# DEFENCE INNOVATION ORGANISATION

(Under Aegis of Department of Defence Production)
Ministry of Defence, Government of India
New Delhi -110002

## SUMMARY LIST OF DEFENCE INDIA STARTUP CHALLENGE – 5 (DISC 5)

## PROBLEM STATEMENTS

**Overall No. of challenges proposed: 35 (Thirty-Five)**

| Service /DPSU/OFB | No. of challenges shortlisted | Service /DPSU/OFB | No. of challenges shortlisted |
|---|---|---|---|
| Indian Army | **5** | Hindustan Shipyard Limited (HSL) | **2** |
| Indian Airforce | **3** | Mazagon Dock Shipbuilders Limited (MDL) | **1** |
| Indian Navy | **5** | Mishra Dhatu Nigam Limited (MIDHANI) | **3** |
| Hindustan Aeronautics Ltd (HAL) | **9** | Garden Reach Shipbuilders & Engineers Ltd (GRSE) | **4** |
| Bharat Electronics Limited (BEL) | **3** | **Total** | **35** |

### Titles of challenges shortlisted by respective Defence Agencies (DPSUs) & Armed Forces

### Indian Army

1. Situational Awareness for Mechanised Columns.
2. Augmented Reality / Virtual Reality based Sortie Preparation Aid for Helicopter Pilots.
3. Artificial Intelligence based Radio Frequency Spectrum Management.
4. Precision Guided Kit for 81 mm Mortar Ammunition.
5. Silent Overwatch for Infantry Combat Vehicles using Fuel Cell / Alternate Fuel based Auxiliary Power.

### Indian Airforce

6. Development of Part Task Trainer for Mirage 2000 Upgrade aircraft.
7. Development of Wide Band HF Modem for Networked secure voice, data & Video Communication.
8. Infusion of Augmented reality in Technical Type training and Usage of Smart glasses to assist Technicians.

## Indian Navy

9. Non -lethal Devices for stopping Vessels at Sea.
10. Enhancing Underwater Domain Awareness (UDA) by the use of Artificial Intelligence/machine Learning or other Novel Techniques.
11. Miniaturisation for implementation on mini and micro drones and drone SWARMS. Nodal Directorate: DNAS.
12. Private 5g Network for Machine to Machine Communication for Indian Navy.
13. Development of inertial energy storage system for naval applications.

## Hindustan Aeronautics Ltd (HAL)

14. Image recognition and target tracking and non-cooperative collision avoidance systems for UAVs.
15. Miniaturization of electronics modules by use of low power industrial devices and ruggedized hardware and software components.
16. Development of a bore-sighting / alignment system for SU -30 MKl aircraft sensors, tray and weapon adaptors.
17. Development of Artificial Intelligence based training modules for technicians for operation and maintenance of SU – 30 MKl aircraft.
18. Development of Structural Health Monitoring (SHM) system for SU-30 MKl aircraft – Stabilizer using photonic system.
19. Design and Development of Spark plug part no SP 87PA of AL-31FP aero engine.
20. Development of Software module for audio data compression and decompression compatible with ADSP21060 and ARM (Cortex 7 series) processors.
21. Adaptive Data Rate Modem for Wireless Mobile Ad-Hoc Network.
22. FM CW Real Time RADALT Tester.

## Bharat Electronics Limited (BEL)

23. Motion Pattern Classification on online/active data.
24. Find out the overlapping percentage of two 3D objects and display of combined geometry.
25. Helmet mount Conformable antenna.

## Mazagon Dock Shipbuilders Limited (MDL)

26. Robotic Arm for inspection, cleaning and painting of tanks on ships to save on time, cost and avoid accidents.

## Mishra Dhatu Nigam Limited (MIDHANI)

27. Development of fast & economical cutting machines for Metal Bars above dia 400mm.
28. Development of Automation and Data capturing in a quality control lab.
29. Development of NDT technique for quality assessment of cast ingot.

## Garden Reach Shipbuilders & Engineers Ltd (GRSE)

30. Design of Active Roll Stabilization System for Naval Ships.
31. Development of an AI enabled Robot to carry out Phased Array Ultrasonic Inspection on curved/ straight ship Hull structure.
32. Low Insulation observed on parallel DC Supply.
33. Low Insulation of Galley Equipment observed during operation on board ships.

## Hindustan Shipyard Limited (HSL)

34. Control of EMI/EMC and reduction of Radar Cross Section on Naval ships.
35. Development of NVG compatible Lighting and helo visual landing aids for use onboard ships.

# DISC 5

# DETAILED PROBLEM STATEMENTS

# OF

# INDIAN ARMY

**CHALLENGE 1**

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| **Organization Name** | Indian Army, Directorate General of Armoured Corps (DG AC), IHQ, MoD (Amy) |
| **Problem Statement/ Challenge title** | Situational Awareness for Mechanized Columns. |
| **Challenge domain** | The Battlefield Situational Awareness presently available to commanders at all levels in mobile formation is on adhoc basis whereas in the current technologically advanced modern warfare scenario, there is a need of integrated network system which will enable faster decision making by commanders in a dynamic tank battle. In a fast, fluid and mobile battle the need for situational awareness of commanders are crucial towards command and control of all his elements. |
| **Challenge brief/definition** | (a) Situational awareness through continuous positioning of own elements.<br>(b) Terrain information through pre-fed maps upgraded to Defence Series Maps<br>(c) Sharing of data like a diagrammatic plan in digitized format.<br>(d) Communication and information sharing (within a hierarchical structure) to improve command, control and coordination.<br>(e) Should be scalable and upgradable to receive ISR (Intelligence, Surveillance and Reconnaissance) and IFF (identification of Friend or Foe) inputs.<br>(f) Form factor to facilitate handling during mobile operations. |

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| **Future Expectation from the prototype / Technology developed** | (a) Enhancement in operational effectiveness through improved visibility in the mobile battlefield.<br>(b) Improved fire power coordination, resulting in effective destruction of the enemy.<br>(c) Effective Command and Control with quick decision making.<br>(d) Improved tactical and logistics planning and balance at each stage. |

