

# DRDO

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## DRDO HANDED OVER 15 LICENSES FOR TOT TO 17 INDUSTRIES IN DEFEXPO 2020



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# DRDO HANDED OVER 15 LATOT TO 17 INDUSTRIES IN DEFEXPO 2020

**D**RDO handed over 15 licenses for transfer of technology (LATOT) to 17 industries in DefExpo 2020 during the MoU signing ceremony 'Bandhan' on 7 February 2020. The LATOT would enhance cooperation and synergy between industry and government organisations. Technologies transferred by DRDO are from the area of electronics, laser technology, armaments, life sciences, materials science, combat vehicles, naval systems, aeronautics, sensors, etc. The products transferred include: Mine Field Marking Equipment Mk-II, e-Nasika, DMS HIDDEN Fuel-I, Bi-Modular Charge System, 500 kg General Purpose Bomb, 250 kg Pre Fragmented Bomb, Electronic Fuze for 81 mm Mortar Bomb, Post Impact Delay

Fuze for Air Delivery Bomb, Vehicle Mounted ECM System, IR Flare for CMDS, Process Monitoring of Vacuum Assisted Resin Transfer Moulding, Man-mounted Cooling System, Optical Target Locator 600, High Power Li-Ion Battery Technology and Combat Free Fall Parachute System. These high-technology products will boost the defence manufacturing sector with self-reliance and enhance the operation capabilities of Armed Forces.

In a big push to the Uttar Pradesh (UP) defence corridor, Uttar Pradesh Expressways Industrial Development Authority (UPEIDA) signed a Memorandum of Understanding (MoU) for knowledge partnership with DRDO. The partnership is expected to provide impetus to further boost the development

of the defence production corridor in UP. The MoU was exchanged between Dr G Satheesh Reddy Secretary, DDR&D and Chairman, DRDO, and Shri Awanish Kumar Awasthi, CEO, UPEIDA.

Speaking on the occasion, Raksha Mantri Shri Rajnath Singh praised DRDO for record transfer of 114 technologies to industries in last one year. He also said that the industries have been benefited with the efforts put in by DRDO through its Technology Development Fund and by providing free patents and test facilities. These confidence building measures need to be fully exploited by the industries to propel the nation forward towards self-reliance, he added further.

Raksha Mantri also lauded the



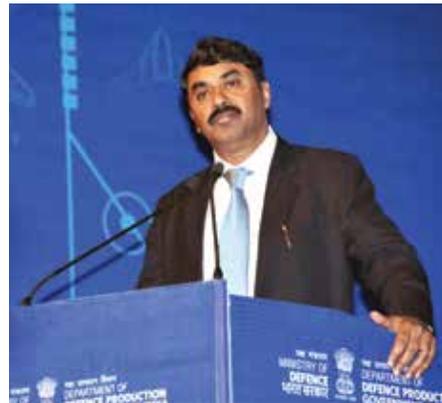
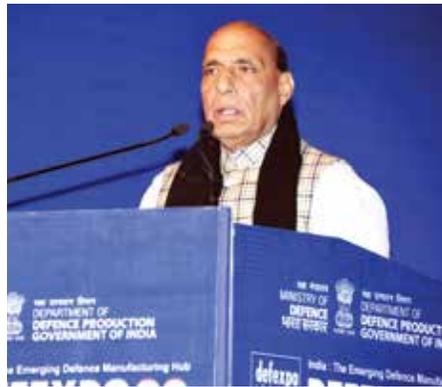
Handing over of LATOT by Chairman DRDO Dr G Satheesh Reddy (right)



MoU between DRDO and UPEIDA and expressed that this will facilitate technical and knowledge support to the corridor by DRDO and would help grow a well-planned and efficient industrial base that will lead to increase in defence production in the country. He also announced that DRDO will provide technical and hand holding support to industries for export of DRDO developed products and for innovation and R&D by industries.

In his address, Hon'ble Chief Minister of UP Yogi Adityanath expressed his confidence that MoU with DRDO will extensively benefit the development of the UP as well as the region in particular.

Speaking on the occasion, Dr G Satheesh Reddy said that DRDO, under the guidance of Raksha Mantri Shri Rajnath Singh, will provide all technology support for the development of UP defence corridor as this will give thrust to the 'Make-In-India' programme. Dr Reddy elaborated that the recent success of DRDO technologies like Anti-Satellite Missile, Man Portable



**RM Shri Rajnath Singh (top) and Dr G Satheesh Reddy speaking at MoU signing ceremony Bandhan at DefExpo 2020**

ATGM, Naval LCA, Torpedo Varunastra, Radars, Sonars, Advanced materials has not only made country more self-reliant in defence technology but also provided immense opportunities to the industries in defence manufacturing sector. He further stressed that the industries are invaluable partners and it is an apt time for Indian industry to take advantage of the latest policies of the Government and further steer the country by enhancing the efforts towards self-reliance through indigenous technologies, job creation and nation building.

