DISC 12

Defence India Startup Challenge

Problem Statements

S. No	Name of Agency	Number of Problem Statements
1.	Indian Army	05
2.	Mission DefSpace	01
3.	Indian Navy	05
4.	Indian Air Force	05
5.	Indian Coast Guard	04
6.	BEL	04
7.	HAL	01
8.	BEML	01
9.	MIDHANI	01
10.	BDL	02
11.	AWEIL	01
12.	BRO	02
13.	AFMS	09
Total		41

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INDIAN ARMY

PROBLEM STATEMENTS

Problem Statement – 1: Li-fi Tech for OT's/ MRI Centers

Organization Name	**Indian Army**
Problem Statement/ Challenge title	Li-fi tech for OT's / MRI Centers
Challenge brief/definition	a. Li-fi is a bidirectional wireless system that transmits data via LED or infrared light. b. Li-fi can assist IOT (Internet of Things) in interconnecting all sophisticated medical devices and helps in leveraging data out of the various advanced waveform. c. Because of its ability to operate without any electromagnetic interface, it can assist IOT in aero-medical evaluation as also in underwater communications related to medical emergencies in submarines and ships.
Future Expectation from the prototype / Technology developed	• Bidirectional wireless system • Assist IOT • Interconnecting all med devices • Electromagnetic interface • Aeromedical evaluation

Problem Statement – 2: C-UAS bubble for VA/VP Protection Using GNSS Jamming

Organization Name	Indian Army
Problem Statement/ Challenge title	C-UAS bubble for VA/VP Protection Using GNSS Jamming
Challenge brief/definition	The modern-day conflicts world over has seen cost effective solutions being employed to attack VAs/APs/HVTs. These include employment of loitering ammunition, UAS, Drone Swarms etc. Many of these attack vectors use some form of electronic guidance and control signals to navigate towards the target. The need to protect Vulnerable Areas (VAs) and Vulnerable Points (VPs) from UAS, precision guided weapons/ missiles/ loitering munitions that uses Satellite Positioning Systems/Mobile networks is of primary importance. Such UAS/weapons are using technology like hybrid navigation system based on Inertial Navigation System (INS), Global Navigation Satellite System (GNSS) and 2G/ 4G/ 5G networks, there is thus a felt need for creation of an electronic Protection Dome for VA/VPs/HVTs with a range of 25-30 kms. The electronic Dome would provide soft kill options for any incoming threat vector and prevent electronic spectrum fratricide thereby giving freedom of operation for own assets.
Future Expectation from the prototype / Technology Developed	1. Detection, identification & classification and Jamming of Cont Sig of C-UAS (upto 18 GHz) 2. Jamming and Spoofing (Position & Time) of GNSS.

Problem Statement – 3: Antiskid Tracks for BMP

Organization Name	**Indian Army**
Problem Statement/ Challenge title	Antiskid Tracks for BMP in HAA and Glaciated Terrain
Challenge brief/definition	The Mechanised Infantry has seen a rise in its employment from conventional terrain like deserts and ORT to HAA and mountains. Being an equipment heavy arm, there are number of technical and tactical issues that arise with the BMPs being employed in HAA. One of the key strengths of the BMP is the ability to manoeuvre, however this ability gets hampered due to the ice accumulation on ground and snow over which BMP is required to move. The BMP tracks are made of metal, which due to prolonged used in mobile and static employment get deteriorated and there is a loss of friction resulting in the slipping and skidding of the BMP while taking turns and applying brakes.
Future Expectation from the prototype / Technology developed	Antiskid tracks to maintain effective traction in icy terrain, thus overcoming the issue of skidding and slipping.

Problem Statement – 4: Analysis of SAR Imagery

Organization Name	**Indian Army**
Problem Statement/ Challenge title	Analysis of SAR imagery using various tech to include SAR & EO Imagery fusion and Metadata exploitation.
Challenge brief/definition	The SAR imagery is extremely useful during inclement weather in Target Areas and at night when Electro-optical (EO) sensors are rendered unusable. However, SAR imagery is difficult to interpret without EO reference image and extensive interpreter training & experience. Even with availability of both, metadata file containing critical material information remains un-exploited as it requires a domain specialization. 1. SAR and EO imagery may be fused to render SAR imagery more 'readable' and in the process features may also be extracted to highlight the changes. The user can define unchanging features such as terrain and major infra as well as standard targets to 'replace'/ enhance the image and targets therein. 2. **Metadata** SAR is interpreted at the best like an EO imagery using qualitative associated features of shape, background etc. However, metadata on many occasions contain derivable information about the materials which may be useful for an interpreter. The software tool may readily be trained/ programmed to provide interpretation on these aspects, which otherwise require specialized knowledge of physics and working of SAR.
Future Expectation from the prototype/ Technology developed	The Software solution is required till sufficiently high-resolution SAR images are not available. Subsequently with high resolution images also metadata exploitation may be continued to be utilized.

Problem Statement – 5: Tethered Drone Mounted B/FWS Antenna

Organization Name	Indian Army
Problem Statement/ Challenge title	Tethered drone mounted B/FWS antenna for extended coverage area
Challenge brief/definition	There is requirement of increasing the height of FWS antenna(s) / components of gNode B on a tethered drone operating at an altitude of 100 meters so as to enhance the coverage area of FWS node without compromising the throughput at the cell edge. Present Tactical Communication system based on Field Wireless System (FWS) are based on mobile platforms. The area is illuminated based on retractable masts of height upto 18 mtrs. Based on the height of the antenna, power output, frequency band being used in FWS, absorption and interference due to terrain or man-made structures, there exist large number of shadow area. These shadow areas prohibit seamless availability of mobile signals. To enhance the coverage area of FWS, there is a need for increasing the height of the FWS antenna upto 100 meters. The increase in height can be achieved by developing the FWS antenna on a tethered drone.
Future Expectation from the prototype / Technology Developed	1. The tethered drone should have endurance for prolonged continuous operations upto 72 hr. 2. The material used should provide substantial radar cross section reduction. 3. The camouflage pattern employed should make it difficult to detect through naked eye/ any optical equipment. 4. The audio signature of the solution should be minimum.

MISSION DEFSPACE

PROBLEM STATEMENT

Problem Statement – 6: V/UHF Satellite Applique Unit

Organization Name	Indian Army (Mission DefSpace)
Problem Statement/ Challenge title	V/UHF Satellite Applique Unit for Satellite Software Defined Radios (SDRs).
Challenge brief/definition	There is a requirement of indigenous Handheld V/UHF Satellite SDRs for being utilised by Indian Armed Forces in remote areas in Indian Subcontinent. Desirable features are as follows (form factors and specifications are approximate guidelines and are subject to change for betterment): - • Total weight including battery – below 700gm • Programmable V/UHF Freq band • SCA 4.1 or above compliant. • Data Rate – Min 8 Kbps at all times over entire band. • MANET Compatibility • Fall back mode for connecting terrestrial TETRA/ UHF station. • Support communication on the move with speeds up to 60 Kmph • Support minimum 256bit AES for Communication Security

INDIAN NAVY

PROBLEM STATEMENTS

Problem Statement – 7: Solid-State Amplifiers for 'X' Band Radars

Organization Name	**Indian Navy**
Problem Statement/ Challenge title	Development of Indigenous Solid-State Amplifiers for 'X' Band Radars
Challenge brief/definition	The escalating dependence on foreign Original Equipment Manufacturers (OEMs) for the production and maintenance of X-band radar amplifiers presents a critical challenge to national security and technological autonomy. This reliance introduces vulnerabilities, including potential risks such as supply chain disruptions, technology transfer issues, and limited control over crucial components. This project seeks to develop domestically produced solid-state radar amplifiers (SSAS), reducing dependence on foreign OEMs and promoting 'Atmanirbharta' (self-reliance)
Future Expectation from the prototype / Technology Developed	This project aims to thoroughly investigate and address the challenges specific to the reliance on foreign OEMs in X-band radar amplifier systems. The overarching goal is to fortify domestic capabilities, ensure resilience, and advance technological self-sufficiency in the development and maintenance of X-band radar amplifiers.