**CHALLENGE 2**

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| **Organization Name** | Indian Army, Directorate General of Army Aviation |
| **Problem Statement/ Challenge title** | Augmented Reality / Virtual Reality based Sortie Preparation Aid for Helicopter Pilots |
| **Challenge domain** | Technical Infusion to add value in Trg. |
| **Challenge brief/definition** | (a) Virtual Reality technology should be employed to train aviators in flight procedures on ground. Army helicopter pilots need in various regular training procedures related to flying Actual Flying of use of simulators flight can meet their training requirements. However, with the prohibitive cost of actual flying and very limited access to flight simulators there is a need for a cost-effective means to train the pilots.<br>(b) Aviators need to practice flight procedures on ground to optimize the learning value of the live sortie missions flown by them. Employment of Virtual Reality technology will enhance the level of preparedness prior to undertaking a live sortie msn. Virtual Reality technology can also be employed for simulating bad weather conditions as well as for practicing flythroughs in the trn expected during the sortie. |

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| **Future Expectation from the prototype / Technology developed** | (a) Portable &Scalable.<br>(b) Ruggedized as per military specifications.<br>(c) Easy loading of trn maps.<br>(d) Near realistic controls. |

**CHALLENGE 3**

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| **Organization Name** | Indian Army, Directorate General of Signals |
| **Problem Statement/ Challenge title** | Artificial Intelligence based Radio Frequency Spectrum Management. |
| **Challenge domain** | Artificial Intelligence |
| **Challenge brief/definition** | (a) Statement of Problem- Probable Interface/ jamming faced by Equipment/ Systems operating in the TBA due to heavily congested Electro Magnetic Spectrum Space.<br>(b) Evolution of Problem- The increase in spectrum usage multiplies manifold in a dynamic battlefield where units and sub units are on the move and are entering or existing a given area. New units from reserve or neighboring formations also. get inducted or de-inducted as per progress of the battle. The no of wireless emitters including communication elements and Radar have also increased manifold in the TBA. The increasing density of surveillance elements including UAVs add to the future requirement of Spectrum as also increasing the probability of EM Spectrum Interference.<br>(c) How is it being overcome? The problem is futuristic and is being resolved presently, through manual distribution of frequencies through Signal Instructions. As more wireless |

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| | devices and services utilize the electromagnetic spectrum, the ability to share space for divergent purposes will become increasingly important. Al systems that can discover more efficient ways to share could be the key to providing priority signals with a clear channel whenever needed. |
| **Future Expectation from the prototype / Technology developed** | The wireless spectrum has been managed and utilized over many decades through a complex regulatory framework and a patchwork of policies. The current methods of assessing spectrum needs are complicated due to the growing level of interdependencies in the spectrum domain. Human allocation of spectrum so far has yielded satisfactory results but as the number of services which require the band increases exponentially, we will need to shift towards more optimal management techniques. Artificial Intelligence (Al) has been successfully applied in domains such as voice recognition, image detection etc. In these examples, Al has scaled better than human capacity and is almost as reliable. Experts believe the Al has the potential to yield similar results in wireless spectrum engineering. |

**CHALLENGE 4**

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| **Organization Name** | Indian Army, DG Inf/ Inf-3 |
| **Problem Statement/ Challenge title** | Precision Guided Kit for 81 mm Mortar Ammunition |
| **Challenge domain** | Modernizations of equipment profile to increase the accuracy of 81mm Mortar ammunition |

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| **Challenge brief/definition** | Infantry Battalions are authorized 81mm Mortar as Battalion support weapon to provide close fire support to assaulting Infantry once the artillery fire is lifted. With modernization of equipment profile the requirement to increase the accuracy of 81mm Mortar ammunition, various upgrades are being considered worldwide. Keeping in mind the dispersion in the fall of bomb of 81mm Mortar at the object/target end, there is requirement to develop capability to increase the accuracy of the 81mm Mortar ammunition by precision guidance for accurate engagement and reduced collateral damage. With the Precision Guided Kit the Circular Error Probability (CEP) of < 10 m can be achieved whereas the same for the unguided projectile is approx. 70m. Therefore, limited quantity of the overall authorization of 81mm Mortar ammunition upgraded with a Precision Guided Kit to engage high value targets in the area of influence of an Infantry Battalion. |
| **Future Expectation from the prototype / Technology developed** | To provide pin point accuracy of engagement. |

**CHALLENGE 5**

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| **Organization Name** | Indian Army, ADG Mech Inf |
| **Problem Statement/ Challenge title** | Silent Overwatch for Infantry Combat Vehicles using Fuel Cell / Alternate Fuel based Auxiliary Power |
| **Challenge domain** | Silent-Watch and Energy Management |

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| **Challenge brief/definition** | ICV BMP-2 deployed in High Altitude Areas (HAAs) presently have lead acid secondary batteries which are used to supply power to radio Surveillance equipment in the engine switched off mode. Prevalent low temperatures at High Altitude Area results in low charge holding and faster discharging of 24V secondary batteries of ICVs. The situation becomes critical operationally when there is a need for silent watch (main engine switched off while surveillance devices & radio sets are on).<br><br>Evolution of the Problem- silent watch by the BMPs during various tactical situations. BMP-2/2K utilizes the present lead acid batteries to operate the sights, communication equipment, gun traverse and dome lights in order to carry out the silent watch of the battle field without switching or the main engine. Due to rapid loss of charge of the lead acid batteries. There is a requirement of frequent starting of the engine to charge these lead acid batteries which leads to loss of surprise. There is also derating of the lead acid batteries in the HAA due to extreme climate conditions and rarified atmosphere. |
| **Future Expectation from the prototype / Technology developed** | There is an immediate requirement of a Silent Overwatch for infantry combat vehicles using Fuel Cell / Alternate Fuel based Auxiliary Power which should enable silent operation of the ICV BMP-2 to include power to operate. Commander thermal Imaging Sight, Gunner Thermal Imaging Sight communication equipment, main armament, gun traverse and internal dome lights in a silent mode operation continuously for 6 to 7 hours without impinging upon the existing secondary batteries of the vehicle.<br><br>Expected prototype technical Solution must be able to do the following-<br>a) Silent Watch Capability -6 Hrs , b) System Architecture - Should be able to fit in the interna Space of BMP-2/2K, c) Intelligent Power |

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| | Management Module - To monitor and optimize power requirement of various electronic Components, d) Operation Conditions – Temp: 15 to +50o C & weather Condition: All weather conditions. |

# DISC 5

# DETAILED PROBLEM STATEMENTS

# OF

# INDIAN AIRFORCE

**CHALLENGE 6**

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| **Organization Name** | Indian Airforce |
| **Problem Statement/ Challenge title** | Development of Part Task Trainer for Mirage 2000 Upgrade aircraft. |

