Confederation of Indian Industry

ARMY DESIGN BUREAU

FUTURE CORE TECHNOLOGIES AND PROBLEM STATEMENTS

MESSAGE

SHRI MANOHAR PARRIKAR

HON'BLE DEFENCE MINISTER

Ministry of Defence is committed towards realising the vision of our Hon'ble PM thereby achieving greater self-reliance through **'Make in India'** endeavours. Formulation of DPP 2016 is a cognisant step which aims at institutionalising the procurement procedure to give a boost to such initiatives of the Government of India. The **'Make'** procedure has been refined further to ensure increased participation of the Indian industry and accentuate the role of MSMEs in defence sector. In order to promote indigenous design and development of defence equipment, the **'Buy-IDDM'** category of acquisition has been introduced and has been accorded the top most priority. In pursuance of these objectives, Indian Army has also established the **Army Design Bureau** to form an effective interface with the Academia, R&D agencies and Defence Industry.

This booklet is an effort to provide a ready reckoner for the Industry of the **future challenges and technological requirements** as envisaged by the Indian Army. I am sanguine this would enable our Industry to correctly perceive the **'felt needs'** and focus their resources to **achieve the common goals**. The synergised efforts of both **'user and the provider'** will certainly enhance the nation's self-reliance in defence sector.

'Jai Hind'

MESSAGE

Indian Army is rapidly transforming into a modern, high technology force capable of meeting complex future challenges and be a formidable pillar of National Security. Aligning itself with Make-in-India initiative, Indian Army has given tremendous impetus towards achieving modernisation through indigenisation. The issue of finding cost effective indigenous solutions to various requirements of Indian Army has been accorded utmost priority.

Raising of Army Design Bureau was a major step towards operationalisation of commitment towards Make-in-India and indigenisation. Army Design Bureau has synergised interaction with Indian Industry and Academia to understand the needs and future requirements of Army.

In pursuant to its initiative of indigenisation, Indian Army has come up with a compilation of Core Technology Requirements for future and Problem Statements of current equipment. I am confident that this publication would enable domestic Defence industry to develop a comprehensive understanding of Army's requirements and focus their resources towards finding innovative solutions and products for Indian Army.

Jai Hind !

(Dalbir Singh)
General

Confederation of Indian Industry

MESSAGE

I would like to compliment Hon'ble Raksha Mantri and the leadership of the Indian Army for a series of initiatives taken to actively engage with the Indian Industry. Military modernization is a continuous process that is essential to ensure India's defence preparedness and Indian Army uses a variety of high technology equipment to help maintain a winning edge for the armed forces. Greater involvement of the Indian Industry will not only help in realizing the indigenization plans of the Indian Army but also leverage inherent capabilities of Indian Industry towards building modern and best-in-class weapon systems to strengthen our forces.

In line with Hon'ble Prime Minister's Make in India initiative, under the leadership of Deputy Chief of Army Staff (P&S), industry interactions were held across the country to apprise the Indian industry about capital procurements and upcoming MAKE Projects of the Indian Army. This path breaking initiative has received overwhelming response from industry and has helped companies across India, access to such information.

I must congratulate the Army Design Bureau for putting together this compendium of 'Future Core Technologies and Problem Statements'. Such a publication will help Indian Industry channelize their investments and resources towards indigenous design and development of core-capabilities that are of critical importance to the Indian Army.

On behalf of the Indian Industry and CII, I would like to once again thank the Indian Army for their initiatives and assure an unwavering support in their realizing their goals of achieving modernization through indigenization.

Baba N Kalyani
Chairman, CII National Committee on Defence

Confederation of Indian Industry

MESSAGE

Technology plays a crucial role in development of capabilities and systems to meet desired future operational efficiency. The strategy should be to ensure that there are linkages between capability development, military systems and technology. Formation of Army Design Bureau is a testimony to the Indian Army's efforts to achieve self-reliance through promotion of indigenous content. Such a Bureau will play a key role in the acquisition process becoming the interface to help Indian industry in developing and designing weapon and other systems indigenously.

This booklet will immensely help the Indian industry to understand the future challenges that the Indian Army could face and, also, throw light on the requirements of technology in the near future. This will facilitate forecasting and planning for the Indian industry.

On behalf of CII, I would like to reaffirm our commitment to the initiatives of Ministry of Defence and the Indian Army. CII is actively working towards Hon'ble Prime Minister's vision of "Make in India" and firmly believes that India will soon become self-reliant in defence.

Chandrajit Banerjee
Director General, CII

DEPUTY CHIEF OF ARMY STAFF (P&S)

FOREWORD

Technology is a non linear tool which can bring multiple changes to military power and usher in high levels of competitiveness. Technology threshold of a Nation is of strategic significance in the sphere of comprehensive national power. Going up the technology ladder is the surest way to become competitive and ensure sustained growth. Technology development has to stride through research and development, acquisition, absorption and production besides improvements in performance, quality and cost effectiveness. While the progress made by domestic defence industry is noteworthy, there are many more 'miles to go', before we achieve our rightful position.

The Indian Army remains committed to achieve greater self-reliance through promoting indigenous research and development and pursuing 'modernisation through indigenization'. Numerous interactions have been carried out with the Academia, R&D establishments and Industry to seek their views on the modalities of identifying and defining our major challenges which could then be worked upon with greater focus. This compilation is an outcome of detailed iterations carried out with major stakeholders, namely, the Field Army, Training Institutions and Planning Establishments. The **'Felt Needs'** have been compiled as a set of problem statements in this document. An introduction has been made to outline **'Future Core Technologies'** for the Army. This would be followed up further after more deliberations.

With the collaboration and support of the Academia, R&D and Industry Indian Army will win India's war with Indian solution.

'Jai Hind'

(Subrata Saha)
Lieutenant General

INDEX

PART - 1

FUTURE CORE TECHNOLOGIES

ARMOURED FIGHTING VEHICLES (AFV)

1. AFVs are a system of systems wherein each facet has a direct or an indirect impact on the other. Key technologies related to each facet namely, mobility, protection and firepower are given in succeeding paragraphs.

Mobility

2. **Automotive System: Diesel and Turbines**. Developers of AFV will continue to focus on more power, light weight, a smaller package and reasonably long life of propulsion system. In order to achieve 'extraordinary' acceleration, it is necessary to couple conventional diesel engine to a turbine. The 'Hyberbar' engine will be able to accelerate from zero to full power at 1500 hp in 2.8 seconds, while conventional diesel engine requires 8-12 seconds. The quest for more compact power pack has lead to renewed interest in gas turbines, which needs to be explored. A fuel efficient power pack with optimized automatic transmission system is the need of the hour.

3. **Tracks and Suspension System**. Continuous-band tracks are a design alternative that reduces track weight, maintenance and acoustic signature of AFV. Combinations of active suspension sys with sensors, control units and a hydraulic power source is needed to automatically alter the suspension characteristics which will more effectively match the speed of the vehicle with the terrain profile.

Protection

4. **Survivability**. The most effective way to prevent being hit is to minimise the possibility of detection by making the armoured vehicle small and compact and as difficult to detect by a variety of battlefield sensors including radar, acoustic and electro-optical systems, as possible.

5. **Survivability in Urban Environment**. AFVs are likely to operate in urban environment, hence, would require features like additional protection at the turret, Commander's cupola, reactive armour to protect the tank's sides and slant armour to protect tank's rear from RLs / RPGs etc.

6. **Signature Management**. Current and expected future threat scenarios require signature management measures of multi spectral type, and they require an extremely short reaction time. IA requires signature management in design measures, basic camouflage,additional camouflage and temperature camouflage.

7. **Armour Protection**. The main battlefield threats against tanks are ATGMs, unguided anti tank rockets and grenades, shaped charge HEAT gun rounds, KE gun rounds, top-attack weapons like intelligent sub-munitions and terminally guided artillery rounds, etc. Given optimised designs, integrated ERA offers tanks highly effective protection both against the penetrators of APFSDS projectiles and the jets of shaped charge weapons, including those with tandem warheads.

8. **Material**. Increasing the level of protection of a vehicle involves considerations of cost and weight. We require high-performance armour system with advance materials such as reduced back armour, spallation, elimination of parasitic mass leading to weight reduction, excellent corrosion resistance, inherent thermal & acoustic insulation properties and reduced parts count.

9. **Soft Kill Sensors**. The soft kill sensors must discriminate between true and false targets. They must also discriminate between missiles or other projectiles that threaten the vehicle being protected and those that will miss or are aimed at other targets.

10. **Hard Kill Systems**. Active Protection System (APS) are needed for AFVs. The radar should determine threat levels adequately and the self-defence munitions should not cause high levels of collateral damage, particularly to accompanying dismounted infantry.

Firepower

11. **Electric Weapons**.Conventional tube weapons are the product of a mature technology and have now reached a high level of performance. However, on account of the gas-dynamic processes of thermally transformed powder, the muzzle velocity of projectile is theoretically limited to approximately 2300 m/second. Contemporary tank guns still offer a considerable growth potential and electric guns will be able to exceed this and become an attractive proposition.

12. **Tank-fired Missiles**. Missiles with shaped-charge warheads are susceptible to various countermeasures, especially reactive armour. There is a need to develop high velocity KE missiles with heavy-metal, long-rod penetrators which can defeat tank armour.

13. **3rd Generation Anti Tank Guided Missile (ATGM)**. To defeat the present day armour and protection measures, the need is for 3rd generation ATGMs having passive seekers/ anti jamming laser guided system with uncooled detectors capable of engaging targets at ranges upto 4-5 Kms with Depth of Penetration(DOP) being 800 - 1000 mm.

14. **Fire Control System (FCS)**. Ground sensors, non-line-of-sight launch systems and the network capability will enhance soldiers' understanding of the situation in dynamic battlefield conditions by promoting a common perspective of enemy and friendly locations on digital maps and provide timely actionable intelligence.

15. **3rd Generation TI Sights**. The futuristic requirement is of 3rd generation TI Sights with cooled/ uncooled detectors having a minimum Focal Plane Array (FPA) of 640x 512µ with Detection/ Recognition/ Identification ranges upto 7/5/3 kms.

NIGHT VISION & POWER PACKS / ENGINES

Night Vision Technology

16. The ability for individual soldiers and weapon platforms to observe, acquire and accurately engage targets at night and in poor visibility is critical to conduct of operations. Contemporary military night vision equipment encompasses two key technologies i.e, Image Intensification (II) and Thermal Imaging (TI). Advances continue to be made in both these technologies, with fused imagery (II and TI fusion) being state of the art.

17. **Military Exploitation of Contemporary II Technology**. Developments in II technology have enhanced the detection range of II devices upto 1000-1200m. The comparative lower cost of these devices along with their better contextual image production (vis a vis TI devices) has ensured that weapon sights and lower range military observation / surveillance equipment continue to be based on this technology.

18. **Cooled TI Technology**. Thermal imaging technology (Cooled) originated in military applications to function under no light and adverse weather conditions. Heat signatures emitted by objects are picked up by materials called 'detectors', as a contrast with the surroundings of the object under observation. Thermal detectors, cryogenic cooler assemblies and optics (Germanium / Silicon lenses) are the key technology in thermal imaging. **Mercury Cadmium Telluride (MCT) and Indium Antimony (InSb) detectors are the two leading detector technologies**, with InSb being the newer development. Detector materials are manufactured in the form of wafers and configured in arrays. **FPAs** are the core component of detector technology giving rise to better resolution, lesser weight and longer detection, recognition and identification ranges.

19. **Uncooled TI Technology**. The endeavour to incorporate TI technology in individual soldier system reinforced the need for such TI devices to be more compact, lower in weight, with reduced power supply requirements. Uncooled TI detectors are known as Micro bolometers which detect temperature differences without requirement of cryogenic cooling. Currently, the two most used materials (with identified growth potential) are Vanadium Oxide (VOx) and Amorphous Silicon (a-Si). FPAs of configuration 1024x768 have thus been developed. The current usage of uncooled TI in military systems is limited to devices where the recognition ranges are required to be less than 1.2 kms for a human target and upto 2 kms for an AFV target. This limitation is due to the requirement of larger Germanium (Ge) lenses, for higher recognition ranges. Large diameter Ge lenses increase the cost of the uncooled devices to a point where they are no longer economical. They are also difficult to produce, as the material is not workable at sizes beyond 20 cm. In addition, large lenses bulk up the form factor and make the devices unsuitable for short range weapon systems. It is likely that, with improved FPAs and optics, these devices with enhanced range will replace cooled TI systems.

20. **Fused Imagery Technology**. Recent advances in vision technology aims to fuse TI and II images towards accurate identification and targeting. These devices would provide a composite image output (II plus TI) operation. The incorporation of uncooled TI in these fused sensors would ensure that cost and form factor meet bulk production requirements. The II inputs (SWIR) provides the complete contextual picture while the thermal imaging ensues that live targets are not missed.

Power Packs / Engines

21. One of the ***biggest trends*** right now in automotive engineering is ***improving engine efficiency and fuel economy***. This includes downsizing, down-speeding, direct fuel injection, and boosting.

22. **Downsizing and Turbo Charging**. The two main benefits in downsizing an internal combustion engine are thermodynamic and mechanical. From a thermodynamic point of view, the engine operation will move towards higher loads, at which the engine efficiency is higher and from the mechanical point of view, the positive effect would be reduction of the friction in the piston units, together with the reduction of the number of cylinders. Downsized engines are lighter than conventional engines, thereby reducing vehicle mass and the improving vehicle fuel consumption. Turbo charging recovers the energy of the exhaust gases to increase the inducted charge, therefore increasing the power-to-displacement ratio. A downsized and turbocharged engine has the potential to have the same or better performance as a non-downsized, normally aspirated engine, with the advantage of a significant increase of fuel efficiency.

23. **Advanced Combustion Modes**. Engineers are working to increase the efficiency of internal combustion engines by developing several advanced combustion modes. One of these modes is called Homogeneous Charge Compression Ignition (HCCI). In the HCCI combustion, a highly homogenized mixture of air, fuel, and combustion products from the previous cycle is auto-ignited by compression. This combustion mode aims at combining the advantages of modern diesel and gasoline combustion processes, namely low emissions and high efficiency. Another research trend targets ways to recover the energy that is normally dissipated through the coolant and the exhaust gas systems of automotive power trains using innovative waste heat recovery devices. These systems can convert thermal energy into mechanical or electrical energy, thus increasing the overall efficiency of the vehicle.

24. **Hybrid Engines for Armoured Fighting Vehicles(AFV)**. Today, developers are also looking at green technologies for future vehicles. Vehicles which rely less on fuel and the costly logistical process are a valuable asset for any military planner. Researchers are testing the new hybrid Ultra Light Vehicle (ULV). The ULV is driven by two electric motors and a light weight diesel engine, the latter provides power to the motors and high-torque at low speeds. Importantly, the electric motors eliminate the need for a drive shaft and so the underbody will perform better in an IED or mine blast. A smooth underbody, coupled with protection could offer enhanced survivability for soldiers.

COMBAT SOLDIER

25. The IA has taken up to equip Infantry with advanced weaponry, communication network and instant access to situation on the battlefield. It aims to provide the soldier with enhanced lethality, protection, situational awareness, survivability and mobility while making the soldier a self contained fighting machine.

Core Components

26. **Lethality**. There is an urgent need to develop rifles, carbines and light machine guns to replace the existing INSAS class of weapons. The hall-mark of new weapons should be reliability, robustness, night firing capabilities and modular cum inter changeable parts. The weapons themselves are of little use unless supported by compatible and indigenously manufactured ammunition. The weapon system be built around the 7.62 mm calibre weapon with enhanced range and provision to attach grenade launcher. It should be light in weight. The sub system will have a thermal imaging weapon sight and a reflex sight. The weapon should have picatinny rails to facilitate various add-on equipments needed for various missions and thus improving versatility.

27. **Survivability**. Various components having bearing on sub system survivability are Ballistic Protection, Sighting System, Situational Awareness, Mobility and Combat Gear. Aim is to minimize casualties and provide higher degree of survivability against bullets, shrapnel, mines, laser and NBC attacks. The challenge is to optimize 'Protection vis-a-vis the weight penalty'. As part of protection, there is a requirement of a bullet proof jacket which is modular, light in weight and composed of material capable of stopping a 7.62 mm round fired from a very close range of 10m. The bullet proof helmet should be capable of stopping a 9 mm round at close range. It needs to cater for facial protection, ballistic and laser eye protection, provision for mounted search light, thermal sensors, an advanced night vision device, and an audio head set. The helmet should provide protection against bio-chemical threats. The visor is intended to be integrated and to act as a head-up display monitor.

28. **Mobility**. Maintain Soldier's agility and manoeuvrability by precise navigation and developing load distribution system with an aim to optimize individual's combat load and reduce fatigue.

29. **Situational Awareness**. Situational awareness forms major bedrock for any Infantry based operation. The need is to integrate C4I systems with various sensors/ sources and Global Positioning System to ensure integration into the overall combat network architecture. Latest means of communication, frequency/ bandwidth management and technology need to remain in sync, in order to cope up with rapid advancements of technology.

30. **Sustainability**. The uniform be lightweight and should cater for energy absorbing protection with smart surfaces, integrated with computing and communication devices, energy supply sensors, dynamic camouflage, chemical and bio-warfare protection and personal climate control arrangements.

ARTILLERY

Guns

31. The future artillery weapons would adopt a standard calibre of 155 mm. Advanced metallurgy and material technology comprising of carbon composites, ceramics, metal matrix and composites are going to be the main structural materials for the future systems. These technologies would enable weapon platforms to be made lighter and would find their application in all weapon platforms and support systems.

32. Technological development related to future artillery systems can be categorised under the following trends:-

(a) **Range**. Enhanced ranges with improved consistency and minimal barrel wear and tear.

(b) **Rate of Fire**. Sustained high rate of fire with burst fire capability for shorter duration.

(c) **Lethality**. High lethality munitions and projectiles with common fuze for ground burst, airburst and penetration mode.

(d) **Accuracy & Response Time**. Higher accuracies and minimum response time to accurately engage targets and for proving intimate close support to own troops.

(e) **Survivability**. Higher survivability under adverse conditions.

Ammunition System

33. Availability of better explosives possessing much higher brisance without loss of handling safety. Precision munitions and low cost kits to convert dumb ammunition into smart ammunition are the future trends in Artillery ammunition. Specific details of the same given in succeeding paragraphs.

34. **Terminally Guided Munitions (TGMs)**. These are semi-active laser guided top attack munitions for destruction of pin point static or moving targets. The target is designated by a ground / Helicopter / UAV based Laser Designator.

35. **Sensor Fuzed Munitions (SFMs)**. These munitions follow concept of ‘shoot to kill’ and have onboard guidance system with two or more sensor fuzed sub-munitions inside a shell. No external illumination of the target is required. The sub-munitions are released above the target, they acquire targets using sensors and destroy them using Explosively Formed Penetrators (EFP).

36. **Trajectory Correctable Munitions**. These munitions employ GPS aided inertial guidance and navigation with base fins, four axis canard control and base bleed technology. Trajectory glide and onboard navigation is used to achieve extended range with CEP of 10 meters or less.

37. **Course Correctable Fuze (CCF)**. It is an economical via media, where a course correctable fuze is fitted on existing dumb shells to convert them into smart munitions.

38. **Bi-Modular Charge System (BMCS)**. The BMCS provides advantages in terms of achieving longer ranges, comparatively cooler charge system resulting in longer barrel life, elimination of wastage of propellants and ease of logistics.

