Confederation of Indian Industry

ARMY DESIGN BUREAU

COMPENDIUM OF PROBLEM STATEMENTS
VOLUME II (2017)

CHIEF OF THE ARMY STAFF

MESSAGE

Military modernisation is an ongoing process which is essential for ensuring defence preparedness. There is a need for sustained capability building and to achieve self reliance in military technology.

In the recent months, measures have been initiated to establish better interface between Army, Industry and Academia. These measures are aimed to provide the impetus to the cherished goal of modernisation of Army through indigenisation.

To carry out cutting edge futuristic research and state of the art product development, the basic issue is to understand the user requirements. The preparation of this compendium (**COMPENDIUM OF PROBLEM STATEMENTS VOLUME II 2017**) is a step forward to involve & integrate the Academia and Industry in this process. I am confident that this compendium will assist towards high quality focused research in niche areas, from which the Indian Army will benefit tremendously.

'Jai Hind'

(Bipin Rawat)
General

VICE CHIEF OF THE ARMY STAFF

MESSAGE

In our ongoing endeavours to give impetus to indigenisation and achieve optimum synergy between the user and the provider, interactions have been initiated between Army, Industry and Academia, to understand each other's requirements, capabilities and concerns.

In furtherance of its initiative towards indigenisation, Indian Army has prepared the "**COMPENDIUM OF PROBLEM STATEMENTS VOLUME II 2017**". I am confident that this publication will enable domestic defence industry and academia to develop a comprehensive understanding of Army's technological requirements.

I am sanguine this compendium will enable the defence industry and academia to correctly perceive the challenges and synergise their efforts to achieve our common goal of indigenisation of defence related technology. The joint efforts of both 'the user and the provider' will certainly enhance the nation's self reliance in defence sector.

'Jai Hind'

(Sarath Chand)
Lieutenant General

DEPUTY CHIEF OF ARMY STAFF (P&S)

MESSAGE

In furtherance to impetus on indigenisation and achievement of focussed research by Academia and R & D centres of the industry, the present compendium on '**COMPENDIUM OF PROBLEM STATEMENTS VOLUME II 2017'** has been prepared. This compendium provides additional areas of technological research desired by the Indian Army in the immediate future.

I am certain that these Problem Statements will provide the Industry and Academia another comprehensive insight into the immediate technological research requirements of Indian Army. An insight into these Problem Statements offers the Academia and Industry an opportunity to actively participate in an endeavour to increase the indigenous military technology base.

An endeavour to indigenise from the Root of the Problem

'Jai Hind'

(Subrata Saha)
Lieutenant General

INDEX

PROBLEM DEFINITION STATEMENT – 1

DE-RATING OF ENGINE AT HIGH ALTITUDE AREAS

1. **Title**. De-rating of Engine at High Altitude Areas.

2. **User Directorate(s)**. Directorate General of Mechanised Forces.

3. **Type of Problem**. Unsolved Problem.

4. **What is the Problem (Need)**.

   (a) **Statement of Problem**. Tanks and Infantry Combat Vehicles are being employed at High Altitudes (Between 13,000 to 17,000 feet). The rarefied atmosphere and reduced oxygen content results in degraded engine performance and de-rating of the engine.

   (b) **Evolution of the Problem**. It is a natural effect of atmospheric conditions.

   (c) **How it was Being Overcome**. Problem has not yet been overcome. It limits optimum exploitation of the tanks and Infantry Combat Vehicles.

5. **Who has the Problem.**

   (a) **User (Skill Sets)**. Problem is being faced by Mechanised Forces.

   (b) **Operating Environment**. High Altitude Areas.

6. **Why is it Important to Solve**. It is important to solve the problem so as to incorporate measures to increase the performance and life of the engine in High Altitude Areas, as also to assist in formulating engine life norms and consequent logistic planning for these areas.

7. **Contemporary Solutions by Other Countries/ Organisations**.

   (a) Enhance air aspiration into engine inlet manifold.

   (b) Modify fuel composition which requires lesser air for combustion.

8. **Timelines**.

   (a) Feasibility Study – Three / Four months.

   (b) Technology Solution – Six / Eight months.

   (c) Implementation in field.

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PROBLEM DEFINITION STATEMENT – 2

IMPROVING COOLING EFFICIENCY OF T-90 RADIATOR

1. **Title**. Improving Cooling Efficiency of T-90 Radiator.

2. **User Directorate(s)**. Directorate General of Mechanised Forces.

3. **Type of Problem**. Unsolved Problem.

4. **What is the Problem (Need)**.

   (a) **Statement of Problem**. The radiators of the Indian manufactured T-90 Tanks are failing / not meeting the desired standards. The T-90 engine is a heavy engine and frequently operates under extreme temperature conditions. Optimum radiator function is critical for effective engine performance during operations, especially during high temperature conditions.

   (b) **Evolution of the Problem**. The locally manufactured radiators do not function optimally.

   (c) **How it was Being Overcome**. Problem has not yet been overcome. It inhibits operating the Tank for long durations or in high temperature conditions.

5. **Who has the Problem**.

   (a) **User (Skill Sets)**. Problem is being faced by Mechanised Forces.

   (b) **Operating Environment**. In all operating conditions, and especially during high temperature conditions.

6. **Why is it Important to Solve.** It is important to solve the problem in order to operate Tanks for sustained periods and especially under extreme temperature conditions.

7. **Contemporary Solutions by Other Countries / Organisations**. Proper design optimisation and quality control of the radiator.

8. **Timelines**. Research, manufacture of prototype and trials to be completed in one year.

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PROBLEM DEFINITION STATEMENT – 3

PRE-HEATER FOR BRIDGE LAYING TANK T-72

1. **Short Title**. Pre-Heater for Bridge Laying Tank T-72.

2. **User Directorate(s)**. Directorate General of Mechanised Forces.

3. **Type of Problem**. Unsolved Problem.

4. **What is the Problem (Need)**.

   (a) **Statement of Problem**. The Bridge Laying Tank T-72 has been designed indigenously, based on an existing T-72 tank design. Under normal operating conditions, there is no need for a pre-heater in the vehicle. However, in High Altitude Areas, due to extreme temperature conditions, there is a need for pre-heaters in order to start the Bridge Laying Tank. Due to differing space utilisation and availability, the existing pre-heater of the original T-72 tank cannot be fitted in the Bridge Laying Tank.

   (b) **Evolution of the Problem**. The indigenous design of Bridge Laying Tank T-72 did not cater for fitting a pre-heater inside the vehicle.

   (c) **How it was Being Overcome**. Problem has not yet been overcome. It prevents starting up of the Bridge Laying Tank in High Altitude Areas, especially during extreme temperature conditions.

5. **Who has the Problem.**

   (a) **User (Skill Sets)**. Problem is being faced by Mechanised Forces.

   (b) **Operating Environment**. In High Altitude Areas, in extreme temperature conditions.

6. **Why is it Important to Solve**. It is important to solve the problem in order to operate the Bridge Laying Tank T-72 in High Altitude Areas, especially under extreme temperature conditions.

7. **Contemporary Solutions by Other Countries/ Organisations**. Re-design the existing pre-heater and fit in the vehicle.

8. **Timelines**.

   (a) Feasibility Study – Three months.

   (b) Technology Solution – Six months.

   (c) Implementation in field.

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PROBLEM DEFINITION STATEMENT – 4

THERMAL IMAGER DETECTOR TECHNOLOGY

1. **Short Title**. Thermal Imager Detector Technology.

2. **User Directorate(s)**. Directorate General of Mechanised Forces.

3. **Type of Problem**. Unsolved Problem.

4. **What is the Problem (Need)**.

   (a) **Statement of Problem**. The Thermal Imager Detector technology does not exist in the country today. For the last two decades we have been importing these detectors for all indigenously manufactured Thermal Imaging based devices. Self-reliance in this field can only be fully achieved if we develop this technology indigenously. The current technologies available globally are MWIR (3-5µ) and LWIR (8-12µ).

