



**DEFENCE AVIATION POST**  
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**ARMY DESIGN BUREAU**



**1<sup>ST</sup> COMPENDIUM ON  
SOLUTIONS TO PROBLEM STATEMENTS**

**APRIL 2018**







## FOREWORD

The Indian Army remains committed to achieving the goal of self-reliance in defence production through the 'Make in India' paradigm. The flagship Make in India programme under the able guidance of the Hon'ble Prime Minister, has been at the forefront of numerous changes that have taken place in the Indian Army over the last couple of years. The Army Design Bureau (ADB), along with the industry associations have, in the last year, organised 19 Army-Industry bilateral and 12 Army-Academia-Industry trilateral events across various cities in the country. The purpose of these events was to engage Academia, R&D organisations, Industry and the Army in a cross exchange of ideas to develop technologies for future warfare. The result of these interactions were three volumes of **Future Core Technologies** and **Problem Statements** that showcased the 'felt needs' of the Indian Army.

As a follow up action to the earlier efforts, the ADB, along with FICCI and DefenceAviationPost.com, engaged with the Indian Industry and Academia over the last few months to propose 'Solutions to the Problem Statements'. The aim is to provide a platform for researchers, innovators and the industry to showcase state-of-the-art technologies that could be later absorbed as defence acquisition or could be channelized for defence production through the intervention of the private sector. The Government has provided various conduits through which solutions at various stages of design and development could conveniently be taken up the Army. Projects in the conceptualisation stage could be funded through the Technology Development Fund, while those nearing the development of a prototype could be taken up by the Army Innovation Fund and projects that have achieved a functioning prototype could be absorbed as Make-II project of production by the industry.

Indian Army is delighted that nearly 50 plus solutions have already been proposed by the Industry and Academia, and the same has been published in this solutions compendium. The team at ADB will now evaluate these solutions and take it to the next step. This kind of engagement between the users, industry and academia will not only provide the Army indigenous solutions to problems of future technological capabilities but will also enable development of the indigenous defence industry base in the country. I wish for a continued effort in this direction and for many more solutions by the industry and academia.

'Jai Hind'

(S K Patyal)

Lieutenant General

Deputy Chief of the Army Staff (P&S)





## FOREWORD

In this era of fast evolving world of technology, cost efficient development of indigenous capabilities, products and technologies, would serve to be the real force multiplier in giving our armed forces the defining edge in future battlefields.

The relentless encouragement and enabling policy environment provided by the Government of India (GoI) through series of reforms over the last few years has served as impetus to industry to innovate and work on development of indigenous technologies, products and solutions. Under the watchful eyes of the Industry friendly leadership at the helm of Ministry of Defence, relentlessly promoting Indigenisation of the Defence Sector by embracing the Government's flagship initiative 'Make in India', Defence & Aerospace sector is poised to become a major contributor to GDP growth over coming years.

Our Armed Forces, and the Indian Army in particular have been very proactive over past few years in reaching out to industry to absorb upcoming technologies and indigenous solutions for their day-to-day operations. The much-needed dissemination of critical requirements of Indian Army has been expedited through the constitution of Army Design Bureau (ADB). FICCI provided able support to this endeavour by associating with ADB to bring together Army - Industry - Academia in a strong partnership culminating in issuing "Compendium of Problems" by the Army HQ.

In the last one and a half year the Army - Industry - Academia dialogue has traversed a long way across the industrial & academic clusters in India, with Army spelling its operational requirements, to next logical phase of the industry and academia offering home grown solutions to the problems. The overwhelming participation of industry & academia at the Solutions Seminar conducted by FICCI is a testimony to the commitment of Indian industry & academia to innovate and work with the armed forces.

I take this opportunity to thank Army Top Leadership starting with General Bipin Rawat, UYSM, AVSM, YSM, SM, VSM, ADC, Chief of the Army Staff, and Lt General Sarath Chand, PVSM, UYSM, AVSM, VSM, ADC, Vice Chief of the Army Staff for constant encouragement, for no epoch making initiatives can take firm roots without constant encouragement at the Top. Lt Gen SK Patyal PVSM, UYSM, SM, PHD, Deputy Chief of the Army Staff (P&S) and his team of officers continued to drive this initiative and for the support extended by his team. Lt Gen Subrata Saha, PVSM, UYSM, YSM, VSM\*\* (Retd), former Deputy Chief of Army Staff (P&S) provided the leadership and became the path finder for this initiative being nurtured by the succeeding leadership. I must also acknowledge the efforts of industry and academia members for sharing their concept solutions which have now been documented in the form of this '1st Compendium of Solutions to Problem Statements'. While a conducive environment has been enabled by the Indian Army in bridging the communication gap, Industry and academia now looks forward to an enabling policy framework to take forward these solution proposals to a logical end. Few early success stories have started emerging in the form of programs cleared under the Technology Development Fund scheme.

FICCI will continue to be partner to the endeavour of the Indian Army and bring to the table indigenous and cost-effective solutions with the help of the academia and industry combine.

**J D Patil**

Chairman  
FICCI Defence Committee





## FOREWORD

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The development of an indigenous defence industrial base in the country is one of the main pillars of the 'Make in India' initiative of the Government of India (GoI). Hence, it is fitting that the theme of this year's Defexpo - "India: The Emerging Defence Manufacturing Hub" resonates with this objective. More recently the Government has been pro-active in pushing forward reforms in defence and aerospace business.

The personal initiative taken by Smt. Nirmala Sitharaman, Raksha Mantri, to integrate the existing organic clusters of industry (with significant presence of MSMEs) with large system integrators in a contiguous geographical region by way of announcing the defence industrial corridors will certainly contribute in establishing a robust defence industrial base in India.

FICCI has been playing an active role in realising the establishment of this defence industrial base through various initiatives that it does with the stakeholders including GoI, state governments, institutions like Niti Aayog and various thinktanks. One such unique initiative that FICCI undertook along with Army Design Bureau and DefenceAviationPost.com was to create a strong User-Industry-Academia interface through a series of 'Seminars on Solutions to Problem Statements' across the country. The seminars held in New Delhi, Coimbatore and Bangalore enabled FICCI to document 50 plus solutions presented by Industry and academia that address the problem statements of Indian Army.

For the support and guidance provided in this journey by Lt Gen Subrata Saha, PVSM, UYSM, YSM, VSM\*\* (Retd.), former Deputy Chief of Army Staff (P&S) as a mentor to this initiative, we are thankful. An attempt has been made to present the solutions by Industry and Academia through this '1st Compendium of Solutions to Problem Statements'. I am hopeful that Indian Army will be benefitted by the proposed solutions and will take this effort to a logical conclusion.

I am confident that this compendium will encourage other centres of academic excellence to engage with industry to find solutions for emerging operational requirements of our armed forces. FICCI is committed to continue this dialogue between the Indian Army, industry and academia on an ongoing basis.

**Dr. Sanajaya Baru**  
Secretary General  
FICCI

**Disclaimer**

The information and opinions contained in this document have been compiled on the basis of information data received by FICCI from the industries and academia. This document is for information purpose only. The information contained in this document is published for the assistance of the recipient but is not to be relied upon as authoritative or taken in substitution for the exercise of judgment by any recipient. This document is not intended to be a substitute for professional, technical or legal advice. All opinions expressed in this document are subject to change without notice.

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## SOLUTION TO PROBLEM STATEMENT NO 1, VOL - I

# ALPHA DESIGN TECHNOLOGIES LTD.

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**Problem Statement:** Identification of Friend or Foe (IFF) system for AFV.

**Details of the Solutions:**

(a) **Brief Description:** Identification, friend or foe (IFF) is an identification system designed for command and control. IFF system comprises of an Interrogator, Transponder and Antenna and other sub units. IFF systems enables military and national (civilian air traffic control) interrogation systems to identify aircraft/ships/vehicles as friendly or foe and to determine their bearing and range from the Interrogator. The Transponders fitted on those systems will respond to interrogation queries. The received identification of the systems will help the battle field commander to take decision on coping up with the agile battle field dynamics.

(b) **Indigenous or Ex Import:** Indigenous

(c) **Present State (Concept / Proof of Concept):** Prototype and Engineered systems are developed.

**Assistance Sought from the Army:**

- a) Sanction of Rs 3 Crores for making (6 – 8) land vehicular versions of devices.
- b) Approval for integration trial on certain specified Army vehicles.

**Likely Timeline:** Next 6 to 12 months.

**Outcome Envisaged:** Installation in certain army platforms and providing a platform to evolve IFF based field identification norms.

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*Senior Vice President (Software)*

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## SOLUTION TO FUTURE CORE TECHNOLOGIES (PARA 13 & 14) FOR TANK T-72 – UPGRADING OF TISAS AND FIRING OF ATGM THROUGH TANK T-72., VOL - 1 ALPHA DESIGN TECHNOLOGIES LTD.

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**Problem Statement:** The T-72 fleet of tanks has been partially modernized, there still remains more than 35% of the fleet to be upgraded further - in terms of the enhancing target detection and engagement capabilities. Further there is also a need to enhance the lethality of the T-72 tanks by introducing an ATGM at larger ranges and longer depth of penetration.

### Details of the Solutions:

- (a) **Brief Description:** Although the TISAS upgrade is available in about 35% of the T-72 Tanks held by Indian Army, they are bereft of a Gunners day sight, Eye safe Laser Range Finder, ability of the Commander to take over the Main Gun, critical sensors, sophisticated ballistic computer, etc. These shortcomings can be easily overcome by adding certain modules to the existing system and include an Automatic Target Tracker. Provisioning for Missile Firing through the Barrel of the T-72 shall further extend its ranges for engagement of targets drastically.
- (b) **Indigenous or Ex Import:** 60-80% Indigenous.
- (c) **Present State (Concept / Proof of Concept):** ADTL has already manufactured a major parts of these building blocks, fitted, and successfully validated the entire TIFCS system in more than 200 Nos of T-72 Tanks of the Indian Army. Using the same building blocks it will be possible to upgrade the existing T-72 tanks equipped with TISAS for modernizing them and bringing their Operational effectiveness to the levels of the TIFCS with added functionality of Automatic Target Tracker. In the same manner, it is also possible to incorporate the missile firing through the Main Gun of the T-72 as done in the case of Tank T-90.

### Assistance Sought from the Army:

- (a) Access to Tank T-72 equipped with TISAS.
- (b) Access to documents relating to the organization of the Fighting Compartment of the Tank T-72 and Tank T-90 for effecting the modifications in loading mechanism, Missile Guidance Unit and their interface Connection Documents.

**Likely Timeline:**

- (a) Proof of Concept of TISAS Upgrade within 2 months.
- (b) Proof of Concept of firing of ATGM through barrel of T-72 within 6 months.

**Outcome Envisaged:**

Lethality of the Tank T-72 will be enhanced manifold in terms of engaging targets effectively at larger ranges.

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## SOLUTION TO PROBLEM STATEMENT NO 18, VOL - I

# ALPHA DESIGN TECHNOLOGIES PVT. LTD.

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**Problem Statement:** Software Defined Radio (SDR) in Mobile Adhoc Network (MANET) Environment.

**Details of the Solutions:**

**(a) Brief Description:** Alpha Design Technologies has been involved in the development of SDR related subsystems and software builds for past 8 years. It's strong R&D team which has been ramped up gradually on the advanced technologies like SCA (Software Communication Architecture), Dynamic TDMA, Mobile Ad-hoc networking in the Military context. Our SDR based platforms & related Software including RTOS, BSP & Drivers have been supplied to DEAL (DRDO), Dehradun and the Baseband Hardware and Naval SDR waveforms (FH with Dynamic TDMA and MANET) to WESEE.

Proposed SDR Solution (supported by MANET) will offer the following features/ benefits that will address the current problem.

- Provides interface for Indian Regional Navigation Satellite.
- Sys (IRNSS) besides GPS/GLONASS navigational sys is also desired.
- Support unicast, multicast, and broadcast modes of message transmission.
- Supports data rates up to 2 Mbps.
- The secured data communication in ad-hoc network environment.
- Supports peer to peer, self-forming and self-healing network over the wireless link.
- The MAC Layer implementation.
- Timing and Network synchronization.

**(b) Indigenous or Ex Import:** Indigenous

**(c) Present State (Concept / Proof of Concept):** Indigenous Handheld, Manpack and AFV versions of SDR Prototype development is in progress. Expected to be ready for field

trials by Dec 2019. However, looking for funding for making at least 10 sets of each of the above form factors, that will be required for field demonstration. Trials for Manpack and Handheld SDR in MANET environment are proposed during Dec 2018.

**Assistance Sought from the Army:** Request a funding of INR 20 Crores for the above.

**Likely Timeline:** Two Years (01 Jan 2018 till 31 Dec 2019).

**Outcome Envisaged:** Fully proven Engineering Proto types of SDR (Handheld, Manpack and Vehicular versions) in MANET Environment.

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## SOLUTION TO GENERIC PROBLEMS

# AMITY UNIVERSITY

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**Problem Statement:** Rechargeable Battery made of waste material.

**Details of the Solutions:**

**(a) Brief Description:** The present invention relates to the method for the preparation of a rechargeable battery from the waste material including wood ash and discarded activated carbon cylinder of water purifier based battery and also comprises aluminium anode, amorphous carbon with graphite as a cathode and wood ash mixed with water in 2:1 ratio as an electrolyte. The application of the rechargeable battery can be used for mobile charging / lighting source or for other general purposes.

