



# EME

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APRIL - 2021

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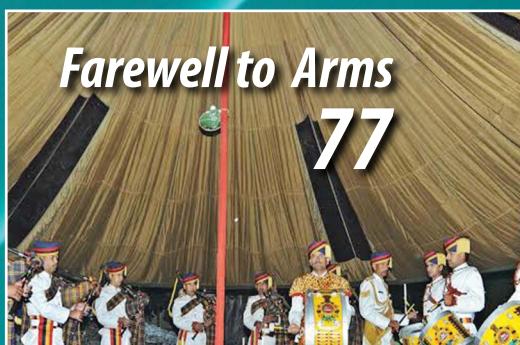


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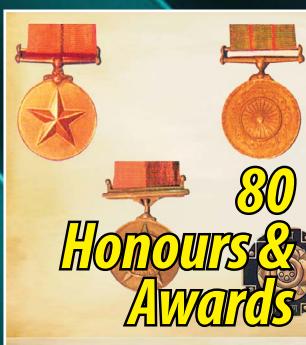


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# FROM THE EDITOR'S DESK



## **Breaking News - EME Journal goes Online!!!!**

At the very outset, we take this opportunity to present all our ardent readers, for the first time in the history of EME Journal, the Pilot E-Journal. The first edition of year 2021 is your same EME Journal but in digital form which will be easier to disseminate and faster to reach among the entire Eagles fraternity. Over the years, the EME Journal has carved a niche of its own and this has been possible due to the valuable contributions by all our esteemed subscribers and continued patronage by our senior dignitaries.

The Apr 2021 E-Journal is a Non-Thematic edition which showcases the spectral variety of intellect, integral to numerous roles our Corps dons. The articles will actually attract readers from all domains, be it Radars, Computers, Aviation, A Vehicle, Corps specific etc. Worth mentioning the Articles on "Transform EME – An Agile Combat Service", "Low Reynolds Number Flow Over Low Aspect Ratio Corrugated Wing" and "Extended Reality and Its Military Applications" aptly demonstrate the technical acumen of the officers of our Corps. Thereafter, you will find a tribute to one of the Unsung Heroes of our Corps, Late Maj AA Basith, Indian Army's First Olympic Sailor. His selfless contribution towards Sailing will definitely touch everyone's heart.

The second wave of COVID-19 has hit the country and this time with multiple variants. Although, majority of Eagle's fraternity must have been vaccinated but still we must not put our guard down and continue to take all necessary precautions.

We would love to hear from all the Eagles in form of feedbacks/ suggestions regarding the first ever E-Journal. Your kind feedbacks will decide our future course of action for the next edition. We request one and all, whether serving or retired, to give your honest feedback about how do you find the electronic version of EME Journal. Feedbacks/ suggestions can be sent directly to us on our e-mail ID i.e. [emejournal@gmail.com](mailto:emejournal@gmail.com) or WhatsApp number i.e. 8328118023.

*As Always, Happy 'E'-Reading.....*



Associate Editor  
**Maj Prateek Malhotra**

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# TRANSFORM EME – AN AGILE COMBAT SERVICE

Col S Hariharan

## Introduction

Agility refers to moving quickly and easily. Especially when it is applied on engineering projects including its management, it is defined as division of tasks into shorter phases of work and frequent reassessment and adaptation of plans.

Agility is a methodology of applying energies in a direction to propel an organisation on growth trajectory. It is achieved by ratcheting all the gains made and then finding new opportunities to enhance competence, which should ultimately lead to enhanced effectiveness.

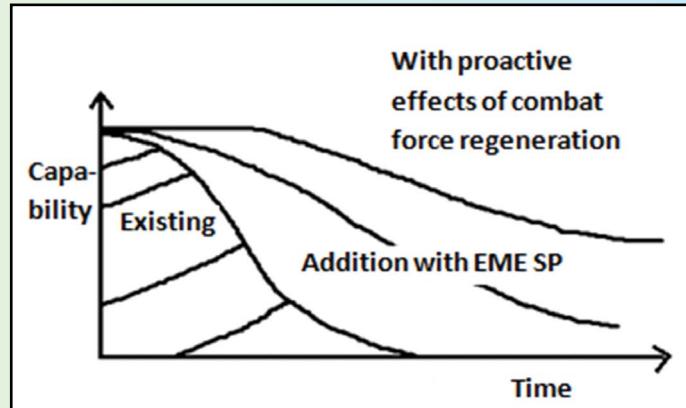
Requirement of agility in the organisation can be answered by a simple question, "Can you expect a better performance and comfort just by placing accessories without comfort or just by an upgraded engine without focus on other interplaying elements? Answer is a resounding 'NO'. Hence, agility in an organisation is a holistic collection and application of best practices.

## Contemporary Context of Employment of Eagles

In the contemporary context Equipment Management (EM) is a command function, which was considered to be the forte of Eagles for about 60 years. Now the general cadre views it as command function but at grass root level, still considered as EME responsibility.

**Equipment Capability.** Equipment Capability is the ability of a combat weapon or equipment system to generate a desirable operational outcome or effect. In the operational context it represents Equipment Readiness (ER).

When one compares equipment capability with respect to time with/ without actions by EME on Force Regeneration, it throws light in the deep allays of quantum of hard work which has gone to keep the fleet mission ready. As shown by the graph, the mission reliability slope reduces with EME support and when it is in-situ with technology infusion ER and mission reliability gets better.



Some combat systems are of old vintage which have ESP issues or of new procurement nature with maintainability issues, the onus of keeping the fleet running is on Eagles. Even the implementation of TSS Inventory Management System (TIMS) hasn't paved the way for availability of spares, as transfer of spares is still the responsibility of EME and Ordnance, rather it should be driven by EM staff.

We have with some weapon systems like that of AAD systems hit grotesque levels of shortage of spare parts and technical obsolescence. Make-in-India has reduced imports, still India is on 'Leader Board in World Defence' market. At places to have few modest dollars we are compromising on quality. At the end 'Quick Fix Solutions' are adopted, which fall astray in one season.

We are in an era of near 100% reliability which was introduced by Motorola Inc in the 90s era with six sigma in place, but 'Corps of EME' and the environment is in myopic concepts of 'Ideas & Innovation' and 'Jugad' which is fragile. There is a need to infuse transformation process which could rest on:-

- Infusing process of industrial engineering and operational management at all levels of Workshops.
- Build human resources capability for future weapon systems like space, cyber, UAV, technical intelligence etc.
- Empower people to quicken situational response and contextual intelligence.

As we have seen umpteen challenges, it is essential to right size the wings of eagles to agile combat support missions which should be based on some governing principles.

### **Principles : Agile Combat Service**

- Increase in priority to satisfy the customer through early and continuous support.
- Prefer changes after gauging them on the weighing scales of efficiency and effectiveness.
- Develop synergy between field level of requirements, second tier of workshops and manufacturing agencies.
- Enhance and up skill people to motivate individuals who can adapt faster with new systems and technology.
- Continuous attention to technical excellence.
- Agile process be introduced with promotion to sustainable development.
- Develop self organised teams at unit level as best architecture, requirements and designs are given by them. At unit level, Flexi-FRT and FRT serves this purpose.
- At regular intervals, audit of teams is necessary to assess their effectiveness which with times gets adjusted to individual behaviour.
- None of the agile changes be Rigid (meaning difficult to change), Fragile (changes causing process or systems to break), Immobile, Viscous (having high resistance in doing right thing), Opaque (hard to understand and execute), needless complexity and needless repetition.

### **Transform EME : Agile Combat Services**

To create an agile "Combat Service" there is a need to transform 3Ps (Purpose, People and Process) in the organisation to frontline arm in engineering support. This force should ensure that any equipment which goes through them has reliability of six sigma. These are some points which can be considered:-

- **System Approach.** Engineering support endeavors to restore mission capability in weapon systems through planned and impromptu engineering interventions called resuscitation. Systems Approach should yearn at incorporating both operational and technical content of the job.
- **Responsibility to Ensure ER and not EM.** EM is a command responsibility. Over the years EME has taken flaks on ARV WZT-2 and BMP-1 failures. We

have been giving a feeling to the environment of something will be done. Recently, during COVID-19 EME is trying to help Field Army in keeping medical equipments operational, which otherwise is the responsibility of AFMSD or their vendors. So, the 'Forca Eagles' should draw clear lines between ER and EM. CLR T-90 is a classic example of endeavour of EME to enhance ER. Similar models of 'State-of-the-Art' hub centres be developed.

- **Creation of Knowledge Based Organisation (KBO).**

Team work is key to most EME operations. We need to devise methods to foster KBO. Some strategies are :-

- Create culture of FRTs which remain together during op and peace time and they be given a platform to function like a surgical team.
- Creation of cluster of three-four units which are holding similar equipment profile and have peace-field locations. Maximise postings between these three-four units for persons. Example, there are eight independent armoured workshop, so, there is a case in point to create two clusters of four each independent armoured workshops. This will foster team synergy and better affiliation to the unit.
- FRT/ AVT (FR)/ AVT (LR) competitions should be conducted at different levels even if it is done in place of individual skill competition. This will generate team spirit and development of competence as a team.
- Tenure of officers in a unit should be longer. As per an article on "Tips for Managing Organisational Change" by Greg Satell at Harvard Business Review, leaders should continue in a setup for 4-5 years. In the present structure of managing profile of officers it is an utopian task but manageable if officers are also profiled to three years in units like Artillery Regiments.
- DGEME Professional Excellence award' is an inspirational award for all ranks and should be given to the teams.
- **Intake Differential.** An i-Phone can be

operated by an undergraduate but it can't be manufactured by a post graduate without all skills. Taking this as an analogy, high technology weapon systems can be operated by a lesser educated person but not its engineering support. To take the EME to next level it is essential that all entries of PBOR be of ITI or graduate level and officers be engineering graduates only.

- **Techno Tactical Language.** IME-200 and Army Training Note on EME operations should be the start point at using techno tactical language at all formations.

• **Configure an Army Force Regeneration Plan.** An Army Force Regeneration road map be prepared and implemented during peace time with a balanced mix of technical maintenance, medium reset and base reset (OH) for major weapon systems including small arms and its sights as these are the infantryman's most prized asset. Soldier systems are the most deployed weapon systems, hence their deterioration due to age, deployment and usage effects in axiomatic. Sadly, someone has decided to do away with base reset of small arms. There is a need to setup Soldier System's readiness evaluation teams in all field workshops to guarantee 360 degree readiness of both individual and crew served small arms and weapon sights. The Bofors gun failure rates during Kargil substantiate this fact as the Bofors failed to deliver desired battle endurance.

• **Outsourcing Vs In House production.** During EWTs, operational times and present pandemic situation it has been realised that 100% reliance on outsourcing becomes bottleneck activity in the entire engineering support gamut. While outsourcing has its own advantages, at the same time EME should not relent its capability in totality. Outsourcing option is recommended to only bolster the capability by capacity addition. During EWTs it was observed that demand of Tatra self-starters increased to gigantic proportions to be liquidated in available time frame. Recently, OEMs have been found wanting in repair of medical equipments. Hence, EME expertise should be preserved.

- **Rightsizing.** It is a challenge to downsize

rather rightsize without compromising on ER.

- **Quality Control (QC).** There are number of quality issues pointed out after a combat system leaves factories and workshops. Our present systems of Quality Control need to at least reach to the practices followed in the industry during 1980-90s era. In 1942-1950 era, Walter Schwartz and W. Edwards Deming introduced statistical techniques in QC. We are yet to adopt them. Statistics in engineering support need to be introduced in courses of instruction.

- **Technical Inspections of Workshops.** Initial technical inspection i.e. around 2000-2010 was carried out based on documentation and key indicators of a workshop functioning. Thereafter, it was formulated based on performance of workshop in peace, training and operational events. Now, it also depends on 'Ideas and Innovations' and also impression formed over a period of time. This entire process of Technical Inspection is subjective and lacks objectivity. There is a need to introduce numerical based parameters to assess and this should be a continuous process through WASP and BEEHIVE applications.

- **Delivering Agile Solutions to IA's Engineering Problems.** Agile engineering solution is different from traditional techniques. In this technique a high-level plan, based on outline requirements of a high-level view of the solution is given. From that point, the end state is created iteratively and incrementally with each increment building on the output of steps preceding it.

- **Inventory Management.** One of the study shows that 70% of inventory held in a TS and TSS are not being used to optimal capacity. Reasons are many and on the other hand even after holding 70% unused items, we need spares and assemblies which are critical. There is another problem of visibility of required item at all India level. Though Ordnance has done some progress on it, still a lot more is desired. EME needs to ramp up its technical process by introducing Blockchain Technology for inventory management, its movement and visibility because it affects the most for two agencies i.e. the

users and the maintainers.

- **Record-Keeping.** In order to have an eye to manage equipments effectively, good maintenance and repair records are essential. The present system of record-keeping is reactive and it is only for feeding data and carrying out analysis. E.g. - Chitale Diary used VMWARE technology to discriminate foraging activities of dairy cattle, recording of locations and activity sensors to enhance the productivity by 60%. In the case of combat equipments also Geo tagging, automate population of engineering activities and its running parameters will enhance better record-keeping. This model of record-keeping with all pop ups of predictive or scheduled maintenance will enhance overall reliability.

There are few models to make various systems and process agile which Eagles can undertake as mentioned above. We need to take other system of 'Corps of EME' functioning as a holarchy and develop organisational agility, financial agility, HR agility etc, which will enable 'Forca Eagle' to work as an adaptable and agile organism.

- Working on the Agile model will enhance flexibility, seize new opportunities as they appear, Increase customer satisfaction, enhanced combat capability, enhanced ER and reduce waste in inventory, defects, transportation and over-processing on a task. EME

working has to synergise with Government PSUs and industries, so that a Public Private Partnership framework can be developed.

### Conclusion

Corps of EME has evolved over a period of time and its glorious history and tradition continuous with the manifesto to transform Corps of EME as Agile Combat Service, a new capability development strategy is needed to be adopted. Some of the methodologies are given in this article to make Eagles a modern engineering support vertical of the Indian Army. A simultaneous start at multiple platform of the engineering support planning process is needed with a framework to work towards a conceptualised vision and having milestones in place.



Col S Hariharan was commissioned into the Corps of EME on 08 June 2002. Officer is graduate in Mechanical Engineering from AIT, Pune, MSc Military Science from DIAT, Pune and M Tech in Quality Management from BITS, Pilani. A TSOC qualified officer served as AA&QMG in an Armd Bde and UNMISS. He commanded an Indep Armd Wksp and presently, commanding a Field Wksp (Engr Bde).

## MAJ VIGNESHWER RK, SENA MEDAL



On 05 May 2020, Maj Vigneshwer RK, Company Commander of Shar Company Operating Base planned to carry out specific search based on an input about presence of two terrorists in Shar village of district Pulwama.

The officer employing his tactical ingenuity and detailed knowledge of terrain, meticulously established cordon around target area sealing off any escape routes. While the officer alongwith his buddy was rechecking the cordon, he perceived a suspicious sound in the field area inside cordon. The officer moved ahead to illuminate the area and was fired upon by terrorist. Taking cover of ground, the officer immediately retaliated back with a volley of fire. He further utilised weapon mounted thermal imaging sight to ascertain terrorist location and spotted him trying to escape by breaking the cordon. Exhibiting unmatched marksmanship and field craft and with utter disregard to personal safety the officer maneuvered to a better firing position to engage the terrorist thereby neutralising one terrorist on the spot.

For displaying conspicuous courage, initiative and commendable leadership under heavy enemy fire, which resulted in elimination of two terrorists, Maj Vigneshwer RK has been awarded Sena Medal (Gallantry) on Republic Day 2021.

# MASSIVE MIMO : CHALLENGES AND FUTURE TRENDS

Lt Col Praveen Kumar

## Introduction

MIMO is a technology for wireless communications, in which multiple antennas are used at both the transmitter and the receiver. In particular, MIMO is one of several forms of smart antenna technology, where the antennas at each end of the communications system are combined to minimize errors and optimize data rate. In conventional wireless communications, a single antenna is used at the transmitter and another single antenna is used at the receiver, also known as single-input single-output (SISO) system. In some cases, this gives rise to problems with multipath effects. With multipath, transmitted signal bounces off buildings, trees, walls, ceilings and other objects, reaching the receiving antenna multiple times via different angles and at slightly different times. MIMO technology takes advantage of a radio-wave phenomenon called multipath propagation where transmitted information bounces off walls, ceilings, and other objects, reaching the receiving antenna multiple times via different angles and at slightly different times.

## MIMO System Description

MIMO is effectively a radio antenna technology as it uses multiple antennas at the transmitter and receiver to enable a variety of signal paths to carry the data, choosing separate paths for each antenna to enable multiple signal paths to be used.

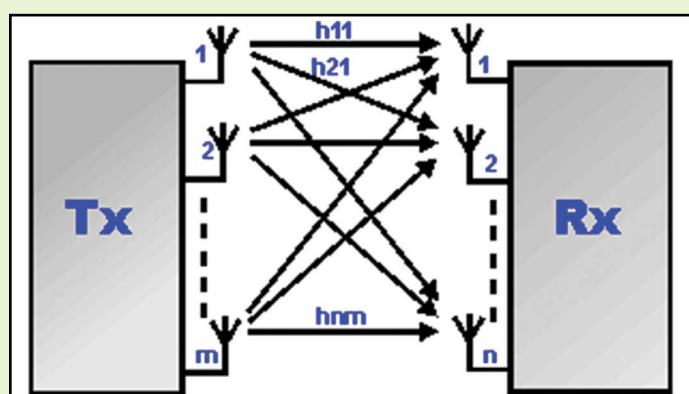


Fig 1: MIMO - Multiple Input Multiple Output

One of the core ideas behind MIMO wireless systems is space-time signal processing in which time is complemented with the spatial dimension inherent in the use of multiple spatially distributed antennas, i.e. the use of multiple antennas located at different points. Apart from the antenna configurations, there are two flavors of MIMO with respect to how data is transmitted across the given channel. These two systems are listed below.

- MIMO-implemented using diversity techniques, provides diversity gain and thus improving the reliability.
- MIMO-implemented using spatial-multiplexing techniques, provides degrees of freedom or multiplexing gain and thus improving the data rate of the system

## Diversity

Two fundamental resources available for a MIMO system are diversity and degrees of freedom. In diversity techniques, same information is sent across independent fading channels to combat fading. When multiple copies of the same data are sent across independently fading channels, the amount of fade suffered by each copy of the data will be different. This guarantees that at least one of the copy will suffer less fading compared to rest of the copies. Thus, the chance of properly receiving the transmitted data increases. In effect, this improves the reliability of the entire system. This also reduces the co-channel interference significantly. This technique is referred as inducing a "spatial diversity" in the communication system. Consider a SISO system where a data stream  $[1, 0, 1, 1, 1]$  is transmitted through a channel with deep fades. Due to the variations in the channel quality, the data stream may get lost or severely corrupted that the receiver cannot recover. The solution to combat the rapid channel variations is to add independent fading channel by increasing the number of transmitter antennas or receiver antennas or both.

The SISO antenna configuration will not provide any diversity as there is no parallel link. Thus the diversity is indicated as zero (0).

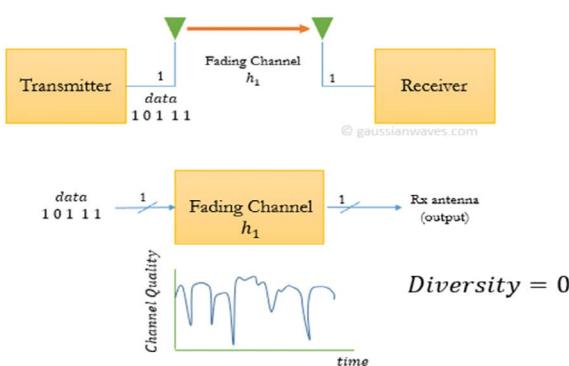


Fig 2: Diversity in SISO system

Instead of transmitting with single antenna and receiving with single antenna (as in SISO), we can increase the number of receiving antennas by one more count. In this Single Input Multiple Output (SIMO) antenna system, two copies of the same data are put on two different channels having independent fading characteristics. Even if one of the link fails to deliver the data, the chances of proper delivery of the data across the other link is very high. Thus, additional fading channels increase the reliability of the overall transmission – this improvement in reliability translates into performance improvement – measured as diversity gain. For a system with NT transmitter antennas and NR receiver antennas, where NT is the number of transmit antennas and NR is the number of receive antennas, the maximum number of diversity paths is  $NT \times NR$ . In the following configuration, the total number of diversity path created is  $1 \times 2 = 2$ . In this way, more diversity paths can be created by adding multiple antennas at transmitter or receiver or both. The following figure illustrates a 2x2 MIMO system

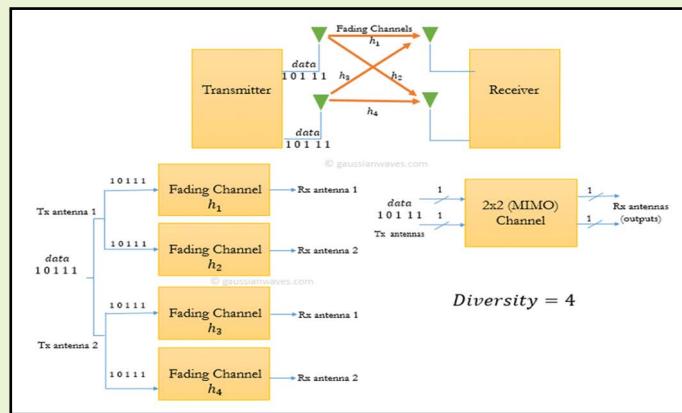


Fig 3: MIMO with diversity

with number of diversity paths equal to  $2 \times 2 = 4$ .

### Spatial Multiplexing

In spatial multiplexing, each spatial channel carries independent information, thereby increasing the data rate of the system. This can be compared to Orthogonal Frequency Division Multiplexing (OFDM) technique, where, different frequency sub channels carry different parts of the modulated data. But in spatial multiplexing, if the scattering by the environment is rich enough, several independent sub channels are created in the same allocated bandwidth. Thus the multiplexing gain comes at no additional cost on bandwidth or power. The multiplexing gain is also referred as degrees of freedom with reference to signal space constellation. The number of degrees of freedom in a multiple antenna configuration is equal to  $\min(NT, NR)$ . The degrees of freedom in a MIMO configuration governs the overall capacity of the system. Following figure illustrates the difference between diversity and spatial multiplexing. In the transmit diversity technique shown below, same information is sent across different independent spatial channels by placing them on three different transmit antennas. Here, the diversity gain is 3 (assuming 3x1 MISO configuration) and multiplexing gain is 0. In the spatial multiplexing technique, each bit of the data stream (independent information) is multiplexed on three different spatial channels thereby increasing the data rate. Here, the diversity gain is zero (0) and the multiplexing gain is 3 (assuming 3x3 MIMO configuration).

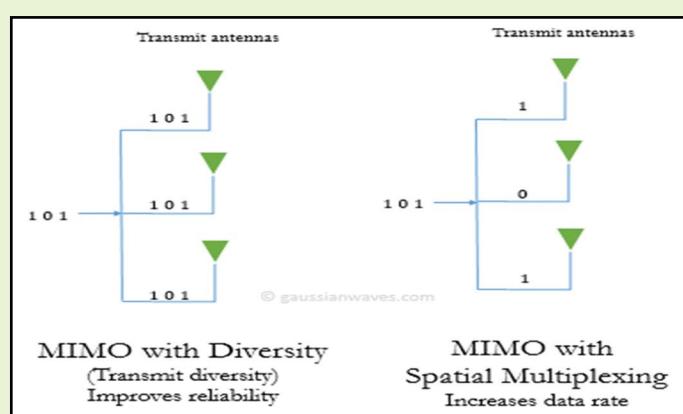


Fig 4: MIMO with Diversity and Spatial Multiplexing

### Massive MIMO potential

- Massive MIMO can increase the capacity 10 times or more. Massive MIMO increases data rate, because

more antennas mean more independent data streams can be sent out and the more terminals can be served simultaneously. Each terminal can be given the whole bandwidth.

- Massive MIMO can be built with inexpensive, low-power components. With massive MIMO, expensive, ultra-linear 50 Watt amplifiers used in conventional systems are replaced by hundreds of low-cost amplifiers with output power in the milli-Watt range. Massive MIMO reduces the constraints on accuracy and linearity of each individual amplifier and RF chain.
- Improved energy efficiency, because the base station can focus its emitted energy into the spatial directions where it knows that the terminals are located.
- Reduce interference because the base station can purposely avoid transmitting into directions where spreading interference would be harmful.
- Massive MIMO enables a significant reduction of latency on the air interface. Massive MIMO relies on the law of large numbers and beamforming in order to avoid fading dips, so that fading no longer limits latency.
- Massive MIMO simplifies the multiple-access layer. The channel hardens so that frequency-domain, scheduling no longer pays off. Each terminal can be given the whole bandwidth, which renders most of the physical-layer control signaling redundant.
- Massive MIMO increases the robustness to intentional jamming. Massive MIMO offers many excess degrees of freedom that can be used to cancel signals from intentional jammers.
- These degrees of freedom can be used for hardware-friendly signal shaping. A massive MIMO system has a large surplus of degrees of freedom. For example, with 200 antennas serving 20 terminals, 180 degrees of freedom are unused.

### Challenges in Massive MIMO

Despite the huge advantages of Massive MIMO, many issues still need to be tackled which are listed as following:-

- Pilot Contamination in practical cellular networks consist of many cells. Owing to the limited availability of frequency spectrum, many cells have to share the same time-frequency resources.

Thus, multicell setups should be considered. In multicell systems, we cannot assign orthogonal pilot sequences for all users in all cells, due to the limitation of the channel coherence interval. Orthogonal pilot sequences have to be reused from cell to cell. Therefore, the channel estimate obtained in a given cell will be contaminated by pilots transmitted by users in other cells. This effect, called "pilot contamination", reduces the system performance. The effect of pilot contamination is major inherent limitation of Massive MIMO. It does not vanish even when the number of BS antennas grows without bound. Considerable efforts have been made to reduce this effect. The eigenvalue-decomposition-based channel estimation, pilot decontamination, as well as pilot contamination precoding schemes are proposed in various research papers.

- **Unfavourable Propagation.** Massive MIMO works under favourable propagation environments. However, in practice, there may be propagation environments where the channels are not favourable. For example, in propagation environments where the numbers of the scatterers are small as compared to the numbers of users, or the channels from different users to the BS share some common scatterers, the channel is not favourable. One possibility to tackle this problem is to distribute the BS antennas over a large area.