   (b) **Evolution of the Problem**. Thermal Imager Detector technology has not been developed in the country.

   (c) **How it was Being Overcome**. Problem has not yet been overcome.

5. **Who has the Problem.**

   (a) **User (Skill Sets)**. Problem is being faced by Mechanised Forces.

   (b) **Operating Environment**. Under all operating conditions.

6. **Why is it Important to Solve.** It is important to solve the problem in order to achieve self-sufficiency in this field.

7. **Contemporary Solutions by Other Countries/ Organisations**. NA.

8. **Timelines**.

   (a) Feasibility Study – Six months.

   (b) Technology Solution – One/ Two years.

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PROBLEM DEFINITION STATEMENT – 5

SENSOR THREAT WARNING SYSTEMS

1. **Short Title**. Sensor Threat Warning Systems.

2. **User Directorate(s)**. Directorate General of Mechanised Forces.

3. **Type of Problem**. Unsolved Problem.

4. **What is the Problem (Need)**.

   (a) **Statement of Problem**. Survivability is the most important parameter in modern tank design. Survivability encompasses detection avoidance, hit avoidance and hit survivability. While the last aspect is a function of ballistic protection amongst other factors, the first two aspects can be achieved by either blinding the enemy's viewing/ aiming/ homing devices, or preventing him from taking accurate aim on the tank, while simultaneously using the time gained to reach a safe position. This system gets activated by a layout of multi-spectrum sensors which provide warning of any incident laser/ IR/ radar signals.

   (b) **Evolution of the Problem**. Increasing multi-directional and rapid attack threat spectrum has necessitated the use of sensors to detect incoming attacks even prior to their launch.

   (c) **How it was Being Overcome**. Problem has not yet been overcome.

5. **Who has the Problem.**

   (a) **User (Skill Sets)**. Problem is being faced by Mechanised Forces.

   (b) **Operating Environment**. Under all operating conditions.

6. **Why is it Important to Solve.** It is important to solve the problem in order to enhance the survivability of the tank.

7. **Contemporary Solutions by Other Countries/ Organisations**. Similar systems are being developed by other countries.

8. **Timelines**. Research, manufacture of prototype and trials to be completed in one year.

9. **Point of Contact**.

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PROBLEM DEFINITION STATEMENT – 6

LOSS OF ORIENTATION

1. **Short Title**. Loss of Orientation.

2. **User Directorate(s)**. Directorate General of Mechanised Forces.

3. **Type of Problem**. Unsolved Problem.

4. **What is the Problem (Need)**.

   (a) **Statement of Problem**. While manoeuvring on the battlefield, very often, tanks have to move with their cupolas closed down. Under such conditions and especially at night, the tank commander finds it very difficult to observe all around and can lose orientation rapidly. It is not always possible for him to travel with the cupola open and with his head outside the tank. There is a need for the commander to be able to have 360^0 visibility around the tank to retain orientation and better situational awareness.

   (b) **Evolution of the Problem**. Increasing all-round threat spectrum has led to increasing instances of the commander to travel “closed-down”.

   (c) **How it was Being Overcome**. Problem has not yet been overcome.

5. **Who has the Problem.**

   (a) **User (Skill Sets)**. Problem is being faced by Mechanised Forces.

   (b) **Operating Environment**. Under all operating conditions.

6. **Why is it Important to Solve**. It is important to solve the problem in order to enhance the safety of the tank crew.

7. **Contemporary Solutions by Other Countries/ Organisations**. Use of day-night 360^0 panoramic viewing device for the commander.

8. **Timelines**. Research, manufacture of prototype and trials to be completed in one year.

9. **Point of Contact**.

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PROBLEM DEFINITION STATEMENT - 7

CAMOUFLAGE IN FIELD: ARMOURED FIGHTING VEHICLES (AFVs)

1. **Short Title**. Camouflage of Armoured Fighting Vehicles (AFVs) in field.

2. **User Directorate(s)**. Directorate General of Mechanised Forces.

3. **Type of Problem**. Unsolved.

4. **What is the Problem (Need)**.

(a) **Statement of Problem**. AFVs are required to be camouflaged from enemy's aerial and ground based sensors by day and night in the visual, ultra violet, infra red, thermal and radar bands. The true camouflage will only be achieved if a well concealed AFV is able to reach its objective without enemy being able to locate it or is able to evade an attack on itself.

(b) **Evolution of the Problem**. The observation technologies have advanced from purely visual to cover the complete spectrum, which includes Ultra Violet, Infra Red, Thermal and Radar Bands. These improvements have resulted in round the clock requirement of camouflage against aerial and ground based sensors.

(c) **How it is Being Overcome**. The present methodology is by following camouflage techniques of paints and multi spectral camouflage nets. However, all these are passive means and do not provide the level of camouflage which is expected in the future conflicts where the plethora of sensors will provide transparency and greater information on location, movement and intent to the adversary.

5. **Who has the Problem**. The problem is a challenge for AFVs of the Army in field conditions.

6. **Why is it Important to Solve.** The challenge is to protect personnel, equipment, logistic facilities and strategic assets against detection in the complete spectrum. The sensors are fitted right from satellites, aircrafts, helicopters, UAVs in the third dimension to the ground based long range surveillance equipment operating continuously during day and night. Thus, camouflage now is a necessity for survivability of the force right from the time it moves out of its permanent locations to the time it prosecutes its might on the enemy.

7. **Contemporary Solution by Other Countries**. The future camouflage technologies which are being developed across the world are as under:-

(a) **E-Camouflage**. Tank camouflage has come a long way since the good old days of painting them green. E-Camouflage uses a set of electronic sensors attached to the tank's exterior, the system would process the vehicle's surroundings and recreate the colors, lines, and shapes common in its environment on the tank's hull, making it extremely difficult to see. Since the images on the tank's exterior would change as the surroundings change, ostensibly such an active camouflage system could cloak the vehicle even as it moves across an environment. This equates to camouflaging in "real-time". The electronic camouflage will enable the vehicle to blend into the surrounding countryside in much the same way that a squid uses ink to help as a disguise. Unlike conventional forms of camouflage, the images on the hull would change in concert with the changing environment always ensuring that the vehicle remains disguised thus enabling it to merge into the landscape and evade attack.

(b) **Quantum Stealth**. It is a material that renders the target completely invisible by **bending light waves around the target**. The material removes not only **visual, infrared** (night vision) and **thermal signatures** but also the **target's shadow.** It is light weight, made of Nano technology or Meta materials. This is being developed by a Canadian Company.

8. **Timelines**.

(a) Development of a system - 12 months.

(b) Prototype and trials - 24 months.

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PROBLEM DEFINITION STATEMENT – 8

OIL LEAKAGE FROM CYLINDRICAL MAST OF 17 METER MOBILE MAST

1. **Short Title**. Oil leakage from Cylindrical Mast of 17 Meter Mobile Mast.

2. **User Directorate(s)**. Directorate General of Mechanised Forces.

3. **Type of Problem**. Technology Infusion.

4. **What is the Problem (Need)**.

   (a) **Statement**. There has been frequent oil leakage from all the 17 Meter Mobile Masts in every unit.

   (b) **Evaluation of Problem**. The problem has been reported from 2012 onwards. The hydro pneumatic seals were replaced, but the problem has not been fully resolved.

   (c) **How is it Being Over Come**. By replacement of seals, but solution is not satisfactory.

5. **Who has the Problem**.

   (a) **User**. Mechanised Infantry Battalions.

   (b) **Operating Environment**. 17 Meter Mobile Masts are operated in field by the units.

   (c) **Periodicity of Exploitation**. It is operated on day to day basis for training.

6. **Why is it Important to Solve**. 17 Meter Mobile Masts are authorised on War Establishment. These are used for erecting Medium Range Battle Field Surveillance Radars. In the absence of adequate oil pressure in the mast, it will not erect to the maximum height and deny optimum range for the radar and adversely impact operations. Thus, it is very essential to solve the problem.