Surveillance and Targeting Systems

39. The ***Surveillance Capability*** should be able to create real or near real time '**Situational awareness'** of the area of interest. Technologies should be developed which assist in detection and designation of targets using layered system of sensors. This will include: -

(a) **UAVs/ UCAVs**. In the mid as well as the long term, UAVs with on board multiple sensors like SAR, long range electro-optical (LREO) sensors, ELINT, COMINT, EW, communication repeaters, GPS, pod of IRLS and laser designators for targeting, etc would be required. The development of an Unmanned Combat Aerial Vehicle (UCAV) would be the next logical step towards minimizing sensor to shooter time with both the sensor and the shooter being on the same platform.

(b) **Micro / Nano UAVs**. Micro / Nano UAVs have variety of potential uses in military operations, including reconnaissance, surveillance, detection of intruders, border patrol, targeting and bio-chemical sensing. Types of nano UAVs are as enumerated below:-

(i) **Close-In Covert Autonomous Disposable Aircraft (CICADA)**. It is described as a 'paper airplane with a circuit board' and is intended to be deployed in 'swarms'. The CICADA swarm is dropped from an airplane to glide down to the earth's surface, directed by an on-board GPS which can guide the drones to within 4.5 meters of its target destination from a 17 kms descent. These are designed to operate as miniature, remote listening posts that, when scattered across a large area can be used to monitor enemy activity.

(ii) **Personal Reconnaissance System**. Personal reconnaissance system can track enemy movements and investigate suspicious objects. It is intended to be employed by troops in contact with enemy or in close proximity of enemy to obtain target data, pictures and videos transmitted to a portable base station. The system is equipped with regular and thermal cameras, has range of 1 to 2 km, it is hand launched and recovered and is ideal for missions requiring stealth surveillance.

(c) **Battlefield Surveillance and Weapon Locating Radars**. The BFSRs should have all weather day and night capability. Modern Weapon Locating Radars (WLRs) should help in quick and accurate location of multiple hostile mortars, guns and rockets simultaneously and also be capable of directing own artillery fire. WLR development should be based on active phased array or better technology to reduce reaction time for counter bombardment.

(d) **Positioning and Targeting**. The induction of rocket systems with range varying from 40 km to 90 km, necessitates the integration of satellite based positioning systems (IRNSS) for accuracy in locating, targeting and Post Strike Damage Assessment (PSDA).

Rocket and Missile Technology

40. **Rocket Systems**. The maximum range of the current rocket systems being inducted into the service is 90-100 kms. There is a need to develop rocket system of the range of 120-150 kms indigenously with reduced dispersion. The ranges could also be enhanced to 120-150 km by developing MBRL systems in the 250-300 mm calibre class. Solid propellants with high specific impulse should be developed for achieving longer ranges with radar based Trajectory Correction Systems.

41. **Missile Systems**.

(a) The aim is to develop missiles with longer ranges and higher accuracies for surgical strikes on high value strategic targets with minimum collateral damage.

(b) In case of cruise missiles, INS/GPS and Terrain Contour Matching Guidance (TERCOM) the current methods for cruise stage guidance while Active MMW/IR Seeker and Digital Screen Matching Co-relation (DSMAC) should be the main modes for terminal guidance. Milimetric Wave (MMW) seekers have better propagation qualities and resolution in battle field conditions and during adverse weather.

(c) Anti missile active and passive seeker defence technologies be developed for supersonic cruise missiles (like Brahmos), for short range missiles, long range sub-sonic cruise missiles and hyper sonic long range missiles.

COMBAT ENGINEERS: FUTURE TECHNOLOGIES

42. **Metallurgy**.

(a) **Composite Materials**. Composites which are light in weight and having sufficient strength, can be used for fabrication of track expedients to

enable quick passage of vehicle over poor trafficability stretches in inaccessible areas. These alloys could be metallic, composite or polymer based.

(b) **Aluminum Alloys**. Strong, sturdy and light weight aluminum alloys for fabrication of military bridging system upto load classification of 60 tons.

43. **Bridging System**. Military bridging plays a vital role in opening and keeping open routes across dry and wet gaps, both natural and artificial. The equipment has to cater for various load classes due to multifarious equipment in the inventory. Some of the bridges required in the near future are as given below:-

(a) **Mechanical Bridging System**. Mechanically launched modular bridging system with load classification of 60 Ton which can be launched upto 50 meters span in less than two hours. The modular designed bridges should be without any support and easy for construction in field conditions.

(b) **Manual Bridging System**. Manual bridging system of load classification 60 Ton with maximum spans of 200 meters. It should be modular in design and capability of being used over river and canal obstacles. The floating bridging system should be easy to assemble manually in five to six hours.

(c) **Aerial Cable Ways**. Aerial cable ways with suitable load carrying capacity are required for remote areas. These cable ways should have motorised mechanical haulage arrangements, easy to assemble, light in weight and ruggedised for deployment in extreme cold conditions.

(d) **Heliportable Bridging System**. Light weight bridge that can be constructed in plains and then carried under slung by helicopter are required. These bridging system should have 60 Ton capability and cover 15 to 20 meters spans.

44. **Mine Breaching**.

(a) **Mine Protection Shoes**. Protective shoes which can provide safety to a soldiers foot from an Anti Personals Mine containing upto 60 grams of explosive content. The shoe should be light in weight, easy to wear and walk in field conditions.

(b) **Influence Mine Breaching System**. A breaching equipment which can be fitted on to Armoured Fighting Vehicles to destroy Influence Mines ahead of the Armoured Fighting Vehicles by creating its magnetic / seismic signal.

(c) **Vehicle Mounted Mine Detection System (VMMDS)**. Vehicle Mounted Mine Detection System (VMMDS) having a combination of metal detector, ground penetrating radar and Infrared detection technologies. It should be able to detect presence of mines from sufficient stand-off distance.

45. **Mine Laying**.

(a) **Mechanical Mine Layer(MML)**. Self propelled Mechanical Mine Layer / burier based on High Mobility Vehicles or Tracked Vehicle which are capability of laying Anti Tank Mines. The MML should be able to lay 250-300 mines per hour and be integrated with navigation and minefield recording system.

(b) **Vehicle Based Mine Scattering System**. A vehicle based Mine Scattering System which is capability of scattering both Anti Personnel and Anti Tank Mines on either side and to the rear of the vehicle.

(c) **Automated Mine Field Recording System**. The equipment based on GPS with GIS background is required for recording of the individual mines. The hand held GIS / GPS based system should accurately and automatically record all the minefield data on to digitised maps with sub cm accuracy.

46. **Camouflage & Deception**.

(a) **Sign Management & Stealth Technical**. Camouflage system which can modulate the signature of the object it covers to deceive the observer and help in protecting the assets. It could be covering, paints, stealth technology solutions to achieve camouflage in field conditions.

(b) **Dynamic Camouflage Battle Suits**. Battle suits which are capable of changing its colour pattern as per the background to provide dynamic camouflage as per prevailing ground conditions

(c) **Multi Spectral Camouflage Net (MSCN)**. Camouflage equipment which has multi spectral capability to prevent identity/ recognition of equipment covered by it against Visual, Infrared, Thermal and Radar based sensors.

47. **Water Supply**.

(a) **High Head Water Pumps**. Light weight, manually carried High Head Water Pumps which can lift water upto 300 meters head for use in mountains. The pumps should have inbuilt engine working on fossil fuels.

(b) **Water Purification System**. A comprehensive mobile water purification system which utilises the latest techniques to provide clear portable water meets BIS standards with capability upto 13500 liters / hour.

(c) **Desalination Plants**. Mobile Desalination Plants which can be used in field conditions to provide clear portable water mounting BIS standards with capacity upto 13500 liters / hours.

48. **Liquid Soil Stabilizer**. To improve the bearing capacity of the soil by enhancing its strength liquid soil stabilizer are required which can be spread easily and faster. It should make the surface stable and strong enough for use as helipad in a short period.

49. **Air Cushion Vehicles (ACVs)**. The reconnaissance / patrolling and troop carriage capability is planned to be enhanced with inductions of ACVs for the Inland Water Transport units. These ACVs should have faster speed, capability of ops in shallow depth/ marshes, limited sea ferrying capability and have all others modern features like navigation, communication and limited protection against small arms firing.

50. **Mobilisation Decontamination System**. Mobile Decontamination System which can carry out chemical and nuclear decontamination of men, equipment and vehicles include tanks under field conditions. The system should be based on an HMV and capable of establishment under field condition within two hours. It should carry enough water for initial functioning of the system.

INFORMATION AND COMMUNICATION TECHNOLOGY

51. Like others, military is embracing, and being affected by, the Information and Communication Technology revolution too in a big way. This is leading to a new generation of sophisticated weapon systems with Electronics and Information Technology at their heart from Armoured Fighting Vehicles, Fire Power Systems and Logistics to the Combat soldier. The aspiration of the military are also enhanced by the plethora of sophisticated communications and IT equipment in the civilian arena.

52. The challenges facing the military so far as communications and IT are concerned can be broadly summarised as under:-

(a) Lighter devices with long battery life.

(b) Integration of plethora of communication equipment and systems.

(c) Security of communications, devices and applications.

(d) Obsolescence.

(e) Spectrum and bandwidth management as data requirements increase and move towards wireless devices.

(f) Applications development.

53. The manifestation of up gradation in technology will require improvements in fields given in subsequent paras.

54. **Radios**. With increase in number of radios in battle space, there is a need for radios that use intelligence to automatically adapt themselves to user needs and bandwidth requirements i.e. Cognitive Radios. This would include various levels of self configuration including automatic mode selection, optimal power output, power consumption and spectrum access.

55. **Smart Phones**. No other technology has changed our lives as much as smart phones. Military, like others, would like smart phones to provide multiple benefits including applications designed for military use, longer battery life, ruggedisation and faster data speeds. The biggest challenge lies in providing security for applications and device.

56. **Satellite Based Communication Devices**. Satellites provide the unique advantage of ubiquitous coverage and will continue to remain a preferred system of standby communications to ground based systems. The military would require devices which are portable, secure, integrable with other communication devices and can support greater bandwidth.

57. **Optical Fibre**. Till the emergence of an alternate media, optical fibre will form the primary means of backbone communications owing to their inherent security and extremely high bandwidth capacity. The military would require ruggedised OFC with high capacity terminal equipment which can perhaps replace field copper cables at some point of time.

58. **Integration**. As communication options, technologies and systems multiply, the greatest challenge lies in integrating these to work efficiently and securely. System integration is the biggest challenge facing a communications and IT specialist and would require integrating equipment from multiple firms with different protocols and interfaces.

59. **Social Media Analytics**. With widespread use of social media, its analysis for useful intelligence assumes greater importance. Tools need to be developed to enhance reach and engagement, analyse audience size and profile, carry out content analysis including sentiment and analyse traffic.

60. **Application Development**. While Army has progressed substantially with regards to creating cutting edge IT infrastructure, the applications running on them have lagged behind. These applications need to be user friendly, based on open source software, customisable and modular. These applications need to encompass operational, management, geographic and administrative domains.

61. **Operating Systems**. Operating systems with indigenous source codes are a necessity to obviate dependence on costly and insecure operating systems from foreign firms. These need to be customisable, usable in a wide variety of weapon systems and support backward integration.

62. **Basic Electronic Devices**. Despite of a robust electronics industry, a key area requiring immediate attention is fabrication of basic semi-conductor devices. This assumes significance in view of the fact that these could be the largest source

of malware and affect the entire supply chain, thereby having a critical effect during operations. Industry, with government support will need to create infrastructure for fabricating semi-conductor devices at the earliest.

63. **Cloud Computing**. Cloud Computing and virtualisation will provide the military with a few unique advantages. Firstly, these are cost effective, provide best possible use of existing equipment and are scalable. Secondly, as the number of equipment reduces its security becomes easier. Thirdly, with a premium on trained manpower, it provides the most optimum use of HR. Industry will need to provide solutions for infrastructure, platforms and software.

64. **Data Analytics**. One of the greatest challenges in the information era is the management and exploitation of plethora of data being generated by a variety of equipment ranging from sensors, combat equipment, cloud storage, social networking and multitude of internet enabled devices, commonly referred to as Big Data. Big data could potentially assist in automating some of the current labour intensive tasks and present information in a flexible and user friendly way. Much of data analytics is based on the fact that information is increasingly social (generated and transmitted by many users), mobile (collected by multitude of sensors and internet-based devices) and local (geo-spatially tagged). While much of data analytics happening in the commercial world have applicability in military, there is a need to create customised, intuitive and scalable solutions for unique military scenarios. Big data will allow large quantum of information to move quickly, be stored indefinitely and thus provide an opportunity to gain useful insights over time.

65. **Quantum Computing and Communications**. Quantum computers will be able to easily decrypt communications that are currently secure. Quantum based communication will also be able to work for long distances without being intercepted. There is a need to develop Quantum computing based solutions for communications and cryptography.

66. **Cryptography**. With advances in super computing, it may be possible to decrypt some of the encryption algorithms hitherto available. A field which, by its nature, requires indigenous capability has been dominated by government agencies. However, possibilities exist in development of advanced algorithms by the private industry, duly customized, for the military.

67. **Communication Media**. The trend in communication media as in the case of commercial arena is towards wireless devices and increased bandwidth. Towards this end advances in Free Space Optics and Laser based wireless communications, 5G wireless and latest multiplexing techniques have widespread military application and will need to be developed.

68. **Artificial Intelligence**. AI has emerged as one of the core technologies which will affect a wide variety of systems / equipments / weapons being developed and used by the Army. While its primary interest is in autonomous systems, both on ground and in air, it has likely applications in many other sectors.

These include autonomous agents in cyber security, autonomous sensors, time-critical intelligence, predictive and adaptive logistics.

69. **Electronic Warfare**. Being sensitive, development of this category of equipment will require indigenous effort. New trends in EW equipment including UAV/ aerostat based COMINT and ELINT payloads, advanced analytical software for spectrum capture including automatic location finding, fractal antennas, anti UAVs (RF) and radio finger printing will require further research and development.

ARMY AIR DEFENCE

Missile Propulsion and Guidance

70. **Surface to Air Missile (SAM) Systems.** Development / acquisition of SAM system with longer range, detection and multiple engagement capabilities is essential to enhance the standoff ranges with desired precision and increased survivability. Inevitably these would need to have high acceleration, agility, intelligence, ability to receive mid-course guidance and target recognition features to successfully engage manoeuvring, stealthy and supersonic hostile airborne objects. Developing such systems would involve optimization of following core technologies as pertaining to missiles and its subsystems:-

(a) **Propulsion System**. Suitable air breathing propulsion system needs to be developed for achieving supersonic and hypersonic velocities. The system could feature with utilization of higher density fuel, high thrust motor and rocket motor thrust magnitude control. The development of ramjet engine technologies will also accrue similar dividends. Among various rocket propulsion options available, solid and liquid rockets motors can give performance of up to around **300** seconds of specific impulse. Real breakthrough in performance should be aimed in propulsion systems beyond cryogenic engines by enhancing solid ramjet system developed for Akash System. Liquid ramjet system currently under development by the advanced countries can give a performance of up to 1000 seconds, while the supersonic combustion ramjets (scramjets) will drastically increase the performance to up to 3000 seconds and help in realizing the supersonic missiles like LRSAM, MRSAM, QRSAM /LLQRM/ Hyper Velocity Missiles for future.

(b) **Guidance, Seeker and Control Technologies**. Developing of improved mid-course guidance sys by combining INS and GPS to provide higher accuracies is becoming essential. The contemporary / futuristic missiles will incorporate GPS / INS, in flight guidance optimization and automatic target recognition. With the development of longer range SAMs, development of suitable seekers will need to be undertaken concurrently to ensure high accuracies. These seekers will need to posses all weather

capabilities incorporating advanced Electronic Counter Countermeasure

(ECCM) feature. The seeker technologies will include multi spectral, Synthetic Aperture Radar (SAR) and strap down and uncooled IR seeker.

(c) **Warhead**. While the warhead technologies have reasonably matured, efforts to improve upon the same would have to continue. Directional radio fuses for warheads need to be developed to concentrate fire power in the direction of the target and enhance lethality. High energy density warhead, multi mode warhead and power sub munitions would further enhance the lethality.

71. **Sensors**. Technologies that need indigenous R&D efforts include the following:-

(a) **Multifunction Phased Array Radars**. Phased array technology permits rapid beam steering capabilities which can provide almost continuous all round track-while scan surveillance capabilities, doing away with the limitations inherent in the rotating antenna. Advancements in component technology has resulted in development of solid-state microwave sub-sys viz, oscillators, low-noise and low power amplifiers, phase shifters, T/R modules using MMIC technology etc.

(b) **Synthetic Aperture Radars (SAR)**. SAR provides high-resolution three-dimensional imaging capabilities, a technology which has considerably matured over the last three decades. SAR combines all-weather and cloud-penetrating capabilities with optical resolution imaging capabilities, and is essential for effective and accurate airborne and satellite reconnaissance, including missile guidance. Development/ procurement of SAR therefore need to be accorded high priority.

(c) **Millimeter Wave Rdr (MWR)**. MWRs, operating at millimeter-wave frequencies around 94GHz (frequency band that coincides with a spectral region of minimal atmospheric absorption), have potential to generate high-resolution two-dimensional imagery. Developmental efforts on the related technologies need to be vigorously pursued.

(d) **Transmitters**. Wide-band transmitters, capable of generating complex signals for detection capabilities, need to be developed. Development in this area to evolve and optimize complex signals needs indigenous efforts so that the terminal performance of the rdr could be improved.

72. **Directed Energy Weapons (DEW)**. Use of high power chemical laser and particle beam based weapons is going to be realised in the near future. These weapons would have a wide range of applications starting from non-lethal dazzling weapons to soft kill weapons against targets such as satellites, electronic systems, information networks and sensitive electro-optic surveillance and tracking systems. Research needs to be undertaken in the areas of high powered lasers, particle beams and microwave beams to attain enhanced range, precision and lethality in future weapon systems like missiles, PGMs and other standoff armament delivered

by the aircraft as well. **The immediate needs of the Army in this field are as follows:-**

(a) **Anti UAV Weapon.** DEW for engaging enemy UAV in the 8-10 kms range capable of being designated and controlled by appropriate detection and tracking systems.

(b) **Precision Weapons and Dazzlers**. These should be developed for use by Special Forces / Anti Terrorist forces to make operations swift and surgical with minimum collateral damage.

ARMY AVIATION

Technological Advancements in Aviation

73. Future inventory of Army Aviation should ideally be capable of all-purpose all-weather role with multifarious tasks in order to support field forces in the Tactical Battle Area. The present day war requires modern fighting capability to match the highly mobile and fluid operations. Future advancements in technology directed toward achieving all-terrain, all-weather day and night operational capability, thus achieving full spectrum third dimensional capability. Certain important fields of development in aviation technology are as enumerated below:-

(a) Aircrafts in General.

(b) Helicopter Performance.

(c) Weapon Systems.

(d) Battlefield Survivability.

(e) Man Machine Interface.

(f) Autopilot System.

(g) Flight Controls.

(h) Avionic and Display Systems.

(j) Communication Systems.

(k) Surveillance System.

(l) Navigation Systems.

(m) All Weather Day and Night Capability.

(n) Engine.

(o) Advanced Structural Systems.

(p) Safety Features. (crashworthy features)

(q) Maintenance and Reliability.