**(b) Indigenous or Ex Import:** Indigenous

**(c) Present State (Concept / Proof of Concept):** Proof of Concept

**Assistance Sought from the Army:** Induction of the technology to the Army after Field Trial.

**Likely Timeline:** Ready for Field Trial.

**Outcome Envisaged:** Induction or Inclusion of this product in the armed forces.

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## SOLUTION TO PROBLEM STATEMENT NO 33, VOL - I

# AMITY UNIVERSITY

**Problem Statement:** High calorific value food.

**Details of the Solutions:**

- (a) **Pulse parcels:** Pulse parcels are made from three kinds of pulses which are known to be rich sources of proteins and also have good biological value. Certain products like chia seeds, sesame seeds, fennel seeds and pointed gourd will impart the laxative, mood elevating, appetizer, High fiber food product for the soldiers.
- (b) **Rich Muffins:** The muffins are traditionally made from the refined wheat flour, butter and sugar. Mostly desserts are made from point of view of the taste and flavours but the Nutritional composition is not kept in mind. We have developed a Dessert or Muffin from different composition to provide the nutrition as well with taste, flavor and texture. Water chestnut flour and maize flour was used for making of the muffins. These flours are rich in minerals and vitamins. Another flour used to prepare muffins was maize flour.
- (c) **High Calorie Chikkis:** The present study was conducted to prepare a food product in form of chikkis with rice flakes flour and figs. The chikkis weight was 100gms after the whole processing was carried out. The chikki is high in IRON, CALCIUM and PHOSPHORUS required by human body for supporting metabolism and healthy bones. This chikki could be helpful in treating/managing the Iron deficiency Anemia & Bone disorders such as Osteoporosis, Rickets, Hypocalcaemia, Arthritis etc.
- (d) **Indigenous or Ex Import:** Indigenous
- (e) **Present State (Concept / Proof of Concept):** Proof-of-Concept

**Assistance Sought from the Army:** Induction of the technology to the Army after Field Trial.

**Likely Timeline:** Ready for Field Trial.

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## SOLUTION TO PROBLEM STATEMENT NO 13, VOL - I

### AMRITA SCHOOL OF ENGINEERING

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**Problem Statement:** Light weight, High toughness composite for military bunkers - A novel approach for safe and quick construction in border areas.

**Details of the Solutions:**

**(a) Brief Description:** After extensive study and research a bunker structure is conceptualized which is low in weight and high in strength/ stiffness ductility and high ballistic capacity. It is a composite structure, a steel encased plywood or plywood filled steel tube. Number of experiments are conducted in the laboratory to prove the effectiveness of the suggested design. Additionally, the plywood filled steel structure will never have a catastrophic failure like concrete structure, no matter what the level or intensity of bombardment is. Also plywood is having good thermal and sound insulation property, which will make inside the bunker warm during cold climates, which is usually encountered in border areas. The thermal resistance or insulating effectiveness of plywood panels is  $R=8.67 \text{ (m}^2 \text{ oC)/(W.m)}$ , the higher the R value, the more effective the insulation.

**(b) Indigenous or Ex Import:** Indigenous

**(c) Present State (Concept / Proof of Concept):** From the study it is observed that the hollow steel sections quickly buckle under load, whereas Plywood filled sections shows high load carrying capacity, ductility, and energy carrying capacity. The light weight plywood filled steel tubes are totally free from catastrophic failures associated with RCC. All tests and calculations indicate that plywood filled beams can absorb huge amount of energy and hence can take huge ballistic loads. As all tests are limited to laboratory size beams, fabrication and testing at the prototype levels are required. Further, a mathematical model is to be developed so that the structure can satisfy the specific requirements.

**Assistance Sought from the Army:** Financial support for manpower, consumables and testing.

**Likely Timeline:** As detailed earlier, Tata Power SED is prepared for the NCNC

**Outcome Envisaged:** A Light weight, High toughness and high strength composite military bunkers which can be used for safe and quick construction in border areas.

**Prof. R. Subba Rao & Dr. K. M. Mini**

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## SOLUTION TO PROBLEM STATEMENT NO 13, VOL - I

# AMRITA VISHWA VIDYAPEETHAM

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**Problem Statement:** Light Weight Blast Proof Composite.

**Details of the Solutions:**

**(a) Brief Description:** Development of high temperature resistant ceramics matrix composite as outer layer, and Development of honeycomb steel plate, followed by Development of high temperature thermoplastic composite; sandwiching all three, with lightweight and easy to transport as aim.

**(b) Indigenous or Ex Import:** Indigenous

**(c) Present State (Concept / Proof of Concept):** Proof of concept

**Assistance Sought from the Army:** Field trials (blast proof testing)

**Likely Timeline:** 2 years

**Outcome Envisaged:** Three segments (i) high temperature resistant ceramics matrix composite (ii) honeycomb steel plate and (iii) high temperature thermoplastic composite are to be sandwiched after development, by high temperature resistant adhesive bonding or by mechanical fastening according to the requirement of Indian Army, CRPF, BSF and ITBP in particular for border areas where due to transportation constraints lighter weight materials and structures are desirable. Therefore, it will serve as alternative of concrete bunkers as well as alternative of thick steel plates, which is presently used as blast proof vehicles by light weight blast proof composite.

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**SOLUTION TO PROBLEM STATEMENT NO 7, VOL - I****AMRITA VISHWA VIDYAPEETHAM**

**Problem Statement:** Aerial Surveillance System

**Details of the Solutions:**

(a) **Brief Description:** 24X7 surveillance using hybrid aerostat up to 3Km. Conventional UAVs have limited duration and is difficult to recover after completion of the mission. Hybrid aerostat on the other hand provides 24X7 surveillance and can be operated by untrained personnel.

(b) **Indigenous or Ex Import:** Indigenous

(c) **Present State (Concept / Proof of Concept):** Scaled down prototype available for demonstration.

**Assistance Sought from the Army:** User requirement, funds for development of the platform and subsequent field trials. The proposal has been submitted to Army Design Bureau with budget Rs. 75 Lakhs. Army Design Bureau has shortlisted the proposal and final approval from Army Design Bureau is awaited.

**Likely Timeline:** 1 year

**Outcome Envisaged:**

(a) 24X7 surveillance at Army bases, International border and strategic assets.

(b) Automatic intrusion detection.

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## SOLUTION TO PROBLEM STATEMENT NO 13, VOL - I

# AMRITA VISHWA VIDYAPEETHAM

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**Problem Statement:** Light Weight Material Permanent Defences.

**Details of the Solutions:**

- (a) **Brief Description:** Outcome of this project will essentially develop light weight bullet proof materials and which will have multi faced applications.
- (b) **Indigenous or Ex Import:** Indigenous
- (c) **Present State (Concept / Proof of Concept):** Findings of this technology appears to be promising, however, more precise investigation is required.

**Assistance Sought from the Army:** Indian Army has endorsed this project to DRDO for Technology Development Fund (TDF) of DRDO.

**Likely Timeline:** Two years from start of the project after receiving TDF-DRDO project grant.

**Outcome Envisaged:** The outcome of this technology will have multi faced applications such as (a) Bullet Proof Vests (b) AFVs, (c) Bullet Proof Vehicles d) Unmanned Aerial Vehicles, (e) Light Combat Aircrafts, (f) Supersonic Aircrafts, (g) Long Distance Missiles, etc.

**Production Agency:** M/S L&T, Coimbatore

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**SOLUTION TO PROBLEM STATEMENT NO 2, VOL - II****BANNARI AMMAN INSTITUTE OF TECHNOLOGY**

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**Problem Statement:** Improving Cooling Efficiency of T-90 Radiator

**Details of the Solutions:**

(a) **Brief Description:** An experiment on a radiator is being proposed. The experimental data will be validated using software on Heat Exchanger/ Radiator. The validated procedure to be applied for the parameters of the prototype, that is the T-90 radiator to assess the cooling parameters and thereby the cooling enhancement.

(b) **Indigenous or Ex Import:** Indigenous

(c) **Present State (Concept / Proof of Concept) :** Concept

**Assistance Sought from the Army :** Funding for the proposed experimental project and to feed data that is needed for the modelling.

**Likely Timeline:** Six months (Starting Jan 2018)

**Outcome Envisaged:** This is a two-step process.

- 1) By conducting a performance evaluation of a radiator through an experimental study, the cooling parameter and the heat transfer modelling mechanism will be validated using a software.
- 2) Once the vital data are validated, the same modelling approach will be applied to the T-90 radiator. The validated modelling approach helps us find parameters that would enhance the cooling efficiency of the T-90 radiator be extended.

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## SOLUTION TO PROBLEMS STATEMENT NO 9, VOL - I

# BHARAT FORGE LTD.

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**Problem Statement:** Development of Smart Ammunition

### Details of the Solutions

- (a) **Brief Description:** Smart Ammunition including sensor fused munition
- (b) **Indigenous or Ex Import:** Indigenous
- (c) **Present State (Concept / Proof of Concept):** Joint development with a foreign OEMs

**Assistance Sought from the Army:** Detailed specifications and evaluation with existing guns post development.

**Likely Timeline:** Will be ready for evaluation soon.

**Outcome Envisaged:** Product under development.

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## SOLUTION TO PROBLEM STATEMENT NO 8, VOL - I

# BHARAT FORGE LTD.

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**Problem Statement:** Mobility of Guns for Mountains

**Details of the Solutions:**

- (a) **Brief Description:** System for mobility of Guns in mountains.
- (b) **Indigenous or Ex Import:** Indigenous
- (c) **Present State (Concept / Proof of Concept):** Readily available mobile platforms for all range of Artillery Guns.

**Assistance Sought from the Army:** Specification of detailed requirements and subsequent evaluation of solution.

**Likely Timeline:** Within a year.

**Outcome Envisaged:** Mobile Guns for Mountainous Terrain.

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## SOLUTION TO PROBLEMS STATEMENT NO 37, VOL - I

# BHARAT FORGE LTD.

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**Problem Statement:** All Terrain Ground Vehicle.

### Details of the Solutions

(a) **Brief Description:** Autonomous Ground Vehicles (AGVS) for multiple applications including high altitudes.

(b) **Indigenous or Ex Import:** Indigenous

(c) **Present State (Concept / Proof of Concept):** R&D

**Assistance Sought from the Army:** detailed specifications and evaluation of proto solution post development.

**Likely Timeline:** Will be ready for evaluation in 2 years.

**Outcome Envisaged:** AGV as specified to address current limitations.

### Mr. Ajay Sharma

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**SOLUTION TO PROBLEM STATEMENT NO31, VOL - III****COGNIT SEMANTICS PVT. LTD.**

**Problem Statement:** Online Translation of Chinese Intercepts in Different Dialects.

**Details of the Solutions:**

**(a) Brief Description:** Solution available is a scalable next generation AI product that can listen into intercepts and automatically transcribe Speech into text for downstream analytics. Main functionalities are:-

- a. Language Identification (14 Languages)
- b. Speaker Identification
- c. Speech to Text – Full Transcript (Manipuri, Mandarin, Pashto, Assamese, Bengali)
- d. Machine Translation from Vernacular to English (Key Phrases to start with)
- e. Key Word Spotting
- f. User trainable Machine learning pipeline
- g. Data Centre Ready
- h. 'Edge' deployments (Portable and no connectivity) on offer as part of product roadmap.

**(b) Indigenous or Ex Import:** 100% Indigenous

**(c) Present State (Concept / Proof of Concept):** Pre-Validation, Ready for Trials

**Assistance Sought from the Army:** Active engagement with user : 1>Field Data to enhance accuracy of system 2> Initial trial support costs till release of P.O.

**Likely Timeline:** Can deploy for trials in 1 week's time of notice.

**Outcome Envisaged:** User can process millions of calls in an automated fashion in the data-center. On-field soldier can have a 'head-set' to automatically listen to a language of interest and have it translated to English in real time with no – internet connectivity.

**Mr. Deepak Kumar**

*Director- Defence Solutions*

**COGNIT SEMANTICS PVT. LTD.**

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## SOLUTION TO FUTURE CORE TECHNOLOGIES, VOL - I ARTILLERY, SURVEILLANCE AND TARGETING SYSTEMS

### D.C. ENTERPRISES

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**Problem Statement:** Micro / Nano UAVs have variety of potential uses in military operations, including reconnaissance, surveillance, detection of intruders, border patrol, targeting and bio-chemical sensing.

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.

#### Details of the Solutions:

**(a) Brief Description:** In forward area situations and in environments where immediate situational awareness is needed, larger multi rotor systems become hard and cumbersome to lug along and setup. The solution is a cheaper, low range unit that allows very simple setup with the ability to be launched immediately. What we propose here will have the following features:

- Light and portable design that is **foldable and easy to carry**- between 300-600gms in weight and can be folded for easy transportation.
- Quick to deploy- Can be setup and deployed in under 3 minutes.
- Near zero visible signature- palm size vehicle becomes almost invisible from altitudes of 30 mts.
- Can be controlled by a single operator from a very simple, light ground station that includes a small phone/tablet for command and control.
- 2/3 axis gimbal stabilization with stabilization accuracy better than 0.01 degrees.
- High definition real time digital video transmission (optional zoom control).
- Range of up to 2 kms.
- 15-30 mins endurance- payload and weather dependant.

- Ability to fly in winds up to 20 kts.
- Complete autonomous flight.
- Ability to autonomously follow the Soldier giving him a bird's eye view from up above.

**(b) Indigenous or Ex Import:** Near 100% indigenous. With Indigenous global state of the art electric micro brushless motors, the drone can be tailored to virtually ANY requirement, incl. rain, snow and high altitude.

**(c) Present State (Concept / Proof of Concept):** Basic vehicle ( Proof of concept ) developed in 2014 and won awards in the National Micro air Vehicle competition-

<http://microbrushless.com/tag/team-silver-arrow/>

<http://www.allthatido.com/micav-2014/>

Vehicle has had some improvements since, but has **not been funded** in any way. Needs further work for ruggedisation and optimization in terms of its ability to fly in rain/snow. Maximum linear dimension ~300mm, weight ~300gms, Autonomous.

Micro air vehicle competition mission was as follows:

Terrorists have overrun a laboratory, where confidential experiments are underway. The terrorists have taken senior personnel as hostages whose imminent contributions are of strategic importance. The laboratory houses sophisticated, critical equipment that have taken years to build. Terrorists have threatened to blow up the laboratory with all that it contains with bomb. The commander of the area is to take defensive and offensive action. He also has intelligence information of ammunition dump located en-route to the laboratory. Before planning a raid on the laboratory he wants to take stock of the situation outside & inside the laboratory and is looking to the MICAV( Micro Air vehicle ) teams to provide him with critical information.

**Assistance Sought from the Army:** Funding and user support to take vehicle from Proof of Concept phase to manufacturing and deployment.

**Likely Timeline:** 12 to 18 months to be productionised and deployed.

**Outcome Envisaged:** Pilot production of mission capable nano UAV's, designed for readily scaled up production, for induction by the Army.

