DRDO NEWSLETTER

A Monthly Bulletin of Defence Research and Development Organisation

ISSN: 0971-4391

www.drdo.gov.in

MARCH 2019 | VOLUME 39 | ISSUE 3

LCA Mk 1 gets FOC

CONTENTS

MARCH 2019
VOLUME 39 | ISSUE 3
ISSN: 0971-4391

39th Year of Publication

Editor-in-Chief: Dr Alka Suri
Managing Editor: B Nityanand
Editor: Manoj Kumar
Editorial Assistance: Biak Tangpua
Multimedia: RK Bhatnagar
Printing: SK Gupta, Hans Kumar
Distribution: Tapesh Sinha, RP Singh

Website: https://www.drdo.gov.in/drdo/pub/newsletter/

Please mail your feedback at:
director@desidoc.drdo.in

Contact: 011-23902403; 23902474
Fax: 011-23819151

LOCAL CORRESPONDENTS

Ambernath: Dr Susan Titus, Naval Materials Research Laboratory (NMRL); **Chandipur**: Shri Santosh Munda, Integrated Test Range (ITR); **Bengaluru:** Shri Subbukutti S, Aeronautical Development Establishment (ADE); Smt MR Bhuvaneswari, Centre for Airborne Systems (CABS); Smt Faheema AGJ, Centre for Artificial Intelligence & Robotics (CAIR); Ms Tripty Rani Bose, Centre for Military Airworthiness & Certification (CEMILAC); Smt Josephine Nirmala M, Defence Avionics Research Establishment (DARE); Shri Kiran G, Gas Turbine Research Establishment (GTRE); Shri Venkatesh Prabhu, Electronics & Radar Development Establishment (LRDE); Dr Vishal Kesari, Microwave Tube Research & Development Centre (MTRDC); **Chandigarh:** Dr HS Gusain, Snow & Avalanche Study Establishment (SASE); Dr Prince Sharma, Terminal Ballistics Research Laboratory (TBRL); **Chennai:** Shri PD Jayaram, Combat Vehicles Research & Development Establishment (CVRDE); **Dehradun:** Shri Abhai Mishra, Defence Electronics Applications Laboratory (DEAL); Shri JP Singh, Instruments Research & Development Establishment (IRDE); **Delhi:** Shri Ashutosh Bhatnagar, Centre for Personnel Talent Management (CEPTAM); Dr Dipti Prasad, Defence Institute of Physiology & Allied Sciences (DIPAS); Dr Dolly Bansal, Defence Institute of Psychological Research (DIPR); Shri Navin Soni, Institute of Nuclear Medicine and Allied Sciences (INMAS); Shri Anurag Pathak, Institute for Systems Studies & Analyses (ISSA); Dr Indu Gupta, Laser Science & Technology Centre (LASTEC); Ms Noopur Shrotriya, Scientific Analysis Group (SAG); Dr Rupesh Kumar Chaubey, Solid State Physics Laboratory (SSPL); **Gwalior:** Shri RK Srivastava, Defence R&D Establishment (DRDE); **Haldwani**: Dr Atul Grover, Defence Institute of Bio-Energy Research (DIBER); **Hyderabad:** Shri Hemant Kumar, Advanced Systems Laboratory (ASL); Shri Pramod K Jha, Centre for Advanced Systems (CAS); Dr JK Rai, Advanced Numerical Research & Analysis Group (ANURAG); Ms Bidisha Lahiri, Centre for High Energy Systems & Sciences (CHESS); Shri ARC Murthy, Defence Electronics Research Laboratory (DLRL); Dr Manoj Kumar Jain, Defence Metallurgical Research Laboratory (DMRL); Dr K Nageswara Rao, Defence Research & Development Laboratory (DRDL); Shri Lalith Shankar, Research Centre Imarat (RCI); **Jagdalpur:** Dr Gaurav Agnihotri, SF Complex (SFC); **Jodhpur:** Shri Ravindra Kumar, Defence Laboratory (DL); **Kanpur:** Shri AK Singh, Defence Materials & Stores Research & Development Establishment (DMSRDE); **Kochi:** Smt MM Letha, Naval Physical & Oceanographic Laboratory (NPOL); **Leh**: Dr Dorjey Angchok, Defence Institute of High Altitude Research (DIHAR); **Mussoorie:** Dr Gopa B Choudhury, Institute of Technology Management (ITM); **Mysuru:** Dr M Palmurugan and Shri NV Nagraj, Defence Food Research Laboratory (DFRL); **Pune:** Dr (Mrs) JA Kanetkar, Armament Research and Development Establishment (ARDE); Dr Vijay Pattar, Defence Institute of Advanced Technology (DIAT); Shri AM Devale, High Energy Materials Research Laboratory (HEMRL); Shri SS Arole, Research & Development Establishment (Engrs) [R&DE (E)]; **Tezpur:** Dr Jayshree Das, Defence Research Laboratory (DRL);
Visakhapatnam: Dr (Mrs) V Vijaya Sudha, Naval Science & Technological Laboratory (NSTL)

FINAL OPERATIONAL CLEARANCE OF LCA TEJAS MK I FOR INDIAN AIR FORCE

In a landmark occasion, 20th February 2019 is a significant day in the journey of Light Combat Aircraft Tejas Mk I for Indian Air Force (IAF), when the formal declaration of Final Operational Clearance (FOC) of the aircraft was made by Secretary, Department of Defence R&D and Chairman DRDO Dr G Satheesh Reddy. The day also witnessed the handing over of FOC Certificate and Release to Service Document (RSD) to the Chief of Air Staff Air Chief Marshal BS Dhanoa, in the presence of Defence Secretary Shri Sanjay Mitra and Chairman and Managing Director of Hindustan Aeronautics Limited Shri R Madhavan.