- **New Standards and Designs are Required.** It will be very efficient if Massive MIMO can be deployed in current systems such as LTE. However, the LTE standard only allows for up to 8 antenna ports at the BS. Furthermore, LTE uses the channel information that is "assumed". For example, one option of the downlink in LTE is that the BS transmits the reference signals through several fixed beams. Then the users report back to the BS the strongest beam. The BS will use this beam for the downlink transmission. By contrast, Massive MIMO uses the channel information that is estimated (measured). Therefore, to reduce Massive MIMO to practice, new standards are required. On a different note, with Massive MIMO, a costly 40 Watt transceiver should be replaced by a large number of low-power and inexpensive antennas. Related hardware designs should also be considered. This requires a huge effort from both academia and industry.

## Current Research Trends

There are several key areas that are being investigated by research organisations. These include:-

- **Millimeter-Wave Technologies.** 5G wireless signals will be transmitted via large number of small cell stations located in places like poles or building roofs. The use of multiple small cells is necessary because the millimetre wave spectrum (30 GHz to 300 GHz) can only travel short distances and is subject to interference from weather and physical obstacles, like buildings.
- **Future Technologies.** This area presents many possibilities from the use of new modulation formats including Generalised Frequency Division Multiplexing (GFDM), as well as Filter Bank Multi-Carrier (FBMC), Universal Filtered Multi-Carrier (UFMC) and other schemes for the management of the multiple access schemes. All these need to be developed. Higher level of processing that will be available by the time 5G is launched means that multi-carrier systems will not require to be orthogonal as in the case of Orthogonal Frequency Division Multiplexing (OFDM). This provides considerably more flexibility.
- **Massive Multiple Input Multiple Output (MIMO).** Although MIMO is being used in many applications from LTE to WiFi, the number of antennas used is very less. However, after utilisation of microwave technology, the number of antennas can be increased. These antennas are placed at equal distance at uniform spacing.
- **Dense Networks.** Reducing the size of cells provides a much more overall effective use of the available spectrum. Techniques to ensure that small cells in the macro-network are deployed as femto cells (small mobile phone base station used in areas of weak signal) and can operate satisfactorily as required.
- **Pervasive Networks.** This technology is being considered for 5G cellular systems, where a user can concurrently be connected to several wireless access technologies and seamlessly move between them.
- **Group Cooperative Relay.** This is a technique that is being considered to make the high data rates

available over a wider area of the cell. Currently data rates fall towards the cell edge where interference levels are higher and signal levels are lower.

- **Cognitive Radio Technology.** If cognitive Radio Technology is used for 5G cellular systems, then it would enable the user device/ handset to look at the radio landscape in which it is located and choose the optimum radio access network, modulation scheme and other parameters to configure it to gain the best connection and optimum performance.
- **Smart Antennas.** Smart antennas are antenna arrays or group of antennas with smart processing algorithms used to identify spatial signal signature. They can be used for either, or both, for the signal transmission and the signal reception. Diversity effect involves the transmission and/or reception of multiple radio frequency (RF) waves to increase data speed and reduce the error rate. This technology would improve signal quality and let mobile telephones operate on less power.

## Conclusion

The massive MIMO is the reality of today and the technology is being used for practical purposes. Massive MIMO is an innovative technology that helps in the achievement of higher system throughput and reliable transmission for 5G and wireless networks. Several open research challenges are still hindering the progress and development of this emerging technology. More research is needed to achieve better signal processing to overcome the limitations of massive MIMO. The massive MIMO is the future that will increase the speed of data to 1000 times than what is available now.



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# LOW REYNOLDS NUMBER FLOW OVER LOW ASPECT RATIO CORRUGATED WING

Lt Col Sushil Chandra

## Introduction

In the past, a great deal of interest and research was carried out to develop micro-aerial vehicles (MAVs) which were envisaged to give a boost to surveillance of the battlefield systems, they were typically of sizes ranging from 10 to 15 cm which could carry payloads up to 250 g. These MAVs were to fly at very low speeds of 7–10 m/s at low Reynolds number (Re) of approx 104. The development of such surveillance vehicle required a thorough understanding of the aerodynamics of low aspect ratio (AR) wing which is significantly different from high aspect ratio wing. Main contributors towards lift enhancement in case of low aspect ratio wing is the existence of wing tip vortices which is responsible for non-linear increase in lift even at low Reynolds number and also circulation around the wing being the other contributor which is linear in nature and prominent in high aspect ratio wings. Also since these MAVs were to fly at low speeds which correspond to low Re thus the effect of Re on aerodynamic performance of low aspect ratio is also an important factor while considering methods to enhance their performance in terms of aerodynamic parameters such as CL (Lift Coefficient) and CD (Drag Coefficient). In nature many insects have corrugations, these corrugations are thought to be the reason for higher maneuverability and better low speed flying capabilities of these insects. For example, a particular case of dragonfly wing, which has a corrugated cross-section, these corrugations as shown in Fig. 1 form valleys where small vortices get trapped which affect the aerodynamic characteristics of the wing. Masatoshi et al found in their study that in the corrugated wing, the protruding corners cause the generation of unsteady vortices which promote transition, so the corrugated dragonfly-inspired airfoil was found to be acting as “turbulator” to generate unsteady vortices due to which

laminar boundary layer transits to turbulent very quickly. Levy et al carried out a study to compare corrugated wing and Eppler E-61 and they found that corrugated wing was superior in terms of aerodynamic performance as flow which separates from the corrugations forms spanwise vortices and intermittently reattaches to the aft upper arc region of the airfoil. The vortices that are trapped in the valleys formed in the corrugated wing act to transport high-speed flow from outside to the regions that are near to the wall thus reducing the momentum deficit and energizing the flow, these unsteady vortex structures trapped in the valleys of the

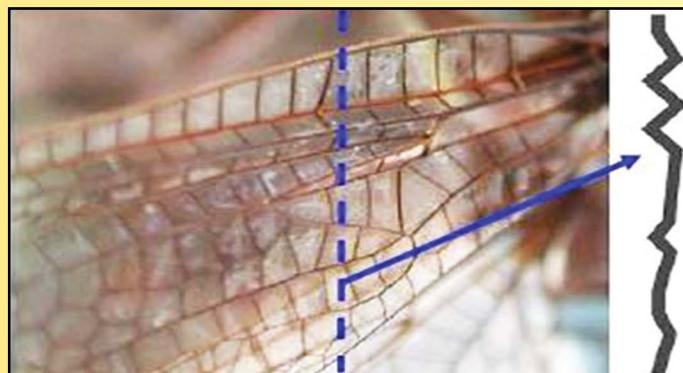
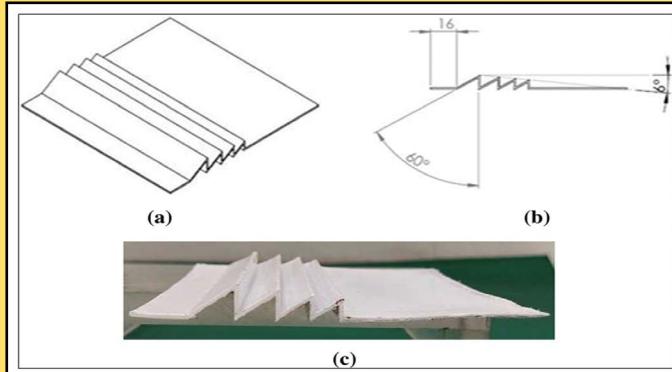
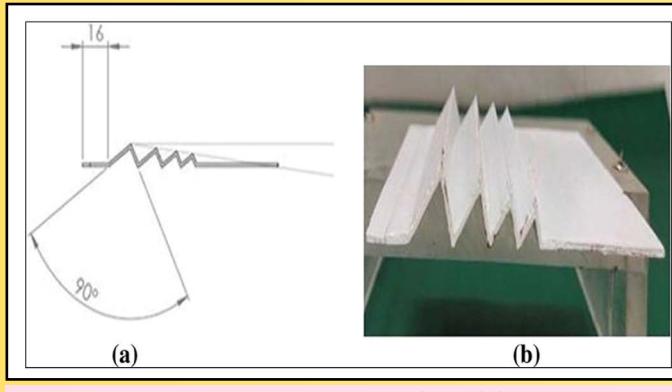


Fig. 1 Corrugated cross-section of a dragonfly wing

corrugated cross-section could pump high-speed fluid from outside to near-wall regions to provide sufficient energy for the boundary layer to overcome the adverse pressure gradient, thus discouraging the flow separation and aerofoil stall. Also, Shahzad et al performed 3D simulation of corrugated profiled airfoil and found corrugated airfoil performed equally well as compared to flat plate in terms of aerodynamic efficiency with benefit of having higher structural strength. In literature, researchers have worked upon dragonfly inspired wing but mostly all of them were above AR 2.0, which in itself does not come in the category of low aspect ratio wing.

**Table 1 Geometric details of wings**

Geometry	Chord	Span	Aspect ratio
Corrugation 60°	120	120	1.0
Corrugation 90°	120	120	1.0
Flat Plate Wing	120	120	1.0

**Fig. 2 60° Corrugated model****Fig. 3 90° Corrugated model**

Also, it was established that in AR 2.0 and above wings corrugations proved to be effective in increasing the lift coefficient. But very limited experimental work exists on application of dragonfly-inspired corrugations on low aspect ratio wing, i.e., AR 1. Keeping this in mind, an experimental study on AR 1 wing with dragonfly-inspired corrugations has been conducted and results are presented in this paper.

### Experimental Setup

All experiments were conducted in low speed wind tunnel with test section of 50 cm × 50 cm located in Aerospace Department, IIT Bombay, at 10 m/s ( $Re = 7.6 \times 10^4$ ). Lift and drag forces were measured using a six-component force balance from JR3 Sensors. Wing models were fabricated using PVC sheet of 1 mm thickness using 3D printing; the geometric details of wing models are given in Table 1. Various wing geometries were tested and then compared with the mean value plot obtained

from [1–8] to indicate the change in aerodynamic forces when corrugations are added to the flat plate geometry. Flat plate geometry was used as base configuration to compare with the results obtained from corrugated wing geometries. In corrugated configurations, corrugation angle was varied, i.e., 90° and 60° to observe the effect of corrugation angle on flow characteristics. A total of three sets of readings were obtained at each angle of attack.

**Fig 4 Flat Plate Wing**

## Results and Discussion

### 3.1 Flat Plate Wing

Flat plate model was placed in the test section and the tunnel was run at 10 m/s, three sets of data were obtained at various angles of attacks. The results obtained were then compared with literature [1–8] as shown in Fig. 5. In Fig. 5a, it is seen that flat plate wing CL increases rapidly with high non-linearity even at small angles of attacks which agrees well with results of the existing literature [1–8]. The difference in maximum stall angle was observed in a flat plate wing model, stall was observed around 30°, while in data extracted for flat plate wing from literature [1–8], stall occurs at around 35°, this disagreement is likely to be the effect of Reynolds number ( $Re$ ), since mean value of CL was obtained from various research papers [1–8] wherein  $Re$  number was mostly of the order of 105, while these experiments were conducted at  $Re \sim 105$ . Also, the value of  $CL_{max}$  obtained for flat plate wing is in good agreement with the existing literature. It is seen in the plot that the lift coefficient increases non-linearly up to stall and then a sudden loss occurs, the non-linear increase in CL is the result of lift contribution from wing tip vortices which are very strong in low aspect ratio (AR) wings. At stall angle, these wingtip vortices break thus resulting in loss of induced lift which in turn reduces the overall lift, which justifies the sudden reduction in CL.

Coefficient of drag  $CD$  was plotted against  $\alpha$  (Angle of Attack) at various angles of attack as shown in Fig 5b and then compared with  $CD$  (mean) obtained from existing literature [1–8]. It was observed that drag increases with an increase in the angle of attack which is expected and agrees well with existing literature. At stall, a sudden reduction in  $CD$  is observed as shown in Fig. 5b, which at first appears to be unusual, as increase in angle of attack is generally associated with increase in drag. But in case of low AR wings, since wing tip vortices have a significant contribution towards lift enhancement; this increased lift also provides induced drag. As stall angle is approached wingtip vortices break and their contribution towards lift enhancement also vanishes which causes loss in lift-induced drag and thus a sudden reduction in drag is observed with increase in the angle of attack but when  $\alpha$  is further increased drag again tends to increase which is due to obvious reasons. A good agreement was observed between the tested flat plate wing model and existing literature, so the disagreement in the maximum value of  $CD$  and stall angle is attributed to the difference in  $Re$ .

### 3.2 Corrugated 60° and 90° at Leading Edge (LE)

Corrugations at an angle of 90° and 60° were employed at the leading edge (LE) on a flat plate wing with 6° gradations in peaks as shown in Figs. 2, 3 and

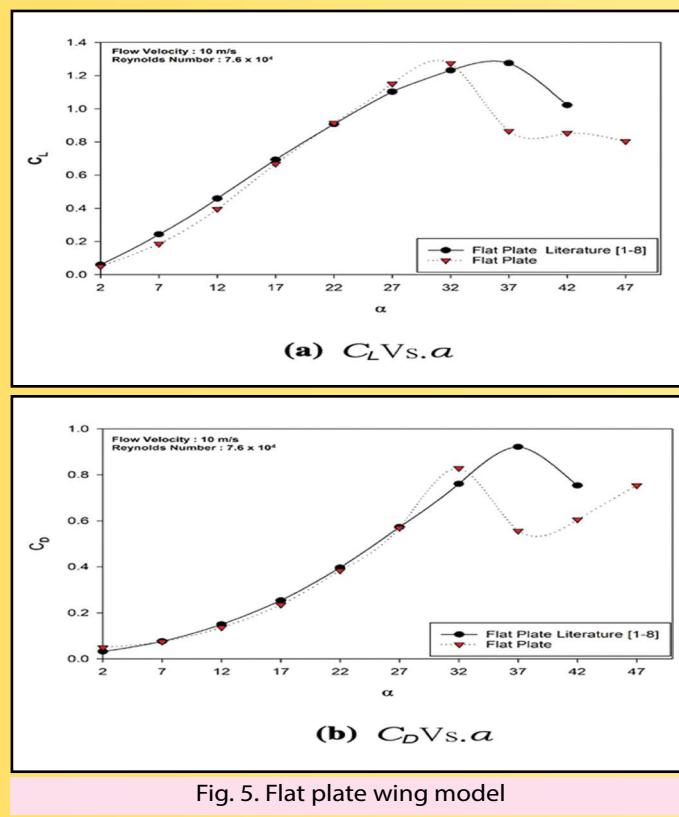


Fig. 5. Flat plate wing model

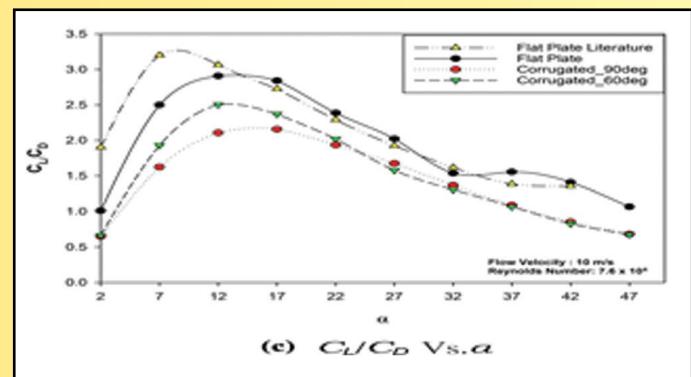


Fig. 6. 60° and 90° corrugations at LE

plots as shown in Figure 6.

It was observed that 90° corrugated wing performs much better than 60° corrugations in terms of lift coefficient, the reason for this could be that trapped vortices in case of 90° corrugations were found to be stronger as shown in Fig. 7 when compared to 60° corrugations as shown in Fig. 8. Also, in comparison to flat plate wing, both corrugation geometries under perform in terms of aerodynamic forces and efficiency, the reason for such drastic reduction in lift coefficient can be attributed to two factors. First, the leading-edge separation bubble is restricted as shown in Figs. 7 and 8, and also wing tip vortices are suppressed by corrugations as shown in Fig. 9. Plot for  $CD$  against  $\alpha$  was plotted for both corrugated geometries and then compared with flat plate wing. It was observed that both geometries produce much less drag in comparison to flat plate wing, the reason for this reduction is due to less induced drag and less pressure drag as leading-edge separation bubble is nearly absent. Between 90° and 60° corrugation geometry, drag is lesser in 60° corrugation which is obvious as the peaks in case of 90° are more protruded thus causing more drag. Also,  $CL/CD$  against  $\alpha$  plot was obtained to give exact comparison in terms of aerodynamic efficiency. It was observed that flat plate wing performs much better than both the corrugated geometries, the reason for this is the near absence of leading edge separation bubble and weak wing tip vortices as shown in Figs. 8 and 9, causing drastic reduction in lift which reduces the wing effectiveness of both the geometries despite corrugated geometry having lower drag.

### 3.3 Corrugated 60° and 90° at Trailing Edge (TE)

LE corrugation geometry was reversed to make the

corrugations at the trailing edge (TE), and then plots were obtained for CL, CD and CL/CD as shown in Fig 10. It was observed that CL increases more in comparison to CL when corrugations were employed at the LE, this improvement is due to the fact that contribution from leading edge separation bubble and wing tip vortices is again available but not as prominent as in case of flat plate. Hence, though CL is higher in comparison to LE corrugations but still lesser than flat plate geometry. Also, in Fig. 10c it is seen that though aerodynamic efficiency in terms of CL/CD for 90° corrugation is less than flat plate, but it performs better than flat plate at higher angles of attack. This may be due the fact that corrugations assist in flow to remain attached even at higher angles of attack, the flow becomes turbulent on striking the first peak, as well as the presence of trapped vortices as shown in Fig. 11 creates regions of negative pressure thus keeping the flow attached. Also corrugations at TE perform better than corrugations placed towards LE, this is due the fact that contribution towards lift enhancement from leading edge vortex (LEV) and LE separation bubble as shown in Fig. 12 is available which was suppressed in case of corrugations towards LE , this indicates that presence of leading edge separation bubble and wingtip vortex induced drag when corrugations are placed at the TE. In Fig. 10, CL/CD against  $\alpha$  for TE corrugation geometry it was observed that CL/CD for TE corrugated geometry is much higher than LE corrugated geometry which is due to higher CL

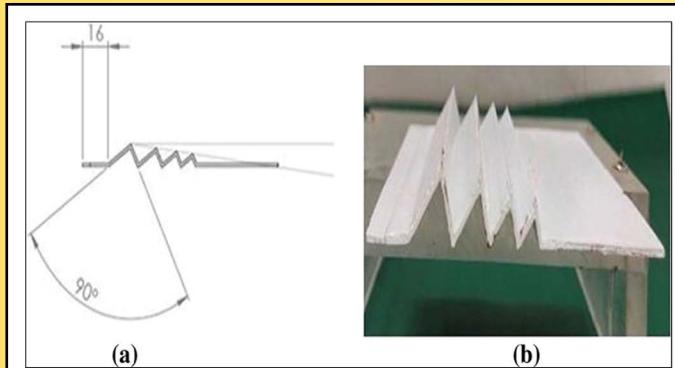


Fig. 7 Flow visualization of 90° corrugations at LE

due to resurgence of LE separation bubble and LEV, but still less than flat plate wing.

### Conclusion

In nature, many insects fly at low Reynolds number and despite having corrugated wing cross-sections their

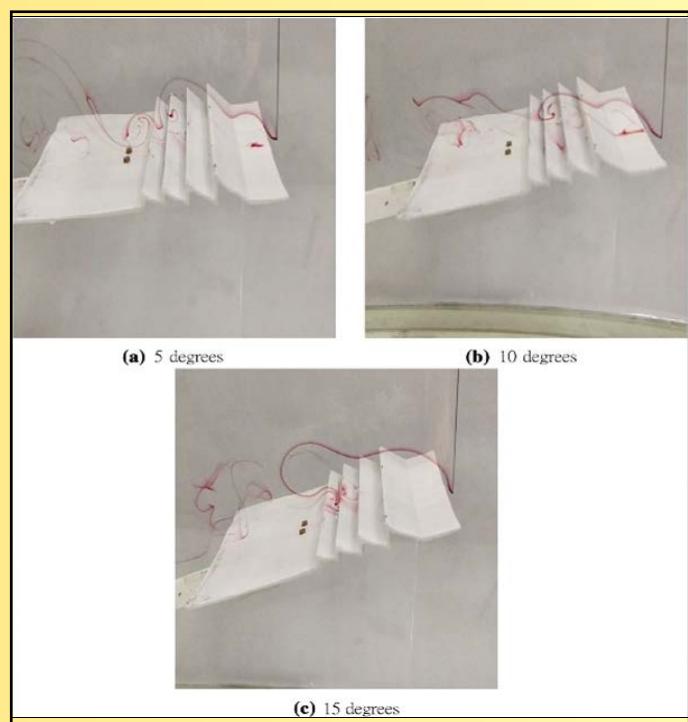


Fig. 8 Flow visualization of 60° corrugations at LE

flight maneuverability is high. In the past one-decade, micro-aerial vehicles (MAV) have revolutionised the scope in which these small flying vehicles can be used especially in battle-field surveillance. In their initial development era, high AR theories were applied to characterise their performance, but researchers like Muller [1] established the fact that high AR theories cannot be applied to low AR wings at low Reynolds number. In the literature, some work on use of dragonfly

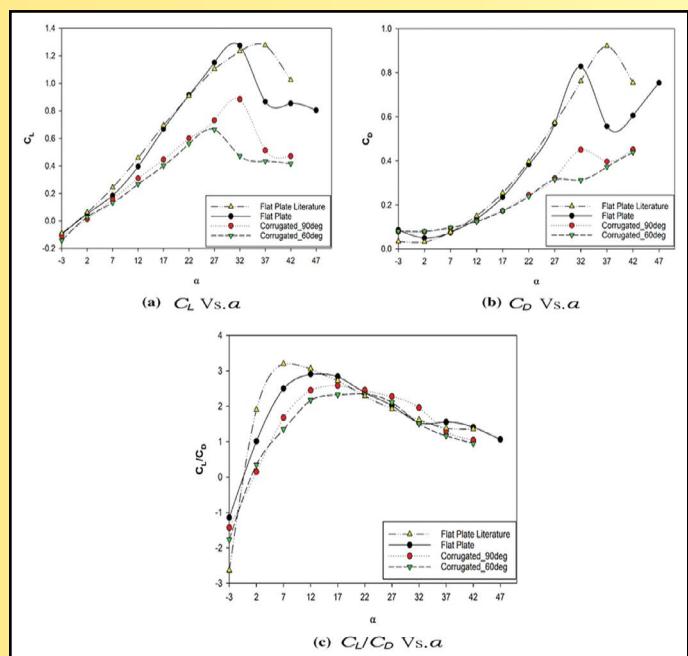


Fig. 10 60° and 90° corrugations at TE

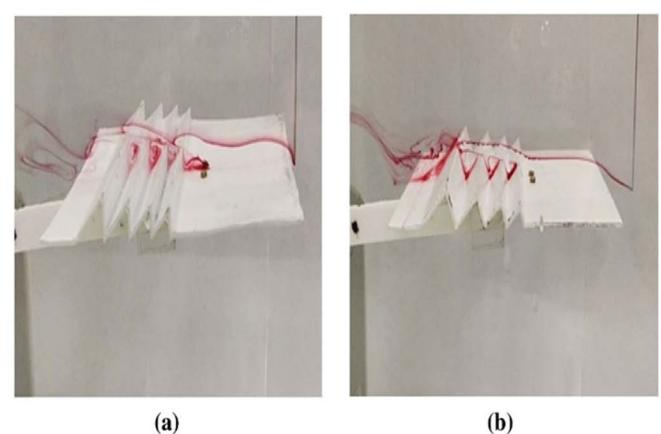


Fig. 11 Trapped vortices in corrugated TE at  $\alpha = 5^\circ$ , a  $60^\circ$ , b  $90^\circ$

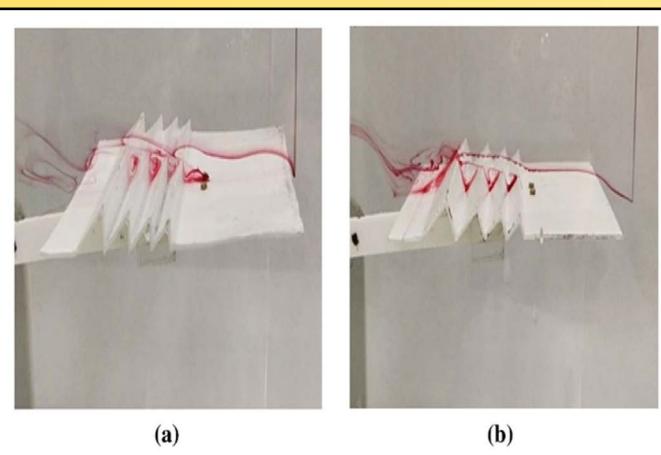


Fig. 12 Leading edge vortex (LEV) in corrugated TE at  $\alpha = 10^\circ$ , a  $60^\circ$ , b  $90^\circ$

wing corrugation profile [9] on flat plate wing has been carried out and it was found that lift increases by employing corrugations, which was attributed to trapped vortices in the valley region of corrugations.

## References

1. Torres GE, Mueller TJ (2004) "Low-aspect-ratio wing aero-dynamics at low reynolds numbers" by University of Notre Dame, Notre Dame, Indiana 46556. AIAA 42(5):865–873.
2. Okamoto M, Azuma A (2011) Aerodynamic characteristics at low Reynolds numbers for wings of various planforms. AIAA 49(6):1135–1150.
3. Mizoguchi M, Itoh H (2013) Effect of aspect ratio on aero-dynamic characteristics of rectangular wings at low Reynolds numbers. AIAA 51(7):52.
4. Shields M, Mohseni K (2012) Effects of sideslip on the aerodynamics of low-aspect-ratio low-Reynolds-

number wings. AIAA 50(1):85–99.

5. Mizoguchi M, Kajikawa Y (2016) Aerodynamic characteristics of low-aspect-ratio wings with various aspect ratios in low reynolds number flows. Trans Jpn Soc Aero Sp Sci 59(2):56–63.

6. Pelletier A, Mueller TJ (2000) Low Reynolds number aerodynamics of low-aspect-ratio, thin/flat/cambered-plate wings. J Aircr 37(5):825–832.

7. Liu YC, Hsiao FB (2012) Aerodynamic investigations of low- aspect-ratio thin plate wings at low Reynolds numbers. J Mech 28(01):77–89. <https://doi.org/10.1017/jmech>.

8. Taira K, Colonius T (2009) Three-dimensional flows around low- aspect-ratio flat-plate wings at low Reynolds numbers. J Fluid Mech 623:187–207. <https://doi.org/10.1017/s0022112008005314>.