**Mr. Uttam Chandrashekar**

Chief Executive Officer

**D.C. Enterprises, Bangalore**

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## SOLUTION TO PROBLEM STATEMENT NO 117, VOL - 1

### D.C. ENTERPRISES

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**Problem Statement:** Mobility, Precision Drones with Higher Payloads for Delivering Stores. A number of defended localities in High Altitude Areas are not connected by road which necessitates ferrying of loads to these locations using mules/porters. Further, number of such locations is under developed with limited/ no habitation, which makes availability of adequate number of porters during operations uncertain.

**Details of the Solutions:**

**(a) Brief Description:**

Hybrid drones with autonomous operation and dedicated payload bays can be designed to carry the intended payload ( up to 50kgs ). High altitude performance and range can be achieved using custom designed electric propulsion systems.

**(b) Indigenous or Ex Import:**

Near 100% Indigenous content:

Indigenous brushless motors

Indigenous electronics

Indigenous Inertially stabilized cameras

Indigenous airframe

**(c) Present State (Concept / Proof of Concept):** Basic concept has already been developed.

Needs up-scaling and redesign based on requirements. To carry a payload of 50kgs, the system will weigh about 100-150kgs depending on range and altitude specifications.

Motors and propulsion system will be indigenously designed and developed from the ground up, based on requirements.



Advanced knowledge and experience working with many kinds of drones gives us flexibility to design based on requirements.

**Assistance Sought from the Army:**

Funding for actual size prototype design and fabrication.

User support for trials.

**Likely Timeline:**

As mentioned in volume I:

- (a) Product Conceptualization. Three months.
- (b) Research and Design. Twelve months.
- (c) Manufacturing of Prototype. Twelve months.
- (d) Field/ User Trials. Six months.
- (e) Manufacturing. Twelve months.

**Outcome Envisaged:** Fully functional Beta prototype units ready for deployment in extensive field trials in possible application areas.

**Mr. Uttam Chandrashekar**

Chief Executive Officer

**D.C. Enterprises, Bangalore**

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## SOLUTION TO PROBLEM STATEMENT NO 22, VOL - I

### D-ESPAT PVT. LTD.

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**Problem Statement:** Compact and ruggedized power supply.

**Details of the Solutions:**

- (a) **Brief Description:** Weight & Volume Reduction, Long Endurance, Fast Charging using Lithium Ion / Polymer Secondary Batteries instead of VRLA and SMF Batteries.
- (b) **Indigenous or Ex Import:** Cells Imported. BMS System Integration, Form and Fit are Indigenous.
- (c) **Present State (Concept / Proof of Concept):** Proof of Concept

**Assistance Sought from the Army:** Need testing facilities.

**Likely Timeline:** Within 6 months.

**Outcome Envisaged:** An efficient product.

**Mr. Mujibur Rahman**

*Manager – Business Development*

**D-ESPAT PVT. LTD.**

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**SOLUTION TO PROBLEM STATEMENT NO 39, VOL - I****DIGITAL INTEGRATOR PVT. LTD.**

**Problem Statement:** Location Awareness System

**Details of the Solutions:**

**(a) Brief Description:** We agree to fact that "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." Therefore we need a solution to address this by integrating Digital techniques. Using voice & Data communications & integration of Sensors and acquiring locations using fusion of GPS + GSM & Passive Mapping methods. The use of indigenous IRNSS is not very sure at this moment due to limited accuracy. As and when this improves we can fully dependent on this instead of GPS, it will ensure availability and confidentiality.

**(b) Indigenous or Ex Import:** H/W Plate form may be Ex Import, but SW Solution will be Indigenous.

**(c) Present State (Concept / Proof of Concept):** We can PoC for Non-CI requirements with seed money allocation by ADB or alternative sources.

**Assistance Sought from the Army:** Where ever help required from Army we are sure necessary interface shall be provided by ADB.

**Likely Timeline:** POC in 8-12 months. Proto Product can be made in 6- 8 months after firm confirmation of QR and funding.

**Outcome Envisaged:** End result will meet the desired requirement of Indian Army There will be multiple versions with time (3 to 4 as the system will evolve).

**Mr. Sunil Vyas**

**Digital Integrator Pvt. Ltd.**

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## SOLUTION TO PROBLEM STATEMENT NO 40, VOL - I

# DIGITAL INTEGRATOR PVT. LTD.

**Problem Statement:** Vehicle Log System for Maintenance and Accounting of Military Vehicles.

**Details of the Solutions:**

**(a) Brief Description:** The system will be designed around Embedded system with facility to record various parameters like temperature , Speed , Distance, Engine & Brake oil . It will have facility to monitor the status of Door, Fuel Tank & Battery Voltage . The system will have WiFi or Bluetooth or Ethernet interface to transfer the data on Local Terminal/Server in Workshop or HQ . By monitoring the above parameters many of the preventive maintenance can be done & proper Log Book can be generated. It can generate the reminders for Changing the Engine Oil , Brake Oil , Tyres & any consumable item. The system will maintain the daily usage of Vehicle with user name & other parameters also can be clubbed as per user requirement. The system can have optional GPS interface with GEO-Fencing feature , RFID Interface or Smart card Interface and LCD Interface. The data storage capacity can be decided after discussion . There may be primary & secondary storage . The primary storage may be related to vehicle sensors & secondary storage may be related to usage & log book.

**(b) Indigenous or Ex Import:** Indigenous

**(c) Present State (Concept / Proof of Concept):** POC can be done in 6-month time after getting the fund & freezing the specifications.

**Assistance Sought from the Army:** Requires detailing on the Vehicle to be interfaced and a proto vehicle or simulated environment to test the system. Funding for the project.

**Likely Timeline:** 10-12 months after approval of commercials & getting the fund.

**Outcome Envisaged:** Daily Logbook of Vehicle can be replaced with Digital Logger & in turn lot of man power & maintenance cost.

**Mr. Sunil Vyas**

Digital Integrator Pvt. Ltd.

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## SOLUTION TO PROBLEM STATEMENT NO 17, VOL - I

# ELEKTRONIKLAB INDIA PVT. LTD.

**Problem Statement:** Remote Tele maintenance - Telemedicine – Live Stream Video – broadband communication on the go.

**Details of the Solutions:** Inmarsat BGAN terminals fixed or vehicular

(a) **Brief Description:** Portable BGAN terminals for broadband comms on the go.

(b) **Indigenous or Ex Import:** Import

(c) **Present State (Concept / Proof of Concept):** In use.

**Assistance Sought from the Army:** Trials.

**Likely Timeline:** Ready for supply.

**Outcome Envisaged:** Business Order

**Mr. Nanda Kumar**

*Chief Executive Officer*

**Elektroniklab India Pvt. Ltd.**

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**Work:** 044-2433695 | **Mob.:** +91 9840043437

## GENERIC SOLUTION

# ELEKTRONIKLAB INDIA PVT. LTD.

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**Problem Statement:** Soldiers in remote area have to be brought to the nearest base for treatment – with each platoon carrying 1 evitalz (telemedic kit) 5 vital signs of the soldier can be transmitted to the base hospital for expert advice. This can form part of a weekly or monthly monitoring of soldier health.

**Details of the Solutions:** Portable Telemedicine with transmission to base solution

- (a) **Brief Description:** Portable vital sign monitor + transmission to hospital + video consultation with doctor possible with Inmarsat BGAN terminals.
- (b) **Indigenous or Ex Import:** imported sensors India software & app
- (c) **Present State (Concept / Proof of Concept):** Prototype under trail

**Assistance Sought from the Army:** Trials.

**Likely Timeline:** Ready for supply.

**Outcome Envisaged:** Business Order

**Mr. Nanda Kumar**

*Chief Executive Officer*

**Elektroniklab India Pvt. Ltd.**

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## SOLUTION TO PROBLEM STATEMENT NO 5, VOL - I

# ELEKTRONIKLAB INDIA PVT.LTD.

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**Problem Statement:** A single device that can do both Global Voice + Tracking.

**Details of the Solutions:** Isatphone2 based tracking

(a) **Brief Description:** Isatphone2 based tracking for all assets (Man & Machine)

(b) **Indigenous or Ex Import:** Import + Indian Software for tracking

(c) **Present State (Concept / Proof of Concept):** Ready to use

**Assistance Sought from the Army:** Trials.

**Likely Timeline:** Ready for Supply.

**Outcome Envisaged:** Business Order.

**Mr. Nanda Kumar**

*Chief Executive Officer*

**Elektroniklab India Pvt. Ltd.**

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## SOLUTION TO PROBLEM STATEMENT NO 5, VOL - I

# ELEKTRONIKLAB INDIA PVT. LTD.

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**Problem Statement:** GPS devices don't categorise GIS data gathered nor transmit back info to the HQ .

**Details of the Solutions:** GPS + GIS gathering app (smart GIS)

(a) **Brief Description:** Android base geo info gathering App for easy Point of Interest mapping.

(b) **Indigenous or Ex Import:** Made in India

(c) **Present State (Concept / Proof of Concept):** In Use

**Assistance Sought from the Army:** Trials.

**Likely Timeline:** Ready for Supply.

**Outcome Envisaged:** Business Order.

**Mr. Nanda Kumar**

*Chief Executive Officer*

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**SOLUTION TO PROBLEM STATEMENT NO 26, VOL - I****ELEKTRONIKLAB INDIA PVT.LTD.**

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**Problem Statement:** No solution to track troops – vehicles – aircrafts anywhere? How do they alert HQ that they are in trouble in remote location?

**Details of the Solutions:** A global blue force tracking system to monitor troops – vehicles – helicopters – aircrafts – Ships with emergency alert button.

(a) **Brief Description:** Blue Force Tracking for all assets ( Land – Sea - Air)

(b) **Indigenous or Ex Import:** Import + made in India

(c) **Present State (Concept / Proof of Concept):** Working

**Assistance Sought from the Army:** Trials.

**Likely Timeline:** Ready for Supply.

**Outcome Envisaged:** Business Order.

**Mr. Nanda Kumar**

*Chief Executive Officer*

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## SOLUTION TO PROBLEM STATEMENT NO-27, VOL - II

# ELGI ULTRA INDUSTRIES LTD.

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**Problem Statement:** Fuel Oil Lubricants Storage in Operational Conditions.

**Details of the Solutions:**

- (a) **Brief Description:** Collapsible fire-retardant fuel tanks and self-sealing fuel tanks for bulk storage and transportation of fuel oils and lubricants.
- (b) **Indigenous or Ex Import:** Presently imported, but being indigenised.
- (c) **Present State (Concept / Proof of Concept):** Proof of concept ready to be tested.

**Assistance Sought from the Army:** Trials.

**Likely Timeline:** Ready for Supply.

**Outcome Envisaged:** Business Order.

**Mr. V.S. Sriram kumar**

*Head - Projects*

**Elgi Ultra Industries Ltd.**

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## SOLUTION TO PROBLEM STATEMENT NO 20, VOL - II

### FC TECNRGY PVT. LTD.

**Problem Statement:** Reduced Life of Hand Held Thermal Imager Battery.

#### Details of the Solutions

**(a) Brief Description:** FC TecNrgyPvt Ltd has worked extensively on developing a solution for this problem over the last 10 to 12 months after having got the inputs related to this problem from the Northern Command especially 3 Advance Base Workshop of Northern Command.

**The Solution.** After analyzing the problem Statement to include the HHTI battery Operation and the different Terrain and Climatic Conditions as obtaining in the Field/Operational Areas, our In-house has designed and manufactured a Smart Lithium Ion Battery (while keeping its dimensions, voltage and storage parameters the same as the existing HHTI Battery) and developed an Intelligent Interface for it with a Small, Manportable and Mil Grade DMFC Fuel Cell. This Solution permits a greater than 24 hours (nonstop) power supply to HHTI or charge the backup batteries while the main battery is in operation. Our teams have already tested this All Weather and All Terrain Solution in Lab as well as field conditions and we are now ready to field it for further trials and evaluation.

A similar solution has also been designed for the Star V Mk II Radio Set.

**(b) Indigenous or Ex Import:** Indigenous and Import Both.

**(c) Present State (Concept / Proof of Concept):** Proof of Concept

**Assistance Sought from the Army:** Assist in getting the Solution Trial Evaluated with time laid down time frame, clarity on numbers required and if successful than how will the solution be procured with its likely time lines.

**Likely Timeline:** The Solution can be fielded by us in six weeks' notice.

**Outcome Envisaged:** Induction of smart charging solution for HHTIs for the Indian Army that is based on a combination of a smart battery and DMFC Fuel Cell.

#### Ms. Gaganpreet Kaur

Manager (Sales & BD)

FC TecNrgy Pvt. Ltd.

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## SOLUTION TO PROBLEM STATEMENT NO 35 & 38, VOL - I

# FC TECNRGY PVT. LTD.

**Problem Statement:** Modular Generators for High Altitude & Unattended Surveillance Camera.

### Details of the Solutions

**(a) General** Our team has worked extensively on developing a solution for this problem over the last 18 to 20 Months. A Modular Generator like this was desired by the Northern Army Commander and the MG EME (Northern Command) and three prototypes were fielded in stages before the emergence of the final design which was approved by the Command HQ. To design and develop a modular Generator "All-In-One Energy Box" to cater for the essential power requirements of small and remote High Altitude Area Posts or to power an Unattended Surveillance Camera high Altitude and extreme for many days and weeks together if required.

**The Solution** The "All in One Energy Box" is a modular and scalable power solution based on a specially designed cold weather proof Box that and the Power is generated by a Direct Methanol Fuel Cell. This Modular Generator also contains for Fuel for More than 4 Dyas of Non Stop Operation, Its Own Anti Cold Climate Battery Power and multiple interfaces to provide limited AC as well as DC Power.

**(b) Indigenous or Ex Import:** Indigenous and Import Both.

**(c) Present State (Concept / Proof of Concept):** Proof of Concept

**Assistance Sought from the Army:** Assist in getting the Solution Trial Evaluated with time laid down time frame, clarity on numbers required and if successful than how will the solution be procured with its likely time lines.

**Likely Timeline:** The Solution can be fielded by us in six weeks' notice.

**Outcome Envisaged:** Induction of smart charging solution for HHTIs for the Indian Army that is based on a combination of a smart battery and DMFC Fuel Cell.