The FOC involves addition of key capabilities to the Initial Operational Clearance (IOC) aircraft, which are Beyond Visual Range Missile capabilities, air-to-air Refuelling, air-to-ground FOC earmarked weapons and general flight envelope expansion.

The RSD provides the capabilities, features and technologies that FOC standard aircraft will have on induction into IAF. The FOC standard aircraft drawings have already been handed over to Hindustan Aeronautics Limited (HAL) to start production after incorporating key changes over the IOC standard Aircraft.

Initial Operational Clearance (IOC) of the aircraft took place in the year 2013 and IOC standard Aircraft were inducted into the 45th Squadron of IAF in July 2016. The IAF has since flown over 1500 sorties successfully on the aircraft. It is a proud day for all the agencies involved in the design, development and production of the aircraft, i.e., Aeronautical Development Agency (ADA), the autonomous society of DRDO as the design agency and HAL as the manufacturer. Many other DRDO laboratories like ADE, GTRE, LRDE, CEMILAC, etc., as well as other agencies such as BEL, CSIR, DG-AQA, and private sector have contributed in the journey of LCA.

Handing over of Release to Service Document of LCA Mk 1 to Chief of Air Staff Air Chief Marshal BS Dhanoa

DIPAS TRANSFERS TECHNOLOGY FOR SOLAR SNOW MELTER

Defence Institute of Physiology and Allied Sciences (DIPAS), Delhi, transferred the technology of Solar Snow Melter to M/s Vishwa Traders, Kanpur; M/s Madnani Industries, Kanpur; and M/s Vijay Aluminium Works, Kanpur, on 15 February 2019. Dr Bhuvnesh Kumar, Director, DIPAS, handed over the document of TOT. Inventor scientists Dr Sanjeev Kumar Sharma and Shri Satish Chouhan were also present on the occasion.

The solar snow melter would enable water requirements of the troops posted in the high altitude locations. The equipment works on the principle of greenhouse effect. The sun facing surface of the melter is made up of double walled polycarbonate sheet, which allows the sun rays to enter inside the heat exchanger but do not allow the reflected infra-red radiation to escape.

The copper heat exchanger melts the snow into water. It provides 5-7 litres of water per hour without using any oil or electricity. Its successful trials have been conducted at Leh, Changla and Tawang.

LRDE INKS LATOT WITH INDUSTRY

Electronics and Radar Development Establishment (LRDE), Bengaluru, signed the Licensing Agreement for Transfer of Technology (LAToT) for production of Medium Power Radar, Arudhra, with Bharat Electronics Limited (BEL) on 4 January 2019. Arudhra is a fully active aperture rotating multi-beam multifunction phased array radar with staring mode. It has capability for detection and tracking of low RCS, high speed and highly manoeuvring targets.

DRDO AND MIZORAM UNIVERSITY SIGNS MOU FOR ESTABLISHMENT OF ADVANCED TECHNOLOGY CENTRE

DRDO signed a Memorandum of Understanding (MoU) with Mizoram University for establishment of Advanced Technology Centre at Mizoram University, Aizawl. The centre was named as DRDO MZU North East Science and Technology Centre (NESTC). The MoU was signed by Dr G Satheesh Reddy, Secretary, DDR&D and Chairman, DRDO, and Prof. KRS Sambasiva Rao, Vice Chancellor, Mizoram University on 5 February 2019 at DRDO HQ.

NESTC will facilitate focussed basic and applied research by utilizing the knowledge base of faculty, researchers and incubators at Mizoram University and also engage other institutes in North East. It will capture and nurture the scientific talent available in the area. NESTC will also help in promoting skill development and producing trained manpower in crucial technological areas. The establishment of DRDO MZU NESTC will also enhance DRDO presence in the North Eastern states of India.

EVENTS

DESIDOC PARTICIPATES IN WORLD BOOK FAIR

In its endeavour to promote and popularize science among civil society, Defence Scientific Information and Documentation Centre (DESIDOC), participated in the World Book Fair held during 5-13 January 2019 at Pragati Maidan, New Delhi. Shri KS Varaprasad, DG (HR), DRDO, inaugurated the DESIDOC stall and appreciated the Centre for enhancing DRDO's visibility among civil society. DESIDOC displayed its in-house publications to highlight DRDO's academic pursuit and its determined efforts towards contribution in the knowledge economy of the country and establishing connectivity with masses, researchers, academicians and students.

RAISING DAY CELEBRATIONS

INMAS, DELHI

Institute of Nuclear Medicine and Allied Sciences (INMAS)celebrated its 58th Annual Day on 13 February 2019. Lt Gen Bipin Puri, PVSM, VSM, PHS, Director General Armed Forces Medical Services and Senior Col Commandant was the Chief Guest and Dr AK Singh, OS and Director General, Life Sciences was the Guest of Honour on the occasion. Directors from DRDO HQ and various labs, former employees and family members of INMAS were present during the function. The function saw the culmination of a fortnight long scientific, societal, sporting, fun and cultural activities which were held at the institute. Dr Tarun Sekhri, Director, INMAS, welcomed the guests and highlighted the recent achievements of the laboratory and shared with the gathering the growth path and future vision of INMAS especially in the areas of radiation biology, molecular imaging, CBRN research and combat casualty. The Chief Guest Lt Gen Puri, in his addresses aloud the contribution of INMAS in peaceful use of nuclear medicine. In view of current world scenario regarding use of nuclear and biological weapons by various states, he emphasised that INMAS should enhance its training facilities of CBRNE Defence for Armed Force as well as other agencies. Dr Ajay K Singh in his address appreciated the efforts of INMAS in the area of Radiation Biology, imparting training to military and paramilitary forces in field of CBRN Defence. The Chief Guest presented DRDO Lab-level awards and Cash awards to meritorious employees of INMAS for their outstanding contributions.

