



CABS

About the Lab

Centre for Airborne Systems (CABS) as the nodal agency in DRDO is tasked to develop complex airborne systems for Air to Air, Air to Ground and Air to Sea surveillance. CABS acts as a system house and an integration agency, utilizing all available infrastructure and expertise in the country including Industry Partners and Academia for development of Airborne Electronic Force Multiplier systems focusing on systems such as Airborne Early Warning and Control(AEW&C), Intelligence, Surveillance, Target Acquisition & Reconnaissance (ISTAR), Medium Range Maritime Reconnaissance (MRMR)/ Multi Mission Maritime Aircraft (MMMA) and SIGINT COMJAM Aircraft(SCA) systems. CABS is also the development agency of Identification Friend or Foe (IFF) for Tri-services.

CABS has also been accredited with Aerospace Standard (AS9100D) and AFQMS certification.



AEW&C

Netra



AEW&C system is a potent force multiplier, providing surveillance, tracking, identification and classification of the Airborne/ Sea surface targets. The information from multiple sensors are collated, associated and fused to provide a cogent and comprehensive air situation picture on configurable consoles. Further capabilities include threat assessment and enabling the interception of the hostile targets through guidance of own interceptors. India is the fifth country in the world to have developed this system indigenously.

- Active Electronically Scanned Array 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 Track Management capability
- Multi Sensor Data Fusion to enable a better situation awareness in order to have faster and more reliable decisions and significantly enhancing mission effectiveness
- Intercept Control and Battle Management acts as a decision aid
- Ergonomically designed Reconfigurable Operator Consoles
- Real-time situational awareness through display of integrated tactical air situation picture
- Indigenously developed mission software with DO178 B Certification
- Air to Air refuelling
- Integration with IACCS

AEW&C Mk II

AEW&C Mk II is the enhanced AEW&C system on a larger platform. The system shall provide enhanced situational awareness through increased performances in mission systems taking advantage of larger size of the Aircraft. It is capable of detecting, identifying and classifying threats present in the surveillance area and also acts as a Command & Control Centre to support air defence operations. The surveillance system with its multiple Communication and Data Links can alert and direct fighters, while providing Recognized Air Situation Picture(RASP) to commanders through Ground Exploitation Stations(GES) on ground. This system thus can support Air situation and offensive strike missions as well as assist forces in the tactical battle area. Electronic and Communication Support Measures can intercept, identify and classify non-friendly radar transmissions and communication signals respectively.



Features

- Advanced AEW&C system
- 06 systems for the Indian Air Force
- Enhanced Situational Awareness
- Enhanced Coverage
- Best in class detection ranges
- State of the Art Sensor fusion

Sensor Suite

- AESA based Primary radar with increased performance
- IFF Mk XII (A)
- Self Protection Suite
 - Radar Warning Receiver
 - Missile Approach Warning System
 - Counter Measure Dispensing System

ELINT & COMINT Suite

- CSM – Intercept Communication Signals
- ESM – Detection & classification of hostile air-defence

Mission Suite

- Central node of the AEW&C to perform C4ISR ops.
- Multi Sensor Data Fusion
- Identification, classification and auto handling of threat
- Interception Management
- Guidance & Recovery

Internal Configuration

- 12 Operator Consoles
- 12 Rest Crew Seats

Communication Suite

- Services Defined Data Links/Communication Systems (LOS/BLOS/Legacy)
- Net-centric Operation

Flight Test Bed

(FTB)

It comprises of generic External Modifications to mount large Avionics / Electronic Warfare Systems for flight Testing towards technology demonstration before offering it to user.



**Airbus A319 Based
Flight Test Bed**

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, FTI racks for Instrumentation.

Aircraft Characteristics

- MTOW: 68000 kg
- Mission Payload: 6000 kg
- Fuel: 18500 kg (Wing tank)
- Length: 33.84 m
- Wing span: 35.80 m
- Power plant: CFM56-5B6 turbofan

Internal Configuration

- 6 Operator Workstation Console
- 2 Instrumentation Racks
- 1 or 2 Power distribution Racks
- 8 Rest Crew Seats
- 2 Discussion Tables

MRMR/MMMA

Medium Range Maritime Reconnaissance/ Multi-Mission Maritime Aircraft



Indian Navy / Indian Coast Guard has projected a requirement for an Indigenous Medium Range Maritime Reconnaissance / Multi Mission Maritime Aircraft equipped with multiple mission sensors to be developed by CABS, DRDO as the nodal agency.