### Ms. Gaganpreet Kaur

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## SOLUTION TO PROBLEM STATEMENT NO 41 & 42, VOL - I

### FC TECNRGY PVT. LTD.

**Problem Statement:** Military Grade Power Bank & Power Banks for Communication Equipment.

#### Details of the Solutions

(a) Power Generation, Storage as well as Usage in remote and difficult areas is a complex and challenging issue which has been mostly addressed through adhoc measures. This challenge is all the more complex for the Defense & Security Forces due to the sensitive nature of mission critical surveillance, communication devices and other sensors. There is no single solution and a minimum redundancy is extremely essential.

**The Solution.** Our domain and technical experts have worked on developing ruggedized power bank over the last 12 to 14 months. Our Power Bank is ideal for High Altitude and Cold Climates and scalable with the capacity for Provide Non Stop Peak Power Upto Nine Hours and charge / power multiple devices simultaneously. This Power Bank and its variants can be charged by Main Electricity (220 V AC) / Fuel Cells/ Solar/ DG Sets. We have tested two variants extensively over the last 8 months and further refinements are on. We can field this product for further evaluation by the Indian Army in Field Conditions.

(b) **Indigenous or Ex Import:** Indigenous.

(c) **Present State (Concept / Proof of Concept):** Proof of Concept

**Assistance Sought from the Army:** Assist in getting the Solution Trial Evaluated with time laid down time frame, clarity on numbers required and if successful than how will the solution be procured with its likely time lines.

**Likely Timeline:** The Solution can be fielded by us in six weeks' notice.

**Outcome Envisaged:** Induction of smart charging solution for HHTIs for the Indian Army that is based on a combination of a smart battery and DMFC Fuel Cell.

#### Ms. Gaganpreet Kaur

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## SOLUTION TO PROBLEM STATEMENT NO 4, VOL - I

# GHARDA CHEMICALS LTD.

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**Problem Statement:** Body Armour

**Details of the Solutions:**

**(a) Brief Description:** Gharda Chemicals Ltd has developed indigenously by our own worldwide patented process PEK (polyether ketone) which is a high temperature high strength thermoplastic polymer. This will be used by Prof Shantanu Bhowmik, Head, Projects, Amrita University, to develop solutions for body armour incorporating carbon fibre.

**(b) Indigenous or Ex Import:** Indigenous

**(c) Present State (Concept / Proof of Concept):** Proof of Concept

**Assistance Sought from the Army:** Prof Bhowmik has sought financial assistance from Army for funding for this project. Gharda Chemicals will supply the raw material, PEK, to be used in Body Armour.

**Likely Timeline:** 2 years

**Outcome Envisaged:** Light weight Body Armour.

**Dr. Mathew Abraham**

*General Manager*

**Gharda Chemicals Ltd.**

**Add.:** Technical and Market Development - Polymers Gharda Chemicals Ltd., B-27/29, MIDC Indl Estate, Dombivali (E), Thane District - 421 203

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**SOLUTION TO PROBLEM STATEMENT NO 13, VOL - I****GHARDA CHEMICALS LTD.**

**Problem Statement:** Light Weight Materials Permanent Defense.

**Details of the Solutions:**

**(a) Brief Description:** Gharda Chemicals Ltd has developed indigenously by our own worldwide patented process PEK (polyether ketone) which is a high temperature high strength thermoplastic polymer. This will be used by Prof Shantanu Bhowmik, Head, Projects, Amrita University, to develop solutions for Light Weight Materials Permanent Defense incorporating carbon fibre.

**(b) Indigenous or Ex Import:** Indigenous

**(c) Present State (Concept / Proof of Concept):** Proof of Concept

**Assistance Sought from the Army:** Prof Bhowmik has sought financial assistance from Army for funding for this project. Gharda Chemicals will supply the raw material, PEK, to be used in Light Weight Materials Permanent Defense.

**Likely Timeline:** 2 years

**Outcome Envisaged:** Light Weight Materials Permanent Defense.

**Dr. Mathew Abraham**

*General Manager*

**Gharda Chemicals Ltd.**

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## SOLUTION TO PROBLEM STATEMENT NO 9, VOL - II

# HIND DEFENCE EQUIPMENT PVT. LTD.

**Problem Statement:** Dead zone surveillance system

**Details of the Solutions:**

- (a) Brief Description:** Hind Defence has a tie up with various foreign manufactures who provide the user with a wide range of UAVs, light weight, man portable, VTOL/ tethered which are capable of carrying the surveillance equipment to the desired height and location, thereby drastically reducing the dead zone in any surveillance grid. These systems are simple to use, do not require any major training programmes and are also largely maintenance free. Use of these UAV's will be a force multiplier to any commander in the field. Surveillance loads can be suitably modified to include SAR, SWIR, Target Marker, SIGINT, Hyperspectral, Hi-Res Digital SLR etc.
- (b) Indigenous or Ex Import:** Ex Import, to be subsequently manufactured in India under the Make in India Policy.
- (c) Present State (Concept / Proof of Concept):** In service in various countries.

**Assistance Sought from the Army:** NIL.

**Likely Timeline:** Readily available, subject to terms and conditions.

**Outcome Envisaged:** Equipment can be fielded for limited trial/ demonstration on NCNC basis at any location given by the Army.

**Mr. Manish Kshirsagar**

*Director*

**Hind Defence Equipment Pvt. Ltd.**

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**SOLUTION TO PROBLEM STATEMENT NO 20, VOL - II****HIND DEFENCE EQUIPMENT PVT. LTD.**

**Problem Statement:** Reduced life of Hand Held Thermal Imager Battery

**Details of the Solutions:**

**(a) Brief Description:** Hind Defence has a tie up with OPGAL of Israel which provides the user with a unique TI camera coupled with an Android based mobile phone(which is used as a monitor) which has very distinct advantages and a wide range of application for surveillance and firing solutions. The same is light weight (138 gms), long battery life (works on battery of the mobile phone), data recording and live streaming, is IP Certified (IP 54), thereby drastically reducing the weight required to be carried by an Infantry soldiers. The system is simple to use, does not require any major training and is also largely maintenance free. Use of this TI Device will be a force multiplier to any surveillance and Recce detachments, patrolling and or ambush party, LRPs, static sentry posts, Search and Rescue Parties etc.

**(b) Indigenous or Ex Import:** Ex Import, to be subsequently manufactured in India under the Make in India Policy.

**(c) Present State (Concept / Proof of Concept):** In service.

**Assistance Sought from the Army:** NIL.

**Likely Timeline:** Readily available, subject to terms and conditions.

**Outcome Envisaged:** Equipment can be fielded for limited trial/ demonstration on NCNC basis at any location given by the Army

**Mr. Manish Kshirsagar**

*Director*

**Hind Defence Equipment Pvt. Ltd.**

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## SOLUTION TO PROBLEM STATEMENT NO 8, VOL - II

# HIND DEFENCE EQUIPMENT PVT. LTD.

**Problem Statement:** Oil leakage from cylindrical mast of 17 meter mobile mast.

**Details of the Solutions:**

(a) **Brief Description:** Hind Defence has a tie-up with foreign manufactures which provide the user with a light weight TETHERED UAV, with a 24x7x365 days capability to remain airborne, with power backup from vehicle, which is capable of carrying up the surveillance antennae's up to 150 M height. The same system is also man portable and simple in operation. Use of this UAV will negate the need of an antennae and has distinct advantages over Mast type of antennae's.

(b) **Indigenous or Ex Import:** Ex Import, to be subsequently manufactured in India under the Make in India Policy.

(c) **Present State (Concept / Proof of Concept):** In service in various countries/ Armies.

**Assistance Sought from the Army:** NIL.

**Likely Timeline:** Readily available, subject to terms and conditions.

**Outcome Envisaged:** Equipment can be fielded for limited trial/ demonstration on NCNC basis at any location given by the Army.

**Mr. Manish Kshirsagar**

*Director*

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**SOLUTION TO PROBLEM STATEMENT NO 22 & 23, VOL - II****HIND DEFENCE EQUIPMENT PVT. LTD.**

**Problem Statement:** Design and Development of Aerial Surveillance Platform and Long Range Optical Target Locator.

**Details of the Solutions:**

(a) **Brief Description:** Hind Defence has a tie up with US based manufacturers for a unique VTOL UAV, the very cutting edge in UAV technology. The UAV is powered by a 02 stroke air cooled engine, capable of running either on petrol (87 MT or higher grade) or Diesel fuel. It is an equipment based on a modular concept with low operating cost, low maintenance, high performance, with minimal RCS, with an operating altitude of 5000M and an operating range of 30 miles (Telemetry) with surveillance range depending upon the payload. With a 10 hrs endurance, it is a perfect solution to IAs requirement of a Tactical UAV for surveillance and data gathering. Use of this type of UAV will be a force multiplier to any strike corps formation and as well as any Infantry formation, especially in CI/ CT Ops. The same UAV, due to it's virtually ZERO requirement of take-off runways and elaborate recovery platforms. Therefore can easily be utilised in mountainous terrain thereby drastically reducing dead zone in surveillance grids.

(b) Currently the UAV is designed for multitude of payloads like SAR, SWIR, Target Marker, SIGINT, Hyperspectral and Hi-Res Digital SLR. For use as a weapon platform, necessary government clearances will be sought.

(c) **Indigenous or Ex Import:** Ex Import, to be subsequently manufactured in India under the Make in India Policy.

(d) **Present State (Concept/ Proof of Concept):** Under user trials with USMC and US Navy.

**Assistance Sought from the Army:** NIL.

**Likely Timeline:** Readily available, subject to terms and conditions.

**Outcome Envisaged:** Equipment can be fielded for limited trial/ demonstration on NCNC basis at any location given by the Army

**Mr. Manish Kshirsagar**

Director

Hind Defence Equipment Pvt. Ltd.

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## SOLUTION TO PROBLEM STATEMENT NO 9, VOL - II

# IDEAFORGE TECHNOLOGY PVT. LTD

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**Problem Statement:** Surveillance in dead zone

**Details of the Solutions:**

**(a) Brief Description:** Surveillance in dead zone- Based on the requirements of the mentioned problem statement, Idea Forge has indigenously developed Netrav3 system, which is an Unmanned aerial vehicle capable of surveillance in an area of 5 kms radially. The system is equipped with a HD daylight and a thermal payload-externally swappable for both day and night time surveillance. The optical zoom capabilities enable the user to zoom and identify targets from a very long distance. With an endurance/airtime of 60 minutes from take-off, the system is very robust and useful for all terrain deployment in all-weather conditions. The quick and easy interface of the system along with the multiple failsafe modes ensures maximum safety of the system with minimum inputs on the users end.

**(b) Indigenous or Ex Import:** Indigenous solution.

**(c) Present State (Concept / Proof of Concept):** Ready and available for procurement.

**Assistance Sought from the Army:** Pilot induction in the army.

**Likely Timeline:** Available for immediate field trials and procurement.

**Outcome Envisaged:** Solution for the above-mentioned problem statements.

**Mr. Deshraj Singh / Mr. Nikunj Kaklotar**

*AGM/Associate*

**Ideaforge Technology Pvt. Ltd.**

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**SOLUTION TO PROBLEM STATEMENT NO 22, VOL - II****IDEAFORGE TECHNOLOGY PVT. LTD.**

**Problem Statement:** Combat Zone Tracking System.

**Details of the Solutions**

- (a) **Brief Description:** For fulfilling the requirements of problem definition no 22, ideaForge has developed a combination of Netrav3 and Netra Pro UAV systems which can be used as a seeker and shooter combo. Netrav3 is capable for surveillance in a range of 5 kms with high resolution imagery and video outputs. The precise location data provided by the system along with the high-resolution video and zoom capability of the system can be used to easily identify targets and their real-time locations. This real-time data can be used to eliminate or monitor the designated targets. Then Netra Pro, with a payload lifting capacity of up to 1 kg, can be used to deliver all sorts of payloads at the designated target location.
- (b) This Seeker (Netrav3) and Shooter( Netra Pro) combo can be very useful in tactical situations.
- (c) **Indigenous or Ex Import:** Indigenous solution.
- (d) **Present State (Concept / Proof of Concept):** Ready and available for procurement.

**Assistance Sought from the Army:** Pilot induction in the army.

**Likely Timeline:** Available for immediate field trials and procurement.

**Outcome Envisaged:** Solution for the above-mentioned problem statements.

**Mr. Deshraj Singh / Mr. Nikunj Kaklotar**

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## SOLUTION TO PROBLEM STATEMENT NO 22, VOL - II

# IDEAFORGE TECHNOLOGY PVT. LTD.

**Problem Statement:** Development of Aerial Surveillance Equipment.

**Details of the Solutions:**

**(a) Brief Description:** Surveillance in dead zone- Based on the requirements of the mentioned problem statement, ideaForge has indigenously developed Netrav3 system, which is an Unmanned aerial vehicle capable of surveillance in an area of 5 kms radially. The system is equipped with a HD daylight and a thermal payload-externally swappable for both day and night time surveillance. The optical zoom capabilities enable the user to zoom and identify targets from a very long distance. With an endurance/airtime of 60 minutes from take-off, the system is very robust and useful for all terrain deployment in all-weather conditions. The quick and easy interface of the system along with the multiple failsafe modes ensures maximum safety of the system with minimum inputs on the users end.

**(b) Indigenous or Ex Import:** Indigenous

**(c) Present State (Concept / Proof of Concept):** Ready and available for procurement.

**Assistance Sought from the Army:** Pilot induction in the army.

**Likely Timeline:** Available for immediate field trials and procurement.

**Outcome Envisaged:** Solution for the above-mentioned problem statement

**Mr. Deshraj Singh / Mr. Nikunj Kaklotar**

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**SOLUTION TO PROBLEM STATEMENT NO 22, VOL - II****IDEAFORGE TECHNOLOGY PVT. LTD.**

**Problem Statement:** Seeker and Shooter Combo.

**Details of the Solutions:**

**(a) Brief Description:** IdeaForge has developed a combination of Netrav3 and Netra Pro UAV systems which can be used as a seeker and shooter combo. Netrav3 is capable for surveillance in a range of 5 kms with high resolution imagery and video outputs. The precise location data provided by the system along with the high-resolution video and zoom capability of the system can be used to easily identify targets and their real-time locations. This real-time data can be used to eliminate or monitor the designated targets. Then Netra Pro, with a payload lifting capacity of up to 1 kg, can be used to deliver all sorts of payloads at the designated target location. This Seeker (Netrav3) and Shooter( Netra Pro) combo can be very useful in tactical situations.