Various employee engagement and team building activities were organised for INMAS employees and their families. A colourful cultural programme was also presented by the team INMAS.

NMRL, AMBERNATH

Naval Materials Research Laboratory (NMRL) celebrated its 66th Raising Day with great zeal and fervour on 5 January 2019. Prof. Devang V Khakhar, Director, IITB, was the Chief Guest and Dr Samir V Kamat, DS and DG (NS&M), the Guest of Honour on the occasion. Retired senior scientists and officials grace the occasion as the Special Guests. Dr M Patri, Director, NMRL, in his welcome address highlighted the overall growth and achievements made by the laboratory. The Chief Guest expressed a sense of great pride in the accomplishments made by NMRL over the years and extended to join hands together for progress of S&T. DG (NS&M) enthused the entire NMRL fraternity to work together as a unit to achieve greater heights in their mission to provide latest technological solutions to the Defence forces. Lab-level and cash awards were presented to the employees for their outstanding and meritorious performances in their field of activities. The function ended with a mellifluous renditions of songs and performances of orchestra by the in-house talents.

R&DE(E), PUNE

Research and Development Establishment (Engineers) [R&DE (E)] celebrated its 57th Annual Day on 8 February 2018. As a part of Annual Day celebrations, Aga Memorial Lecture was organised in honour of Brig. Aga, the founder Director of R&DE (E). The lecture was delivered by Lt Gen (Retd) DB Shekatkar, PVSM, AVSM, VSM on 'Enhancing Combat Capability and Rebalancing of Defence Expenditure'.Former employees who had contributed significantly to the establishment were felicitated by Shri VV Parlikar, Director R&DE (E), and Shri PM Kurulkar, DoMS. A workshop on Innovation at R&DE(E) was also organised on the occasion. Mementos were distributed to employees who completed 25 years of service. Lab-level DRDO Awards and Cash Awards were given to the meritorious employees. A rolling trophy under Swacha Baharat Abhiyan, was awarded to the group in the establishment who contributed significantly to the cleanliness. A colourful cultural programme by the employees of the establishment was the highlight of the Annual Day Celebration.

Annual sports were also organised during the week and prizes were distributed to the winners of the various sport competitions.

DIHAR – LAHDC USER INTERACTIVE MEET

Ladakh Autonomous Hill Development Council (LAHDC), Leh, headed by the Chief Executive Councillor (CEC) Shri Jamyang Tsering Namgyal, along with his team comprising of Executive Councillors (Agriculture, Horticulture, Forest and Cooperative) and Councillors, representing different regions of Ladakh had a User Interactive Meet at Defence Institute of High Altitude Research (DIHAR) on 30 January 2019.

The team was apprised of the various accomplishments of DIHAR with regard to technology adoption and popularization of winter potato storage, mulching and watermelon cultivation, value addition and certification of local germ plasm. The team visited various types of greenhouses and saw diversified crops being grown there even during the peak winter months. CEC appreciated the R&D works of DIHAR and requested to take a proactive role in fulfilling the vision of LAHDC to make and brand Ladakh as a pure organic food producer. Dr OP Chaurasia, Director, DIHAR acknowledged the support of LAHDC in fulfilling the mandate of the institute and assured them of continual scientific support to make Ladakh a model district in the country.

ALL INDIA JOINT RAJBHASHA TECHNICAL SEMINAR - UTKARSH

Bengaluru-bassed DRDO laboratories, viz., Electronics Radar and Development Establishment (LRDE), Aeronautical Development Establishment (ADE), Gas Turbine Research Establishment (GTRE), Centre For Air Borne System (CABS), Defence Avionics Research Establishment (DARE), Defence Bio-Engineering & Electro Medical Laboratory (DEBEL), Centre for Military Airworthiness & Certification (CEMILAC), Centre for Artificial Intelligence and Robotics (CAIR), Microwave Tube Research and Development Centre (MTRDC), and Combat Vehicles Research and Development Establishment (CVRDE), Avadi, Defence Food Research Laboratory (DFRL), Mysuru and Naval Physical Oceanographic Laboratory (NPOL), Kochi, jointly organised All India Rajbhasha Technical Seminar UTKARSH 2019 during 31 January 2019 to 1 February 2019 at LRDE.

The seminar was inaugurated by Dr Surendra Pal, DS Kothari Chair, DRDO, under the chairmanship of Director, LRDE. The Directors of Bengaluru-based DRDO labs and Vice Chairman of OLIC participated in the inaugural function.

Articles on various subjects, viz. Electronics, Aeronautical, Mechanical, Microwave, Life Science, Rajbhasha and Management were also presented. Paper presentation was organised for non-Hindi speakers to promote and encourage them. Awards were given for the best Papers.

A video clipping of the achievements of the participating labs/estts was also screened during the seminar. The Programme concluded with Presentation of Awards to the awardees.