Union Minister of State (Defence) Shri Shripad Yesso Naik; Minister of Industrial Development, Government of Uttar Pradesh, Shri Satish Mahana; Defence Secretary, Shri Ajay Kumar; Chief of the Army Staff, General Manoj Mukund Naravane, PVSM, AVSM, SM, VSM, ADC; and CEO, UPEIDA and Additional Chief Secretary, Government of Uttar Pradesh Shri Awanish Kumar Awasthi, along with officials from MoD and UP Government and industrialists from entire country were present on the occasion.

## DRDO AT DEFEXPO 2020

**D**RDO displayed a wide range of indigenous strategic and tactical weapon systems, defence equipment and technologies at DefExpo 2020 held in Lucknow from 5 February to 9 February 2020. DRDO was a major participant at 11th edition of the biennial defence exhibition and displayed more than 500 indigenously developed products with active participation from major laboratories belonging to its different technology clusters.

Key exhibits from the Aero cluster included: LCA Mk-II on the tarmac, indoor models of LCA Mk-I, LCA Navy, AEW&C, Aerostat and Kaveri Engine among others. ASAT, BrahMos, and Rustom-II models were displayed in the India Pavilion.

India's first ASAT missile used in

Mission Shakti to demonstrate anti-satellite precision strike capability was the main attraction of the Missiles and Strategic Systems (MSS) cluster at DefExpo. The other outdoor missile displayed were: LRSAM and BrahMos Mobile Autonomous Launcher. The indoor exhibits included: models of Nag, Helina, Astra, LRSAM, QRSAM, NGARM, Akash, Prithvi, and multiple products and technologies such as RLG-based INS-GPS, Systems-on-Chip, BrahMos OBC and MIU.

Highlights from the Armament and Combat Engineering (ACE) cluster were the live demonstration of the Advanced Towed Artillery Gun System (ATAGS), Arjun MBT Mk-IA, Wheeled Armoured Platform (WhAP), Counter Mine Flail, and deployment of Advanced Composite

Modular Bridging System (ACMBS). Outdoor exhibits included Arjun MBT Mk-I, Autonomous Unmanned Ground Vehicle (AUGV), WhAP, ATAGS and the UXOR robot. Indoor exhibits from the cluster included ROV Daksh, CSROV-Mini, SROV-Scout, NBC RV Mk-I, AERV, CBRN Mini UGV, AAD, MPDS, BMCS, ATGM, EDK, Pinaka Mk-I and Mk-II Rocket Systems.

Major exhibits from the Electronics and Communication Systems (ECS) cluster at the India Pavilion included: QRSAM Radar, Atulya Fire Control Radar, SDR System and Naval Communication Intelligence System (Nayan). Various other products such as Thermal Imager, Ground Penetrating Radar, Optical Target Locator, 4D Active Phased Array Multifunction

Radar (Ashwini), Laser Fence, Laser Dazzler and various Surveillance Systems, models of Data Link System for Rustom II, Laser Ordnance Disposal System (LORDS), Hand-held Explosive Identifier (Preemptor) and other technologies were the other major attractions.

Exhibits of Micro Electronic Devices and Computational Systems (MED & CoS) cluster at India Pavilion included robotic products (KRIDA, Robot Sentry). Indoor exhibits of the cluster included: RF Devices, e-Nasika, Mini

UGV, Secure Mobile Handset among other.

The Naval Systems & Materials (NS&M) cluster exhibited Heavy-Weight Torpedo Varunastra in the outdoor area. Indoor displays were: Torpedoes (TAL, ALWT), Decoy systems (ATDS-X, Maareech), various sonar systems (ALTAS-X, Hull Mounted, Dunking) and various products related to NBC and Radiation detection with focus on naval application.

Outdoor exhibits from Life Sciences (LS) cluster were: Biodigester, Biotoilet,

Iron Removal Unit, Motor Bike Ambulance, etc. The indoor exhibits of LS cluster included survival equipment, detection and diagnostic equipment and products necessary for operating in the most hazardous environment.

System Analysis & Modelling (SAM) cluster exhibited War Gaming at India Pavilion. Indoor exhibits at DRDO Pavilion included working models of Integrated Fire Suppression System (IFDSS), Mobile Ramp (MMR) and the Army Air Defence Deployment Simulator System.