**(b) Indigenous or Ex Import:** Indigenous

**(c) Present State (Concept / Proof of Concept):** Ready and available for procurement.

**Assistance Sought from the Army:** Pilot induction in the army.

**Likely Timeline:** Available for immediate field trials and procurement.

**Outcome Envisaged:** Solution for the above-mentioned problem statement.

**Mr. Deshraj Singh / Mr. Nikunj Kaklotar**

*AGM/Associate*

**Ideaforge Technology Pvt. Ltd.**

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## SOLUTION TO PROBLEM STATEMENT NO 22, VOL - II

# JOHNNETTE TECHNOLOGIES PVT. LTD.

**Problem Statement:** Design and Development of Aerial Surveillance Platform Quadcopter.

**Details of the Solutions:**

**(a) Brief Description:** The JR3 is a ready to fly quadcopter. It includes everything to fly your own video drone out of the box. To start flying just unbox, power on transmitter, and connect battery to aircraft, arm and start flying.

**Specifications:** Weight: 4.5 kg; Range: 3 km; Endurance: 45 mins, ops; Altitude: 400m above sea level; Payloads: Day/Night Camera, Thermal Imaging Camera Tarot 2d fimb; Payload weight: 600 grams maximum; Propulsion: Electric; Ceilings : 500 m; Speed: 40 kmph

**(b) Indigenous or Ex Import:** Indigenous

**(c) Present State (Concept / Proof of Concept):** Ready

**Assistance Sought from the Army:** Permissions will be required for test flying, part funds may be required depending on Army's needs and training of operators needs to be officers and not jawans as Drones are high tech gadgets.

**Likely Timeline:** Generic Specs based Drone is ready. In case a specific design is need then that depends on the type of the drone needed.

**Outcome Envisaged:** We are highly custom oriented company and we do achieve all the goals of our end customers. Time may be taken but we have a proven track record on the innovation segment of unmanned vehicles.

**Lt Cdr John Livingstone (Retd)**

*Founder CEO & Product Architect*

**Johnnette Technologies Pvt. Ltd.**

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## SOLUTION TO PROBLEM STATEMENT NO 9, VOL - I

# LARSEN & TOUBRO LTD.

**Problem Statement:** Dispersion of Artillery Shells – Advanced Fire Control System.

**Details of the Solutions:**

**(a) Brief Description:** Artillery Fire Control System (AFCS) provides precise ballistic solution for artillery systems. The AFCS can incorporate various artillery projectiles and provides internal and external ballistic solution based on weapon characteristics and ammunition aero dynamics. The AFCS can be integrated with various on-board sensors like inertial navigation System, Muzzle velocity radar, and Communication systems in order to take various inputs like Metrological data, muzzle velocity, target data for calculating precise ballistic solution. This system can also provide integration with Forward observers and command post for coordinated firing procedures. This AFCS provides complete autonomous operational capability to artillery guns. The AFCS provides MRSI (Multiple Round simultaneous impact) computations as well.

**Key – Features**

- Shell Modelling for Aero dynamic coefficients
- Internal Ballistic computation (Muzzle Velocity Predication, Charge temperature, Chamber Specs)
- External Ballistic computation (Metrological Data corrections, Earth Rotation, Gravity)
- Sensor interface such as MVR, INS, Sighting systems, Communication systems
- Engagement Planning
- Coordinate conversion from WGS84-UTM-LAMBERT Grid and vice versa
- MRSI (Multiple Round simultaneous impact)
- Useful for Line and Area clearance

**(b) Indigenous or Ex Import:** Indigenous

**(c) Present State (Concept / Proof of Concept):** In production.

**Assistance Sought from the Army:** Suitable platform for fitment and trials of the product.

**Likely Timeline:** 01 Year.

**Outcome Envisaged:** Enhanced accuracy of in service guns by employing common AFCS.

**Mr. Harshan Budke**

*General Manager – Product & Technology Development*

**Larsen & Toubro Ltd.**

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## SOLUTION TO PROBLEM STATEMENT NO 24, VOL - II

# LARSEN & TOUBRO LTD.

**Problem Statement:** Man Portable Radio Relay Frequency Equipment.

**Details of the Solutions:**

**(a) Brief Description:** Today's tactical communication demands for high traffic capacity, reliable data transmission, light weight, short deployment time, and resilient to electronic warfare. The proposed Radio Relay Solution can operate in either Fixed Frequency or Frequency Hopping Mode, based on the latest Internet Protocol (IP) technology with Ethernet interfaces. All other accessories like mast, antenna etc. are proposed to be made of light weight composites. The RR is modular and light weight (~ 15kg). If the network needs E1/E3/Fibre optic interfaces an Indoor Unit (~ 15kg) will be used.

**(b) Indigenous or Ex Import:** High levels of indigenisation with some components being ex-import.

**(c) Present State (Concept / Proof of Concept):** Prototype showcased in various expos.

**Assistance Sought from the Army:** Statutory clearance for the frequency from the authorized Department, (b) Support for System Qualification, (c) Support for Field and LongRange Communication trials, (d) User assistance/requirement for implementation of Security in Radio Relay System (e) User Operational scenarios.

**Likely Timeline:** (a) Customization of the Radio Relay: 3months (b) Field User Trials: 1-month (c) Induction: 2 Months Jan 2018 to Dec 2019.

**Outcome Envisaged:** The tactical network is upgrading to a high bandwidth IP network. The IP based Radio Relay will form the high capacity backbone and access link to support the transmission of information required by the field forces.

**Mr. Muralidharan S**

*SR. DGM - Business Development, Marketing*

**Larsen & Toubro Ltd.**

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**SOLUTION TO PROBLEM STATEMENT NO 4, VOL - I****LARSEN & TOUBRO LTD.**

**Problem Statement:** Body Armour

**Details of the Solutions:**

**(a) Brief Description:** This solution involves developing an excellent lightweight thermoplastic polymeric composite which will provide the necessary bullet proof resistance for body armour. The thermoplastic resin proposed is developed in India and fibre proposed is carbon fibre with fabric configuration. Computer simulations will provide the required configuration for the composite material and same will be tested and proven experimentally. On proving of Light Weight Bullet Proof Material, the same will be used to design a Vest.

**(b) Indigenous or Ex Import:** Indigenous

**(c) Present State (Concept / Proof of Concept):** L&T along with Amrita University of Coimbatore, as its academic support and technology provider is involved in development of this technology, which is to be developed. Simulation study along with experimental validation are to be conducted during development.

**Assistance Sought from the Army:** Provision of lab/facility for Testing of Bullet Proof Materials as per NIJ0101.06 Standard and Vests developed from the Light Weight Bullet Proof Material.

**Likely Timeline:** 02 Years; Jan 2018 to Dec 2019.

**Outcome Envisaged:** A Light Weight Bullet Proof Material and thereon a Lightweight Vest made from this material.

**Mr. Harshan Budke**

*General Manager – Product & Technology Development*

**Larsen & Toubro Ltd.**

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## GENERIC SOLUTION

# LARSEN & TOUBRO LTD.

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**Problem Statement:** High Frequency Sonar Dome for underwater application.

**Details of the Solutions:**

- (a) **Brief Description:** High Frequency Sonar Dome. Exploring opportunity to replace existing Titanium high frequency dome with composite dome to improve acoustic performance and thereby enable longer range of detection for active windows.
- (b) **Indigenous or Ex Import:** Indigenous
- (c) **Present State (Concept / Proof of Concept):** All qualification tests conducted with support from NPOL on prototype. Though it has successfully passed through all tests, NPOL has suggested if manufacturing quality can further be improved. Work-in-progress with material supplier.

**Assistance Sought from the Army:** Naval Product. Can be explored as an alternate material for Radomes for land based applications.

**Likely Timeline:** ~2 years

**Outcome Envisaged:** Can be deployed in future applications

**Mr. Mahesh Kumar Verma**

*Deputy General Manager (Product & Technology Devt. Centre)*

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**SOLUTION TO PROBLEM STATEMENT NO 2, VOL - II****MATCON AEROSPACE PVT. LTD.**

**Problem Statement:** Improving Cooling Efficiency of T-90 Radiator.

**Details of the Solutions:**

- (a) **Brief Description:** Hydraulically driven fan cooled compact radiator system.
- (b) **Indigenous or Ex Import:** Radiator (initially imported), hydraulic pump (imported) and all other items indigenous.
- (c) **Present State (Concept / Proof of Concept):** Concept based on our proven experience on Schilka tank - Hydraulically driven fan cooled 3 layered radiator systems to improve cooling efficiency.

**Assistance Sought from the Army :** Details of the present engine cooling system

- (a) Engine coolant time/temp profiles during mobility with corresponding ambient temperature.
- (b) Drawings and photos of the engine compartment with location of Radiator.

**Likely Timeline:** 9 – 12 Months

**Outcome Envisaged:** Reduced engine overheating and enhanced mobility of the Tank.

**Dr. R. Gopalakrishnan**

*Managing Director*

**Matcon Aerospace Pvt. Ltd.**

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## SOLUTION TO PROBLEM STATEMENT NO 13, VOL - I

# PURDUE UNIVERSITY/ SPACE AND DEFENCE STARTUP

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**Problem Statement:** Light Weight Material Permanent Defences

**Details of the Solutions:**

**(a) Brief Description:** Derived from space station technologies, we are offering light-weight, rugged, modular, deployable permanent defences (shelter) for troops deployed in super high-altitude areas, and other harsh terrain conditions and extreme environment where carriage and construction of shelters is highly challenging. The proposed deployable shelters would contain some or all the following features depending on performance requirements and protective priorities:

- Anchoring of the shelter. Rigidity and ruggedness of the structure.
- Air-locking arrangement to include power management.
- Waste disposal arrangement. Environment and life support system.
- Ballistic protection against splinters and small projectiles.; fire retardant
- Minimum weight, minimum encumbrance, and rapid deployment.
- Hyper-pressurization for extreme high altitude physical and mental health
- Optimized for extreme weather, avalanche, and wind blast protection
- Other applications: Special ops shelter, avalanche rescue, buoyancy add-on enablers etc.

**(b) Indigenous or Ex Import:** Indigenous with minor import component

**(c) Present State (Concept / Proof of Concept):** High TRL. TRL > 6 but needs to be tailored for operating conditions in High Altitude Areas e.g. Siachen, Saltoro Ridge. Modular design adapted for a variety of HAA operating conditions.

**Assistance Sought from the Army:** R&D Funds under Technology Development Funds. Assistance for on-site assessment of hazards (avalanche, weather) for all potential troop



deployment sites for detailed functional and performance requirements, and protective priorities.

**Likely Timeline:** A prototype integrated (habitat, power system, other features) prototype would be ready for deployment for testing at the end of TDF efforts (1.5 – 2 years).

**Outcome Envisaged:** TDF design and development efforts would result into variety of candidate habitation designs based on performance requirements, defined protective priorities, and operational conditions. The designs would be ready for infusion and full-scale, high-fidelity and large-scale production would be done in India.

**Prof. Sarag Saikia**

*Research Assistant Professor*

**Purdue University/ Space and Defence Startup**

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## SOLUTION TO PROBLEM STATEMENT NO 39, VOL - I

### PURDUE UNIVERSITY/ SPACE AND DEFENCE STARTUP

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**Problem Statement:** Stratospheric Drone for Persistent Flight Coverage (Surveillance and Targeting Systems).

**Details of the Solutions:**

**(a) Brief Description:** We offer an advanced near-space lighter-than-air manoeuvrable drone with unprecedented altitude-control capability that can operate in stratosphere that can observe large areas for weeks, months or even years that can serve as a platform for persistent surveillance and intelligence gathering. The drone would cost order of magnitude less than the high-performance drones (MQ-1 Predator) and orders of magnitude less than satellites.

- Persistent coverage over area of interest.
- Long duration (up to three months).
- Low-cost, rapidly deployable, and reusable system.
- Up to 150 kg payload.
- Visible, thermal, hyperspectral, sigint sensors.

**(b) Indigenous or Ex Import:** Indigenous with minor import component.

**(c) Present State (Concept / Proof of Concept):** High TRL. TRL > 6. Proof of Concept demonstrated. Requires fabrication and testing in stratosphere and concurrent sensor development (or use adapted space-based sensors).

**Assistance Sought from the Army:** R&D Funds under Technology Development Funds to push the TRL to 7 and then to 9 within the next 1 to 2 years.

**Likely Timeline:** A fully integrated stratospheric surveillance system to be fabricated within 8 – 12 months and a full-scale system with sensors to be flown in about two years.

**Outcome Envisaged:** TDF design and development efforts would result into India's first ultra-long duration stratospheric drone with unprecedented altitude-control (e.g. 55000 ft to 70000 ft) capability and with persistent surveillance coverage.

**Prof. Sarag Saikia**

*Research Assistant Professor*

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## SOLUTION TO PROBLEM STATEMENT NO 33, VOL - I (HIGH CALORIFIC VALUE FOOD)

# RAMAIAH UNIVERSITY OF APPLIED SCIENCES

**Problem Statement:** 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.

**Details of the Solutions:**

(a) **Brief Description:** 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. 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. As a concept, high calorific value materials like whey protein powder, along with spicy components / sweeteners, saline components like Sodium chloride, potassium chloride, sodium citrate, and Moringa leaf powder are developed in to beads or bars.

(b) **Indigenous or Ex Import:** Indigenous

(c) **Present State (Concept / Proof of Concept):** Proof of Concept

**Assistance Sought from the Army:** Financial assistance

**Likely Timeline:** 24 months

**Outcome Envisaged:** Beads / Bars are packed in sachets of twenty five grams to provide appx. Ninty Kcal of energy per serving.

**Technical Description (Initial Test Details and Specifications)**

Each 25 g bar / Beads Sachet contains:

Whey protein	-	22.15 g
Moringa powder	-	0.4g
Chat Masala /Spices	-	qs
Sodium Chloride	-	0.260 g
Potassium Chloride	-	0.150 g
Sodium citrate	-	0.290 g
Dextrose	-	1.350 g
Piperine	-	5 mg
Isaphgul powder (fine)	-	qs.