Problem Statement – 8: Offline NLP Based Near Real Time Multilingual Language Translation System

Organization Name	**Indian Navy**
Problem Statement/ Challenge title	Offline Natural Language Processing Based Near Real Time Multilingual Language Translation System (Hardware and Software) for various use cases
Challenge brief/definition	The field of NLP has seen a significant progress and various software solution have been developed for language recognition, translation, transcription, speaker recognition, speaker diarization, keyword identification, emotion detection, voice to text, text to text and text to voice etc. Accordingly, Indian Navy aims to develop such system for wide range of use cases. However, the entire solution is expected to be offline, trained on Indian Navy specific parlance, multilingual, near real time and also extremely secure. The system will be required to be developed in two modes i.e. standalone and cloud (Will be integrated with NUD after VAPT by India Navy CERT team). Accordingly, the problem statement aims to develop following modules of the system: **Module 1 (Real Time Translation for Training Schools).** An offline, near real time, multilingual translation module capable of reducing language barrier between the instructor and the student at the training school. The software will have multiple features like speech and text translation and will support languages of all friendly nations including India's own coastal languages. **Module 2 (Multilingual Translation and Voice Generation System for IN Ships).** An offline translation module, for ships, which will be integrated with the COMINT system and will have an ability to transcript and translate all languages of regions, where India Navy operates such IOR languages, Arabic dialect, Houthi Yemen, Somali, Pashtu South Asian languages, Mandarin etc. The system will also have a feature to generate audio alarms in various languages based on the voice / text data input and will also have an ability to interface with LRAD system available onboard ships. **Module 3 (Cockpit Voice Recording Translation and Analysis module for Air Stations).** An offline system, for air stations, capable of digital analysis of audio recordings for deriving

	multiple attributes like voice recognition, emotion detection, keyword and conversation deviances from simple recorded audio files

Problem Statement – 9: Starter to Enable the powering up of the Russian Gas Turbine Generator GTG 1250-2E

Organization Name	**Indian Navy**
Problem Statement/ Challenge title	Develop a starter that enables the powering up of the Russian Gas Turbine Generator GTG 1250-2E fitted on board IN ships.
Challenge brief/definition	IN ships have Russian origin gas turbine-based power generators of 1250 KW. The Gas turbine-based turbo compressor is the prime mover of the power plant that is coupled to a Reduction Gear box. The other end of the Reduction Gear box is connected to the alternator. The whole power plant is called Gas Turbine Generator (GTG-1250-2E). However, to start and power up the GTG, the initial torque is provided by two DC starter motors and are mounted on the Reduction Gear Box. The engagement cycle of the starter and the powering of the turbo compressor follows a pre- determined start cycle. The starters provide two types of start i.e cold and hot start in which the starters draw current in the range of 1900-3000 Amps. The GTG starters are of Russian origin and there is no indigenous substitute for the same. The challenge is to develop a starter (Qty 01) that meets the form, fit and function in providing the initial torque requirements of powering the GTG as per the start cycle. Based on the trials on overhauled GTG at Eksila, Visakhapatnam, the item will be replacement for Russian GTG 1250 2E.
Future Expectation from the prototype / Technology Developed	The proposed starter should have long life, minimal maintenance and high reliability that can operate in adverse operating conditions such as humidity, dust, vibrations, heat, etc. onboard a warship in marine environment. Further, it should be capable of providing/ withstanding at least five successive starts, followed by minimal intervening cooling down period.

Problem Statement – 10: Underwater Smart Communication Buoy

Organization Name	**Indian Navy**
Problem Statement/ Challenge title	Design and Development of Underwater Smart Communication Buoy
Challenge brief/definition	Design and development of Underwater Smart Communication Buoy for underwater passive surveillance in open sea upto depth of 200m with feature to surface at regular intervals for transmission of data to base station through satellite communication. The buoy should have the capability to operate autonomously at variable programmed depth & location, collect acoustic data, and employ edge computing for data analysis and transmission of only critical data to base station via satellite link. The buoy should be compact, smart and self-sustaining upto 90 days in open seas without human intervention. This project seeks to develop domestically produced Underwater Smart Communication Buoys, reducing dependence on foreign OEMS and promoting 'Atmanirbharta' (self-reliance).

Problem Statement – 11: Deep Sea Seal for Shaftlines

Organization Name	**Indian Navy**
Problem Statement/ Challenge title	Development of an Indigenous Deep-Sea Seal for Shaftlines.
Challenge brief/definition	To develop a Deep-Sea Seal for shaft diameter of 250 mm The Deep-Sea Seal or commonly known as the Stern Tube Seal is one of the critical components of the shaft line, which ensures the watertight integrity by way of the stern tubes on board ships. These seals are fitted on approximately 15 different classes of ships in commission with IN and are being installed onboard most of the new ships under construction at various shipyards. This seal is considered more effective than the conventional stern gland packing, and it also reduces the chances of scoring of main propulsion shaft. Presently all deep-sea seals being utilised are imported from foreign OEMs
Future Expectation from the prototype / Technology Developed	The indigenous deep-sea seal should provide adequate sealing arrangement as defined and should be able to withstand harsh marine conditions of high humidity and temperature. Post successful trials, the indigenous deep-sea seal would be considered for fitment onboard existing IN ships as replacement (when due) as well as for new construction projects.

INDIAN AIR FORCE

PROBLEM STATEMENTS

Problem Statement – 12: Drone based/ Innovative range scoring system for Air to Ground weapons

Organization Name	Indian Air Force
Problem Statement/ Challenge title	To develop a Drone based/ innovative range scoring system for Air to Ground weapons.
Challenge brief/definition	To develop a drone based/ innovative range scoring system to provide air to ground weapon systems weapon firing accuracy results by using multiple drones/ systems equipped with sensors like camera/sound/light flash. 1. Air to Ground weapon firing is one of the most important aspect of Air Power. It is absolutely imperative to assess the Weapon impact in peace time so that it can be used for training and improvement in Pilots skill levels. The present scoring systems in IAF ranges are adequate. However, IA ranges like KNFFR(Kargil) and MFFR(Suratgarh). which are jointly utilised by IA and IAF do not have any standard infrastructure for scoring usage. In addition, the specific utilisation of IA, extreme weather conditions and Isolated terrain, creation of infrastructure is a long drawn process with huge costs. 2. Therefore, a Drone based Range Scoring System is found essential for training. Such a system should be able to assess the score, provide error, give an instantaneous display to the operators for transmission to the pilot. 3. Such a system should be light weight/ should be man portable. It should be operated by a maximum of two operators though a single console. It should be autonomous for tasks like fixing position of target, assessment of score, data calculation, pilot/aircraft callsign correlation/ data sorting etc based on IAF policies and SOPs. 4. The system should be All-weather and capable of operating from the Extremely high temperatures of MFFR(Suratgarh) to extremely cold temp of KNFFR(Kargil). 5. It should be able to operate in Dust, Heat, light, High vibrations, snow, strong winds and high altitudes. 6. It should have Geolocation capability corrected for errors. It should have IN/GPS system based for correcting errors. 7. The payload should be suitable/interchangeable at high altitude upto a height of 6km from ground. 8. It should have inherent emergency protocols in cases of emergencies like network failure etc.

Problem Statement – 13: Flight Data Recorder (FDR) Using Onboard Camera

Organization Name	**Indian Air Force**
Problem Statement/ Challenge title	Flight Data Recorder (FDR) Using Onboard Camera
Challenge brief/definition	Currently many aircraft utilized by the IAF have limited parameters being recorded in FDR. This leads to insufficient data during analysis of the flight. It is proposed to utilize multiple onboard high-quality camera (with built in memory and battery) to capture the gauges live. The AI based image analysis can be utilized to decode the gauge images to values every seconds. This data would provide the information of every gauge (Digital/ Analog) in the format required for analysis of sorties.
Future Expectation from the prototype / Technology Developed	At second stage of this project, AI based data (obtained from this) analysis can be used for predictive maintenance issues. The advantage of this setup is mainly in the reduced modification requirement in any aircraft. i.e. only the mounting of camera with power supply (if possible, for long duration) facility needs to be catered.