HRD ACTIVITIES

COURSE ON APPLICATION OF NANO SIZE INGREDIENTS IN SOLID ROCKET PROPELLANTS

ACEP course on "Application of Nano Size Ingredients in Solid Rocket Propellants" was conducted at Advanced Centre for Energetic Materials (ACEM), Nasik. Dr VN Krishnamurthy, Sc 'H' (Retd), VSSC/ISRO inaugurated the course and delivered the keynote address on Application of Nano Size Ingredients in Solid Rocket Propellants. He also released a compendium of lecture notes on the occasion.

Shri Srinivasan Seshadri, General Manager, ACEM, welcomed the participants and emphasized the importance of the application of nano sized ingredients in futuristic propellant compositions.

A total of nine lectures were delivered covering basics of Nanoscience and Technology, Synthesis of Nano Transition Metal Oxides, Nano explosives, Nano Boron, Nano Aluminium, Characterisation of

Nano Ingredients, their application in Solid Propellants along with handling, storage and safety aspects of Nanomaterials. Speakers were invited from DRDO Laboratories, DIAT, NCL, Ozar College and local industry. Visit to the laboratory and other processing and testing facilities at ACEM was also conducted as part of the course.

Dr RK Pandey, OS and Associate Director, HRMRL, Pune, graced the valedictory session as the Chief Guest and gave away certificates and prizes to the participants. Dr SC Bhattacharyya, Sc 'G' was the Course Director and Shri R S Patil, Sc 'E' was the Course Coordinator

WORKSHOP ON SCIENTIFIC MISSIONS OF INS SAGARDHWANI

Naval Physical and Oceanographic Laboratory (NPOL), Kochi organized a one-day workshop on Achievements of INS Sagardhwani (marine acoustic research ship of NPOL) Scientific Missions on 7 January 2019. The workshop was inaugurated by Vice Adm Anil Kumar Chawla, AVSM, NM, VSM, FOC-in-C Southern Naval Command. Dr KV Sanil Kumar, Sc 'G' and Group Director, Ocean Sciences welcomed the gathering.

In his inaugural address, Vice Adm Chawla, reiterated Indian Navy's commitment to indigenization of naval technologies. He also stressed that Indian Navy and DRDO need to have collaborative efforts with academic institutions and private industries to utilize the best brains of the country for meeting indigenization goals on time. He lauded NPOL for organizing the technical workshop, which assumes greater significance in the Silver Jubilee Year of inception of INS Sagardhwani. Shri S Kedarnath Shenoy, OS and Director, NPOL, also addressed the function.

The inaugural function was followed by two technical sessions on Ocean Environment and Ocean Acoustics. In these sessions, 12 research papers were presented based on the research utilizing Sagardhwani data. Forty naval officers from the Indian Navy and scientists from NPOL attended the workshop. Dr A Raghunatha Rao, Sc 'F', was the Chairman of the Workshop.

WORKSHOP ON INNOVATIONS

A workshop on Innovation was organised on 6 February 2019 at Research and Development Establishment R&DE(E), Pune. Shri Ajay Panse, Innovation Strategist and Champion Research & Innovation, TATA Consultancy Services, was the Chief Guest who gave the keynote address on innovation and case studies.

On this occasion, officers and staff were invited to submit innovative works that they had carried out in their respective fields. A total of 145 innovator teams responded and out of which, the top five teams showed their innovations in the workshop and were presented with a Commendation Certificate. Another 11 innovations were selected for remarkable contribution and were awarded certificates. A compendium of all 140 innovations was also published during the workshop.

TRAINING PROGRAMME ON FINANCE & MATERIALS MANAGEMENT

A five-day training Programme on Finance and Materials Management was conducted by CGDA HQ at National Academy of Defence Financial Management, Pune during 14-18 January 2019. The programme was inaugurated in the presence of Shri VV Parlikar, OS and Director, R&DE (Engrs), Pune; Shri MK Sinha, IDAS, IFA (R&D), Pune; and Shri Mihir Kumar, IDAS, Director NADFM, Pune.

The programme covered various topics related to Finance and Material Management. Officers from DRDO and Defence Accounts Department (DAD) discussed and resolved multiple important issues and also generated new ideas for further improvement in system and better synergy between all the stakeholders.

Shri PK Mehta, DG (ACE), graced the last day of the programme as the Chief Guest. Dr AK Bhateja, OS and Director, DFMM, was also present. Thirty-three participants, both from DRDO and CGDA, attended the programme.

HINDI WORKSHOP

Defence Scientific Information and Documentation Centre Delhi, organized a one-day Hindi workshop on 31 January 2019. Dr Rashmi Agarwal, Sc 'E', INMAS, Delhi, delivered a lecture on "थायराइड का प्रबंधन". Dr Rajeev Vij, Sc G, who organised the workshop, briefed the participants about the need of increasing awareness of this common disease.

Dr Alka Suri, Director, DESIDOC, inaugurated the workshop and spoke about the various initiatives taken by the DESIDOC to encourage use of the Rajbhasha in day-to-day working. Dr Agarwal in her informative lecture elucidated how to cope and manage Thyroid. Ninety-eight participants attended the workshop.

Dr Rashmi Agarwal delivering talk on थायराइड का प्रबंधन

ORIENTATION PROGRAMME FOR APPRENTICE TRAINEE AT ITR

An Orientation Programme for Apprentice Trainee was organized at Integrated Test Range (ITR), Chandipur during 4-8 February 2019. Dr BK Das, OS and Director, ITR, inaugurated the programme.