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| **Challenge domain** | Simulation |
| **Challenge brief/definition** | (a) Objective. Following objectives are required to be achieved.<br>(i) Accurately model and simulate the cockpit controls and Multi-<br>Functional Displays (MFDs) including all pages, subpages and<br>functions of Mirage 2000 upgrade cockpit.<br>(ii) Create simulation models to allow basic flying (equivalent to<br>CAT B simulator) on the part task trainer.<br>(iii) Allow pilots to practice to practice various modes of operation<br>of the aircraft.<br>(iv) Allow pilots to practice all pilot - aircraft interface.<br><br>(b) Description. The proposal is to develop a part task trainer for Mirage 2000 upgrade aircraft. The part task trainer should have an accurate replica of the Mirage 2000 upgrade aircraft stick and throttle. The MFDs, Head Up Display (HUD), Function Selector and Display Unit (FSDU) and other displays can be replicated on LCD/TFT/OLED display panels with touch screen albeit with correct visual representation. The pilots should be able to undertake basic flying and be able to accurately simulate all existing modes and functions of the aircraft. The cockpit controls, buttons, levers, switches etc are required to be replicated for reasonably accurate form.<br><br>(c) Misc Information. Access to Mirage 2000 upgarde aircraft and relevant technical documentation will be provided once the Non-Disclosure Agreement (NDA) has been signed. The information has to be handled under all existing rules and regulations. |
| **Future Expectation from the prototype / Technology developed** | A total of 05 PTT are envisaged for Mirage 2000, subsequently PTT could be developed for other ac. |

**CHALLENGE 7**

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| **Organization Name** | Indian Airforce |
| **Problem Statement/ Challenge title** | Development of Wide Band HF Modem for Networked secure voice, data & Video Communication. |
| **Challenge domain** | Development of all band High Frequency (HF) digital modem for video interaction targeting data rate capabilities in excess of 48Kbps, ultimate data rate being 512kbps. The developed modem to be compliant with STANAG and MIL-STD-188-110D standards |
| **Challenge brief/definition** | HF communication could be achieved globally under all weather conditions. HF is a free of cost long distance (over the horizon) communication, akin to Satcom. Each sub-band of HF range, (3 MHz to 30 MHz) is unique in its behavior and affected by ionospheric conditions and sunspot activities. Hence the available bandwidth at a given instant is limited between 100 KHz to 600KHz, multiple bands inclusive. Given this limited bandwidth resource & environmental dependence achieving bidirectional voice, data & video comn over HF is a challenging research activity.<br><br>**Development Approach / Methodology:**<br>Digital signal processing based Multiple band and Multiple carrier modulation and demodulation design approach is envisaged, which will eventually lead to Multiple Input and Multiple Output (MIMO) radio designs. Phase and Orthogonal modulation techniques may be employed to reduce bit rate errors and gain higher signal to noise ratio. Digital direct conversion technology will be employed to achieve wide band transmission and reception capabilities. Design architecture may adhere to relevant STANAG and MIL-STD-188-110D standards to enable interpretability with existing HF comn sets and long operational lifetime. Broadband tuned antenna to be employed for low weight and efficient man pack radio sets. Artificial Intelligence (AI)/Machine Learning (ML) may be employed to develop efficient and automatic communication frequency selection (based on SNR) and hopping algorithm for efficient |

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| | video communication. Customized video coder and decoder is envisaged with specialized encryption and decryption algorithm. |
| **Future Expectation from the prototype / Technology developed** | Developed proof of concept and working prototypes will encourage research and development of Ultra Wide Band HF MIMO radios catering to multi user video conferencing application. Advancements in semiconductor research catering to development of HF System-on-Chips, and AI/ML based ionosphere weather modeling and predictions. |

**CHALLENGE 8**

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| **Organization Name** | Indian Airforce |
| **Problem Statement/ Challenge title** | Infusion of Augmented reality in Technical Type training and Usage of Smart glasses to assist Technicians. |
| **Challenge domain** | Training methodology adopted in TETTRAs and TIs on Aircraft and Systems require forward looking technologies such as Augmented Reality(AR) to enhance the quality of training and imbibe skills which otherwise could not be made possible. |

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| **Challenge brief/definition** | Smart AR Glasses for Engineers and Technicians while Carrying out Maintenance Activity.<br>(i) Technicians undertake maintenance activities which mandates them to refer to multiple publications, diagrams and animations to correctly diagnose and perform the intended activity. In the present form, there are limitations in terms of physically visualizing the systems / subsystems and simultaneously referring to multiple documents.<br>(ii) Smart glasses can deliver critical information wrt wiring assemblies, troubleshooting procedures, diagrams, checklists, 3D walkthroughs, animations and other reference materials in the technicians' line of sight, while allowing them to keep their hands free to carry out the task. Further voice command driven reference images and instructional videos during workflow, allows new technicians to train quickly on job.<br><br>**(a) Non-availability of Vendors with Proven Track record.** Currently vendors who have a proven track record of implementing AR technology in a military set up are not available. Vendors with required skillset and a proven prototype of the product can be associated for further Proof of Concept in IAF set up.<br>**(b) Integration with e-MMS.** IAF e-MMS uses IBM Maximo COTS tool which is required to be integrated with the Smart Glasses. The technician should be able to receive, select and confirm completion of tasks through Voice commands and same should be updated in the electronic Maintenance Management System (e-MMS) data base. |

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| **Future Expectation from the prototype / Technology developed** | (a) Usage of the AR by all Technical Training Institutes of IAF (TETTRAs & TIs) for enhancing quality of training imparted.<br><br>(b) Usage of Smart glasses by Aircraft , GW , Radar, AFNet, Armament Fusing and Bomb Disposal technicians for enhancement in quality of maintenance thereby improving aerospace safety. |

# DISC 5

# DETAILED PROBLEM STATEMENTS

# OF

# INDIAN NAVY

**CHALLENGE 9**

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| **Organization Name** | Indian Navy |
| **Problem Statement/ Challenge title** | Non -lethal Devices for stopping Vessels at Sea |
| **Challenge domain** | Mechanical / Chemical |
| **Challenge brief/definition** | (a) There may be a need to stop vessels at sea without resorting to the use of force. This would be useful during peacetime operation such as for VBSS (visit Board, search, Seizure) operations or to stop a boat that is heading towards friendly forces (at sea or in harbor/ anchorage) where the intent of the boat cannot be ascertained.<br>(b) The vessels so stopped should not suffer any permanent, damage but the speed of the vessel should be slowed down, or ideally the vessels brought to a halt altogether.<br>(c) The word vessel is used in its broadest sense and could cover vessels from small, high sped boats to larger ships.<br>(d) Boat stopping devices are commercially available which use a pneumatically launched rope with a drogue (sea anchor) which can get entangled with the boats propellers and show down the boat due to the resultant drag. The rope has to be 'fired' across the bow of the boat for it to be effectively ensnared. Such a device has limitations such as inability to be used when a boat is heading directly towards the ship which is using the device as in such a case, the rope would lie parallel to the boat path and is unlikely to get ensnared.<br>(e) For large vessels, a mechanical device such as this may be impractical. A chemical solution may be attempted where a viscous gel – like structure is formed around the vessels propeller thus hindering movement. Such gel should dissipate (or dissolve in sea water) after a certain amount of time.<br>(f) The solution may be separate or a combined solution may be provided. The means of delivery of the device should also form a part of the proposed solution. |