9. Kesel AB (2000) Aerodynamic characteristics of a Dragonfly wing compared with technical aerofoils J Ex Bio.

10. Shahzad A, Hamdani HR, Aizaz A A (2017) Investigation of corrugated wing in unsteady motion. J Appl Fluid Mech 10(3):833–845.

11. Levy DE, Seifert A (2009) Simplified dragonfly airfoil aero- dynamics at Reynolds numbers below 8000. Phys Fluids 21(2):901–917.

12. Tamai M, Wang Z, Rajagopalan G, Hu H (2007) Aerodynamic performance of a corrugated dragonfly airfoil compared with smooth airfoils at low reynolds numbers. In: 45th AIAA aerospace sciences meeting and exhibit 8–11 January 2007.



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# EXTENDED REALITY AND ITS MILITARY APPLICATION

Lt Col Gulshan Mehta

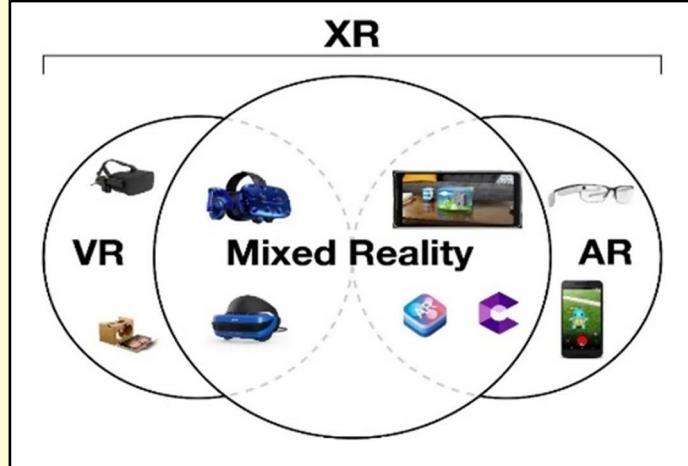
## Introduction

The ways in which we understand and perceive the world around us as humans are known as senses. We have five traditional senses known as taste, smell, touch, hearing, and sight. The stimuli from each sensing organ in the body are relayed to different parts of the brain through various pathways. If we are able to immerse all five senses into a computer-generated scene, we can enable the user to distinguish between true reality in our physical world and extended reality generated by a computer program. The same thing is implemented in an Extended Reality (XR) environment. At the moment only two of the five senses are widespread in Virtual Reality (VR) devices, these are Sound and Sight. Touch, to some extent, is still simpler and already has visible progress with the advance in Haptic Feedback technology, but taste and smell are more difficult to implement. Although bringing them into VR would definitely help with full immersion, however, taste and smell are heavily in the perception category and have the least to do with interaction. The basic aim of XR, is to control the basic five senses of the human body.

## Extended Reality (XR)

It is a term referring to all real and virtual combined environments and human-machine interactions generated by computer technology and wearables. It includes representative forms such as Augmented Reality (AR), Mixed Reality (MR) and Virtual Reality (VR) and the areas interpolated among them.

XR is a superset which includes the entire spectrum from "the complete real" to "the complete virtual" in the concept of Reality–Virtuality Continuum introduced by Paul Milgram. The virtuality continuum is a continuous scale ranging between the completely virtual, a virtuality and the completely real, reality. The reality–virtuality continuum therefore encompasses all possible variations and compositions of real and virtual objects. It has been described as a concept in new media and computer science, but in fact it could be considered a matter of anthropology.



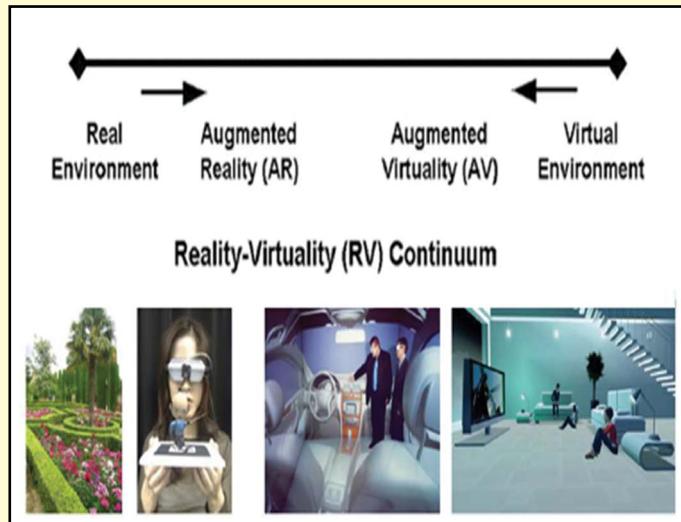
## Augmented Reality (AR)

AR is an overlay of Computer-Generated Imagery (CGI) on the real world. The key note here is that the augmented content doesn't recognise the physical objects within a real-world environment. In other words, the CGI and the real-world content are not able to respond to one another. This technology is an interactive experience of a real-world environment where the objects that reside in the real world are enhanced by computer generated perceptual information, sometimes across multiple sensory modalities, including visual, auditory, haptic, somatosensory and olfactory. The overlaid sensory information can be constructive (i.e. additive to the natural environment), or destructive (i.e. masking of the natural environment).

## Mixed Reality (MR)

MR is the merging of real and virtual worlds to produce new environments and visualisations, where physical and digital objects co-exist and interact in real time. Mixed reality does not exclusively take place in either the physical or virtual world, but is a hybrid of reality and VR, encompassing both AR and augmented virtuality via immersive technology. MR is similar in definition to AR, however opposed to simply placing images and text over the top of real world, this technology aims to create an environment in which the user will treat the objects as if they are really there.

## Virtual Reality (VR)



VR encompasses all virtually immersive experiences. These could be created using purely real-world content (360° Video), purely synthetic content (Computer Generated) or a hybrid of both. Desktop-based VR involves displaying a 3D virtual world on a regular desktop display without use of any specialised positional tracking equipment. Many modern first person video games can be used as an example, using various triggers, responsive characters and other such interactive devices to make the user feel as though they are in a virtual world. A common criticism of this form of immersion is that there is no sense of peripheral vision, limiting the user's ability to know what is happening around them.

A head-mounted display (HMD) fully immerses the user in a virtual world. A VR headset typically includes two small high-resolution OLED monitors which provide separate images for each eye for stereoscopic graphics rendering a 3D virtual world, a binaural audio system, positional and rotational real-time head tracking for six degrees of movement. Options include motion controls with haptic feedback for physically interacting within the virtual world in an intuitive way with little to no abstraction and an omnidirectional treadmill for more freedom of physical movement allowing the user to perform locomotive motion in any direction.

**VR simulation requires two main components**, a source of content and a user device or in other words, software and hardware. VR tools should be providing realistic, natural, high-quality images and interaction possibilities. For this, HMD rely on features like resolution,

field of view, refresh rate, motion delay, pixel persistence and audio/video synchronisation.



## Applications of XR

Mixed reality has been used in applications across fields including art, entertainment and military training. As discussed above, the technology tinkles with the human brain and makes him feel that he is actually present inside the virtual world thereby increasing realism in the training. Due to this specialised feature, the XR can efficiently be used in various fields as discussed in the subsequent paragraphs.

### Simulation Based Training (SBT)

We have moved from e-learning to Simulation Based Learning (SBL) which includes VR-based training and interactive, experiential learning. This approach, widely adopted in military and aviation with an aim "To maximize training safety and minimize risk", is today used extensively, especially in the medical education. SBT integrates cognitive, technical and behavioural skills into an environment where learners believe the setting is real, act as they would be responding in the field and feel safe to make mistakes for the purpose of learning from them. Simulator is basically an apparatus that generates test conditions approximating actual operational conditions. Certain types of simulation-based training have also been used in medicine. In general, however, medicine has lagged behind other industries and professions in using this methodology to improve human performance. SBT is extensively being used in following fields:-

- **Aviation.** For training of Pilots, familiarisation of aircraft controls, practice flying in different terrain and weather conditions and aircraft maintenance.

- **Air Traffic Control Simulation.** It involves reproducing real-life flight scenarios which include runway take offs, air scenes and also weather conditions.
- **Ship Simulation.** It involves reproducing real-world naval scenarios which include ship docking, ocean scenes and also weather conditions.
- **Medical.** Medical students use simulation tools to practice surgeries, crisis interpretation and administer prescription. It involves replicating real-life medical scenarios with the use of dummy models.
- **Mathematics.** Mathematicians and economists use simulation to study probabilities and statistics in theoretical events.
- **Manufacturing.** Manufacturing plants uses simulation tools to plan, design and train its technicians on the automated processes and manufacturing systems.
- **Driving.** Involves reproducing realistic car movements, traffic, driveways and weather conditions in a virtual environment.
- **Maintenance.** It involves use of models of the actual equipment for familiarisation and includes steps for repair and maintenance.
- **Military Simulation.** It involves the use of real-life military scenarios and drills. They take on differing degrees of realism and allow soldiers to undertake what is sometimes referred to as 'war games' while not incurring any real casualties.

### Global Military Applications of XR

- The US military has been using VR technology for training since roughly 2012. Many US military trainings are already done using simulations, as opposed to live exercises, with a focus on flight, battlefield and medic training. This is the most practical adoption of the technology as simulations are much more cost effective than training in actual fighter jets, hence the military being an early adopter of the platform. XR military applications include combat training, mission rehearsal, concept development, material design and testing, medical training and personnel selection.

- Combat reality is simulated and represented in complex, layered data through Head Mounted Display (HMD). Military training solutions are often built on Commercially Off the Shelf (COTS) technologies, such as Virtual Battlespace 3 and VirTra, both of which are used by the United States Army. As of 2018, VirTra is being used by both civilian and military law enforcement to train personnel in a variety of scenarios, including active shooter, domestic violence and military traffic stops. Mixed reality technologies have been used by the United States Army Research Laboratory to study how this stress affects decision-making. With mixed reality, researchers may safely study military personnel in scenarios where soldiers would not likely survive.
- In 2017, the U.S. Army started developing the Synthetic Training Environment (STE), a collection of technologies for training purposes that was expected to include mixed reality. As of 2018, STE was still in development without a projected completion date. Some recorded goals of STE included enhancing realism and increasing simulation training capabilities and STE availability to other systems.
- It was claimed that mixed-reality environments like STE could reduce training costs, such as reducing the amount of ammunition expended during training. In 2018, it was reported that STE would include representation of any part of the world's terrain for training purposes. STE would offer a variety of training opportunities for squad brigade and combat teams, including Stryker, armoury and infantry teams. STE is expected to eventually replace the U.S. Army's Live, Virtual, Constructive – Integrated Architecture (LVC-IA).

### Applications of XR in Indian Army

VR has been adopted by the military to include all three services, where it is being used for training purposes. This is particularly useful for training soldiers for combat situations or other dangerous settings where they have to learn how to react in an appropriate manner. A VR simulation enables them to do so but without the risk of death or a serious injury. They can re-enact a particular scenario, for example engagement with an enemy in an environment in which they experience this but without the real-world risks. This has proven to be safer and less costly than traditional training methods.

A state-of-the-art AR/VR Lab is present in Simulator Development Division (SDD), Secunderabad for development of XR Simulators for the Indian Army. The vertical came up in the year 2017 and since then the establishment has been working on 11 projects out of which six stands completed as on date to include AR and VR based Engine Familiarisation System for T-90, AR based Advanced Mannequin System, VR based Combat Medical Care Simulator, VR based IGB for Tank, IGLA Missile Firing Simulator and Observation Post End Training Simulator.

In addition, large number of VR projects are in pipeline at SDD to include Aerial Delivery Training Simulator, Air Maintenance Simulator, Aircraft Flying and Maintenance Training Simulator, Aircraft Recognition Simulator, OSA-AK Firing Simulator. It is anticipated that the future projects from standalone XR system will shift to convergence of AI and robotics with XR. This will ensure a paradigm shift the way Indian Army trains its soldiers.

A Virtual Reality Centre (VRC) of Navy was inaugurated by Navy chief Admiral Sunil Lamba in New Delhi in Apr 2019 with an aim to provide a "major boost" to indigenous warship design capabilities of the Navy. The VRC at the Directorate of Naval Design (Surface Ship Group) also seeks to provide impetus to "self-reliance and greater fillip" to warship construction.

### Way Ahead

Over the years, modern militaries have increasingly found using VR technology successful. Significant developments in the information and communication technology fields have brought in rapid improvements in VR technology. For all these years, training is one major area where VR has found maximum utility and the same would continue in the near future too. However, it is well understood that the virtual training may not be able to replace the physical training or actual operational training and experiences gathered during various military exercises but still it could play a major role in various other aspects of training both because of technological and financial advantages. The importance of VR is likely to increase in near future much more for a variety of reasons as mentioned below:-

- Rapid developments in technology are offering

new near real solutions and making wealth of tools available to cater for various military requirements beyond training.

- Twenty first century military challenges are both conventional and asymmetric in nature demanding evolution of innovative technologies to address them and VR could offer some of the answers.
- VR offers solutions without causing any loss or damage to humans and equipment.
- Technology is now available at a manageable price. The present generation personal computers have the capabilities of the supercomputers of yesteryears. Various sophisticated accessories required for the VR experience are available at affordable prices.
- Same hardware can be used to run different VR software thereby giving flexibility to train on different fields thereby saving money and space.

### Conclusion

The XR technologies successfully keeps the 'clutter' away while taking operational decisions because it works on different dimensions simultaneously and make available only the required information. This allows the decision maker to take a correct, timely and quick decision. Because of all such advantages, more states are likely to invest in XR technologies for their militaries in near future. Various developments in the XR technology are also been aptly supported by the global video gaming industry. The future advancements in the video gaming industry are likely to help the Army's XR developments too. Overall, the XR technologies demonstrate the potential to change the nature of warfare foundations for the future.



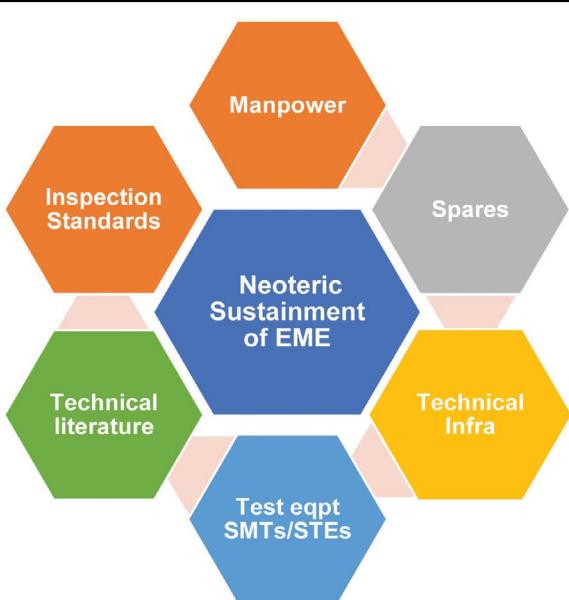
Lt Col Gulshan Mehta is an alumnus of Indian Military Academy, Dehradun and was commissioned into the Corps of EME in Jun 2007. The officer has done Advance Course in 2013, UAV System Engineer Course from Remotely Piloted Aircraft Technical Training School, Bhisyana in 2016 and M Tech (Telecommunication System Engineering) from IIT, Kharagpur in 2019. The officer is presently posted as project officer in Simulator Development Division, Secunderabad.

# THE AVANT-GARDE EME: NEOTERIC SUSTAINMENT AND CONFIGURATION MANAGEMENT

Lt Col ALK Agnihotri

## The Neoteric Tide

The rapid evolution of modern recent technologies for Indian Army is primarily aimed at technological capability enhancement, increased military preparedness, increased reaction capability to unconventional threats and creation of an indigenous infrastructure for technological development and sustainment. Battle integration of these technologies with our innate combat capability will transform Indian Army into a cohesive body ready for operational and technological challenges. These neoteric technologies include robotics, augmented reality, virtual reality, artificial intelligence, quantum computing big data etc. EME will have a pivotal role in implementation and subsistence of these technologies in Indian Army. The sea change pitched by these technologies necessitates a sustainability analysis for EME in light of their varied implications on the functional and technical aspects of the corps. An implicative sustainability analysis of such neoteric technologies on EME in terms of its six pillars of sustainment are elucidated in succeeding paragraphs ahead.



## Implicative Pillar wise Sustainability Analysis of Neoteric Tenors on EME

### • Manpower

- Technical upgradation of existing manpower on latest technologies, related repair concepts and functional aspects for providing optimum repair and recovery cover accordingly is required.
- Training capsules with OEM will be the need of the hour for all eagles to refine their technical understanding and comprehend intricate equipment repair aspects.
- Trade wise distribution of new technologies will be required for clearly defining the increased scope of repair for each tradesman.
- Trade Technology Enhancement (TTE) courses with trade wise distribution is required at training establishments covering latest repair and maintenance concepts for newly inducted technologies and modern equipment.
- Progressive Performance Evaluation of trained manpower required at field workshop level for subsequent performance enhancement measures to finally master the new technology and equipment.
- 'Train the Trainer' concept adoption from command till workshop level for speedy and in house flow of training information on newly inducted technology and equipment.

### • Spares

- Region wise OEM mapping and spare procurement streamlining is required for repairs by EME.
- Stocking policies required to be promulgated for spares of newly inducted equipment.
- Addendums to MS, PRS and CES for

- clear scope of spare authorisation and repair pertaining to newly inducted equipment.
- Ordnance EME anticipatory co-ordination in demand of spares in view of freshly introduced spare inventories for maintenance of efficient supply of spares down till workshop level.
- Backward/ Forward compatibility analysis of spare inventories to keep up with speedy changing technological trends and to obviate recurring changes to inventories.
- **Technical Infrastructure**
  - Equipment specific technical infrastructure for quality repairs as per requirements at Field and Base levels will be required.
  - Upgradation and augmentation of existing technical infrastructure as per latest industry standards to provide repair and recovery cover to newly inducted equipment will be required.
  - Commercial tie-ups at corps level for setting up standardised technical infrastructure is required at respective EME echelons of repairs for ensuring quality repairs.
  - Area/ Command specific standardisation of technical infrastructure is required as per operational constraints and anticipated exploitation pattern of newly inducted equipment.
  - Phased budgetary planning is required for new technical infrastructure for supporting latest technological developments.
- **Test Equipment SMTs/STEs**
  - Standardisation of newly required test equipment as per functional requirements of equipment maintenance and repairs is required.
  - Planning and setting up of certified testing conditions for newly inducted equipment for intricate parametric testing of equipment functionality is required.
  - Addendums to authorisation of new SMTs/ STEs at Field/ Base levels for augmenting systematic and efficient repairs.
  - Co-ordination with civil test labs and agencies for interim/ time bound field testing of

various equipment domains in newly inducted batches.

- Calibration and maintenance schedules of newly inducted SMTs/ STEs need to be elucidated for yielding accurate results and optimum functionality.

- **Technical Literature**

- Standardised issue of equipment specific technical literature at base and field levels for clear understanding of repair techniques and maintenance procedures.
- Addendums to EMERs for standardised EME cover to newly inducted equipment for their entire stipulated life are required to be issued.
- PRS, CES and MS preparation as per planned equipment induction and their envisaged exploitation pattern is required.
- Equipment specific detailed advisories for maintenance and repairs of freshly inducted equipment ensuring quality repairs are required.
- Symptomatic fault analysis tables are required for newly inducted equipment for providing optimum repair and maintenance cover for its stipulated life.

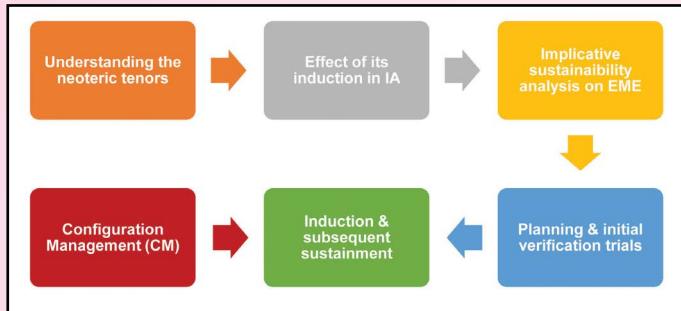
- **Inspection Standards**

- FIS/ BIS to be devised for freshly inducted equipment for ensuring efficient functioning and repairs as per requirements.
- Planning and setup of inspection infrastructure is required for state of art technology and equipment at base and field levels.
- Commercial tie-ups for OEM inspections during initial phase of lifecycle of equipment are required.
- Detailed inspection procedures for the new state of art equipment for ensuring thorough inspection and monitoring of equipment functionalities are required.
- Additional inspection infrastructural requirements for complete checks with recommended testing conditions are required

to be planned and augmented for freshly inducted equipment.

### Suggested-Point Contemporary Approach Towards Neoteric Technological Advancements

- Understanding the technology in terms of its embedded core concepts and operational flow procedures.



- Effect of its induction in Indian Army in terms of new equipment/ changes in existing equipment, anticipated role and likely exploitation pattern.
- Implicative sustainability analysis on EME in terms of six pillar sustainability philosophy applied to each newly inducted technology.
- Planning and initial verification trials of equipment repair sustainment with training of manpower, key repair constraints and anticipated sustainability issues.
- Induction and subsequent sustainment of new verified repair schedules, infrastructure and test equipment alongwith continuous technical upgradation.

### Configuration Management (CM)

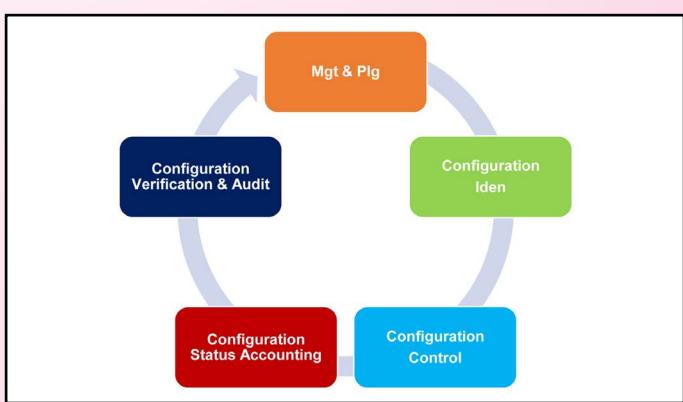
Configuration Management can be enunciated as "A process for establishment and maintenance of consistency of a system or of a product's performance, function and physical attributes with its requirements, design and operation throughout its life"

- Key Essence.** CM is an activity intended to institute a technical and administrative direction over entire life cycle of a product along with its configuration items conjoined with its product configuration information. It includes recording and constant updating the configuration of equipment with its associated items and technical documents. Accessibility to key information of the equipment as related to its document is provided to concerned tradesmen through an responsive database giving them detailed data insight.

- The Desideratum of CM.** Evolving operational requirements, defect investigations, emerging technological trends, optimised indigenous capability of OEM, key investigative variations in reliability, maintainability, performance and failure pattern of an equipment/ module, requirements of base overhaul of equipment/ assembly and transformatory innovations etc form the key ingredients necessitating configuration management.

- The CM Process Contributors.** Key ingredients of a CM process categorically include Inputs, Facilitators, Constraints and Outputs. Inputs include information required to implement mission parameters, quality assurance standards, maintainability requirements and any basic changes incorporated post in-service induction. Facilitators include tools, methods, information, technologies, inter functional grid of OEM, User, Maintenance agencies, DRDO and AHSP. Constraints include inhibiting factors, Op imposed deviations, inadequate parametric definitions and time shortages. Outputs basically include final outcomes achieved from the entire CM process.

- The CM Activity Loop.** Key activities of CM include Management Planning, Configuration Identification, Configuration Control, Configuration Status Accounting and Configuration Verification and Audit. Management planning include basically organisation and systematic planning of all inputs, facilitators, constraints and finally generation of outputs. Configuration identification include establishment of baselines, formulation of documents for updated configurations and gradual evolution of an interactive database. Basically this activity ensures inclusions of all configurational



upgradations in a planned and systematic manner. Configuration status accounting basically includes maintenance of an informative and interactive database for product information recording. This activity facilitates the status monitoring to all stakeholders and agencies involved in the product design and development process. Configuration verification and audit encompasses performances validation processes aimed at optimising the consistency of performance of equipment.

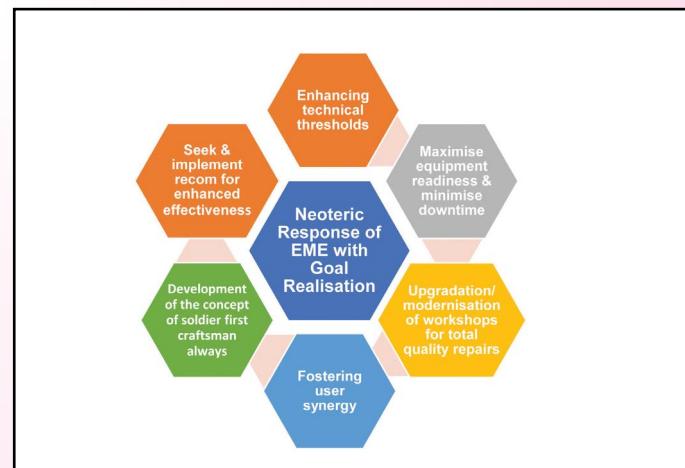
- Benefits of CM.** CM accrues major impacting benefits which include clear understanding and specification fixing of measurable performance with maintenance parameters, clear recording of the product attributes, improved and realistic decision making for configuration upgrades, systematic documentation of configuration upgrades, better evaluation of configurational upgrade options, building up database by data capturing at every stage for further references. Above all, CM provides optimised mission reliability and facilitates the collaboration and integration of neoteric technological trends with the main requirements of the fighting force in various terrain and climatic conditions.

- Limitations of Extant CM Systems.** Existence of a centralised configuration authority needs deliberation and to be given proper shape. Resource allocation for CM processes is required. Identification and standardisation of documents, fixing and documenting of trial tested configurations, subsequent modifications according to maintenance and logistics plans need to be incorporated and adhered to for all configurational upgradations. An interactive database for sharing configuration document, brainstorming the approved configurational upgradations, implementation and monitoring of configurational upgrades needs to be given a reformed shape. Further final checks before implementing the configurational upgrades needs to be done by the suggested centralised configuration control authority.

- Suggested Way Forward for the CM System.** To decrease the cost, provide better project monitoring & control and to institute value addition to the organisation as a whole, a top down

approach is suggested rather than cumbersome bottom up approach. The division of responsibility and accountability at all echelons of the CM process needs to be well defined and is suggested to be enhanced. Interactive and knowledge sharing environment should be encouraged between all agencies involved in the entire CM loop. A revised and renewed look towards the concept and working of configuration management needs to come into existence. Professional expertise from the civil sector be sought in the entire CM loop wherever felt essential. Conjoined study projects with the top research institutes like IITs and IIMs are suggested to be undertaken and their recommendations be vetted by the OEMs for its onward implementation. Increased interactions both within and outside the Corps be institutionalised by organisation of seminars, interactive forums and talks on the concept of CM. A nodal agency be devised for systematic maintenance of docu related to CM so as to derive maximum benefit from data recording.

