated tactical air situation picture
- Air to Air refuelling
- Integration with IACCS

# LCA Mk-I

## PERFORMANCE

- Max speed : Supersonic at all altitudes
- Service Ceiling : 50,000 ft
- 'g' Limits : +8/-3.5

## SPECIAL FEATURES

- Compound Delta Planform
- Relaxed Static Stability
- Composite Structure
- Fly-by-wire Flight Control
- Computer based monitor and control of Electro Mechanical Systems
- Glass Cockpit
- Multi-Mode Radar
- Air to Air Refueling
- Beyond Visual Range Combat Capability
- Advanced Auto-Pilot along with Critical Altitude Recovery, Disorientation Recovery and Gust Alleviation Features
- Day/Night Operations

## DIMENSIONS

- Span : 08.20 m
- Length : 13.20 m
- Height : 04.40 m

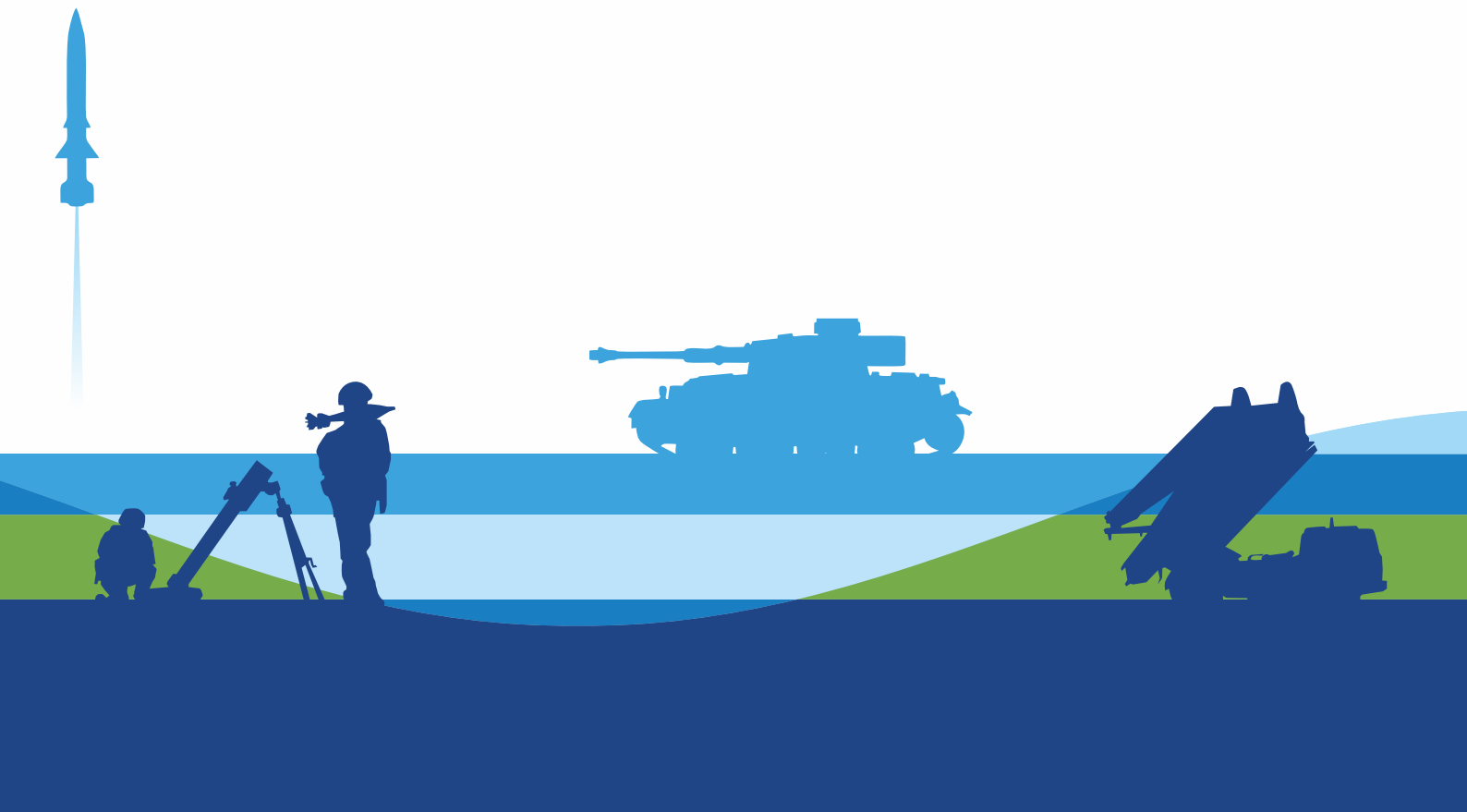