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| **Future Expectation from the prototype / Technology developed** | Subject to successful trials of the prototype solution and based on the overall cost, such systems may be procured for use by the Navy and will also have utility for the Coast Guard and the Marine Police at state level. |

**CHALLENGE 10**

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| **Organization Name** | Indian Navy |
| **Problem Statement/ Challenge title** | Enhancing underwater Domain Awareness (UDA) by the use of Artificial Intelligence/machine Learning or other Novel Techniques |
| **Challenge domain** | Al, ML, Acoustics |
| **Challenge brief/definition** | (a) Comprehensive Underwater Demain Awareness (UDA) requires fusing data from disparate sources.<br>(b) Voluminous data that may be obtained from disparate sensors such as sonars and sonobuoys (at the theatre level) needs to be fused for sense-making.<br>(c) Presence of background noise and non -submarine Contact (which may also be biological in origin) can complicate the detection problem.<br>(d) Use of suitable trained AI/ML models that can help in detection of submarines would greatly aid in enhancing UDA.<br>(e) The solution need not be limited to AL/ML alone and could also target other aspects that enhance UDA such as better signal processing and decision support if they improve the existing capability even where AL/ML techniques are not used. |
| **Future Expectation from the prototype / Technology developed** | Subject to successful trials of the solution the system may be inducted in the Indian Navy depending on the improvement over current procedures and cost benefit analysis. |

**CHALLENGE 11**

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| **Organization Name** | Indian Navy |
| **Problem Statement/ Challenge title** | Miniaturisation for implementation on mini and micro drones and drone SWARMS |
| **Challenge domain** | |
| **Challenge brief/definition** | (a) Distributed aperture radar for maritime ISR including imagery/SAR imagery.<br>(b) Passive EW measures for overwhelming enemy AD/deception of enemy missiles.<br>(c) Home on radiation based navigation system.<br>(d) Navigation aids for ops in GNSS denied environment. |
| **Future Expectation from the prototype / Technology developed** | |

**CHALLENGE 12**

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| **Organization Name** | Indian Navy |
| **Problem Statement/ Challenge title** | Development of a Private 5G network for machine to machine Communication |
| **Challenge domain** | Communication |

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| **Challenge brief/definition** | **Background.** 5G is a critical Strategic technology and will fuel ubiquitous connectivity in future and is likely to have long-term economic and military advantage .5G standards incorporate new security features and gives 5G networks the potential to operate much securely when compared with existing commercial wireless network.<br><br>**Challenge.** Development of a private 5G in box kind of solution with user defined security features, which can coexist with commercial 5G operations without inference. The solution should endeavor to follow 5G standards. The solution should aid in the following :-<br><br>● Enhanced mobile Broadband(eMBB) towards providing a portable solution delivering higher quality And rich content to multiple users with full mobility.<br><br>● Help in large scale machine -to-machine communications from widespread sensor networks and multiple connected devices. |
| **Future Expectation from the prototype / Technology developed** | Implementation of data intensive communication application like AI/ML based tools |

**CHALLENGE 13**

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| **Organization Name** | Indian Navy |
| **Problem Statement/ Challenge title** | Development of inertial energy storage system for naval applications |
| **Challenge domain** | |

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| **Challenge brief/definition** | IESS aims to harness energy from high inertia flywheels. They are also known as flywheel UPS.<br><br>**Challenge** : design and development of a compact IESS with a power Electronic convertor based ride through mechanism to ensure uninterrupted power supply to the load/equipment during partial power failure. Broad specifications are as follows:-<br><br>● Power:100 KW of more<br>● Weight: 50kg or less<br>● Volume:30,000 cc or less<br>● Backup times: 5sec or more<br>● Ride through Mechanism: SMPS based converter, with stabilised power supply |
| **Future Expectation from the prototype / Technology developed** | Potential future use of IESS for application in IN are as follows:-<br><br>● Integrated compact converters with built-in UPS feature for weapon/sensor system<br>● Power Quality correction for sensitive equipment<br>● Implementation of uninterrupted shore supply by integrating high capacity IES Systems with grid and shore based back-up generators<br><br>Replacement of existing weapon supply with IES based power supply system to ensure “No-Break” supply and requisite power Quality. |

# DISC 5

# DETAILED PROBLEM STATEMENTS

# OF

# HINDUSTAN AERONAUTICS LTD (HAL)

**CHALLENGE 14**

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| **Organization Name** | Hindustan Aeronautics Ltd (HAL) |
| **Problem Statement/ Challenge title** | Image recognition and target tracking and non-cooperative collision avoidance systems for UAVs. |
| **Challenge domain** | Recognition & Tracking of the target(s) based on the images from sensors such as CCD, FLIR, SAR/ISAR video from Radar, EO systems. AI based image recognition & tracking and non-cooperative collision avoidance system for UAVs. |
| **Challenge brief/definition** | **Description:**<br>Aim is to automatically recognize the ground targets using images captured from various on-board sensors such as CCD, FLIR, SAR/ISAR or EO systems and tracking of the same after detection. This includes detection, classification, recognition, and tracking of the targets. AI/ML based algorithms may be used.<br>**Objectives of the Challenge / Scope of Work:**<br>To develop and validate the algorithms for target recognition & tracking and also for non-cooperative collision avoidance system.<br>**Evaluation Criteria:**<br>Algorithms can be verified on ground using simulator; and in-air on HAL flying platforms having the required sensors. |
| **Future Expectation from the prototype / Technology developed** | Can be used in day/night Aerial surveillance of infiltration on the border areas using UAVs. Useful in Net centric operations for target sharing among various nodes. Also, it can be used for non-cooperative collision avoidance system in UAVs. |