### Neoteric Response of EME with its consonant Goal Realisation



- Enhancing Technical Thresholds.** Providing repair cover to newly inducted equipment will innately enhance the technical threshold of all eagles by virtue of its imbibed challenges of understanding new technologies, analysis of the new equipment repair and maintenance schedules alongwith its sustainment philosophy.
- Maximise Equipment Readiness and Minimise Downtime.** With the emerging trend of continuous and increased dependency of combat

on state of art technologies it innately necessitates a rapid articulated repairs approach (RAR) for maximising Op readiness by reduction in repair downtime using latest formulated repair techniques. Therefore, overall equipment readiness is maximised and downtime is considerably minimised.

- Upgradation/ Modernisation of Workshops to Achieve Total Quality Repairs.** Infrastructural upgradation at Field/ Base workshop for fresh wave of equipment will entail natural upgradation/ modernisation of workshops in terms of testing infrastructure, repair equipment, new testing and standardised inspection conditions and multivariable parametric analysis of equipment.
- Fostering User Synergy.** For clear understanding of functionality aspects of the newly inducted equipment and their associated repair techniques a deep sense of synergised jointness is facilitated. Apropos, involvement of user in various repair stages of the newly inducted equipment will lead to mass user synergy.

- Development of the Concept of Soldier First Craftsman Always.** The immediate swarm of neoteric technologies to augment and enhance the Battle readiness and Op superiority in modern warfare alongwith the associated need of their repairs will help in further blossoming the concept of soldier first. Further, eveready approach of EME

of meshing with latest technological trends and providing repair cover will validate the phrase of craftsman always.

- Seek and Implement recommendations for Enhanced Effectiveness.** Incorporation of latest repair methodologies, inspection routines, improved technical infrastructure and upgraded technical literature will ensure optimised and increased effectiveness. The flexible shoulder extended by EME with seeking and implementing innovative repair techniques to increase mission readiness of vehicle/ equipment with a continuously evolving repair epicentre will overall help to achieve the goal of enhanced effectiveness.



Lt Col Arjun LK Agnihotri is an alumini of IMA, Dehradun and was commissioned into Corps of EME on 10 Dec 2007. The officer is BE Electronics from Pune University and has excelled in his Advance Course in Communication with 'AI' grading.

He has served as Instr Cl 'B', GSO-1 Training at MCEME, Secunderabad and was nominated for Instr Exchange programme with Myanmar Army during this tenure. The officer is a recipient of GOC-in-C, SC Commendation Card. The officer is also an International level Squash player, Captained Services and Army Squash teams and is a distinguished recipient of EME Blue and EME Blazer for squash. He is presently posted as OC Workshop with an EME Battalion.

## ACKNOWLEDGEMENT AND FEEDBACK FORM

Certified that I have received the Apr 2021 issue of EME Journal. My comments are :

	Excellent	Good	Average	Poor
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Design

Layout





Pictorials





Articles





Any other suggestion/comment \_\_\_\_\_

# RADIO PHOTONIC RADAR

Maj Prateek Malhotra

## Abstract

In this review, an overview of Radio Photonic Radar and its working is discussed. Radio-Photonic radar are the new generation of radar systems, which are still under development and research, with only few prototypes of it being demonstrated till date. This type of radars makes use of radio-photonic devices and systems for generation of Electromagnetic Waves used for the detection, tracking and ranging of targets. Radio Photonic Radar has the advantages of very high resolution and ultra-wide bandwidth due to its operation at very high frequencies as compared to present day radar systems. Also because of their smaller size antennas, they are more suitable to be deployed on UAVs, Drones and other smaller platforms in future.

## Introduction

The history of radar dates back to late 19th century, when Heinrich Hertz showed that the radio waves are reflected by metallic objects. Since then the development and research of radar systems are continuously being undertaken and the Radio Photonic Radar, which are the next generation radar systems, are the result of the continuation of research and development in the radar systems. The present day radar systems have the disadvantage of limited bandwidth and less resolution because of its operation at lower frequency ranges. If higher carrier frequencies are to be used in them, then that requires up-conversion and down conversion for generating these higher frequencies, which adds lots of noise to the system. The noise comes in the system because of only electronic technology is being used for the generation of RF signals, which has less signal fidelity and high noise levels at higher frequencies. On the contrary, in a Radio Photonic Radar, photonics is used for the generation of high frequency carrier signals which are highly stable, coherent and have very less noise. In their case, the Opto-Electronic oscillators or

heterodyning of two lasers in a photodiode can easily generate higher frequencies in the range of 40 Ghz and above and also they are highly stable.

The research and development for a fully functional Radio Photonic Radar is being undertaken by various agencies in different countries. In Russia, the Russian School of Photonics and KRET is developing radio photonic technology to be used in radio photonic radar and the first prototype of it is expected to come by 2021. The US and China are also working on developing a fully functional radio photonic radar. Among these, a team of researchers in Italy demonstrated a prototype of a fully functional radio photonic radar under the project named PHODIR (Photonics based fully Digital Radar) in the year 2014. The team tested and conducted the extensive field trials of this radio photonic radar in various conditions and scenarios and the results were very promising. We will discuss the construction, working and field trial results of this radio photonic radar under project PHODIR.

## Construction and Working

The radio photonic radar built under project PHODIR is shown in Fig 1. It mainly consists of a radio photonic Transceiver, a Digital Signal Processor (DSP), a RF Front End and an Antenna. The heart of any radar system is the Oscillator which generates the RF signals used for the detection of the targets. In Radio Photonic Radars, Opto electronic oscillators or heterodyning of two lasers in a photodiode can be used to generate high frequency RF Signals. In PHODIR radar, the RF signals are generated by means of locking a pair of modes from the spectrum of Mode Locked Laser, which are further detected by photodiode to generated corresponding RF electronic signals.

A detailed view of PHODIR Transceiver is shown in Fig 2. In the transmitter circuit of the transceiver, the RF signals are generated by exploiting the heterodyne



Fig. 1. The Radio Photonic Radar (PHODIR)

detection of a pair of mode by photodiode from the Mode Locked Laser (MLL). The radar waveform is generated by the Direct Digital Synthesizer (DDS). The modulating signal from DDS is fed to the modulator, which is used to modulate the signal from MLL before its detection by photodiode. After the detection by the photodiode, the optical signal is converted to the corresponding RF electronic signal and is fed to the high power amplifier and further to the antenna via circulator.

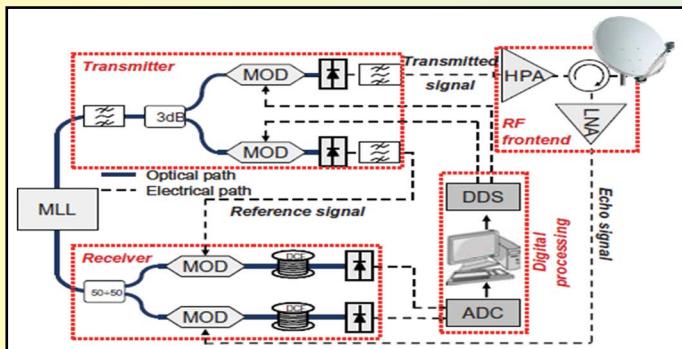


Fig. 2. PHODIR Transceiver

In the receiver circuit of the transceiver, the echo signal from the target is received by the antenna and is then amplified in Low Noise Amplifier. It is further fed to the modulator, which modulates the laser signal from same MLL taken from the transmitter circuit. The received signal is compared to the reference signal, after its conversion into RF electronic signal by the photodiode. These signals are further processed in DSP to find the range, speed and other information about the target.

## Field Trials and Results

Extensive field trials of the PHODIR radar were conducted and the results of these trials were very promising. The radar performed better than the present day radar, when both are used for detecting same targets in same scenario. The first trial was conducted on air traffic close to the Airport of Pisa, Italy as shown in Fig 3. The system was tuned to transmit a pulse of pulse width 1 micro second and pulse repetition frequency was kept at 10 KHz, which gives a range resolution of 150m



Fig. 3. PHODIR, Radio Photonic Radar Field Trial on Air Traffic

and range of 15 Km. The carrier frequency used in the PHODIR Radar was 9.9 GHz. The results of the trial were compared and cross checked with the Airport Radar and the performance of the PHODIR radar was excellent in the detection of airplanes and in finding their trajectory and speed.

Another trial was conducted in maritime scenario at the port of Livorno, Italy as shown in Fig 4 and the results of the PHODIR radar were compared with normal coherent radar, SEAEAGLE. The range, trajectory and detection of ships by PHODIR radar was at par and in some cases better than the SEAEAGLE radar. The PPI pictures of the same scenario taken by the PHODIR radar and SEAEAGLE radar are shown in Fig 5 (a) & (b).



Fig. 4. PHODIR, Radio Photonic Radar Field Trial in Maritime Scenario

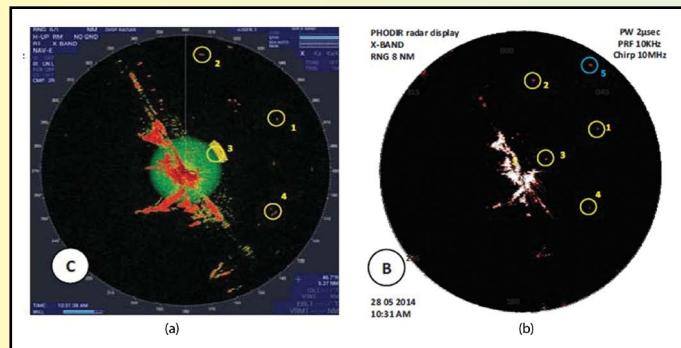


Fig. 5. PPI Screen Shots of SEAEGLE and PHODIR Radar Respectively.

### Advantages Over Conventional Radars

- Carrier Frequency.** Photonics based radars can directly generate upto 100 GHz of frequency without up conversions whereas conventional radars can generate below 2 GHz without up conversions.
- Phase Stability.** Radio Photonics Radar has superior phase stability as compared to conventional radars.
- Signal Jitter.** Signal jitter of photonics based transmitter is less than 15 fs whereas in electronics based transmitter is greater than 20 fs due to which there is low distortion of signal in Radio Photonics Radar.
- Sampling Jitter.** Sampling jitter of photonics based transmitter is less than 10 fs whereas in electronics based transmitter is greater than 100 fs due to which the sampling rates are high in Radio Photonics Radar.
- Instantaneous Bandwidth.** In both transmitter and receiver, the instantaneous bandwidth of Radio photonics radar is higher than conventional radar and also the instantaneous bandwidth is easily extendable with MLL at higher repetition rate.
- Compact.** Since no up-conversion or down conversion modules are required in Radio Photonics radar, it becomes less bulky as compared to conventional radars.

**Multi Band RF generation.** Since RF signals are generated and detected using same coherent laser combination which are phased locked, therefore multi band RF generation can be done which is not there in conventional radars.

**Distribution of RF signals.** Easy distribution of RF signals from transceiver to antenna ensures low noise, low loss and immunity to EMI in Radio Photonics Radar which is not there in conventional radar.

### Conclusion

Radio Photonic Radar can bring new era in the field of radar systems by working efficiently at higher frequency ranges, which in turn give them excellent range resolution and high bandwidth. With higher resolution, these radar can counter the present stealth technology being employed by fighter planes like F-35 and F-22. Extensive research and development by different agencies all over the world is being undertaken in the field of Radio Photonic Radar System, to make a fully functional Radio Photonic radar with excellent detection and resolution capabilities to be used by armed forces and other agencies. The results of the field trials of PHODIR Radio Photonic Radar, is very promising and encouraging in this respect. The use of Radio-Photonics in the radar systems is the future of radar systems.



Maj Prateek Malhotra is an alumnus of OTA Chennai and got commissioned into the Corps of EME on 17 Sep 2011. The offr has done B.Tech in Computer Science and acquired Distinguished grading in Advance Course in Radars. The officer has commanded an AD Workshop and presently posted as Instructor CI B in MCEME and also performing the duties of Associate Editor of EME Journal. Maj Prateek Malhotra is also a recipient of COAS Commendation Card.

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# ENGINEERING SUPPORT TO AMPHIBIOUS OPERATIONS - BEST PRACTICES

**Maj Pawan K Raydu**

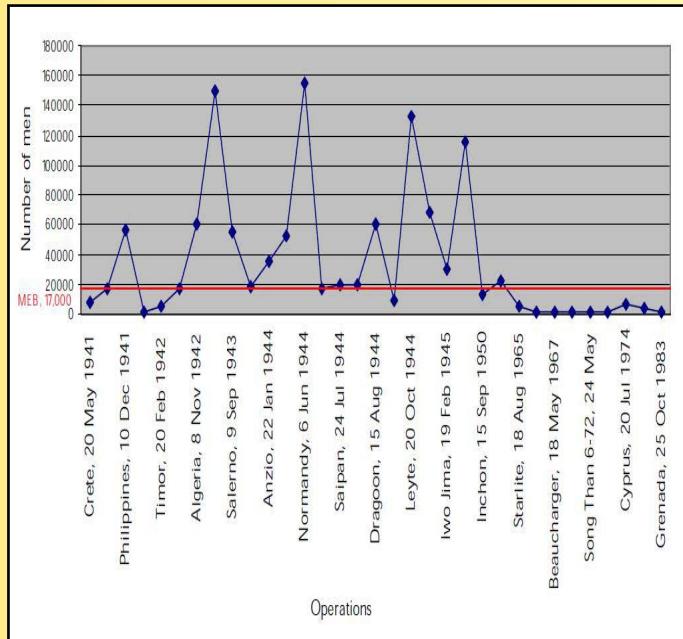
## Introduction

Amphibious operations require the highest levels of coordination and cooperation between the participating forces and the unified efforts that is required to achieve the objectives laid down for each operation. For any successful Amphibious Operation, associated repair and recovery support plan plays a vital role on attaining desired victory. Considering the limited capabilities of military equipments on sea and shore, repair and recovery support to landing force requires immense amount of proficiency as well as adoption of latest and emerging technological trends and best practices followed by various armies across the globe. With the introduction of complex and sophisticated vehicles and equipment in IA, we need to upgrade our repair and recovery practices for the Amphibious Operations. The existing system being incomplete requires a de-novo look for overcoming challenges and shortfalls from basic to strategic level.

## Historical Perspective of Amphibious Operations

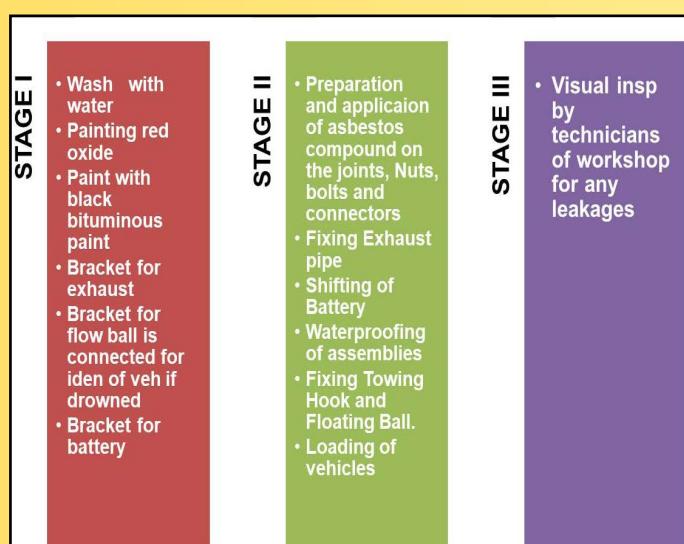
Historically, amphibious operations have been the mode of delivering ground forces to a theatre of war. When a theatre has been non-contiguous to friendly territory yet possessed a coast, amphibious operations have been essential to the war effort. Thus, amphibious warfare is particularly relevant to maritime powers such as the United States, the United Kingdom, and Japan. Separated by large bodies of water from their adversaries, these countries can deploy substantial ground forces against an opponent only if they possess territory or an ally contiguous to the war zone, or if they can conduct amphibious warfare. History of Amphibious operations dates back to 1940, where the amphibious warfare took place to annihilate an adversary. Nazi's occupied France and drove the British from the European continent. Germany effectively gained control of continental Europe's coast. Despite being entirely on the defensive, British recognized the strategic imperative of returning to the continent if Germany was ever to be completely defeated. During World War II, hundreds of amphibious

assaults were conducted and the modern concept of amphibious warfare came into being. The below figure depicts strength of the troops participated in various Amphibious Operations.

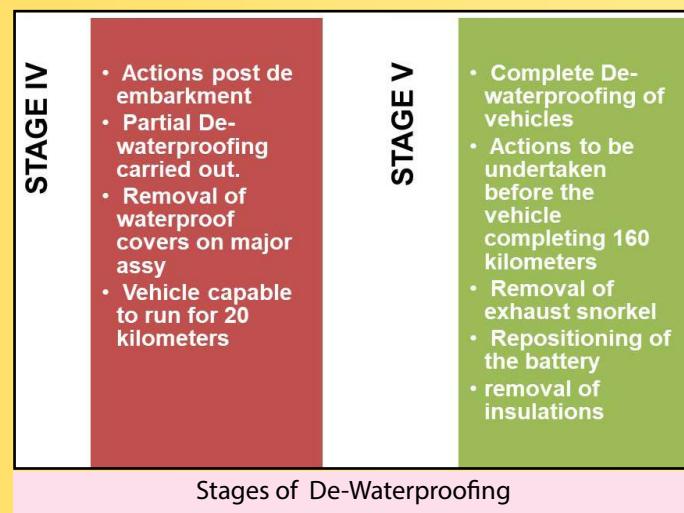


## Present System of Amphibious Repair and Recovery Operations and Its Challenges

The primary role of Corps of Electronics and Mechanical Engineers in any amphibious operation is to carryout 'Beach Recovery' and 'Waterproofing of Vehicles'. Providing Engineering support in terms of repair and recovery to the vehicles and equipment of the affiliated formation during induction and de induction is an inherent task. Waterproofing of the vehicles requires immense amount of precision and quality of work. It is the treatment carried out on vehicles to make them capable to wade through a depth of 3 to 4 feet of water from landing craft to shore without causing undue damage as a result of wading. The water proofing is carried out in five stages (includes de-waterproofing also). The figure depicted below clearly shows various actions undertaken for waterproofing and de-waterproofing in the amphibious formations:-



Stages of Waterproofing



Stages of De-Waterproofing

The above mentioned stages are essential to be carried out for ensuring the vehicles serviceability and its availability for the amphibious operation

### Challenges of Engineering Support in Amphibious Operations

The present system of engineering support to Amphibious Operations has been validated and evolved with changes as per the operational requirement and is designed to provide engineering support from planning till execution stage. This system is highly capable and proven its efficiency and efficacy time to time, however, with the induction of modern and variety of equipment in IA, the corps of EME is facing the under mentioned shortcomings:-

- Waterproofing.** The methodology being used for waterproofing is age old and there has been no

change in the materials used. The process being manual is time taking as the waterproofing material needs to be prepared and applied manually.

- Availability of Waterproofing Stores.** The stores are being procured centrally and issued by ordnance echelon taking a heavy lead time to reach workshop. Due to its stocking at various echelons, quality of material upon reaching already gets downgraded as it has already outlived shelf-life. As a result, quality of waterproofing gets affected.

- Availability of Fresh Water at Shore.** Washing of vehicles with fresh water at shore on de embarking is an urgent requirement to prevent corrosion which may deteriorate the vehicle.

- Training of Technicians.** Amphibious Operations being sophisticated, warrants meticulous training of technicians and rehearsals. On-the-Job Training is the only training being provided as no formal training is provided to technicians before being posted to the workshops.

- Inventory Management.** Inventory management in IA is a complex and a long process and takes time in materializing. The lead time of inventory to reach field workshop is extensive which delay the repairs of vehicle/ equipment and reduces the availability of equipment to the landing force.

### Best Practices Being Adopted by Foreign Armies

- Use of Advanced Landing Platforms.** US army is using landing platform LCAC for de-embarkment of landing forces which ensures safe landing of not only troops but also vehicles and equipment on shore without contacting water. This saves on time taken for waterproofing, de-waterproofing and immediate deployment of landing forces.



- Specialised Vehicles and Equipment.** Armies of developed countries are using specialised amphibious vehs/eqpts which don't require waterproofing or very less waterproofing so that they are always ready for operations. Most land vehicles, even lightly armoured ones can be made amphibious simply by providing them with a Waterproof hull and a propeller. This is possible as the vehicle's displacement is usually greater than its weight, and thus it will float. Heavily armoured vehicles however sometimes have a density greater than water (their weight in kilograms exceeds their volume in litres) and will need additional buoyancy measures. These can take the form of inflatable floatation devices, much like the sides of a rubber dinghy or a waterproof fabric skirt raised from the top perimeter of the vehicle, to increase its displacement.

- Advanced Waterproofing Techniques.** Nano technology paints, ceramic coating, Super hydrophobic coatings in dry surface application are used as the material being ready to apply thereby taking less time and saving crucial time during on going operations. Electrical and electronic components of these vehicles and equipments are already waterproofed and don't need any treatment.

- Portable Mobile Water Purifier Units.** Mobile Lightweight Water Purifier units (LWP) manufactured by New Orleans-based company MECO of United States which can purify almost any water source during military actions, emergency response and even disaster relief efforts. The LWP is a highly mobile, reverse osmosis (RO) unit to support company/battalion-size units in the field. Specifications include a portable water production



of 125 gph on fresh or brackish water and 75 gph on 60,000 ppm TDS salt water. The system treats highly turbid water containing bacteriological contamination, brackish water, seawater and water contaminated with nuclear, chemical and biological warfare agents.

- Unmanned Aerial Systems in Combat Logistic Support.** To revolutionise logistics on battlefield, US Military has started using Drones for forward delivery of inventory which will speed up the rate of replenishment of vehicles/ equipments required for operations. This will help in reduction of operational cost, implementation of more complex tactics and most importantly protection of soldier's lives.

### Recommendations

- Procurement/ Development of landing Platforms.** Landing platforms like LCACS has transformed amphibious operations and has given an edge to the landing force over adversary. These landing platforms have reduced the time and effort required for de-embarkment of landing force and vehicles/ equipment.

- Use of NanoTech Painting and Putty.** There is a need to adopt nano technology painting for vehicles/ equipment which can provide better waterproofing and will save on time and efforts.

- Procurement of Portable Mobile Water Purifier Units.** Portable water purifier units will help in washing of vehicles post reaching immediately at shore where fresh water is not readily available. This will further reduce the load for carrying fresh water and will save on time and life of vehicle.

- Training of Technicians.** At present there is no formal training being provided to a technician to undertake repairs and recovery during amphibious operations. Team of technicians should be selected for training on repair and recovery in amphibious operations and be posted to the workshop. There is a requirement of having a core group of technicians trained for amphibious operations and should be posted in a manner that one team is always available with the workshop.

- Upgradation of Inventory Management System.** In order to overcome logistic delays, inventory management system should be upgraded

and automated. Armies of developed countries are using automated system as discussed above for inventory management. IA should look forward to automate whole inventory management system including spares management at field workshop, ordnance depots, civil vendors and OEMs. The model will not only facilitate the Landing Force's ability to efficiently determine what will be needed where, but can also assess risk in near real time in order to account for uncertainty.

- Induction of New Recovery Vehicles and Heavy Duty Cranes.** The present recovery vehicles and cranes available are of old vintage and technology and are not reliable and do not suffice the requirement of loading and unloading onto the ship. Versatile recovery platforms like REM-KL M816 and Wrecker platforms are to be explored for effective recovery efforts. Recovery vehicles having hydro-pneumatic systems, operated from cabin with ease are required for recovery of vehicles during Amphibious Operations. These types of recovery platforms will help in carrying out recovery operations in an efficient manner and early recycling of vehicles/ equipment.

### Conclusion

With the changing times and battlefield scenario, it becomes most important to change our own practices of repair and recovery in support of Amphibious

operations. Recycling of vehicle/ equipment at a faster rate will help in successful completion of any mission. IA is inducting latest and technologically advanced vehicles/ equipment in support of these operations and for repair and recovery of these equipments needs adoption of latest technology and best practices. Armies of developed countries are upgrading their repair and recovery practices and we also need to adopt and upgrade our practices as elaborated. To increase the mission readiness and equipment availability to the Landing Force Commander, we need to adopt modern and efficient repairs and recovery procedures. Armies of developed countries have already graduated themselves to these best practices and newer concepts and now its necessity for our country to upgrade to these technologies and implement modern practices.



Maj Pavan Kumar Rayudu is an alumnus of OTA, Chennai and was commissioned in the Corps of EME on 17 Sep 2011. The officer has done Diploma in Electronics and Communication Engineering and B Tech in Electronics and Communication Engineering from JNTU, Hyderabad. The officer has done advance course in Communications. The offr has served in EME Bn, PARA(SF), Signal Gp EME Wksp, Indep Armd Wksp and is presently commanding a Wksp of an EME Bn in peace.

## Unit Copy Subscriptions (UCS)

Unit	Amount (RS)
1 and 3 EME Centre	50,000.00
MCEME and EME School	15,000.00
HQ TG EME, HQ Base Wksp Gp and Army Base Wksp	7,000.00
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7 Series EME Bns, Corps Zone Wksps, 14 & 39 EME Bns, Indep Armd / Mech Wksp	3,000.00
Indep Sig Gp Wksp, Veh Depot Wksp, Indep Fd Wksp, Rkt Regt Wksp, Fd Wksp (Engr Bde), Plant Wksp, Sata Regt Wksp, WEE Wksp, Eqpt Depot Wksp, AD Wksps, AD Static Wksp, Gopalpur, Static Wksp Port Blair and other minor EME units (CT- 1 Basic Only)	1,500.00

Auth : DGEME Coord letter No B/54273/CI/CC Sectt Dated 10 Sep 2017 & Ref Corps Instr No Fin-02, Issue-05 dt 30 Aug 2017 on 'Subscription Policy of EME RA Funds'.

Units are requested to forward their unit copy subscription (UCS) every year by 01 May as per the above mentioned rates. DD / cheque (multi city) must be drawn in favour of 'EME Journal c/o MCEME

# SCIENTIFIC EFFECTS FOR SENSORS DESIGNING

EE A K Panda

## Introduction

Sensor is a device capable of sensing a particular form of energy and its amplitude. The device can transfer one form of energy to another desired form, say liquid flow to voltage, vibration to voltage or pressure to change in resistance. Transducer is an advanced form of sensor which is capable of sensing as well as transmitting the energy or equivalent signal from one location to another by physical medium or remotely. This facilitates telemetry.