Primary Roles (MRMR)

- Maritime Surveillance
- Anti Submarine Warfare
- Maritime Domain Awareness
- ELINT and COMINT

Secondary Roles

- Special Operations/ Parachute Operations
- Search and Rescue
- Communication and Casualty Evacuation
- Cargo Transportation
- Personnel Transportation
- Air Ambulance

Primary Roles (MMMA)

- Maritime Surveillance and Interdiction
- Pollution Surveillance
- Search and Rescue



Broad Features

- Role equipment with easy role conversion
- Open architecture based Mission Management System (MMS) for integrated mission and data management
- Three Dual-display Multifunctional Tactical Console (MTC)
- Active Electronically Scanned Array based Maritime Patrol Radar (MPR) with long range maritime and airborne target tracking, small target detection mode and various imaging/ classification modes
- Identification of Friend & Foe (IFF) Radar with Mode S and Mode 4 Capability
- Automatic Identification System (AIS) with Encrypted messaging mode
- Pollution Surveillance Suite (PSS) comprising of
 - Side Looking Airborne Radar (SLAR) for oil spill detection
 - IR/UV line Scanner (IRUV) for oil spill thickness estimation
 - Visible line Scanner (VIS) for oil color codes
 - Laser Fluoro Sensor (LFS) for oil type classification
 - Micro Wave Radiometer (MWR) for Thick oil measurement

- Electro Optical Infra Red Payloads (EOIR) comprising of
 - Micro Wave Infra Red (MWIR)
 - Short Wave Infra Red (SWIR)
 - Visual Imaging Sensors (Day Light and Low Level Light Camera)
 - Spotter Scope
 - Laser Range Finder (LRF)
 - Laser Illuminator and Pointer
- Communication Support Measure(CSM) for detection, identification and localization of radios with Direction finding.
- Full Duplex High bandwidth Datalinks (C-Band, Ku Band SATCOM, INMARSAT) for video and voice transfer
- Mission Communication System for Air-to-Air, Air-to-Ground operation with HF, V/UHF voice and Intercom facility for seamless mission handling
- Guns for Interdiction

Intelligence, Surveillance, Target Acquisition & Reconnaissance (ISTAR) System



ISTAR

The Intelligence, Surveillance, Target Acquisition and Reconnaissance (ISTAR) system is a manned multi-role mission aircraft capable of performing ISR missions for defence and security forces.



Sensor Suite

- High resolution multispectral (EO-IR) Long Range Oblique Photography (LOROP) sensor
- Long range Synthetic Aperture Radar (SAR-GMTI system) with sub-metric resolutions
- All-weather day and night capabilities for collecting tactical and strategic geospatial intelligence from large stand-off ranges

Mission Suite

- Software application clusters and technology stack deployed on state-of-the-art hyper-converged infrastructure (HCI) based on high-performance rugged enterprise-level hardware
- Near-real time geo-spatial data processing, fusion and exploitation of sensor products
- Reconfigurable dual display workstation consoles for 06 onboard operators for efficient and synergized HMI for ISTAR mission planning and operations
- AI/ML/DL powered automated work-flows to handle the enormous area coverage rates and high spatial resolution of the aerial imaging sensors

Data links

- High throughput secure line-of-sight data links, satcom data link and tactical radio links for integration with other networks and agents
- Network centric warfare with near real-time dissemination of actionable intelligence for accelerated sensor-to-shooter cycle
- Force multiplier with teaming of multiple potent ISTAR platforms and their collaboration with extended ground-based intelligence exploitation stations

Airborne Platform

- High altitude, long endurance Special Mission Aircraft (SMA) based on business class jet, with Self Protection Suite

Technologies used

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, high data-rate LoS data-links, satcom data-links, onboard mission communications suite. AI/ML based Image Intelligence (IMINT) for Automatic target recognition Change detection and Common Operational Picture (COP).

SIGINT COMJAM

System



Features

- State-of-the-art airborne SIGINT & COMJAM system
- High performance COMINT and ELINT sensors with very High Sensitivity and High Probability of Interception (HPOI)
- Integrated RWR, MAWS and CMDS for self-protection.
- High speed Scan and Search for signals within frequency bands of interest according to preprogrammed scan regime
- Signal acquisition parameter measurements, data reduction by iteration and signal type classification
- Signal Direction-of-Arrival (DOA) measurements
- AI based Emitter definition creation and Emitter location fix.
- Fast Geo-location (FIX) of transmitting targets
- Automatic Signal Initiated Jamming
- Standard interface to exchange data with Command and Control Centers
- Remote control from Ground Station via Line-of-Sight and SATCOM Data Links.