7. **Contemporary Solution by Other Countries/ Organisations**. The Mobile Masts of French Origin do not have these problems.

8. **Timelines**. Research, manufacture of prototype and trials should be completed in one year.

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PROBLEM DEFINITION STATEMENT – 9

DEAD ZONE SURVEILLANCE SYSTEM

1. **Short Title**. Dead Zone Surveillance System.

2. **User Directorate(s)**. Directorate General of Army Air Defence.

3. **Type of Problem**. Main short coming of the surveillance system used in Indian Army is the dead zone or the blind area which the surveillance antenna is not able to cover. A dead zone in defence is left out from observation.

4. **What is the Problem (Need)**.

(a) Aim of any surveillance system is to provide observation into our Area of Responsibility and also to provide early warning.

(b) Elevated platform enhance the ranges as well as cover dead grounds, however the problem still persist.

(c) In order to achieve maximum defence potential, same is recommended to be covered by multiple agencies such as:-

(i) Surveillance System.

(ii) Observers.

(iii) Firing weapons.

5. **Who has the Problem**.

(a) **User**. With help of prevailing Surveillance System, the user can get extended ranges depending upon type of terrain or meteorological conditions.

(b) **Operating Environment**. Problem aggravates in mountain terrain where due to folds of ground, accessibility of each area becomes more difficult.

6. **Why it is Important to Solve**.

(a) To overcome shortcoming in present Battle Field Surveillance Radar.

(b) Extend surveillance ranges.

(c) Increase efficiency of existing systems.

(d) **Proposed System**

(i) Surveillance system with range from 0-5000 meters to be developed.

(ii) See through fog, rain and inclement weather.

(iii) Could be integrated in present surveillance system.

(iv) Plotting facility.

(v) Data transfer facility.

7. **Contemporary Solution by Other Countries/ Organisations**. NA.

8. **Timelines**. Research, manufacture of prototype and trials to be completed in one year.

9. **Point of Contact**.

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PROBLEM DEFINITION STATEMENT – 10

INTEGRATED COMMAND POST VEHICLE

1. **Short Title**. Integrated Command Post Vehicle.

2. **User Directorate(s)**. Directorate General of Artillery.

3. **Type of Problem**. Modifications at Unit level, however not yet standardised.

4. **What is the Problem (Need)**.

   (a) **Statement of Problem**. With the introduction of an automated command and control system, the Battery Command Post (BCP) has undergone major overhaul in terms of hardware, primarily Enhanced Tactical Computers and its accessories. This has led to reduced working space inside the vehicle which in turn affects the command and control being exercised by the Gun Position Officer handling the Command Post.

   (b) **Evolution of the Problem**. With an aim of keeping pace with the ongoing modernization of the armed forces, a project was introduced to automate the command and control at the gun end and increase the accuracy simultaneously reducing the response time. This is over and above the conventional fire control systems which are authorized to and required at a command post.

   (c) **How it is Being Overcome**. Presently the problem is being overcome locally by minor modifications in the vehicle and the conventional fire control instruments being laid out separately.

   (d) **Any Innovations to Locally Overcome the Problem**. Modifications carried out at unit level are existing, however are not standardized at any appropriate level.

5. **Who has the Problem**. The problem is being faced by the command post staff who are responsible for the calculation and passage of firing data to the guns.

6. **Why it is Important to Solve**. It is important to solve the problem to enable engagement of targets with speed and accuracy and inflict maximum damage with least probability of errors.

7. **Contemporary Solution by other Countries/ Organisations**.

8. **Timelines**.

   (a) Development of a system - 12 months.

   (b) Prototype and trials - 24 months.

9. **Point of Contact**.

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PROBLEM DEFINITION STATEMENT – 11

HIGH POWER MICROWAVE RADIATION SYSTEM

1. **Short Title**. High Power Microwave Radiation (HPM) System.

2. **User Directorate(s)**. Directorate General of Army Air Defence.

3. **Type of Problem**. Technology infusion.

4. **What is the Problem**.

(a) **Statement of Problem**. The requirement is to create a light weight, mobile system with enhanced ranges which operates over a wide frequency range to target and disable airborne weapon systems such as UAV / drones / helicopters.

(b) **Evolution of the Problem**. An HPM system can target multiple aerial objects at various ranges by broadcasting microwave radiations over a wide frequency spectrum, thereby destroying electronics of the targets within range.

(c) **How it was Being Overcome**. Not yet overcome.

(d) **Any Innovations to Locally Overcome the Problem**. Nil.

5. **Who has the Problem**. The problem pertains to equipment design and configuration.

6. **Why it is Important to Solve.** An HPM system will have an impact on multiple targets at various ranges. It will also be effective against all electrical equipment within range and would have broader applications in the complex battlefields.

7. **Contemporary Solution by Other Countries / Organisations**.

(a) Ground-based HPM System developed by Russia (Super High Frequency Weapon (3-30 GHz)).

(b) Air-Borne Multi Shot (PRF) HPM weapon demonstrated by USA as part of Counter-electronics High-powered Microwave Advanced Missile Project (CHAMP).

(c) Real-Life “Phaser” developed by Raytheon, USA.

8. **Timelines**.

Ser	Event	Recommended Timelines	Remarks
(a)	Study of the system, interaction with the technical experts and users. Study of contemporary solutions.	S to S Plus Six Months (S being the day of commencement of the project)	
(b)	Preparation of a prototype solution and interfacing with equipment	S Plus Six to S Plus 15 Months	

Ser	Event	Recommended Timelines	Remarks
(c)	Field and user Trials	S Plus 15 to S Plus 24 Months	To include trials on aerial targets.
(d)	Preparation of Final Report	Earliest but Not Later than S Plus 24 Months	

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PROBLEM DEFINITION STATEMENT – 12

AIR- GROUND COMMUNICATION BETWEEN ARMY AVIATION HELICOPTERS WITH GROUND TROOPS AND ENHANCED BATTLE FIELD TRANSPARENCY

1. **Short Title**. Improvement of communication of Army Aviation helicopters with ground troops and provision of real time battle field situation to pilots and commanders on board the helicopters.

2. **User Directorate(s)**. Directorate General of Army Aviation.

3. **Type of Problem**. Unsolved / Technology Infusion.

4. **Nature of Problem**.

(a) **Statement of the Problem**. Helicopters operate on Very High Frequency / Ultra High Frequency bands and ground troops operate on Very High Frequency band. Air-Ground communication is extremely difficult on High Frequency band. On Very High Frequency band, the band spectrum is preoccupied with air to air communication. If air-ground communication is further added to it, it will lead to congestion which will be detrimental to flying operations.

(b) **Evolution of the Problem**. While operating in close support with ground troops, the pilots face two major problems:-

(i) **Communication**. Achieving uninterrupted and secure air-ground communication is a challenge faced by most armies. However, in helicopter operations, it is an absolute essential requirement, as they are required to land in close proximity of the ground forces in fluid battle field situations. A helicopter pilot needs communication with the support troops on ground to cater for any last minute change in weather, landing site or battle field situation. The present technique involves a joint army-air team (Air Control Team) with a tentacle (Very High Frequency radio set), which will be present with the support formation and direct the aircraft as it approaches the area. However, this technique is more suited for fighter operations rather than helicopter operations. To enable real time cohesion between air and ground forces, there is a need to establish effective communications between them.

(ii) **Battle Field Situation**. In an active war scenario, as well as during anti terrorist operations, the battle field situation is always vague and helicopter operations ride on a fair amount of uncertainty. Surgical operations like infiltration / exfiltration of Special Forces teams from enemy territory, induction of pathfinder teams into en territory and casualty evacuation operations require the pilot to be aware of the exact location of own troops.

(c) **How is it Being Overcome**. The Advanced Light Helicopter has been provided with a High Frequency radio set on board. At present, due to the air mobility of the helicopter, the communication is extremely unreliable and unsecure.

