

# DRDO

NEWSLETTER



A Monthly Bulletin of Defence Research and Development Organisation

ISSN: 0971-4391

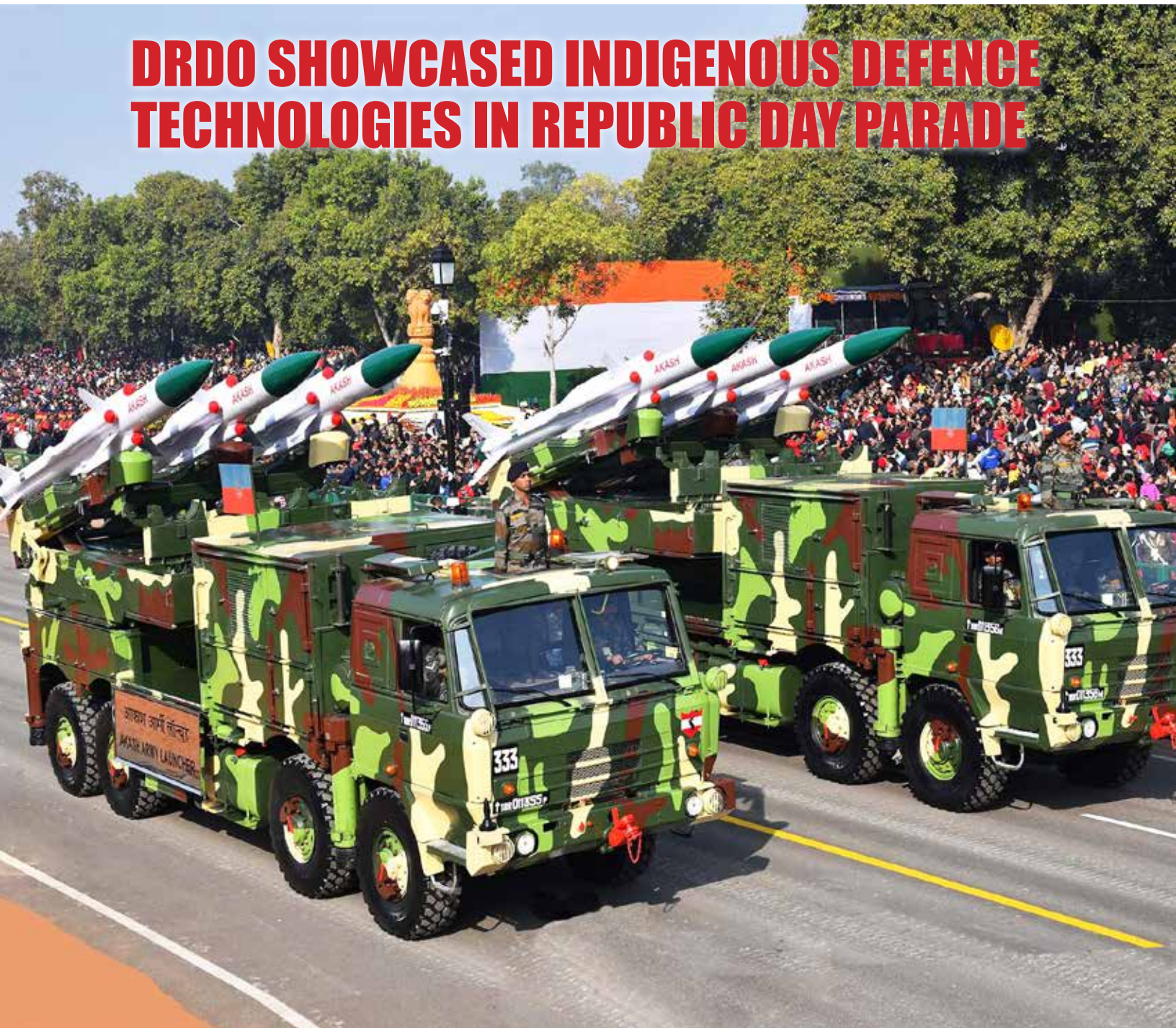
www.drdo.gov.in

FEBRUARY 2019

VOLUME 39

ISSUE 2

## DRDO SHOWCASED INDIGENOUS DEFENCE TECHNOLOGIES IN REPUBLIC DAY PARADE



TOT >> p06

EVENTS >> p7

HRD ACTIVITIES >> p14

SPORTS ROUND-UP >> p16

DRDO SERIES >> p18

VISITS >> p20

# CONTENTS

FEBRUARY 2019  
VOLUME 39 | ISSUE 2  
ISSN: 0971-4391

**COVER STORY** ..... **04**

**DRDO Showcased Indigenous Defence Technologies in Republic Day Parade**



**INNOVATION** ..... **05**

**TOT** ..... **06**





<b>EVENTS</b> .....	<b>07</b>	<b>PERSONNEL NEWS</b> .....	<b>17</b>
<b>HRD ACTIVITIES</b> .....	<b>14</b>	<b>DRDO SERIES</b> .....	<b>18</b>
<b>SPORTS ROUND-UP</b> .....	<b>16</b>	<b>INFRA DEVELOPMENT</b> .....	<b>20</b>



<b>VISITS</b> .....	<b>20</b>
---------------------	-----------

## 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](mailto:director@desidoc.drdo.in)

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

### LOCAL CORRESPONDENTS

**Ahmednagar:** Lt Col. AK Singh, Vehicles Research & Development Establishment (VRDE); **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 Bhuvanewari, 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)

# DRDO SHOWCASED INDIGENOUS DEFENCE TECHNOLOGIES IN REPUBLIC DAY PARADE

**D**RDO displayed indigenously designed and developed Medium range Surface-to-Air Missile (MRSAM), Akash, in the Republic Day Parade 2019. MRSAM is an Air and Missile Defence (AMD) system intended for the protection of own territories and ground forces against attacks by enemy aircraft and guided weapons.

DRDO also showcased Arjun

Armoured Recovery and Repair Vehicle (Arjun ARRV). Armoured recovery and repair vehicles ensure efficient and speedy repair and recovery operations during combat. Arjun AARV has been developed to meet the needs of Arjun MBT regiment for recovery and repair functions of Arjun MBT. The indigenous system is comparable with contemporary ARVs. The DAC has approved the

procurement of ARRV. These would be manufactured by M/s BEML.