IFF LRUs

IFF-INTERROGATOR



IFF-TRANSPONDER



COMBINED INTERROGATOR & TRANSPONDER



Identification Friend or Foe(IFF) Mk XII(A) system

The IFF MK XII(A) System consists of three variants namely Interrogator, Transponder and Combined Interrogator Transponder (CIT). CABS, DRDO has designed and developed all the three variants as per the typical configuration available in International market. The products are designed as per the regulations laid down in ICAO - Annex - 10 and STANAG 4193. Each of the variant of IFF MK XII(A) system is designed with suitable antenna that include different configuration of E-scan as well as M-scan with Mode S level-2 capability. Development of indigenous Handheld IFF Tester has been completed

Broad Features

- Mode IS2 (In Line with Mode 5) Compatible
- Modular Approach
- Conduction cooled ATR Chassis
- Monopulse Technique
- Advanced Target Processing
- Open VME/CPCI Architecture
- Extensive BITE facility
- E-Scan and M-Scan Antenna Compatibility
- Antenna Diversity Operation
- Inter and Intra system Blanking capability
- Applique crypto unit
- Operating Temp: - 40° C to +71° C
- Environmental: MIL STD 810E/MIL STD 461E

IFF-INTERROGATOR



The IFF MK XII(A) interrogator is a compact, lightweight system using state-of-the-art technology and can be used for ground/surface as well as airborne application. It operates as per the recommendation of Annexure-X of ICAO and STANAG 4193. It is designed using VME architecture that provides complete flexibility for futuristic upgrades. Operation in Mode S-Level 2 gives capability of selective addressing and data link features which is very critical in dense air-traffic.

Application

- Long Range Surveillance
- Medium Range Surveillance
- Short Range Surveillance
- Fire control
- Manpads

Status

Designed, Developed and Integrated in Various defence platforms

Technologies Used

- IFF MK XII(A) with modes 1,2,3/A,C,S(L-2) ,IS1 & IS2
- Modular approach
- Solid state Transmitter
- Dual Channel Monopulse receiver
- Advanced Monopulse target processing
- Extensive BITE facility
- E-scan, M-Scan Antenna Capability

Industry Participation

M/s Data Patterns, M/s Alpha Design

Potential for Export

Yes

IFF-TRANSPONDER



The airborne/surface IFF Mk XII (A) transponder is a compact light weight system and can be tailor made into different form factor depending upon the platform requirement. It is designed using CPCI/SBC based architecture that provides complete flexibility for futuristic upgrades with all the system features as per standard laid down by ICAO/ STANAG 4193. It has MIL 1553 and ARINC 429 Interface for Integration with mission controller and data computer/aircraft system.

Application

- Commercial aircrafts
- Military Aircrafts
- UAVs

Status

Designed, Developed and Integrated in Various defence platforms

Technologies Used

- IFF MK XII(A) with modes 1,2,3/A,C,S(L-2) ,IS1 & IS2
- Modular approach
- Conduction cooled ATR Chassis
- Solid state transmitter of 600W
- Inter and Intra blanking capability
- Antenna Diversity operation
- Control and Display unit for remote control operation

Industry Participation

M/s Data Patterns, M/s Alpha Design

Potential for Export

Yes

COMBINED INTERROGATOR & TRANSPONDER



The IFF MK XII(A) Combined interrogator transponder is state of the art compact light weight system that can be used in either interrogator mode or transponder mode specially designed for airborne application to avoid fratricide while using BVR weapons. It has Gigabit Ethernet/MIL 1553B/ARINC 429 interface that are mostly available interfaces for integration with mission controller and other aircraft systems.

Application

- Military aircrafts
- UAV
- Before Launch BVR

Status

Designed, Developed and Integrated in Various defence platforms

Technologies Used

- IFF MK XII(A) with modes 1,2,3/A,C,S(L-2) ,IS1 & IS2
- Solid state Transmitter
- Modular approach
- E-scan, M-Scan Antenna Capability
- Inter and Intra blanking capability
- Antenna Diversity operation
- External Crypto applique unit.