(r) Simulators Training.

Aircrafts in General

74. Army Aviation would continue to induct modern systems and sub-system modernize the existing fleet for optimum utilisation and prolonged life of the equipment.

(a) **Light / Medium Multi-Role Helicopters**. Capability to perform multiple roles is one of the biggest advantages of helicopter platform. Trend is towards reducing the inventory by being able to perform multiple roles with a single machine.

(i) **Utility and Troop Transportation**. A typical light helicopter should be able to carry five to 10 combat persons and a Medium lift helicopter should be able to lift 20-25 combat soldiers over 200 to 300 km.

(ii) **Fire Support**. Light and medium helicopters should be capable of providing inherent protection against small arms to the heli-borne troops enabling them to operate alongside the ground troops for optimal exploitation of TBA.

(b) **Armed Reconnaissance and Surveillance**. Helicopters would need to be capable of undertaking close and confirmatory reconnaissance and maintain visual and electronic surveillance over a vast and hostile terrain in all weather and by day and night. For this, future platforms, especially light reconnaissance and surveillance helicopters, should have advanced electro-optical systems, radars and sensors along with limited weapons, and self protection systems depending upon the perceived threat.

(c) **Attack Helicopters**. Light and medium Attack Helicopters are capable providing decisive edge in manoeuvre battle. The latest trends in this field are directed towards:-

(i) Highly agile and maneuverable platforms with enhanced fire power and precision strike capability.

(ii) Integrated avionics, weapon, navigation and self protection system to order to provide self contained as well as aided sensing, analysis, decision making and targeting capability.

(iii) Enhanced all weather, day and night flying and fighting capability with reduced down time for maintenance, refuelling and arming.

(d) **Electronic Warfare Helicopters**. An Electronic Warfare Helicopter should be able to capturing signal and electronic intelligence and also be capable of denying enemy his own communication by effectively jamming larger area.

75. **Weapon Systems**. Helicopter borne armament package basically include guns both turret and podded, rockets with carrier shells capable of being fired in direct and indirect firing mode, Air to Air Missiles and Air to Ground Missiles. Trend is also to fire smart bombs and rockets from helicopter platforms equipped with millimetre wave seekers for anti-tank missiles to counter the IR protection and ECM measures adopted by likely targets in the TBA.

76. **Battlefield Survivability**. A high degree of survivability needs to be built in into the helicopters of the future in order to survive in an intense battle field. Survivability is based on the maxim “avoid being seen, if seen do not be hit, and if hit, survive to fight”.

77. **Stealth**. Adequate means to avoid being detected using Low Radar Signature techniques, Low Thermal and IR Signature and Noise Reduction.

78. **Means to Avoid Being Hit (If Seen)**. Adequate means to avoid being hit by employing advance techniques like Missile Approach Warning System (MAWS), Directed Infrared Counter Measures (DIRCM), Counter Measure Dispensing System (CMDS) and Integrated Self Protection Suite (ISPS).

79. **CROSSHAIRS**. Counter Rocket Propelled Grenade and Shooter System with Highly Accurate Immediate Responses to take the detection capabilities of a helicopter to a definite new level. It works by using advance sensors able to detect the supersonic shock wave or “crack” produced by a bullet in flight and pinpointing its source and thus is able to warn aircrews of incoming small-arms or machine-gun fire with enough time to take evasive action and launch a counterattack.

80. **Man Machine Interface**. Advancements in this field are towards prevention of human factor contribution to the accidents and mission failures by influencing sensing, perception, expectations, decision-making and action on part of pilot.

81. **Automatic Flight Control System (AFCS)**. Enhanced autopilot features coupled on board avionic systems (e.g. OAS, GPWS, and TACAS etc) and navigation systems permit the pilot to undertake high gain missions in all weather conditions, poor visibility and dark nights.

82. **Flight Controls**. Modern trend is towards having power operated flight control systems with built in redundancy, which in case of failure are able to revert to standby system. For light weight helicopters, manual mode operations are also possible as a standby mode.

83. **Avionics and Display System**. The tactical and helicopter related information should be readily available for real time decision making by the crew. Onboard computers with advanced decision-making software to reduce crew workload while increasing situational awareness.

84. **Communications**. Onboard communications managed by Radio Management System interfaced with IADS. Single frequency hopping radio set capable of communicating in Low VHF to High UHF band in secure mode and with capability of transmitting from very low power output to high power outputs to

achieve longer ranges. Incorporated data link to interface with other airborne platforms like Fighters, UAVs, AWACs, ships and helicopters. This would provide better battlefield situational awareness, reduce fratricide and enhance air space management.

Surveillance Systems

85. **Integrated Reconnaissance and Surveillance System**. Future battlefield and roles would require visual, Ultra Violet (UV), Infra Red (IR) and electronic mapping/ survey of own territory, vital areas and would not be restricted to enemy area. In order to meet present and future battlefield transparency requirements, surveillance and reconnaissance systems consisting of Ultra Violet Sensors, Electronic Surveillance, Infra Red Band Sensors, Visual Band Sensors, Synthetic Aperture and Inverse Synthetic Aperture Radars (SAR and InSAR) and Active Electronic Scanned Array (AESA) would be required.

Navigation Systems

86. **Navigation**. The present trend is towards having essentially a primary satellite based navigation system and a secondary independent navigation system duly integrated with the satellite based primary system. Both systems would have capability of independent operation and would be capable of providing accurate navigation data in case of failure of the other system. Ability to fly low and navigate at night and poor visibility in any type of terrain and anywhere on earth, are necessary for sustenance in battle field inside or for any contingency arising outside the country.

All Weather Day and Night Capability

87. **Collision Avoidance Systems**. This factor assumes even greater importance while flying in degraded visibility conditions in high density air operations as would be the case in TBA, the sys would encompass Ground Proximity Warning System (GPWS), Terrain and Collision Avoidance System (TCAS), Obstacle Avoidance System (OAS), Radio Altimeter, Weather Radar, Laser Detection and Night Vision Goggles (NVG).

88. **Power Plant**. Development trends in this field are towards having electronic engine control mechanisms (e.g. FADEC) with dual channels, and cross talk in case of multiengine helicopter. Improvements in this field have resulted in aircraft capable of carrying higher payload, increased radius of action and endurance

Advanced Structural Systems

89. **Airframe**.

(a) Future aircrafts should be air transportable by C-17, C-130 or IL-76 class aircrafts. They should be easy to dismantle and re-assemble even in field conditions.

(b) Cold weather operations would be facilitated by provisioning icing detection and anti-icing devices for rotor blades and engine(s).

(c) Adequate vibration control measures, both passive and active, to reduce the crew and airframe fatigue.

(d) **Integrated Dynamic Systems or Gear Boxes**. Metallurgical advancements to have light weight and sturdy dynamic systems with intermeshing gears enabling them to withstand high torque loads and dry running capability.

(e) Alloy/ composites/ fibre glass/ laminates main rotor and tail rotor blades and outer body structures to give them higher load bearing strength with lighter weight, greater life and survivability.

90. **Signature Management and Stealth Technology**. Stealth should become a major design feature of all modern platforms and weapons especially in the design of UAVs and helicopters. This should be aimed at by controlling directionality (by flat panels tilted away from radars), reflectivity, thermal shielding, tempering sound emissions with tail rotor shrouds and multi - blade main rotor systems and signature management.

Training

91. **Simulators**. To reduce cost of training, depict scenarios not possible during actual flight and practice procedures for emergency handling, weapon firing and combat manoeuvres etc suitable simulators need to be acquired. Simulators must have six direction of freedom and give near realistic training to the air crew. Simulators for weapon training both in individual training mode and in multi-aircraft tactical mission mode would be required to be procured.

PART - 2

PROBLEM DEFINITION STATEMENT

PROBLEM DEFINITION STATEMENT - 1

IDENTIFICATION OF FRIEND OR FOE (IFF) SYSTEM FOR ARMOURED FIGHTING VEHICLES

1. **Short Title**. IFF System for Armoured Fighting Vehicles.

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

3. **Type of Problem**. Unresolved.

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

   (a) **Statement of Problem**. To positively identify the opposing armoured vehicle prior to engagement.

   (b) **Evolution of the Problem**. On battlefield, Armoured fighting vehicles would be required to engage enemy armoured fighting vehicles in time critical situations necessitating shortening of decision loop for engagement without positive identification of friend or foe which at times lead to fratricide by friendly fires. IFF system is a tool of **Combat Identification**, "the process of attaining an accurate characterization of detected objects in the operational environment sufficient to support an engagement decision". It also contributes to the overall tactical decision making.

   (c) **How it is Being Overcome**. Presently, the problem has not been overcome. It is the visual judgment of the commander of the Armoured fighting vehicle to engage the opposing armoured vehicle.

   (d) **Any Innovations to Locally Overcome the Problem**. Formations/Units do innovate to overcome the problem by carrying out fluorescent markings on the front and rear, metal markers or attachments which always do not prove to be successful in positive identification of friendly vehicle or otherwise.

5. **Who has the Problem**. The problem is being faced by the crew of Armoured fighting vehicles on the battlefield.

6. **Why it is Important to Solve**. It is important to solve the problem to prevent fratricide on the battlefield leading to loss of men and equipment.

7. **Contemporary Solution by other Countries / Organisations**. The leading design manufacturers of Armoured fighting vehicles worldwide are working towards developing visual solutions duplicated by the electronic solutions for positive identification to obviate chances of fratricide during engagements on the battlefield.

8. **Timelines**.

(a) Development of a system -12 months.

(b) Prototype & trials - 6 to 8 months.

9. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No - 011-23019003
Email – ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Directorate General of Mechanised Forces
Tele No - 011-23333569

PROBLEM DEFINITION STATEMENT- 2

BUOYANCY ENHANCERS FOR TRACKED VEHICLES

1. **Short Title**. Buoyancy Enhancers for Tracked Vehicles.

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

3. **Type of Problem**. Partially resolved.

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

   (a) **Statement of Problem**. To augment buoyancy of upgraded tracked vehicles whereby they remain amphibious in the battlefield despite additional weight penalty due to upgrades.

   (b) **Evolution of the Problem**. The tracked vehicles held on the inventory of Indian Army are amphibious and are capable of crossing water channels in the battlefield. However, to keep the vintage equipment aligned to the current technology, system/sub systems need to be upgraded which impacts the overall weight affecting the buoyancy of the tracked vehicle while crossing water channels. The need is to develop quick inflatable attachments which could attached to the underbelly, side guards or the wheel hubs of a tracked vehicle prior to entry into water and deflated post exit.

   (c) **How it is Being Overcome**. Presently, the tracked vehicles held on the inventory of Indian Army are of old vintage with very few upgrades. The altering of weight configuration is a restrictive factor in seeking upgrades.

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

5. **Who has the Problem**. The problem is being faced by Mechanised Infantry in finalizing the upgrades for the tracked vehicles since the amphibious capability or the buoyancy is affected.

6. **Why it is Important to Solve**. It is important to solve the problem to facilitate system up gradation of tracked vehicles without adversely impacting amphibious capability of these vehicles.

7. **Contemporary Solution by other Countries / Organisations**. The leading manufacturers of Tracked Vehicles worldwide are in pursuit of developing solutions for enhancing buoyancy of tracked vehicles.

8. **Timelines**.

   (a) Development of a system - 2 months.

   (b) Prototype & trials - 6 to 8 months.

9. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No - 011-23019003
Email – ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Directorate General of Mechanised Forces
Tele No - 011-23333569

PROBLEM DEFINITION STATEMENT- 3

SOLAR ASSISTED AUXILIARY POWER UNIT FOR ARMOURED FIGHTING VEHICLES

1. **Short Title**. Solar Assisted Auxiliary Power Unit for Armoured Fighting Vehicles (AFVs).

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

3. **Type of Problem**. Poorly resolved.

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

   (a) **Statement of Problem**. Provision of power supply to system /sub system of AFV in surveillance mode in battle field.

   (b) **Evolution of the Problem**. The engine of an AFV is the main source of power for functioning of all system/sub systems. It is imperative to have an alternate source of power catering for the requirement when deployed in surveillance mode on battlefield thereby conserving the engine life and carrying out the assigned task in a discrete manner. An **Auxiliary** Power Unit assisted by solar power capable of running continuously for six hours and capable of operating in temp rgs of -20ºC to +55ºC would be the ideal solution. The system must be compatible with the main power supply of the AFV with a voltage range from 22V DC to 29V DC (Nominal Voltage 27V DC).

   (c) **How it is Being Overcome**. Presently, the problem has not been overcome. Battle field surveillance is being carriedout by utilizing the main engine of the AFV which adversely impacts engine life and compromises the location of the AFV on the battlefield.

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

5. **Who has the Problem**. The problem is being faced by the crew of AFVs on the battlefield.

6. **Why it is Important to Solve**. It is important to solve the problem to conserve the engine life of an AFV.

7. **Contemporary Solution by other Countries / Organisations**. The leading AFV design manufacturers worldwide are developing solutions to resolve the requirement of power during surveillance mode in AFVs.

8. **Timelines**.

(a) Development of a system - 12 months.

(b) Prototype & trials - 6 to 8 months.

9. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No - 011-23019003
Email – ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Directorate General of Mechanised Forces
Tele No - 011-23333569

PROBLEM DEFINITION STATEMENT - 4

BODY ARMOUR

1. **Short Title**. Body Armour.

2. **User Directorate**. Director General of Infantry.

3. **Type of Problem**. The problem is poorly solved.

4. **What is the Problem**.

   (a) **Statement of the Problem**. The existing Kevlar body armour used by the soldier in the form of bullet proof jacket and patka is heavy and offers limited protection.

   (b) **Evolution of the Problem**. The existing bullet proof jacket is of 2002 vintage. It does not provide all round protection. It has a hard armour plate in the front and in the rear but no protection on the sides and neck and collar area. It is found to be heavy (5.5 Kg) and ergonomically uncomfortable to wear. It does not meet the international standards for protection (NIJ level III) for 7.62 x 51mm ammunition. The bullet proof patka is also heavy and weighs 1.7 Kg. It covers only the sides of the head and leaves the top exposed. The forehead plate does cater for ballistic protection from 7.62 mm ammunition, however, the side plates cater for protection only from 9 mm ammunition.

   (c) **How it was Being Overcome**. The problem is yet to be overcome. However, process is on to procure bullet proof jackets with neck and collar pads.

   (d) **Any Innovations to Locally Overcome the Problem**. No innovations have been carried out.

5. **Who has the Problem**. The requirement is for the troops deployed in counter insurgency areas and carrying out operations on daily basis in a hostile environment.

6. **Why is it Important to Solve**. Army needs new generation body armour in the form of bullet proof jackets and patkas which are ergonomically designed, light weight and modular. It should provide required protection against current and emerging small arms threat.

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

   (a) **Graphene Composite**. Graphene is manufactured as a material for use in body armour. Structurally, Graphene is a sheet of single carbon atoms bonded together in a honeycomb shape, strong for its slight weight, potentially making it an ideal material for body armour.

(b) **Nanomaterials in Ballistics**. It is based on nanoparticles that become rigid enough to protect the wearer as soon as energy threshold is surpassed. It is light and flexible, allow soldiers to be more mobile.

(c) **Iron Based Thickening Fluid**. An oily fluid filled with iron particles when activated with a magnet, transforms to a rigid material within less than a second as these particles are pulled together due to the effects of the magnet.

(d) **Carbon Nanotubes**. Cabon nanotubes, due to their unique combination of high elastic modules and high strain to failure are capable of elastically storing an extreme amount of energy, which can cause the bullet to bounce off or be deflected. This attribute of carbon nanotubes can also provide the armour improved protection against blunt trauma effects.

8. **Timelines**. Two to three years.

9. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No - 011-23019003
Email – ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Directorate General of Infantry
Tele No - 011-25694694

PROBLEM DEFINITION STATEMENT - 5

SITUATIONAL AWARENESS

1. **Short Title**. Situational Awareness.

2. **User Directorate**. Director General of Infantry.

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

4. **What is the Problem**.

   (a) **Statement of the Problem**. The present day infantry soldier is not equipped with any situational awareness sub-system to keep him updated on the battlefield.

   (b) **Evolution of the Problem**. The existing helmet of an infantry soldier is used as a standalone only to cater for protection. There is no provision of a helmet assembly which acts as a hub for real time situational awareness. Within the sub unit, communication is carried out by voice as the soldier is not equipped with radio set and there is no arrangement for real time feed of images or data. Acquisition and engagement of target is difficult. A soldier is not fully aware of the progress of the battle, dispositions of own as well as en forces which restrict exploitation of fleeting opportunities at the sub unit level.

   (c) **How it was Being Overcome**. The problem is being addressed to an extent by ensuring effective command and control at the level of sub unit where the sub unit commander ensures that troops are updated from time to time through briefings and during battle by voice control.

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

5. **Who has the Problem**. The requirement is for the soldiers operating in conventional and sub conventional operations.

6. **Why is it Important to Solve**. The situation in operations will require a transformed soldier capable of contending with fleeting opportunities. Existing helmet needs to be evolved into a helmet assembly that caters not only for protection but as a situational awareness hub of the soldier. It should have arrangement for mounting an advanced night vision device. The visor as part of the protection system against dust should also be integrated to act as a heads-up display monitor. To facilitate inter communication within the sub unit, the soldier needs to be equipped with software defined radio.

7. **Contemporary Solution by Other Countries/ Organisations**. To enhance the soldier situational awareness, the US land warrior programme has developed an assembly to provide communications (speaker and microphone) and a hands-free display (helmet mounted display for viewing maps and test

messages) mounted on to a standard helmet. These technologies are being integrated into the information system to provide key capabilities to the soldier including:-

(a) Fused, multi special, helmet mounted sensors.

(b) High resolution, see-through, helmet-mounted display.

(c) Communications (Speaker and microphone).

8. **Timelines**. Two to three years.

9. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No - 011-23019003
Email – ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Directorate General of Infantry
Tele No - 011-25694694

PROBLEM DEFINITION STATEMENT- 6

NIGHT VISION DEVICE

1. **Short Title**. Night Vision device.

2. **User Directorate**. Director General of Infantry.

3. **Type of Problem**. Poorly solved.

4. **What is the Problem**.

   (a) **Statement of the Problem**. The presently held weapon night sights and night vision binoculars based on 2nd generation technology are not very effective.

   (b) **Evolution of the Problem**. The existing night vision sights are stand alone sights that can be fitted on weapons. The weapon has to be raised to the eyes for aiming at the target. The image formed is of poor quality and range is very limited. Moreover, the equipment is based on 2nd gen image intensification technology and is not effective especially while operating in pitch dark conditions. As a result, acquisition and engagement of targets at night is difficult.

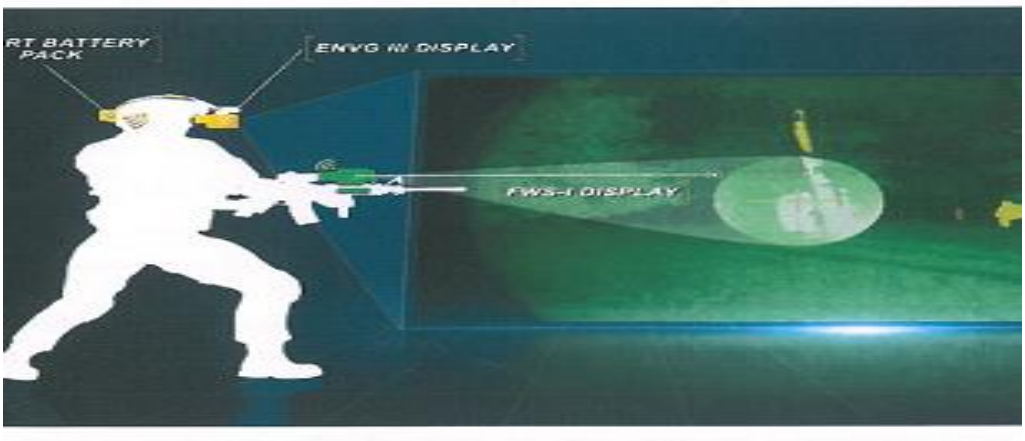
   (c) **How it was Being Overcome**. The problem is being overcome to an extent by means of illumination of target area using illumination bombs.