## CHALLENGE 15

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| **Organization Name** | Hindustan Aeronautics Ltd (HAL) |
| **Problem Statement/ Challenge title** | Miniaturization of electronics modules by use of low power industrial devices, ruggedized hardware and software components. |
| **Challenge domain** | Miniaturization of electronics for avionics applications |
| **Challenge brief/definition** | Future avionics for UAV and Fixed Wing/Rotary wing applications require light weight, small size and lesser powered computers. For this purpose, miniaturization of electronic modules using FPGA/SOC is required.<br><br>SOC : System on Chip |
| **Future Expectation from the prototype / Technology developed** | Light weight, small size and less power airborne computers for avionics applications |

## CHALLENGE 16

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| **Organization Name** | Hindustan Aeronautics Ltd (HAL) |
| **Problem Statement/ Challenge title** | Development of a bore-sighting / alignment system for SU -30 MKl aircraft sensors, tray and weapon adaptors. |
| **Challenge domain** | This system shall perform Bore-sighting / alignment of sensors, tray and weapon adaptors without need of Reference / Harmonization Board and three-point levelling of an aircraft.<br>The current system requires three-point levelling of aircraft & placement of Reference board and have certain limitation like human error, large manpower and time requirement. These limitation leads to occurrence of large amount of snags and additional flying efforts for acceptance and delivery of aircraft to customer. It also affects fleet readiness. Hence a system which is quick, accurate, and reliable and demand less man power is required. |

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| | Bore-sighting in context to aircraft and its system refers to a process of adjustment / measurement of deviations of a local co-ordinate axis system of sensor with respect of aircraft axis system. The deviations of a local co-ordinate axis system of sensor further adjusted or compensated for proper functioning of aircraft systems.<br>The challenge domain are as follows:<br>a) Elimination of requirement of aircraft levelling and placement of reference board.<br>b) Reduction in man-hours requirement.<br>c) It shall eliminate human error (Parallax errors while using optical system and use of plumb bob).<br>d) Linear accuracy: It shall not be less than 0.5 mm at a distance of 0.1 m to 22 m. The measurement distance is from axis of Bore-sighting Alignment System origin to point of interest under measurement.<br>e) Angular accuracy: It shall not be coarser than 0.25 mil (milli radian) at a distance from 0.1 m to 22 m. The angular accuracy shall be applicable in all three directions i. e. Roll, Pitch and Yaw. Angular measurement accuracy is considering total system errors i.e. Mechanical manufacturing error of trays, hardware error and software calculation errors.<br>f) Simultaneous activities (other than harmonization) on aircraft shall not affect measurement accuracy of the proposed system.<br>It shall be portable. |
| **Challenge brief/definition** | In development of Bore-sighting system for Su 30MKI aircraft the following scope is expected:<br>i. Design and development of measurement technology and harmonization technology as per technical specification.<br>ii. Design and development of fixtures / adaptors required for Bore-sighting / Alignment of sensors / trays and adaptors. At Proof of concept stage, Head-Up-Display (HUD), Inertial and Navigation Global Positioning System (INGPS) sensor and Aircraft Reference Datum for harmonization will be considered.<br>iii. Design and development of User Interface.<br>iv. Design and development of software and algorithm.<br>v. Design and development of laboratory model and demonstration of developed technology principle.<br>vi. Design, Development and manufacturing of prototype system<br>vii. Demonstration of technology using developed prototype system to user and govt. certifying agencies.<br>viii. Submission of all documents (algorithms, source code of software, Design manual, Operational Manual, Maintenance manual.<br>ix. Submission of deliverables that are agreed upon. |

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| | a) The system shall have following essential component:<br>i. Control & Measuring Device (CMD) for measurement and control operation.<br>ii. Portable handheld measuring tool for measurement of point co-ordinates in three dimensional space.<br>iii. Bore-sighting Trays Adaptor & Fixture (BTAF) for capturing of axis information of sensors, tray and weapon adaptors.<br>iv. A computing and display device for computation and user interface.<br>b) The stages of technology development will be in line with general development process:<br>i. Selection of Technology and feasibility study.<br>ii. Technology validation in laboratory.<br>iii. Technology development / Prototype development.<br>iv. Proof of Concept using prototype on aircraft.<br>v. Report generation / Documents.<br>Deliverables: Various reports, algorithms, Source code of software, software executables, prototype product, supporting equipment's if any. |
| **Future Expectation from the prototype / Technology developed** | The developed prototype / technology will be employed for Bore-sighting / alignment of aircraft sensors, tray and weapon adaptors on Su-30MKI aircraft.<br>This technology may be further deployed for Bore-sighting / alignment of other fixed wing and rotary wing aircraft.<br>Also it may deployed for alignment of various zigs and fixtures and calibration of robotic arms. |

**CHALLENGE 17**

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| **Organization Name** | Hindustan Aeronautics Ltd (HAL) |
| **Problem Statement/ Challenge title** | Development of Artificial Intelligence based training modules for technicians for operation and maintenance of SU – 30 MKl aircraft |
| **Challenge domain** | Artificial Intelligence with VR/AR |

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| **Challenge brief/definition** | The proposed system shall be based on Virtual Reality/Augmented Reality and AI for generation of simulated scenarios and analysis of the responses. The training is envisaged at 3 levels. Level-1 will be based on the basics & 3D models elaboration of the desired system. Level-2 will be on the known scenarios and known responses. Level-3 will be on the randomly generated scenarios and their comparative analysis with respect to the actual. Each scenario consists of Faults of the system and its corrective action. |
| **Future Expectation from the prototype / Technology developed** | The technology developed will be used to impart training to the technicians effectively. The technologies will be adopted to the other aircraft systems. |

**CHALLENGE 18**

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| **Organization Name** | Hindustan Aeronautics Ltd (HAL) |
| **Problem Statement/ Challenge title** | Development of Structural Health Monitoring (SHM) system for SU-30 MKl aircraft – Stabilizer using photonic system. |
| **Challenge domain** | For cracks/ defects detection on Su-30MKI aircraft Stabiliser in both assembled and disassembled condition. |
| **Challenge brief/definition** | During exploitation and overhaul of Su-30MKI aircraft, number of cracks are reported from IAF bases and HAL (NK) respectively. At present, visual inspection with/ without magnifying glass and dye penetrant methods are used to identify cracks/ defects on the structure. Sometimes it is difficult to locate the cracks/ defects in inaccessible locations. In few of the cases, the location of the cracks/ defects is accessible only after dismantling of assemblies. In view of the above, an advanced and effective non-contact structural health monitoring system is required to identify cracks/ defects without dismantling of aircraft structure. |
| **Future Expectation from the prototype / Technology developed** | i. The primary objective is to identify the cracks/ defects encountered during exploitation of Stabiliser installed on Su-30MKI aircraft. The evaluation shall be done based on the test results obtained from photonic system and results of visual inspection of Stabiliser after dismantling from the aircraft. |