## DISTINGUISHED VISITORS AT DRDO STALLS



PM Narendra Modi showing keen interest in models of ASAT (left) and Air Launched BrahMos missiles at India Pavilion



Clockwise from top left: RM Shri Rajnath Singh; CDS Gen Bipin Rawat; CAS Air Chief Marshal RKS Bhadauria; Mr James Heappey, Hon'ble Minister of Defence Procurement UK; COAS General MM Naravane and CNS Admiral Karambir Singh at DRDO Pavilion

# MEETINGS WITH FOREIGN DELEGATIONS





# DRDO PRODUCTS AT LIVE DEMO



# REPUBLIC DAY CELEBRATIONS

## CAIR, BENGALURU

Center for Artificial Intelligence and Robotics (CAIR) celebrated 71st Republic Day with lot of enthusiasm. The function started with flag hoisting by Dr UK Singh, OS & Director, CAIR, followed by distribution of various awards to employees and their wards. Sports and Rangoli prizes were also distributed to the winners.

## ITR, CHANDIPUR

The 71st Republic Day was celebrated in Integrated Test Range (ITR), with hoisting of National Flag by Dr BK Das, OS & Director ITR followed by national anthem sung by ITR personnel. Director, ITR, in his address appreciated the officers, staff, and DSC Jawans and Home Guards who work round the clock to safeguard the sovereignty of ITR. He also highlighted the importance of the constitution in our day-to-day life for peace, harmony and integrity.

Tree Plantation was carried out to mark the occasion. About two hundred officers and staff of ITR participated in the programme. The Republic Day programme was conducted by Shri SK Sahani, Sc 'F', Chairman Republic Day Celebration Committee, Lt Col VK Kumar, Chief Security Officer, and their team.



Republic Day Celebrations   
at CAIR (top) and ITR

# RAISING DAY CELEBRATIONS

## CAIR, BENGALURU

Center for Artificial Intelligence and Robotics (CAIR), celebrated its Lab Raising Day and Karnataka Rajyotsava with lot of enthusiasm on 20 December 2019. The morning sessions were dedicated to CAIR Raising Day and technical exhibition and afternoon sessions were dedicated to Karnataka Rajyotsava and cultural programme. Dr Sudhir Kamath, OS & DG (MED&CoS), DRDO, was the Chief Guest for CAIR Day and Dr Ramamurthy, former Sc 'G', CAIR, was the Chief Guest for Karnataka Rajyotsava. Dr UK Singh, OS & Director, CAIR, in his welcome address highlighted various achievements and future programmes of CAIR. This was followed by talks by the Chief Guests. Lab-level DRDO Awards were distributed to the officers and staff of CAIR by Dr Sudhir Kamath. The afternoon sessions were open for the family members of CAIR employees also. The ceremony concluded with a colorful cultural programme performed by the employees and their children.



## DFRL, MYSURU

Defence Food Research Laboratory (DFRL), celebrated its 59th Raising Day on 13 January 2020 with grandeur. Chief Guest Dr AK Singh, DS & DG (LS), DRDO, inaugurated the event. Dr Anil Dutt Semwal, Director, DFRL, presided over the function. Dr GK Sharma, Sc 'G', welcomed the dignitaries, and the present and retired employees of DFRL. Dr Semwal briefed the gathering about the R&D achievements of DFRL in the year 2019 and proposed targets for the upcoming year. Dr AK Singh appreciated the team DFRL for their efforts to achieve goals in a stipulated time. To encourage and motivate the workforce, DRDO Lab-level Awards for various categories were distributed to meritorious employees.



Children performing at CAIR Raising Day (top) and at DFRL Raising Day

Sports awards and other prizes were also distributed to the winners. Dr AK Singh also released DFRL's activity calendar. The day ended with a colourful cultural programme presented by the kids of DFRL employees.

## LRDE, BENGALURU

Electronics and Radar Development Establishment (LRDE) celebrated its Lab Raising and DRDO Day on 1 January 2020. Shri SS Nagaraj, DS & Director, LRDE, presided over the function and spoke about the achievements of LRDE in 2019 and goals



Director LRDE Shri SS Nagaraj addressing the gathering on LRDE Raising Day

for 2020. He presented DRDO Lab-level Awards and DRDO Cash Awards to the employees and Educational

Awards to the meritorious children of LRDE employees. A video on LRDE achievements during the year 2019 was also screened on the occasion.