Problem Statement – 14: Artificial Intelligence for Human Resource Management

Organization Name	Indian Air Force
Problem Statement /Challenge title	Artificial Intelligence for Human Resource Management
Challenge brief/definition	To create an Artificial Intelligence based system to plan and execute movement of personnel on postings to various locations. The AI based model to be based on organisational/ personal requirements and career progression. reference data parameters of officer's qualifications, tenure at location. and professional growth in order to ensure organisational as well as personal contentment 1. Human Resource Management (HRM) is a vital function of the IAF, as it involves attracting. developing and retaining the best talent. One of the challenges of HRM to plan optimal transfers of officers across different units, locations, and roles, based on their qualifications. performance and preferences. Postings help officers to gain new skills. experience, and exposure as well as to enhance their motivation, satisfaction, and loyalty. However, existing methods planning transfers are often manual, subjective, and sometimes inefficient resulting in the following problems: - (a) High costs in terms of manpower utilisation and spent on administrative tasks. such as collecting and analysing officers' data, communicating with individual officers and relevant chain of command and coordinating the posting process. (b) Prevention of Low accuracy and fairness of posting decisions, as they may be influenced by human biases, errors or preferences, and may not consider all the relevant factors and constraints. (c) Poor outcomes and feedback from individuals, field & Cmd HQ as they may not be satisfied with posting decisions or may face difficulties in adapting to the new environment, role, or team 2. Therefore, the objective of this AI is to plan optimal postings of officers based on organizational/ personal requirements, qualifications and tenure. It should be able

	to ensure optimal career planning of the individual based on relevant orders, instructions and regulations while ensuring professional growth in the organization, Al should be able to execute following functions: - (a) Automate and streamline the posting planning process. by using advanced data processing and analytics techniques. such natural language processing machine learning. and optimization. (b) Improve the accuracy and fairness of posting decisions, by using objective and transparent criteria, and by considering multiple factors and constraints, such as organizational needs and goals, officers' performance, qualifications and preferences and relevant policies and regulations. (c) Enhance the outcomes and feedback from individual officers and organization as a whole, by providing personalized and timely recommendations and by supporting the posting implementation and evaluation, such as providing training, mentoring and feedback. A modular AI based system is required to undertake tasks based on historical data. policies, guidelines and individuals' ability to achieve the tasks. The modules may be able to present dashboards present probable solutions, and present analysis of a specific movement on other locations. The software must be able to run on dummy data during developmental phase.
Future Expectation from the prototype / Technology Developed	The AI should be able to handle routine tasks involved in posting planning process keeping personal and organisational needs including correspondence generation, analysis, skill mapping and personal choices.

Problem Statement – 15: Helicopter Electronic Glide path-based Landing system

Organization Name	**Indian Air Force**
Problem Statement / Challenge title	Design & Development of Helicopter Electronic Glide path-based Landing system.
Challenge brief/definition	To design and develop a Helicopter Electronic Glide path-based Landing system. Instrument landing aids providing electronic glide path for landing are unavailable at helipads. Most of the helicopter landings are carried out by visual references, this restricts operations of helipads during poor visibility conditions. A system is required that: - (a) Assists helicopter for landing on helipads in hills in poor visibility. (b) The system must have failure monitoring and degradation visual/aural warnings. (c) The system may generate electronic glide path A system must be able to provide electronic glide path signals. The system may be transportable, configurable for different locations, configured for non- standard glide path angles. The system may be able to provide failure indications, deterioration data and monitor helicopter flight path and may be compatible with aircraft ILS system. The system may be a novel concept for guidance during landing by using ground equipment and compatible portable avionics to be carried onboard helicopter for landing. The deliverables would be Helipad system — 02; Aircraft system – 04
Future Expectation from the prototype / Technology Developed	Integration of system in helicopter avionics

Problem Statement – 16: AI Based Prediction Model for Bird Hazard Management System

Organization Name	**Indian Air Force**
Problem Statement / Challenge Title	Simple Artificial Intelligence Based Prediction Model for Bird Hazard Management System
Challenge brief/definition	1. The aim of this software tool is to predict the risk of bird-aircraft collision in real time. The tool will model the spatial-temporal density distributions of key Bird- species in and around the target airfields. It will generate the bird density distributions based on extensive field observations and real time meteorological Conditions along with expert knowledge. The tool will combine the model bird density distributions with historical bird collision data to predict the quantified risk of bird-aircraft collision at any point of time, any day of year at the target airfields of Indian Air Force. 2. The entire project shall consist of following modules: - (a) Average Bird Density Prediction. This will be the basic module used in bird density predictions. The generated results will be based on historical data. generally expected seasonal trends under average conditions and expert knowledge of bird behaviour and habitat affecting factors (b) Real-Time Bird Density Correction: This module will interface with remote sensors to monitor climate and other meteorological conditions. Based on the real time conditions. it will refine and update the predictions from the previous average model for the immediate next 24hrs to 3 days (c) Bird-Aircraft Collision Hazard Quantification. The level of hazard posed by each individual bird species needs to be quantified. It will be analyzed from the data obtained from Air Force Bird-Strike database. A composite hazard risk will be computed based on the number of strikes. level of associated damage and mass of each individual bird species.
Future Expectation from the prototype / Technology Developed	The technology when developed can be used for all airports (Civil / Military) in India.

INDIAN COAST GUARD

PROBLEM STATEMENTS

Problem Statement – 17: Communication between Machinery Control Room and Engine Room watch keepers

Organization Name	**Indian Coast Guard**
Problem Statement / Challenge title	Communication between Machinery Control Room and Engine Room watch keepers.
Challenge brief/definition	Communication among MCR and Engine Room watch keepers in noisy environment. Good communication between MCR and Engine Room watch keepers plays vital role in safe operation during any evolution and defect rectification. However, because of loud noise inside Engine rooms, effective clear communication is often a challenge, which may lead to miscommunication and accidents.
Future Expectation from the prototype / Technology Developed	Visual communication in forms of display in addition to audio could be a solution which may incorporate following features: - • Auto conversion of audio to text message on the display. • Default in-built text message for standard orders/communication. • Integrated audio video alarm along with display. • Portable remote control for watchkeepers to • Acknowledge and report with standard texts.

Problem Statement – 18: 25KW and 35 KW Radars

Organization Name	Indian Coast Guard
Problem Statement / Challenge title	Development of Indigenised 25KW and 35 KW Radars.
Challenge brief/definition	Non availability of Indigenised 25KW and 35 KW Radars. The RADAR is an acronym for Radio Detection and Ranging. It is used onboard ship for obtaining the pulsed to identify the distance of the objects from the ships. The two types of RADARs installed onboard ICG ships are operating in X-Band 8-12 GHz and S-Band 2-4 GHz of frequencies. The 25 KW and 12 KW of RADARs are installed onboard FPVs, whereas 35 KW and 25 KW RADARs are installed onboard OPVs. The RADARS are not being manufactured in India and needs to be Indigenised.
Future Expectation from the prototype / Technology Developed	Mass production of the RADARs for usages onboard ships as COTS item.

Problem Statement – 19: AC compressor for Marine ACs

Organization Name	**Indian Coast Guard**
Problem Statement / Challenge title	Development of Indigenised AC compressor for Marine ACs.
Challenge brief/definition	Non availability of Indigenised Compressor for Marine ACs. The ICG ships are installed with Air Conditioning compressor of foreign origin generally of Make: Bitzer. The compressors are the most important part of the system for functioning of AC plant. The compressors are generally of capacity 60-80 tons as per cooling requirement of ships air conditioning space. The AC compressors in this capacity are not manufactured in India and needs to be Indigenised.
Future Expectation from the prototype / Technology Developed	Indigenised availability of compressor for marine ACs within the country for ease of maintenance and reduce dependence on foreign OEMs.