The programme aimed to update the knowledge of the apprentice trainees and familiarize on the latest developments of Range Technologies, its implications and future advances. Various topics related to Range Technology, viz. Optical Tracking, S-Band Radar and its applications, Telemetry, Real Time computing system, etc., were covered in the programme. Distinguished faculty and experts from ITR delivered the lectures. Twenty Graduate apprentices and 14 Diploma apprentices of different branches of Engineering from different parts of the country participated in the programme. The Programme was organised by Shri PN Panda, Associate Group Director (HR&PL), and his team.

INCREON -2019

Naval Physical and Oceanographic Laboratory (NPOL), Kochi, organized a two-day In-house Course for Retiring Employees of NPOL (INCREON) 2019 during 21-22 January 2019. Twenty-five employees who are superannuating 2019 and their spouses participated in the course.

The course was inaugurated by Shri S Kedarnath Shenoy, OS and Director, NPOL who highlighted the relevance and significance of the course. Shri M Suresh, Chairman HRD Council, and Shri KV Rajasekharan Nair, Group Director (P&A), offered felicitations. The objective of the course was to prepare the participants for an active and productive retired life.

The course had a special session on early detection of cardio vascular diseases. Lectures on age-related health

disorders, socio and psychological aspects of retired life, and judicious investments post retirement were organised. In-house faculty explained in depth Pension Pay Order (PPO) and pensionary benefits and CGHS and Medical reimbursements to the participants.

A session on Yoga for Healthy Living was also conducted.

SKILL DEVELOPMENT TRAINING PROGRAMME

A two-day skill development training programme on "Value addition of Locally Available Fruits and Vegetables of Arunachal Pradesh" was conducted jointly by Defence Food Research Laboratory (DFRL), Mysuru and Defence Research Laboratory (DRL), Tezpur, during 18-19 January 2019 at DRL Dett., Salari, under the DRDO TD Programme Arunodaya.

The participants were demonstrated the process of pineapple preservation by hurdle technology followed by blanching in sucrose and addition of preservative at the end. The packaging of the processed pineapple was also shown in LDPE (Low Density Poly Ethylene) and PAP (Paper-Aluminium foil-Plastic) wrappers respectively. The participants were shown the process of osmotic-dehydration of orange

slices. Crystallization-dehydration of ginger using jaggery and sugar was also demonstrated. A total of 31 participants from Salari village and Rupa region of West Kameng district of Arunachal Pradesh attended the event including State Department Officials from Govt. Horticulture Farm, Salari.

PERSONNEL NEWS

APPOINTMENT

Dr Seema Vinayak, Sc 'G', has assumed the charge of Director of Solid State Physics Laboratory (SSPL), Delhi on 1 January 2019. She obtained her MSc (Physics) degree from Panjab University, Chandigarh, in 1985 and joined DRDO at SSPL in 1986 as Sc 'B'. She did her MTech and PhD from Department of Physics, Indian Institute of Technology Delhi, in 1991 and 2007, respectively.

Dr Vinayak has to her credit more than 30 years of experience in the indigenous development of high frequency semiconductor devices and MMICs for strategic applications. She has successfully spearheaded several MMIC related ToTs to production. Her specific areas of expertise include development of AlGaN/GaN HEMT device and MMICs, MESFET based 12-18 GHz GaAs MMIC technologies, W band GaAs Gunn and Schottky barrier beam-lead Diodes and Nichrome thin film resistors in GaAs MMICs.

She has to her credit more than 50 publications in national and international journals, seminars, conferences, and workshops. She has received several prestigious awards including DRDO Outstanding Team Work Award for pathbreaking research in year 1999 for the development of GaAs-based MMIC Technology, DRDO Technology Award in year 1995 for the development of mm wave devices, Certificate of Commendation from SA to RM in the year 1990, Gold Medal for the development of Nichrome thin film resistors in 2006, DRDO Pathbreaking Research/Outstanding Technology Development Award for the year 2016 as the team leader for the development of AlGaN/GaN HEMT Technology. She is currently leading several strategic R&D programmes of the DRDO.

AWARDS

SPPS Distinguished Scientist Award

Society for Plant Protection Sciences (SPPS) conferred 'Distinguished Scientist Award for Year 2018', to Dr Madhu Bala, Sc 'G' and Director, Defence Institute of Bio-Energy Research (DIBER), Haldwani for her significant contributions in the field of Microbiology. Dr RS Paroda, Chairman TAAS and former DG, ICAR and Secretary, DARE, Govt of India, presented the award to Dr Madhu Bala at the inaugural function of 1st International Conference on Climate Change and Adoptive Crop Protection for Sustainable Agri-horticulture Landscape.

Vasvik Industrial Research Award

Dr AK Mukhopadhyay, OS and Associate Director, DMRL, Hyderabad, has received "Vasvik Industrial Research Award" for the year 2018 in the field of Material and Metallurgical Sciences and Technology. The award was given in recognition of exemplary contributions towards self-reliance by indigenous development and production, quality assurance and type testing of various grades of specialty aluminium alloys for applications in defence and space sectors.

HIGHER QUALIFICATIONS ACQUIRED

Shri HH Kumar, Sc 'G', Armament Research and Development Establishment (ARDE), Pune, has been awarded PhD by DIAT (DU), Pune, for the thesis entitled "Synthesis and Characterization of Nano-crystalline La-PNS-PZT composition for power harvesting in strategic applications."