**NMRL, AMBERNATH**

**6**7th Raising Day of Naval Materials Research Laboratory (NMRL) was celebrated with great enthusiasm on 3 January 2020. Dr Srikumar Banerjee, Chancellor, Homi Bhabha National Institute, Mumbai (former Chairman, Atomic Energy Commission & Secretary, Department of Atomic Energy) was the Chief Guest and Shri Santosh Kumar Sinha, GM (IOFS), Ordnance Factory, Ambarnath, was the Guest of Honour of the function. Dr M Patri, Director, NMRL, presented an overview of the growth and achievements made by the laboratory. Chief Guest in his address inspired the NMRL fraternity to provide latest technological solutions to the armed forces as well as commercial sector. Guest of Honour, appreciated NMRL for the accomplishments



**Release of NMRL Annual Report**

made over the years. NMRL Annual Report was released on the occasion. DRDO Lab-level and Cash Awards were presented to the employees for

their meritorious contributions. The afternoon session comprised cultural performance by in-house talents, followed by a musical programme.

**DESIDOC GOLDEN JUBILEE ORATIONS**

**D**efence Scientific Information and Documentation Centre (DESIDOC), Delhi, as a part of its Golden Jubilee Celebrations organised an oration by Dr Vinay Sahasrabuddhe, President, Indian Council of Cultural Relations (ICCR) and MP Rajya Sabha on “Multiple Dimensions of India’s Soft Power Potential” on 7 January 2020 at Dr Bhagavantham Auditorium, Metcalfe House. Dr Chitra Rajgopal, DS & DG, R&M, DRDO, Dr Alka Suri, Director, DESIDOC, Dr Rajeev Vij, Sc ‘G’, convener of the oration, were present on the occasion.

Dr Sahasrabuddhe enriched the audience with his vast experiences, ideas and thoughts. He talked about how India’s Soft Power Potential is influencing world and the cultural diplomacy initiatives by Indian Prime



**Dr Vinay Sahasrabuddhe delivering DESIDOC Golden Jubilee Oration**

Minister across the world. The oration was followed by a scintillating dance performance by Dr Rekha Mehra and

her team. In continuation of the series on Golden Jubilee Orations, another

oration on “Secrets of Success and Happiness” was delivered on 29 January 2020 by Shri Gaur Gopal Das, Lifestyle Coach and motivational speaker. Dr Sudhir Kamath, DG, Micro Electronic Devices and Computational Systems (MED & CoS), DRDO, was the Chief Guest of the function.

Gaur Gopal Das enriched the audience with his ideas and thoughts. Based on the timeless wisdom coming down from the ages, his talk made the audience think deeper and find simple solutions to difficult problems. Dr Sudhir Kamath appreciated the achievements and presentation made by Gaur Gopal Das and described his thoughts as a source of inspiration for the society. Dr Rajeev Vij, Convener of the programme proposed the vote of thanks.



Gaur Gopal Das (left) being felicitated by Dr Sudhir Kamath, DG, (MED&CoS), DRDO

## HRD ACTIVITIES

# SECURITY SENSITISATION PROGRAMME

A security sensitisation programme was conducted by Intelligence Bureau (IB) for 215 senior scientists/security officers of DRDO on 16 January 2020 at Dr DS Kothari Auditorium, DRDO

HQ. Proceedings commenced with Maj Gen MK Hada, Director, Vigilance & Security, welcoming the participants and the delegation of IB. Maj Gen Hada spoke about the importance of inculcating security consciousness in all

DRDO personnel. Dr G Satheesh Reddy, Secretary, DDR&D, and Chairman, DRDO, emphasized that security has a universal domain, which requires intrinsic and active contribution by all, irrespective of the nature of work or



rank held by the person, and should not be considered as the sole responsibility of the Director of the Lab and the Security Officer.

Team IB sensitised the participants on a wide range of topics including: Current national and international security scenario; multi-dimensional threats to vital installations; contingency planning and dealing with

crisis situations; precautions while interacting with foreigners; document and personal security; cyber security threats; verification and mitigation methodology, and threat to DRDO from foreign intelligence agencies. It was brought out that due to the cutting-edge R&D work being undertaken by DRDO labs, the foreign intelligence agencies are interested in garnering intelligence

on the classified projects.

The vulnerabilities, various modus operandi to obtain information and how to guard against the same were also elucidated with examples. The discussions were educative and informative and were well received as was evident from the enthusiastic response from the participants during the Q&A sessions.