Problem Statement – 20: shaft bearings used onboard Vishwast, Samarth, Sachet class of Vessels

Organization Name	**Indian Coast Guard**
Problem Statement/ Challenge title	Indigenization of shaft bearings used onboard Vishwast, Samarth, Sachet class of Vessels.
Challenge brief/definition	ICG Vishwast, ICGS Samarth and ICGS Sachet Class ships have M/s Railko shaft bearings installed. Further, it is submitted that the lead time of Railko bearings are approx. 5-6 weeks and are imported from I-JK. Renewal of the bearings have an impact on the docking period of the ship and the DCD of the ship gets affected. An indigenization for manufacturing of Railko bearings can reduce the lead time for supply of spares. Further, the manufacturer should cater for stage inspection along with class recommendations in order to have a quality control of the product.
Future Expectation from the prototype / Technology Developed	The indigenization of the bearings can reduce the lead time of the product

BHARAT ELECTRONICS LIMITED (BEL)

PROBLEM STATEMENTS

Problem Statement – 21: Silicon / Compound Semiconductor based high power pulsed Laser Diode

Organization Name	Bharat Electronics Limited
Problem Statement/ Challenge title	Design and fabrication of Silicon / Compound Semiconductor based high power pulsed Laser Diode used for Proximity Fuze
Challenge brief/definition	Silicon or Compound Semiconductor based Pulsed Laser Diode used for proximity fuze have the following specifications: a) Material: GaAs / InGaAs b) Laser Diode: Pulsed Laser Diode c) Peak Power: 500 Watts d) Wavelength: 905nm e) Spectral BW: 7nm f) Beam Spread: 10^{o} Degrees g) Number of elements: 2 X (4 X 3) h) Emitting Area: 800 x 300 um i) Max Pulse Duration: 150 ns
Future Expectation from the prototype / Technology Developed	The developed prototype laser diode should be such that it can be used in the existing proximity fuze and hence should match the form factor along with all the functional specification of the imported laser diode

Problem Statement – 22: Proximity Sensor of Aerial Bomb Fuze for activating Fuze firing circuit

Organization Name	**Bharat Electronics Limited**
Problem Statement / Challenge title	To develop Proximity Sensor of Aerial Bomb Fuze for activating Fuze firing circuit
Challenge brief/definition	The Proximity Sensor should function correctly when the Fuze is subjected to the following carriage envelope: - a) Max Altitude : 18 km or more b) Mach No. : 1.5 or more c) 'G' Loading : -4g to +7.5g d) Ambient Operating temp: -50°C to +71°C The Proximity sensor: a) Should be able to be mounted inside existing Aerial Bomb Fuze. b) Should activate Fuze firing circuit at height of 9±3M from target at all weather conditions and terrain. c) Should be immune to external RF noise d) Should have no maintenance through its entire life cycle. e) Reliability ≥ 95% f) Shelf Life : Minimum 15-years with the required reliability The Proximity sensor is assembled inside plastic (Noryl, GFN2) enclosure (Radome) and potted with polyurethane potting material.
Future Expectation from the prototype / Technology developed	Prototype will be integrated with Aerial Fuze and subjected to validation trials. Upon successful validation, bulk production will be taken up depending upon end customer requirements.

Problem Statement – 23: Proximity Sensor of Naval Artillery Fuze for activating Fuze firing circuit

Organisation Name	**Bharat Electronics Limited**
Problem Statement / Challenge title	To develop Proximity Sensor of Naval Artillery Fuze for activating Fuze firing circuit
Challenge brief/definition	The Proximity Sensor shall function on proximity against fast moving high performance aerial targets and sea skimming missiles where the characteristics of the target are within the following envelope: - a) Speed of the Target: Up to 1.5 Mach b) Minimum Attack Height: > 5m above the peak of waves. c) Minimum Target Dia: 0.3m d) Height of Function: 0.5m to 30m above the target. e) Range of Functioning: 500m from muzzle to Max. Gun range. The Proximity Sensor: a) Should be able to be mounted inside existing Artillery Proximity Fuze cone. b) Should comprise of RF antenna working on FMCW principle with characteristics of beam pattern such that the sensitivity at the front is zero and maximum at 30-50° wrt fore and aft axis. c) Should provide Sea clutter rejection. d) Should survive the Naval SRGM Artillery Gun firing acceleration e) Should be immune to external RF noise f) Should have no maintenance through its entire life cycle. g) Reliability ≥ 95% h) Shelf Life : Minimum 10-years with the required reliability i) Operating conditions of -20°C to +55°C with Humidity of +95% The Proximity sensor is assembled inside plastic (Noryl, GFN2) enclosure (Radome) and potted with polyurethane potting material.
Future Expectation from the prototype / Technology developed	Prototype will be integrated with Naval Fuze and subjected to validation trials. Upon successful validation, bulk production will be taken up depending upon end customer requirements

Problem Statement – 24: Frequency Difference of Arrival based Direction of Arrival for Radar Signals

Organization Name	**Bharat Electronics Limited**
Problem Statement / Challenge title	Frequency Difference of Arrival (FDoA) based Direction of Arrival for Radar Signals
Challenge brief/definition	Accurate measurement of DoA (direction of arrival) based on FDOA technique. New DoA measurement technique which provides more accurate measurement of DoA in highly compact size of the AHU (Antenna Head Unit) without any restrictions on position of AHU being mounted on platform.
Future Expectation from the prototype / Technology developed	Currently utilizing the existing technology which are based on Amplitude and Phase techniques, but due to platform constraints imposed by customer, a suitable technical solution based on FDOA technique is identified and will be used in all upcoming future programmes.

HINDUSTAN AERONAUTICS LIMITED (HAL)

PROBLEM STATEMENT

Problem Statement – 25: Wireless and Telemetry-based Temperature & Strain Measurement system

Organization Name	HAL
Problem Statement / Challenge title	Development of "Wireless and Telemetry-based Temperature & Strain Measurement system"
Challenge brief/definition	Wireless Temperature & Strain measurement system is required to monitor Bearing Health during operation when both the races of Bearing are rotating (at different rpm) a) Bearing Inner Race speed: 16500 rpm b) Bearing Outer Race speed: 24500 rpm c) Preferable location to measure Temperature / Strain: Inner Race d) Preferable Radial Height: 35 mm e) Envelop (outside which measurement need to be sensed): F700 mm f) Sensor to be etched / sticked on target component and signal to be transmitted to a receiver [mounted outside engine casing (static part)] g) Max. Temperature Sensor needs to sustain during assembly: 190 ˚C for 45 minutes (heating in oil bath) h) Max. Temperature Sensor has to read during operation: 200 ˚C i) Max. Static Temperature Sensor has to read: 300 ˚C j) Temperature in vicinity: 150 ˚C (approx.) k) Environment (where Sensor to be mounted) is expected to be submerged in Oil (OX27 / OX35) during operation
Future Expectation from the prototype / Technology developed	Wireless Measurement of Temperature & Strain so developed will be used for ground application on fan engine under development at HAL

BHARAT EARTH MOVERS LIMITED (BEML)

PROBLEM STATEMENT

Problem Statement – 26: Hydraulically operated Main Winch with 50T single line pull

Organization Name	**BEML**
Problem Statement / Challenge title	Design and development of Hydraulically operated Main Winch with 50T single line pull - Arjun ARRV
Challenge brief/definition	Problem Statement brief: a) Double capstan type winch, the rope under tension enters the winch and winds itself on the twin capstan drums, which are grooved for preventing the rope from slipping axially over the drum surface. b) The rope leaving the capstans with nominal tension and is stored in a winding drum. Drives should be provided to both the capstans which rotate at the same rpm and the storage drum rotating speed needs to be matched with capstan winch by mechanical / hydraulic means. c) Compact design for better space management inside the Arjun ARRV hull hydrostatic driven storage drum is required. Hydrostatic drives also permit steplessly variable speeds, thereby enabling better operational flexibility and control, particularly when very high loads need inching by the recovery winch. Challenge brief a) Hydraulically operated, Double capstan-type with storage drum and Pay-on mechanism. b) 50 tonne single line Pull with Max. stall pulling force for winch system shall not exceed 60 tonne. c) Hydraulic system Working Pressure shall be 360 bar (Max.) with Overload protection & Auto Stop Mechanism. d) Min. Braking force of wire rope should not be less than 100 T, the rope end fixed to the winch rope shall withstand at least 2 times the rated pulling force of 50 tonne and the rope end shall be field replaceable by minimum shortening of rope length, allowing quick deployment. e) Integrated hydrostatic drive with continuously variable speed control for both winch-in and winch-out. f) Winch IN - Maximum single line pulling force of 50 tonne shall be achieved at a rope speed >= 7 m/min and Winch OUT Maximum pull force of 2 tonne shall be achieved at a rope speed >= 55 m/min. g) Compact design to suit within the envelope inside Arjun ARRV.

	h) Main Winch shall be complied with JSS-55555, MIL 810F and MIL 2164A. i) The associated accessories shall include Rope cleaning device & Hour Meter, Essential tools for adjustments, operation & maintenance and Seal kit. j) Single control system (Pendant with 10m chord) for both Main Winch and Aux. Winch, provision to be made for 2 separate sockets 1 inside the Hull structure & the other at outside the Hull structure, with a fixed instrument panel with LED Indication on Driver Control panel for winches operation
Future Expectation from the prototype / Technology developed	a) The prototype of proposed design shall be developed and engineered on the recovery tanks for performance evaluation. After design completion along with proto validation of the design, the same will be extended for Arjun Armoured Recovery and Repair Vehicle (Arjun ARRV). b) The design technology shall be extended for all the Armoured recovery variants by varying the winching capacity as per the user specification/requirement.