Shri A Sambasiva Rao, Sc 'F', Defence Metallurgical Research Laboratory (DMRL), Hyderabad, has been awarded PhD by NIT, Warangal, for the thesis entitled "Microstructure and Mechanical Property Correlation of Ni-Fe-W and Ni-Fe-W-Co Matrix Alloys."

Shri Himalay Basumatary, Sc 'E', DMRL has been awarded PhD by Indian IISc, Bengaluru, for the thesis entitled "Structure, Microstructure and Magnetic Properties of Fe-Ga and R-Fe base Magnetostrictive Thin Films."

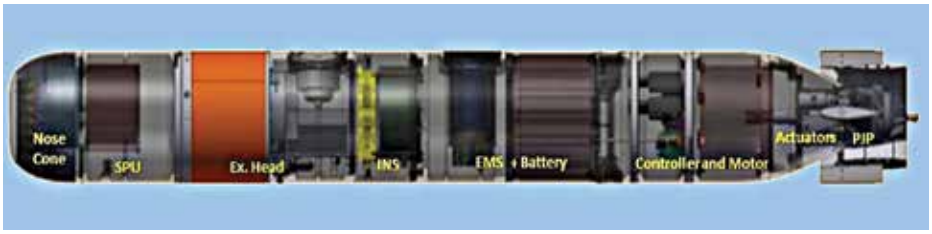
Smt Shuchi Bhagi, Sc 'B', Institute of Nuclear Medicine and Allied Sciences (INMAS), Delhi, has been awarded PhD by Bharathiar University, Coimbatore for the thesis entitled "Deciphering the Genetic Basis of High Altitude Acclimatization."

ADVANCED LIGHT WEIGHT TORPEDO

This column covers the pathbreaking and successful projects and programmes of the DRDO.

Advanced Lightweight Torpedo (ALWT) is an anti-submarine torpedo launched from ship, helicopter or from a fixed wing aircraft. The presence of enemy target is detected by the sonar onboard a ship or an aircraft. Based on target parameters estimated by the sonar and Fire Control System, torpedo is fired with a few preset parameters to ensure that the weapon is in most favourable position to acquire the target, home in and destroy it. As submarine can change course and depth during its evasive manoeuvre, the weapon is to be guided in both horizontal and vertical planes to attack the target.

Lightweight torpedoes around the world conform to a diameter of 324 mm, an overall length of 2.5-3 m and weigh around 300 kg. ALWT has an operational depth of 600 m, is capable of being launched from lightweight torpedo tubes of IN ships, Advanced Light Helicopter and Sea King 42B helicopters of the IN.



ALWT – Torpedo Major Subsystems

ALWT—Salient Features

- Dynamics: Capable of variable speeds ranging up to 50 knots
- Acoustic Homing
  Mode: Active, Passive and Mixed
  Active Frequency: FM, CW or Combination
- Warhead: shaped charge, capable of penetrating the pressure hull of a submarine
- The control and guidance elements of the torpedo is capable of navigating the torpedo to ensure target acquisition with more than 50% probability at 80% of the maximum engagement range of the torpedo
- Seawater activated torpedo battery capable of generating the speed and endurance specified

ALWT being launched from Ship-borne Launcher

SUB-SYSTEMS

The main sub-systems of ALWT are classified in mechanical and electronics sub-systems. Mechanical sub-systems comprise:

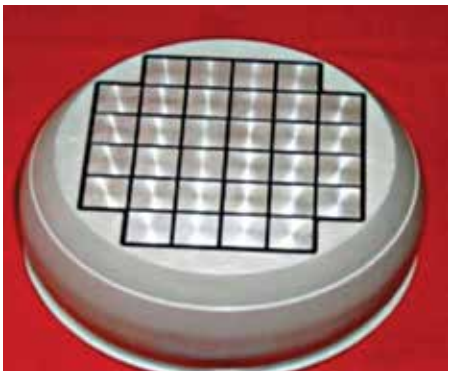
- Nose Cone & SPU Shells
- Exercise Head
- INS & Battery Shells
- Rear Section
- Sealing System
- Propulsion Electric drive and motor
- Pump Jet Propeller (PJP)
- Actuation System
- Exercise Torpedo Recovery Aids: Integrated Pneumatic Recovery System (IPRS) and Sunken Torpedo Recovery System (STRS)
- Flight in Air Mechanism (FIAM) including parachute, torpedo release mechanism etc.

Electronic systems comprise:

- Homing system (Acoustic Sensors, Front End Electronics and Signal Processing System)
- Onboard Computer
- Integrated Instrumentation and Recording System (IIRS) and Recovery Systems
- Inertial Navigation System (INS)/ Attitude & Heading Reference System (AHRS)
- Battery Systems and Scoop Bulk Head
- Power Electronic Drive and BLDC Motor
- Actuation System
- Presetter System

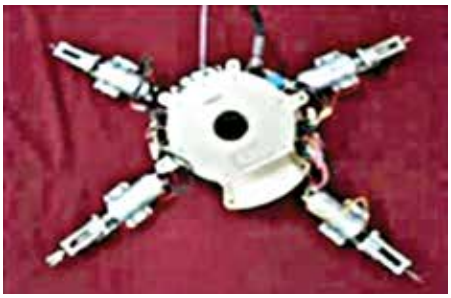
CURRENT STATUS

ALWT has completed 32 technical trials at sea and is gearing up for User Evaluation Trials.