## AKHIL BHARTIYA VAIGYANIK EVAM TAKNIKI SANYUKTA HINDI SANGOSHTHI

**A**khil Bhartiya Vaigyanik Avam Takniki Sanyukta Hindi Sangoshthi was held at Defence Electronics Application Laboratory (DEAL), Dehradun during 16-17 January 2020. The sangoshthi was inaugurated by the Chief Guest Shri Liladhar Jagudi along with Shri PK Sharma, Director, DEAL; Shri Lionel Benjamin, Director, IRDE; Shri Sanjay Tandon, Director, ITM and

Shri PK Dixit, GM, OFD. Sangoshthi souvenir and CD were released on the occasion.

The theme of the Sangoshthi was “Raksha Praudyogiki avam Prabhandhan ka Rashtra ke Nirman may Yogdaan.” The sangoshthi was divided into five sessions in which 35 technical papers were presented. Participants from various government institutions and DRDO labs/estts

including Instruments Research & Development Establishment (IRDE), Institute of Technology Management (ITM), Defence Institute of Bio-Energy Research (DIBER), Joint Cipher Bureau (JCB), High Energy Materials Research Laboratory (HEMRL), CQAI and Solid State Physics Laboratory (SSPL) attended the sangoshthi. Director DEAL distributed the certificates to the participants.



## PATENTS GRANTED

- \* Naval Science & Technological Laboratory (NSTL), Vishakapatnam was granted a patent by Indian Patent Office for ‘Flexible Solar Photovoltaic System and Method’ developed by Mr Basam Venkata Rao, Sc ‘E’ and his team.
- \* A patent (Patent No. 325881) has been granted by the Indian Patent Office for ‘A Frustum Wrap around Antenna’. The pioneering work has been carried out by Shri Diptiman Biswas, Sc ‘F’, of Aeronautical Development Establishment (ADE), Bengaluru.



## TRAINING PROGRAMME ON KANTHASTH SOFTWARE

A one-day training programme on 'Kanthasth Software' for 56 members of TOLIC (Madhya-2), was organized on 17 January 2020 at DRDO HQ by Directorate of Rajbhasha and O&M. Smt Kalpana Sharma, Addl. Secretary, Lok Sabha Sachivalaya, was the Chief Guest and Dr S Guruprasad, DS & DG (PC & SI) was the Guest of Honour. Dr Ravindra Singh, Director, Rajbhasha and O&M, welcomed the guests and participants and gave a brief description of the software recently released by Rajbhasha Vibhag, Ministry of Home Affairs. Smt Kalpana Sharma, in her address, appreciated the efforts of Rajbhasha Vibhag for making Hindi more and more user-friendly in this digital era. She also applauded DRDO HQ for taking the initiative of organizing such training programme and facilitating 56-member offices with this software and making



translation easy and up-to-date with new emerging technologies. Seventy participants attended the course from different offices of Delhi including from DRDO HQ, Delhi-based DRDO labs, Akashvani, Northern Railways, CBSE, O/o Chief Income Tax Commissioner, Dr Ram Manohar Lohia Hospital, O/o

Chief Auditor General, Archaeological Survey of India, CRPF, NIC, etc. Dr GS Gupta, Director, Dte of Personnel, distributed certificates in the valedictory session along with a CD consisting the software and its manual. Shri Babu Lal, Joint Director (OL) presented the vote of thanks.

## ONE-DAY SEMINAR ON ADVANCED COMPOSITES APPLICATION

Advanced Systems Laboratory (ASL), Hyderabad organized one-day seminar on "Advanced Composites Application" on 17 January 2020. Advanced composites are widely used not only in defence and aerospace fields but also in civil, automobile and marine applications. Topics on defence, aerospace and civil sector were the focus in this seminar. Dr M Rama Manohara Babu, DS & Director, ASL inaugurated the seminar and addressed the participants.

Shri Sunil Gidwani, L&T, Gujarat delivered a talk on "Advanced Composites-Manufacturing & Challenges." Shri Subba Reddy, ADA,



Bengaluru, exchanged his ideas on "Design and Development of Advanced Composites Structures for Aircraft Applications." Shri Samudra Das

Gupta, ADE, Bengaluru, stressed upon "Advanced Composites—Unmanned Air Vehicle." Dr S Suriya Prakash, IIT, Hyderabad, delivered a lecture on "Application of Advanced Composites in Civil Engineering."

In the concluding session Dr RK Gupta, Associate Director, ASL, Shri S Bhaskar, GD (Composites); Smt Sharada Prabhakar, TD, ACC and Dr Manoj Burgohain, TD, CPDC, shared their views on the significance of the seminar. One hundred participants from Dr APJ Abdul Kalam Missile Complex attended the seminar.