MISHRA DHATU NIGAM LIMITED (MIDHANI)

PROBLEM STATEMENT

Problem Statement – 27: Electrolytic Manganese Production

<table>
<tr><th>Organization Name</th><td>MIDHANI</td></tr>
<tr><th>Problem Statement / Challenge title</th><td>Indigenization of Electrolytic Manganese production</td></tr>
<tr><th>Challenge brief/definition</th><td>Production of Electrolytic Manganese as per the MIDHANI specification.

There is regular requirement of Electrolytic Manganese metal in steel making industries. Currently good quality of this master alloy is being imported. There is need to have a reliable indigenes source for these master alloy.
Electrolytic manganese is a pure form of the metallic element manganese, Mn. The Mn content between 99.7% -99.9%. It is termed "electrolytic" because the refining process involves electrolysis. That is, a chemical reaction driven by an electric current. It finds wide applications in metallurgical industries as an alloying element. Electrolytic manganese in the form of flakes is used for alloying in highly critical alloy steels, stainless steels, etc due to its low content of undesirable tramp elements.

The specification of Electrolytic Manganese is given below.
<table>
<tr><td>Elements</td><td>Midhani Specification</td></tr>
<tr><td>Mn</td><td>99.7% Min</td></tr>
<tr><td>Si</td><td>0.3% Max</td></tr>
<tr><td>P</td><td>0.03% Max</td></tr>
<tr><td>Co</td><td>0.02% Max</td></tr>
<tr><td>Fe</td><td>0.2% Max</td></tr>
<tr><td>C</td><td>0.03% Max</td></tr>
<tr><td>S</td><td>0.03% Max</td></tr>
<tr><td>H_2</td><td>0.001Max</td></tr>
<tr><td>Size</td><td>15-120mm
(Lumps/Flakes)</td></tr>
</table>
</td></tr>
<tr><th>Future Expectation from the prototype / Technology developed</th><td>There is regular requirement of this Manganese metal by MIDHANI and other steel industries. The product Should meet the specification of Electrolytic Manganese</td></tr>
</table>

BHARAT DYNAMICS LIMITED (BDL)

PROBLEM STATEMENTS

Problem Statement – 28: Ground Power Supply Bottle (GPSB) for Missile

Organization Name	BDL
Problem Statement/ Challenge Title	Development of Ground Power Supply Bottle (GPSB) for missile
Challenge brief/definition	GPSB is a critical component which supplies Nitrogen Gas and powers the missile during tracking of target. Ignition pulse to the missile is provided by GPSB. The GPSB in current batch of missiles available with Indian Armed Forces are life expired. Hence, the same needs to be developed and replacement has to be carried out. New GPSB has to be developed to replace the existing life expired GPSB in missile to make the missile system
Future Expectation from the prototype / Technology developed	The developed prototype should be compatible with missile without affecting its functionality.

Problem Statement – 29: MIL Grade Airborne Connectors

Organization Name	**BDL**
Problem Statement / Challenge title	Indigenous Development of MIL Grade Airborne Connectors
Challenge brief/definition	Currently these connectors are being imported. These are proposed for indigenization to reduce lead times and cost. The connectors are W and R series of M/s AirBorn. The connectors that are developed should be one to one replacement (same size and pin count) to the existing imported connectors.
Future Expectation from the prototype / Technology developed	These connectors should meet MIL Standards. These connectors will be used in Airborne equipment.

ADVANCED WEAPONS AND EQUIPMENT INDIA LIMITED (AWEIL)

PROBLEM STATEMENT

Problem Statement – 30: Autonomous/ Remote Controlled Robot Mounted with Sniper

Organization Name	**AWEIL**
Problem Statement/ Challenge title	To develop autonomous/remote controlled Robot mounted with Sniper
Challenge brief/definition	To develop autonomous controlled robot for remote operations of Sniper Rifles with capabilities like operation in rough outdoor terrains considered as sandy, rocky, muddy remote operation. (GPS guided Navigation).
Future Expectation from the prototype / Technology developed	It will be big advantage for army to fight in tough environmental conditions with-out compromising the safety of soldiers.

BORDER ROADS ORGANISATION (BRO)

PROBLEM STATEMENTS

Problem Statement – 31: Digital Elevation Model of Areas for Tunnel

Organization Name	Border Roads Organisation
Problem Statement/ Challenge title	AI based system to develop a Digital Elevation Model of the areas to work out various tunnel alignments.
Challenge brief/definition	AI based system to take into account the gradient profile of the area, approach roads to tunnel portals and other factors like cost and time for construction for suggesting alignment options. These factors should be operated on toggle mode so that user can stipulate relevant factors.
Future Expectation from the prototype / Technology developed	Suggesting the best option for tunnel alignment based on various stipulated factors.

Problem Statement – 32: Construction of roads

Organization Name	**Border Roads Organisation**
Problem Statement/ Challenge title	Construction of roads over moraines / Permafrost/ glaciated areas.
Challenge brief/definition	a) BRO continues to construct roads in super high-altitude areas along India's Northern borders, where the ground is underlain with permafrost/ moraines/ glaciers. (b) The alarming pace of climate change in recent years has triggered repeated cycles of freezing and thawing of permafrost, because of which the natural sub-grade has become unstable causing damage to existing roads and preventing construction of new roads in such like areas. (c) The challenge is to either find innovative means to stabilise the sub-grade or develop technology for construction of roads over permafrost/ moraines/ glaciers
Future Expectation from the prototype / Technology developed	Boost road infrastructure in snow bound and glaciated terrain

ARMED FORCES MEDICAL SERVICES (AFMS)

PROBLEM STATEMENTS

Problem Statement – 33: Male Incontinence Device

Organization Name	AFMS
Problem Statement/ Challenge title	Development of Male incontinence device
Challenge brief/definition	Urinary incontinence is a problem not only in aging population but also in young soldiers who develop neurogenic bladder either due to spinal cord injury or as a complication of some other surgery. This has a significant negative impact on the physical, mental, emotional, social, and economic wellbeing of the patient. To tackle this problem there are few options available but each one of them is plagued with complications and other issues. These options and the issues with them are as under: 1. Use of absorptions devices such as diapers: Use of diapers is associated with greater risk of urinary tract infections and skin excoriation besides the issue of frequent diaper changes. Also, it may be uncomfortable to wear in a warm tropical climate. 2. Use of penile clamps: The physical device is not suitable for elderly bed bound patients. Also, a regular use of these clamps may lead to penile ulcerations and at times gangrene. 3. Use of U drains or condom catheters: This is the better option of the lot but again its application may be an issue with frequent slippage and urine spills besides development of penile ulcers on prolonged usage. 4. Use of indwelling catheter: Prolonged use of catheter can not only increase the incidence of urinary tract infection but also the brings about changes in the bladder mucosa due to chronic irritation and also allows stone formation. The hunt for an ideal urinary incontinence device is ongoing. A device which is not bulky, comfortable to wear, does not leak, does not cause skin changes and does not increase the chances of urinary tract infection. For this purpose, it is proposed to develop a condom like device which does not stick but is kept in place by some other mechanism without causing any trauma. The condom should have a chamber within it with a non-return valve and a solidifying material which turns the urine into a gel form preventing spillage and hence chances of skin complications or UTI.
Future Expectation from the prototype developed	Should be made commercially available at cheap price.