(d) **Suggested Innovations**. It is suggested that two simple cost effective devices be incorporated to overcome this problem:-

(i) **Radio Frequency Identification Technology Based Chips / Wearable Devices for Ground Force Commanders**. These will resemble a simple wrist watch and will comprise of a Radio Frequency Identification Technology based on chips that will transmit a secure and uniquely coded pulse at regular time intervals. These codes will have encrypted information about the identification of unit / formation, operation and its location. The Radio Frequency Identification Technology unit must operate in EHF/ SHF band, have a line of sight range of approximately 50-100Kms and a battery life of at least a month. The wrist watch should also have a display window to show the message received from the pilot as well as to send a “Save Our Souls” message to the pilot.

(ii) **Personal Digital Assistant (PDA)**. This is a hand held device with preloaded 3D terrain map of the area, Global Position System connectivity and an ability to receive the Radio Frequency Identification Device pulses from all the emitters in the battle field and plot it on the map. Only this device will have the ability to decrypt and decipher the info emitted by the Radio Frequency Identification Device devices. Once the exact location and identification of the unit / troops appear on the terrain map of the PDA, the pilot should be able to select the unit and send a message to the selected unit.

(iii) **Working of the System**. As soon as a pilot or commander on board a helicopter will come within range of Radio Frequency Identification Device signals (50-100 kms), his PDA will start showing the exact location of ground forces on the terrain map. He can send / receive text messages to any unit in the area using his PDA. The pilot can pinpoint the location of troops that he is required to support.

6. **Why it is Important to Solve**. The simple innovation suggested above will have far reaching implications both during hot war and anti terrorist operations in No War No Peace scenario. Some visualised benefits are stated below:-

(a) **Battle Field Transparency**. Commanders on board will know the exact location of their troops when within range.

(b) **Tracing Lost Soldiers**. Easy to locate a soldier separated from his unit.

(c) **Flight Safety**. Chances of pilots inadvertently crossing over to enemy side greatly reduced.

(d) Easy and precise identification of Forward Line of Own Troops from air.

(e) Identification of own forces during bad weather conditions.

(f) Better cohesion between air-ground troops without occupying the Very High Frequency band.

(g) Cheap and reliable system that can be completely indigenised.

(h) Conduct of surgical strikes.

7. **Contemporary Solution by Other Countries**. At present, the most effective display of air-ground communication has been made by the US army during the Second Gulf War in Iraq.

8. **Timelines**. The device can be developed as a 'Make in India" project. The rough timeline can be as follows:-

(a) Product Conceptualization - 6 months.

(b) Research and Design - 1 year.

(c) Manufacturing of Prototype - 6 months.

(d) Field trials/ User trials - 6 months.

9. **Point of Contact**.

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PROBLEM DEFINITION STATEMENT – 13

POWER MANAGEMENT IN HIGH ALTITUDE AREAS IN SUB ZERO TEMPERATURE

1. **Short Title**. Power Management in High Altitude Area in Sub Zero Temperature.

2. **User Directorate(s)**. Engineer-in-Chief Branch.

3. **Type of Problem**. Technology Infusion / Adaption.

4. **What is the Problem.**

(a) The geographic region in Ladakh is ecologically sensitive and has abundant potential for harvesting the renewable sources of energy to meet the demand of an entire region. The region is not connected to any National Grid and has to generate its own requirement of power. There are 360 sunlit days in the region and the wind speed is more than adequate to generate power.

(b) As regards to military infrastructure, there are 21 Stations in Ladakh Region which have peak power requirement of approx 40 Mega Watts. Apart from these there are numerous locations and posts which have captive power generation based on fossil fuels. These remote locations can be made self sufficient if energy is generated in situ. Hence, there is requirement to integrate all the sources of renewable energy to create a Micro Grid, so as to balance out the requirement of all Military Stations. The hybrid sources which need to be integrated are Solar, Wind, Bio-Energy System, Geo Thermal and Micro Hydel Power Stations.

(c) As of now only 105 MW of power is being generated through various hydel power projects, but due to freezing of water bodies in winters, there is a considerable fall in production. There are certain low power Solar power based projects which have been implemented, but these are far and few. The potential of Wind and Geo Thermal Energy is still untapped.

5. **Who has the Problem**. Power shortage affects both user as well as suppliers. There is an inescapable requirement to harness renewable sources of power to prevent an ecological disaster as well as to meet the escalating requirement of power and manage the same by establishing a Micro Grid.

6. **Why it is Important to Solve**. There is an urgent requirement to harness renewable sources of power to prevent ecological disaster and meet the requirement of power.

7. **Contemporary Solution by Other Countries / Organisation.** There has been adequate research and advancement in technology in the field of harvesting renewable sources of energy. Many multinational companies have made forays in this field which can be exploited for providing hybrid power solution.

8. **Timelines**. 12 to 15 months to develop a pilot project for a moderately populated station with strength of approx 600- 800 persons.

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PROBLEM DEFINITION STATEMENT – 14

SEWAGE DISPOSAL IN HIGH ALTITUDE REGIONS

1. **Short Title**. Sewage Disposal in High Altitude Regions.

2. **User Directorate(s**). Engineer-in-Chief Branch.

3. **Type of Problem**. Technology Infusion.

4. **What is the Problem**.

(a) A large no of operational works shelters are being constructed in High Altitude regions. The sewage disposal is continues to be based on the soakage pit – septic tank concept. Septic tanks have to be cleared / freshly constructed once they get filled, creating ecological and sanitation problems. Lot of experimental toilets based on bio digesters were introduced but they have not been found effective. These toilets were mainly based on bacteria / enzymes, which die when temperatures dip to sub zero level. As of now, there is no permanent solution and no structured sewage disposal system.

(b) Locally certain techniques as listed below are being used to avoid freezing of sewage lines, but disposal system is still unaddressed:-

(i) Sewage lines are dug underground.

(ii) All exposed parts of the pipelines including joints and bends are insulated using rock wool.

(iii) Septic tanks are also covered to avoid freezing.

5. **Who has the Problem**. All the troops staying in the areas having sub zero temperatures.

6. **Why it is Important to Solve**. It can be appreciated that the problem highlighted has huge impact on the environment as well as the hygiene of the users. Hence, it is imperative to find a long lasting and standardized solution for such weather conditions.

7. **Contemporary Solution by Other Countries/ Organisation**. The other countries which have such weather conditions usually resort to bio digesters. The bio digesters generally use bacteria, which can sustain and multiply in sub zero temperature. There may be a requirement of creating a heating system to ensure that population of the bacteria is maintained.

8. **Timelines**. The timelines envisaged from the time project is sanctioned are as enumerated below :-

(a)	Product Research	-	Six months.
(b)	Product Conceptualisation	-	Six to Eight months.
(c)	Product Design	-	Three months.
(d)	Manufacture of Test / Pilot Product	-	Two months.
(e)	Field Trials	-	Over one complete season

9. **Point of Contact**.

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PROBLEM DEFINITION STATEMENT - 15

BRIDGING CHALLENGES IN MOUNTAINS AND IMPROVISED EQUIPMENTS

1. **Title**. Bridging Challenges in mountain and improvised equipments.

2. **User Directorate(s)**. Directorate General of Combat Engineers.

3. **Type of Problem**. Technology Infusion.

   (a) Varying Terrain as per altitude.

   (b) Climate and weather condition.

   (c) Poor lines of communication

   (d) **Terrain Implication on Bridging**.

      (i) **Gaps**.
         (aa) Prone to jet winds, rock fall and avalanches.
         (ab) Varied Length.

      (ii) **Site**.
         (aa) Limited construction space.
         (ab) Limited anchor space.

      (iii) **Design**.
         (aa) Terrain specific.
         (ab) Modular and Weather Resistant.

      (iv) **Constr**.
         (aa) Limited local resources.
         (ab) Heavy dependency on conventional methods.