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

5. **Who has the Problem**. The problem is being faced by soldiers operating both in conventional and sub conventional environment. The equipment is required to be used on daily basis.

6. **Why is it Important to Solve**. The ability to operate optimally at night and through conditions of poor visibility has become a crucial battle winning factor. It demands quick acquisition and engagement of target. As our adversaries are in the process of enhancing their night fighting capabilities, there is a need to empower the soldier to fight efficiently during hours of darkness.

7. **Contemporary Solution by other Countries/ Organisations**. The recent development is the **enhanced night vision goggles**. Rifle mounted light weight thermal sight is designed to communicate wirelessly with latest Enhanced Night Vision Goggle (ENVG). By linking these two tech, rapid tgt acqn with enhanced accuracy at night is achieved. It enables soldier to aim his weapon without raising it to his eyes. The system will be used by troops in operations to facilitate speedy acquisition and accurate engagement at night and during poor visibility. US Army is set to deliver this ni fighting capb to its troops by 2018.



8. **Timelines**. Two to three years.

9. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No - 011-23019003
Email - ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Directorate General of Infantry
Tele No - 011-25694694

PROBLEM DEFINITION STATEMENT- 7

FOLIAGE PENETRATION RADAR TECHNICAL INTEGRATION WITH NIGHT VISION / SURVEILLANCE DEVICES

1. **Short Title**. Foliage penetration radar technical integration with night vision / surveillance devices.

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

3. **Type of Problem**. Poorly solved.

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

   (a) **Statement of Problem**. A huge proportion of our forces are deployed in J&K and NE regions of the country. Vegetation cover in such areas is vast which facilitates the irregulars/ANEs to close-in on own troops without being detected and launch surgical strikes. Though a large number of NVDs are held with the unit, foliage penetration remains a challenge. Presently, there is no worthwhile solution to this handicap with our armed forces.

   (b) **Evolution of the Problem**. A large number incidents have occurred where the targets have managed to infiltrate without being detected and inflict heavy causalities on own troops. The NVDs were redundant due to the thick vegetation cover around own location. Vegetation cover, however, is essential to maintain camouflage and concealment but its effect is double edged upsetting own design of operations often.

   (c) **How it was being Overcome**. Local arrangements and innovations are being applied with meagre advantages thereby jeopardizing lives of own troops.

   (d) **Any Innovations to Locally Overcome the Problem**. Innovative ideas and methods have been adopted to acquire EW signals either electronically or mechanically providing optimal reaction opportunities to own troops in case of certain eventualities.

5. **Who has the Problem**

   (a) **User (Skill Sets)**. Own troops deployed in active field.

   (b) **Operating Environment**. Troops deployed in Counter Insurgency /Counter Terrorism and Line of Control /Anti Infiltration Obstacle System postures.

   (c) **Periodicity of Exploitation** . Routinely on a daily basis.

6. **Why is it Important to Solve**. Operational blindness/lack of surveillance renders the fighting ability of own troops and incapacitates the soldier with min/no reaction capability. In-service equipment lack such technology and the innovative solutions are not fool-proof.

7. **Contemporary Solution by other Countries/Organizations**. Foliage penetration radar technology is available with few countries like USA, France, etc. However, the technologies are mostly fitted on airborne devices. Major success has not been achieved in ground based equipments with absolute clarity to facilitate detection, identification and recognition of the target objective at suitable ranges thereby providing adequate reaction capabilities.

8. **Timelines**. At the earliest.

9. **Point of Contact**.

(c) **Primary Contact**.

Army Design Bureau
Tele No - 011-23019003
Email – ddgtechres-mod@gov.in

(d) **Secondary Contact**.

Directorate General of Infantry
Tele No - 011-25694694

PROBLEM DEFINITION STATEMENT- 8

MOBILITY OF GUNS IN MOUNTAINS

1. **Short Title**. Mobility of Guns in Mountains.

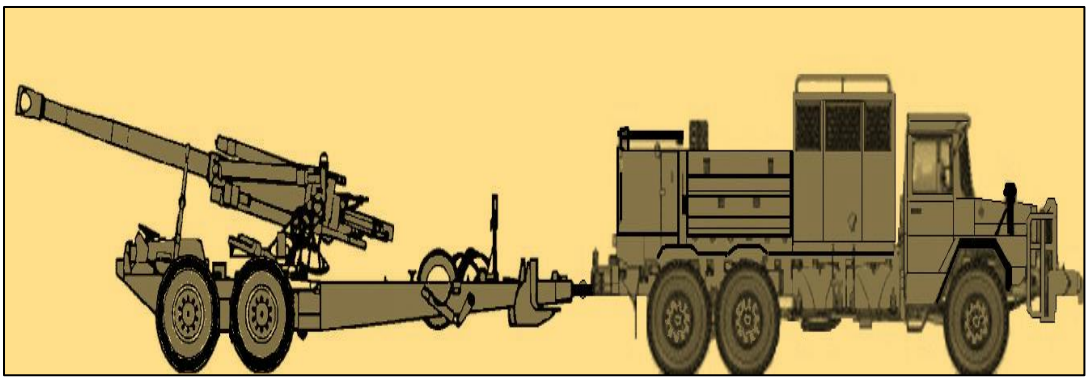
2. **User Directorate (s)**. Director General of Artillery.

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

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

(a) **Statement of Problem**. The mobility of artillery guns is severely constrained in mountains due to difficult terrain, steep gradient, weight and turning radius of towed artillery guns. Integrated mobility solutions are required to enhance the mobility of guns by road.

Mountain Road Characterising Steep Gradient & Sharp Hair Pin Bends



Artillery Gun in Towing Position

(b) **Evolution of the Problem**. The erstwhile mountain guns were of lower caliber and had limited range and lethality. Change in the threat perception and war fighting philosophy necessitated the need for artillery guns with longer ranges and high lethality. The guns & howitzers used in plains were deployed in mountains without any major design changes. Steep slopes of mountainous terrain coupled with narrow roads/tracks with sharp hair pin bends impose severe mobility constraint on gun system presently deployed in mountains.

(c) **How it is Being Overcome**. The problem is being overcome by utilising one or more of the following methods:-

(i) Selective earth work to widen the existing roads & tracks in mountainous areas (time consuming and labour extensive solution).

(ii) Unhooking the gun from prime mover and turning the gun manually to negotiate hair pin bends.

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

5. **Who has the Problem**. The problem is faced by the driver of prime mover and gun crew in mountainous terrain. The problem pertains to mobility of towed guns in mountains, the mobility aspect has not been designed / optimised for the operating environment.

6. **Why it is Important to Solve**. The improvement in mobility of artillery guns in mountains will ensure quick deployment of guns in operational area. It will improve the overall operational preparedness of Indian Army.

7. **Contemporary Solution by other Countries / Organisations**. Combination of one or more of the following solutions is used to improve mobility of guns:-

(a) Reduce turning radius.

(b) Design aspects to reduce the overall length of gun by :-

(i) Limited retraction of barrel in travel mode (130mm gun).

(ii) Folding the barrel over the trails when gun is being towed.

(c) Reduction of weight of gun to improve gradient negations capability of prime mover in mountainous terrain.

8. **Timelines**.

(a) Improvement in design - 12 months.

(b) Use of alternate material to reduce weight of gun-12 months (concurrently).

(c) Prototype & trials - 8 to 10 months.

9. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No - 011-23019003
Email – ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Directorate General of Artillery
Tele No - 011-23333617

PROBLEM DEFINITION STATEMENT- 9

DISPERSION OF ARTILLERY SHELLS

1. **Short Title**. Dispersion of Artillery Shells.

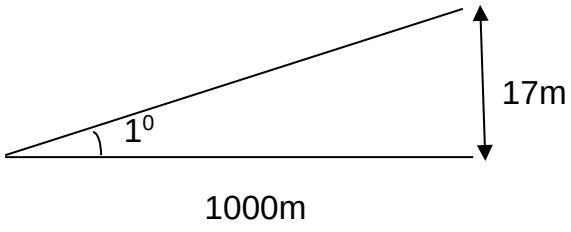
2. **User Directorate (s)**. Director General of Artillery.

3. **Type of Problem**. Poorly solved.

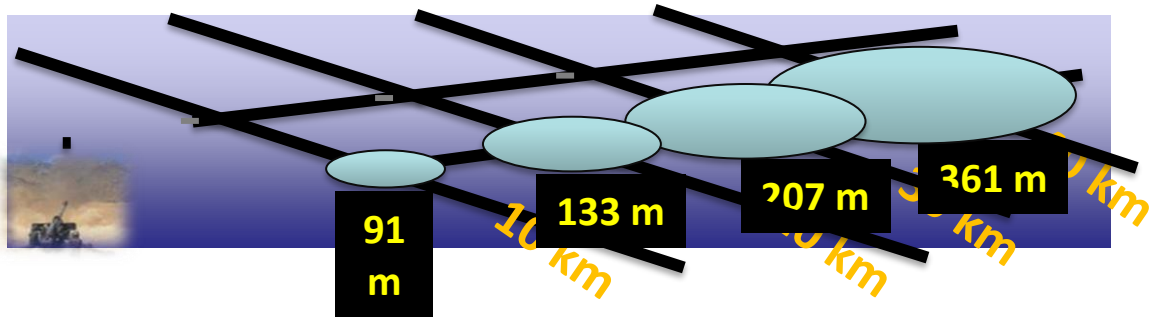
4. **What is the Problem (Need)**.

(a) **Statement of Problem**. The dispersion of artillery shells increases with increase in range, along both the axis (longitudinal and lateral), which needs to be addressed to achieve high predictability and accuracy at all ranges.

(b) **Evolution of the Problem**. The inaccuracies in the artillery fire are primarily attributable to dynamic meteorological conditions, variations / inaccuracies in ammunition and inaccuracies in gun due to tolerance limits of various gun sub systems. The inaccuracies at target end increases as the range increases due to subtention factor. The modern guns have ranges of 30 to 40 km which result in large dispersion at target end and inaccuracy in engagement of target.



1^0 at 1000 meters subtends 17 meters



Dispersion at Various Ranges

(c) **How it is Being Overcome**. Presently the ibid problem is being overcome in a hybrid manner by improving gun sub systems and by predicting or measuring prevailing meteorological conditions.

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

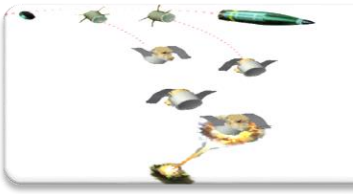
5. **Who has the Problem**. The problem is faced by the artillery forward observation officer, who is responsible for engagement of targets.

6. **Why it is Important to Solve**. It is important to solve the problem to engage enemy targets with speed and accuracy and to inflict maximum damage with minimum ammunition and cost.

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

(a) Development of smart munitions.

Terminally guided munition



Sensor fuzed munition

Trajectory correctable ammunition

(b) Improving the accuracy of gun by employing state of the art fire control systems.

8. **Timelines**.

(a) Design & Development Stage - 12 to 15 months.

(b) Trials - 6 months.

9. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No - 011-23019003
Email – ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Directorate General of Artillery
Tele No - 011-23333617

PROBLEM DEFINITION STATEMENT - 10

LIGHT WEIGHT ALLOY FOR BRIDGES IN FIELD

1. **Short Title**. Light weight alloys for manufacturing of field bridges.

2. **User Directorate**. Combat Engineer Directorate.

3. **Type of Problem**. Poorly Solved.

4. **What is the Problem**.

(a) **Statement of Problem**. Development of light weight alloys for field bridges of the Indian Army which is using imported bridging system of 1970s or earlier technology. Indigenisation of the Military Bridge System through Defence Research and Development Organisation (DRDO) is progressing since 1990s. However, the aluminium alloy used in developing these systems is failing to meet the reliability standards. Hence, the metallurgy of these bridging system is a poorly solved solution.

(b) **Evolution of the Problem**. The Indigenously developed bridging system by DRDO are reverse engineering solutions to existing imported military bridging. The indigenous bridges are designed using aluminium alloy developed by DRDO. These bridging system have developed major problems within short period due to poor metallurgy of the aluminium alloy.

(c) **How it was Being Overcome**.

(i) The rectification of the faults is being carried out by replacing aluminium alloy components with much heavier steel components.

(ii) The deck and beams of the bridge manufactured by even different aluminium alloy are also showing signs of stress in the form of cracks or pitching of roadway surface.

(iii) The shift to steel components wherever feasible is being resorted to. The solution is being developed in an adhoc manner, as the bridges are being exploited and newer faults are detected.

5. **Who has the Problem**. The problem is with the metallurgy of the current bridges which are being used in the Army.

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

(a) The effort to indigenously manufacture field bridge system is not being achieved completely.

(b) The field bridge systems have to be mobile, capable of moving X-Country and laid mechanically or manually. Thus, they need to be light weight and strong.

(c) Light weight alloy material with sufficient strength is required to be developed so that the bridge systems are sturdy, reliable and sustainable up to their envisaged life. The following aspects must be ensured while deploying these materials which will allow their usage without dependence on imports:-

(i) **Raw Materials**. Raw materials required for development of advance materials should be abundantly available in the country with minimum important dependence.

(ii) **Processing**. Refining and processing of raw materials to produce critical materials involve indigenous process and system.

7. **Contemporary Solution by other Countries.** Limited countries manufacturing military bridge systems have well established R & D in metallurgy science. The military bridge system seldom develop any failures due to materials used in manufacturing them.

8. **Timelines**.

(a) Development of new light weight alloy - 12 months.

(b) Manufacturing and trials - 18 months.

9. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No - 011-23019003
Email – ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Engineering-in-Chief Branch
Tele No - 011-23019023

PROBLEM DEFINITION STATEMENT - 11

CAMOUFLAGE IN FIELD : THE INVISIBLE MAN

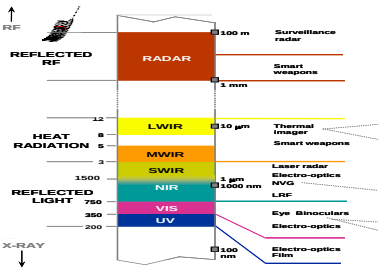
1. **Short Title**. Camouflage of a soldier in field to achieve invisibility.

2. **User Directorate**. CE Directorate.

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

4. **What is the Problem**.

(a) **Statement of Problem**. Soldiers are required to be camouflaged from enemies 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 soldier is able to reach his objective without enemy being able to locate him.



(b) **Evolution of the Problem**. Camouflage is the art and science of concealment and visual deception in war by defeating enemy's observation by disguising or concealing. 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 to overcoming is by following camouflage techniques of camouflage suits, camouflage paints and multi spectral camouflage nets. However, these all are passive means and does 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. **Whom has the Problem**. The problem is a challenge for the individual soldiers and fighting vehicles 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 devp countries have achieved better level of camouflage by improving measures and are developing active camouflage tech required to ensure invisibility of a soldier and a tank in field. The future camouflage technologies which are being developed across the world are as under:-

(a) **Optical Camouflage**. The latest in the field of active camouflage is the concept of Optical Camouflage, which is referred to as the Invisible Man Technology. Optical Camouflage is an active camouflage in which the image displayed is of the scene on the opposite side of the viewer, so that the viewer can see through the wearer, thus rendering it invisible. It works by creating optical camouflage across the visible light spectrum. It would require a coating or suit covered with tiny cameras and projectors, programmed to gather visual data from multitude of different angles and projecting the gather image outwardly to give the illusion of invisibility from all angles. It requires sophisticated nanotechnology in cameras, projectors and computers – yet in development phase.

(b) Other variations of same technology are e-Camouflage. E-Camouflage uses electronic sensors attached to a transport exterior to process surroundings – then recreates colors, lines, and shapes within the environment to the transport device surface. This equates to camouflaging in "real-time". It is an UK based initiative particularly aimed for moving tanks.

(c) **Quantum Stealth**. This is being devp by Canadian Camouflage Design Company. It is a material that renders the target completely invisible by **bending light waves around the target**. The material removes not only your **visual, infrared** (night vision) and **thermal signatures** but also the **target's shadow.** It is light wt, made of Nano technology or Metamaterials.

8. **Timelines**.

(a) Development of Invisible man tech - 24 months.

(b) Manufacturing and trials - 18 months.

9. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No-011-23019003
E Mail-ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Engineering-in-Chief Branch
Tele No-011-23019023

PROBLEM DEFINITION STATEMENT - 12

FUEL AIR EXPLOSIVES FOR MINEFIELD BREACHING

1. **Short Title**. Development of Fuel Air Explosives to breach minefields.

2. **User Directorate (s)**. Combat Engineer Directorate.

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

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

   (a) **Statement of Problem**. Mines are employed by defender to create artificial obstacles to restrict mobility of attacker. The attacker needs to breach these minefields faster than the defender is able to regroup and reposition his resources. The current method of mechanical breaching of mine fields is time consuming besides equipment and manpower intensive. Fuel air explosive is an technology which needs to be developed for quick clearance of mine fields.

   (b) **Evolution of the Problem**. Mobility in battlefield is restricted by employing mines to create minefields to delay, cause attrition, channelize, and create bottlenecks in the axis of advance of the forces. The advancing forces employ various manual and mechanical means to breach lanes through these minefields to ensure mobility of own forces. The time required to breach these lanes needs to be reduced to ensure speed, achievement of surprise and shock action during offensive operations.

   (c) **How it is Being Overcome**.

      (i) The current means include manual and mechanical breaching of vehicle safe lanes by employing specialist equipment and skilled manpower in plains and deserts.

      (ii) Manual breaching is resorted to in mountains to create safe lanes for move of individuals and stores.

5. **Who has the Problem**. The problem is faced by offensive troops of the Army which are required to advance and capture enemy territory for decisive victory in war. It is faced in all terrains and by all formations.

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

   (a) The current methods of breaching besides equipment and manpower intensive impose time penalty during operations and result in casualties.

   (b) A quick explosive option using fuel air explosive will ensure saving of critical time besides equipment, manpower and casualties.

(c) It will provide a solution for breaching all types of mines laid in the minefield.

7. **Contemporary Solution by other Countries/Organisations**. Bulk of the countries still follow mechanical breaching means but certain advance countries have developed breaching capability using fuel air explosives.

8. **Timelines**.

(a) Development of Fuel air explosive - 24 months.

(b) Development of method to spread fuel air explosive over designated area. - 12 months.

(c) Trials - 12 months.

9. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No - 011-23019003
Email – ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Engineering -in-Chief Branch
Tele No - 011-23019023

PROBLEM DEFINITION STATEMENT - 13

LIGHT WEIGHT MATERIAL PERMANENT DEFENCES

1. **Short Title**. Light Weight Material Permanent Defences

2. **User Directorate**. E-in-C Branch

3. **Type of Problem**. Tech Infusion

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

(a) **Statement of Problem**. Coupled with the threat to the borders from unfriendly neighbours, inhospitable and unique terrain along the borders necessitates the need to maintain 24 x 7 vigil along the borders. In order to ensure that our borders especially the Line of Control and Line of Actual Control are guarded day in and day out, there is a requirement to construct bunkers / permanent defences. These bunkers will be used during normal circumstances as well as hostilities for the troops to fight the enemy.

(b) **Evolution of Problem**. The process of construction of permanent defences in the plains and deserts does not offer any difficulty but becomes a logistic nightmare in mountainous terrain especially high altitude areas. The problems are compounded since there is invariably lack of water in such areas. These bunkers are strong enough to withstand the enemy shelling and small arms fire but they have fixed designs and therefore lack flexibility. These bunkers also take a lot of time in construction and require trained skilled manpower to construct. The steel Bunkers have a defined shape and its various panels are cumbersome to lug to high altitude areas. These structures have inherent drawback of being heavy weight and unless flushed to ground, are prone to damage due to firing and shelling. In addition, there is a requirement of regular maintenance of the defences for which again skilled manpower is required.

(c) **How is it Being Overcome**. At the moment, Indian Army has two types of bunkers. These are as follows:-

(i) **Self Help**. These are the bunkers which have been constructed by troops by using local available material like stones, wooden logs and mud. These bunkers invariably collapse due to enemy shelling and small arms fire. These are also prone to vagaries of weather especially rain and snow. Since these have been designed by troops on ground using available space and material they have a very less longevity.

(ii) **Steel / Masonry Work Bunker**. These bunkers/ defence works are constructed by ferrying the construction material to include cement, metal girders, sand, water and other items to the site.

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

5. **Who has the Problem**. The problem is being faced by all troops who are employed in mountainous terrain especially high altitude areas.

6. **Why is it Important to Solve**. The problem needs to be solved since ferrying large scale construction material in harsh mountainous terrain repeatedly either to construct or to maintain coupled with paucity of water is a logistic nightmare and extremely costly.

7. **Contemporary Solutions by other Countries/ Organisations**. Other countries are using light weight and toughened composite material and fly-ash based hollow blocks. The material used is such that it is able to withstand the en shelling and small arms fire on one hand and vagaries of weather on the other. The design is also modular to offer flexibility and least amount of trained manpower for construction and offers much better habitability in the bunker.

8. **Timelines**.

(a) Improvement in Design - Within 06-12 months.

(b) Prototype & Trials - Concurrently 06-12 months.

9. **Points of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No : 011-23019003
Email- ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Directorate General of Combat Engineers
Telephone No : 011-23019610

PROBLEM DEFINITION STATEMENT - 14

HIGH ASSURANCE TESTING FOR HARDWARE

1. **Short title**. High Assurance Testing For Hardware

2. **User Directorate**. Director General of Signals.

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

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

(a) **Statement of Problem.** Military equipment has variety of electronic hardware procured from manufacturers and suppliers from around the world. To ensure security, it is essential to ascertain that the imported hardware is free of embedded malware, backdoors and hidden processes and can be relied upon to operate in hostile cyber environment. There is a need to have “High Assurance Test” capability to test all electronic hardware for embedded malware, backdoors and hidden processes.

(b) **Evolution of Problem**. With increasing level of miniaturisation and complexity of the equipment, besides the dependency of Indian Armed Forces on imported equipment, there is an increasing threat to communication equipment from embedded malware. This has been compounded by the fact that origin of large amount of electronic circuitry being used in communication equipment is of Chinese origin.

(c) **How it was Being Overcome**. At present vendor certification is being used to preclude infection of communication equipment with embedded malware

5. **Who has the Problem**. All branches of the Army with communication equipment.

6. **Why it Important to Solve**. The threat of embedded malware can infest during operations causing disruption / degradation in communication / IT equipment. The embedded malware may also leak out vital information without the knowledge of user even in peacetime.

7. **Contemporary Solutions by other Countries/Organisations**. Most advanced nations have their national laboratories certifying that the communication / IT equipment is malware free before employing these with Armed Forces.

8. **Timelines**.

(a) Design and Devp - 12 Months

(b) Fielding - 12 months

9. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No - 011-23019003
Email – ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Directorate General of Signals
Tele No- 011-23018915

PROBLEM DEFINITION STATEMENT - 15

ALL- IN - ONE MOBILE COMMUNICATION HANDSETS

1. **Short Title**. All-in-one Mobile Communication Handsets.

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

3. **Type of Problem**. Poorly Solved.

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

   (a) **Statement of the Problem**. Today, there are different mobile handsets for different technologies i.e. CDMA, 4G (LTE), Satcom terminals, Combat Net Radios. Therefore, a soldier in the TBA will need to carry and handle different sets at one time which are cumbersome and difficult to manage which reduces the efficiency of the soldier. With the advancement of ICT technology, the subscriber devices form factors have reduced greatly in size. There is a need to have a subscriber device supporting multiple mobile communication technologies.

   (b) **Evolution of the Problem**. Besides CNR a large number of wireless communication media is now available. However this results in multiple user devices being carried.

   (c) **How it was Being Overcome**. Different sets are being used for different purposes.

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

5. **Who has the Problem**. The communication devices are being used by all personnel irrespective of arms / services.

6. **Why it is Important to Solve**. It is important to have all in one mobile communication handsets to mitigate the need to carry multiple handsets into the TBA, simplify the use of various communication devices and increase the fighting capability of the user soldier.

7. **Contemporary Solution by other Countries / Organisations**. Data not available.

8. **Timelines**. The problem can be resolved in phase wise manner.

9. **Point of Contact**.

   (a) **Primary Contact**.

   Army Design Bureau
   Tele No - 011-23019003
   Email – ddgtechres-mod@gov.in

   (b) **Secondary Contact**.

   Directorate General of Signals
   Tele No- 011-23018915

PROBLEM DEFINITION STATEMENT -16

LONG TERM EVOLUTION (LTE) : AIR INTERFACE VULNERABILITIES

1. **Short Title**. Air Interface Security Vulnerabilities of LTE System.

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

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

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

   (a) **Statement of the Problem**. Induction of LTE technology for mobile communications is critical for operational communications. However, commercial LTE technology has various security vulnerabilities, including air interface vulnerabilities, which can lead to Denial of Service (DoS) Attacks. There is a need to identify various security vulnerabilities in commercial LTE and evolve solutions for the same including customized Layer 1, Layer 2 and Layer 3 protocol stacks, randomization of Physical Random Access Channel (PRACH) occurrence in Paging Control Channel (PCCH) frames as well as customized LTE chipsets/external crypto attachment for proper red/black separation, trusted country specific encryption algorithm, Key and Random Challenge (RAN) generation and Key management facilities.

   (b) **Evolution of the Problem**. LTE based mobile communication infrastructure, with enhanced data rates to support voice, data and video services, is required for operational communications. Trusted security solutions are required to be developed for customized LTE solutions suited to military security requirements.

   (c) **How it was Being Overcome**. By keeping military cellular networks separate from commercial networks and proems.

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

5. **Who has the problem**. All users of military LTE networks.

6. **Why it is important to Solve**. An indigenously developed security solution including air interface encryption and customized protocol stack is required to overcome the current security voids. In addition, indigenously customized chipsets/external crypto attachments and crypto algorithms need to be developed by private industry and academia.

7. **Contemporary Solutions by other Countries / Organizations**. Security hardening for commercial LTE (both on standard / off standard) is under development by all major advanced countries for their militaries. This includes on standard implementation by M/s General Dynamics for USA DoD, off standard implementation by M/s ELTA for Israel Def Forces, as well as evolving

awareness and solutions by number of other firms like CASSIDIAN, Motorola etc. Certain Indian firms like M/s Mymo Wireless Technologies, M/s Signal chip Innovations etc are also involved in planning customized mil LTE sys, but are at a nascent stg.

8. **Timelines**. The development of prototype for LTE system would be complete within a time frame of one year from signing of Development Contract. The proposed security should be available for integration within two years from now.

9. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No - 011-23019003
Email – ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Directorate General of Signals
Tele No- 011-23018915

PROBLEM DEFINITION STATEMENT- 17

SECURE COMMUNICATIONS FOR (COTS) EQUIPMENT / IT EQUIPMENT / TELE-COMMUNICATION EQUIPMENT

1. **Short Title**. Secure communication over COTS equipment / IT equipment / Tel-communication equipment.

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

3. **Type of Problem**. Poorly Solved.

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

   (a) **Statement of the Problem**. There is a large number of Secrecy equipment being handled by units such as bulk encryptor, link encryptor and encryptors for Radio, IP encryptor. Each secrecy equipment functions with live keys which are changed periodically as per policy in vogue. Maintenance of varied equipment profile and respective key management is challenging and effort intensive as these secrecy devices are deployed at various field locations which are inaccessible during winters. There is a need to have a single indigenously development secrecy on COTS, IT and telecommunication equipment / platforms.

   (b) **Evolution of Problem**. With large number of secrecy devices, there management is becoming an issue. Large manpower is utilized in cipher courier duties to ensure key management of secrecy device which can be minimized by using a single device.

   (c) **How it was being Overcome**. The problem is presently overcome by sending cipher courier for replacing keys and for carrying out repair of any faulty secrecy equipment.

   (d) **Any Innovation to Locally Overcome the Problem**. Separate secrecy devices are being used for each type of system

5. **Who has the Problem**. The secrecy devices are deployed at all hierarchical levels with communication equipment.

6. **Why it is Important to Solve**. It is important to solve the problem of secrecy over COTS/ITI telecommunication equipment for following:-

   (a) Unified secrecy solution across equipment / platform.

   (b) Minimize key management issues.

   (c) Reduce nuances of operating multiple secrecy devices under same roof.

7. **Contemporary Solution by other Countries/Organizations**. Data not available.

8. **Timelines**. The problem can be resolved in phase wise manner.

9. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No - 011-23019003
Email – ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Directorate General of Signals
Tele No- 011-23018915

PROBLEM DEFINITION STATEMENT - 18

SOFTWARE DEFINED RADIO (SDR) IN MOBILE ADHOC NETWORK (MANET) ENVIRONMENT

1. **Short Title**. Development of SDR for deployment in MANET environment.

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

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

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

   (a) **Statement of the Problem**. SDRs are ideally suited to military usage as they enable multiple waveforms on the same radio platform. However, development of an indigenous trusted waveform remains an area of concern. Further, SDR based MANETs can be exploited to create infrastructure less tactical radio networks. However, most routing protocols for adhoc networks are inefficient with initial convergence / quantum of configuration traffic, leading to low throughputs at user end. They also result in poor power and spectrum efficiency. Further, indigenous security including authentication as well as attack detection and mitigation in the absence of any central infrastructure continues to be challenging.

   (b) **Evolution of the Problem**. SDR based MANETs are ideally suited to replace the legacy radio communication system providing a seamless, reconfigurable and adaptive radio network for operational communication. Indigenous development of trusted waveforms, optimized protocol stack for improved network performance and trusted security solutions for SDRs are required.

   (c) **How it was Being Overcome**. Present generation radio sets are not band on SDR.

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

5. **Who has the Problem**. All radio networks.

6. **Why it is Important to Solve**. Indigenous development of trusted waveforms particularly MANET waveforms, needs to be carried out by private industry and academia. There is also a need for optimized routing protocols to attain improved convergence time, latency, energy efficiency and throughput. The SDRs developed must use efficient Vocoders with high Mean Opinion Score (MOS), for seamless integration of SDR based MANETs with tactical network deployed in field scenario. An interface for Indian Regional Navigation Satellite Sys (IRNSS) besides GPS/GLONASS navigational sys is also desired.

7. **Contemporary Solution by other Countries/Organizations**. A number of private companies, renowned industries and Defence Public Sector Undertakings (DPSUs) have made progress in the field of develop of SDRs.

However, trusted, efficient and indigenous implementations of military specific requirement is required.

8. **Timelines**. Based on current progress by industry and academia, the proposed requirements / functionalities can be incorporated within a time frame of two years from now.

9. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No - 011-23019003
Email – ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Directorate General of Signals
Tele No- 011-23018915

PROBLEM DEFINITION STATEMENT- 19

SOFTWARE BASED ENCRYPTION

1. **Short Title**. Software Based Encryption

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

3. **Type of Problem**. Procedural / Technology.

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

   (a) **Problem Statement**. At present only hardware based encryption system graded by Scientific Analysis Group (SAG) are in use. However, software based encryption system provides similar security vis a vis Hardware based encryption devices.

   (b) **Evolution of Problem**. Software based encryption system are being widely used in all banking and commercial applications. Algorithms used are already in open domain and need to be suitably customised. However, hardware based encryption system which are being used in Indian Army make it impossible to implement at all the end points (user PCs) and are prone to loss / theft / damage. Hence indigenous software based encryption system are required to be developed and graded by SAG for use in Indian Army networks.

   (c) **How it was Being Overcome**. Presently commercial encryption technology like PKI, https etc are being used over and above the hardware based encryption system between communication nodes to provide some assurance of end to end security.

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

5. **Who has the Problem**. All users of Army Data Network.

6. **Why it is Important to Resolve**. Software based encryption is an efficient way to implement secrecy as user will not be required to hold any hardware encryption device. Development of indigenous software based encryption system duly ratified by SAG will resolve:-

   (i) Security of data in transit and data at rest.

   (iii) Loss / Theft / Damage of hardware based encryption system.

7. **Contemporary Solution by other Countries / Organisations**. Most of the countries of the world have resorted to using software based encryption system as it provides adequate security comparable to hardware based encryption system and is less prone to theft /damage.

8. **Timelines**. Developed of end to end software based encryption sys gradable by SAG should take approx 3 years.

9. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No - 011-23019003
Email – ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Directorate General of Signals
Tele No- 011-23018915

PROBLEM DEFINITION STATEMENT- 20

INDIGENOUS HARDENED OPERATING SYSTEM

1. **Short Title**. Indigenous Hardened Operating System (OS).

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

3. **Type of Problem**. Adaptation

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

   (a) **Statement of the Problem**. Indian Army is using operating systems developed by private players i.e. Microsoft, Red Hat etc. There is a requirement to develop indigenous and secure OS, customised to meet the requirements of defence forces.

   (b) **Evolution of Problem**. There have been security threats to commercial OS surfacing on almost daily basis over the internet, which renders all such OS vulnerable. Though patches to the exploits are made available by the OS developing agency, however details of vulnerability in the OS programme and patches thereto are not made public.

   (c) **How it was Being Overcome**. Certain additional hardware / software based technologies are being used to ensure security of the OS being used in Indian Army.

   (d) **Any Innovation to Locally Overcome the Problem**. BOSS is being used but has issues with peripheral equipment.

5. **Who has the Problem**. All users of data terminals.

6. **Why it is Important to Resolve**. The hardened indigenous OS for defence forces is required because:-

   (a) It will provide secure and trustworthy platform for applications to execute.

   (b) Vulnerabilities and patches are visible i.e. vulnerability is known and thereby patch is also tested for any vulnerability before deployment.

   (c) Security of application.

   (d) No outsider i.e. commercial agencies involved in development of OS and further development of patches / updates.

7. **Contemporary Solution by other Countries / Organisations**. Various countries have developments hardened application specific / generalised OS specific to their system requirement.

8. **Timelines**. To be given by developing agency i.e. DRDO / IITs etc.

9. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No - 011-23019003
Email – ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Directorate General of Signals
Tele No- 011-23018915

PROBLEM DEFINITION STATEMENT - 21

ESTIMATION OF TRAJECTORY OF BALLISTIC MISSILES

1. **Short Title**. Determine the trajectory of ballistic missiles from on-board seeker measurements and GPS-INS data fusion.

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

3. **Type of Problem**. Unresolved problem.

4. **What is the Problem**.

   (a) **Statement of Problem**. To improve upon the existing detection and tracking techniques by way of developing advanced guidance algorithms using navigation and target tracking data to generate interceptor path and its implementation.

   (b) **Evolution of the Problem**. The ballistic missiles in the re-entry phase move extremely fast and this phase is decidedly short. Accordingly, there is a need to develop advanced estimation techniques to determine trajectory of ballistic missiles.

   (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 the equipment design.

6. **Why it is Important to Solve**. The ground forces are potential targets for tactical ballistic missiles for which ground forces at present have no counter measure.

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

   (a) Optical Systems for angular measurement - USA

   (b) Statistical orbit Determination - USA

8. **Timelines**.

S No	Event	Recom Timeline	Remarks
(a)	Study of the system, interaction with the technical experts and users. Study of contemporary solutions	***S to S Plus 10 Months*** (S being the day of commencement of the project)	

(b)	Prep of a prototype solution and interfacing with the equipment	S Plus 10 to S Plus 36 Months	
(c)	Fd and user Trials	S Plus 36 to S Plus 42 Months	To include live firing on aerial targets
(d)	Preparation of Final Report	***Earlier But Not Later than S Plus 45 Months***	

9. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No – 011-23019003
Email – ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Directorate General of Army Air Defence
Sena Bhawan
Tele No – 01123333644
E mail ID – dirmodaad7@gov.in

PROBLEM DEFINITION STATEMENT- 22

COMPACT AND RUGGEDIZED POWER SUPPLY

1. **Short Title**. Compact and ruggedized power supply

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

3. **Type of Problem**. Poorly Solved.

4. **What is the Problem**.

   (a) **Statement of Problem**. The large volume and weight of the power supply system affects the operation and maintenance of the main platform.

   (b) **Evolution of the Problem**. The power supply system being used in indigenous msl systems have a reqmt of 120 KVA - 150 KVA. The power supply arrangements presently being incorporated in the systems are bulky, occupy large volumes and have large weight. As a result, the mobility and capacity to negotiate gradients gets severely impacted.

   (c) **How it was Being Overcome**. The systems continue to draw power supply from the bulky gensets provisioned by the equipment manufacturer.

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

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

6. **Why it is Important to Solve**. The weight and volume reduction would result into better ergonomics, more space for other applications/ sub systems and would improve the cross-country mobility and the capability to negotiate the gradients.

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

   (a) Axial flux Technology - Axco Motors.

   (b) Super Capacitor, Fuel cells etc.

8. **Timelines**.

S No	Event	Recom Timeline	Remarks
(a)	Study of the system, interaction with the technical experts and users. Study of contemporary solutions	***S to S Plus Three Months*** (S being the day of commencement of the project)	Literature and equipment expertise available

(b)	Prep of a prototype solution and interfacing with the equipment	S Plus Three to S Plus 10 Months
(c)	Fd and user Trials	S Plus 10 to S Plus 12 Months
(d)	Preparation of Final Report	***Earlier But Not Later than S Plus 13 Months***

9. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No – 011-23019003
Email – ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Directorate General of Army Air Defence
Sena Bhawan
Tele No – 01123333644
E mail ID – dirmodaad7@gov.in

PROBLEM DEFINITION STATEMENT- 23

BEAM STEERING FOR LASERS

1. **Short Title**. Image processing and fine pointing and tracking of laser beam on to the target.

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

3. **Type of Problem**. Tech infusion (need to improve the ensuing project on Anti UAV Laser Weapon System being undertaken by CHESS Hyderabad).

4. **What is the Problem**.

   (a) **Statement of Problem**. The critical requirement is to aim and maintain the laser beam on the vulnerable spot on the target until a kill is achieved.