Problem Statement – 34: AI Based Comprehensive Device for Detection of Cognitive Disturbances

Organization Name	**AFMS**
Problem Statement/ Challenge title	Development of Artificial Intelligence Based Comprehensive Device for Detection of Cognitive Disturbances
Challenge brief/definition	Demand for continuous cognitive excellence exists, but existing methods for monitoring cognitive health are insufficient because of the lack of real-time, objective assessments leading to undetected cognitive impairments and resulting in suboptimal performance in day-to-day life. Current method of detection is based on different devices and questionnaires which are highly subjective in nature at interpretational point of view. Therefore, there is an urgent need for an innovative solution that can continuously and accurately monitor the cognitive functions of any person in real-time, providing Artificial Intelligence based actionable insights to prevent cognitive decline and enhance overall mental health. Development of a comprehensive device containing specific hardware & software is the target of this project. **1. Operational Environment Constraints** Sometimes working environments are characterized by unique and extreme conditions that pose significant challenges for any biomedical device. These include: **Motion and Vibration:** Environments with constant motion and varying degrees of vibration and instability require a neurocognitive assessment tool to maintain accurate readings despite these physical disruptions. **Space Limitations:** Confined spaces require that any wearable or portable device be compact and non-intrusive to avoid interfering with activities. **Harsh Conditions**: Devices must be durable enough to withstand humidity, salinity, temperature extremes, and possible exposure to chemicals or other hazardous materials **2. Data Accuracy and Reliability** Ensuring the accuracy and reliability of cognitive assessments in real-time presents several challenges:

	Sensor Precision: The sensors used to monitor cognitive functions must be highly sensitive and precise to detect subtle changes in brain activity, heart rate variability, eye movements, and other physiological indicators. **Artifact Removal**: Data collected in dynamic environments will likely include noise and artifacts. Robust algorithms, enhanced by AI, are required to filter out irrelevant data and maintain the integrity of cognitive measurements. **3. Real-Time Data Processing** The need for real-time data analysis introduces several technological challenges: **Processing Power**: Real-time analysis requires significant computational resources, which must be balanced with the need for a portable and power-efficient device. **Latency**: Minimizing latency in data transmission and processing is critical to provide timely feedback and alerts. **Algorithm Robustness**: AI and machine learning models must be trained to accurately interpret data from diverse individuals under varying conditions, ensuring reliable performance across the entire population. **4. User Comfort and Acceptance** The device must be designed with the end-user in mind to ensure comfort and acceptance: **Wearability**: The device should be lightweight, ergonomic, and comfortable for extended use without causing discomfort or interfering with regular activities. **User Training**: Users must be adequately trained to use the device correctly and interpret its AI-driven feedback effectively. **5. Privacy and Security** Given the sensitive nature of health data, maintaining data privacy and security is paramount: **Data Encryption**: All collected data must be securely encrypted to prevent unauthorized access. **Compliance with Regulations**: The device must comply with relevant medical data protection regulations, ensuring that personal health information is handled according to strict standards. **User Consent**: Clear protocols must be in place to obtain informed consent from users for data collection and AI-driven analysis. For maximum effectiveness, the neurocognitive assessment tool must integrate seamlessly with existing health management and operational systems:

<table>
<tr><td></td><td colspan="2">Compatibility: The device should be compatible with existing software and hardware systems used in healthcare.
Interoperability: Ensuring smooth data exchange between the assessment tool and other health monitoring systems is critical for comprehensive health management.
Scalability: The system must be scalable to accommodate the needs of a large and diverse population, utilizing AI to manage and analyze the increased data efficiently.

6. Validation and Acceptance
The development and deployment of the neurocognitive assessment tool must be backed by rigorous validation to ensure its efficacy and acceptance:
Clinical Trials: Extensive clinical trials are necessary to validate the accuracy and reliability of the device across various patient groups and conditions.
User Feedback: Continuous feedback from users will be essential to refine and improve the device's AI applications.
Regulatory Approval: Obtaining necessary regulatory approvals for medical devices is critical to ensure safety and compliance with healthcare standards.</td></tr>
<tr><td rowspan="7">Future Expectation from the prototype / Technology developed</td><td>Expectation</td><td>Description</td></tr>
<tr><td>Improved Cognitive Health</td><td>Continuous monitoring and early detection of cognitive impairments, leading to timely interventions.</td></tr>
<tr><td>Enhanced Operational Readiness</td><td>Maintenance of optimal cognitive function, reducing errors and enhancing mission success rates.</td></tr>
<tr><td>User-Friendly Design</td><td>Ergonomic and comfortable wearable device that is easy to use and does not interfere with duties.</td></tr>
<tr><td>Data-Driven Insights</td><td>Real-time data analysis providing actionable insights for both individuals and medical personnel.</td></tr>
<tr><td>Integration with Health Systems</td><td>Seamless integration with existing health management systems present in hospitals for comprehensive health monitoring.</td></tr>
<tr><td>Scalability</td><td>Ability to expand deployment across different healthcare settings and patient populations while maintaining optimal performance, leveraging AI for</td></tr>
</table>

		efficient management of diverse data requirements.
	Durability	Robust design capable of withstanding harsh environments, including motion, humidity, and temperature extremes.
	Secure Data Management	Ensured data privacy and security through encryption and compliance with stringent data protection standards, integrating AI for enhanced data security measures.
	Customizable Algorithms	Machine learning algorithms adaptable to individual cognitive baselines and varying operational conditions.
	Cost-Effectiveness	Economical production and maintenance costs, making widespread adoption feasible.
	Regulatory Compliance	Full compliance with medical device regulations and military standards, ensuring safe and approved use.
	Positive User Feedback	High levels of user satisfaction and acceptance, leading to consistent and correct usage.
	Enhanced Training Protocols	Improved training and support systems for personnel on using the device effectively.
	Real-Time Alerts	Immediate notifications of potential cognitive issues, allowing for proactive management.
	Continual Improvement	Ongoing refinement and updates based on user feedback and technological advancements.
	Enhanced Cognitive Health Monitoring	Utilizing AI for continuous and accurate monitoring of cognitive functions to detect early signs of decline.
	Improved User Experience	Designing user-friendly interfaces and comfortable

		wearable devices for ease of use by patients.
	Data-Driven Insights	AI-driven analytics generating actionable insights from cognitive health data for personalized interventions.
	Integration with Healthcare Systems	Seamless integration with existing healthcare systems for compatibility, interoperability, and scalability.
	Privacy and Security	Implementing robust data encryption and compliance with medical data protection regulations for patient safety.
	Clinical Validation	Conducting comprehensive clinical trials to validate efficacy, reliability, and safety in real-world settings.

Problem Statement – 35: Inflight Urination Device for Female Fighter Pilots

Organization Name	AFMS
Problem Statement/ Challenge title	Development of Inflight Urination Device for Female Fighter Pilots Multirole fighter aircraft worldwide are capable of long duration flying. Inflight urination is a critical combat requirement during such missions. Due to anatomical differences in gender, it is crucial to develop an inflight urination device for female fighter pilots.
Challenge brief/definition	Female fighter pilots are now part of each fleet of fighter aircraft of Indian Air Force. Multirole fighter aircraft are capable of long duration flying. During such sorties, male fighter pilots wear condom catheters for inflight urination, however a solution for female counterpart is not available. Off the shelf products are not compatible with the restraint system of ejection seats. In case any such product may be compatible, they are not tested for aircraft compatibility. In the absence of an effective inflight urination device, female fighter pilots are unable to exploit full potential of these multirole aircraft. Due to the physiological restriction of relieving oneself during long duration sorties, long stretches of duty in harsh climatic conditions, the role of fighter pilots in these fleet are restricted. ***To overcome this challenge, engagement of startups and innovation are required to create prototypes and start testing them for aircraft compatibility.***
Future Expectation from the prototype/ Technology developed	To develop an airworthy product to overcome the physiological limitation of female fighter pilots. The same may be used in future for Indian female astronauts.