      (v) **Repair and Maintenance**.
         (aa) Heavy requirement of quick replacement bridge.
         (ab) High rate of damage.

      (vi) **Slope**.
         (aa) Huge requirement of cutting and filling.

(vii) **Temperature Variation**.

(aa) Cause reduction in materials strength of bridge.

(ab) Maintenance of Bridge affected.

4. **Who has the Problem**. Mountainous terrain poses significant difficulty for induction of men / materials to forward areas. This problem is largely felt by Infantry and Engineer Units.

5. **Why is it Important to Solve**. Bridging of challenging gaps is important for movement of troops, sustenance of logistics support, induction of stores and construction material to forward areas.

6. **Contemporary Solution by Other Countries/ Organisation** :-

(a) Mountain foot Bridge developed by Research and Development Engineers.

(b) Light Weight crevasse crossing Bridge (LWCC) developed by Defence Research and Development Organisation.

(c) Incremental Launch Bridge being used by Chinese Army.

(d) Infantry Assault Bridge being used by United States of America Army.

(e) Modular Steel Bridge being used by civil construction companies.

(f) Composite truss bridge being used by Korean and Chinese Construction Company.

7. **Timelines**. Indigenous solution available off the shelf may be procured at the earliest.

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PROBLEM DEFINITION STATEMENT – 16

WATER MOBILITY EQUIPMENT IN CREEKS

1. **Short Title**. Mobility in Creek area.

2. **User Directorate(s)**. Directorate General of Combat Engineers.

3. **Type of Problem**. Technology Infusion.

4. **What is the Problem (Need)**.

(a) **Statement of the Problem**. The complex terrain of Creek areas pose an immense difficulty to the troops to operate due to non availability of Water Mobility Equipment suited for specific terrain of creeks.

(b) **Evolution of the Problem**. Creeks are the inlets of sea into the landmass. The sea phenomenon has a colossal effect on these creeks. The complex terrain of Creeks comprises of sea water estuaries, mud flats, marsh tracks and mangroves which consists of fine plastic and wet soil. The entire area has to be kept under surveillance and entails physical movement of troops in these areas. This requires special water and all terrain mobility equipment, which at present is not held with the Infantry units responsible for operations in the Creeks.

(c) **How is it Being Overcome**. The problem is being overcome by use of modified Out Board Motors (OBMs) held by the Engineer detachments. The Creek area is also patrolled regularly by the Border Security Force using Special Water Mobility Equipment like Fast Attack Crafts (FACs), Fast Patrol Boats (FPBs) and All Terrain Vehicles (ATVs).

(d) **Any Innovations to Locally Overcome the Problem**. Fishermen boats have been fitted with 30 / 40 / 90 Horse Power (HP) engines by the Engineers to operate in the Creek area. These modified boats are used to ferry the Infantry soldiers.

5. **Who has the Problem**. The problem is being faced by the Infantry soldiers operating in the Creek. The Water Mobility Equipment are required on daily basis, by the Infantry troops to carry out reconnaissance, patrolling and area familiarisation.

6. **Why is it Important to Solve**. The primary responsibility to keep the Creek area under surveillance in peace time scenario is that of Border Security Force. However, the Border Security Force would be under command of Army during Hot War (HW) situation. A smooth transition of operational responsibility, from Peace scenario to Hot War Scenario will only be possible if the Indian Army troops are familiar with this Special Mobility Equipment. Moreover, to operate these specialised equipment in war, adequate training would be required in peace time. This will also instill a sense of confidence in the Infantry troops.

7. **Contemporary Solution by Other Countries/ Organisations**. The water current in the Creek is rough and turbulent unlike the rivers due to the sea tidal effects. The Water Mobility Equipment like Out Board Motors (OBMs) or Boat Assault Universal Type (BAUTs) cannot operate successfully in the Creek. Only specialised equipment would be successful here. The Border Security Force uses Fast Attack Crafts (FACs), Fast Patrol Boats (FPBs) and the All Terrain Vehicles (ATVs) to overcome the problem. Pakistan, on the other side of the border uses Hovercrafts, Riverine Crafts, Marine/ Assault Boats and Marsh/ Swamp Boats.

8. **Timelines**.

(a) Development of a system - 24 months.

(b) Prototype and trials - 36 months.

9. **Point of Contact**.

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PROBLEM DEFINITION STATEMENT - 17

COMBAT ZONE TRACKING SYSTEM

1. **Short Title**. Combat Zone Tracking System for Small Team Operations.

2. **User Directorate(s)**. Directorate General of Infantry.

3. **Type of Problem**. Technology Adaptation and Infusion.

4. **What is the Problem (Need)**.

(a) **Statement of Problem**. Operations by small teams envisage these teams being employed behind the enemy lines, along the lines of passes and in the Intermediate Zone. The sub group employed entails engagement of enemy along a line of successive engagement areas and delay lines. The rapid disengagement, movement and reorganization of these teams for destroying enemy at next position is highly dependent on effective Identification of Friend or Foe and precise map reading during hours of darkness and poor visibility.

(b) **Evolution of Problem**. In the present era of net-centric warfare, there is an emerging necessity for close integration of sensors with shooters and real time connectivity of Commanders with the forward combat elements. A real-time Combat Zone Tracking System will provide not only an updated position of the independent small teams operating in remote areas but also assist commanders in reading and controlling the progress of battle.

(c) **How is it Being Overcome**. Presently this objective is being achieved by locally devised drills and continuous area familiarization, which may be affected due to unforeseen battle contingencies. Reliance on radio set is maintained for passage of own position to Formation Headquarters.

5. **Who has the Problem**. In a highly mobile and intense operational scenario, effectively monitoring movement of our own troops will comprise a major part of establishing a successful Command, Control, Communications, Computers, Intelligence, Information, Surveillance, and Reconnaissance (C4I2SR) net. During peacetime also, the periodicity of employment of this technology in routine automated data processing, operational area familiarization and exercises will be maintained.

(a) **User (Skill Set)**. Scouts, Special Forces, Infantry Ghatak platoon, Mechanised Infantry.

(b) **Operational Environment**. The usability of this equipment will be for small teams deploy in plains as well as in High Altitude Areas up to 20,000 feet.

(c) **Periodicity of Exploitation**. Regular exploitation during training and operations.

6. **Why it is Important to Solve**. The employment of specialized small teams involve mobilization, deployment, engagement, disengagement and subsequent reorganisation into sub groups before the next cycle is repeated. This necessitates use of tracking systems so as to employ these special teams in an effective manner to achieve desired results. A real-time Combat Zone Tracking System will provide a comprehensive solution to the need of monitoring and controlling special teams operating in far-flung areas.

7. **Contemporary Solution by Other Countries/ Organisations**. Presently, the United States Army is employing 'Blue Force Tracking System' to monitor movement of its forces across the battlefields all over the world.

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PROBLEM DEFINITION STATEMENT – 18

EMERGENCY TRAINING SIMULATOR FOR STATIC LINE JUMP

1. **Short Title**. Emergency Training Simulator for Para Jump.

2. **User Directorate(s)**. Directorate General of Infantry.

3. **Type of Problem**. Limitations of trainees to visualise or comprehend emergencies during Para jump which leads to minor injuries of all kinds.

4. **What is the Problem (Need)**. During Para Basic training, paratroopers are trained and briefed for air emergencies like candling, thrown line, leap frogging, entanglement, broken rigging lines and landing emergencies like wall / tree landing, water landing and electric wire landing. Limitations of trainees to visualise or comprehend a situation when he encounters emergency while carrying out jump results in major / minor injuries. Though trainees are briefed to tackle emergencies, it is observed that they are incapable of comprehending the situation in the limited time available.

5. **Who has the Problem**. Paratroopers.

6. **Why it is Important to Solve**. It will assist in development of better response mechanisms in paratroopers to tackle emergencies that may arise during para jumps. It will also lead to prevention of avoidable injuries that may arise during para jumping.