## TRAINING ON SQUASH PREPARATION

A training programme on preparation of squash from orange and mandarin was organized by Defence Research Laboratory (DRL), R&D Centre, Salari on 27 January 2020 with a view to develop skill among rural population for further value addition in surplus orange and mandarin. The training was inaugurated by Dr SK Dwivedi, Director, DRL, Tezpur. Dr Duyi Samyori conducted the programme. A total of 23 participants from remote border areas of Arunachal Pradesh attended the training programme.



## TRAINING PROGRAMME ON PROJECT MANAGEMENT

A short term training programme on 'Project Management' was organized at Integrated Test Range (ITR), Chandipur, during 27-29 January 2020. Dr BK Das, OS and Director, ITR, inaugurated the programme. In his inaugural address, Director, ITR, expounded the need of such training programme for the

benefit of senior scientists and urged the participants to be interactive and draw full benefit from the programme.

The training was an advance course aimed at giving a wider view of project management. Various topics related to project management, e.g., Core Competence for Project Managers, Design of Experiments for Trials,

Strategies for Integrated Process & Product Development, Agile Project Management, Project Time Estimation Techniques, Earned Value Management System (EVMS), Project Leadership System (PLS), Project Management System (PMS), Project Management System (PMS), Project Management System (PMS). Twenty-six participants attended the programme organised by Shri P N Panda, Sc 'F', AGD (HR) and his team.





# BRAINSTORMING ON COATINGS FOR ARMAMENT APPLICATIONS

Armament Research and Development Establishment (ARDE), Pune, organised a one-day brainstorming session on “Coatings for Armament Applications” on 30 January 2020 to provide a platform to address the challenges, possibilities and technologies of surface engineering of guns and their components through synergy between DRDO, academia and industries. Eighty participants from Ordnance Factories, DG (Artillery), International Advanced Research Centre for Powder Metallurgy and New Materials, Hyderabad, IIT Madras, NAL

Bengaluru, sister DRDO labs and 15 coating industries, dedicatedly working on functional coatings, participated in the session. Dr Madhusudhan Reddy, Director, DMRL, and Dr Prahlada, former Vice Chancellor, DIAT were Chief Guests for the occasion.

Dr V Venkateswara Rao, OS and Director, ARDE, welcomed the participants and briefed them about the objectives of the discussion. Dr G Padmanabham, Director, ARCI, delivered the keynote address. Shri PK Mehta, DS & DG (ACE) gave the concluding remarks.

Dr AK Maurya, GM, Small Arms Factory, Kanpur, Dr Harish Barshila, Chief Scientist NAL, Dr Venkatraman, Sc ‘G’, DMRL, Dr Nitin Wasekar and Dr S Kumar, ARCI, Prof. Srinivasa Rao Bakshi, IIT Madras and Dr Praveen Kumar B, Sc ‘E’, ARDE delivered the talks and deliberated on the theme of the programme. Experts from industries, which included L&T Mumbai, Bharat Forge, MEC Jodhpur, Orbit Coatings, Sai Surface Coatings, Metderm Treat and Technocoat too shared their expertise. Dr Praveen Kumar coordinated and conducted the session.



## AI ECOSYSTEM MEET

Centre for Artificial Intelligence and Robotics (CAIR), Bengaluru, organized a meeting to access the capability, technical expertise and work towards an engagement model. Fifteen companies participated in the event, which included four big industry houses namely TCS, Wipro, HCL and L&T. The start-ups also participated enthusiastically and demonstrated products in the area of NLP, Vision, Data Analytics, Drones, etc.



# COURSE FOR RETIRING EMPLOYEES

A two-day training course for the superannuating employees of the calendar year 2020 titled “In-house Course for Retiring Employees of NPOL (INCREON)” was organized by Naval Physical and Oceanographic Laboratory (NPOL), Kochi, during 20-21 January 2020. The training course was conducted for 20 employees and their spouses. The course was inaugurated by Shri S Vijayan Pillai, OS and Director, NPOL, who highlighted the relevance and significance of the course.

The customized training course was conducted for retiring employees to plan and manage their retirement funds effectively, and to acquaint themselves with Pension Pay Order, Pensionary benefits and Central Government Health Scheme (CGHS) and medical reimbursements, effectively manage age related health disorders and also to adapt themselves to the socio and psychological changes that comes with retirement.



The highlight of the course was a session by a Corporate Psychologist and Trainer followed by a lecture by a Consultant Geriatrics. For judicious investments of funds, there were two lectures one by a Financial Investment Planner and the other by Chief Manager (Training), SBI. The lectures on PPO

and pensionary benefits and medical reimbursement were taken by in-house faculty. In a segment titled “Anubhav” a senior retired officer of NPOL shared his experience of retired life and imparted practical tips to the officers. There was a special session on endocrine disorders with emphasis on managing Diabetes.