Problem Statement – 36: Feedback Loop Extravasation Detection & Alarm System

Organization Name	AFMS
Problem Statement/ Challenge title	Development of Feedback loop extravasation detection and alarm system
Challenge brief/definition	To design and develop an automated closed feedback loop Intravenous Fluid (IV) Infiltration and Extravasation Detection and Alarm system and integration in the feedback loop of infusion pump system Approaches to managing extravasation till date primarily focus on measures to aid in preventing tissue damage, reversal agents specific to the type of extravasation, and surgical intervention if necessary. Relative effectiveness of these strategies across the variety of extravasation injuries that present in clinical practice remains contentious. There is a lack of a primary prevention approach in real-life case scenario towards extravasation injuries. An innovative solution for primary prevention and limitation of extravasation at the point of care is needed. Currently there is no automated IV infiltration and extravasation monitoring system capable of continuous monitoring of IV fluid infiltration and subsequent extravasation of the infused IV fluids in the subcutaneous extravascular compartment. This could be in terms of an objective method to quantify infiltration and extravasation through progressive changes in the local tissue dimensions, interstitial compartment pressures and physical characteristics/properties of the skin around the IV cannula insertion site using sensors applied locally distal to the IV cannula insertion site. These sensors can be of materials which can adapt to the local site, potentially integrated with the IV fixation mechanism and operate on optical or piezoelectric principles with a sensitivity to detect minor changes induced by infiltration and extravasation. The challenge lies in designing low-cost automated system which a) Provides an early objective assessment and warning system for IV infiltration and extravasation across various calibres of IV cannulas from 26G to 14G size, AND b) is biocompatible with the skin across all age groups especially neonates, children and geriatric populations, AND c) is capable of handling subjective variability, motion artefacts, undesirable signal drifts over time AND d) integrates and functions well with the existing IV site dressing/securing methods, AND

	e) functions as a feedback loop alarm system wherein acquired signal(s) from the monitoring system are integrated into the IV infusion pump system in order to implement a close-loop alarm and control of the IV infusion pump system, AND f) ease to operate with high fidelity which maximizes monitoring efficacy and objectivity with minimal need for human interface
Future Expectation from the prototype / Technology developed	i. To be integrated with IV infusion pump systems of any make for better patient safety in hospital settings across entire age spectrum ii. Open platform design compatible with existing IV securing techniques iii. Will prevent morbidities associated with the extravasation incidents while saving on precious nursing care times by early detection of even minor swellings at the catheterization independent of individual caregiver subjectivity iv. Should be able to account for motion artefacts imposed by movement of subjects v. Should lead to reduction of extravasation events

Problem Statement – 37: MRI Compatible Multi-Paramonitor with Accessories

Organization Name	AFMS
Problem Statement/ Challenge title	Design and development of Magnetic Resonance Imaging (MRI) compatible multi-paramonitor with accessories
Challenge brief/definition	Design and development of Magnetic Resonance Imaging (MRI) compatible multiparamonitor for monitoring the patients for Pulse oximetry (SpO2), Heart Rate (HR), Non-Invasive Blood Pressure (NIBP), Respiratory Rate (RR), Respiratory gas Monitor (RGM) and End Tidal Carbon di Oxide (ETCO2) with slave monitor. MRI suite has strong magnetic fields due to which regular monitoring equipment available in hospital are incompatible and may even become hazardous to the patient as well as to the equipment. MRI investigation is an essential tool for diagnosis of many diseases and is required for children as well as adults, some of whom are critically ill. These patients require adequate monitoring for delivery of safe anaesthesia for the duration of the imaging taking place which ranges from 60-120 minutes. Without adequate monitoring, specially the ETCO2 monitoring (which is direct monitor for adequate respiration, oxygenation and ventilation), it is extremely unsafe and not advisable to take on the challenge of delivering anaesthesia to children or adults. • Paediatric patients are a regular clientele for MRI due to diagnosis required for many neurological diseases. MRI gantry is tunnel like, and children do not cooperate to lie still for the imaging and hence require sedation or anaesthesia. Without adequate monitoring (especially ETCO2) it is difficult to know whether the patient is breathing adequately and not suffering hypoxia, which will eventually lead to cardiac arrest. Many adults also find the MRI gantry claustrophobic and do not cooperate for the imaging and hence they require sedation/ anaesthesia too. Many times, patients are critically ill and on various drug supports to maintain physiology and they definitely require sedation/anaesthesia for the imaging. Without adequate monitoring, administering sedation or anaesthesia is a huge challenge and thus, keeping in mind patient safety at all times, a good MRI compatible multi-paramonitor (Suitable for use in 0.5 to 3 Tesla MRI environment) with minimum monitoring for HR, SPO2, NIBP, ETCO2 and RGM needs to be developed indigenously. The multi-paramonitors should be safety compliant and certified and patient use. A good foreign monitor costs about 40-50 Lakhs and this cost is a hindrance in procurement of the same.

	Few features which may be of help are added here Pulse Oximeter Features • 20 feet Fiber Optic Sensor (non-magnetic) avoids potentially hazardous heating or image artefacts during MR Scans • Suitable for use in 0.5 to 3 Tesla MRI environment • Built-In Rechargeable Battery back-up of 7 hours (Pulse Oximeter) & 6 hours (with NIBP) • Alarm (Visual & Audio) for alarm limit violation **Capnograph Features** • Sidestream Sensor (LoFlo) • 50ml Sampling rate CO2 sensor that provides consistent and reliable CO2 monitoring of adult, paediatric and neonatal patients • Useful in monitoring the effects of pain-controlled analgesia, monitoring respiratory efforts during procedural sedation • Supplied with 12 feet Sampling Lines • Should have an MRI compatible, re-chargeable battery (6V, 3.2Ah) with backup more than 4 hrs. • Compatible for paediatric as well as adult patients with all accessories being MRI safe • Sp02, pulse rate and capnograph readings in mm Hg/cm H20. • LED display for SpO2 and Pulse readings; LCD display for capnograph • Wave Speed: 3.12, 6.25,.12.5, 25 mm/sec • Display type: Fill or line • Apnea: Delay of 10, 20 and 30 Seconds. • Feature for selection of High and low alarm limit by the user; feature for selection of Alarm and Pulse Beep Volume, give audible and visual low battery indication 15-20 Minutes prior power off **NIBP features** • Provided with Nonmagnetic fibre optic sensor of 20 feet length and Non-magnetic NIBP tubing length of 20 feet. • MRI compatible, re-chargeable battery (6V, 3.2Ah) with backup more than 4 hrs. • Compatible for both Adult and paediatric patients along with MRI compatible accessories for adult, paediatric & neonates. • Bright easy to read LED display. • Weight < 5 kg and Dimensions < 30 x 15 x 30 cm (LxHxD) • Blood pressure by Oscillometric methods (Systolic, Diastolic, MAP) with accuracy of +/- 3 mmHg for BP and +/- 2%. • Three operation modes as, Manual: gives operator-initiated measurements Stat: 4-5 consecutive readings with a gap of 15-30 seconds Auto: Measures reading at fixed time intervals with default intervals of 1,2,3,4,5,10,15,30,60 minutes. • Following inbuilt features for patient's safety: Maximum Cuff inflation Time 60 seconds; Maximum duration of BP reading 100-120 Sec in Adults 60-70 Sec in Paediatric patients;

	Maximum Cuff Pressure 300 mmHg for adults and 150mm hg in Paediatrics. • Alarms during Low battery, Sensor Disconnect and Limit violation. • Direct keys to be available for NIBP inflation start/stop and Alarm silence buttons. • Feature for selection of High and low alarm limit by the user; feature for selection of Alarm and Pulse Beep Volume; audible and visual low battery indication 15-20 Minutes prior power off. A slave monitor which can be placed in the console or placed remotely for monitoring by another personnel outside also to be made. This double monitoring can add a further advantage to patient safety.
Future Expectation from the prototype / Technology developed	Future expectations to develop MRI compatible multi-paramonitors with invasive monitoring like arterial blood pressure monitoring, central venous pressure monitoring etc. MRI compatible transport monitors which can be utilised in monitoring during transport of critically ill patients from ICU/ OT directly to MRI suite. Indigenously develop MRI compatible Infusion pumps and target controlled infusion pumps. These can be utilised for delivering accurate dosage of sedative drugs/ anaesthesia agents. Indigenously develop MRI compatible Defibrillators.

Problem Statement – 38: NBC Protective Suit with Weather Conditioning System

Organization Name	**AFMS**
Problem Statement/ Challenge title	Development of NBC (Nuclear, Biological, Chemical) protective suit with weather conditioning system in place along with Hydration Pack.
Challenge brief/definition	Individual Protection Equipment (IPE) does not suit the hot and humid climate of India during summers **Present /existing Individual Protection Equipment (IPE) does not suit the hot and humid climate of India during summers** India has all weather terrain and delivering services in NBC scenarios by Armed forces during Hot and humid climate, with thick NBC protection kits will be a challenge.
Future Expectation from the prototype / Technology developed	For efficient output from the team involved in CBRN exposure situations, there is need of development of NBC protective suit with weather conditioning system in place along with Hydration Pack (to provide protection against CBRN contamination of the drinking water).