**Dr. S. Bharath**

*Associate Dean & HOD*

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## SOLUTION TO PROBLEM STATEMENT NO 34 VOL - I (WOUND HEALING FABRIC)

# RAMAIAH UNIVERSITY OF APPLIED SCIENCES

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**Problem Statement:** 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.

### Details of the Solutions:

**(a) Brief Description:** Rapid blood loss due to gunshot wounds and splinter injuries are the major causes of deaths in the war field. As the gun shot produces instant bleeding, the response should be to arrest bleeding instantly. Hence the mechanism has to be worn by soldier and one of the best choice is combat uniform. Materials which support clotting of blood like ionic calcium, nano calcium sulphate, psyllum, nano copper along with tissue regeneration stimulants like nanopiperine and sericin are developed into beads. Moist environment and dressings of high micro porosity enhances the wound healing.

**(b) Indigenous or Ex Import:** Indigenous

**(c) Present State (Concept / Proof of Concept):** Proof of Concept

**Assistance Sought from the Army:** Financial assistance

**Likely Timeline:** 24 months

**Outcome Envisaged:** Beads are packed like mini quilts / pillow packs / sachets of one gram each using, muslin cloth / Kraft Paper / Glassine Poly paper. These packs can be draped like inner garment or glued to the inner side of the combat uniform. The proposed materials are Generally Regarded as Safe and have been in use for humans. The novelty is converting them in to nano size particles to increase specific surface area and to make them responsive instantly.

### Dr. S. Bharath

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## SOLUTION TO PROBLEM STATEMENT NO 118, VOL - III

# RAMAIAH UNIVERSITY OF APPLIED SCIENCES

**Problem Statement:** Design and Development of Ambulatory Aid for Physically Disabled.

### Details of the Solutions:

**(a) Brief Description:** A comprehensive ambulatory aid which address the needs of a physically Disabled person to commute without any additional help. A better ambulatory aid will allow the person to be independent. It motivates the patients to go out and mingle with society. An ambulatory aid which can serve multipurpose can be highly helpful.

**(b) Indigenous or Ex Import:** Indigenous

**(c) Present State (Concept / Proof of Concept):**

The ambulatory device is in conceptualizing state.

The concentration is given to the part where the assistive device helps the person to stand up from the sitting position. The seat will be inflated with air and the person seated will be raised in an angle of 60 degrees from the ground. An air pump is provided under the seat. This will assist the disabled to stand up from the seat. Due to the reduction in weight on the seat the pneumatics cylinder will come back to its original position further giving a push to the person to stand. The material for the expandable seat is nylon.

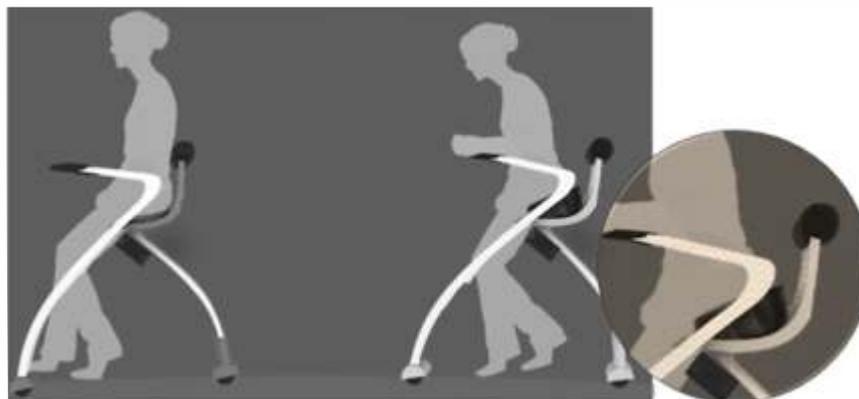


Figure no.1 : Various Ideas of Ambulatory Aid

The Assistive device is provided with a telescopic re-tractive mechanism that helps the device be in same level while climbing the steps. A push button is provided to unlock the mechanism before climbing the steps.

**Assistance Sought from the Army:** Further Research and Technical Assistance.

**Likely Timeline:** 12 Months

**Outcome Envisaged:** A Commercial, ergonomic ambulatory aid that assists physically challenged people to get-up from sitting position as well as help climb the stair case, hence allowing them to be independent. It's motivates the patients to go out and mingle with society. Such products will enable the patients to gain confidence. An ambulatory aid which can serve multipurpose can be highly helpful.

**Ms. Reemi Thakuria**, *Assistant Professor*, **Mr. Lohit H S**, *Assistant Professor*  
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**SOLUTION TO PROBLEM STATEMENT NO 121, VOL - III****RAMAIAH UNIVERSITY OF APPLIED SCIENCES**

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**Problem Statement:** Development of high wear resistance and high strength metal matrix composite spare parts for defence equipment using stir casting/3D printing techniques.

**Details of the Solutions:**

**(a) Brief Description:** The wear at high temperature and pressure is a serious problem in large number of defence equipment and aerospace; therefore there is need for the development and synthesis of new materials having special properties at high temperature situations. The present proposal is intended to develop the high wear resistance and high strength metal matrix composite using liquid metallurgy and 3D printing technology such as direct metal deposition laser sintering (DMDLS). Therefore it is proposed to study the Al metal matrix with the combination of hard reinforcement ceramic particles ( $Al_2O_3$ ,/SiC/B<sub>4</sub>C) and controlled soft reinforcement (Gr/MoS<sub>2</sub>). The investigation of strength and wear mechanism needs to be performed at high temperature and to identify the percentage influence of each wear parameter on wear behaviour. Finally, develop the metallurgical and 3D printed spares for defence equipment.

**(b) Indigenous or Ex Import:** Indigenous

**(c) Present State (Concept / Proof of Concept):**

- Limited work had been adorned on metal matrix composite spares for defence equipment applications in India.
- Application of versatile free-form fabrication using DMDLS technique is capable of producing metallic parts for maintenance of defence related machinery.
- A quick reverse engineering to produce 3D virtual geometry can be achieved.
- Metallurgical/ 3D printing of metal matrix to the specified tolerances for vintage equipment and replaceable spares can be developed.
- Metal matrix with ceramic reinforcement has shown excellent wear resistance and high strength at high temperature applications.

**Assistance Sought from the Army:**

- Reverse engineering to capture the geometry and component dimensional tolerances

and limits of the spares

- The pressure and force sustained by the component during routine operation of the equipment during firing
- The approximate inventory size to determine the speed of 3D printing operation and metallurgical processes

**Likely Timeline:**

Activities	Months					
	1-2	3-4	5-6	7-8	9-10	11-12
Week						
Literature Survey						
Development of MMC'S reinforced with Ceramic particles using Stir casing and 3D printing process						
Evaluate mechanical properties tests for the specimen						
Evaluate wear and corrosion properties of the specimen						
Evaluate surface integrity properties for the specimen						
Development of reverse engineered prototype spares for Defence equipment with accurate dimensions						
Testing of the developed spares and ready to replace in defence equipment						
Report preparation						

**Outcome Envisaged:**

- Capture the geometry and tolerance limits of the component using reverse engineering
- Development of prototype spares using metallurgical techniques including stir casting and 3D printing techniques
- Study the mechanical, tribological and corrosion properties of the developed metal matrix composites
- Testing under different load conditions
- Developed spares are ready to use in defence equipment
- Keeping the inventory of developed spares and to enable sustenance of vintage Air Defence equipment

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## SOLUTION TO PROBLEM STATEMENT NO 64, VOL - I

# RAMAIAH UNIVERSITY OF APPLIED SCIENCES

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**Problem Statement:** Random Matrix Modeling Based Tactical Analytics Services for Data Generated by Military Equipment

**Team Members:**

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M S Ramaiah University of Applied Sciences, Bangalore
- ii. Dr. Pallaviram Sure  
Associate Professor, Dept. of ECE – FET,  
M S Ramaiah University of Applied Sciences, Bangalore

**Details of the Solutions:**

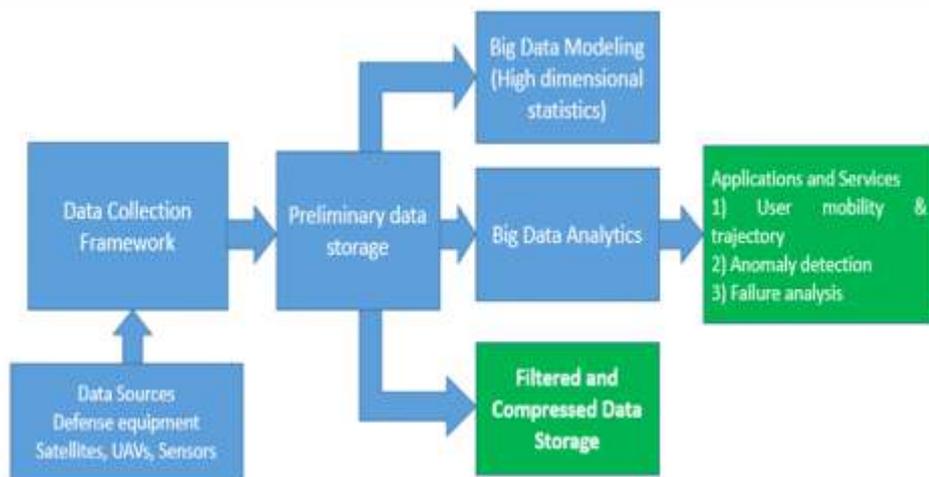
**(a) Brief Description:**

**Aim:** To provide tactical analytics services using the data obtained from military equipment based on high dimensional statistical models such as Random Matrix Models (RMM)

**Objectives:**

- i. To configure a Hadoop cluster for real time data processing
- ii. To design and develop a real time data acquisition framework from various defense equipment, sensors, users and internet devices
- iii. To filter out un-useful data and store informative data using high dimensional statistical representations such as RMM
- iv. To predict user mobility, user location and user trajectory through tactical analytics on big data collected from various sources
- v. To present the analytics using appropriate visualization techniques to benefit the defense community by providing real time user interface for integrated data

The methodology is as described in Figure 1



(b) **Indigenous or Ex Import:** Indigenous

(c) **Present State (Concept / Proof of Concept):** Concept

**Assistance Sought from the Army:**

**Cost in Indian rupees (Lakhs)**

Sl. No	Budget Heads	Year 1	Year 2	Total Cost (in lakhs)
1	Equipment(servers, sensors and Cloud charges)	20	5	25.0
2	Man power (Salaries/ Wages)	2.4	6.3	8.7
3	Consumables	0.5	0.5	1
4	Contingencies	0.75	0.75	1.5
5	Travel	0.2	0.2	0.4
			<b>Total :</b>	<b>36.6</b>

**Likely Timeline:**

Activities	Year 1 (Phase-1)	Year 2 (Phase-2)	Year 3 (Phase-3)
Configuring the Hadoop Cluster	Active	Completed	Completed
Data Acquisition framework for sensors and other devices	Active	Completed	Completed
Data modelling and data compression	Completed	Active	Completed
Filtering and optimized storage	Completed	Active	Completed
Analytics on the big data	Completed	Completed	Active
Visualization methods	Completed	Completed	Active

**Outcome Envisaged:**

**Tactical analytics tool:**

- With the scalable and real time data acquisition techniques, the project can deliver useful and timely analytics from the source data
- GUI for analyzing and interpreting the results: With the appropriate visualization techniques, it is easy to comprehend and interpret the results

**Reports**

- Project reports including the operation manuals

**Dr. C. Narendra Babu**

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## SOLUTION TO PROBLEM STATEMENT NO 33, VOL - I

# RAMAIAH UNIVERSITY OF APPLIED SCIENCES

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**Problem Statement:** Supply of High Calorific Value Food

**Details of the Solutions:**

**(a) Brief Description:**

Food packaging materials currently used are fossil fuel based or petroleum based plastic materials. Flexible packaging materials are non-degradable and causes environmental hazards. Growing environmental concerns has resulted in development of ecofriendly materials. Some of the examples of natural biopolymers are starch and its derivatives, cellulose acetate, chitosan and synthetic biopolymers are Poly Lactic Acid (PLA) and Poly Capro Lactone (PCL). Most promising biopolymer for food packaging material is Poly Lactic Acid (PLA). Most of the biopolymers are reported to be edible. Presently, PLA do not possess the mechanical strength as compared to petroleum based plastics. With the addition of nanoclays, improvements in mechanical properties, barrier properties can be achieved without affecting biodegradability. For any food packaging application, antibacterial property, water and oxygen barrier is most required to retain the taste and calorific value of food. With the use of PLA nanocomposites food packaging material, antibacterial, oxygen and water barrier properties of biopolymer based nanocomposites can be improved significantly.

**(b) Indigenous or Ex Import:**

Biodegradable packaging material developed will be an indigenous development

**(c) Present State (Concept / Proof of Concept):**

**International Status**

Starch and its derivatives is the most commonly studied biopolymers. Starch and its derivatives are commonly edible and are completely degradable. But it has low mechanical properties compared to other biopolymers. PLA is commonly studied synthetic biopolymer due to its biodegradable and tailoring of shelf life or lifespan. In general, biopolymers exhibit low mechanical properties, barrier properties, low heat distortion temperature, low resistance to extreme heat and humidity and low flexibility. The limitations of biopolymers is overcome by addition of nanoclays without affecting the degradability properties. Number of literatures reports improved gas and water

barrier properties of PLA nanocomposites. Not much work is reported on antibacterial behaviour of biodegradable food packaging nanocomposites.

**National Status**

There is limited work reported on development of biodegradable food packaging nanocomposites. Currently, Low Density Polyethylene (LDPE) and Linear Low Density Polyethylene (LLDPE) are used as flexible packaging materials. These petroleum based plastics are impregnated with potassium permanganate and cinnamic acid respectively to act as ethylene scavengers. These addition of ethylene scavengers increases the shelf life by two-three weeks and improves the strength of packaging material. Degradability of these packaging materials is major concern. Also, antibacterial properties are not well established.

**Preliminary Work Carried out by Investigators**

Our preliminary investigations of incorporating nanoclays have demonstrated significant improvement in mechanical and barrier properties. Observed oxygen and water vapour permeation reduction from 25% to 80% and 50% to 60% respectively by using nanoclays. From literature it is reported that addition of nanoparticles will not affect the biodegradability properties of PLA.