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| | **ii.** Development of a photonic system to detect cracks/ defects on Stabiliser structure in assembled and in disassembled condition. Photonic system should be able to detect cracks/ defects on any zone of Su-30MKI structure. |

**CHALLENGE 19**

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| **Organization Name** | Hindustan Aeronautics Ltd (HAL) |
| **Problem Statement/ Challenge title** | P 87PA of AL-31FP aero engine |
| **Challenge domain** | Spark plugs SP-87PA (igniter plug) of surface discharge type installed on combustion chamber of the AL-31FP aero engine. The spark plug cannot be disassembled and has a screen and ceramic insulator between the electrodes. Spark discharges from central electrode to side electrode |
| **Challenge brief/definition** | The spark plug is connected to high voltage generated by an ignition coil. As current flows from the coil, a voltage develops between the central and side electrodes. Initially no current can flow because the fuel and air in the gap is an insulator, but as the voltage rises further it begins to change the structure of the gases between electrodes. Once the voltage exceeds the dielectric strength of the gases, the gases become ionized. The ionized gas becomes a conductor and allows current to flow across the gap in the form of spark.<br>Working pressure: 40 bar<br>Thread dimension of spark plug to ignition cable: M20X1 CL-2a<br>Thread dimension of spark plug to casing of combustion chamber: M20X1.5<br>Weight : 0.28 kg<br>Total Life : 1000 Flying hours, minimum |
| **Future Expectation from the prototype / Technology developed** | This spark plug should have form fit condition to be assembled in main combustion chamber of the AL-31FP engine with minimum life of 1000 flying hrs. Maximum weight of the part is 0.28 kg max. |

**CHALLENGE 20**

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| **Organization Name** | Hindustan Aeronautics Ltd (HAL) |
| **Problem Statement/ Challenge title** | Development of Software module for audio data compression and decompression compatible with ADSP21060 and ARM (Cortex 7 series) processors. |
| **Challenge domain** | Software Development & Integration |
| **Challenge brief/definition** | 1. Solid State Flight data Recorder system consists of Flight data acquisition and cockpit audio acquisition and storage in memory. Four channel audio data is acquired on as per second basis and is then used after compression & decompression in ratio of 4:1 & 1:4 respectively.<br>2. Software Module to be developed by vendor to perform audio lossless compression & decompression in ration of 32:1 & 1:32 respectively.<br>3. Vendor has to demonstrate the developed software module integration with with ADSP21060 & ARM ( Cortex M-7 series ) processors fitted in SSFDRs.<br>4. Compression of Audio data in 32:1 ratio in 50 ms is mandatorily requirement.<br>5. Decompression is to be done in 1:32 ratio as fast as possible but not more than 1 minute. |
| **Future Expectation from the prototype / Technology developed** | At present compression ratio of 4:1 is used in SSFDRs, if a software module compatible with processors is developed it will provide a technology to store larger duration of data in lesser memory space and further audio data download time will also reduced significantly by the technology developed. |

**CHALLENGE 21**

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| **Organization Name** | Hindustan Aeronautics Ltd (HAL) |
| **Problem Statement/ Challenge title** | Adaptive Data Rate Modem for Wireless Mobile Ad-Hoc Network |
| **Challenge domain** | Modem for Wireless networks |

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| **Challenge brief/definition** | Wireless communication channels are characterized by various fading conditions like Gaussian, Rayleigh, Rician etc. Adaptive Data rate burst modem is required to keep the data rate at optimal level for fading conditions. Adaptive Data rate modem also facilitates the implementation of adaptive range scheme for increasing the geographical range of the network.<br><br>The scope of the project is development of Adaptive modulation and demodulation techniques with built-in Error Control Coding to support for variable data rates based on the channel conditions and signal strength |
| **Future Expectation from the prototype / Technology developed** | This is a key technology required for Datalinks. This technology will be a part of the datalinks being developed by SLRDC for UAVs. |

**CHALLENGE 22**

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| **Organization Name** | Hindustan Aeronautics Ltd (HAL) |
| **Problem Statement/ Challenge title** | Frequency-Modulation Continuous-Wave (FM CW) Real Time RADALT Tester |
| **Challenge domain** | C Band R F Signal Processing using DDS technique. |
| **Challenge brief/definition** | The purpose of the system is to test the Radio altimeter for its altitude range profile along with the different pitch & roll conditions for selected terrain. Presently fixed delay line is being used for bench testing and no test equipment is available for testing variable altitude along with different pitch & roll conditions for selected terrain.<br><br>The test equipment shall simulate the terrain reflected signal spectrum (echo spectrum) with respect to the FMCW signal transmitted from the RAM incorporating the altitude delay, spectrum as per pitch & roll condition and terrain attenuation.<br><br>The simulated echo is fed to the RAM receiver for processing and display the height programmed in order to verify the functionality of the RAM. |

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| **Future Expectation from the prototype / Technology developed** | Required for Proving the performance of RAM and reduces flight test effort to greater extent. |

# DISC 5

# DETAILED PROBLEM STATEMENTS

# OF

# BHARAT ELECTRONICS LIMITED (BEL)

**CHALLENGE 23**

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| **Organization Name** | Bharat Electronics Limited (BEL) |
| **Problem Statement/ Challenge title** | Motion Pattern Classification on online/active data |
| **Challenge domain** | Analytics |
| **Challenge brief/definition** | The detection of ship patterns on offline data is possible by applying the mathematical algorithms. However, the problem statement is to detect online ship/vessel manoeuvring patterns in sea such as Zig-Zag, Loop, Parallel movement & sudden stop in mid sea for Radar/AIS track data. |
| **Future Expectation from the prototype / Technology developed** | The output must contain the Identity/Identities of the Vessel, classification of Pattern detected & duration of the pattern detected. The proposed solution should efficient & must cater for large volume of track data (more than ~1 Lakh Track). |

**CHALLENGE 24**

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| **Organization Name** | Bharat Electronics Limited (BEL) |
| **Problem Statement/ Challenge title** | Find out the overlapping percentage of two 3D objects and display of combined geometry |
| **Challenge domain** | 3D GIS Overlapping Objects |
| **Challenge brief/definition** | Software solution should give following output<br>1. The overlapping percentage of two 3D volumes and also highlight the overlapped area with defined colour.<br>2. Geometry of overlapped 3D volume. |
| **Future Expectation from the prototype /** | The solution should provide the overlapping percentage of the defined geometry and also should give the combined geometry of 3D objects after removing the overlapped area. |