Industry Participation

M/s Data Patterns, M/s Alpha Design

Potential for Export

Yes

O-Level Handheld Tester



The indigenous Handheld IFF Tester System is capable of testing IFF MK XII(A) variants namely Interrogator, Transponder and Combined Interrogator Transponder (CIT). CABS, DRDO has designed and developed indigenous Handheld IFF Tester to verify the functional capabilities of IFF MK XII(A) variants as per ICAO - Annex - 10 and STANAG 4193.

Application

- To test IFF MK XII(A) Interrogator
- To test IFF MK XII(A) Transponder and
- To test IFF MK XII(A) Combined Interrogator Transponder (CIT)

Technologies Used

- IFF MK XII(A) with modes 1,2,3/A,C,S(L-2) ,IS1 & IS2
- Solid state Transmitter
- Modular approach
- E-scan, M-Scan Antenna Capability
- Inter and Intra blanking capability
- Antenna Diversity operation
- External Crypto applique unit.

Industry Participation

M/s Data Patterns

Potential for Export

Yes

LIGHTNING TEST FACILITY (LTF)

The Lightning Test Facility can be used to design and test the Lightning protection schemes and ensure the lightning worthiness of aircraft. The Lightning Test Facility can be used to design and test the Lightning protection schemes and ensure the lightning worthiness of aircraft.

The facility is equipped for conducting all the High voltage and High current tests as per International Standards and Regulations. The facility can cater to full aircraft testing



High Voltage Testing

To determine / test probable lightning arc attachment points on the aircraft.

Facility used: Impulse Voltage Generator- Nominal Voltage: 4000 kV



Lightning Attachment Test on Light Combat Aircraft Radome



Lightning Attachment Test on Hansa Aircraft

High Current Testing

To assess and evaluate the thermal effects and electromechanical forces of lightning current

Facility used: Current Generators A, B, C and D:

Generator A: Current up to 200KA, 500 μ s duration, charging voltage of 60 KV

Generator B: Current up to 2000A, 500ms duration, charging voltage of 4KV

Generator C: Current up to 800A, 0.5 to 1.0 s duration, charging voltage of 420V

Generator D: Current up to 100KA, 500 μ s duration, charging voltage of 60 KV

High Current Testing on a Helicopter Main Rotor Blade



High Current test on UAV wing



High Current Testing on a Helicopter Tail Rotor



Light Combat Aircraft under going Lightning Test



High Current Test on Spiral Antenna



High Current Test on Astra Missile

Indirect Effect Testing

Lightning Induced EMI/EMC tests on equipment, subsystem or full aircraft.



Indirect Lightning test on Aircraft equipment



Indirect Lightning Effect Testing on a Helicopter

Automatic Test Equipment



Centre for Airborne systems, DRDO Bangalore has designed and developed Automated Test Equipment (ATE) facility to perform test, maintenance, fault identification, repair and re-testing of all Airborne Early Warning and Control (AEW&C) System LRUs. ATE is designed based on Modular H/W architecture and S/W tools and capable of simulating the Input and measure the response of the AEW&C LRU's.