# WORKSHOP ON CONCEPT OF COSTING: PROJECT MANAGEMENT & PRICING

Defence Bioengineering and Electromedical Laboratory (DEBEL), Bengaluru, conducted a one-day workshop on Concept of Costing: Project Management & Pricing. CMA (Rtd) L Gurumurthy, MCom, FCMA, Secretary (Acting), spoke on the principles of cost accounting and management and interacted with the participants. Thirty-five participants from DRDS and DRTC attended the workshop.

The workshop covered the basic principles of costing and why effective cost estimation is essential to keep a project within the budget. In short, the workshop covered the applications of principles of costing involved in



the formulation of a new project, new product development, ToT and pricing of products developed. The workshop

was very interactive and aimed at building the knowledge and skill set on costing.



# DRDO HARNESSING SCIENCE FOR PEACE & SECURITY

## CHAPTER 4: MARCHING FORWARD

*The article is 48th in the Series of extracts of the monograph, "Defence Research & Development Organisation: 1958-1982", by Shri RP Shenoy, former Director of Electronics and Radar Development Establishment (LRDE).*

### LIFE SCIENCES & HEALTHCARE

#### Defence Institute of Physiology & Allied Sciences

Exposure of extremities to severe cold for prolonged periods would lead to cold injuries, resulting in loss of digits of hands and feet if treatment was not given on time. Since rehabilitation of frostbite victims was difficult, susceptibility tests were devised for cold injuries. Studies also showed that exposure to cold environments for 3 weeks significantly increased adaptation and parasympathetic dominance. Thus deliberate exposure to cold during the first three weeks with gradual discarding of heavy items of clothing was recommended.

DIPAS conducted investigations for identification of soldiers who would be susceptible to AMS, HAPO and frostbite before they were to be inducted into high altitudes. It devised a chemoreceptor sensitivity test which appeared promising. The cold-induced vasodilatation (CIVD) response and heat output of the extremities during cold immersion under controlled laboratory conditions were found effective for screening individuals. Those with poor CIVD response had a low heat output and suffered more than the others.

Heat Stress - Heat stress would not normally be a serious threat to our countrymen under normal resting conditions because of natural adaptation to some extent. However, for soldiers performing physical work in summer in desert and other hot areas, for tank crews, for aviators working

in aircraft cockpits, for sailors toiling in engine compartments of ships, the metabolic heat would add to the strain on the thermoregulatory mechanism of the body. To compensate for the loss of fluid and electrolyte, DIPAS worked out optimum water and salt requirements as well as work schedules for different levels of thermal stress. It was found that under field conditions, 55 per cent of the heat illness was due to exercise-induced heat exhaustion and 25 per cent was due to heat pyrexia. Heat exhaustion due to salt/water deficiency and heat cramps was extremely rare. Potassium supplementation was found beneficial and replenishment of fluid was imperative. While heat-adapted soldiers could be moved to cold areas, it would be preferable to avoid rapid movement of soldiers from cold to hot regions. Studies on the effects of repeated calorie deprivation for troops on long patrol duties showed no cause for alarm due to recovery without adverse effects. Drinking brackish water found in Rajasthan for periods up to about 2 years did not reveal any ill effects.

#### Defence Institute of Psychological Research

The Defence Institute of Psychological Research (DIPR) is one of the oldest institutions under the DRDO, having been established in August 1949 to carry out research and develop procedures for the selection of personnel at Service Selection Boards, to maintain records and relevant statistics, and to train the assessors for effective functioning at the Service Selection Boards. Over a period of

time, its charter was extended to study problems related to morale, motivation and operational efficiency of the Armed Forces. Over more than four decades of its existence, it has completed over 700 projects and published over 470 research reports which have a wide circulation.

The Institute developed over the years an elaborate training system for the assessors, such as Interviewing Officers, Group Testing Officers, Psychologists in the Services Selection Boards, Armed Forces Selection Boards and Recruiting Centres. A number of projects in the field of psychology were aimed at monitoring of selection systems and development of selection tests for officers at Services Selection Boards and for classification of other ranks for allocation of specialised trades in the Army, Navy and the Air Force. In addition, developmental tests for use in selection and classification such as Nurses Aptitude Test, tests for selection of students for admission to AFMC, Pune, Word Association Test, Thematic Appreciation Test for use by Services Selection Boards, various techniques for evaluation and aptitude tests for selection of various trades for airmen and sailors, new schemes for administration of PAB tests at the Air Force Selection Boards, and aptitude tests for categorization of cadet trainees into technical and non-technical groups, were also designed. Expertise was also developed in the standardisation of personality, intelligence and aptitude tests for use in selection and task allocation of the officers of the three Services. To provide feedback for improvement of selection

procedures, follow-up studies were conducted, investigating causes of wastage during training and assessing the job performance level.