   (b) **Evolution of the Problem**. The high precision beam pointing and tracking system is responsible for fine pointing of laser beam on to the target. The major sources of error in achieving the high precision pointing and tracking besides the dynamic target are platform vibrations, beam jitter produced by atmospheric propagation effects, bore sight error and other manufacturing electronics and thermal effect errors.

   (c) **How it was Being Overcome**. The systems continue to operate with inherent inaccuracies.

   (d) **Any Innovations to Locally Overcome the Problem**. Innovations have been attempted by DRDO under Project CHESS but require improvement to achieve desired accuracy and efficiency.

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

6. **Why it is Important to Solve?**. A high accuracy beam pointing system having a pointing accuracy of few micro radians is an essential component of a laser based Directed Energy Weapon system for engagement of fast moving and maneuvering aerial targets.

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

   (a) HELMD Program of USA.

   (b) 40 KW Laser Gun by MBDA, Germany.

8. **Timelines**.

S No	Event	Recom Timeline	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 the equipment	S Plus Six to S Plus 15 Months	
(c)	Field and user Trials	S Plus 15 to S Plus 24 Months	To include live firing on aerial targets
(d)	Preparation of Final Report	***Earlier But Not Later than S Plus 24 Months***	

9. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No – 011-23019003
Email – ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Directorate General of Army Air Defence
Sena Bhawan
Tele No – 01123333644
E mail ID – dirmodaad7@gov.in

PROBLEM DEFINITION STATEMENT- 24

METALLURGY FOR HELICOPTER MAIN GEAR BOX

1. **Short Title**. Metallurgy for Helicopter Main Gear Box (MGB).

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

3. **Type of Problem**. Poorly Solved.

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

(a) **Statement of Problem**. The gearboxes of Advance Light Helicopter (ALH) are plagued by issues of poor metallurgy which is causing premature failures. There is a requirement to improve the metallurgy to prevent frequent chipping and premature failures of MGBs of ALH.

(b) **Evolution of the Problem**. ALH is an indigenously designed and developed helicopter. The main gear box has also been designed and manufactured by HAL. Its function is to convert the engine input of high RPM & low torque to an output of low RPM & high torque. MGB further transmits torque to main rotors and tail gear box through associated gear train. Post induction of ALH, the MGB chip warning alarm was frequently reported which indicated chipping of metal inside MGB. Detailed laboratory analysis of metallic chips confirmed that chips were from the MGB gears. The designed power output of ALH MGB is 568 x 2 KW for sustained operations and peak power permitted is 800 KW for 30 seconds. The metallurgy of the MGB is not able to sustain the power output for which it was designed.

Main Gear Box (ALH)

(c) **How it is Being Overcome**. The problem has not been overcome fully. As an interim solution following measures have been undertaken:-

(i) **Enhanced Checks for MGB**.

(aa) One-time check of entire fleet post detection of failures.

(ab) Institutionalising additional checks based on nature of failure.

(ac) Increasing the frequency of periodic servicing checks.

(ii) **Design Improvement**.

(aa) Optimisation of Transmission System.

(ab) Removing the auxiliary gear box.

(iii) Improvements in metallurgy.

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

5. **Who has the Problem**. The problem is being faced by pilots and maintenance staff of the ALH fleet. The MGB is prematurely failing inspite of being exploited within the OEM specified operational envelope of torque and power.

6. **Why it is Important to Solve**. Component / Material failure is a major safety hazard for helicopters. By solving the problem the safety, serviceability & availability of helicopters for operational and training task will substantially increase. It will also drastically reduce the meantime between failures and aircraft on ground (AOG) state of the fleet.

7. **Contemporary Solution by other Countries / Organisations**. The design and metallurgy aspects of MGB & transmission system of most modern helicopters have been perfected to cater for power and torque requirements. As a best practice most of the components used in aviation industry have a very large safety margin (ranging upto hundred percent) to cater for failure free service life.

8. **Timelines**.

(a) Improvement in metallurgy - 12 months.

(b) Improvement in design - 12 months (concurrently).

(c) Prototype & trials - 6 to 8 months.

9. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No - 011-23019003
Email – ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Directorate General of Army Aviation
Tele No - 011-25694694

PROBLEM DEFINITION STATEMENT- 25

MAGNETIC MAPPING OF ADVANCE LIGHT HELICOPTER

1. **Short Title**. Magnetic Mapping of Advance Light Helicopter

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

3. **Type of Problem**. Poorly solved

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

(a) **Statement of Problem**. The Helmet Mounted Head Up Display, Gun turret and Electro Optical Pods of helicopter need to be precisely synchronised to achieve proportionate movement of onboard devices in all six planes. Magnetic mapping of the helicopter is essential to achieve this synchronisation. Capability / portable device to undertake precise magnetic mapping needs to be developed to perform the task indigenously.

Helmet Mounted Head Up Display

Weapon Platform on Advance Light Helicopter (Weapon System Integrated)

(b) **Evolution of the Problem**. The electronic components, assemblies and sub assemblies fitted in indigenous helicopters have their own magnetic field. The overall magnetic field in a helicopter is the resultant of all sub magnetic fields produced by metallic and electric components. The resultant magnetic field needs to be mapped to synchronise head up display with

various surveillance equipment, electro optical sights and weapon platforms. The resultant magnetic field changes whenever the helicopter undergoes major servicing / overhaul and when components of aircraft are changed. Hence magnetic mapping is a repetitive requirement to ensure synchronisation between head up display and onboard surveillance devices and weapon systems.

(c) **How it is Being Overcome**. No indigenous capability exists, the magnetic mapping of ALH has been outsourced to a foreign vendor.

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

5. **Who has the Problem**. The problem is faced by the helicopter maintenance staff.

6. **Why it is Important to Solve**. In absence of accurate magnetic mapping, onboard surveillance devices and weapon platforms will not be synchronised with helmet mounted head up display and will result in incorrect acquisition and inaccurate engagement of targets.

7. **Contemporary Solution by other Countries / Organisations**. Digital / Electronic magnetic mapping equipment is available for accurate magnetic mapping and synchronisation of helmet mounted head up display with onboard surveillance equipment & weapons.

8. **Timelines**.

(a) Design & development of portable magnetic mapping device - 8 to 10 months.

(b) Prototype & trials - 4 to 6 months.

9. **Point of Contact**.

(a) Primary Contact :-

Army Design Bureau
Tele No - 011-23019003
Email – ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Directorate General of Army Aviation
Tele No - 011-25694694

PROBLEM DEFINITION STATEMENT- 26

SATELLITE BASED TRACKING SYSTEM

1. **Short Title**. Satellite Based Tracking System.

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

3. **Type of Problem**. Technical infusion to add value in operational chain.

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

   (a) **Statement of the Problem**. Peculiarities of helicopter operations (like low flying & contour flying etc) obviate monitoring of helicopters in real time. This may not be critical but leads to significant delays in recovery actions after emergency landing or accident. Control and monitoring, based on cooperation of both ground and airborne segments for low flying helicopters, would assist operations in addition to retaining confidentiality which is typically required in military operations.

   (b) **Evolution of the Problem**. Positional monitoring of Army Aviation helicopters is essential for controlling the airspace and to initiate recovery action in case of crash and emergencies. Low flying helicopters are subject to terrain screening and have intermittent communication with the controlling stations. Secondary surveillance radar capability relevant to aircrafts flying at higher altitudes does not extend this facility to low flying helicopters. No facility is existing for real time reporting of location during normal operations. The present solution being sought relates to application of recent advancements in technological field, not feasible in yesteryears.

   (c) **How it was Being Overcome**. In case of recovery of crashed aircraft, the positional information is relayed using on board 'Emergency Locator Transmitter' through satellites and rescue coordination centres as part of SARSAT system. In normal operations the real time position of helicopter is based on the location reported by pilot, however beyond line of sight and for low flying helicopters the real time position is not known.

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

5. **Who has the Problem**. The problem is faced by the Air Traffic Controllers and Search & Rescue Team for recovery of crashed helicopter.

6. **Why is it Important to Solve**. Real time monitoring of progress of operations, recovery of downed aircraft crew in the earliest time frame and efficient airspace management entails minute to minute control philosophy. It would also make it possible to manage critical assets through dependent surveillance, thereby providing capability for covert military operations.

7. **Contemporary Solution by Other Countries / Organisations**. Not known.

8. **Timelines**. Required timelines of 4-5 years is based on development of on board equipment including its certification as well as space segment module for continuous reception and dissemination to ground based terminals.

9. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No : 011 – 23019003
E-mail : ddgtechres-mod@gov.in

(b) **Secondary Contact**.

(i) Army Avn Test Team
HAL, Flight Test Centre,
Marathahalli - PO
Bangalore - 560037
Tele No : 25237839/25231538

(ii) Directorate General of Army Aviation
Tele No - 011-25694694

PROBLEM DEFINITION STATEMENT- 27

OBSTACLE AVOIDANCE SYSTEM (WIRE STRIKE PROTECTION SYSTEM)

1. **Short Title**. Obstacle Avoidance System (Wire Strike Protection System).

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

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

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

   (a) **Statement of the Problem**. Low flying helicopters of Army Aviation by night rely on the surveyed/updated maps to stay clear of obstacles/ wires. Real time information about these objects can exponentially enhance flight safety and help in avoiding accidents due to wire strike.

   (b) **Evolution of the Problem**. Advent of night vision devices have facilitated night flying at low altitudes. However detection of obstacles with small cross section especially wires is nearly impossible at night with the night vision device. In order to undertake military operations by night, it is imperative that the subject equipment be developed to warn aircrew of obstacles and wires with sufficient reaction time to initiate evasive measures.

   (c) **How it was Being Overcome**. Helicopters around the world employ wire strike protection system, that 'Cuts' the wires in case of a strike, thereby reducing damage and enhancing survivability. This system does not facilitate clearance from other obstructions and is applicable only once the helicopter has struck the wire.

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

5. **Who has the Problem**. Problem is being faced by helicopter pilots.

6. **Why is it Important to Solve**. To increase flight safety and to enable low flying over unknown areas, it is important to solve the problem.

7. **Contemporary Solution by Other Countries / Organisations**. Laser based obstacle avoidance system, capable of generating visual and aural warnings thereby providing sufficient reaction time are available in the world market for low flying helicopters.

8. **Timelines**. Research & design, manufacturing of prototype, certification and trials are estimated to be accomplished in 2-3 years time.

9. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No : 011 – 23019003
E-mail : ddgtechres-mod@gov.in

(b) **Secondary Contact**.

(i) Army Avn Test Team
HAL, Flight Test Centre,
Marathahalli – PO
Bangalore – 560037
Tele No : 25237839/25231538

(ii) Directorate General of Army Aviation
Tele No - 011-25694694

PROBLEM DEFINITION STATEMENT - 28

MOBILE AVIATION SUPPORT VEHICLE

1. **Short Title**. Mobile Aviation Support Vehicle.

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

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

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

   (a) **Statement of the Problem**. Operation of Army Aviation units in field necessitates aviation support available in parent base viz communication for air space management and equipment for weather reporting/forecasting. These facilities may entail non ruggedized equipment that merits careful handling to isolate them from elements of weather. Owing to dynamic nature of operations undertaken by Army Aviation, there is a need to establish a mobile platform with the above facilities.

   (b) **Evolution of the Problem**. Dynamic nature of the operations covering extended distances on one hand and lack of inherent facilities dedicated to meet stated requirements on the other has led to evolution of the problem.

   (c) **How it was Being Overcome**. Ad-hoc set up by operational units.

   (d) **Any Innovations to Locally Overcome the Problem**. General purpose vehicle mounted with necessary equipment on ad-hoc basis.

5. **Who has the Problem**. The Air Traffic Controllers and ground staff.

6. **Why is it Important to Solve**. In order to support existing operational capabilities including missions undertaken by night, there is a requirement to solve this problem.

7. **Contemporary Solution by Other Countries/Organisations**. Specialised ATC vehicles have been developed by other countries.

8. **Timelines**. 1-2 years to include identification of vehicle and equipment.

9. **Point of Contact**.

   (a) **Primary Contact**.

   Army Design Bureau
   Tele No : 011 – 23019003
   E-mail : ddgtechres-mod@gov.in

(b) **Secondary Contact**.

(i) Army Avn Test Team
HAL, Flight Test Centre,
Marathahalli – PO
Bangalore – 560037
Tele No : 25237839/25231538

(ii) Directorate General of Army Aviation
Tele No - 011-25694694

PROBLEM DEFINITION STATEMENT - 29

NIGHT VISION DEVICE FOR AIRCREW

1. **Short Title**. Night Vision device for aircrew.

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

3. **Type of Problem**. Context Management.

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

   (a) **Statement of the Problem**. Night vision for low flying operations or during take-off and landing phases assumes importance for obvious reasons. Limited field of view reduces situational awareness which might be critical in constricted areas. Thus there is a need to enhance field of view of night vision devices employed during flying operations.

   (b) **Evolution of the Problem**. Advancement in field of avionics has enabled unrestricted operations by Army Aviation. One of the critical components of this capability is the night vision sensor. Presently, Army Aviation employs image intensification based sensors for flying operations by night. However, due to limitations of field of view, this entails additional procedures to overcome said deficiency, thereby increasing cockpit load while restricting situational awareness.

   (c) **How it was Being Overcome**. Employment of additional cockpit procedures by the pilots.

   (d) **Any Innovation to Locally Overcome the Problem**.

5. **Who has the problem**. The problem is faced by aircrew.

6. **Why is it Important to Solve**. It is essential to solve the problem to optimise night operation capability and to improve operational exploitation of helicopters while ensuring flight safety.

7. **Contemporary Solution by Other Countries/Organisations**. Employment of multiple image intensification tubes mounted adjunct to each other or use of projected visors using FLIR imagery.

8. **Timelines**. Development of technology, certification and trials are estimated to take 4-5 years.

9. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No : 011 – 23019003
E-mail : ddgtechres-mod@gov.in

(b) **Secondary Contact**.

(i) Army Avn Test Team
HAL, Flight Test Centre,
Marathahalli – PO
Bangalore – 560037
Tele No : 25237839/25231538

(ii) Directorate General of Army Aviation
Tele No - 011-25694694

PROBLEM DEFINITION STATEMENT- 30

WEATHER RADAR

1. **Short Title**. Weather Radar.

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

3. **Type of Problem**. Context Management.

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

   (a) **Statement of the Problem**. Weather radar working on echo principle indicates reflections of various intensities from droplets of various sizes for weather assessment in front of the helicopter. The principle does not facilitate detection of turbulence which becomes a concern with respect to structural limits and control of helicopter. Thus there is need to detect and caution the aircrew of impending turbulence on the helicopter's planned flight path, as severe turbulence affects safety of flight especially when flying in close proximity of terrain.

   (b) **Evolution of the Problem**. Helicopters normally fly two to three thousand feet above the ground level. The present fleet does not have weather radar to warn about the turbulence. Turbulence, especially when flying in mountainous terrain, can 'throw' the helicopter in dangerous proximity to terrain, thus necessitating measures for early warning to ensure flight safety.

   (c) **How it was Being Overcome**. Aircraft handling procedures have been promulgated wherein actions to be taken by pilot on encountering turbulence/down draft are stipulated. However, no early warning is available for avoidance of turbulent weather.

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

5. **Who has the Problem**. Helicopter pilots.

6. **Why is it Important to Solve**. In order to enhance flight safety and to enable aircrew to avoid entering into turbulent weather.

7. **Contemporary Solution by Other Countries/Organisations**. Ground based equipment provides wind shear warnings that assist in landing and take off operations in an established airport.

8. **Timelines**. Development of technology, certification and trials are estimated to take 4-5 years.

9. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No : 011 – 23019003
E-mail : ddgtechres-mod@gov.in

(b) **Secondary Contact**.

(i) Army Avn Test Team
HAL, Flight Test Centre,
Marathahalli – PO
Bangalore – 560037
Tele No : 25237839/25231538

(ii) Directorate General of Army Aviation
Tele No - 011-25694694

PROBLEM DEFINITION STATEMENT- 31

MICROWAVE LANDING SYSTEM

1. **Short Title**. Microwave Landing System.

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

3. **Type of Problem**. Technical Infusion.

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

   (a) **Statement of the Problem**. Landing and takeoff operations in poor visibility conditions due to weather or time of the day are critical and plague Army Aviation operations. Based on the available technology, there is a possible adaptation of automatic landing systems deployable in field to overcome this limitation and provide a safer and more efficient operational environment.

   (b) **Evolution of the Problem**. Enhanced scope of operations to all weather, day and night capability presents various challenges that were rare in yesteryears. At present there is no automatic landing system, which can be deployed in field, to assist pilot in landing.

   (c) **How it was Being Overcome**. Localised approach procedures, survey of obstructions and visual landing procedure is currently used.

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

5. **Who has the Problem**. Helicopter Pilots.

6. **Why is it Important to Solve**. In order to augment flight safety especially in operations under poor weather conditions.

7. **Contemporary Solution by Other Countries/Organisations**. Not known.

8. **Timelines**. Adaptation to a manpack solution and ruggedized for military operations is estimated to undertake 1-2 years.

9. **Point of Contact**.

   (a) **Primary Contact**.

   Army Design Bureau
   Tele No : 011 – 23019003
   E-mail : ddgtechres-mod@gov.in

(b) **Secondary Contact**.

(i) Army Avn Test Team
HAL, Flight Test Centre,
Marathahalli – PO
Bangalore – 560037
Tele No : 25237839/25231538

(ii) Directorate General of Army Aviation
Tele No - 011-25694694

PROBLEM DEFINITION STATEMENT- 32

LOAD CARRYING ROBOTS

1. **Short Title**. Load Carrying Robots.

2. **User Directorate (S)**. Director General of Supply & Transport.

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

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

(a) **Statement of Problem**. The logistic supply to posts in high altitude areas is being carried out by using troops, civil porters and in some cases animal transport. Logistic supply based on these means is dependent on the weather conditions and enemy action. There is a requirement to design load carrying Robots which can carry logistic supplies in terms of rations, water & ammunition to inaccessible posts.

(b) **Evolution of the Problem**. A large part of IA is deployed in High Altitude Areas along Western & Northern Borders including Siachen Glacier. The deployment areas are located on mountain tops and on the forward slopes which are inaccessible by roads and tracks. The logistic supply to these posts is being presently carried out by troops, porters and in some cases helicopters / fixed wing aircrafts. Animal transport is also employed where animal transport tracks are available. This system is time consuming, dependent on fair weather conditions and results in exhaustion of troops thereby reducing their operational efficiency. In addition, the troops, porters and animal transport are prone to enemy action as well.

(c) **How it is Being Overcome**. Presently the logistic supplies are being maintained by employing troops, porters, animal transport and in some cases helicopters / fixed wing aircrafts.

(d) **Any Innovations to Locally Overcome the Problem**. Pipelines for fuel have been laid in some sectors.

5. **Who has the Problem**.

(a) **User**. Troops deployed in high altitude areas.

(b) **Operating Environment**. High altitude environment with following parameters:-

(i) Altitude - 9000ft to 21000ft

(ii) Temperature - 0 to -50 degree Celsius.

(iii) Snow / Sleet / Fog / Windy conditions with minimal visibility.

(iv) Invariably under enemy observation.

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

6. **Why is it Important to Solve**. Load carrying Robots if developed will reduce the stress on the troops since these robots will be able to negotiate ice walls and be capable of using fixed ropes to climb up the steep gradients in mountainous terrain. This will ensure that the logistic supply to remotely located inaccessible posts is not dependent on weather conditions and enemy action.