ATE Lab at Airforce station

Salient Features

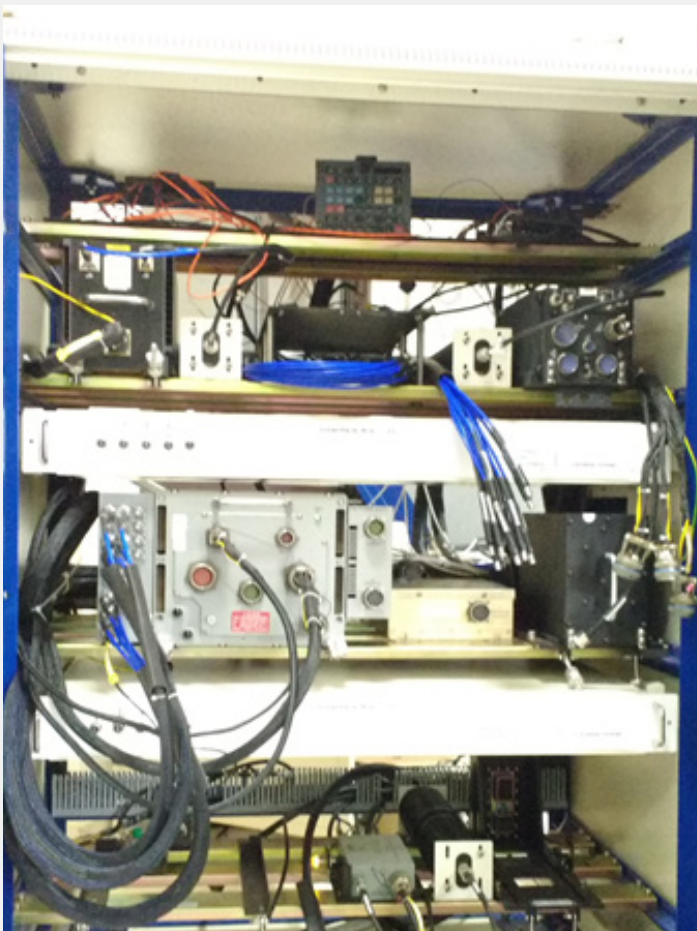
- ATE is configured with PXI based modular instruments and General test & Measure equipment.
- It has various Input output interfaces like RS422, RS232, MIL 1553 RS-485, ARINC429, LVDS, TTL/LVTTL Gigabit Ethernet, 64 channels DIO.
- It is capable of handling various signals such as RF, Discrete, Analog as well as digital signals.
- ATE LRU racks configured with front LRU locking mechanism and rear blind mating connectors customized as per ARINC guidelines.
- VPC G12 mass interconnection to provide the interconnectivity between the LRUs and the instruments.
- RF Switch Matrix capable of simultaneous 8x8 switching of installed RF Instruments to RF ports of the LRU for various measurements.
- ATE GUIs are designed in such a way that user can easily access all the LRUs and Tests. The features includes:-
 - > Admin Login /Logout
 - > Self-Test Capability
 - > Configuration of instruments and LRUs for tests
 - > Auto-detection of LRUs
 - > Report generation of Test results



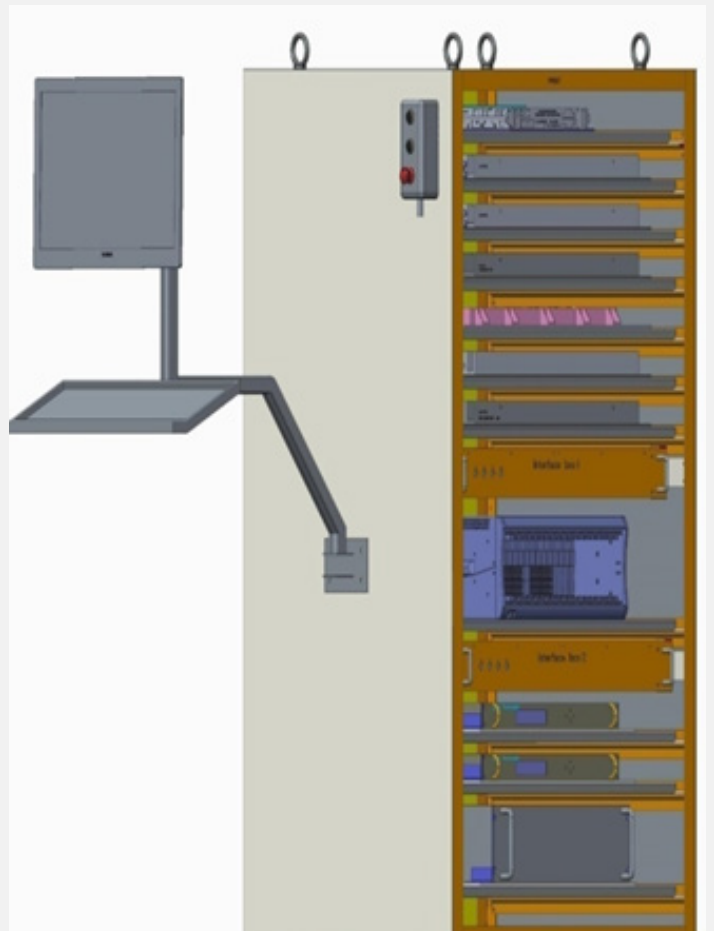
LRU Rack 1



LRU Rack 2



LRU Rack 3



AAAU ATE interface test bed

Operator Training Station (OTS)

- Ground based system for training the operators in a realistic, simulated environment for the Tactical Training, Command and Control, Battle Management
- Behavior of sensors under different Scenarios and Replay & Reconstruction of mission recorded data



Mission Systems Integration Rig (MSyIR)

The MSyIR facilitates the development, integration, testing and evaluation of mission avionics of airborne surveillance system prior to actual flight test in a controlled environment. This facility would duplicate exact functional system architecture and design requirements, so as to directly adopt the system architecture in the finalised programmes such as AEW&c Mk-II, MMMA or Aerostat mounted surveillance system.