7. **Contemporary Solution by Other Countries / Organisation.** There are training simulators for Para Jump held with Western countries (United States of America - Parisian Simulators, South African Special Forces - E-Sigma Sokol Simulators, Israel Army - Mini Bungee and United Kingdom — Ifly Simulators).

8. **Timelines**.

   (a) **Conceptualization**. 12-18 months.

   (b) **Research and Design**. 1-2 yrs.

   (c) **Manufacture Prototypes**

   (d) **Field Trials**. } 2-3 yrs.

   (e) **Manufacturing.**

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PROBLEM DEFINITION STATEMENT - 19

VIRTUAL REALITY BASED TRAINING SIMULATOR FOR ROOM INTERVENTION/ URBAN WARFARE

1. **Short Title**. Virtual Reality Training Simulator for Room Intervention/Urban Warfare.

2. **User Directorate(s)**. Directorate General of Infantry.

3. **Type of Problem**. Lack of availability of infrastructure for training of troops for room intervention / urban warfare.

4. **What is the Problem (Need)**. At present, troops are being trained in infrastructure which is permanent and has limited capability for modification as per requirement, thereby depriving troops of realistic training which is a necessity in present day Counter Insurgency / Counter Terrorist operational scenario.

5. **Who has the Problem**. Para / Para (Special Forces) troops.

6. **Why it is Important of Solve**. Para / Para (Special Forces) Battalions are specialized troops that are employed in specialist tasks such as room intervention in Counter Insurgency / Counter Terrorist scenarios. Virtual reality based training simulator is required to impart realistic training to troops for room intervention / urban warfare with modified structure, computerized or mechanical operating system through which variety of situations can be depicted for training. Further, the proposed infrastructure will also facilitate the instructor / operators to portray various permutations and combinations of situations and terrain as desired.

7. **Contemporary Solution by Other Countries/ Organisation**. There are training simulators for room intervention / urban warfare held with Western countries.

8. **Timelines**.

   (a) **Conceptualization.** 12-18 months.

   (b) **Research and Design**.

   (c) **Manufacture Prototypes**. 2-3 yrs.

   (d) **Field Trials**.

   (e) **Manufacturing**.

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PROBLEM DEFINITION STATEMENT – 20

REDUCED LIFE OF HAND HELD THERMAL IMAGER BATTERY

1. **Short Title**. Reduced life of Hand Held Thermal Imager Battery.

2. **User Directorate(s)**. Directorate General of Infantry.

3. **Type of Problem**. Unsolved.

4. **What is the Problem (Need)**.

   (a) **Statement of Problem**. To analyse the reduced life of Hand Held Thermal Imager Battery, this adversely affects its performance during operations.

   (b) **Evolution of Problem**. Hand Held Thermal Imager Battery issued to the Infantry and Rashtriya Rifles Battalions is being used extensively during routine operations. Due to extensive use, the life of battery which is supposed to be three to four hours, reduces to twenty minutes or less. The problem is further compounded due to extreme climatic conditions.

   (c) **How is it Being Overcome**. The problem is being overcome by carrying additional batteries (locally purchased) during an operation which increases the load on personnel thus, reducing the efficacy.

   (d) **Innovations to Locally Overcome this Problem.** The Hand Held Thermal Imagers are connected to a power source like generator in static locations.

5. **Who has the Problem**. The infantry soldier faces the problem.

6. **Why it is Important to Solve**. The limited life of Hand Held Thermal Imager battery is hampering the operations during poor visibility conditions and at night thus affecting the morale of the troops. Also, as most of the infiltrations along Line of Control take place during night / poor visibility conditions, limited life of Hand Held Thermal Imager battery hampers the operations.

7. **Timelines**. The problem needs to be solved immediately as it is hampering the operations of Field Army.

8. **Point of Contact**.

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PROBLEM DEFINITION STATEMENT – 21

REMOTELY OPERATED SYSTEM FOR INSERVICE WEAPONS AND VEHICLES

1. **Short Title**. Remotely Operated System for In-service Weapon and Vehicles.

2. **User Directorate(s)**. Directorate General of Infantry.

3. **Type of Problem**. Technology Infusion.

4. **What is the Problem (Need)**.

   (a) Units deployed in Counter Insurgency / Counter Terrorist operations need to swiftly retaliate when terrorists / insurgents open fire on them.

   (b) **Statement of the Problem**. The soldiers in hardened / protected vehicles are unable to bring down appropriate amount of fire on terrorists / insurgents without exposing themselves to hostile fire.

   (c) **Evolution of the Problem**. Army vehicles are subjected to hostile fire in Counter Insurgency / Counter Terrorist areas. Mine Protected Vehicles have been provided to units, however, these vehicles while protecting lives do not permit adequate firepower to bear upon the terrorists / insurgent.

   (d) **How is it Being Overcome**. All vehicles have roof mounted opening from where a soldier with auto weapon fires at the terrorists / insurgent. Bullet proof plates have been fixed around the roof opening. However, despite these plates, the soldier is exposed to hostile fire.

5. **Who has the Problem**.

   (a) **User**. All units operating in Counter Insurgency / Counter Terrorist area face the problem.

   (b) **Operation Environment**. Counter Insurgency / Counter Terrorist areas.

   (c) **Periodicity of Exploitation**. On a daily basis.

6. **Why is it Important to Solve**. Remotely operated weapon system will allow the soldier to fire on a terrorist / insurgent from within the protected vehicle without exposing himself to hostile fire.

7. **Contemporary Solution**. The technology is widely available.

8. **Timelines**. Research, manufacture of prototype and trials should be completed in one year.

9. **Point of Contact**.

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PROBLEM DEFINITION STATEMENT – 22

DESIGN AND DEVELOPMENT OF AERIAL SURVEILLANCE PLATFORM HEXACOPTER / QUADCOPTER, SEEKER AND SHOOTER COMBAT MANAGEMENT SYSTEM

1. **Short Title**. Design and Development of Aerial Surveillance Platform Hexacopter / Quadcopter with Day and Night Capability for High Altitude Area / Line of Control / Line of Actual Control / Hinterland.

2. **User Directorate(s)**. Directorate General of Infantry.

3. **Type of Problem**. Adaptation.

4. **What is the Problem (Need)**.

(a) There is need to deploy aerial platforms in large numbers, so as to provide the tactical commanders with real time images of the area of interest. Aerial surveillance has proved effective in seeking and consolidation of valuable intelligence.

(b) **Statement of Problem**. Hexacopter / Quadcopter being light weight, can be carried by troops and deployed in area of interest during day as well as night, to gain real time intelligence and to keep the area of operations surveillance. This enhances the operational preparedness and operational effectiveness manifold and also aids in effectively engage infiltrating terrorists / Anti National Elements across Line of Control by dropping Grenade No 36 / Improvised Explosive Device on the designated target area.

(c) **Evolution of the Problem**. The Hexacopter / Quadcopter based Seeker-Shooter Combat Management System developed by the Advance Base Workshop has been tried and evaluated for performance.

(d) **How is it Being Overcome**. The Seeker-Shooter Combat Management System is based on Quadcopter (to function as Seeker to undertake surveillance task) while Hexacopter carries payload (to engage the target and act as shooter). Presently, the function is being carried out with conventional technology.

(e) **Any Innovations to Locally Overcome the Problem**. The Hexacopter / Quadcopter based Seeker-Shooter Combat Management System developed by the Advance Base Workshop can be exploited to neutralize terrorists along Line of Control counter-infiltration role by employing Grenade No 36 / Improvised Explosive Device and also for crowd dispersal / control by employing suitable payloads.

5. **Who has the Problem**.

(a) **User (Skill Sets)**. Infantry would be the main user.

(b) **Operating Environment**. The Combat Management System should work in all operational environments.

(c) **Periodicity of Exploitation**. On a daily basis.