7. **Contemporary Solutions by other Countries / Organisations**. Some Western Armies are known to be researching employment of Robots for their Armies.

8. **Timelines**. 36 - 48 Months.

9. **Technology Infusion**. Technology infusion will be required for the Robots to have ability to carry loads of approximately 50 kgs along slopes having gradient of at least 80 to 85 degrees in snow laden mountains.

10. **Points of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No : 011-23019003
Email- ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Directorate General of Supplies & Transport
Telephone No : 011-23018327

PROBLEM DEFINITION STATEMENT- 33

HIGH CALORIFIC VALUE FOOD

1. **Short Title**. Supply of High Calorific Value Food.

2. **User Directorate(S)**. Directorate General of Supplies & Transport.

3. **Type of Problem**. Tech Infusion.

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

   (a) **Statement of Problem**. Soldiers deployed in high altitude areas are required to be provided with high calorific value food which can be stored in remote posts for prolonged periods of time due to these posts getting cut off.

   (b) **Evolution of Problem**. Over the years, large number of posts in high altitude areas are manned by our troops and they are required to stay there round the year in extremely harsh climatic and terrain conditions. Fresh food supplies round the year are not possible and as such advance stocking is being resorted to which are not liked by the troops. In addition, the carriage of heavy tinned food for stocking in remote posts is also a logistic challenge and non-degradation of packing material is becoming an environmental hazard.

   (c) **How is it Being Overcome**. Presently, the troops in high altitude areas are being issued tinned food and some **'meals ready to eat (MRE)'** but these are not adhering to Indian tastes and have issues related to shelf life.

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

5. **Who has the Problem**. The problem is being faced by all the troops who are deployed in high altitude areas.

6. **Why is it Important to Solve**. The problem needs to be solved because it affects the operational efficiency of the troops as also to reduce the immense logistic challenges. Further, provision of high calorific food conforming to Indian tastes will tremendously enhance the motivation levels of troops.

7. **Contemporary Solutions by Other Countries/ Organisations**. Other countries are using energy bars with tastes/ flavours conforming to their tastes. In addition, the countries use frozen foods like frozen meat/chicken, food concentrates which could be adapted to prepare foods like sambhar, dal, curries etc. Furthermore, certain countries are exploring the possibility of using edible packing material thereby reducing the associated problems of disposal of packing materials.

8. **Timelines**.

(a) Improvement in Design - Within 06-12 months.

(b) Prototype & trials - Concurrently 06-12 months

9. **Points of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No : 011-23019003
Email- ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Directorate General of Supplies & Transport
Telephone No : 011-23018327

PROBLEM DEFINITION STATEMENT- 34

WOUND HEALING FABRIC

1. **Short Title**. Self Healing Fabric.

2. **User Directorate(S)**. Directorate General of Medical Services Army.

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

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

   (a) **Statement of Problem**. In the present operational environment, rapid blood loss due to gunshot wounds and splinter injuries are the major causes of deaths in the battle field. There is requirement to design and develop combat uniforms that have the ability to prevent bleeding of a soldier suffering from gunshot wounds / splinter injuries.

   (b) **Evolution of the Problem**. Presently, the injuries sustained by a soldier due to gunshot or splinters is treated by application of First Field Dressing (FFD) which is carried by all soldiers. The FFD is applied by the individual or by his buddy / Battle Field Nursing Assistant (BFNA). In a raging battle, it becomes difficult for the buddy / BFNA to apply the FFD due to ongoing enemy action which invariably may result in excessive blood loss leading to death of the injured soldier before evacuation.

   (c) **How it is Being Overcome**. It is being overcome by application of FFD by individual himself or his buddy as and when situation permits.

   (d) **Any Innovations to Locally Overcome the Problem**. Some Western Armies are utilising rapid coagulating & sealing agents to arrest excess flow of blood.

5. **Who has the Problem**.

   (a) **User**. All soldiers engaged in conventional and sub-conventional operations.

   (b) **Operating Environment**. Conventional and sub-conventional environment.

   (c) **Periodicity of Exploitation**. Soldiers engaged in active operations.

6. **Why is it Important to Solve**. It is important to introduce a long lasting solution in order to ensure that lives of soldiers injured by gunshot wounds and splinter injuries is saved by prevention of excessive blood loss by introduction of combat uniform capable of healing the wounds. This uniform should be designed to convert itself into a temporary tourniquet at the spot of gunshot wound or splinter which will prevent blood loss. Reduction of casualties on the battle field

due to excessive blood loss will ensure that the morale of the soldiers is not impacted adversely and also will prevent exorbitant cost of losing a trained soldier.

7. **Contemporary Solutions by other Countries / Organisations**. Some Western Armies are utilising rapid coagulating & sealing agents to arrest excess flow of blood.

8. **Timelines**. 12 - 18 Months.

9. **Points of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No : 011-23019003
Email- ddgtechres-mod@gov.in

(b) **Secondary Contact**:-

Directorate General of Army Medical Services
Telephone No – 011-23093632

PROBLEM DEFINITION STATEMENT- 35

MODULAR GENERATORS FOR HIGH ALTITUDE

1. **Short Title**. Modular Generators for High Altitude based on Solar Energy and/ or Fuel Cells.

2. **User Directorate(S)**. Master General of Ordnance Branch.

3. **Type of Problem**. Tech Infusion.

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

   (a) **Statement of Problem**. Soldiers deployed in high altitude areas are required to be provided with continuous electricity in remote posts for prolonged periods of time due to these posts getting cut off and absence of regular electric grid.

   (b) **Evolution of Problem**. Over the years, large number of posts in high altitude areas are manned by our troops and they are required to stay there round the year in extremely harsh climatic and terrain conditions. Provision of round the clock electricity is an operational requirement cum survivability requirement for which large quantum of small generators have been provided. However, in order to run these generators large amount of fuel is required, the carriage of which is a logistic challenge and an extremely costly proposition.

   (c) **How is it Being Overcome**. Presently, the troops in high altitude areas are being issued with a variety of generators and fuel for these are either being carried manually or in certain limited places fuel pipelines have been constructed, but even those are susceptible to disruptions due to inclement weather and/ or terrain configuration.

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

5. **Who has the Problem**. The problem is being faced by all the troops who are deployed in high altitude areas.

6. **Why is it Important to Solve**. The problem needs to be solved because it affects the operational efficiency of the troops as also to reduce the immense logistic challenges.

7. **Contemporary Solutions by Other Countries/ Organisations**. Other countries are extensively using solar energy and fuel cells as an alternative for energy generation. These are modular in nature and based on specific requirement of a post, commensurate solar cells / fuel cells are added to generate requisite quantum of power. In addition, certain developed countries are also utilising human waste for energy generation. Further, use of alternative fuels which can harness the low temperatures (snow) for power generation is also being explored.

8. **Timelines**.

(a) Improvement in Design - Within 12 months.

(b) Prototype & trials - Concurrently 12-18 months

9. **Points of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No : 011-23019003
Email- ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Master General of Ordnance Branch
Telephone No : 011-23018137

PROBLEM DEFINITION STATEMENT- 36

COLD CLIMATE CLOTHING

1. **Short Title**. Light Weight Cold Climate Clothing.

2. **User Directorate(S)**. MGO's Branch.

3. **Type of Problem**. Tech Infusion.

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

   (a) **Statement of Problem**. The present winter clothing being used by Indian Army is cumbersome restricting freedom of movement of the troops and makes use of equipment like radio sets & carriage of personnel loads difficult.

   (b) **Evolution of Problem**. It is a very well known fact that Indian Army operates in the most inhospitable terrain. The spectrum of terrain ranges from deserts of Rajasthan to hills and mountains of Jammu and Kashmir, Uttarakhand and Arunachal Pradesh. One thing common in all these terrain is the requirement of having good winter clothing. The clothing does not offer weather proofing from rain and snow. The snow boots are also made of rubber and they do not offer good grip in slush or snow, in addition there is lack of air circulation in the feet. The cold climate clothing creates problems for users because of its bulk thereby restricting his ability to operate freely and is prone to very quick wear and tear thereby necessitating frequent replacements.

   (c) **How is it Being Overcome**. Troops are buying light weight clothing from the market for their survival.

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

5. **Who has the Problem**. The problem is being faced by all troops who are employed in mountainous terrain especially high altitude areas. In addition, troops who are authorised this clothing in other areas too are facing the problem.

6. **Why is it Important to Solve**. The problem needs to be solved since ease of operation of soldiers while wearing the cold climate clothing is of paramount importance and frequent replacements are extremely costly.

7. **Contemporary Solutions by other Countries/ Organisations**. Other countries are using light weight and modular waterproof clothing where the head gear is compatible with the helmet and lend itself for use of hands free communication. The clothing is virtually maintenance free and is able to sustain prolonged usage.

8. **Timelines**. Preferably within 06-12 months.

9. **Points of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No : 011-23019003
Email- ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Master General of Ordnance Branch
Telephone No : 011-23018137

PROBLEM DEFINITION STATEMENT- 37

ALL TERRAIN GROUND VEHICLE

1. **Short Title**. All Trn Grnd Veh.

2. **User Dte (s) / Est**. Supplies and Transport Directorate.

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

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

   (a) **Statement of Problem**. The terrain on the Northern frontiers is either glaciated, rocky, marshy or moraine infested. Construction of roads and tracks in these areas is time consuming and requires massive effort in terms of reconnaissance and surveillance, construction equipment and subsequent maintenance efforts, mandating a complete revision of operational plans in a specific sector. To develop viable communication network in forward areas along the Northern frontiers, will also have huge financial implications. Therefore, there is a need to develop an all terrain vehicle that may assist in fast movement of stores, equipment and transport in rugged terrain. The operational environment of this vehicle will be High Altitude Areas, i.e, up to 19000ft along flat and rugged terrain as obtained in our Northern and Eastern Sectors.

   (b) **Evolution of Problem**. Presently the troops operating in rugged areas of High Altitude Area (HAA) are required to traverse vast distances on foot which imposes time penalty and exposes troops to undue fatigue. In absence of roads in forward areas it is important that the mobility of these troops is enhanced by providing some variant of all terrain vehicle.

   (c) **How is it Being Overcome**. Mobility over such kind of terrain is presently overcome by use of Animal Transport to ferry stores which have a heavy administrative requirement.

   (d) **Any Innovations to locally overcome the Problem**. There are innovative measures like rope ways and modified load carriers being used. However, these methods are partially successful. The move of troops is restricted to existing foot tracks and carriage of war like stores is by means of Animal Transport.

5. **Who has the Problem**. All troops in High Altitude Areas.

6. **Why it is Important to Solve**. During active operations there is a need for small teams/ sub group to deploy rapidly. During peace time these troops are required to traverse inhospitable terrain while conducting patrols, inter sector patrol as well as for stocking and maintenance of forward defences. Need for air portable, light weight, all terrain vehicle is felt to speed up move of these troops with their stores and equipment.

7. **Contemporary Solution by other Countries / Organisation**. Light Weight All Terrain Vehicle are popularly being used by American and Argentine armies to enhance their mob in HAA.

8. **Timeline**. Since this technology already exists and its infusion will require a lesser time. It may be deployed for effect employment within a period of two years i.e, by the year 2019.

9. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No - 011-23019003
Email – ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Directorate General of Supplies & Transport
Telephone No : 011-23018327

PROBLEM DEFINITION STATEMENT- 38

UNATTENDED SURVEILLANCE CAMERA

1. **Short Title**. Challenges in conduct of continuous surveillance of Passes along the Line of Actual Control (LAC) in High Altitude Area (HAA).

2. **User Directorate / Establishment**. Directorate General of Infantry.

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

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

   (a) **Statement of Problem**. Reconnaissance and surveillance by physical presence of troops along vast frontier is a tedious and manpower intensive process. Therefore, there is a requirement of developing energy efficient surveillance cameras that once deployed along inaccessible areas are capable of communicating real time information to the troops, without actually deploying them on ground.

   (b) **Evolution of the Problem**. There exists a need to have a fool proof surveillance grid which will send back real time information to the troops deployed ahead. The existing surveillance equipments are costly to be deployed at all locations and require dedicated man power so as to operate it round the clock.

   (c) **How is it Being Overcome**. Presently the surveillance cameras are clubbed with the sensors for the said purpose, which however does not meet the requirement as they are man power intensive.

5. **Who has the Problem**. Troops operating in all types of environment i.e, Counter Insurgency Operations, Desert and High Altitude Areas.

6. **Why it is Important to Solve**. Surveillance by physical presence of troops along the entire frontier is a manpower intensive process. The existing system of surveillance is both costly and manpower intensive. Therefore, there is a requirement of developing energy efficient low cost surveillance cameras that once deployed along inaccessible areas are capable of communicating real time information to the troops, without actually deploying them on ground. These devices will be of great use in peace time surveillance and as mode of warning during hot war scenario.

7. **Contemporary Solution by other Countries / Orgs**. Trailer mounted solar powered day-night Thermal Camera with 36 x optical zoom and 12 x digital zoom with wireless transmission**,** capable of carrying out 360^{o} surveillance is being used by many countries. Such systems can be setup upto 15 miles away from reception unit.

8. **Timeline**. This tech is already in use by other countries and development of desired devices within next three years is plausible.

9. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No - 011-23019003
Email – ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Directorate General of Infantry
Tele No - 011-25694694

PROBLEM DEFINITION STATEMENT- 39

LOCATION AWARENESS SYSTEM

1. **Short Title.** Lack of Credible Location Awareness System.

2. **User Dte / Est**. Directorate General of Information Systems.

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

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

   (a) **Statement of Problem**. Lack of a credible location awareness system is a crippling problem faced by the command and control setup in any military operations especially in Counter Insurgency / Counter Terrorism operations.

   (b) **Evolution of Problem.** The non-awareness of location of own troops during operations are a critical deterrent to commanders on ground as well as in control centers in planning and execution of ops. Despite the existence of facilitating technology, we are yet to adopt a credible and lasting solution to this problem.

   (c) **How is it Being Overcome**. Currently voice communications facilitated by tactical communication system are the only means of sharing/acquiring location awareness through verbal communication. There is a requirement of automation of the process of location updation. Exploitation of GPS and Data communication facility in tactical communication is the way forward in solving this problem. The use of indigenous IRNSS instead of GPS will ensure availability and confidentiality. Though local arrangements of location updation using Radio sets / Mobile Cellular Communication System (MCCS) and GPS are done by various units, these are all at prototype level. There is no across the board adoption of a particular technique or its implementation at a large scale. The incorporation of multiple inputs / instances, periodic updating of location information and its compilation and presentation in a common output / platform are things to be considered and deliberated upon.

   (d) **Any Innovation**. Nil.

5. **Who has the Problem**.

   (a) **User**. All military users.

   (b) **Operation Environment**. Combat environment in rugged / network non accessible terrain.

   (c) **Periodicity of Exploitation**. Through out the year.

6. **Why is it Important to Solve**. It will assist in planning and execution of operations and will enhance the efficiency in Command and Control.

7. **Contemporary Solution by other Countries / Orgs**. Nil.

8. **Timeline**. By 2018.

9. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No - 011-23019003
Email – ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Directorate General of Information Systems
Tele No - 011- 26142936

PROBLEM DEFINITION STATEMENT- 40

VEHICLE LOG SYSTEM FOR MAINTENANCE AND ACCOUNTING OF MILITARY VEHICLES

1. **Short Title**. Vehicle Log System for Maintenance and Accounting of Military Vehicles.

2. **User Directorate**. Supply and Transport Directorate

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

4. **What is the Problem**.

(a) **Statement of Problem**. Manual entries and maintenance of documents involves lot of manpower, time and resources for proper accounting of MT and leads to manipulation and inaccuracy. To ensure greater accuracy and digitized / computerised acct and log system in units and formations, a digital log system is recommended in all military vehicles.

(b) **Evolution of Problem**. The system currently in vogue is outdated and has outlived its advantages owing to advancement in technology. The current system involves a lot of documentation and leads to waste of time and resources.

(c) **How is it Being Overcome**. The system recommended is same as used in UN vehicles wherein a permanent car log is attached to the vehicle and all activities are automatically recorded on the vehicle to include:-

(i) Vehicle speed.

(ii) Duration of operation.

(iii) Driver Information - Based on swiping of driver's card.

(iv) Engine performance.

(v) Servicing alert and maintenance requirements, besides others.

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

5. **Who Has the Problem**. The issue is pan Army with all units and formations authorised military vehicles in peace and field stations.

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

(a) Reduces paper work and save manpower.

(b) Automatic monitoring.

(c) Proper and accurate account.

(d) Timely servicing.

(e) Saves cost and resources.

(f) Proper handling of MT vehicles.

(h) Extends vehicle life.

7. **Contemporary Solution by other Countries/Org**. All UN vehicles operate on this principle.

8. **Timelines**. The product is already available and in use in various organisation and countries. The system can be easily designed and fitted to military vehicles in short time span. One year may be required to develop and trial evaluate the system.

9. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No - 011-23019003
Email – ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Directorate General of Supplies & Transport
Telephone No : 011-23018327

PROBLEM DEFINITION STATEMENT- 41

MILITARY GRADE POWER BANK

1. **Short Title**. Military grade Power Bank.

2. **User Directorate / Establishment**. Directorate General of Signals.

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

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

   (a) **Statement of the Problem**. Mobiles and MCCS are the mainstay of communications especially during peace time. Charging of mobiles and MCCS is a big issue in field areas especially for troops operating over difficult terrain for longer durations.

   (b) **Evolution of the Problem**. There is a requirement of a waterproof, shockproof and dust proof power bank which can survive in all weather conditions.

   (c) **How is it Being Overcome**. Using local power banks which are still evolving and not of military grade specifications.

   (d) **Any Innovations to Locally Overcome the Problem**. None.

5. **Who has the Problems.** The problem is with all field formations utilizing the mob and MCCS system.

6. **Why it is Important to Solve**. Communication is the bedrock of all successful operations. Troops operate over difficult terrain for long durations and do not have access to electricity to charge their radio sets, mobiles or MCCS sets. To solve this issue there is a requirement to have military grade charging power banks.

7. **Contemporary Solution by other Countries/Org**. Western armies especially USA and France are using Jarv's Military Grade Change Power Banks to charge smart phones, tablets etc.

8. **Timelines**. One year for development and trial evaluation.

9. **Point of Contact**.

   (a) **Primary Contact**.

   Army Design Bureau
   Tele No - 011-23019003
   Email – ddgtechres-mod@gov.in

   (b) **Secondary Contact**.

   Directorate General of Signals
   Tele No- 011-23018915

PROBLEM DEFINITION STATEMENT- 42

POWER BANKS FOR COMMUNICATION EQUIPMENT

1. **Short Title**. High performance power banks for communication equipment.

2. **User Directorate / Establishment**. Directorate General of Signals.

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

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

   (a) **Statement of Problem**. High performance, compact and ruggedized power banks are required for communication equipment during Long Range Patrols, Expeditions and isolated communication detachments for sustained power supply without the need of carrying generators and FOL to provide reliable power supply.

   (b) **Evolution of the Problem**. Long Range Patrols, Mountain Expeditions and isolated communication detachments during conduct of operational tasks require light weight and ruggedised power source for reliable power supply rather than transporting bulky battery charging units, generators and FOL for the same in high altitude area and rugged mountainous terrain.