## WEIGHT

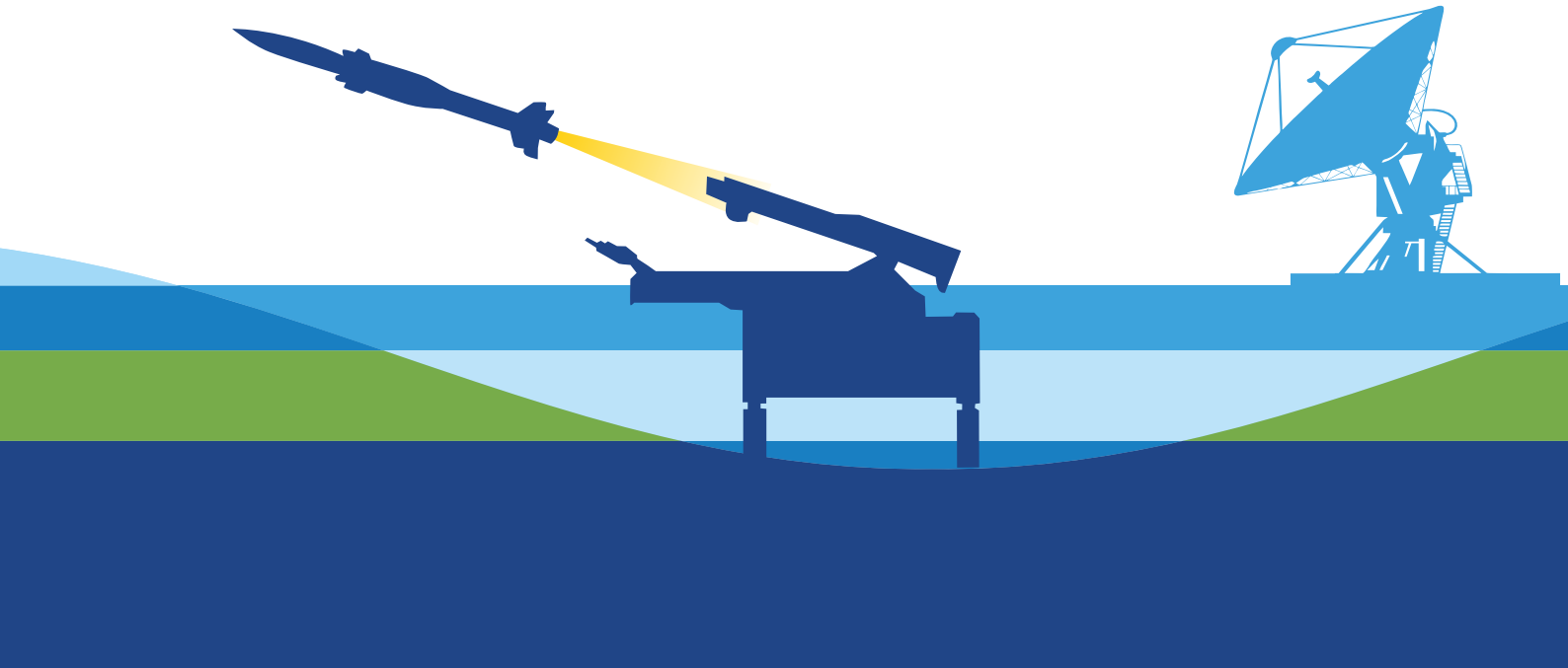
- Take-off Clean : 10330 kg
- Empty : 7040 kg
- External Stores : 3910 kg

# Tactical Airborne Platform for Aerial Surveillance (TAPAS)


- TAPAS is a Medium Altitude Long Endurance (MALE) UAV used for Intelligence, Surveillance, and Reconnaissance (ISR) missions. It has line of sight (LoS) range of 250 Km and Beyond Line of Sight (BLoS) up to 1000 Kms. It can operate at altitude up to 30000 ft with and endurance of 24 hours.

- Used for Intelligence, Surveillance, and Reconnaissance (ISR) missions, Artillery fire corrections, Battlefield post strike assessment.





# Soaring towards Atmanirbhar Bharat

## with Cutting Edge Defence Systems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