Another important research area was on the mental health of the soldiers including mental depression, suicides, boredom, isolation, study of aetiological factors in the adjustment of men in the Armed Forces with a view to identify the potential breakdown cases at the selection stage, factors that promote successful adaptation, psychophysiological effects of prolonged duties concerned with watch keeping in high altitude pickets, problems like huge dropout rates among trainees and morale of disabled soldiers.

Valuable work was also carried out on issues related to leadership, organisational effectiveness, morale, motivation, job satisfaction, discipline, group processes, sociometry, team building activities, training for adaptation to change, development of psychometric tests for assessing leadership potentiality in service officers, psycho-dynamics of courage in operational contexts, effects of high altitude and low temperatures on mental performance and techniques for interrogation of prisoners' of war.

DIPR conducted in-depth studies on the dynamics of training at the Services training academies like the National Defence Academy, and the Indian Military Academy. Improved training techniques were devised for instructors and the behaviour of pupils were evaluated through instructional feedback. It also conducted courses for DRDO for the senior scientists on self-development as part of the continuing education programme.

## MATERIALS

A wide variety of metals and non-metals are required for the development of the hardware that form military equipment and systems. The range is almost limitless and even a small sample, such as light alloys for structures, high temperature materials

for turbines, high strength materials for armour, plastic and synthetic/composite materials for aerospace, materials for radar invisibility, and now smart materials provides us an estimate of the expertise necessary to exploit these in defence systems. Often, these materials have to perform reliably under exacting and extreme conditions of temperature, environment and mobility which characterise military weapons and equipments. Two laboratories of DRDO namely, the Defence Metallurgical Research Laboratory (DMRL), Hyderabad and the Defence Materials and Stores Research and Development Establishment (DMSR&DE), Kanpur are devoted to the study and development of these critical materials for defence applications.

### Defence Metallurgical Research Laboratory

With the formation of DRDO in 1958, TDE (Metals) at Ishapore was bifurcated into an R&D entity called DMRL and the rest as Chief Inspectorate of Metals. Both the new entities were housed in the same premises of TDE (Metals) till 1962 when a decision was taken to expand DMRL by infusion of personnel, equipment and buildings to bring it at par with modern metallurgical R&D institutions. The location was shifted to Hyderabad and a reputed Indian metallurgist was appointed as the Director and was entrusted with the task of building the Institution.

The move from Ishapore to Hyderabad, and the setting up a new laboratory, including construction of buildings, placement of personnel, installation of plant, machinery and other equipments, was completed by 1969. Even before this, the Laboratory started functioning from rented buildings. The initial focus was to build the competence of the scientists in the area of strategic materials which are of interest to defence.

The activities for the development of metals and alloys required for

aircraft, electronics, tanks and missiles continued in the 1970s. A powder metallurgy plant was set up for research on various applications of powder metallurgy for defence applications. The major application area was towards rendering help to the defence PSUs/factories in specific products. One such area was anti-armour ammunition. In the 1970s, a requirement was reflected to DMRL to develop the core for a particularly lethal type of projectile, the high velocity armour piercing (AP) projectile, which by its kinetic energy was able to penetrate deeply into the tank armour. The effectiveness of the AP (armour piercing) ammunition against the tank was due to the core, which for the first generation was a long-rod penetrator of tungsten carbide with a specific gravity of 14. DMRL succeeded in developing the processes and fabricating the tungsten carbide core. It even set up a pilot plant for supplying these and the nose cones. In addition, DMRL also set up pilot plants to provide shatter alloy, lighter alloy castings for sighting and vision instruments for tanks/AFVs and permanent magnets of various types for use by the microwave industry. Further, development of magnets for magnetrons that power radar systems and recovery of tungsten and cobalt was also undertaken.

In 1973, it was decided by the Ministry of Defence to set up in the vicinity of DMRL, a public sector company, Mishra Dhatu Nigam Ltd (MIDHANI) for exploiting the technology that had been developed by DMRL in a variety of special metals and super alloys required for defence applications. The strategic importance of the work of DMRL lay in the fact that only a few manufacturers in the world had the capability and capacity to supply these and their availability to us in times of war and even in times of peace was subjected to the pulls and pressures of the Cold War.

*To be continued...*