   (c) **How is it being Overcome**. Presently personnel have to carry bulky battery charging generators and FOL for recharging batteries of various communication equipment. The power bank technology can be enhanced to make efficient, compact and ruggedized power banks to suite all purposes.

   (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, Mountain and High Altitude Area.

   (c) **Periodicity of Expl**. Throughout the year

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

   (a) During conduct of Long Range Patrol, Mountain Expeditions and for isolated communication detachments, individuals have to be self sustainable for long durations in mountainous terrain where transportation

of bulky battery charging units and generator, FOL for the same poses a huge problem.

(b) Developing high performance, light weight and ruggedised power banks will provide efficient and sustainable power supply for communication equipment.

7. **Contemporary Solution by other Countries / Organisations**. Technology does not exist with other countries / organisation.

8. **Timelines**.

(a) Research and Development - 3 Months.

(b) Manufacture of Eqpt - 6 Months.

(c) Field / User Trials - 1 Months.

(d) Induction - 2 Months.

9. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No - 011-23019003
Email – ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Directorate General of Signals
Tele No- 011-23018915

PROBLEM DEFINITION STATEMENT- 43

ULTRA LIGHT RECOVERY VEHICLE

1. **Short Title**. Ultra Light Recovery Vehicle.

2. **User Directorate / Establishment**. HQ Central Command

3. **Type of problem**. Technology Infusion

4. **What is the Problem**. Presently Armed Forces employ Light / Heavy Recovery vehicles to extricate vehicle casualty for repairs or to keep axis of maintenance / bottleneck clear of disruptions. However, their employment is restricted by terrain and road conditions:-

(a) **Terrain Restrictions**. Due to high unladen weight of the recovery vehicles, their employment gets limited especially in deserts, riverine terrain with boggy ground surface and during cross country move.

(b) **Rd Conditions**. In mountains, particularly in areas with under developed communication lines, the terrain does not offer enough road space for maneuverability and turning of even Light Recovery Vehicles. The problem gets further aggravated when the vehicle casualty is towed behind the recovery vehicle.

5. Due to above mentioned restrictions; there is a requirement of Ultra Light Recovery Vehicle, based on 4x4 Jeep / Light Vehicle with recovery equipment mounted behind. The recovery vehicle should have following capability:-

(a) Capability to recover light vehicles and unladen 2.5 Ton and 5/7.5 Ton lorries.

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

(c) Self recovery capability.

(d) Recovery of vehicle with fixed as well as suspended tow.

(e) Winch with minimum ratio of 6:1.

6. **Who has the Problem**. All users in the Army.

7. **Why it is important to solve**. Irrespective of terrain and road conditions, it is of paramount importance to keep the axis of maintenance open by extricating vehicle / equipment casualty and recycling them at the earliest during operations. Ultra Light Recovery vehicle would fill the void in engineering support activities especially in terrain which is inaccessible to heavier recovery vehicles.

8. **Contemporary Solution by other Countries/Organisation**. Not known.

9. **Timelines**. Since the problem and its solution pertain to technology infusion, timelines may be defined after product conceptualisation and feasibility study.

10. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No - 011-23019003
Email – ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Directorate General of EME
Tele No – 01123333644

PROBLEM DEFINITION STATEMENT- 44

DEVELOPMENT OF SNOW MOBILES FOR GLACIATED AND SNOW BOUND TERRAIN

1. **Short Title**. Design and Development of Snow Mobiles for Snow and Glaciated terrain.

2. **User Dte(s) / Est**. Engineer-in-Chief Branch.

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

4. **What is the Problem (Need)**. Snow Mobile is an appropriate mode of transportation for men and materials in glaciated and snow bound terrain. It is the mainstay of logistic maintenance for all posts in snow bound and glaciated areas. In absence of roads and tracks in such areas, snow mobiles are cost effective and faster mode of transport. Snow Mobiles are used for a variety of tasks such as carriage of heavy loads to forward posts, casualty evacuation from the forward post to helipad, carriage of ammunition and fuel etc.

5. **Statement of Problem**. There is a need to develop low cost Snow Mobile having adequate power (approx 30 BHP) to meet the transportation requirement in snow / glaciated areas.

6. **Evolution**. The deployment of Indian Army in snow bound areas and glaciated terrain makes it imperative to have fast and reliable mode of logistics sustenance. Engineering challenges in constructing motorable roads and tracks in glaciated terrain makes it obligatory to depend on alternate mode of transportation in such areas.

7. **How it is being Overcome**. By employment of porters, cable ways and limited numbers of imported snow mobiles, the problem is presently being overcome.

8. **Any innovations to Locally Overcome**. Nil.

9. **Who has the Problem**. Troops deployed in the snow bound / glaciater terrain and Siachen Glacier.

10. **Why it is important to Solve**. Development of indigenous Snow Mobiles of adequate horsepower will enhance the operation are capability of Army deployed in the glaciated terrain.

11. **Contemporary Solution by other Countries / Organisations**. Snow mobiles are available globally.

12. **Timelines**. Design and trials are possible within one to two years.

13. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No - 011-23019003
Email – ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Engineer-in-Chief Branch
New Delhi
Tele No – 011-23019023

PROBLEM DEFINITION STATEMENT- 45

INTEGRATED NAVIGATION DEVICE

1. **Short Title**. Navigation Device with integrated GPS, digital compass and GIS application, with facility to use raster, vector and 3-D maps.

2. **User Dte**. Infantry Directorate.

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

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

   (a) **Statement**. The current GPS used is of old vintage, is less user friendly and does not include integrated digital map, compass and GPS application. Thus a soldier has to use three to four devices for navigation, which increase the over all weight and number of equipment being carried by a soldier.

   (b) **Evolution**. The requirement of finding own position and multiple routes towards intended area of move/operations is one of the most important requirement of fighting troops. The same is not being adequately addressed as of now with available Commercially Off the Shelf (COTS) GPS device.

   (c) **How is it Being Overcome**. At present GPS based COTS procured sys are authorised on WE of all unit/establishments and are being issued through Ordnance channel.

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

5. **Who has the Problem?**. Troops operating in field areas / Counter Insurgency operations.

6. **Why it is Important to Solve?** Indian Army requires accurate, robust and fail safe navigation device with pre- loaded military maps as offered by contemporary technology for faster, intuitive position finding and navigation. However, presently COTS equipment based on foreign GPS application is being used which are prone to inaccuracies and denial at critical time of war. Hence, there is an urgent need to develop an indigenous hardware supported by the ISRO launched IRNSS Navigation system which should be enabled with a unique GIS platform for military maps in various formats.

7. **Contemporary Solution**. US, NATO countries and the Chinese have developed their exclusive navigation system based devices which provide them dedicated user defined GIS application for military purposes.

8. **Timelines**. Two years including development, design, field trials and fielding.

9. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No - 011-23019003
Email – ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Directorate General of Infantry
Tele No - 011-25694694

PROBLEM DEFINITION STATEMENT- 46

ACCLIMATIZATION FOR HIGH ALTITUDE DEPLOYMENT

1. **Short Title**. Acclimatization of troops for high altitude deployment at lower altitude.

2. **User Dte (s)/Est**. Infantry Directorate.

3. **Type of Problems**. Poorly solved.

4. **What is the Problem (Need)**. Indian Army is deployed in high altitude areas in Northern and Eastern borders. Some unit have dual roles in such areas whereas the current deployment of these units is at lower altitude, but in case of urgent operational requirements these units would be required to deploy in high altitude with minimal delay. For achieving this state of readiness it is imperative that the troops remain acclimatised at all time.

(a) **Statement of Problem**. The present acclimatization process involves three stages of acclimatization at an altitude of approximately 2600 m, 3600 m and above 4500 m for a duration of 4 to 6 days, by physically staying at these altitudes. The system is time consuming and requires adequate infrastructure & open areas for troops. Hence there is a need wherein the troops are acclimatized on regular basis at low altitudes or at area of their current deployment.

(b) **How is it Being Overcome**. The problem is being overcome by undergoing acclimatization by physically staying at prescribe altitude for fixed duration of time. The acclimatization schedule involves under mentioned schedule :-

(i) **Stage I**- Acclimatization a period of 6 days at an altitude of 2700- 2600 m.

(ii) **Stage II**- Acclimatization for a period 4 days at an altitude of 3600-4500 m

(iii) **Stage III**- Acclimatization for a period of 4 day at an altitude of greater than 4500 m.

(c) **Any Innovations to Locally Overcome the Problem**. No.

5. **Who has the Problem**. The problem is faced by all soldiers, who are going to operate in high altitude areas and presently deployed in the plains or at lower altitudes.

6. **Why it is Important to Solve**. To improve the operational preparedness and to react to any emergency requirement in shortest time frame.

7. **Contemporary Solution by Other Countries/Organizations**. Presently few countries are using technology where in the troops deployed in low altitude are acclimatised at all times for high altitude deployment. The technology is based on **'Live Low Train High'** concept. Where in there are altitude simulation tent/altitude simulation room or Mask based Hypoxicator system. These simulation tents/simulation room have similar barometric pressure as well as reduced oxygen content as found in high altitude areas. The troop are made to undergo training in this simulated environment thus making them acclimatised for high altitude deployment.

8. **Timelines**. One to two years for designing of prototype and testing.

9. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No - 011-23019003
Email – ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Directorate General of Infantry
Tele No - 011-25694694

PROBLEM DEFINITION STATEMENT- 47

SMART VEST FOR IDENTIFICATION OF FRIEND OR FOE (IFF)

1. **Short Title**. Smart Vest for IFF.

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

3. **Type of Problem**. Tech Infusion.

4. **What is the Problem**.

   (a) **Statement of the Problem**. At present, there is no tool/equipment to identify friend or foe and adhoc tools are used for IFF which are not fool proof and there are chances of error in IFF which may result in fratricide.

   (b) **Evolution of the Problem**. Over the last two and half decades, Army is heavily employed in counter insurgency operations. While carrying out these operations, quick identification and engagement of terrorists is crucial to prevent casualties. As terrorists have also started using combat outfit, it is difficult to immediately differentiate a terrorist from a soldier especially in poor weather conditions.

   (c) **How is it Being Overcome**. Using local tools like a piece of white cloth on Helmets or Torch light etc which are prone to errors and may result in fratricide.

   (d) **Any Innovations to Locally Overcome the Problem**. LEDs fixed on helmets.

5. **Who has the Problems**. The equipment is required for troops deployed in Counter Terrorist operations.

6. **Why it is Important to Solve**. To reduce any chances of fratricide, there is a requirement of foolproof system to identify friend or foe.

7. **Contemporary Solution by other Countries/Org**. Not known. Smart IFF vest with built in code and GPS to auto identify own troops wearing the same vest and having same code is an effective equipment to reduce fratricide during operations.

8. **Timelines**. 2 to 3 years.

9. **Point of Contact**.

   (a) **Primary Contact**.

   Army Design Bureau
   Tele No - 011-23019003
   Email – ddgtechres-mod@gov.in

   (b) **Secondary Contact**.

   Directorate General of Infantry
   Tele No - 011-25694694

PROBLEM DEFINITION STATEMENT- 48

SNIPER SCOPE

1. **Short Title**. Sniper Scope.

2. **User Dte (s) / Est**. Directorate General of Infantry.

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

4. **What is the Problem**.

   (a) **Statement of Problem**. The snipers are force multipliers to any Infantry/ Scouts Battalions. The high standard of sniper training and their imaginative employment leads to decisive and out of proportion results. However in High Altitude Areas, sniper accuracy is affected by inaccurate distance measurement due to terrain conditions and high cross wind component at target end.

   (b) **Evolution of Problem**. It has been found that in high altitude areas, the fire of Sniper Rifle has been inaccurate due to terrain and weather conditions. To achieve effective results out of the precision fire of a sniper rifle, it is important that the forced incidental errors due to environmental factors be reduced to minimum.

   (c) **How is it Being Overcome**. Presently this is being overcome by conventional styles of lead method of target engagement and judging distance. Third generation telescope sights are accurate to an extent in measuring distance but it requires extensive training at long range. Laser Range Finder and Hand Held Thermal Imagers are being used to measure accurate distance however, it imposes the penalty of additional battle load on the sniper detachments.

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

5. **Who has the Problem**. The equipment is required for small teams deployed in Counter Terrorist operations, plains as well as in HAA up to 20000ft. It will be used on regular basis.

6. **Why it is Important to Solve**. Sniper detachments are essential and decisive elements of Infantry Battalion /Sub Groups and form a critical part of Operations. These sniper detachments operate in conditions where judging distance and cross wind error component adversely affects the external ballistics before the bullet strikes the target. The new sniper scope with inbuilt distance and cross wind component correction will help the sniper to engage the every with precision.

7. **Contemporary Solution by other Countries / Org**. Optical refracting telescope with variable magnification sites are being widely used in many armies. However, these sights don't cater for high speed cross winds and rarefied air in High Altitude Areas.

8. **Timeline**. 3-4 years.

9. **Point of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No - 011-23019003
Email – ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Directorate General of Infantry
Tele No - 011-25694694

PROBLEM DEFINITION STATEMENT- 49

AUTOMATED EQUIPMENT HEALTH MONITORING SYSTEM (AEHMS) FOR EQUIPMENT AND VEHICLES

1. **Short Title**. Automated Equipment Health Monitoring System.

2. **User Dte(s) Est**. Directorate of General of EME Directorate

3. **Type of Problem**. Technology Infusion/Poorly solved.

4. **What is the Problem**.

(a) **Statement of Problem**. Indian Army has, in its inventory, a wide range of vehicles/ equipment and therefore ensuring full mission capability at all times, in order to achieve the desired op role, remains a challenge. Presently no real time flow of data and monitoring mechanism exist between the user and the repair agency for carrying out timely preventive maintenance and ensure improved serviceability state.

(b) **Evolution of Problem**. The inventory of all equipment, in-service and futuristic, places great reliance on use of sensor and digital technology. Vital and timely inputs needs to be monitored through Automated Equipment Health Monitoring System in order to ensure evolution from the present corrective maintenance philosophy to preventive maintenance philosophy. The present system relies heavily on manual processes affecting availability of the equipment and its full mission capability.

(c) **How it is Being Overcome**. The present process is purely based on manual report and returns. The process being adopted is archaic and not in sync with the technological advances made.

(d) **Any Innovations to Locally Overcome the Problem**. Workshop Automation Software Package (WASP) has been developed but is being used partially by the repair agencies only. Software to cater for individual needs at various levels have been developed by Ordinance, MISO and other stake holders to monitor the population of equipment, inventory management and repair and maintenance data.

5. **Who has the Problem**.

(a) **User**. The user cannot ensure complete maintenance of the equipment either due to limited knowledge or due to absence of Automated Equipment Health Monitoring System which can generate early warnings as per laid down preventive maintenance schedules.

(b) **Operating Environment**. Scientifically collated data of equipment being exploited in various operational environment is not available for better sustainment and repair & maintenance of the equipment.

(c) **Periodicity Exploitation**. The limit of exploitation and life of component which decides periodicity of replacement is also manually monitored thus posing limitations to effective monitoring of the equipment readiness state.

6. **Why it is Important to Solve?**. The product once developed will automate the complete/critical equipment readiness state. The system should include:-

(a) **Digital Log Book**. Present manual log book needs to be replaced by a digital log book. The data will be ported either manually or based on data input ports provided by the OEM. The preventive maintenance or component replacement warnings should be automatically alerted to the users.

(b) **Software Management System**. The software management system will provide interface to various digital log book for compilation and analysis of data at various levels to include:-

(i) Preventive maintenance summary.

(ii) Inventory Management.

(iii) Consumption of Oil, Lubricants & Spares.

(iv) Exploitation of Equipment.

(v) On road/off road state.

(vi) Miscellaneous facilities.

7. **Contemporary Solution by Other Countries /Organisation**. OEM specific software have been developed by various software companies providing remote servicing as well as networked services through authorised agencies/ service dealer network. The other ERP based projects are also under development by Corps of Ordnance and EME related to proposed problem statement.

8. **Time Lines**. The suggested time lines are as under:-

(a)	Product conceptualisation	- 12-18 Months.
(b)	Research & Design	- 12-18 Months.
(c)	Manufacturing & Design	- 18-24 Months.
(d)	Mfr Prototype	- 06-12 Months.
(e)	Trials/Users trials.	- 12-18 Months.
(f)	Manufacture	- 12-18 Months.

9. **Point of Contact**.

(a) **Primary Contact** .

Army Design Bureau
Tele No – 011 23019003
Email – ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Directorate General of Electronics and Mechanical Engineers
Tele No – 011 23019330

PROBLEM DEFINITION STATEMENT- 50

FUEL, OIL AND LUBRICANTS (FOL) STORAGE IN OPERATIONAL CONDITIONS

1. **Short Title**. Storage of FOL in operational conditions.

2. **User Dte (s) Est**. Supply and Transport Directorate.

3. **Type of Problem**. Poorly Solved.

4. **What is the Problem**.

(a) **Statement of Problem**. The Army provides bulk petroleum to all land based forces in a theatre of operations, and most of the FOL handling units in field are required to establish a Petroleum Point (PP) for this purpose. Depending on the size of the operation, this may mean that several thousand litres of fuel must be received and stored in barrels and jerricans in make shift shelters with limited storage capacities and which are vulnerable to enemy shelling, terrorist action and fire hazard.

(b) **Evolution of Problem**. The enormity of the problem can be gauged from the aftermath of the recent terrorist action on the FOL dump at Uri. Old vintage barrels and jerricans being used for storage and transportation of FOL in field conditions are susceptible to enemy actions thus increasing the scope for collateral damage.

(c) **How it is Being Overcome**. Army has been using jerricans, barrels and containers with varied specifications for storage of FOL products. In some cases where accessibility is ensured, the Oil Companies have established underground storage in form of TOK tanks.

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

5. **Who has the Problem**. The equipment is required by all the fighting formations deployed in forward areas.

6. **Why it is Important to Solve**. An alternate mechanism to ensure proper storage of FOL products in field areas is essential to prevent / minimise collateral damage. Technological advances in materials and fabrication technology has led to the manufacture of larger and lighter fabric tanks made from thinner thermoplastic urethanes which are fire resistant and has a capacity of over 50000 litres. These tanks can be deployed rapidly and recovered using fewer personnel and less equipment, Collapsible Storage Tanks (CSTs) are constr from heavy duty, reinforced fabric that allows them to be rolled into compact, transportable units. Once deployed, they are simply unrolled into a dike system and filled on site, The quantity and the mode of transport will depend on the operation and terrain and must be capable of being dropped with or without parachute.

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

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

(b) **Elastec/ American Marine Pillow Tank**. These are collapsible storage containers that provide temporary as well as long terms liquid storage. Versatile usage including for land based and air drop operations, these are used by the US marines.

(c) **Quick Tanks-Open Top Aluminium Frame**. Quick tank has a robust aluminium frame that supports the open top liner. A choice of fabrics and sizes make the Quick Tank an affordable solution to the storage needs. The Quick Tank is a complete portable storage facility developed for rapid deployment and temporary storage of liquids.

8. **Time Lines**. Collapsible tanks are available COTS, hence procurement can commence with immediate effect.

9. **Pt of Contact**.

(a) **Primary Contact**.

Army Design Bureau
Tele No – 011 23019003
Email – ddgtechres-mod@gov.in

(b) **Secondary Contact**.

Directorate General of Supplies & Transport
Telephone No : 011-23018327

Contact Us

011-23019003

E-mail – ddgtechres-mod@gov.in

Publishing Courtsey

CII

Confederation of Indian Industry