6. **Why it is Important to Solve**. It will assist in effectively carrying out undetected surveillance using payloads (Day and Night Cameras / Grenade / IED) deployed at up to a ceiling altitude of 3000m above mean sea level. It would increase the efficiency and effectiveness of the unit.

8. **Timelines**. Research, manufacture of prototype and trials should be completed in one year.

9. **Point of Contact**.

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PROBLEM DEFINITION STATEMENT – 23

LONG RANGE OPTICAL TARGET LOCATOR

1. **Short Title**. Long Range Optical Target Locator.

2. **User Directorate(s)**. Directorate General of Infantry.

3. **Type of Problem**. Technology infusion.

4. **What is the Problem (Need)**. Troops engaged in modern asymmetric warfare are often exposed to high risk threats including surprise attacks by well planned and camouflaged ambushes involving automatic firing and sniping etc. To cope with such lethal traps, military forces must be equipped with necessary tools for surveillance, locating hostile forces and responding effectively and rapidly with minimum exposure to the threats. A device that provides a signature of the enemy's optical devices will augment the security / surveillance grid. The threat could be in terms of a sniper equipped with a day sight, any passive night vision device, or any other optical / electro optical surveillance device, viz., binocular, surveillance cameras, laser range finders, designators etc.

   (a) **Statement of Problem**. There is a requirement of a Long Range Optical Target Locator capable of detecting and locating optical threats, which can facilitate Indian Army operating at or close to Line of Control, in detection of any planned offensive in that area, or for border surveillance.

   (b) **How is it Being Overcome**. Presently, the security and surveillance grid is based upon Radar and other optical instruments, which do not have capability to detect enemy optical devices.

5. **Who has the Problem**.

   (a) **User (Skill Sets)**. Infantry troops deployed on Line of Control should be able to handle the equipment with nominal training.

   (b) **Operating Environment**. Posts on Line of Control.

   (c) **Periodicity of Exploitation**. Daily.

6. **Why it is Important to Solve**. This equipment will provide an important tool for detection of commonly employed active or passive surveillance devices with minimum exposure to the threats.

7. **Timelines**. Research, manufacture of prototype and trials to be completed in eighteen months.

8. **Point of Contact**.

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PROBLEM DEFINITION STATEMENT – 24

MAN PORTABLE RADIO RELAY FREQUENCY EQUIPMENT

1. **Short Title**. Man portable Radio Relay Frequency equipment.

2. **User Directorate(s)**. Directorate General of Signals.

3. **Type of Problem**. Unsolved.

4. **What is the Problem (Need)**.

   (a) **Statement of Problem**. Radio relay frequency equipment is the only means to provide E1 connectivity without laying optical fiber cable. However, for effective utilization in mountain terrain and high altitude areas, man portable version of radio relay frequency equipment should be developed, so as to provide fast and efficient connectivity.

   (b) **Evolution of the Problem**. Radio Relay Frequency equipment are heavy and bulky, thus, deployment and sustainment of detachments poses a huge problem in High Altitude Areas.

   (c) **How is it Being Overcome**. Presently, huge logistic support is required to deploy and sustain Radio Relay Frequency repeaters and terminal stations in High Altitude Areas.

   (d) **Any Innovations to Locally Overcome the Problem**. Nil.

5. **Who has the Problem**.

   (a) **User (Skill Sets)**. All Arms and Services.

   (b) **Operating Environment**. All types of environment i.e. Counter Insurgency Operations, Mountains and High Altitude Areas.

   (c) **Periodicity of Exploitation**. Very frequent.

6. **Why it is Important to Solve**.

   (a) During conduct of operations in mountainous terrain vis-à-vis desert / plain areas, maintenance of Radio Relay Frequency detachments requires immense logistics support as the equipment works on line of sight.

   (b) Thus, to reduce the logistics effort and improve availability, there is an emergent need to reduce size of Radio Relay Frequency equipment to make it man portable.

7. **Contemporary Solution by Other Countries/ Organisations**. As Radio Relay Equipment is manufactured by Defence Public Sector Undertaking, this technology does not exist with other countries / organisation.

8. **Timelines**.

(a) Research and Development - 3 Months.

(b) Manufacture of Equipment - 6 Months.

(c) Field / User Trials - 1 Months.

(d) Induction - 2 Months.

9. **Point of Contact**.

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PROBLEM DEFINITION STATEMENT – 25

ELECTRONIC WARFARE SYSTEM WORKING ON STAR TOPOLOGY

1. **Short Title**. Mesh Topology to be used in Electronic Warfare System instead of present day Star topology.

2. **User Directorate(s)**. Directorate General of Signals.

3. **Type of Problem**. Adaptation.

4. **What is the Problem (Need)**. The problem is as highlighted in succeeding paragraphs:-

(a) **Statement of Problem**. Need to establish a mesh topology Electronic Warfare grid which is not bound by the Radio Line Of Sight of the equipment used or the need to communicate with Direction Finding vehicles and Jammer vehicles (sensors shelters).

(b) **Evolution of the Problem.** There is a need for both voice and data communication between sensor shelters and control entity. Voice is being used for command & control and data transmission to the Early Warning Command Post.

(c) **How is it Being Overcome**. Present system does not cater for independent communication among the entities. Instead, it relies on a system of omni directional antennae for rearward information transmission to the Control Centre. To overcome this, there is a need of an omni antenna at all entities with mesh routers installed, to cater for need based deployment of the sensors, as per the commander's appreciation of electronic Order of Battle.

(d) **Any Innovations to Locally Overcome the Problem**. Innovations and trials were conducted in the year 2012-13 using wireless antennae. Not only was the existing Spread Spectrum Radio Relay bypassed, but also triple play services in terms of voice, data and video were possible owing to higher bandwidth. Subsequently, meshing of this system working on IP phones was amalgamated with the legacy computer posts and data transfer achieved.

5. **Why is it Important to Solve**.

(a) **Increase Range**. Increased Range is achieved as the grid is no longer bound by the Radio Line Of Sight of the radios employed.

(b) **Faster Message Delivery**. Various protocols incorporated in the routers viz., Open Shortest Path First (OSPF) and Adhoc on Demand Vector (AODV) can help in faster message delivery.

(c) **Built in Redundancy**. Multiple routes are available for the information to flow thereby guaranteed delivery of information. Even if the attrition rate is taken into account, message will always flow due to multiple paths being available.

(d) **Change in Frontage**. A complete change can be affected in terms of deployment of the shelters which is no longer bound by Radio Line of Sight issues. E1 connectivity can further bolster the communication process.

6. **Solutions by Other Countries**. Countries like the United States of America and present day system like Integrated Communication Electronic Warfare System (ICEWS) (France) make use of IP radios to relay information. However, routing tables have to be defined at each stage. Trials are presently on to establish mesh routers to enable reception and transmission of information using same router so that in turn each shelter can be used as a transmitter as well as receiver.

7. **Timelines**. Brief timelines proposed are as under:-

(a) **Conceptualization**. Six months to formulate the General Service Qualitative Requirement.

(b) **Research and Development**. One year time for Research and Development and studying contemporary technologies.

(c) **Manufacture of Prototype**. Six months to make a prototype.

(d) **Trials**. Six months for accelerated trials.

(e) **Manufacture for the End User**. One year after completion of trials.

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PROBLEM DEFINITION STATEMENT - 26

CONTAINERISED LOGISTICS SHELTERS

1. **Short Title**. Containerised Logistics Shelters.

2. **User Directorate(s)**. Directorate General of Supply and Transport.

3. **Type of Problem**. Unsolved.

4. **What is the Problem (Need)**.

(a) **Statement of the Problem**. Loading / unloading of mobilization and logistics stores consumes a large amount of time and manpower which affects mobilisation readiness.