The change in form of energy may be thermal to electrical or acoustical to electrical or chemical to thermal. For changing the form of energy, one of the scientific effects plays a significant role. The aim of choosing a particular scientific effect amongst many alternatives available is to get better customised output form.

## Requirements of Scientific Effects

The physical quantities like flow, vibration, pressure, displacement, heat and chemical compositions are required to be measured, information codified, need to be transmitted far away for real time monitoring, data storage, timely retrieval and data analytics demands a particular form of energy for convenient use. However, the raw nature of input available at initial state may not be suitable for all these purposes mentioned above. Therefore, it is essential to convert the form of energy to a required and acceptable form for effective multi-purpose use.

The form of raw energy may be thermal, chemical, acoustical, biological, nuclear, optical or even mechanical. However, for ease of input assessment and data handling, it is preferred to convert the mentioned form of energy into four convenient forms or modes such as voltage or current or frequency or pulse mode. Each mode has its own advantages and drawbacks like voltage and current modes are preferred over short distance and analog base, whereas, pulse mode suitable for longer distance with digital interface.

## Scientific Effects Used

The most prominent effects used for designing sensors for day to day use are as follows:

- **Seebeck Effect.** In this effect, an electromotive force (EMF) is produced when temperature gradient is maintained across two metal junctions having different work function. It is used for furnace/ boiler temperature monitoring.
- **Peltier Effect.** In this effect, when electric current is allowed to pass through a pair of metals kept at constant temperature, then heat is either generated or absorbed, e.g., Heating or Cooling effects.
- **Thermo Resistive Effect.** In this effect, temperature coefficient of resistivity changes due to change in temperature. It is used to measure temperature by changing resistance of a metal and consequently producing electrical signal. Pressure, Gas composition, Temperature of gas kept in a cylinder can be measured by using this effect.
- **Electro Resistive Effect.** In this effect, change in resistivity of a metal subject generates EMF. Proximity and stray effects are identified by this effect.
- **Piezoelectric Effect.** In this effect, EMF is produced across asymmetrical crystalline materials due to change in separation of faces corresponding to applied pressure. It is used for vibration and acceleration monitoring.
- **Piezoresistive Effect.** It is the change in resistivity of a metal due to change in weight or pressure or force. It is used as strain gauge to measure fuel quantity and larger weights in weigh bridge.
- **Hall Effect:** It is also known as Galvanomagnetic effect. When asymmetrical crystalline material is subjected to EMF in one direction, magnetic field in second direction then current flows in third

direction. It is used for mobile network intensity monitoring at localities.

- Electro Osmosis Effect.** In this effect, applied emf causes liquid to move along the stationary walls of a container. It is used in Petrochemicals / Health care to make fluid flow at determined velocity.

- Electrophoresis Effect.** In this effect, applied voltage causes solid particles to move through stationery liquid in a container. It is used for Filtration of solid impurities and in health care to administer medicines.

- Dorn Effect.** In this effect, production of voltage is by the motion of solid particles passing through the liquid. It is used to identify presence of solid particles or measuring contamination level.

- Capacitive Effect.** In this effect, change in physical dimensions and separation between two parallel conducting surfaces results in generation of electrical signal and vice versa. It is used to monitor fluid level, component alignment, pressure and hygroscopicity.

- Inductive Effect.** In this effect, due to change in ferrous core position consequent to displacement of piston or shaft the self inductance of coil changes resulting in emf generation. With the help of this effect, change in lever positions and piston positions, linear and angular displacements can be monitored.

- Electrostatic Effect.** Physical movement of two parallel conducting surfaces due to application of HVDC. It is used for concrete pressing, pressboard & ply board making.

- Thermal Effect.** Current flow in a wire can make thermal expansion. Smooth deflection of an object can take place out of this expansion. Limit switch & protective device for machines can be designed out of this effect.

- Induction Effect.** Magnetic field can attract or repel a ferromagnetic material. Amplitude of current, voltage, power and electrical energy can be measured conveniently by using this effect.

- Photoconductive Effect.** The change in conductivity of certain substances take place under electromagnetic radiation normally light. Semiconductors such as selenium, the sellenides, tellurides and germanium show a marked increase in electrical conductance under incident light.

- Photoelectric Effect.** This effect causes the

liberation of electrons from a surface subjected to light. Lamp efficiency and illumination level can be monitored by using this effect.

- Photovoltaic Effect.** This effect causes production of an electromagnetic force or voltage when radiant energy usually light incident upon a junction of two dissimilar materials such as a P-N junction.

- Magnetostriction Effect.** When a ferromagnetic material is magnetised, change in physical dimensions occur due to molecular movement. This effect is used to design limiting switch and protective relays.

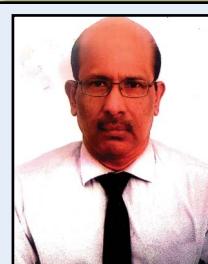
## Advantages of Effects

Sensor based measurement and monitoring using scientific effects carry following essential advantages:-

- Amplification and attenuation of parameter with static devices.
- Minimal mass - inertia and friction effect.
- Easy control with low power level.
- Convenient information process, storing, retrieval, display, measurement and control.
- Application of Telemetry (Measurement from a distance).
- Robust, user friendly, maintainable and low cost.

## Conclusion

For present day requirements of automation, data analytics, AI based monitoring and telemetry arrangements sensors are the basic elements. Further understanding of sensor functioning one has to know the basic scientific effects on which each sensor functions.



Executive Engineer Mr AK Panda has done ME in Power Systems from BIT Mesra. He is the proud member of The Institution of Engineers (India) and Chartered Engineer of India. The officer has had a tenure in Army Base Workshop handling Production, Methodisation and QA. The officer has served as Dy Dir EME (Civ). The officer has presented various papers during Indian Engineering congress. He is presently posted as an Instructor in MCEME, Secunderabad.

Methodisation and QA. The officer has served as Dy Dir EME (Civ). The officer has presented various papers during Indian Engineering congress. He is presently posted as an Instructor in MCEME, Secunderabad.

# A TRIBUTE TO LATE MAJ AA BASITH, INDIAN ARMY'S FIRST OLYMPIC SAILOR

**Lt Col Deepak Dikhit (Retd)**

This is my personal tribute to Late Maj AA Basith, one of the greatest sailors of our Corps.

I am also writing this to share what I knew about him and what all he did for sailing, not just for the Corps but also for the country. He was a lot more than just an Olympic sailor.

I am undoubtedly most benefited by his sailing skills, knowledge, expertise, coaching, training, event management, networking, benevolence and generosity. Credit for what I have achieved in sailing and the good life I have lived with glamour and glory of association with this great sport is entirely due to Maj Basith (and Brig V Nagabhushan, then Commandant, MCEME and Maj Gen S Dutta, VSM). I am immensely grieved with his passing away recently in the US.

He was a grand one-man show of the EMESA in 70s and 80s but his contribution to Indian sailing also was no less. No aspect of sailing was without contribution from Maj Basith. Sailing in the Olympics was perhaps something that just happened in his busy life and once it was over, he got on with promoting sailing. It wasn't like, "You know when I went to the Olympics....". It was done and dusted. He gave back to the sport more than what he might have got from it.

With typical clarity of vision and forethought, he visualised constraints of yachting equipment availability for the EME Sailing Association and first built five Enterprise Class boats in the Base Workshop in Bangalore. He was a go-getter who would stop at nothing. To promote a distinctive class for EMESA's home-water (Hussain Sagar Lake), he later started building OK Dinghy in a Field Workshop in Secunderabad. Various equipment, accessories and fittings of a sail boat such as spar, mast,



boom, blocks, cleats, jam-cleats, D-shackles, mainsheet travelers and even sails followed rapidly. He got books on wood, contacted forest officers, visited timber dealers, ply-wood manufacturers, paint manufacturers, traders, shops and found just the source that he needed to get the right stuff for all his boat-building requirement. That was the time when India was a closed economy and such exotic things were not allowed to be imported. But he was always planning ahead. OK Dinghy construction was undertaken because he was determined to start OK

Dinghy nationals in Secunderabad in 1975 and make it an annual event there. Starting with that humble beginning, the event is now annual Hyderabad Sailing Week, EME's most popular sporting event with over 150 boats and nearly 300 sailors competing for honors in challenging monsoon winds right in the heart of the twin city. It does not happen anywhere else in the country.

His commitment to sailing in EME was absolute. MCEME was to have its Corps Reunion in 1976 and to further promote sailing among EME Officers, he was instrumental in initiating annual EME Sailing Championship and the EMESA started the DEME's Trophy (now, the DGEME's Trophy). He knew how to get things done and could persuade and convince senior officers for all-out effort to enhance Corps' sporting prospects. Being a native of Hyderabad was a big bonus, as he could get funds for the events. In 1976, Secunderabad also was the venue for 2<sup>nd</sup> OK Dinghy Nationals and the South Asian Yachting Regatta, climaxing in one of the greatest sailing years for the twin cities. All three major events organised with a stellar contribution from Maj Basith within a short span. He had full support of the Corps, the DEME, Brig Nagabhushan and Gen Dutta. Lateral benefit for the EMESA was a new breed of young enthusiastic sailors whom he motivated at CME Pune during the Enterprise Nationals in NDA.

We (Gens NB Singh, Dahiya, Kochhar, Mhaisale, Brig Munjal, Col Jaggi, etc.) had just been initiated into sailing by Brig Jagdish Singh and EME's two teams needed a number of crew and that was to be the beginning of life-long affair with sailing for Col Jaggi and me. He was determined to prepare EME team for forthcoming regattas and our training continued under his strict regimen at Secunderabad. He regularly organised practice and coaching session at Hussain Sagar. From him I learnt that one could see the wind, estimate its strength and judge the shifts. His training for us comprised various aspects of the sport - on tactics, starts, tuning, covering when ahead and breaking cover when trailing and the racing rules. He would usually

be there when the last boat returned and then started post-mortem of everyone's performance – mistakes, rules infringed, cheating on penalty and what have you done. And it was not unusual for him to treat us for dinner those who got delayed in the Sailing Club or to take us to his home for one. He made sure we got spared from classes during major events. He once even got an External Examination and the Term Break rescheduled, at the cost of curses from the remaining course officers and their wives because Brig Munjal and I had to go for the Enterprise National Championship at Goa in 1977.

After all the hectic sailing of 1976, he started training, those of us who were interested in boat building, measurement, race management, etc. Thereafter, Col MP Jaggi would go on to become one of the most sought-after National Race Officer and Judge in the country for nearly two decades. Trend has flourished ever since and now India's only two International Judges, Brig Jagdish Singh and Brig GS Julka are from the EME.

Roll over to 1981 and hectic preparations were on for the IX Asian Games. Maj AA Basith was assigned responsibility for technical planning and preparation and procurement of yachting equipment for the Games. He was then India's only Measurer and Inspector of yachting equipment and was ably supported by Col Jaggi during the Asiad. He had to visit England for understanding technical issues and arranging boats for the Indian Team as well as those for charter to other countries' sailors also. I was doing my post-graduation in Cranfield. He wrote to me to arrange his visit to meet a number of experts. We, along with my wife, then drove around all over – to International Yacht Racing Union office, to some famous high performance OK Dinghy builder whose boat was desired for the Indian team, Fireball Chief Class Measurer, Enterprise World Champion Roger Hance who was to supply spar, coaches for the Indian Team and Fireball Kit supplier and a carpenter who would build Fireballs at the Games' venue in Mumbai. Always a perfect gentleman and a good sport, he would, in the evenings, flatter my wife for her cooking and at night Maj Basith would sleep on the floor without any fuss in our students' one-bed-

room flat in the Institute. Back in India, he was again at what he was really so good at – this time building Fireball alongside that British carpenter.

Later in the summer of 1982, he was manager-cum-coach for the OK Dinghy and Windglider (windsurfing) teams for the European tour and what a trip it was. With help from Commodore Pestonji (a sailing colleague, posted as Naval Advisor in West Germany), he bought an old Audi and a trailer and drove us – Gen Pillai, Mr Pradipak, Maj AK Singh and myself, with our two dinghies and two Windgliders (which he had arranged free of cost for us from the manufacturer in West Germany), all around regatta venues, often dropping one team in one country and picking up the other from another. There was only one condition for getting lift on his car – no one else would even touch the steering wheel!

And this last one was the best that I will always remember him and be grateful to him for. At the iconic Kiel Week Regatta, we met the President of the International Windglider Association (IWA), Mr Ben De Roos and he informed us of the Olympic Training Regatta being held after a couple of weeks at Long Beach (USA) with the discipline set to make its maiden entry in the 1984 Los Angeles Games. It was a new development and it was not in our itinerary. After all the events in Europe were over, Maj Basith drove us to Amsterdam and visited the IWA HQ and got a wild-card entry for me for that event. But there was no money, no leave and no visa for the US. Neither was there time to return to India and arrange for all these. Like a good CO, Maj Basith just took the decision – I was to go, he would take care of my leave on return to India (a signed-leave application to the DEME, Commandant MCEME), I was to borrow money from my old college mates at Cranfield. He also requested the President IWA for free hospitality for me at Long Beach which he so kindly arranged for.

Now was the last hurdle – arranging Visa to the US from a country where we did not reside. Nevertheless, we returned to Frankfurt and he put on his Olympic blazer and confidently walked that fine morning into the Office of US Consulate there without even an appointment and

got me a visa to the US before lunch! In the afternoon, the British visa was arranged without ado, for I had been a student there a year before. In the night, I took a train to London and Maj Basith set out to sell the car and return to India.

That was Major Ahmed Abdul Basith – a man for all seasons, a sportsman, a sailor, a coach, a manager par excellence, a race officer, a boat builder, a measurer, a team-person, a motivator, a friend and above all a great officer and a gentleman. Really a lot more than just an Olympic sailor. An Eagle, who soared higher and higher, and finally went above the clouds.



Lt Col Deepak Dikhit (Retd), was commissioned in to the Corps in 1973. He has done Degree Engineering Course, followed by ORRE and M Tech from the Cranfield Institute of Technology. He has also done an ATGM Simulator course at erstwhile Yugoslavia. The Veteran Officer is a renowned Windsurfer and a Sailor who has won Windsurfing event of the First Asian Regatta in 1981 and went on to represent India in a number of championships in Asia, Europe and North America including the Asian Games (1982 & 1986) and the Pre-Olympics at Los Angeles. He is the Corps' first Offshore Sailor who have sailed from Vishakhapatnam to Diego Garcia and Mauritius as a member of the Joint Services Sailing Expedition to Indian Ocean Islands. He has served in both the EME Centers, MCEME and Army EMC Agency, Mhow besides field units in Ambala, Mizoram and Leh. Lt Col Dikhit has actively trained young officers and organised coaching camps for the EME Officers at Goa. He was also the National Windsurfing Coach for four years. He took up to academics after retirement from the Army and finally retired as the Director General of a Charitable Educational Group under U.P. Technical University. He returned back to sailing again in 2017 and since then he is the National Judge appointed by the Yachting Association of India. He has also qualified as an International Judge and National Race Officer.

# A SOARING EAGLE & LADEN JOURNEY OF OBSESSION

**Lt Col Anuj Bindra**

**"I MIGHT BE SLOW BUT I WILL KEEP MY FLOW, I WILL NOT STOP TILL I REACH THE TOP"**

1630 hrs, 11 Dec 2004, routine discharge of my duties and then an IED blast. I still remember the first question that crossed my mind on realisation that I'd lost a limb, "Will I be able to walk ever again on my legs?" A question that shook me to the core of my being, haunted and infused a plethora of thoughts that led to psychological entanglement in my cerebrum. My journey, long and arduous, began from there.

Being in my early twenties, a military trained fresher and possessing a 'never say die attitude' ensured that my confidence did not waver even once. Post two and half years of hospitalisation and with the unstinted support of my better half (both pre and post marriage) as well as family members, I was back on track in terms of both my professional and personal life.

At this juncture, there was a self-realisation that I must channelise my energy levels to make sure that adrenaline as well as ego of the sportsman, bubbling inside me, gets pacified. This triggered the process of hallucination and as a result I started dreaming.

'PAINS' is also positive if you understand its indepth meaning i.e Positive Attitude In Negative Situation. I am a witness to the above fact as I myself could not recognise my hidden energy, until I was pushed beyond the wall to prove my very existence in this world. However, the way this push was offered to me, by none other than almighty, was too painful but, it gave me an opportunity that I grabbed in a misconstrual manner.

"It's not what you look at that matters, it's what you see."

The turning point finally came 13 years after commencement of my journey, with a thought that tinkered lobes of my brain. A new quest had commenced, and that was, how to bridge the gap between the dream and the action?

And the answer that I found while walking on this path was, the fire in my belly must burn brighter than the fire around me in this journey, no matter how many hurdles and challenges come in my way. And thus, I

formulated a 4D mantra for myself – Dedication, Desire, Devotion and Discipline.

After falling down for thousand times, I picked myself up and as of today have more than 15 marathons to my credit including 5 km, 10 km and 21 km with my artificial prosthesis.



"By taking pride in what I am and persistent push towards excellence" is the mantra that I believe, will lead me to reach the pinnacle, where I would be able to transform at least a single soul and help out to live with pride and dignity.

I hope that my obsession of walking on this path will encourage and inculcate an attitude that will enable people like me, who are also striving to rise above this psychoanalytic paradigm, to find a ray of light in their ultimate journey of life.

**"DREAM TOO COME TRUE,  
IF THEY ARE CHASED WITH PERSEVERANCE"**

Lt Col Anuj Bindra is a Battle Casualty (War Wounded) soldier who got commissioned into the Corps of EME on 20 Mar 2004. The Officer is a Short Service Commissioned (Tech) who got wounded during his Infantry attachment. The Officer is an Aviation Advance Course qualified and is currently posted as Instr Cl 'A' in CTW, Secunderabad. The officer is an active sports person, a marathoner and an enthusiastic cyclist.

# I AM THE ARMY

**COL BHUPINDER SINGH CHIB**

I am the army of a nation strong, I can never ever be wrong.

I am man's necessary creation, to defend the borders of his nation.  
Independence was a day of beginning, a reflection of a nation grinning.

Partition was forced upon us, with a future hard to guess.

I was brutally divided into two, left with resources very few.

I was soon put to test, to protect the nation's supreme crest.

War is what I had been preparing all along, but not with men who shared same folk song.  
Sometimes humanity is a difficult expression, but I am here to serve and not to question.

I am the army of a nation strong, I had never ever been wrong.

People respect me for the glory of the past, for I am above religion or caste.

Floods or tsunami, drought or fire, I am there to calm the ire.

I have been fighting the terrorists for long, the values within had made me so strong.

The nation, but, has a short term memory, remembers me only when in worry.

I bled so many times to save the country, but still I get treated like one of sundry.

I am the pillar of a nation strong, trying to keep it together since long.

I have seen glory in the past, always kept high the mast.

Things have changed with the time, values are getting covered with the grime.

I am witness to the proliferation of corruption, politicians building wealth and not the nation.

The suffering has not got any thin, but the bleeding is now from within.

I too succumbed to the greed many a times, the greed to collect few more dimes.

I, the pride of the nation, am fighting hard, to save the image from being charred.

The culture and values are still so strong, but I don't know where I went wrong.

As the nation celebrates my day, I am here with a message to convey.

Nation depends on true nationals, who could stand out from the irrationals.

Let us get our acts together, have the courage to add new feather.

I am a way of life, and not a career alone, the choice to be with me is purely your own.

I am a light for the youth to follow, to prevent the society from getting hollow.

Our forefathers had dreamt of a nation strong, the nation to which we all belong.

Let's be a part of their dream, and show the world our steam.

I am the army of nation strong, you are the nation of an army so strong.



Col Bhupinder Singh Chib, an alumnus of AIT Pune and IMA Dehradun, was commissioned into Corps of EME on 13 May 2000. Apart from basic courses, the officer has qualified on OALE (R) course at MCEME and staff Course at DSSC Wellington. He has been instructor at EME School Vadodara and has tenanted staff appts of AQMG in a Mtn Bde and AMS-16. He has been part of Indian Army AD contingent in Sri Lanka and EME Det Cdr in UNMISS. He commanded a Div EME Battalion in peace and has been Works Manager at Army Base Wksp, Agra. The officer is presently posted as Col EME of a Corps in active field location



# Rajdhani Mail



**Handing/ Taking Over.** Lt Gen Tumul Varma, SM, VSM has assumed the appointment of DG EME & Sr Col Comdt of the Corps of EME on 01 Jan 2021 vice Lt Gen Anil Kapoor, AVSM, VSM, DG EME & Sr Col Comdt superannuated on 31 Dec 2020.



**DG EME Address.** Lt Gen Tumul Varma, SM, VSM, DG EME & Sr Col Comdt addressed all officers of Dte Gen of EME and HQ Tech Gp EME on 23 Mar 2021. The discourse was towards aligning the entire Team at Dte Gen of EME with the challenges that the Corps of EME shall be beset with in the near future and the outlining of short term and mid term goals for ensuring that the relevance of the Corps of EME is not only ascertained but progressively enhanced through well planned, efficiently orchestrated, result oriented and value based initiatives across the sustainment support spectrum.



**Wreath laying Ceremony and Central Tea.** Lt Gen Tumul Varma, SM, VSM, DG EME & Sr Col Comdt paying homage to the Martyrs at the 'National War Memorial' on assuming the appointment of DG EME & Sr Col Comdt on 01 Jan 2021.



## IMPORTANT MESSAGE

All the Units/Offrs who are sending inputs for EME Journal, both articles or unit news, must send the concerned photographs in a separate folder. Photographs placed in word document loose their resolution during printing. Hence, the original photographs placed in the word document may be named with the event and copied in a separate folder. For example, if 505 Army Base Wksp is sending a photograph on display of Idea and Innovation, then the photograph should be named as '505 ABW - Idea and Innovation Display' and the file format must be jpeg. In case of articles, you can name the picture starting with 'Figure-1.-\_\_\_\_\_. Please attach a separate CD containing word document and folder containing high resolution photographs in JPEG format and forward it to EME Journal in stipulated time period.

You can also send the inputs through AWAN at the MCEME/ GSO1 MCEME/ Col GS MCEME.



# COLLEGE CAUSERIE



## TRAINING ACTIVITIES

- Memorandum of Understanding (MoU) with Poornima University.** A MoU with Poornima University has been signed on 28 Jan 2021 to encourage academic cooperation and promote research and knowledge exchange between the parties. A Centre for Research Collaboration (CRC) will be established at MCEME to facilitate Ph D program in the field of Communication, Radar, Computer Science, Electronics and Mechanical Engineering and in the field of Management.



- ALH Cockpit Simulator.** An ALH Cockpit Simulator has been established at Simulator Room of Faculty of Aeronautical Engineering, MCEME. The same has lead to quality improvement in the way training is being imparted at the faculty.



- Academic and Technical Association Between MCEME and Ordnance Design Centre, Ordnance Factory Medak.** MCEME and Ordnance Design Centre, Ordnance Factory Medak have agreed to collaborate in the Academic and Technical fields. Accordingly, an agreement has been signed on 19 Feb 2021. The event was presided over by Comdt MCEME and Mr Alok Prasad, General Manager, OFMK. Development and designing of an AVT (LR) based on ICV BMP-II chassis will be progressed on the basis of the same, in addition to assistance in academic projects/ lectures etc.



- Cyber Awareness Week.** Cyber awareness week was observed from 21 Dec 2020 to 05 Jan 2021. Seven lectures on daily basis were conducted and total of 197 officers and 578 JCOs/ OR attended the same.

- Simulator Maintenance Hub.** A state of art Simulator Maintenance Hub has been established at Faculty of Electronics, MCEME to impart training to technicians on repair/maintenance of simulators in the Indian Army. Lt Gen Anil Kapoor, VSM, AVSM (Retd) (then DG EME & Sr Col Comdt Corps of EME) inaugurated the same on 10 Dec 2020 during his visit to MCEME.



- Demo of Swarm of Drones.** Comdt, MCEME visited New Delhi from 04 Jan to 15 Jan 2021 for display of Swarm of Drones during Army Day parade on 15 Jan 2021, where-in Comdt was detailed as Presiding Officer for planning, coordination and display of Swarm of Drones. India, for the first time, demonstrated its intent to deploy Swarm of Drones for offensive military operation in the future, including Kamikaze kinetic attacks on enemy targets like tanks, helipads, radars, fuel dumps and terror camps by 'child' drones released by 'mother' drones.

## MISCELLANEOUS ACTIVITIES



the associated skills of sailing, that being boat rigging, launching and recovery and capsizing drill. The young sailors were excited and remained motivated towards learning the sports of sailing. EME Sailing Association took a unique initiative of training 13 kids from an orphanage home free of cost. The conduct of camp was challenging with regard of ensuring safety of participants on and off water while on the same time strictly adhering to COVID-19 norms.

**Heartfulness Meditation.** Heartfulness Meditation is being organised at MCEME under the aegis of Shri Ram Chandra Mission, mentored by Lt Gen SRR Aliyengar, PVSM, AVSM, VSM (Retd) and ably assisted by a highly professional team of three volunteers from the Heartfulness Institute, as per dirns recd from HQ ARTRAC. First phase i.e foundation leg of the capsule on Heartfulness Meditation was conducted from 27 Jan to 01 Feb 2021 for staff and student offrs of MCEME. Phase-II capsule on Heartfulness Meditation is being conducted every Saturday, wef 13 Feb 2021 at 1630 hr for 12 weeks upto 08 May 2021.

- YAI Certification Coaching Camp Mar 2021.** EME Sailing Association under the aegis of MCEME has conducted 'YAI Sailing Coaching Camp 2021' under the National Level coaches for all categories (My first Experience, Basic Level-I, Basic Level-II, Basic Level-III & Racing Skills) wef 21 Mar to 30 Mar 2021. A total of 85 entries were received including 51 girls/women and 34 boys entries in the subject coaching camp, providing a unique opportunity to acquire basic and advanced level of sailing techniques. The participants also practiced





# SCHOOL SCANNER



## TECHNICAL ACTIVITIES

- **MoU Between EME School and Rashtriya Raksha University (RRU).**

On 11 Jan 2021, a MoU was signed between EME School and Rashtriya Raksha University (RRU), Gandhinagar for collaboration between the two institutions to provide appropriate academic recognition to the Professional Military Education (PME) of persons and add value to the training carried out at EME School. This would facilitate technical and academic advancement of EME persons besides sharing of academic resources, best practices and undertaking joint technical projects.