Homing Systems

Compact IIRS & OBC



4 Axis Controller

Propulsion Motor

INS

Shaped Charge

READERS' FEEDBACK

(Your feedback is important to us as it gives scope for improvement and serve the Organisation in a better way)

1. **Name of the Establishment:**_____

2. **How would you rate the *DRDO Newsletter* as a medium to adequately present DRDO developments?**

   Excellent ☐ Very Good ☐ Good ☐ Fair ☐ Satisfactory ☐

3. **How would you rate the technical contents of the *Newsletter*?**

   Excellent ☐ Very Good ☐ Good ☐ Fair ☐ Satisfactory ☐

4. **How would you rate the quality of photographs in the *Newsletter*?**

   Excellent ☐ Very Good ☐ Good ☐ Fair ☐ Satisfactory ☐

5. **Ideal number of pages you would like for the *Newsletter*?**

   8 Pages ☐ 12 Pages ☐ 16 Pages ☐ 20 Pages ☐

6. **In which format do you prefers the *Newsletter*?**

   Print ☐ E-pub ☐ Video magazine ☐

7. **When are you receiving the *Newsletter*:**

   In the previous month of publishing ☐ In the same month of publishing ☐

   In the next month of publishing ☐

8. **Suggestions, if any, to further improve the technical content of the *Newsletter*?**

_____

_____

_____

Signature:
Name:
Address:.....
.....
.....

Please send your suggestions to:

The Editor, DRDO Newsletter, DESIDOC, DRDO, Metcalfe House, Delhi - 110 054

DRDO HARNESSING SCIENCE FOR PEACE & SECURITY

CHAPTER 4: MARCHING FORWARD

The article is 36h 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).

ARMAMENTS

Armament Research and Development Establishment

The representative list of significant contributions would include the development of escape aid cartridges, signal cartridges, and distress visual night signal cartridge for the Air Force. The development work on Seat Ejection and Escape Aid Cartridges had been initiated when the supply of these for aircraft of UK origin was stopped by the Government of UK during the 1965 conflict with Pakistan. As a trained pilot is an important asset of any Air Force, measures to save his life even under the most adverse conditions of flight, had to be incorporated in the aircraft. All combat aircraft were therefore provided with crew escape aid systems which demanded the highest degree of operational reliability. Escape aid cartridges would be fitted in the ejection seat system of the aircraft and since the aircraft would be grounded without them, ARDE took up the development with all speed. After they were approved by the IAF for introduction into Service, production on a pilot plant basis by ARDE had to be resorted to since the requirements were small for each aircraft and not attractive for industry. The development effort and the pilot plant would continue even after the IAF switched over to aircraft of Russian origin.

The decade of the 1960's was also the period of adjustment and understanding between the design and production agencies. There were ups and downs in the interactions between the agencies, namely DRDO and the Ordnance Factories, mainly because the designers on their part focussed on technological innovation and gave lesser importance to production worthiness, while the production agencies straight away rejected designs that could not be produced with the existing machinery, tools and fixtures. Another difficulty was that of finding manufacturers who would participate in the development process which required production of ammunition in small lots for trials at short notices before zeroing in on the final design. The Ordnance Factories were not interested placement of orders by the Services for the store. All requirements of parts and components during development, including the numbers needed for evaluation before finalisation, and those needed for user evaluation and trials had to be procured from small-scale private sector manufacturers. The government rules required that bulk production orders for ammunition and weapons systems would have to be placed on ordnance factories, which discouraged participation from the private sector. Modification of the existing rules was not easy but with persistence by the designers, the rules were changed to accommodate small scale entrepreneurs in the private sector to participate in the development process with the provision that the 80 per cent of the first order of parts and components for volume production would be placed on the agencies participating in the development process.

The development of a variety of warheads for gun and mortar application and the involvement of ARDE in technology absorption of a range of new products in the earlier decade provided the knowledge base and the confidence to develop new range of products with increasing performance levels and higher technology content. The major contributions of the 1970's were,

- 105 mm Indian field gun for the field artillery
- Several stand-alone projects in the areas of gun and mortar ammunition, fuses, land mines, air and naval armaments.
- 51 mm infantry platoon mortar and its ammunition family
- Pilot plants in the vital areas of PZT piezo-ceramic materials and pyro power-cartridge for life/mission-critical aircraft escape-aid and stores separation systems.

The 105 mm Indian Field Gun was developed as a replacement to the 25 Pounder gun used by the Indian Army. The initial development activities were carried out at ARDE in the 1960's and later transferred to the gun development team that was earlier involved in the development of the Howitzer. The activities included the design and development of the carriage for the gun, the associated ammunition namely HE (High Explosive), High

Explosive Squash Head (HESH), smoke and star shells, modification of the prime mover and design of a new gun barrel using the existing breech and muzzle brake for extending the range of the weapon to the desired value. The gun with its ammunition was tried out by the Artillery, accepted for introduction into Service and the units started rolling out of the production line in early 1970's. This was culmination of close interaction between ARDE, the Army and the Ordnance Factories and demonstrated the continuity of the R&D effort in area of guns over more than one product and in a time period of about one and a half decade.

Another important activity of ARDE was the upgunning of the Russian tank T-55 which had been acquired from Russia. The Indian Army had in its arsenal a large number of T-55 tanks with 100 mm gun as its main weapon. With this calibre and firing Armour Piercing (AP) and High Explosive Anti Tank (HEAT) shells, the tank was clearly outgunned in comparison to the tanks of Western origin. ARDE proposed to mount the indigenously produced 105 mm gun for the Vijayanta tank on the T-55 so that it would be equipped with excellent fire power. This programme was carried out in close collaboration with the 502 Army Base Workshop, Cooper Engineering Works and two ordnance factories. The close coordination among the user, design agency and the manufacturers ensured free interchange of information and data between the agencies and to its success. For ARDE, this was also an excellent opportunity to gain insight into the problems the gun designer would face in designing the weapon for a tank.