(b) **Evolution of the Problem**. Various mobile stores are required to be carried to operational areas by field formation units. During mobilisation, these stores have to be loaded on to vehicles manually, which consume manpower and time. Logistics units carry the necessary logistics loads as per scales for the entire formation, which again has to be loaded manually. Pre loaded containers can be kept ready with the mobilisation stores / logistics loads, pre-loaded. to be mechanically loaded on to a flatbed load carrier thereby saving manpower and time. After mobilisation stores are drawn, empty containers may be used for stocking loads by logistics echelons.

(c) **How is it Being Overcome**. At present, loads are manually loaded by hired labour / porters / troops.

5. **Why is it Important to Solve.**

(a) Reduce mobilisation timings.

(b) Units effective at the operational area in a quicker timeframe.

(c) Greater flexibility in employment of the units.

(d) Manpower freed up for preparation / rehearsal of operations.

(e) Secure robust shelters can be made blast poof and protect against weather.

(f) Can be used in Mountainous terrain also till road Head.

6. **Contemporary Solutions by Other Countries / Organisation**.

(a) Mobilisation container shelters.

(b) Kitchen trailers.

(c) Mobile offices.

(d) Communication exchanges.

(e) Mobilisation workshop containers.

7. **Timelines.**

(a)	Product Conceptualisation	-	1-2 yrs
(b)	Research and Development	-	1-2 yrs
(c)	Prototype	-	1 yr
(d)	Field trials /user trials.	-	2 yrs
(e)	Manufacturing	-	2 yrs
			6-8 Yrs

8. **Point of Contact**.

(a) **Primary Contact**.

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(b) **Secondary Contact**.

Directorate General of Supply and Transport
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PROBLEM DEFINITION STATEMENT – 27

FUEL OIL LUBRICANTS STORAGE IN OPERATIONAL CONDITIONS

1. **Short Title**. Storage of Fuel, Oil and Lubricants in Operational Conditions.

2. **User Directorate(s)**. Directorate General of Supply and Transport.

3. **Type of Problem**. Storage of fuel, oil and lubricants.

4. **What is the Problem (Need)**.

   (a) **Statement of Problem**. The Army provides bulk petroleum to all land-based forces in a theater of operations and most of the fuel, oil and lubricant units in field are required to establish a Petroleum Point for this purpose. Depending on the size of the operation, this may mean that several thousand liters of fuel must be received and stored each day, which is susceptible to enemy shelling and terrorist action. To accomplish this task, petroleum units have to quickly establish large, fire resistant fuel storage and dispensing systems. Presently this is being done by using barrels and jerricans which have limited storage capacity and are also vulnerable to fire.

   (b) **Evolution of the Problem**. Old vintage barrels and jerricans being used for storage and transportation of fuel, oil and lubricants in operational conditions are susceptible to enemy artillery shelling and terrorist actions.

   (c) **How is it Being Overcome**. Army has been using small containers like jerricans, barrels and containers for lubes and greases for storage of fuel, oil and lubricant products.

   (d) **Any Innovations to Locally Overcome the Problem**. Nil.

5. **Who has the Problem**. Army Supply Corps deployed in operational areas.

6. **Why it is Important to Solve**. The collapsible fabric petroleum tanks are the best alternative. Technological advances in materials and fabrication techniques led to the manufacture of larger and lighter fabric tanks made from thinner thermoplastic urethanes, which are fire resistant. The new technology permitted development, manufacture and fielding of collapsible tanks with a capacity of over 50,000 litres. These tanks can be deployed rapidly and recovered using fewer personnel and equipment. Collapsible Storage Tanks are constructed from heavy duty, reinforced fabric that allows them to be rolled into compact, transportable units. Once deployed, they are simply unrolled filled on site. The quantity and the mode of transport will depend on the operational terrain and must be capable of being dropped with or without parachute.

7. **Contemporary Solution by Other Countries / Organisations**.

(a) **Pillow Tanks**. These are inexpensive temporary containers utilized for a variety of fuels by NATO forces.

(b) **American Marine Pillow Tanks**. These are collapsible storage containers that provide temporary, as well as, long term liquid storage. They are versatile in usage, both for land based and air drop operations.

(c) **Quick Tanks-Open Top Aluminum Frame**. Quick Tank has a robust aluminum frame that supports the open top liner. A choice of fabrics and sizes make the Quick Tank an affordable solution for storage needs. The Quick Tank is a complete portable storage solution developed for rapid deployment and storage of liquids under extreme temperature conditions.

8. **Timelines**. Research, manufacture of prototype and trials to be completed in one year.

9. **Point of Contact**.

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PROBLEM DEFINITION STATEMENT - 28

DEVELOPMENT OF LIGHT-WEIGHT

NON-SKID CHAIN ACCESSORIES FOR TYRE SIZE 12.00 x 20

1. **Short Title**. Development of Light-Weight Non-Skid Chain Assembly.

2. **User Directorate(s)**. Directorate General of Electronics and Mechanical Engineers.

3. **Type of Problem**. Technology infusion.

4. **What is the Problem (Need)**. Non Skid Chains (NSC) are used on pneumatic tyres of vehicles to obtain a sure and safe grip on slippery surfaces such as snow, mud and ice. Non-Skid Chains are essential for 'B' Vehicles / Guns / Self Propelled howitzers deployed in service by the user. Non-Skid Chains are used world over and have seen lots of improvements. The material used varies from steel / aluminum alloy to rubberized metal and high quality plastics. The main factors for the chains are ruggedness, toughness, less ductility and brittleness. Presently, chains used in Indian Army are of steel, which are heavy. Also, due to non-availability of snow tyres, there is always a need for a lighter Non Skid Chains.

5. **Who has the Problem**. Units deployed in High Altitude Area / glaciated terrain.

6. **Why it is Important to Solve**. The design of Non Skid Chains presently in use is heavy and cumbersome. Hence, fitment of Non Skid Chains on the tyres of vehicles plying in snow bound area by one or two persons is a very difficult task. Considering modern trends and latest developments on the subject, the use of existing heavy weight chains, which is approximately 42 Kg, needs to be redesigned into a lighter one. Hence, design of an alternate Non Skid Chain, which should be lighter in weight, simple in design and capable to operate at sub zero temperature conditions, is felt necessary.

7. **How this can be Done**. The Non Skid Chain presently used on Stallion and other applicable vehicles is too heavy. The weight should be reduced to 40% to 50%, without compromising the load characteristics / performance of the chain. Moreover, number of links in contact between the tyre and the snow surface are to be increased for better rolling grip traction by adopting cross type pattern of Non Skid Chain. During the development, lesser wire diameter of standard steel material, having better load bearing properties, has to be considered. The cross links shall absorb shock / impact, while operating the vehicle on uneven surfaces.

8. **Contemporary Solution by Other Countries/ Organisations**. Improvised solutions / specialized tyres.

9. **Timelines**. Modification requires reduction in weight and fabrication of lashing mechanism. It is possible to complete the entire life cycle of development, modification, trial and testing within six months.

10. **Point of Contact**.

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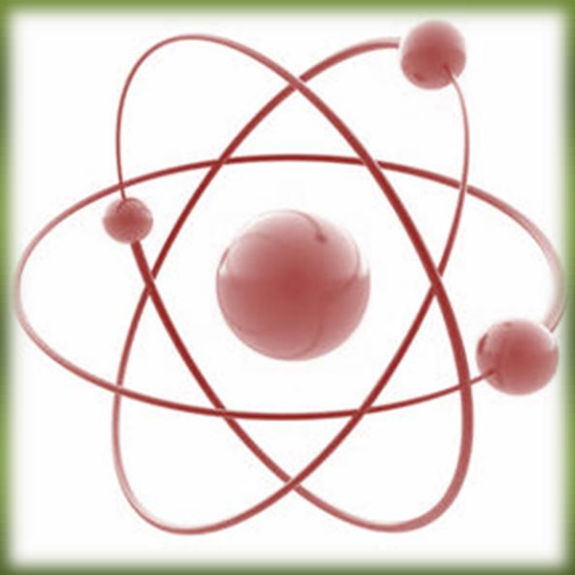

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