**Assistance Sought from the Army:**

- Type of foods used by troops
- Operational temperatures
- Required shelf life for food

**Likely Timeline:**

Activities	Year							
	Year1				Year 2			
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Procurement of raw materials and equipment	█							
Synthesis of polylactic acid/nanoclay nanocomposite		█	█					
XRD, Electron Microscope, Mechanical, Chemical Testing and Analysis		█	█	█	█			
Permeability studies in oxygen and water vapour atmosphere for nanocomposites				█	█			
Analysis of theoretical model to estimate interfacial interactions					█	█		
Photodegradability studies				█	█	█		
Prototypes for trials						█	█	
Documentation								█

**Outcome Envisaged:**

- Prototype of flexible biodegradable food packaging film

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## SOLUTION TO PROBLEM STATEMENT NO 123, VOL - III

# RAMAIAH UNIVERSITY OF APPLIED SCIENCES

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**Problem Statement:** Poor battery life of LRF LH-30

**Details of the Solutions:**

**(a) Brief Description:** Rechargeable Li-ion batteries are gaining more importance in portable electronic devices and stationary devices due to its high energy density. Graphite is one of the commercially used anode in Li-ion batteries. Maximum theoretical capacity of graphite anode is 372 mAh/g. Theoretical maximum capacity of 372 mAh/g can hardly meet the demands required for use in electronic devices. To meet the requirements in higher power densities and better cycling stability, significant efforts have been made to develop new anode electrode materials with graphene and molybdenum di-sulphide (MoS<sub>2</sub>). These materials have excellent electronic and structural properties and can provide larger surface areas for lithium adsorption and lower energy barriers for lithium diffusion. That is these materials can provide fast charge/discharge rates and high specific capacities up to 670mAh/g. Among these materials, have a higher band gap and good electrochemical performances. Development of anode materials with graphene and MoS<sub>2</sub> may help in solving the existing issues of battery.

**(b) Indigenous or Ex Import:** The development of hybrid graphene oxide and MoS<sub>2</sub> nanoparticle anode for Lithium battery will be an indigenous product.

**(c) Present State (Concept / Proof of Concept):**

**International Status**

There is extensive literatures available in international scene about promising potential of MoS<sub>2</sub> nanoparticle and graphene oxide hybrid layer used as anode material.

**National Status**

There is limited reporting of development of MoS<sub>2</sub> nanoparticles in Lithium battery. Not much reporting is found on development of hybrid graphene oxide and MoS<sub>2</sub> anode material for Lithium ion battery.

### Preliminary Work Carried out by Investigators

Currently, graphene is used as anode material. The storage capacity is very low compared to graphene oxide and MoS<sub>2</sub> nanoparticle. Anode material can be replaced by a hybrid graphene oxide and MoS<sub>2</sub> particle layer synthesised by Chemical Vapour Deposition (CVD). Process parameters of MoS<sub>2</sub> nanoparticles synthesis is optimised on both quartz and graphite substrate using CVD process. Morphological studies revealed formation of MoS<sub>2</sub> nanosheets. Resistivity of the synthesised MoS<sub>2</sub> nanoparticles on graphite substrate showed encouraging results.

### Assistance Sought from the Army:

- Specifications and details of existing battery
- Operational temperatures

### Likely Timeline:

Activities	Year 1			
	Q1	Q2	Q3	Q4
Procurement of raw materials and equipment	■			
Synthesis of nanoparticles using CVD at low temperatures		■ ■ ■ ■		
XRD, Electron Microscope and EDX Analysis		■ ■ ■ ■		
Optimisation of process parameters for synthesis of nanoparticles in CVD		■ ■ ■ ■		
Development of thin film Lithium ion battery at laboratory scale			■ ■ ■ ■	
Testing of Lithium ion battery			■ ■ ■ ■	
Laboratory scale prototype of Lithium ion battery for field trials				■ ■ ■ ■
Documentation				■

### Outcome Envisaged:

- Prototype of Hybrid MoS<sub>2</sub> Nanoparticle and Graphene Oxide Anode material for Lithium Ion Battery

#### Dr. Srikari S.

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## SOLUTION TO PROBLEM STATEMENT NO 122, Vol - III

# RAMAIAH UNIVERSITY OF APPLIED SCIENCES

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**Problem Statement:** Extreme Cold Climate (ECC) Clothing for Crew of Armoured Fighting Vehicle (AFV)

### Details of the Solutions:

#### (a) Brief Description:

In cold climate temperature goes down as low as -40 degree centigrade, so requirement of protective clothing is very crucial. Wind chill is also one of the factor effecting the heat loss. Designing of clothing for extreme cold weather involves many external and internal parameters. Textile material used in this, should provide maximum protection with minimum bulk and weight so that the armour will feel comfort to discharge his duty without any physical stress. The protection against the extreme cold mainly depends on type of thermal insulation and resistance of the developed thermal material. Modified or Double-ply fabric made of cotton, wool, acrylic, fleece, or polyester are normally used for development of thermal material for cold climate. The two plies work like two layers of clothing. They do not allow the body heat to escape. Thermal wear made of wool provides maximum protection.

Usually coat of ECC is a three layered garment having detachability. The "layer method" of dressing is more effective than a single bulky garment. Several layers are built up, each of which has its own part to contribute, insulating air is trapped between as well as within layers, and flexibility is maintained as conditions change.

**Foundation layer:** a base to wick away moisture and insulate. The layer next to the skin, this should be soft, comfortable and able to wick away perspiration quickly so leaving you feeling dry in spite of your exertions in the cold

**Mid layer:** insulation, flexible and light to trap body heat. A versatile layer that provides insulation with the ability to easily remove or put on the layer. Buttons, zips and the like allow for ventilation during exertion or the ability to quickly close everything up when the weather worsens.

**Outer shell layer:** water proof, windproof, breathable tough. This layer provides direct weather protection, it must be windproof and may be waterproof depending on the temperature it will be used at. Sometimes literally a "shell" or with additional insulation built in. Studies conducted by Recreational Equipment Co-Op show that in still air, wind shells worn over any garment can add up to 25°F of warmth. In windy conditions, wind shells can increase warmth by 50°F or more.

**Extremities:** keep the heat in and stay comfortable. Head, hands, fingers, feet and toes, not forgetting ankles, wrists and neck.

Hence, design and development of ECC for crew of armoured fighting vehicle will be researched for more compatibility in terms of cold protection, motivating, soothing aromatic to boost the enthusiasm and spirit of persons without deployment of regiments in high altitude area.

**(b) Indigenous or Ex Import:**

Material developed will have maximum insulation having Self- life of more than 3 years and water proof outer layer for protecting the wearer from moisture penetration. The developed new design can be used in hospitals, high altitude areas (more than 6,000 ft. to 14,000 ft.), will protect the wearer for a longer period of exposure (+100 C to -200 C). Three layered detachable Dungaree with coat and hood with adequate lining helps in protection from cold winds.

**(c) Present State (Concept / Proof of Concept):**

- Presently Soldiers wearing Extended Cold Weather Clothing System gear move through a snowy terrain after dismounting from a helicopter in March 2010. Army scientists are working with nanotechnology to produce cold-weather uniforms that will heat up when switched on and wick moisture away more efficiently.

**COURTESY OF THE U.S. ARMY**

- Thermal protective performance (TPP) of fire fighters' clothing under high-temperature and high-humidity conditions were developed which describes the influence laws of moisture on thermal protection and the moisture distribution in actual fire environment. Different evaluation methods used for assessing the effect of moisture on the TPP were investigated, with an emphasis on test devices, evaluation indexes as well as their relationship and limitations. Findings – The moisture from the ambient, clothing and human perspiration plays an important role in determining the TPP of fire fighter protective clothing. The research on moisture-driven heat transfer in fire-fighter's clothing system was primarily focussed on pre-wetted methods of multi – layer fabric



- Clothing for micro climates that is the space between skin and the clothing plays a major role in the heat and mass exchanges from or to the body. The fluid dynamics approach was used to perform numerical studies of fluid flow and heat transfer across cylindrical clothing. Transient simulations were performed for three different values of microclimate thickness to diameter ratio (0.05, 0.10 and 0.25), considering a two-dimensional cross-section of a human limb surrounded by a porous fabric and exposed to cool external air (10°C). The obtained local heat transfer along the skin shows that increasing the microclimate thickness ratio from 0.05 to 0.25 decreases the convective heat fluxes by up to 100% in the upstream regions of the microclimate, and increases them up to 190% in the downstream regions. This asymmetry, which indicates an increasingly important role of natural convection as the microclimate thickness ratio is increased, is often overlooked in space-averaged approaches due to the opposite changes in the different regions of the microclimate. Local variations in temperature along the outer fabric and in convective fluxes along the skin were significant, reaching up to 14K and 90%, respectively. The critical thickness ratio above which natural convection should not be ignored was found to be 0.1 (e.g. corresponding to a microclimate thicknesses of 11 mm or 8 mm, around an upper arm or forearm, respectively).

**Assistance Sought from the Army:** Assistance for conducting pilot research on the development of product

**Likely Timeline:** 12 months

**Outcome Envisaged:**

- Development of fibre, fabric, clothing with efficient protection for extreme cold climate for crew of armoured fighting vehicle involves varied design factor and thorough investigation through various tests and pilot study
- The use of newly advanced fibres with synthetic insulation materials such as Thinsulate, Thintech, Prima Loft, Thermoloft, Hydrofil and Go Retex for development of multi layered textile fabric is the novelty of a research
- Cumulative resistance of these developed textile materials will be researched for air permeability property adjacent to textile material, air entrapment between skin and textile layers
- Production and construction of more than 3 layered jackets, Dungarees, caps, hoods and gloves with aluminized surface for prevention of heat loss and outer layer for protection against the chill and wind

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## SOLUTION TO GENERIC PROBLEMS

### SAI PROCOAT

**Problem Statement:** High Performance Formula for Chemical and Moisture Resistance with LINE-X XS-350

**Details of the Solutions:** Line-x protective coatings provide more or less permanent solutions for Blast/ Spall Mitigation, Salt Water, Extreme temperatures, Chemicals, Corrosion/ Erosion/ Wear and Tear, Abrasion/ Instrumental Impact, Humidity/ Waterproofing / Air leakage. Line-x coatings have very high tensile & Tear strength. Line-x can provide a lasting solution with almost ZERO maintenance for Equipment/Tracks for wheeled vehicles, Membrane to construct an emergency Helipad, Bullet proof Vests.

Line-x can enhance the life of the metal / rubber parts by protecting from Corrosion, Abrasion etc and also provide material strength for as under:

- a) Rubber parts such as Battery Box or Trays, Flanges, Gaskets, Radiator hose, Filter & Fuel hose, Fuel Tanks & Drums, Hydraulic hoses exposed to salinity / harsh temperatures.
- b) Rubber lining of the tank wheels.
- c) Line-x coating provides resistance against instrumental impact besides corrosion & abrasion hence will prevent damage to tank metal/underside in case of collusion – when the paint peels off and corrosion starts.
- d) Exposed metal of field guns.
- e) Arresting aging effect due to saline conditions and Harsh temperatures on Concrete Bunkers.
- f) Prevent corrosion of floating platforms and boats.
- g) Prevent rusting of water storage tanks fitted in trucks /Battle tanks etc.
- h) Provide light weight, sturdy & portable base for LMG/Mortar to operate with ease in uneven terrain

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## SOLUTION TO PROBLEM STATEMENT NO 31, VOL - I

# SMART ENOVATION INDIA PVT. LTD.

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**Problem Statement:** Microwave Landing System

**Details of the Solutions:**

**(a) Brief Description:** This document presents a solution to alleviate difficulties faced by helicopter pilots during landing. Visibility of the landing site plays an important role in enhancing smooth, safe and quick landing. However the visibility conditions deteriorate due to weather or time of the day. In case of landing at ill prepared sites or during emergency operations additional constraints on visibility as well as unknown obstructions pose further difficulties for operations. To provide safer and efficient environment for landing a solution based on available technology needs to be adapted. Modern sensor technologies provide various options for detecting obstructions as well as mapping landing sites before final approach even during poor weather as well as in dark. However, there is a need to customise these to satisfy special constrains posed by desired application. In case of helicopters, microwave sensors along with specialised software can provide early information of the obstructions in the flight path on the monitor. These will be effective during any time of the day as well as other situations of Poor/No visibility due to weather etc. This proposal outlines the development of an adaptation of microwave landing system which can be mounted on the helicopter and deployed in the field. This system will then provide additional assistance to the pilot during landing for visualising field in the flight path as well as the condition of landing site in all weather and lighting conditions.

**(b) Indigenous or Ex Import:** 75% indigenous | 25% export

**(c) Present State (Concept / Proof of Concept):** The current product is in use in automotive sector by putting 2 antenna to assist the driver during Low | No visibility conditions [~300 meters range] . Second, application is towards ground airport [~ 1000 meters range] | port [~ 1000 meters range] to assist during no & low visibility condition. The technology is patented. We are adapting the same technology to build our indigenous solution.

**Assistance Sought from the Army :**

- (a) Detailed inputs on the technical requirements and specifications | sizing & location constraints | projected volume requirements;
- (b) Access to helicopters to mount and test during validation phase
- (c) Acceptance criteria
- (d) Financial assistance

**Likely Timeline:** 2 years from T0. Timeline will depend on clarity from user organization

**Outcome Envisaged:** Delivery of Indigenous working, tested, proven prototype of helicopter landing assist.

**Mr. Ravi Venugopal Gunti, Chief EEO, Mr. Mandeep Sibia, Global Alliances & Partnerships  
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## SOLUTION TO PROBLEM STATEMENT NO 16, VOL - I

# SOOKTHA CONSULTING PVT. LTD.

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**Problem Statement:** Air Interface Security Vulnerabilities of LTE System

**Details of the Solutions:**

- (a) **Brief Description:** End-to-end LTE/5G system with proprietary mechanisms to address the vulnerabilities
- (b) **Indigenous or Ex Import:** Indigenous
- (c) **Present State (Concept / Proof of Concept):** Proof of Concept

**Assistance Sought from the Army:** Identification of focus group to ratify specifications

**Likely Timeline:** September 2019

**Outcome Envisaged:** Robust indigenous communications system

**Mr. Ambarish A**

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## SOLUTION TO PROBLEM STATEMENT NO 38, VOL - I

# TATA POWER SED

**Problem Statement:** Unattended Surveillances Camera

**Details of the Solutions:**

- (a) **Brief Description:** Tata Power SED's **RAJAK™ TBC-DNL-ULR-1** is Ultra Long Range equipment for 24x7 Day & Night surveillance. It comprises of various modules like a Day camera, a Cooled TI camera, LRF, etc. in a single rugged housing and comes with various peripherals. The equipment is capable of detecting a human at upto 20 km during night ambience.
- (b) **Indigenous or Ex Import:** The **RAJAK™ TBC-DNL-ULR-1** Ultra Long Range System is indigenously designed and developed in-house by Tata Power SED in its Optronics manufacturing & test facility in Bangalore.
- (c) **Present State (Concept / Proof of Concept):** Some proto units of **RAJAK™ TBC-DNL-ULR-1** have already been manufactured and demonstrated to various Defence & Paramilitary agencies at different locations in the country and the response is quite encouraging. Tata Power SED is ready to cater to the Indian requirements as & when.