World War II and it was the first ever attempt to introduce electronics in armaments. While the Indian Navy was using fuses imported from the UK, the Indian Army did not possess these. Since its aerial burst was effective against ground troops, the development of the fuze was undertaken by ARDE. It was the prime contractor and was responsible for the development of the explosive train.

The electronics part was concurrently developed by two R&D agencies, namely the Bhabha Atomic Research Center (BARC) of the Department of Atomic Energy and by the Solid State Physics Laboratory (SSPL) of DRDO. The BARC was involved in the development of the VT fuze for the 25 Pounder gun while the SSPL's involvement was for the development of the VT fuze for the 75/24 Pack Howitzer. The VT fuses for the 105 mm IFG and the 75/24 Pack Howitzer were successfully completed and they rolled out of the production line in 1973. For this project, ARDE had two customers, namely the Army and the Indian Navy, two associate R&D agencies in development namely BARC and SSPL, and three production agencies, namely Electronics Corporation of India (fuze for 105 mm IFG) and HAL, both in Hyderabad and an ordnance factory.

It was no easy task for ARDE to finalise in association with the agencies involved in development and production and with the User Services, the modalities for testing and proofing the rounds and quality acceptance procedures. The development work on fuses was continued with BARC and SSPL and was crowned with success, with BARC involved in the VT fuze for the 76.2 mm gun for the Navy and SSPL for the VT fuses for the 130 mm Russian gun for the Army and the 4.5 inch gun for the Navy. In addition to these, ARDE developed and got a wide variety of ammunition manufactured for the three Services. Some of these were, illuminating ammunition, antitank mine, improved tear gas grenade and triple-chaser for the police, limpet mines, chaff dispensing warhead, IR cartridges, practice and operational pods for IAF, plasticised white phosphorous filled ammunition for 120 mm grenade and 81 mm mortars, sub-calibre inserts for 105 mm Vijayanta and for 20 Pounder Centurion tank guns, launching device for 36 mm grenade, photo flash cartridge for low-level night photography, training ammunition and so on.

ARDE had also undertaken the development of a new mortar with higher range and better lethal terminal effects for Infantry platoons. These were smooth bore muzzle-loaded weapons and would replace the World War II vintage 2 inch mortar held by the Indian Army. The development of the 51 mm mortar had as its objective, doubling the range without unduly increasing the weight. For increasing the range, the gun had to be fired at higher pressures which called for a forged base plate integral with the breech. As this had not been incorporated in the earlier 2 inch mortar, a period for learning by doing was necessary. Initial trials in the 1970's were very promising.

Another venture was the development of the non-detachable mine Mk III which could be laid with a mechanical mine layer. This would be a long mine with nearly double the explosive component and a pneumatic fuze which would activate the mine even when a small portion of the track passed over the body of the mine. The development had been completed and was cleared for initial trials phase by the Services.

There were other project activities, such as the development of the 7.62 mm Pashan Light Rifle (PLR) and that of the 105 mm SP Gun, though not culminating in production, nonetheless, provided invaluable experience and helped build up competence in Small Arms and Main Armament Systems for Armoured Fighting Vehicles, respectively.

To be continued...

VISITORS TO THE DRDO LABS/ESTTS

DEBEL, Bengaluru

Dr AK Singh, OS and DG (LS), DRDO, visited Defence Bio-Engineering & Electro Medical Laboratory (DEBEL) on 18 January 2019. DG (LS) chaired the Executive Board Review of DEBEL's ongoing projects and Programme Management Board of the Society for Biomedical Technology (SBMT). He also inaugurated the Biomechatronics facility, which will be used for human gait analysis in real time, providing data of immense utilities in carrying out Human Exoskeleton related project activities at DEBEL. He was apprised of the lab testing facilities related to ILSS of Tejas aircraft, SES and Chem-Bio lab.

DG (LS) being briefed about the activities of DEBEL

DIPR, Delhi

Dr G Satheesh Reddy, Secretary, Department of Defence R&D and Chairman, DRDO, visited Defence Institute of Psychological Research (DIPR), Delhi, on 25 January 2019. He was accompanied by Dr S Guruprasad, OS and DG (PC&SI); Dr AK Singh, OS and DG (LS); and Dr Chandrika Kaushik, Director, DISB. Dr Reddy reviewed the activities and ongoing projects of DIPR and offered valuable suggestions and further directions. Chairman DRDO took keen interest in the activities of DIPR and suggested to expand the area of work for DRDO fraternity. Chairman also visited CPSS Lab and Pilot Mental Workload Assessment Facility at DIPR during his visit.

Secretary DDR&D being briefed about CPSS by the Director DIPR

DRL, Tezpur

Maj Gen MU Nair, SM, Chief of Staff, HQ 4 Corps, visited Defence Research Laboratory (DRL)on 21 February 2019. Dr SK Dwivedi, Director, DRL, welcomed the Corps Commander. A comprehensive overview of the on-going research programme of the laboratory including the Programme Arunodaya was presented to him by Dr BJ Gogoi, Sc 'E'.

Maj Gen MU Nair being briefed about DRL technologies

Published by Director, DESIDOC, Metcalfe House, Delhi-110 054