Problem Statement – 39: Peripheral Intravenous Cannula (PIVC)

Organization Name	AFMS
Problem Statement/ Challenge title	Development of a safer peripheral intravenous cannula (PIVC) with longer indwell duration
Challenge brief/definition	To design and develop a safer peripheral intravenous cannula (PIVC) with longer indwell duration with minimal thrombophlebitis and infections to replace current IV cannulas. To innovate a next generation of peripheral intravenous cannula (PIVC) for longer indwell times of at least 10-14 days with minimal potential for thrombophlebitis and infections with design and biomaterial modifications leading to a) thrombosis retardant properties of the surface of the IV cannula b) hydrophilicity c) optimized combination of stiffness needed for insertion followed by malleable and thermo-responsiveness to body temperature for better intraluminal adaptation and lessening of tip induced endothelial injury d) minimal yet sufficient intraluminal length for good intraluminal retention compatible with movements of the limb on which the IV cannula is fixed e) body surface contour adapting fixation flanges for firm fixation with minimized movement at the cutaneous puncture site f) microbial biofilm retarding properties of the surface along the hub and length of the PIVC g) anti-inflammatory surface h) inert properties with absent chemical interaction/antigenicity with the infused fluid/drug/blood j) adequate surface area for pincer grasp during insertion k) cost effective with single insertion vis a vis multiple insertion with PIVC

Future Expectation from the prototype / Technology developed	To replace current generation of peripheral IV cannulas in the medical setup especially with: a) settings with high risk of hospital acquired infections viz. acute care areas, intensive care and daycare patients b) special patient groups - neonates and young infants with small veins, persons undergoing chemotherapy/repeated blood transfusions over years (e.g. thalassaemic) wherein veins become thrombosed and fibrosed over years.

Problem Statement – 40: Ultrasound Chip Based Non-Invasive Urodynamic Monitoring System

Organization Name	AFMS
Problem Statement/ Challenge title	Development of ultrasound chip based non-invasive urodynamic monitoring system
Challenge brief/definition	To design and develop an inexpensive ultrasound chip placed over the lower abdomen for real-time imaging and dynamic monitoring of urinary bladder function Urodynamic monitoring is vital for urinary bladder function assessment. Current urodynamic monitoring systems are invasive necessitating indwelling catheters for pressure volume and compliance monitoring. While accurate, they still are limited by their invasiveness, risk of UTI and limited datasets due to need for sedation for use in children and special populations like autistic spectrum disorder/intellectually disabled or hyperactive children. Ultrasonographic estimates of bladder function are suboptimal due to the limited time period for which a continuous study can be carried out and operator fatigue while holding the bulky probe for long time. A miniaturized skin-based ultrasound probe chip can facilitate a continuous real-time acquisition of bladder dynamics and static properties. The challenge lies in innovating a wearable ultrasound chip based non-invasive urodynamic monitoring system for continuous real time imaging and monitoring of urinary bladder dimensions, volumes and estimate pressure, compliance and tissue characteristics of urinary bladder wall with following properties a) light weight and wearable over the lower abdomen with local skin compatibility. b) compatible with routine activities of daily life. c) continuous recording and storage for subsequent intelligent analysis systems. d) provide reliable, reproducible and discriminatory markers for functional bladder pathology. e) incorporate ability to quantify and assess sequential changes in multiple bladder parameters before, during and after voiding like volumes, bladder wall thickness, shape, tissue characteristics like vibrometry, elastography, compliance, biomechanics, and micromotion.

	f) able to provide estimates of changes in the bladder pressures before, during and after voiding. g) amenable for continuous data acquisition, storage and analysis using machine-based learning approaches for further evolution into closed feedback loops for patient involved/physician directed interventions.
Future Expectation from the prototype / Technology developed	1. To provide a point of care objective long-term non-invasive urodynamic monitoring system for children and adults for a) decision making in various urological conditions including need for further invasive urodynamics b) to replace invasive urodynamic studies across neonates and especially abled children with intellectual disability, autistic spectrum disorders, neurological conditions and recurrent UTIs c) research in urodynamics of neonatal and infantile bladders d) therapeutic intervention trials for enuresis and bladder dysfunction e) patients with incontinence f) characterization of bladder function for potential military/space applications e.g. characterization and development of devices/processes for bladder evacuation during long duration military operations or prolonged flights 2. To provide datasets for development of applications with incorporated AI/ML algorithms for patient involved monitoring of voiding function as well as design of closed feedback loop therapeutic interventions related to triggers for bladder voiding in various conditions. 3. Conceptually, these can be adapted subsequently for real-time continuous evaluation of cardiac function too.

Problem Statement – 41: Anti-fogging Solution for Vision Field of CBRN Respirator

Organization Name	**AFMS**
Problem Statement/ Challenge title	Development of anti-fogging solution for the vision field of CBRN respirator.
Challenge brief/definition	The vision field of the Chemical, Biological, Radiological and Nuclear (CBRN) respirator is crafted from plastic material. Once the entire Individual Protective Equipment (IPE) ensemble is donned, the vision of water vapor condensing from exhaled breath onto the plastic surface. Consequently, the fog obstructs visibility, impending routine activities. This limitation poses significant challenges, particularly in high-stake scenarios where clear vision is essential for safety and operational effectiveness. The vision field of CBRN respirator becomes foggy within few minutes of wearing the complete IPE suite 1. **Condensation of Water Vapor**: Exhaled air from soldiers wearing CBRN protective equipment (IPE with respirator) leads to the accumulation of water vapor on the inner surface of their visors, causing condensation. 2. **Visibility Obstruction**: The condensation results in the fogging of visors, which obstructs vision and reduces the ability of soldiers to maintain situational awareness in a CBRN environment. 3. **Impact on Operational Efficiency**: The fogging impairs soldiers' ability to perform critical tasks, including identifying hazards, navigating terrain, and handling equipment, thereby reducing overall operational efficiency. 4. **Safety and Performance Concerns**: Impaired vision can lead to increased risk of accidents or errors during CBRN operations, potentially compromising both individual and team safety. 5. **Need for Innovation**: Current solutions, such as anti-fog coatings or manual cleaning, are not sufficiently effective in prolonged or high-stress situations. There is a need for research and development of new, durable modalities to prevent visor fogging and enhance performance in CBRN environments. To address the problem of visor fogging in CBRN protective gear, a combination of material science, design innovations, and technical solutions could be explored. Here are some potential solutions:

	1. Anti-Fog Coatings with Enhanced Durability • **Hydrophilic Coatings**: These coatings absorb moisture and spread water into a thin, transparent layer rather than allowing it to form droplets (fog). Advanced hydrophilic coatings can be integrated into visors for long-lasting performance. • **Hydrophobic Nanocoatings**: These repel water, causing droplets to roll off the surface rather than adhere to it. Nanomaterials like silica-based or fluorinated coatings could be researched for high-performance anti-fog capabilities. **2. Dual-Layered Visors** • **Double-Layer Technology**: A dual-layer visor system (similar to ski goggles) can create a thermal barrier between the inside and outside surfaces, reducing the temperature difference that leads to fogging. These can be designed with sealed air pockets to prevent condensation. **3. Anti-Fog Inserts** • **Permanent Anti-Fog Films**: Transparent films made of materials like cellulose acetate can be applied inside the visor. These inserts are anti-fog by nature and are often used in scuba masks and ski goggles, which face similar condensation challenges. **5. Integrated Ventilation Systems** • **Miniature Fans or Airflow Channels**: Small battery-operated fans or ventilation ducts can be built into the visor to maintain air circulation, preventing humidity buildup inside the visor. This is similar to the defogging systems used in automotive windshields. **6. Innovative Materials Other than Polycarbonate** • **Trivex**: A newer polymer material used in high-performance optical lenses, Trivex is lightweight and provides better chemical resistance and anti-fog properties compared to polycarbonate. • **Gorilla Glass**: Originally designed for smartphone screens, this chemically strengthened glass can be adapted for visors. It offers extreme clarity, durability, and the potential for anti-fog coating application. • **Aerogels**: These highly porous, insulating materials can be explored for potential visor inserts or layers that manage condensation by regulating temperature and absorbing moisture.