Rig Internal Structure



Salient Feature

- Software models of sensors for Software in loop (SIL) simulation
- Environment simulators
- Hardware in loop (HIL) simulators
- End-to-end system integration and facility for avionics
- Conduct full avionics test with environment simulators and actual hardware in loop
- System level configuration management
- Record and playback
- Trap, check and inject inputs at data and signal level along various interfaces between the system
- Capability to operate in Radiation mode and non-radiation mode.
- Ground check out facility
- Repository management
- Analysis tools
- Facilitates ground station support for airborne system



Ground Cooling facility



Roof top Antenna

Electro Optic / Infra Red (EOIR) System

for Maritime and Pollution Surveillance



Thermal Imager

(MWIR)

- ▶ Type : InAsSb XBn
- ▶ Resolution : 1280 x 1024
- ▶ Spectral Range : 3 to 5 μm
- ▶ FOV : 1.5° to 18°



Laser Range

Finder

- ▶ Type : Semiconductor Pulse Laser
- ▶ Range : 80 – 20 Km
- ▶ Range Accuracy : $\pm 5\text{m}$
- ▶ Eye safe Class I



Day Camera+Low light

- ▶ Type : Semiconductor Pulse Laser
- ▶ Range : 80 – 20 Km
- ▶ Range Accuracy : $\pm 5\text{m}$
- ▶ Eye safe Class I



- ▶ Type : InGaAs
- ▶ Resolution : 640 x 512
- ▶ Spectral Range : 0.6 to 1.7 μm
- ▶ FOV : 1.1°