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| **Technology developed** | |

**CHALLENGE 25**

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| **Organization Name** | Bharat Electronics Limited (BEL) |
| **Problem Statement/ Challenge title** | Helmet mount Conformable antenna. |
| **Challenge domain** | Antenna design and development |
| **Challenge brief/definition** | Conformable antennas are new area of development in antenna field. It will allow proper use of space available for strategic projects. Achieving conformable shape without any degradation in electrical and radiation property of antenna is a challenge covering UWB frequency ranges |
| **Future Expectation from the prototype / Technology developed** | Antenna should have conformable shape as specified and should comply with electrical properties as well as environmental specification |

# DISC 5

# DETAILED PROBLEM STATEMENTS

# OF

# MAZAGON DOCK SHIPBUILDERS LIMITED (MDL)

**CHALLENGE 26**

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| **Organization Name** | Mazagon Dock Shipbuilders Limited (MDL) |
| **Problem Statement/ Challenge title** | Robotic Arm for inspection, cleaning and painting of tanks on ships to save on time, cost and avoid accidents |
| **Challenge domain** | Robotics & Hardware |
| **Challenge brief/definition** | Ships use fuel, oils, sludge, sewage, water and other fluids, which are stored in tanks. When stored in tanks, these fluids tend to stick inside the tanks forming layers of semi-solid substance. Moreover, many impurities of these fluids settle down and stick to the surface of the tanks. It is therefore imperative that the tanks are cleaned on a regular basis on ships.<br><br>Generally, tanks cleaning on the ship is done during dry dock and whenever the inspection of the tanks is due. Cleaning is done for inspection or if there is any work to be done inside the tanks such as cracks, leaks, etc.<br><br>Tank cleaning inspection and repairs is a necessary procedure performed on board ships. This process, when carried out by humans, tends to be hazardous, sometimes leading to explosion and accidents. In spite of all the necessary safety precautions and enclosed space entry procedures, accidents still occur while inspecting, cleaning and repairing tanks on board ships. |
| **Future Expectation from the prototype / Technology developed** | Robotic Arm developed can be used on ships and submarines for inspection, cleaning and painting of tanks to<br>(a) Save on time delays in inspecting, cleaning and repairing tanks<br>(b) Avoid accidents which still occur inside the tanks on board ships.<br>(c) Reduce manpower cost.<br><br>The target users are Indian Navy, Coast Guard, Merchant Marine, Mazagon Dock Ship Builders Limited and other shipyards |

# DISC 5

# DETAILED PROBLEM STATEMENTS

# OF

# MISHRA DHATU NIGAM LIMITED (MIDHANI)

## CHALLENGE 27

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| **Organization Name** | Mishra Dhatu Nigam Limited (MIDHANI) |
| **Problem Statement/ Challenge title** | Development of fast & economical cutting machines for Metal Bars above dia 400mm |
| **Challenge domain** | Equipment development |
| **Challenge brief/definition** | Cutting of large size ingots/semis (> 400 mm dia.) of metals is an integral part of the manufacturing process of special alloys. This is presently carried out through electric discharge sawing (EDS) or Band Saw machines.Cutting of high strength alloys like super alloys, Special steels & titanium alloys is a very time-consuming process often making it a bottleneck in the process line. |
| **Future Expectation from the prototype / Technology developed** | Super alloys, Titanium alloys and Special steel are widely used in various strategic sectors and also have huge potential for export. Technology developed will be useful for all manufacturers as well as fabricators of special alloys. Further any cost effective bulk cutting method will be useful across all metal processing and a range of other industries. |

## CHALLENGE 28

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| **Organization Name** | Mishra Dhatu Nigam Limited (MIDHANI) |
| **Problem Statement/ Challenge title** | Development of Automation and Data capturing in a quality control lab |
| **Challenge domain** | Technology development / Development of software |

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| **Challenge brief/definition** | MIDHANI manufactures various alloys (super alloys, titanium alloys & special steel) and in various product forms. Further, to supply materials to strategic sectors, lot of testing and certification is to be carried out and records are to be maintained for longer periods. As of now testing process is largely manual starting from sample collection, preparation, testing and generation of reports. Handling large numbers of samples and multiple tests makes it difficult. Hence automation in testing process such as identification marking and centralized processing of data captured in individual tests are very essential. |
| **Future Expectation from the prototype / Technology developed** | Software which can help in data management starting from sample code, sample movements history from different work center, test results and online report generation will be useful for all metallurgical testing laboratories. |

**CHALLENGE 29**

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|---|---|
| **Organization Name** | Mishra Dhatu Nigam Limited (MIDHANI) |
| **Problem Statement/ Challenge title** | Development of NDT technique for quality assessment of cast ingot |
| **Challenge domain** | Technology development |
| **Challenge brief/definition** | Till date there is no NDT technique available for quality assessment of large cast ingots / large semis for identification of defects such as voids, inclusions, internal cracks etc.This leads to rejections at much later stages incurring additional process costs and delaysin delivery. |
| **Future Expectation from the prototype / Technology developed** | Processing of High value materials like Super alloys, Titanium alloys and Special steel are very expensive and time taking. Development of NDT technique for cast ingot will help to reduce process loss in subsequent stages. Such technology will find applications in all heavy component manufacturing industries. |

# DISC 5

# DETAILED PROBLEM STATEMENTS

# OF

# GARDEN REACH SHIPBUILDERS & ENGINEERS LTD (GRSE)

**CHALLENGE 30**

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| **Organization Name** | Garden Reach Shipbuilders and Engineers Ltd. |
| **Problem Statement/ Challenge title** | Design of Active Roll Stabilization System for Naval Ships |
| **Challenge domain** | Ship Dynamics, Fluid Mechanics |
| **Challenge brief/definition** | Interconnected Roll Compensation Tanks on P&S with ballast control using Controlled High Pressure Air supply above free surface.<br><br>Input for Design: Principle dimensions of Ship, Hydrostatics/GZ Curve, Response amplitude operator (RAO) for Roll motion for 02 conditions (Heading, Speed, Sea State), Radius of Gyration, any other specific input required<br><br>Deliverables: Simulation in Matlab, All associated calculations-Tank Volume, Mass flow as function of time between tanks, Pump capacity, Schematic drawings of whole arrangement. |
| **Future Expectation from the prototype / Technology developed** | Normally warships are fitted with Fin Stabilizers which creates roll stabilization due to hydrodynamic lift, hence these are not very effective when ships are moving at lower speeds. In addition to above limitation, it creates additional and unwanted drag leading to larger fuel consumption.<br><br>In order to overcome this, Active roll stabilization as above is envisaged. Similar technology is available in market mainly from foreign vendors, therefore it offers an opportunity to develop indigenous technology to fulfill this gap in naval design/construction domain in line with Atmanirbhar Bharat goal. |