- **Guest Lecs / Webinars**

- A webinar on '**Review of Professional Military Education (PME)**' was organised on 04 Dec 2020 by HQ ARTRAC (Doctrine Br).
- A webinar on '**Algorithmic Warfare as a New Domain of Warfare in the Indo-Pacific**' was



organised by Rashtriya Raksha University, Gandhinagar on 15 Dec 2020.



- A guest lecture through video conference on '**Latest Trends in Surveillance Systems at IRDE**' was delivered by Mr Himanshu Singh, Sc 'F', IRDE Dehradun on 17 Dec 2020.

- A guest lec through video conference on '**Development of New Generation Weapons**' was delivered by Lt Col Amarjit Singh (Retd), Chief Marketing Officer, Bharat Forge Ltd on 22 Dec 2020.

- A guest lecture through video conference on '**Modern Trends in Barrel Manufacturing**' was delivered by Mr Ahtasham Akhtar, JAG Rank, Field Gun Factory Kanpur on 12 Jan 2021.

## TRAINING ACTIVITIES

- **Online Training on Assault Rifle SIG SAUER.**

Online training on Assault Rifle SIG SAUER was conducted for M/Techs (SA) and Techs (SA) of Northern Command wef 04 Feb to 06 Feb 2021 by this School. The training was attended by 02 officers, 05 JCOs and 66 OR.



- OEM Training on Assault Rifle SIG SAUER.** OEM training on Assault Rifle SIG SAUER was conducted at EME School wef 15 Feb to 24 Feb 21. 03 officers, 12 JCOs and 36 OR from various commands attended the course.



- Fabrication of LED Based Search Light.** Prototype of LED Search Light with 50W LED elements with detection range 500 mtrs and Identification range 300 mtr alongwith a pan and tilt mechanism which can be operated through remote control has been fabricated at EME School. Presently, the prototype is under field trials at an Infantry Brigade in field.



- AI Based Detection and Identification of Target using HHTI Feed.** An Artificial Intelligence (AI) based system for detection of target in the thermal imager videos of HHTI has been developed at FIT, EME School. The project has been developed on Deep Neural Network (DNN) using an algorithm coded in python software. The project is being undertaken in conjunction with BISAG, Ahmedabad. Phase-I of the project has been completed and has been forwarded for field trials in field army under the aegis of HQ Northern Comd (EME). Phase-II and III will be undertaken subsequently, in which fusion of inputs from various OE sensors into the AI Program will be achieved. The capabilities of the system are as under: -

- Vibration alert on target detection.
- Can identify 3 categories of targets i.e Human, Vehicle and Animal from Thermal Video of HHTI.
- Raise an alarm on detection of targets.



- Fabrication of Helmet Mounted Camera with Wi-Fi Capability.** Prototype of Helmet mounted with an IR camera with a range of 100 mtrs, integrated with dongle for Wi-Fi connectivity has been developed at EME School and is presently under field trials at an Infantry Brigade in field.

# CENTRE SPEAKING

## 1 EME CENTRE

- Visit of GOC DB Area.** Lt Gen A Arun, YSM, SM, VSM, GOC DB Area visited 1 EME Centre. The General Officer was briefed by Comdt, 1 EME Centre on the various training initiatives undertaken by the Centre.



**Swarnim Vijay Varsh Celebration.** On 13 Feb 21 the Victory Flame was received by Comdt 1 EME Centre and thereafter it was taken to EME War Memorial for the Wreath laying. As a part of celebrations, a felicitation ceremony was held in honour of Lt Col Nagulapalli Narsing Rao (Retd), VrC a veteran of 1971 War at Patel's Green Front, Yaprak, Secunderabad. A Cultural program was organized by Students of Army Public Schools of Hyderabad to 'Commemorate Swarnim Vijay Varsh' in coord with 1 EME Centre, in which Smt. Chitra Ramachandran, IAS, Special Chief Secretary to Government, Education Department, Telangana State was the chief guest.



- Visit of DG EME.** Lt Gen Anil Kapoor, AVSM, VSM (Retd), then DG EME & Sr Col Comdt of the Corps of EME visited the Centre on 26 Dec 20. The DG EME was briefed on the various training initiatives undertaken at the Centre.



- UHQ Rally.** Recruitment Rally under Unit HQ Quota was conducted for sons of War Widows/ Ex-servicemen/ Servicemen including wards of TA personnel for the trades Soldier Tech (Avn), Soldier Tech, Soldier GD and Soldier Tradesmen (Chef & Steward) category and open category for outstanding sportsmen (Kayaking & Canoeing, Rowing, Aquatics (Swimming/ Diving) and Volleyball). Approx 4000 candidates reported for the Rally. Common Entrance Exam (CEE) for candidates qualified in physical and medical tests has been conducted on 28 Feb 21.

## 3 EME CENTRE

- Orientation Program for Recruits/ Trainees.** An orientation program for recruits/ trainees was conducted on 19 Dec 2020 by the sports teams of 3 EME Centre to motivate them to pickup different sports.



- Visit of GOC 21 Corps along with GOC PMP Sub Area.** Lt Gen Atulya Solankey, SM, GOC 21 Corps along with Maj Gen V K Tripathi, GOC PMP Sub Area visited 3 EME Centre on 18 Jan 2021.

- Passing Out Parade (POP).** POP of Course Ser No BMT-2292 was conducted on 02 Jan 2021 and Course Ser No BMT-2294 was conducted on 09 Jan 2021 at Drill Square of 3 EME Centre.



- Swarnim Vijay Diwas.** Band display was done at Shaurya Samarak on the occasion of Swarnim Vijay Diwas on 12 Jan 2021.

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# BASE WORKSHOP GROUP CORNER

## CHANGE OF COMMAND

- Maj Gen RS Yadav took over the Command of Base Workshop Group from Maj Gen Neeraj Varshney, VSM on 15 Jan 2021.
- Brig P Bajpai took over the appointment of Commandant & MD, Army Base Workshop, Delhi from Brig Biju Shantharam on 13 Jan 2021.



- Brig Vijay Vikram Suri took over the reins of Army Base Workshop, Pune from Brig Jasdeep Singh on 13 Jan 2021.



- Unit Citation.** It is first time in the history that two Army Base Workshops have been awarded Unit Citations in the same year:-

- Army Base Workshop, Agra has been conferred with GOC-in-C Central Command Unit Citation for the year 2019-20 on 05 Feb 2021 for their exemplary work and proactive engineering support to Field Army.
- Army Base Workshop, Pune for their exceptional quality production output of A Vehicles and proactive engineering support to NC and EC has been awarded GOC-in-C Southern Command Unit Citation for the year 2019-20 on 05 Feb 2021.

## TECHNICAL ACTIVITIES

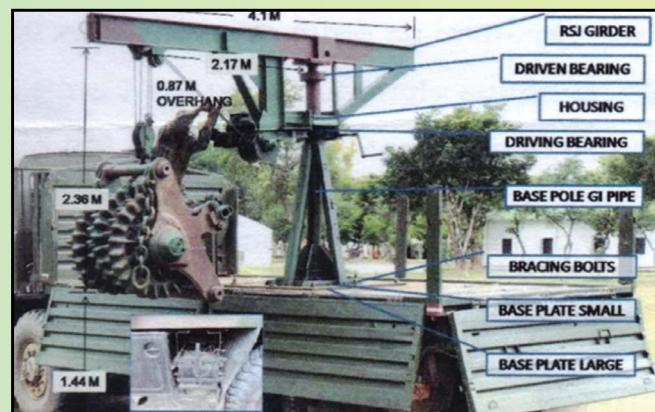
- Centre of Excellence for Rubber Technology.** ABW Pune has developed a State-of-Art Rubber Component Manufacture Section and bogie wheel re-rubberisation capability. A total of 1500 dies have been designed and developed in-house. ABW Pune targets in-house manufacturing of 50 new components every year and also re-rubberises around 500 bogie wheel discs per year.





- Gun Mount for 12.7 mm NSVT in Ground Role.**

ABW Pune has modified the Gun Mount for 12.7 mm NSVT for units of Northern and Eastern Command for employment in ground role.



- Motor Tug Launch (MTL).** Pilot Overhaul of two MTL have been completed by ABW Prayagraj and the trials are under progress in an Engineer Regiment.



- Fabrication of RR Veh.** ABW Prayagraj is undertaking the fabrication of RR vehicles (Containerised) for Signal Regiments of IA. Two RR vehicles have been fabricated while balance two vehicles will be modified in due course.

- Indigenisation of Technical Support Vehicle (MTO-80) for Tank T-90.** ABW Pune has developed a prototype of Technical Support Vehicle MTO-80 (Special maintenance lorry for Tank T-90) mounted on TATA HMV 6x6 with MHC in support of Field Army. The vehicle is likely to be developed in the PY 2021-22.



- Fabrication of Self Loading Device (SLD) for Trawls.** One of the Engineer Unit had developed SLD for Trawls using single pulley cum gear system assembly with 360 degree rotation for loading/ unloading of trawls on ALS/ HMVs. ABW Prayagraj was nominated for fabrication of 60 SLDs for Engineer Regiments of the IA.



- Pilot Overhaul of STRELA 10M Engine.** ABW Kakinara has successfully completed the Pilot Overhaul of two Strela 10M engines. The pilot overhaul of third engine is under progress.



- Warranty Repairs of HHTI with LRF & HHTI Bi-Ocular.** BEL Liason Cell has been established at ABW Agra to coordinate warranty repairs for HHTI with LRF and HHTI Bi-ocular. 13 HHTIs with LRF and 11 HHTI Bi-Ocular along with sub assemblies have been forwarded to BEL, Macchilipatnam for warranty repairs. In-house repair of Front Panel Assembly and STE of Ballistic Computer (PK1 & PK2) is also being carried out by ABW Agra.

- Wireless Electronic Detonator Circuit (WEDC).** Development of FoPM and trials of WEDC has been carried out by ABW Bengaluru at MEG Centre. Freezing of design is under process after which bulk production will be carried out.



- Volvo Simulator for SFC.** ABW Bengaluru is fabricating Volvo simulator for SFC. Team from M/s Volvo Trucks India Ltd handed over the Volvo cabin to ABW Bengaluru on 17 Feb 2021 for manufacturing of Volvo simulator.



- 7.62mm Belt Filling Machine PKT.** ABW Bengaluru has commenced the bulk Fabrication of 7.62 Belt Filling Machine PKT post successful trial evaluation by mechanised infantry units. Information has also been disseminated to all Armd Div/ Indep Armd/ Mech Bdes/ Armd bde to place their requirement of belt filling machine to ABW Bengaluru.



## OPERATIONAL ACTIVITIES

- Support to Field Army.** A No of Mission Oriented Teams were sent to field units for providing in-situ engineering support to northern and eastern borders. ABWs also provided proactive engineering support by provision of spares and carrying out extensive repairs to war like equipment of the IA. A few details are as given under:-

- Support to 14 Corps.** Spares of ICV BMP-II/IJK and TkT-72 incl rotables were issued to 14 Corps units by Delhi and Pune ABWs on clean exchange basis during the current heightened security situation. In addition, 1267 Assemblies/ sub assemblies were also repaired in the field units during PY 2020-21.

- Turret Repairs of ICV BMP-II.** Major repair to turret assemblies of two ICV BMP-II of a Mech Inf (R&S) battalion in the western sector was carried out by ABW Pune.

- Repair of Op Critical Eqpt of NC and EC.** ABW Agra has carried out expeditious repairs to 25 opto-electronic equipment of Northern Command and 26 opto-electronic equipment of Eastern Command respectively in Jan 2021. A cumulative of 410 and 176 equipment of Northern and Eastern Command respectively have been repaired during the current production year on priority.

# COMMAND EME NEWS

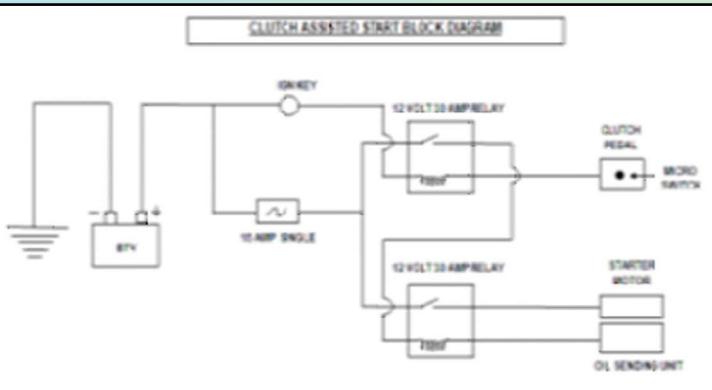


## EASTERN COMMAND EME



### TECHNICAL ACTIVITIES

- Medium Reset of AFVs at SHAA.** *Specialist Eagles* has the distinction of carrying out Medium Reset of AFVs in Super High Altitude Area in North Sikkim at an altitude of 15000 ft, in-situ, under most harsh and inhospitable weather conditions in the entire IA since 2013. MR Det of *Specialist Eagles* has been meeting its target of MR since raising and enhancing op readiness of the formation.



- Idea & Innovation.** Team *Spear Eagles* has fabricated a 'Clutch Assisted Start and Safety Against Double Cranking' for safety from MT accidents owing to gear starting and damage to self starter due to double cranking.

- Major repair undertaken.** Body structure of one Cheetah helicopter was replaced in-situ by team of HAL and ADMFW technicians in collaboration with technicians of a Maintenance Section unit in stipulated time frame.



- Engineering Support to Radar.** *Igla Eagles* was instrumental in repairing Low Level Light Weight Radar, Bharani at a forward post and a 3D Tactical Control Radar (3D TCR). The repair of LLLR Bharani has led to making them available for deployment in High Altitude Area for frontline border surveillance. Technicians of workshop have played a significant role in making 3D TCR serviceable which is crucial for long range search and tracking of enemy aerial activities.

**• Inter Services Coordination.** Team of HAL technicians were air-lifted from HAL, Barrackpore in an Indian Air force aircraft in Oct 2020 by liaison with DG OL&SM (OL-2), thereby ensuring green bubble movement of technicians from Barrackpore to Dimpaur during COVID pandemic when no transport was available. This effort was appreciated and ensured in making the hepter serviceable in a record time frame.



**• Engineering Support at Forward Locations.** A team from **Spear Eagles** adequately kitted with RTF kits and SMT/ STEs was inserted in deeply infested CI Ops and far flung locations of Nagaland and carried out mission critical repairs of EW assets to make them worthy of re-deployment in formation AOR.



**• HHTI with LRF Fitted on 23 mm ZU Gun for Night Firing.** HHTI with LRF sight was mounted on 23 mm ZU Gun by **Igla Eagles**, which enabled night firing capability and employability of gun for night firing role.



**• Critical Engineering Support Missions.** **Sarvottam Eagles** helped in capability building of formation by dismantling and assembling size IV Dozer at a forward location thus enhancing track construction capability in remote areas.



**• Idea & Innovation.** **Soaring Eagles** were effective in fructification of a No of in-house modification and fabrication for SIG 716 assault rifle, MMG and Sniper which were displayed at a Mtn Div.



• **OEM Joint Service Cum Training Camp.** To further strengthen the Indian Army-Industry partnership, ***Spear Eagles*** conducted a mega OEM service cum training camp in collaboration with Tata Motors Ltd and Ashok Leyland on 28 and 29 Jan 2021. The aim of this Camp was to share best maintenance practices between EME technicians and OEM reps and impart useful vehicle preventive maintenance advice to user units. OEM team conducted nine training sessions on various systems/ sub systems of vehicle and free service/ repair/ defect rectification.



## OPERATIONAL ACTIVITIES

- **Op Snow Leopard and Op Rinpoche-2020.**

***Soaring Eagles*** provided proactive, prompt, effective and responsive EME support to the formations participated in the ops. The unit ensured maximum vehicles and equipment availability in extreme winters in HAA. The unit also carried out the extensive validation of newly constructed op tracks. The efforts were highly appreciated by the users.



- **Helicopter Insertion of Repair Teams.**

***Sarvottam Eagles*** showcased its technical prowess by successfully validating several new repair concepts which include usage of Plastic Welding & BDAR kit by Foot Based Repair Teams and Heli insertion of customised repair teams at critical equipment centers.

• **AVRO Recovery at Dimapur Airport.** The team led by ***Spear Enablers*** provided the requisite assistance and recovery cover to an aircraft of the IAF stuck at Dimapur airport.



- **In-situ Repair to Engineer and Plant Equipment.**

***Sappers Eagles*** of EC is tasked for op track construction in Arunachal Pradesh. The detachments of the workshop are providing in-situ repair cover to the Engineer and Plant equipments of the formation.

- **Retrieval of Emergency Force Landing**

**Cheetah Hepter.** On 28 Dec 2020 a Cheetah hepter of an Army Avn Sqn was undertaking a flying task. On return leg from Op area, the hepter developed symptoms akin to engine failure during mid air flight at 17500 feet and the crew carried out successful emergency landing. The hepter was successfully retrieved from the landing site which involved complete dismantling alongwith critical components including engine assembly, fuel booster pump and engine oil cooler in serviceable state required for carrying out defect investigation. The mission involved a team consisting of an Offr, two technical supervisors and five technicians of **Tista Eagles**.



- **Recovery of MI-17 Hepter of IAF.** An MI-17 Hepter of IAF had crashed in North Sikkim area. The crash site is not connected by road and wreckage lying at the crash site was required to be recovered by heli lift. However, the 5 Ton hepter was in toppled position and had to be placed in upright position for the requisite lift. A team of one offr and four Opr & Dvrs (Rec) of **Striking Eagles** successfully carried out the arduous recovery task. The wreckage was air-lifted by a Chinook. The complete activity was carried out in 4 hrs.

### MISC ACTIVITIES

- **Establishment of Spear Sainik Institute.** **Spear Eagles**

**Eagles** was entrusted with the responsibility of establishment of Station Sainik Institute for recreation of JCOs/OR and families. The unit conceptualised and established state of the art model Sainik Institute with utmost precision which has brought lot of cheers to the JCOs/OR and families of the Stn. The Institute was inaugurated by Mrs Nisha Kalita, Zonal President AWWA on 01 Jan 21.



- **Welfare of ESMs/ Widows and Dependents.** The

**Spear Eagles** organised an interaction with ESM and widows including dependents as per its role of mother unit of eight districts of Nagaland. The event was a huge success wherein various policies and intructions were shared with the attendees and also actions were taken to resolve their issues. It was followed by tea and felicitation by Brig EME.



# CENTRAL COMMAND EME

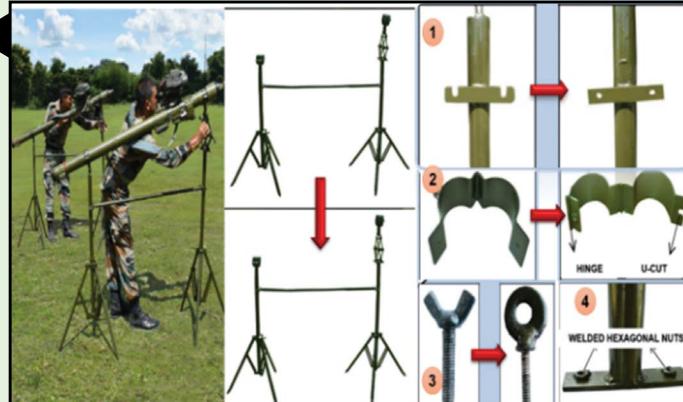


## OPERATIONAL ACTIVITIES

- In-house Fabrication of Nine Modified Thermal Imaging Sight Alignment Stands. *Ranvijeta Eagles*** has fabricated nine modified TI Sight Alignment Stands for IGLA Missile System. These stands are used for harmonisation of TI Sight and since the Op deployment of the parent unit is on varied axis, the requirement of TI sight alignment stand was operational imperative.



- ALS Based Modified Mobile Workshop Lorry.** Modified Mobile Workshop Lorry has been designed by ***Ranvijeta Eagles*** to cater for engineering support requirements in Tactical Battle Area during ops. The vehicle is based on ALS with added features to field FRTs suitably kitted with RTF kits in TBA during ops to provide intimate, in-situ repairs as far ahead as possible. The lorry has been provided with pneumatic tools, electrical test bench, battery tester, angle grinder, pipe cutting machine, portable welding plant and other diagnostic tools under field conditions where no electricity is available. The lorry has also been provided with bins and racks for carrying fast moving as well as bulk spares for B Vehs, tool boxes, SMTs/ STEs, administrative stores, mobilisation stores and ration.



- Heavy Recovery Support. *Para Eagles*** is providing heavy recovery support to Aerial Delivery Research and Development Establishment (ADRDE), Agra which is developing heavy drop platforms for Airborne ops. AV-15 of the unit is involved in validation of P-7 platforms recently developed. Unit has also provided both light and heavy recovery cover to US MTT, conducted by US Airborne troops and Army Airborne Training School, Agra (AATS) in which heavy drop from C-17 Globe Master and C-130J Hercules were successfully carried out.



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# SOUTHERN COMMAND EME



## OPERATIONAL ACTIVITIES

- Participation in AMPHEX-21.** AmpheX Ex-2021 was conducted at Kakinada Beach, Vishakhapatnam wef 05 Jan 2021 to 02 Feb 2021 for induction and de-induction of columns including Recovery on seashore. A strength of 01 Offr, 02 JCOs and 17 OR of **Bison Eagles** participated in the Ex.



- Intelligence & Surveillance Recce Ex. Trinetra** **Eagles** participated in the Ex which provided the unit an opportunity to mobilise major compliments with respect to equipment, men and material and to test the efficacy of engineering support plan on vintage HT-16 and new generation SUJAV/ LVBD/ LPJ EW systems.

## TRAINING ACTIVITIES

- Participation in Formation**

**Field Firing.** The technicians of the **Scorpion Eagles** participated in field firing wef 28 Jan to 10 Feb 2021 and provided close engineering support to all units. Newly posted Opr & Dvr (Rec) were given on the job training on carrying out various recovery activities during the field firing.



- NBC Over Pressure in AFVs. Scorpion** **Eagles** has successfully carried out in-situ serviceability check for development of NBC over pressure in all AFVs of a Mech Bde and 80% A Vehicles of the formation have been made capable of fighting NBC warfare.



- **OEM Training Cadre on Tata Safari Storme. Agnibaaz Eagles** conducted an online service camp for users and maintainers in Dec 2020 and also finalised an MoU with M/S Tata Motors for supply of spares for Tata Safari Storme.

## TECHNICAL ACTIVITIES

- **PSQR Trials of ARRV for MBT Arjun.** 2<sup>nd</sup> Ph PSQR Trials of ARV for MBT Arjun was conducted wef 01 Feb 2021 to 24 Feb 2021 at PFFR for which CO of **CZW of Konark Corps** was the OIC trials. The ARRV provides engineering support to mechanised formation and can be utilised for undertaking field and light repairs, periodic technical maintenance (TM) tasks, change of major assemblies and repair & recovery of damaged/disassembled MBT.



- **Integrated TI-ESSA an TIFCS Lab.** A state of the art, integrated TI-ESSA & TIFCS lab has been established at **Sudarshan Chakra Eagles** for the repair and testing facility for Thermal Sights of Tk T-90, Tk T-72 and ICV BMP-II. This will enable arresting of repairables with CZW.

## ACKNOWLEDGEMENT AND FEEDBACK FORM

Certified that I have received the Apr 2021 issue of EME Journal. My comments are :

Excellent

Good

Average

Poor

Design





Layout





Pictorials





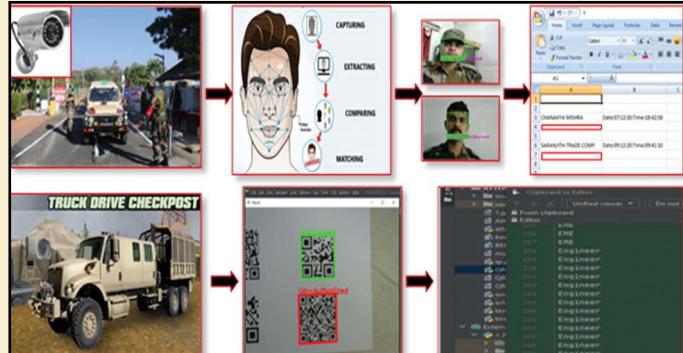
Articles





Any other suggestion/comment \_\_\_\_\_

**Fabrication of Electronic All Terrain Vehicle (e-ATV).** An e-ATV has been conceptualised, designed and fabricated by **Southern Comd Strike Sappers' Eagles** for silent ops in SC AOR. The novel e-ATV is powered by 4 KW BLDC motor deriving power from Li-ion battery. The sub assemblies are mounted on an indigenously fabricated frame utilising Chromium Molybdenum Steel Alloy providing high tensile strength to the vehicle keeping the overall weight in check. The e-ATV has been extensively tested for op tasks with capability to accommodate two soldiers with full battle load.



**Scout Masters Competition.** Inter Command Scout Master Competition was held wef 01 to 08 Feb 2021. CO, **Black Mace Eagles** headed the Technical Commission Video Referral Sys (VRS) and provided a dedicated team comprising of all trades for flawless engineering support during all five stages of the competition which was appreciated by Formation Cdr.



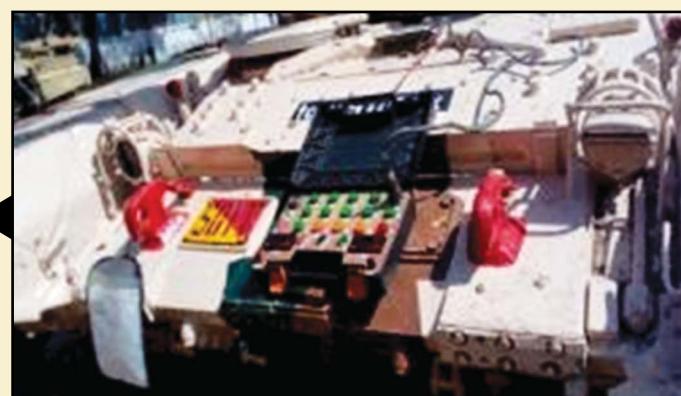
**Test Jig for Tk T-90.** A portable test jig for checking the starting and charging circuit of Tk T-90 has been developed in house by **Ahmednagar Eagles** which has major pay offs during the routine repairs of Tanks and MR.



- AI Based Face Recognition and Surveillance System.** **Shahbaaz Eagles** has developed an Artificial Intelligence (AI) based Face Recognition System. The system takes input from existing CCTV camera feed and authenticates/ authorises entry of vehicles using AI based algorithm.



- Underwater Extrication of Casualty.** Sep (Opr & Dvr Rec Mech) Sudheer Kumar of **Black Mace Eagles** showed tremendous courage and initiative while carrying out recovery ops of ICV BMP-II that had submerged during floatation run up to Scout Masters Competition. The recovery team acted swiftly and extricated the casualty from 25 ft deep water without any loss to life.