**Assistance Sought from the Army:** We solicit Indian Army's cooperation in getting the equipment demonstrated (NCNC) at various field locations where this class of equipment could be deployed. Being restricted item (for Defence & Homeland Security use only) Army shall also assist in the logistics involved in the demo.

**Likely Timeline:** As detailed earlier, Tata Power SED is prepared for the NCNC demo wherever required. We would just need 15 days advance intimation for preparations at our end.

**Outcome Envisaged:** After the NCNC demo, if the equipment performs upto the satisfaction/ expectations of the end-user, the direct purchase of the equipment should be done taking into consideration the price justification for the same.

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## SOLUTION TO PROBLEM STATEMENT NO 6, VOL - I

# TATA POWER SED

**Problem Statement:** Night Vision Device

**Details of the Solutions:**

(a) **Brief Description:** Tata Power SED's **RAJAK™ TBC-DNL-1** is a multifunction observation system which encapsulates a Day camera, a Cooled TI camera, LRF, GPS, DMC in a rugged enclosure and still the system is quite light weight (< 4kgs). It is capable of mounting on a small PTZ motor for remote control and achieves ranges of upto 10 km for vehicle detection in clear weather scenario.

**The system comes in 2 variants – with and without LRF (i.e., DNL & DN).** Real-time video-feed can be taken onto a rugged console for remote observation at upto 100m via Ethernet cable and upto 10 km (Line of Sight) wirelessly depending upon the types of Tx-Rx radios used.

(b) **Indigenous or Ex Import:** The **RAJAK™ TBC-DNL-1** Mid-Range Observation System is indigenously designed and developed in-house by Tata Power SED in its Optronics manufacturing & test facility in Bangalore.

(c) **Present State (Concept / Proof of Concept):** **30 units of the DNL-1 version** are being **exported** (Export Order details can be shared if required) and **50 units of the DN version** of these equipments have already been supplied to BSF after winning a global tender. These eqpts are proposed to be deployed at the Border areas manned by BSF.

**Assistance Sought from the Army:** We solicit Indian Army's cooperation in getting the equipment demonstrated (NCNC) at various field locations where this class of equipment could be deployed. Being restricted item (for Defence & Homeland Security use only) Army shall also assist in the logistics involved in the demo.

**Likely Timeline:** As detailed earlier, Tata Power SED is prepared for the NCNC demo wherever required. We would just need 15 days advance intimation for preparations at our end.

**Outcome Envisaged:** After the NCNC demo, if the equipment performs upto the satisfaction/ expectations of the end-user, the direct purchase of the equipment should be done taking into consideration the price justification for the same.

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## SOLUTION TO PROBLEM STATEMENT NO 48, VOL - I

### TATA POWER SED

**Problem Statement:** Sniper Scope

**Details of the Solutions:**

- (a) **Brief Description:** Tata Power SED's **RAJAK™ TWS** series of Weapon Sights are single channel TI (Un-cooled) based weapon-cum-observation systems in monocular configuration. **This series of Weapon Sights comes in 3 variants – Long, Medium & Short Ranges (i.e., LR, MR & SR)** depending upon the weapon being used (CQB Carbine, Assault, LMG, MMG, RL, Sniper, etc.). The smallest version RAJAK-TWS-SR can also be head/ helmet mounted for short range observation. Real-time video-feed can be taken onto a console for remote observation and in-built video recording capability can also be provided, as per the user requirement.
- (b) **Indigenous or Ex Import:** The **RAJAK™ TWS** Weapon Sights are indigenously designed and developed in-house by Tata Power SED in its Optronics manufacturing & test facility in Bangalore.
- (c) **Present State (Concept/Proof of Concept):** Tata Power SED has designed, developed & manufactured **RAJAK TWS** in various ranges (LR, MR, SR) and these Night Sights have been demonstrated and trial evaluated on different weapons (like SIG Sauer 551, M4, AK, Tavour, Negev, INSAS, Dragunov, etc.). Tata Power SED's Night Sights are compatible with any weapon having a standard picatinny rail. However, in absence of this rail (like in INSAS Rifle & LMG, and Negev Sniper Rifle) we have developed specific weapon mount adapters to suit the weapon.

**Assistance Sought from the Army:** We solicit Indian Army's cooperation in getting the equipment demonstrated (NCNC) on various in-service weapon platforms. Being restricted item (for Defence & Homeland Security use only) Army shall also assist in the logistics involved in the demo.

**Likely Timeline:** Tata Power SED is prepared for the NCNC demo wherever required. We would just need 15 days advance intimation for preparations at our end.

**Outcome Envisaged:** After the NCNC demo, if the equipment performs upto the satisfaction/ expectations of the end-user, the direct purchase of the equipment should be done taking into consideration the price justification for the same.

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**Tata Power SED**

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**SOLUTION TO PROBLEM STATEMENT NO 6, VOL - I****TONBO IMAGING INDIA PVT. LTD.**

**Problem Statement:** Night Vision Device

**Details of the Solutions:**

- (a) **Brief Description:** Tonbo proposes use of their already existing suite of weapon sights, helmet sights and head mounted displays to solve this problem. The proposed solution is based on thermal imaging weapon sights with wireless video interface, transmitting video in real time to a head mounted display or to the night vision goggles.
- (b) **Indigenous or Ex Import:** High levels of indigenisation with some components being ex-import.
- (c) **Present State (Concept / Proof of Concept):** We have already conducted multiple tests with including with our Special Forces namely 9 Para, KA SWAT, NSG etc. A variant was also delivered to NSG in 2015 with wired video communication between the weapon sight and the helmet sight.

**Assistance Sought from the Army:** Provide opportunity to Conduct NCNC trials, Buy Pilot systems.

**Likely Timeline:** Ready to be deployed.

**Mr. Ankit Kumar**

*Chief Technology Officer*

**Tonbo Imaging India Pvt. Ltd.**

**Add.:** L&T 104 Shivalaya, 17th C Main, 5th Cross Road, 5th Block, Koramangala, Bengaluru - 560 095

**Email:** harsh@tonboimaging.com | **Mob.:** +91 9901765754

## SOLUTION TO PROBLEM STATEMENT NO 5, VOL - I

# TONBO IMAGING INDIA PVT. LTD.

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**Problem Statement:** Situational Awareness

**Details of the Solutions:**

**(a) Brief Description:**

Tonbo has designed, developed and supplied 1st Generation ENVG (D) III / FWS-I compliant helmet mounted sensors to National Security Guard. These systems are light weight magnesium alloy construction and supports a 640x480 Shutterless Thermal Sensor and a Low Light Day Sensor with digital sensor fusion.

**(b) Indigenous or Ex Import:** Indigenous

**(c) Present State (Concept / Proof of Concept):** The solution already exists with Tonbo. These systems are already deployed / in process of getting deployed with Indian Army (Northern Command) and Sp. Ops units of Paramilitary Forces.

**Assistance Sought from the Army:** Provide opportunity to Conduct NCNC trials, Buy Pilot systems.

**Likely Timeline:** Ready to be deployed

**Outcome Envisaged:**

**Mr. Ankit Kumar**

*Chief Technology Officer*

**Tonbo Imaging India Pvt. Ltd.**

**Add.:** L&T 104 Shivalaya, 17th C Main, 5th Cross Road, 5th Block, Koramangala, Bengaluru - 560 095

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## SOLUTION TO PROBLEM STATEMENT NO 29, VOL - I

# TONBO IMAGING INDIA PVT. LTD.

**Problem Statement:** Night Vision Device for Air Crew

**Details of the Solutions:**

**(a) Brief Description:**

We propose our next generation head mounted display (HMD) integrated with head tracking and the imaging sensor suite for complete situational awareness. In the sections below we describe the HMD, sensor suite and also the integration mechanism.

**(b) Indigenous or Ex Import:** Indigenous

**(c) Present State (Concept / Proof of Concept):**

We already have our first few pilots being produced of both the sensor suite and the head mounted display. We believe in the next 2 years we will be ready to demonstrate and deploy our next generation head mounted displays integrated with our sensor suite package.

**Assistance Sought from the Army:** Provide opportunity to Conduct NCNC trials, Buy Pilot systems

**Likely Timeline:** Following is the tentative timeline proposed by Tonbo

ADB Acceptance: T0

Production of Evaluation System: T0+10months

User Evaluation: T0+8months to T0+14months

Joint Program Review: T0+16months

Tentative Delivery Schedule post Joint Review

Notice of Award: D0

Rate of Supply (D0+6months onwards): >15 Systems/month

**Outcome Envisaged:**

**Mr. Ankit Kumar**

*Chief Technology Officer*

**Tonbo Imaging India Pvt. Ltd.**

**Add.:** L&T 104 Shivalaya, 17th C Main, 5th Cross Road, 5th Block, Koramangala, Bengaluru - 560 095

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## SOLUTION TO PROBLEM STATEMENT NO 6, VOL - II

# TONBO IMAGING INDIA PVT. LTD.

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**Problem Statement:** Loss of Orientation

**Details of the Solutions:**

**(a) Brief Description:**

Tonbo is proposing Wolfpack Multi-Aperture Multi-Spectrum 360° Panoramic Situational Awareness Sensor Package to combat Loss of Orientation for tank commanders.

Wolfpack is a multi aperture and multi spectral real-time panoramic imaging system designed to increase situational awareness and self defence capability of a closed hatch land platform. It is a network of an array of multi-spectral cameras constantly staring (staring array) in different directions around the vehicle and generates fused 360° panoramic images covering the surroundings of the entire platform. It is designed to be retro fitted on most land platforms. It offers simultaneous visualization from multiple consoles.

**(b) Indigenous or Ex Import:** Indigenous

**(c) Present State (Concept / Proof of Concept):** Tonbo has been actively developing the solution for 360° situational awareness since 2015. The 1st generation of WolfPack system has undergone trials with System Integrator in North America for a major program as well as to European SI for a program in Middle East.

**Assistance Sought from the Army:**

**Conduct NCNC Trials**

**Buy Evaluation/Pilot System**

Tonbo is proposing estimated budget of 2 Cr for producing 02 Nos. of Wolfpack 360° to Army Design Bureau that includes:

- 08 Nos. of Wolfpack 120° Sensor Heads (24 x LWIR Cameras & 24 x Low Light CMOS Cameras)
- 02 Nos. of Processors



- 02 Nos. of UI

**Likely Timelines:**

**Following is the tentative timeline proposed by Tonbo for WolfPack 360° Situational Awareness System to Army Design Bureau.**

**ADB Acceptance: T<sub>0</sub>**

**Production of Evaluation System: T<sub>0+3months</sub>**

**User Evaluation: T<sub>0+3months</sub> to T<sub>0+6months</sub>**

**Joint Program Review: T<sub>0+6months</sub>**

**Tentative Delivery Schedule post Joint Review**

**Notice of Award: D<sub>0</sub>**

**Rate of Supply (D<sub>0+6months</sub> onwards): > 100 Systems/month**

**Outcome Envisaged:**

**Mr. Ankit Kumar**

*Chief Technology Officer*

**Tonbo Imaging India Pvt. Ltd.**

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## SOLUTION TO PROBLEM STATEMENT NO 21, VOL - II

# TONBO IMAGING INDIA PVT. LTD.

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**Problem Statement:** RCWS for Inservice Vehicles and Weapons.

**Details of the Solutions:**

**(a) Brief Description:**

Tonbo has experience designing and deploying EOFCS (Electro Optical Fire Control System) for 12.7mm (x99mm / NATO & x108mm/RUSSIAN) weapon platforms for land and sea based stabilized remote control weapon stations with multiple SI's globally. Further, Tonbo has experience with both Line of Fire Stabilized as well as Line of Sight Stabilized RCWS systems.

**(b) Indigenous or Ex Import:** Indigenous

**(c) Present State (Concept / Proof of Concept):** The solution already exists with Tonbo. The system is already deployed on Arjun MBT.

**Assistance Sought from the Army:** Conduct NCNC trials/ Buy pilot Systems

**Likely Timeline:** Ready to be delployed

**Outcome Envisaged:**

**Mr. Ankit Kumar**

*Chief Technology Officer*

**Tonbo Imaging India Pvt. Ltd.**

**Add.:** L&T 104 Shivalaya, 17th C Main, 5th Cross Road, 5th Block, Koramangala, Bengaluru - 560 095

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## GENERIC SOLUTION ON PUNCTURE PROOF TYRES

### VAJRA RUBBER PRODUCTS (P) LTD.

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**Problem Statement:** Puncture Proof Tyres

**Details of the Solutions:**

(a) **Brief Description:** Whole materials can be adapted to carbon fibre components that are highly durable and can reduce weight by more than 60%. Here, you can also use light, high-strength rubber.

We can also introduce a new technology of filling the polymer inside the tires instead of pneumatic air. It ensures a puncture-proof in the war zones.

(b) **Indigenous or Ex Import:** Indigenous

(c) **Present State:** We have developed and supplied carbon composite shims instead of metallic shims for flex seals. This has been successfully molded with rubber. The results are yet to come since the flight tests are to be done.

**Assistance Sought from the Army:** Field Trials

**Likely Timeline:** Ready for Supply

**Outcome Envisaged:** Business Orders

**Mr. John Ranji**

*Project Engineer*

**Vajra Rubber Products (P) Ltd**

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## About FICCI

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### Contact Us: \_\_\_\_\_

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