Laser Pointer

- ▶ Power: 165 mW
- ▶ NIR
- ▶ Class 3B Non-Eye safe

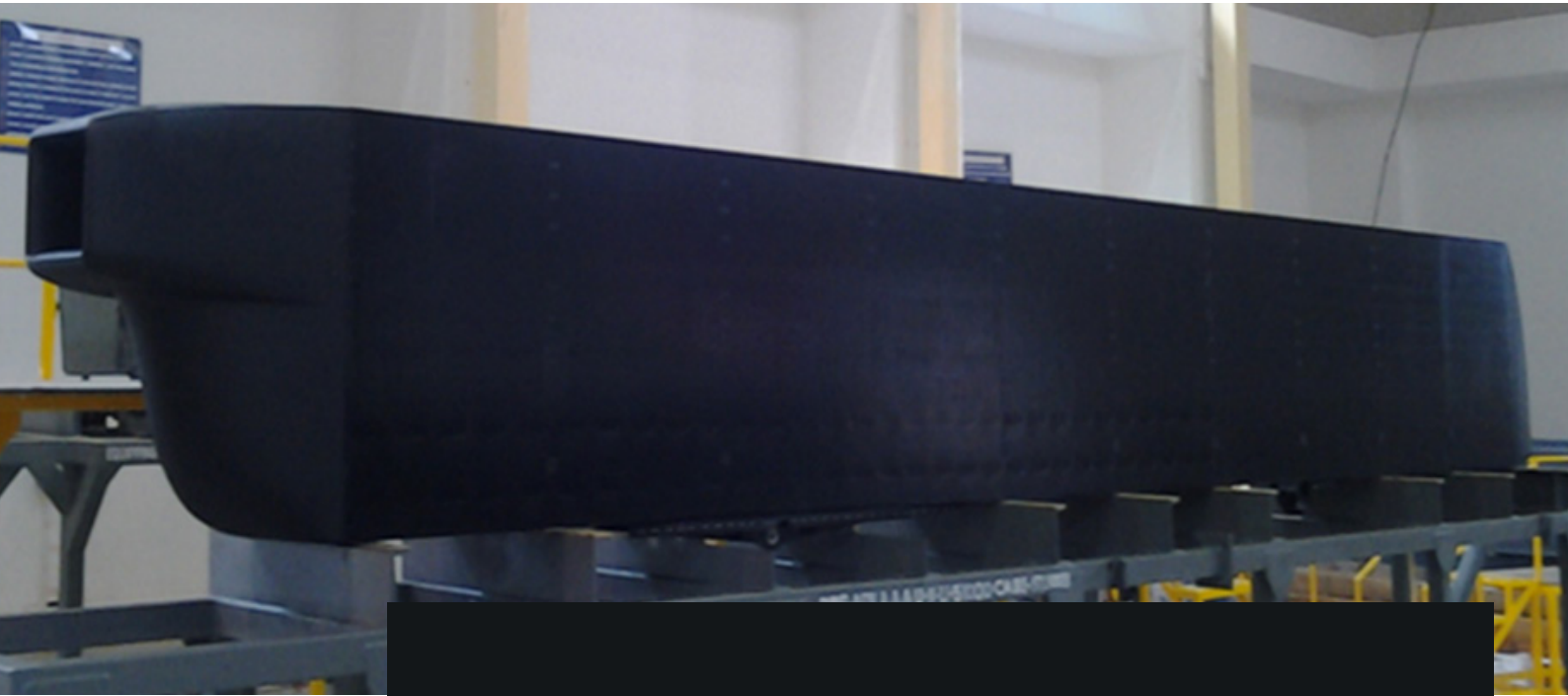


Key Features

- 4 Axis stabilized Turret
- Field of Regard : $\pm 360^\circ$ both in Azimuth & Elevation
- $<10\mu$ rad Stabilization Accuracy
- IMU, Geo Pointing and Geo Referencing
- Video Tracking
- Simultaneous display of 4 HD videos
- Weight < 55 Kg ; Power < 280 W (28V)
- Dia ~ 380 mm; Height ~ 490 mm
- Extensive BITE
- Handgrip Control
- Integrated with Mission Management System and Multifunctional Tactical Console
- Moving Map Display
- Made In India product with M/s Tonbo Imaging as industry partner

AAAU

Model for Netra



The AAAU houses Front-End of Primary Radar (PR) and Secondary Surveillance Radar(SSR) electronics. The PR is an Active Electronically Steered Array(AESA) Radar with a normal detection range and an extended against RCS of fighter class aircraft. Two radiating planar arrays assembled back to back and mounted on top of the aircraft fuselage provide 240° coverage on either side of AAAU. The SSR emits a message querying the target in a particular sector for friend/foe. Replies from the target are automatically associated with Primary Radar detections