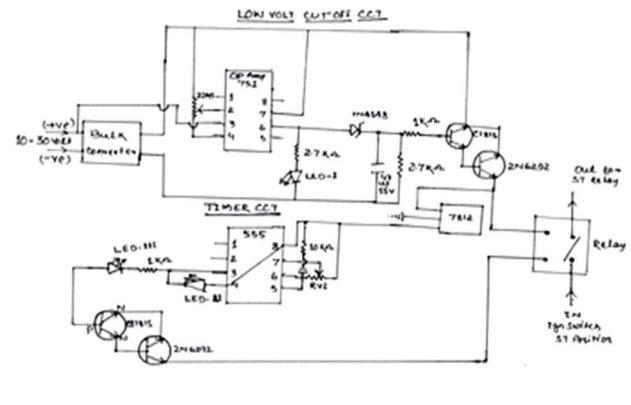


- Safety Device of Starter Motor for Tatra – 815**

**Veh.** An IC based timing circuit has been fabricated by **Trinetra Eagles** for TATRA-815 wherein the fitted circuit prevents the driver from engaging the self-starter beyond stipulated time thereby ensuring that the starter motor does not burn out.



**Sliding Canopy For HMVs.** The Idea and Innovation of “**SLIDING CANOPY FOR HMVs**” which was fabricated by **Scorpion Eagles** was selected from Southern Command for Idea & Innovation Competition 2020-21 at Army level, which was well appreciated by DCOAS (P&S).

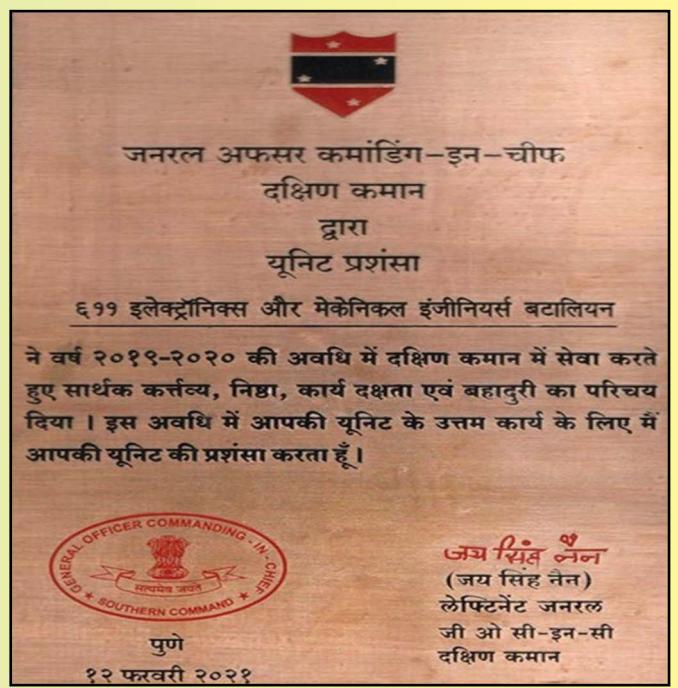


- Major Assembly Repair.** Major repair of faulty Boom assembly and winch reducer of ARV WZT-3 was successfully carried out by **Ahmednagar Eagles**.



- GO-C-in-C Southern Comd Unit Appreciation.**

**Golden Katar Eagles** was awarded GOC-in-C Southern Comd Unit Appreciation for the year 2020 for excellence in all spheres. Col Admuthe Shashikiran Bacchappa, CO **Golden Katar Eagles** and Sub Maj Rajesh Kumar Singh received the appreciation during investiture ceremony held on 12 Feb 2021.





# SOUTH WESTERN COMMAND EME



## TECHNICAL ACTIVITIES

- Night Daily Inspection of Chetak.** In order to facilitate launching of sortie at first light and before Ni flying, Ni Daily Inspection is carried out by technicians of a **Maint Flight unit**.



- In-situ Repair by HAL Team.** Team of various assemblies of hepters being repaired by HAL Team at respective bases to achieve op readiness.



- Wind Sensor Test Equipment for Tk T-90.** Wind sensor forms an integral part of Fire Control System of Tk T-90 and provides input signal to Ballistic Computer based on the cross wind velocity. This set of Test Equipment (TE) checks and ensure 'S' and calibrated functioning of wind sensor. At present only one set of TE is held in each Armd Div of IA. **DOT Eagles** studied the TE and fabricated six such sets, one each for the Armd Bdes of the formation. Wind sensor test equipment was adjudged as "Best in South Western Comd" amongst eight Idea & Innovations and was displayed at Army HQ. Sub Pushpendra Rana has been awarded on the spot GOC-in-C SWC Commendation card for the same.



- MGB & MRH Replacement.** Major servicing and component replacement of Chetak hepters are being carried out by technicians of **Maint Flight unit** alongwith major component replacement to maintain highest op readiness of hepters.



- Repair of AERV.** During an equipment regenerative drive, it was found that two AERVs were unserviceable since 2011 due to multiple defects. Technicians of **DOT Eagles** took this as a challenge and succeeded in making two AERVs fully functional.



- FCS Counter for TkT-90.** *DOT Eagles* had fielded FSC Counter (to record requisite life of various components of FCS) in Idea & Innovation competition 2020-21 and same got selected at Comd Level for demonstration at Army Level Competition. Before presenting it at Army Level, the field trials of innovation was carried out at MFFR with additional features of gauging life of ballistic computer.



- Dust Proof Repair Facility.** With an objective to ensure quality repairs to critical equipment, *Strike One Eagles* took on the mantle of establishing a dust proof room within existing resources. A state of the art Condition Based Repair infrastructure comprising of 2 Ton Gantry crane has been established. Requisite planning for further enhancing repair capabilities by provision of lapping machine and other suitable GPTEs are under progress.

- GOC-in-C, South Western Comd Unit Appreciation (2019-2020).** On the occasion of Army day 2021, *Ranbankura Eagles* has been awarded 'GOC-in-C, South Western Comd Unit Appreciation'. Col Shailendra Kumar Singh, Commanding Officer and Sub Maj Santosh Kumar received the Unit Citation. This is the first unit citation in the history of the unit since its raising in the year 1981.



## TRAINING ACTIVITIES



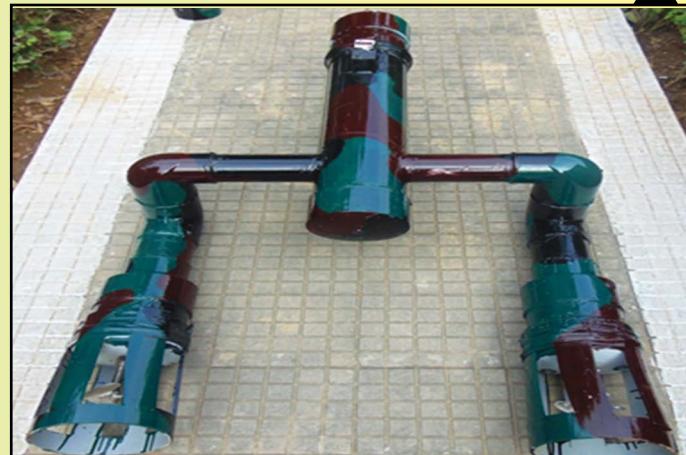
- **Ex Takniki Vishleshan.** To hone the skills of AVT (FR) and MCRT in TBA, an ex has been executed by **DOT Eagles** with an aim to make technicians, recovery oprs and junior leaders proficient in combat engineering support.



- **K-9 Vajra Induction and Validation.** 36 K-9 Vajra have been inducted in the formation and all have completed their firing to include conversion/ practice firings successfully with support of **DOT Eagles** and LRWs.



- **Obstacle Crossing Expedient.** The Obstacle Crossing Expedient to facilitate crossing by troops under full battle load across the water obstacle during Br H Ops with surety, speed, stealth, surprise and with less reliance on swimming skills has been innovated by **Red Eagles**. It was shortlisted from South Western Comd and was displayed to the COAS on 12 Jan 2021.



- **Under Water Recovery Training.** **DOT Eagles** is progressively enhancing its capabilities for underwater Recovery Ops and training for the same is being undertaken in a phased manner. Individuals trained at Indian Naval Diving School, INS Vendurthy, Kochi are posted to the unit and recently, underwater Recovery Ex was conducted by this unit.



- **Training Facility to Replicate Repair and Recovery in TBA.** To improve technical proficiency in planning and executing EME drills, procedures, repair and recovery techniques of AVT (LR), AVT (FR) and MCRT in TBA, training facility has been conceptualised in the form of sand model to conduct SMDs & TEWTs by **DOT Eagles**.

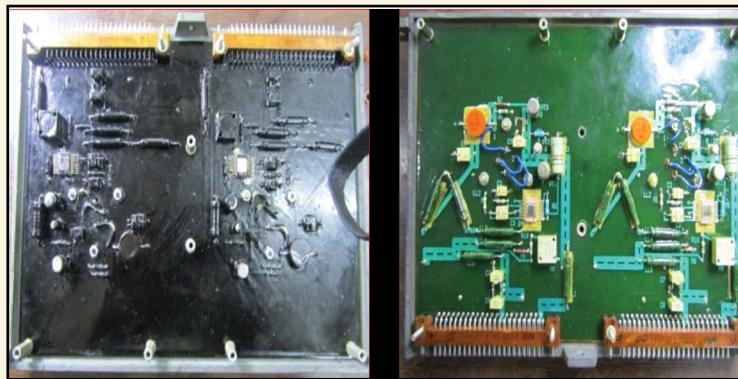


# WESTERN COMMAND EME



## TECHNICAL ACTIVITIES

- 3D Print Handle: 84 mm RL Mk-III.** Carrying handles of seven Swedish origin 84mm RL held with Infantry got damaged over a period of time and were not forthcoming ex Gun Shell Factory, Cassipore, WB since Jan 2020. As an alternative, a 3D printed handle has been fabricated by **Charging Ram Eagles** to replace the damaged carrying handle. The cost of fabrication per handle is Rs 2,300/- ex trade and a one time cost for designing the piece (Skill charges) is Rs10,000/-.



- Repairs to SMERCH Weapon System.** A **Rocket Regt** of Western Comd took the initiative to address long outstanding repairs of critical defect in SMERCH Weapon System. With no ESP ex OEM and very limited ToT, the workshop pro-actively took the repair of Electronic Control Unit (ECU) of the transmission systems, component level repair to H-Console and electronic cards of Control & Measuring Equipment (CME) of SMERCH ammunition.



- Repair of Pump Stab Motor of OSA-AK.** The pump stab motor of 02 x OSA-AK Weapon System held in Kharga Corps have been EOA since 2013. **CZW of Kharga Corps** attempted repairs and after repeated trials, one of the motor has been made functional. Efforts are underway to attempt repair to the other defective equipment.

- Modification of ICV BMP-I into AVT (LR).** **CZW of Kharga Corps** undertook the task of modification of ICV BMP-I into AVT (LR) for enhancing the repair capability of Combat Team (CT). Internal modification of the BMP was undertaken for fixing the crane and allied accessories. The modification has been validated by trials for all the functions.



- Air Transportation of MUA of Tk T-72.** To achieve quick regeneration of 'A' Vehicle casualty in TBA, air transportation of MUA for Tk T-72 was carried out by **Golden Arrow Eagles** during Op KAMYAB of an Infantry Div, wherein track links were transported by hepter to casualty location and further collected and repaired by AVT (FR).



- Fitment of 'A' Veh MUA in Field.** The capability of AVT (FR) in utilising available RTF and war kits pack of spares for effective close engg support was validated wherein they carried out repairs and fitment of Tk T-72, barrel fitment of 'I' Tk and in-situ repairs of engine and transmission system of Tk T-72.



• **Advanced Land Navigation System (ALNS) in Tk T-72.** CIH Regt which is under the load of **Charging Ram Eagles** since Nov 19, was due for fitment of 09 ALNS since 2008 due to non availability of Test Jigs and trained manpower. A dedicated team of 1 Offr, 02 JCOs and 05 OR was nominated for the task. The team worked relentlessly and carried out no of trials for the fitment and finally achieved breakthrough even without any technical expertise on the subject.



- Fitment of 'A' Vehicle Engine Assembly.** One engine assembly of Tk T-72 of an armd regiment and one engine assembly of Tk T-55 held with infantry regiment were fitted by **Golden Arrow Eagles** and the 'A'Vehs were made mission ready.



- Recovery Ops.** Two recovery ops were undertaken by **Golden Arrow Eagles** during Op KAMYAB, where side turned ALS was recovered towed and repaired within 72 hrs of accident. Another recovery of overturned 2.5 Ton which resulted in Fatal Casualty, the vehicle was successfully extricated and recovered back to workshop for repairs.

## OPERATIONAL ACTIVITIES

- Engineering Support to ETF.** *Lucky O Seven Eagles* and **Fd Wksp (Engr Bde) of WC** provided close engineering support to ETF ex formations being deployed along the LAC for engineer task in HAA. The EME persons have been closely integrated with ETF for the complete palletisation of critical plant and earth moving equipment and later reassembling in HAA where no road exist.



- Repairs in Hours of Darkness.** *Independent Armd Wksp* of Western Comd carried out validation of fitment of 01 Barrel and 02 Engines of Tk T-72. Overall timing achieved by AVT (FR) for fitment of engine assembly was 22 hrs per engine and 38 hrs for barrel fitment including adm break.

### ISO 9001: 2015 CERTIFICATION

**Charging Ram Eagles** has been conferred with ISO 9001: 2015 certification on 06 Jul 2020 for achieving utmost user satisfaction. The unit has effectively demonstrated consistency in providing services that meet the user requirements. ISO audit team gauged the unit as per the Quality Management System (QMS) parameters. During the course of Audit, following was demonstrated to certification body:-

- A presentation covering overview of the unit without disclosing any Op information.
- Emphasis on Services offered (types of repairs) and Supply Chain management.
- Technical Qualification of posted manpower. (Diploma Holders and Technical grades)
- Interaction with user reps with respect to the satisfaction level achieved.
- KPIs viz MTTR, MTBF etc highlighted and procedures for post repair support is explained.
- Display of Plant, Machy and Modern Technology equipment available in the workshops.

### Fringe Benefits of ISO Certification.

- Assists an EME Wksp to keep pace with best practices followed in civil industries.
- Presents an independent view on current procedures being followed.
- Globally acclaimed certification.
- Improvement in maintaining required data for KPIs.
- Eff engagement of tech in repair activities.



## TRAINING ACTIVITIES

- **Interactive Forum (IF) on Repair and Maintenance of Communication Equipment.** Corps level IF on Repair and Maintenance of Communication Equipment was conducted by **Golden Arrow Eagles** wef 28-30 Jan 21. A strength of 01 JCO and 09 OR attended the cadre. The IF aimed at optimised repairs at all levels of Field Workshops, RegREM and CentREM. In-situ checks and repairs at Infantry units were instituted in the IF to provide increased confidence and practical field exposure to trainees.



- **EX AAROHAN XXII.** Being part of Rapid Fmn, **Charging Ram Eagles** is responsible for setup of OCCO for the formation. In view of this, this Bn regularly conducts OCCO cadre to train all the elements from various units. A cadre on the sub was conducted with a view to train pers in various nuances of deployment of dets of OCCO and practice of induction of veh through an obstacle system both in day and night.



- **Div Level Cadre on Recovery Activity.** A Div level cadre on Recovery Activity, Self Recovery Techniques and Serviceability Check of ALS LRV was conducted by **Golden Arrow Eagles** wef 05-07 Oct 2020. The cadre is organised to refresh the knowledge of Dvr & Opr (Rec).



### IDEA & INNOVATION

An algorithm developed by Lt Col AV Singh of **Sharp Shooter Eagles** on '**AI (Fuzzy Logic) Based Target Identification System for BFSR**' was displayed to COAS during Army Day. The Algorithm has been developed on a laptop which uses Doppler audio signal samples of real time enemy targets.

The innovation was appreciated by COAS and Certificate of Merit was awarded to Lt Col AV Singh, Innovator by COAS.





# NORTHERN COMMAND EME



## OPERATIONAL ACTIVITIES

- Critical In-situ Repair.** Critical in-situ Dozer repair was carried out by technicians of **Sub Zero Eagles** at forward locations under harsh weather conditions.



- Critical Engineering Support.** Critical Engineering Support in Fitment of Engine assembly of ALH at forward location has been provided by **Dah Eagles**.



- Op Snow Leopard.** **Highest Armd Wksp** got the opportunity to prove its mettle during the ongoing 'Op Snow Leopard' in Eastern Ladakh. The unit meticulously planned and successfully provided combat engineering support to the Armd formation having 3 Armd Regiments and 3 Mechanised Units. The unit was instrumental in prompt CFR of AFVs and swift induction of desired combat force at the point of decision before the arrival of enemy at the LAC. The expeditious and bold action by the unit not only increased the strength of own AFVs in the face of adversary but also boosted the morale and confidence of own Infantry and CG commanders. This ensured the occupation of dominating heights with augmented strength within the time plan.



- Overhaul of Snow Mobile.** In-situ overhaul of Snow Mobile engine carried out by **Siachin Eagles** at forward location.



- Critical Repair in Op Snow Leopard.** EME Bn (**Chinar Eagles**) of **Chinar Corps** carried out critical repair of Armament equipment in Op Snow Leopard.



## OPERATIONAL ACTIVITIES

- **Aerial Cableway Repair.** Repair task of Aerial cableway of an infantry unit was undertaken by **Sub Zero Eagles** for winter cut off post on 05 Jan 2021.



- **In-situ Repair at EW Dets.** **EW Eagles** of Northern Comd carried out repair of equipment of forward EW dets during Op Snow Leopard.



- **Repair of EW Jammer.** **EW Eagles** of Northern Comd carried out repair of critical Electronic Warfare Jammer Equipment LPJ 500W at in Op Snow Leopard.



- **Recovery Support for Cheetah.** Recovery support for mounting of Rotor assembly of Cheetah hepter has been provided by **Sub Zero Eagles**.



- **ARV Engine Fitment at HAA.** Critical engine assembly fitment of ARV at 18000 ft was carried out by **Dah Eagles**.



- **Engineering Support to ARV.** EME Bn (**Chinar Eagles**) of **Chinar Corps** provided engineering support to ARV along the induction route during Op Snow Leopard.

## TECHNICAL ACTIVITIES

- **Repair of Runway Repair Equipment of IAF.** CZW (**Chinar Eagles**) of **Chinar Corps** repaired two Runway Repair Machines of the IAF in record time. The equipment is of 1990 vintage and were lying off road for years



- **Accommodating RRS Shelter of HT-16 on TATA 2.5 Ton chassis.** **EW Eagles** of Northern Comd carried out shifting of RRS Shelter of HT-16 on TATA 2.5 Ton chassis for deployment of vehicle as EW Shelter for New Generation Equipment.



- **Op Sadbhavana.** Under the project 'Op Sadbhavana' **Highest Armd Wksp** distributed 200 Hygiene & Sanitation kit among the local population. Wksp has always played a pivotal role in technical training and assistance to the locals.



- **Repair of EOA Radar.** USFM Radar was made serviceable after 8 years by proactive approach of **Sky Shooter Eagles**.



- **Op Oriented Innovations.** Offrs of CZW (**Chinar Eagles**) of **Chinar Corps** participated in Chinar Corps Idea and Innovations competition and were awarded for 'AI based Change Detection System' and 'IED Simulator'.





- **Online IF on ECM Jammer Mk-II.** CZW (**Chinar Eagles**) of **Chinar Corps** conducted first online IF on ECM Jx Mk-II.



- **In-Situ Repair of Medical Equipment.** 81 different types of medical equipment have been repaired in-situ by EME Bn (**Chinar Eagles**) of **Chinar Corps**.



- **First Field Level Maintenance Training: TARANG SHAKTI.** First FLM training by OEM on newly inducted LIC II EW System (TARANG SHAKTI) for EME Technicians from all over India for 08 Weeks was conducted wef 01 Dec 20 to 23 Jan 21 at **EW Eagles** of Northern Comd.

## GOC-in-C Northern Command Unit Appreciation

- **Dah Eagles** was awarded the coveted GOC-in-C Northern Command Unit Appreciation on 27 Feb 2021. Lt Gen Yogesh Kumar Joshi, UYSM, AVSM, VrC, SM, GOC-in-C, Northern Command awarded GOC-in-C Unit Appreciation to Col Rupender Malhotra and Sub Maj B Nandi at Udhampur.





# ANDAMAN & NICOBAR COMMAND (ANC) EME



## TECHNICAL ACTIVITIES

- Engineering Support During Amphibious Ex.**

Repair and Recovery support was provided in a tri-services environment by **Amphibious Eagles** during Annual Ex in the month of Jan 21. Technicians of the workshop provided engineering support in the Amphibian Demo by Tri Services Comd during the visit of Honorable President of India from 24 Feb 2021 to 28 Feb 2021.



- Visit of CINCAN.** Lt Gen Manoj Pande, AVSM, VSM, Commander-In-Chief, Andaman & Nicobar Comd vis the **Amphibious Eagles** and witness the 'Life Enhancement of BMP-II'.

**CINCAN Commendation Card.** For relentless technical support to units under ANC, 02 OR of **Amphibious Eagles** were awarded with CINCAN Commendation card as appreciation to their efforts:-

- Hav Girish Kumar J (Auto Tech Engg Eqpt)
- Cfn Rahul (Auto Tech A Veh)
- Amphibious Eagles** has been nominated as Nodal workshop in Andaman & Nicobar Command for R4 repair of Small Arms.

## UPDATE ON EHL

EHL is being improved to act as a knowledge portal to enhance the technical threshold of all ranks on latest trends in technology and futuristic advancements in technological domains. All Offrs, JCOs and OR are requested to create individual login ID on EHL for accessing the knowledge online facility.

For more details contact - Col Srikant, SE (NSC) - 36516.

# SPORTS AND ADVENTURE

- 24 Hrs Bengaluru Stadium Run 2021.** Cfn Geeno Antony of 1 EME Centre participated in the 24 hrs Bengaluru Stadium Run 2021 wef 23 to 24 Jan 2021 held at Jayaprakash Narayana Rashtriya Yuva Kendra, Yehlanka, Bengaluru, Karnataka and secured second position in the male category (219.6 Km in 24 Hrs).



- Open Navy Windsurfing Championship 2021.**

Open Navy Windsurfing Championship 2021 was held at Naval Jetty, Chicalim, Goa wef 27 to 31 Jan 2021 under the aegis of Indian Naval Sailing Association and Yachting Association of India. One Coach and four players of Corps of EME Sailing Team participated in the event and their achievements are as follows:-

Ser No	Army No	Name	Class	Medal
(a)	17043764L	Sep Saurabh Kumar	Race Board Men	Gold
(b)	17043281N	Sep Tenka Madhu		
(c)	17019004K	Sep Islam Kathat	BIC Nova, Men	Silver
(d)	17043596X	Sep Jogendra Thakur		



- Cologne Boxing World Cup.** Sub Mohd Hussamuddin represented Indian Team in Cologne Boxing World Cup, held in Germany from 17 to 20 Dec 2020 and secured Bronze medal in 57 Kg Wt Category.



- Wrestling.** Senior Wrestling World Cup 2020 was held at Serbia (Belgrade) wef 12-18 Dec 2020. Hav Arjun Halakurki of Corps of EME Wrestling Team represented India in the championship.

- 65th Senior National Wrestling Championship**

**2020-21.** 65th Senior National Wrestling Championship 2020-21 was held at Jalandhar wef 20-21 Feb 2021. One Coach and three players of Corps of EME participated as part of Services Team during the championship and their achievements are as follows:-

Ser No	Participant	Wt Cat	Event Cat	Achievement
(a)	Hav Arjun Halakurki	55 Kg	Greco Roman	Gold Medal
(b)	Hav Md Rafiq Holi	77 Kg		Silver Medal
(c)	Hav M Taibanganba	63 Kg		Bronze Medal



**• Sky Diving Display.** A display of Military Band, Horse Show and Sky Diving was organised for all ranks and families in Sukna Military Station. Col Balasubrahmanya RA, Col EME, HQ 33 Corps participated in Sky Diving and completed his 160<sup>th</sup> para jump which include 101 sky dives during the event. The officer has achieved the rare distinction of having the maximum No of Para Jumps in the Corps of EME to his credit.



- 64th Inter Services Weightlifting Championship**

**2020-21.** 64th Inter Services Weightlifting Championship 2020-21 was held at ASI, Pune wef 21-24 Feb 2021. Two players of Corps of EME participated as members of Army Red Team in the championship and their achievements are as follows:-

Ser No	Participant	Wt Cat	Achievement
(a)	Hav Jagdish Vishwakarma	96 Kg	Gold Medal
(b)	Sep Piyush Singh	77 Kg	Bronze Medal



**• TUFFMAN 24 Hrs Stadium Run.** Lt Col Swaroop Singh Kuntal of 3 EME Centre participated in 24 hours Tuffman Stadium Run at Chandigarh on 13-14 Mar 2021. By running continuously for 24 hr and completing 191.3 km, Lt Col Swaroop Singh Kuntal has proved his mental toughness, physical fitness and ultimate human endurance. In the past, the EME officer has won several triathlons and ultra-marathons. In Oct 2019, he became the fastest Indian in Ironman Malaysia and in Nov 2019, he won Ultraman India.

# DESPATCH FROM JCOS/OR

## BEWARE OF WHAT YOU SHARE (SOCIAL MEDIA PAGES)

**Nb Sub Kuldeep Singh**

Today's era of Facebook, Twitter and other social media are great for keeping in touch with your friends and knowing about the latest trends and update but it isn't always wise to post or share everything you think others would be interested in.

On our personal social media pages, we may find no harm in posting the occasional rant about a professor, fellow student, or a co-worker that's ticking you off. After all, it's our page and we have a constitutional right to freedom of expression. What we do on our page is our free choice and no one can tell us what to say or not to say. But, with freedom comes responsibility and if we will not be careful, the things we publish can have serious consequences on our society. In recent years, irresponsible postings on social media have got people fired from jobs, expelled from educational institutes, used in courts, and even jailed. Thus, before sharing information online, always consider what we are sharing and who we want to share the information with.

On an even more sinister level, sharing certain types of information on social media can also expose you to frightening dangers, such as burglary, identity theft, stalking, rape and even murder.

So does this mean we should abandon social media completely and never post anything on the Internet again? No, it simply means that we should remain more responsible and vigilant about the dangers and threats associated with social media sharing. Certain points that should be kept in mind while using social media are listed below :-

- **Privacy Setting.** When creating a profile, first priority should be to adjust our privacy settings. Make sure that our posts are only visible to our intended friends and groups. If you add details to your profile, keep them hidden to strangers so that they cannot be used as clues for our private account passwords. We should review our privacy setting periodically.