**CHALLENGE 31**

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| **Organization Name** | Garden Reach Shipbuilders and Engineers Ltd. |
| **Problem Statement/ Challenge title** | Development of an AI enabled Robot to carry out Phased Array Ultrasonic Inspection on curved/ straight ship Hull structure. |
| **Challenge domain** | Non-Destructive Testing: Ultrasonic Inspection of weld seams and butts during Ship Construction. |
| **Challenge brief/definition** | Welding is one of the most critical activity of ship construction which is done in huge quantity. To ensure the quality and performance of welds, Non-Destructive Test (NDT) is carried out extensively. NDT aids in identifying presence of any weld defects such as cracks, porosity, lack of fusion, slag inclusion,etc.<br><br>The AI enabled Robot shall be able to:<br>A) Navigate on the curved/ straight hull surface without human intervention while following the weld seam/ butt. Also be able to navigate through cross weld joints (merging point of seams and butts) while carrying out UT.<br>B) Conduct phased array ultrasonic test on Seam and butt weld joints while traversing on the hull structure.<br>C) Verify the integrity of weld joint as per naval standards.<br><br>The thickness of plates on which AI enabled robotic UT is envisaged in the range of 3.15 mm to 25 mm primarily.<br>The result of UT shall be governed by the weld quality specified in naval standards. The AI should be able to generate inspection report specifying whether the quality of weld joint is accepted or not. |
| **Future Expectation from the prototype / Technology developed** | This technology would be able to replace conventional way of Film based Radiography technique presently used in shipbuilding industry completely.<br><br>It is envisaged that human dependency on conducting and subsequently evaluation of the test results will eventually be minimized. |

**CHALLENGE 32**

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| **Organization Name** | Garden Reach Shipbuilders and Engineers Ltd. |
| **Problem Statement/ Challenge title** | Low Insulation observed on parallel DC Supply |
| **Challenge domain** | Low Insulation on 24V DC supply source Distribution Board (DB) |
| **Challenge brief/definition** | Low insulation is observed on 24V DC supply source DB due to many parallel path circuits required on board. Due to this low insulation, the control PCB cards are damaged frequently. |
| **Future Expectation from the prototype / Technology developed** | The desirable Insulation value should be 1 Mega Ohm.<br>In a DB, If any circuit is operating in low insulation, the visual/audio information of the same should be available on the source end so that user can isolate only that circuit for DI/DR. |

**CHALLENGE 33**

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| **Organization Name** | Garden Reach Shipbuilders and Engineers Ltd. |
| **Problem Statement/ Challenge title** | Low Insulation of Galley Equipment Observed during operation on board ships |
| **Challenge domain** | Low Insulation of Galley Equipment During Running Condition At 415V AC Supply |
| **Challenge brief/definition** | The insulation value of galley equipment's is observed in Kilo ohm during operation on board the ship. However, it is desired how to have this insulation value in Mega ohm during operation.<br><br>Note: During operation of the Galley equipment the insulation value at switchboard feeder section drops from 10 M ohm to 3k ohm. |

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| **Future Expectation from the prototype / Technology developed** | Desirable value of Galley equipment during operation should be more than 02 Mega Ohm. |

# DISC 5

# DETAILED PROBLEM STATEMENTS

# OF

# HINDUSTAN SHIPYARD LIMITED (HSL)

**CHALLENGE 34**

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| **Organization Name** | Hindustan Shipyard Limited (HSL) |
| **Problem Statement/ Challenge title** | EMI/EMC SHIELDING FOR BRIDGE WINDOW GLASSES ON NAVAL SHIPS |
| **Challenge domain** | Electrical , Electronics-Electromagnetic and Stealth design aspects of warship design |
| **Challenge brief/definition** | On the ships fitted with high power emitters on the decks, the radiated emissions could seep through the bridge windows into the bridge wherein the sensitive and sophisticated electronic navigation, communication equipment and control systems are installed and would cause malfunctioning of these equipment. Therefore there is a need to provide EMI/EMC shielding for the bridge window glasses without losing the visibility requirements. |
| **Future Expectation from the prototype / Technology developed** | If bridge window glasses with required level of EMI/EMC Shielding could be developed with a protective filming without losing the transparency/ visibility through Bridge window glass.. If a film coating can be provided which ensures electrical conductivity, both EMI-EMC and RCS problems in ship design / operation of warships can be solved.<br><br>The development of the suitable coating or film can be completed in approximate period of 2 years. All the major Indian naval ships will be able to use this technology for EM / RCS reduction. Considering the large number of ships being built with more and more powerful radars/sensors, the need for the technology will be high in future. |

**CHALLENGE 35**

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| **Organization Name** | Hindustan Shipyard Limited (HSL) |
| **Problem Statement/ Challenge title** | Development of NVG compatible Lighting and helo visual landing aids for use onboard ships |
| **Challenge domain** | Electrical, Electronics-Naval technology, |
| **Challenge brief/definition** | Naval ships that operate helicopter need visual landing aids that enable the pilots for safe operation of the helicopters. In addition, for operation at night, standard and night vision goggle (NVG) compatible lighting and landing aids are required to ensure secrecy of flight operations without compromising safety. Presently these systems are imported. With a large number of ships with helicopters being built for Indian Navy and Coast Guard, indigenous availability of few, if not all components of the helicopter deck lighting and visual landing aids will reduce dependence on foreign manufacturers. |
| **Future Expectation from the prototype / Technology developed** | The entire system comprises of following key elements-<br>(i) Deck lighting – deck edge lights, periphery lights, oblique landing lights.<br>(ii) Stabilized Glide Path indicator<br>(iii) Stabilized horizontal Roll bar<br>(iv) Landing Period designator<br><br>The development of the all the above may be costly and time consuming. To start with Navy approved MIL-Grade light manufacturers can collaborate with suitable start-ups to develop NVG compatible lights. Considering the large number of ships being built, NVG helo deck lighting becoming the norm, the need for the technology will be high in future. |