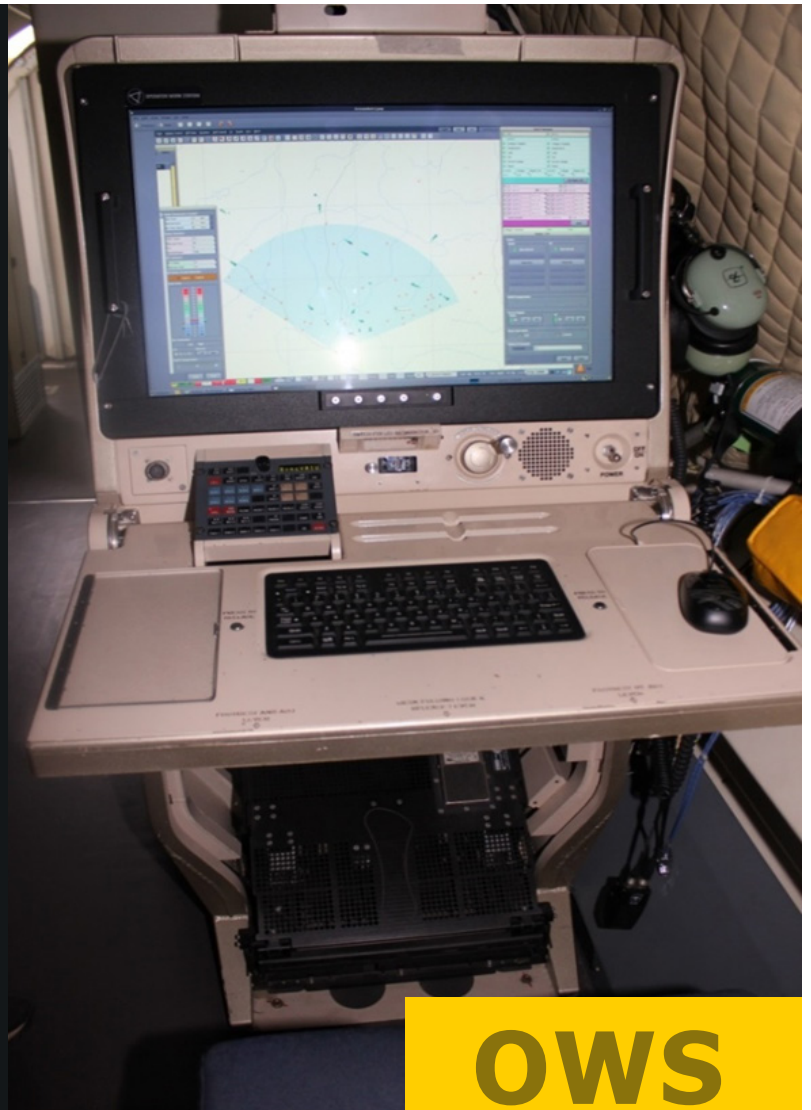
Specifications

- AAAU structure is designed for aerodynamic loads and aero-elastic requirement.
- Easy accessibility for electronic components inside AAAU
- The front hood and antenna panel are structurally optimized for bird impact as specified in FAR requirements
- Rain/Lighting protection as per FAR 25
- Dimension : 8.24mx0.915mx0.52m
- Weight : 1550 Kg
- Houses integrated antenna panel for PR and SSR, TRMM, Multi output power supply, ABFU and SSR electronics

Operator Work Station

OWS) Console

The Operator Workstation (OWS) segment of C4I provides the interface to operators to interact with AEW&C system. Each OWS displays integrated tactical air situation picture to operators. OWS functionality deals with Human Machine Interface (HMI) required for the proper operation of AEW&C systems. It provides display of tactical data, tools to insert Operator's inputs to Air Situation Picture (ASP), display of overall system serviceability.



OWS

Specifications

- Rugged console structure
- Ergonomically designed as per Mil-STD-1472F
- 24" rugged Liquid crystal display, Keyboard & Mouse
- Rugged Qualified Processor System
- Foot rest with PTT switch
- Facility to anchor head phone and mic
- Indicator LEDs & Switches
- Electrical & Mechanical Interface to aircraft structure
- Cooling Fan, Power Supply
- Integrated Audio Control Panel, Jack Box & Cabin Altitude Warning



Transmit Receive Multi Module (TRMM)

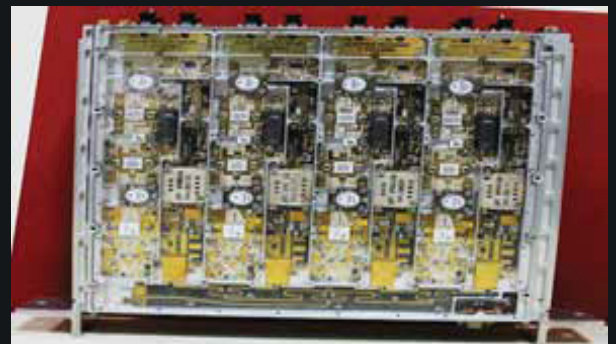
TRMMs are indigenously designed developed using state-of- the-art technologies & patented The units are used in building active array for radiating interface of airborne radar.

Productionised with private partner The units subjected to severe environmental qualifications to meet Airborne applications. Optimised design adopted for thermal management



Broad Features

- Airborne Radar application
- Air cooled Transmit Receive module
- 8 TR modules packed in one TRMM
- Integrated TR & Left-Right switch
- Digital control circuitry to control Switches, Phase Shifters & Attenuators
- Delivers of Pulsed RF with peak power of 65 W per TR module
- Adoption of Extensive BITE facility



AEW&C GROUND SYSTEM

Ground Exploitation System (GES)

- Provides Real-Time Ground to-Air and Air-to-Ground communication link for voice and data
- C - Band Line Of Sight (LOS) communication with AEW&C system
- Satellite communication with AEW&C system via GSAT-8
- V/UHF radio communications with AEW&C system
- AEW&C system establishes communication with 3 nos. of GES simultaneously over V/UHF, C- Band and SATCOM



Mission Planning & Analysis Station (MIPAS)

- Enables operators to plan the mission and carry out Post Mission analysis, playback and reporting of the mission sorties
- A laptop based MIPAS also is included for operation from Air-Bases other than from the Home Base





Centre for Airborne Systems (CABS)

Ministry of Defence

Belur, Yemlur Post

Bengaluru - 560037