- **Be Skeptical.** If someone is offering a lucrative

offer i.e money, smart phone or new car, it is almost certainly a trap. Verify the authenticity of the offer before providing any details.

- **Avoid Strangers.** If a good looking guy or girl has just sent a message, do check if you know him/her or is it someone you have never seen before in real life. Cyberspace provides malicious actors with both anonymity and camouflage, which allows to manipulate victims. Stay on the safe side, limit who can contact you and if possible interact only with people you know personally.

Certain guidelines that can protect us against harm when sharing posts online are listed below :-

- **Golden Rule.** If you are not comfortable having the whole world knowing about something, do not post it. Regardless of our privacy settings, some people may still be able to access the content you have restricted.
- **Remember Everything is Permanent.** Once we post something, consider it as permanently published. Even if we delete it soon after, it will be stored in cache memory somewhere and be saved by others.
- **Cautions of Predators.** Do not post revealing photos, updates or content that would make us a target of sexual predators and other criminals. Never share information that could endanger our possessions such as details of our physical locations, our daily schedule and dates when we will be going on holidays and what security precautions we are taking.
- **Avoid Sharing Sensitive Information.** Never reveal sensitive information regarding our finances or banking. Do not share the passwords we use or info that could give clues to our passwords i.e. Pet's name, date of birth etc. Never betray the confidentiality of others whether they entrust information to you, or if you are having conflict with them.

- Checking In.** By "Checking In" to some place, we give away our location. But sharing our location with a GPS enabled service in real time enables anyone following us on social media to recognise that we are away from home and estimate the time it will take us to complete our visit.

- Revealing Images.** While many people consider photos a fun to share and connect with friends but posting certain photos can be dangerous. For instance, much like statues, vacation photos alert thieves that we are not home. Lastly, some people post photos of official documents to celebrate a milestone. Beware that marriage license, student loans and mortgage completions contain sensitive information that we can be used for identity theft.

- Accepting Request.** Be careful about accepting friend or follow requests from people you do not know very well or even at all. Fraudsters can bypass the privacy setting and other contents as a friend and follower.

## Conclusion

Social media is both boon and bane. It has a wide spectrum of the reasons for our usage. Some use it to find their out of communication friends while some may use it to steal identities and sensitive information. With the advent of technology it shall be criminal not to utilise the gift of science by the fear of all the wrong things that may happen by using social media. What is required is to be cautious in the way we use social media and rest in going to be fine. So next time we are posting something to our social media profile, first consider whether it is really worth sharing or not.



Nb Sub Kuldeep Singh is Master Tech Opto Technician and presently posted in a Corps EME Bn. The JCO got enrolled into the Corps of EME in 2001 and became JCO in Feb 2021. The JCO specialises in Medical equipment and had a tenure in Kazakhstan

## IN THE LOVING MEMORY OF LATE LT GEN YV RADHADAKRISHNA, AVSM

Lt Gen YV Radhakrishna, AVSM (Retd) was born on 25 Dec 1931 in Yetkur near Guntur. He did his graduation in Electrical Engineering from Annamalai University and subsequently joined Banaras Hindu University as a lecturer in Electrical Engineering.

He joined the 6<sup>th</sup> Technical Graduates Course in 1952 in IMA and was commissioned on 07 Jun 1953, with seniority of Jun 1952. Later Gen Radhakrishna specialised in Armament Engineering and did a Armament course in the USSR in 1965.



During his career spanning over 36 years in the Army, the General had served in a number of instructional, staff and command appointments. He had served as an instructor in EME School in 1966. He commanded a workshop in the Valley in 19 Inf Div in 1968, raised and commanded a Corps EME Bn in Eastern Command in 1973. He also commanded the Apprentice Training School in Bhopal in 1978. As a Brig, he commanded 3 ABW in Northern Command in 1981. His last command was as Comdt MCEME from 1988 till Dec 1989. The General Officer also served in a number of staff appointments within and outside the Corps. He served as President SSB in Bhopal in 1979. As Brig, he served in the AGs Branch, as Maj Gen he was ADGEME twice, once in 1985 and the second time in 1987. He also had the honour of being selected for the rank of Lt Gen in the Staff Stream in 1987. He was awarded the AVSM in 1987. He was Col Comdt of the Corps of EME from 1986 onwards. That was a role very close to his heart and he was famous in the Corps for his empathy and focus on welfare.

The General Officer headed a study on overhaul policy of A Vehs in 1986 which is still being followed in the Army and called the Radhakrishna Committee study report.

Post retirement the General was active in politics for a short period and was Vice President of BJP, Andhra Pradesh in the early 1990s. A keen educationist, he served on the board of directors of Bhartiya Vidya Bhavan for a long time. He was well known in Secunderabad for his varied welfare activities which he spear headed to help retired servicemen and their widows.

The General took his last breath on 10 Dec 2020 and is survived by his wife, Mrs Premila Radhakrishna, daughter Tara Radhakrishna, a doctor in USA, Sons Brig YVR Vijay, an EME Officer and Dr YVS Sanjay, a doctor in USA.

# FAREWELL TO ARMS

**The following Officers proceeded on retirement**

Jan 2021

S.No	Army No	Rank	Name	Unit
1	IC-46645	Col	Sanjay Kumar Dubey	509 ABW
2	IC-48862	Col	Jeetendra Singh	67 UP BN NCC Lucknow
3	IC-60464	Lt Col	SK Sharma	628 EME BN
4	IC-60021	Lt Col	Chitta Ranjan Sahoo	1 Armd Div
5	IC-56118	Lt Col	Medepalli Sudhakar	Mag No 4
6	IC-55942	Lt Col	Prashant Negi	164 Inf Bn (TA)
7	IC-71813	Maj	Nitish Kumar Singh	21 CZW

Feb 2021

S.No	Army No	Rank	Name	Unit
1	IC-48461	Brig	SB Kodaru	CQA (HV), Avadi
2	IC-46057	Col	Suresh Kumar	HQ 11 Corps
3	IC-47319	Col	BS Bisht	HQ BWG
4	IC-48242	Col	Ravi Deep Singh	1 Punjab NCC Bn
5	IC-48392	Col(TS)	Mahendra Prasad	33 Corps

Mar 2021

S.No	Army No	Rank	Name	Unit
1	IC-46830	Col	BC Pandey	SQAE, Jabalpur
2	IC-50703	Col	Baljinder Singh	HQ DRDO, New Delhi
3	IC-54578	Col	Rajeev Ranjan Lohani	Dte Gen of EME (Trg)
4	IC-60060	Lt Col	Harshinder Thakur	164 (I) FWC
5	IC-60408	Lt Col	Amit Jakhar	MILIT, Pune
6	SS-44116	Maj	P Roshnirama	HQ IGAR (East)

## LAST POST

IC-04239 Padma Shri Maj Gen Som Nath Bhaskar, PVSM (Retd) has passed away on 07 Jan 2021. The present address of Mr Kamal Bhaskar (Son) is as follows:-Mr Kamal Bhaskar, Flat No. 208, 2nd Floor AK Enclave, Road No.3 Banjara Hills, Hyderabad, Telangana-500034.

IC-13900 Maj Gen Bhoop Singh Rathee, VSM (Retd) has passed away on 05 Feb 2021. The present address of Mrs Asha Rathee (Wife) is as follows:- Mrs Asha Rathee, 340A, SHVP Colony, Sector-15, Panchkula (HR)-131113.

IC-19346 Brig Surinder Singh (Retd) has passed away on 16 Feb 2021. The present address of Mrs Satinder Kaur (Wife) is as follows:- Mrs Satinder Kaur, 2135, Phase VII, Mohali, Punjab-160059.

IC-05908 Col Satya Pal Verma Malik (Retd) has passed away on 22 Jan 2021. The present address of Mr Sunil Malik (Son) is as follows:- Mr Sunil Malik, 598, Sector-29 Noida (UP)-201303.

IC-13245 Col Prakash Somji (Retd) has passed away on 10 Jan 2021. The present address of Mrs Geeta Somji (Wife) is as follows:- Mrs Geeta Somji, B-301, Sunshree Emerald, NIBM Road, Pune, Maharashtra-411048.

IC-22947 Col VP Shrinivasan (Retd) has passed away on 22 Mar 2021. The present address of Dr Anupama Shrinivasan (Daughter) is as follows:- Dr Anupama Shrinivasan, Plot – B4, Asha Officers Colony, RK Puram, Secunderabad – 500056.

IC-30321 Col Mahesh Chand (Retd) has passed away on 17 Feb 2021. The present address of Mrs Nilu Chand (Wife) is as follows:- Mrs Nilu Chand, 36, Comfort Green, Neori By Pass Road, Near New Jail, Bhopal (MP)-462038.

IC-30606 Col Pritam Singh Jamwal (Retd) has passed away on 17 Jan 2021. The present address of Mrs Sneh Jamwal (Wife) is as follows:- Mrs Sneh Jamwal, Girah Slathian, Mandi Udh, Jammu-181141.

IC-49406 Col Surya Kant Panda (Retd) has passed away on 09 Jan 2021. The present address of Mrs Rina Panda (Wife) is as follows:- Mrs Rina Panda, Flat No. 804, Sector-121, Noida, UP-201301.

IC-06576 Lt Col Ram Dev Khattar (Retd) has passed away on 10 Feb 2021. The present address of Col Sharad Khattar (Retd) (Son) is as follows:- Col Sharad Khattar, G-106, Som Vihar Apartments, RK Puram, New Delhi-110022.

IC-07934 Lt Col Pachuveetil Balagopalan (Retd) has passed away on 20 Feb 2021. The present address of Mrs Shantha Kumari Balagopalan (Wife) is as follows:- Mrs Shantha Kumari Balagopalan, G-25-0801, Sandeep Vihar, AWHO, Kannamangala, Bangalore-560067.

IC-29316 Lt Col Arjun Singh Shekhawat (Retd) has passed away on 13 Feb 2021. The present address of Mrs Sushil Shekhawat (Wife) is as follows:- Mrs Sushil Shekhawat, 28, Veer Vihar, Queens Road, Jaipur-302021.

IC-14960 Maj Ahmed Abdul Basith (Retd) has passed away on 08 Feb 2021. The present address of Mrs Kalyani Basith (Wife) is as follows:- Mrs Kalyani Basith, 1008, Wintergreen Lane, Darien II, 60561, USA.

IC-29147 Maj Hanumantha Rao Malladi (Retd) has passed away on 16 Jan 2021. The present address of Mrs Laksmi Malladi (Wife) is as follows:- Mrs Laksmi Malladi, E-202, Patel's Green Park, Yaprak, Secunderabad, Telangana-500087.

EC-53686 Capt Balwant Singh Ruprai (Retd) has passed away on 14 Jan 2021. The present address of Mrs Swaran Kaur (Wife) is as follows:- Mrs Swaran Kaur, Flat No E-201, Ranjit Vihar-2, Plot No 16, Sector-23, Dwarka, New Delhi-110077.

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**Our Tele No : 8328118023 (WhatsApp facility available)**

## JCOs / Other Rank

S.No	Army No	Rank	Trade	Name	Date of Demise	NoK
1	14677029W	Nk	Auto Tech (B Veh)	D A K Mansukh Lal	19 Oct 2020	Smt Saroj Devi (Wife)
2	17035341H	Cfn	Auto Elect (A Veh)	Santhosh Mahadev Mali	09 Dec 2020	Smt Indumati (Mother)
3	14637678Y	Hav	Armt Tech (AFV/AD)	Mukesh Kumar	13 Dec 2020	Smt Anita Patel (Wife)
4	14629110L	Hav	Auto Tech (B Veh)	Bijay Kumar	16 Dec 2020	Smt Chandrita (Wife)
5	14643107W	Nk	Armt Tech (Fd)	Davinder Singh	18 Dec 2020	Smt Jyoti (Wife)
6	JC-758547A	Sub Maj (Hony Lt)	M Tech (SA)	Tentu Satyam	18 Dec 2020	Smt T Lakshmi (Wife)
7	14685164Y	Hav	Opr & Dvr (Rec)	Chaudhary Sandeep Kumar BS	20 Dec 2020	Ssmt Renu Chaudhary (Wife)
8	JC-774793P	Nb Sub	M Tech Gun	Prathap Chandra Pradhan	21 Dec 2020	Smt Ranju Latha P (Wife)
9	JC-768452N	Sub	M Tech (A Veh)	Hari Singh Yadav	25 Dec 2020	Smt Papita Devi Yadav (Wife)
10	JC-761336H	Sub	M Tech (Gun)	Arun Ojha	28 Dec 2020	Smt Guriya Ojha (Wife)
11	14681075H	Hav	Opr & Dvr (Rec)	Manjeet Singh	29 Dec 2020	Smt Gurpreet Kaur (Wife)
12	14662469M	Nk	Auto Tech (B Veh)	Shailendra Kumar Pal	01 Jan 2021	Smt Anju Devi (Wife)
13	17041319N	Cfn	Auto Tech (A Veh)	Sandeep	02 Jan 2021	Smt Kamlesh Devi (Mother)
14	JC-772541K	Nb Sub	M Tech (Commn)	Arun Jyoti Biswas	04 Jan 2021	Smt Moumita Biswas (Wife)
15	JC-768737A	Sub	Auto Tech (A Veh)	Pratap Singh	09 Jan 2021	Smt Saroj Singh (Wife)
16	17035510Y	Cfn	Refg Tech	Mohit Kumar	13 Jan 2021	Smt Neelam (Wife)
17	17040361A	Cfn	Tech (SA)	D Motilal	15 Jan 2021	Smt Jamili Bai (Mother)
18	17001378X	Cfn	Auto Tech (A Veh)	Dinesh Verma	19 Jan 2021	Smt Asha Rani (Mother)
19	14655104P	Hav	Auto Elect(B Veh)	Srikant Pandey	22 Jan 2021	Smt Vedna Pandey (Wife)
20	14637804A	Hav	Auto Tech (B Veh)	Prasanta Kumar	23 Jan 2021	Smt Sabika Roy (Wife)
21	JC-776216F	Sub	SKT	Shahukara Srinivasa Rao	01 Feb 2021	Smt S Padmavathi (Wife)
22	14648724H	Nk	Dvr (MT)	Damodar Tomar	05 Feb 2021	Smt Maya Devi (Wife)
23	17031444K	Cfn	Auto Tech (B Veh)	Praveen Kumar Mishra	12 Feb 2021	Shri A K Mishra (Father)
24	14652277F	Hav	Tech (Commn)	Ashutosh Kumar Singh	13 Feb 2021	Smt Pratima Singh (Wife)
25	14669200P	Nk	Auto Tech (B Veh)	Chandrarrao Pandranki	14 Feb 2021	Smt P Sudha Rani (Wife)
26	JC-763190Y	Sub Maj	M Tech (Commn)	Mohammad Anavar Khan	17 Feb 2021	Smt Shama Khan (Wife)
27	17008035K	Sep	Opr & Dvr (Rec)	Sasankha Sekhar Samal	19 Feb 2021	Smt Sashimita Samal (Wife)
28	17035927Y	Sep	Dvr (MT)	Polukanti Sivagangadhar	19 Feb 2021	Shri Polukanti Ramudu (Father)
29	14656021W	Hav	Armt Tech	Puneet Kumar	23 Feb 2021	Smt Rekha Rani
30	14630436N	Hav	Auto Tech (B Veh)	Dharmanand Tiwari	07 Mar 2021	Smt Manju Tiwari
31	14645149F	Hav	Tech Commn	Surendra Kushwaha	13 Mar 2021	Smt Geetanjali Kushwaha

# HONOURS AND AWARDS

S.No.	Rank & Name
<b>Param Vishisht Seva Medal</b>	
1	Lt Gen Sanjay Verma, AVSM, VSM** (Retd)
<b>Ati Vishisht Seva Medal</b>	
1	Lt Gen Tirtala Subramanian Anantha Narayanan
2	Maj Gen Bhanu Pratap Singh
<b>Sena Medal (Gallantry)</b>	
1	Maj Vigneshwer RK
<b>Bar to Vishisht Seva Medal</b>	
1	Brig Sandeep Chaudhary, VSM
<b>Vishisht Seva Medal</b>	
1	Maj Gen Neeraj Varshney
2	Brig Vivek Kumar Sharma
<b>COAS Commendation Card</b>	
1	Col P Sashi
2	Col Deepak Kumar
3	Col Bharati Kant Shukla
4	Col Sandeep Sood
5	Col Shikharesh Vatsa
6	Col Kuldeep Yadav
7	Col Abhishek Whig
8	Lt Col Saurabh Ahuja
9	Lt Col Ravi Kumar S
10	Maj Shivani Jerath
11	Capt Anupam Pandey
12	Nb Sub Dinesh Kumar Kushbaha

13	HMT Divakar Kaushik
14	HMT Ramkrishna Prajapati
15	Narender Kumar
16	Hav Raveen R
17	Hav Murugan K
18	Hav Sukhbir
19	Hav Gitte Dashrath Keshav
20	Hav Ratnakalli Riyaz Ahamed
21	Hav Gandam Kondiah
22	Nk Veer Singh
23	Cfn Pritam Singh
<b>VCOAS Commendation Card</b>	
1	Col Vikram Vijay Suri
2	Lt Col Sukhdev Arora
3	Lt Col Kuljeet S Padam
4	Lt Col Vikrant Bakshi
5	Sub Suresh Parmar
6	Sub Chandan Bishal
7	Sub Netrapal Singh Nagar
8	HMT Koka Praveen
9	HMT Deepak Kumar Sahu
10	HMT Anil Kumar Yadav
11	Hav Puneet Kumar
12	Hav Himanshu Shekhar Patra
13	Hav Alluraiah Narlagorla
14	Sep Arjun Halakurki

## UPDATION OF EMAIL IDs FOR E-JOURNAL

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# PROMOTION STATE : MAR 2021

S No	Trade/Cat/Band	NK		HAV		NB SUB		SUB		SUB MAJ	
		DATE OF ENROLMENT	DATE OF PROMOTION TO NK	DATE OF ENROLMENT	DATE OF PROMOTION TO HAV	DATE OF ENROLMENT	DATE OF PROMOTION TO HAV/HMT	DATE OF ENROLMENT	DATE OF PROMOTION TO NB SUB	DATE OF PROMOTION TO SUB	DATE OF PROMOTION TO SUB MAJ
<b>Master Tech Cat</b>											
1	Master Tech (Elect)					29-Apr-02	01-Mar-15	01-May-21			
2	Master Tech (Gun)			08-Oct-03	09-Aug-15	01-May-21					
3	Master Tech (Opto Electronics)			18-Apr-05	07-Aug-16	01-May-21					
4	Master Tech (Rtr)			07-Mar-05	12-Feb-17	01-May-21					
5	Master Tech (A Vehicle)			04-Nov-04	19-Jul-15	01-May-21					
6	Master Tech (B Vehicle)			14-Jan-05	27-Sep-15	01-May-21	28-Apr-95	01-Apr-15	01-Apr-21	01-Aug-15	01-May-21
7	Master Tech (C Vehicle)			23-Sep-04	18-Oct-15	01-May-21					
8	Master Tech (Comm)			24-Feb-97	11-Sep-10	01-May-21					
9	Master Tech (CE)			20-Apr-02	30-Jun-13	01-May-21					
10	Master Tech (Networking)			04-Mar-04	26-Apr-15	01-May-21					
11	Master Tech (SA)			30-Aug-05	28-Aug-16	01-Dec-20					
<b>Master Tech Avn Cat</b>											
12	Master Tech (AF)					20-Dec-04	23-Nov-14	01-Mar-21			
13	Master Tech (AE)					29-Mar-04	23-Nov-14	01-Mar-21			
14	Master Tech (Elect)					29-Sep-04	16-Oct-16	01-Mar-21	04-Jan-03	01-May-16	01-May-21
15	Master Tech (RP)					03-Sep-04	16-Oct-16	01-Mar-21			
16	Master Tech (AVNS)					23-Sep-03	24-Nov-13	01-Dec-20			
17	Master Tech (ARM)					-	-	-			
<b>Artn Avn Cat</b>											
18	Artn Tech (AF)			01-Apr-17	01-Mar-21	03-Mar-97	01-May-11	01-Mar-21			
19	Artn Tech (AFN)			01-Apr-17	01-Mar-21	22-Feb-97	01-Feb-09	01-Mar-21			
20	Artn Tech (Effect)	01-Mar-21	11-Jan-04	01-Apr-17	01-Mar-21	18-Sep-00	01-Jan-10	01-Mar-21	30-Mar-01	01-Jan-18	01-Jul-16
21	Artn Tech (I & P)		09-Jan-04	01-Apr-17	01-Mar-21	24-Dec-96	01-Aug-09	01-Mar-21			31-Dec-21
22	Artn Tech (Avn)		29-Mar-12	01-Apr-17	01-Mar-21	29-Jan-03	01-Jan-14	01-Mar-21			
<b>Artn Eligible Cat</b>											
23	Auto Elect A Vehicle	24-Mar-09	01-May-21	09-Sep-04	01-Dec-14	01-Sep-20	29-Dec-95	01-Sep-09	01-Jan-21	28-Feb-95	01-Jan-19
											01-Jan-18
											01-May-21

S No	Trade/Cat/Band	NK		HAV		NB SUB		SUB		SUB MAJ	
		DATE OF ENROLMENT	DATE OF PROMOTION TO NK	DATE OF ENROLMENT	DATE OF PROMOTION TO HAV	DATE OF ENROLMENT	DATE OF PROMOTION TO NB SUB	DATE OF ENROLMENT	DATE OF PROMOTION TO SUB	DATE OF PROMOTION TO SUB	DATE OF PROMOTION TO SUB MAJ
24	Auto Elect (B Vehicle)			07-Jul-03	01-Sep-12	06-Feb-21	02-May-95	01-Aug-11	01-Jan-21		
25	Auto Tech (Engr Eqpt)	24-mar-09	01-Mar-21	30-Sep-04	01-May-11	22-Feb-21	21-Oct-97	01-Dec-09	01-Jun-20		
26	Auto Tech (A Vehicle)			18-May-02	01-Sep-11	01-Jan-21	30-Apr-96	01-Jan-11	01-Jan-21		
27	Auto Tech (B Vehicle)			15-Mar-03	01-Dec-11	01-Feb-21	01-Jan-96	01-Feb-11	01-Feb-21		
28	Tech (Opto Electronics)			17-Oct-09	01-Apr-17	01-Jan-21	30-Dec-96	01-Sep-09	01-Mar-21		
29	Tech (G/E)			24-Mar-08	01-Apr-17	01-Jan-21	29-Aug-96	01-Apr-10	01-Mar-21	28-Feb-95	01-Jan-19
30	Tech (Computer)			23-Jun-09	01-Jun-16	01-Mar-21	05-Sep-02	01-Jan-13	01-Mar-21		01-Apr-21
31	Tech (Radar)			30-Sep-04	01-Apr-17	01-Jan-21	07-Jul-01	09-Jul-11	01-Mar-21		01-Jan-18
32	Tech (Communication)			01-Feb-03	01-Jul-14	05-Oct-20	10-Jul-99	01-May-09	01-Mar-21		01-May-21
33	Armt Tech (F/D)			10-Jan-03	01-Jan-14	01-Jan-21	28-Mar-01	01-Oct-11	01-Jan-21		
34	Armt Tech (AFV/AD)			29-Mar-01	01-Mar-13	08-Feb-20	11-Sep-95	01-Jan-13	01-Jan-21		
Artsian Non Eligible Cat											
35	Dmn Tech			09-Jul-02	01-Sep-15	01-Mar-21	28-Oct-96	01-Jan-14	01-Jan-21		
36	Refg Tech			07-Oct-98	01-Mar-17	29-Jun-19	26-Nov-96	01-Jun-18	01-Mar-21		
37	Artisan Metallurgy			23-Mar-01	01-Mar-12	16-Jan-21	10-Sep-93	14-Feb-12	01-Mar-21		
38	OIRP (A)			-	-	Obsolete Trades	-	-			
39	Mach Sp (Indn Tmr, Mach, T, Maker)			13-mar-01	01-Jul-13	01-Jan-21	28-Dec-93	01-Jan-11	01-Jul-18		
40	Welder			26-Sep-01	01-Dec-12	09-Jan-21	27-Apr-94	01-Nov-11	13-Jun-18	25-Feb-93	01-Oct-15
41	Artisan Wood Work (Incl LM, Moulder & P/Maker)			19-Apr-03	02-Mar-13	01-Mar-21	06-Dec-01	01-Apr-10	01-Aug-20		01-Apr-21
42	Ptr & Dctr			03-Feb-03	01-Sep-15	14-Sep-19	30-Dec-95	01-Mar-18	01-Sep-19		01-Feb-18
43	Support Staff (ER) Incl Tailor (U)			12-Jan-02	01-Apr-14	08-Feb-20	30-Dec-95	01-Mar-18	01-Oct-20		
44	Limb Maker			03-Sep-03	01-Dec-12	01-Feb-21	28-Dec-95	01-Mar-12	01-Oct-20		
Other Independent Trades											
45	Clk (SD)			17-Jun-11	01-Jan-17	01-Apr-21	31-Mar-01	01-Mar-09	01-Apr-21	29-Apr-95	01-Mar-16
46	SKT			17-Jun-11	01-Jan-17	01-Apr-21	23-Mar-03	01-Jun-11	01-Apr-21	28-Mar-01	01-Mar-19
47	Tech SA			22-Dec-11	01-Apr-21	01-Oct-20	19-Oct-01	01-Feb-11	01-Sep-20	02-Feb-01	01-Jan-17
48	Opr & Dvr (Rec)			17-Oct-09	01-Apr-21	28-Oct-06	01-May-12	01-Mar-21	01-Mar-21	25-Sep-02	01-Dec-15
49	Musn			19-Apr-09	01-Apr-21	15-Jan-02	27-Aug-13	01-Oct-20	-	05-Mar-97	02-Apr-16
50	Dvr (MT) & Dvr (Sp)			29-Apr-04	01-Apr-21	29-Nov-01	01-Mar-17	09-Jan-21	01-Apr-15	01-Mar-21	28-Oct-93
51	Chef Comm			08-Feb-02	01-Jan-18	23-Jan-21					
52	Mess Sp (Chef Mess, Steward & Mess Keeper)			08-Feb-02	01-Jan-18	23-Jan-21					
53	Dresser			08-Feb-02	01-Jan-18	23-Jan-21					
54	House Keeper			08-Feb-02	01-Jan-18	23-Jan-21					
55	W/Man			08-Feb-02	01-Jan-18	23-Jan-21					

Not Applicable

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