Besides, the Air Force Tableau titled 'Indian Air Force Encouraging Indigenization' showcased the scaled-down models of the aircraft, radar and missile system developed indigenously. The models displayed included Light Combat Aircraft, Low-Level Light Weight Radar, and Akash Missile System.





# ANURAG & RIC BUILD INDIGENOUS RADIATION FAULT TOLERANT PLATFORM FOR AERIAL ON-BOARD COMPUTER APPLICATIONS

**A**dvanced Numerical Research and Analysis Group (ANURAG), Hyderabad, and Research and Innovation Centre (RIC), Chennai have designed, developed, integrated and validated indigenous ABACUS processor-based Radiation Fault Tolerant and Secure Platform (FTSP) for various DRDO aerial on-board computer applications. The primary objective of the research was to evolve a computing platform, which can mitigate the effects/faults generated due to cosmic radiation. This research paves way to addresses the denial of radiation hardened technology products for strategic applications, which primarily fall under the export control category and are expensive.

The fault tolerant computing platform is based on ANURAG's ABACUS processor—a 32-bit processor

based on the RISC architecture suitable for multi-tasking applications. The ABACUS architecture has been converted in to fault tolerant architecture by incorporating Triple Modular Redundancy (TMR) and Single Error Correction and Double Error Detection (SEC-DED) techniques. The processor is supported by a compiler tool chain and Integrated Development Environment (IDE).

The fault tolerant computing platform in FPGA with real-time sensors used in aerial vehicle with 1553B, AHRS, GPS, pressure sensor, RF link, etc., was developed by RIC Chennai.

The strong potential and demonstrated capability led the user labs to initiate application mapping to gain the reliability advantage, using the fault tolerant hardware for various applications. The fault tolerant

technology has become an indispensable part of any control computer for land and aerial applications. Added to the fact the effect of radiation is now prevalent even at ground level due to reduction in transistor feature size dimension, the technology is in demand for the commercial, automobile, medical, nuclear, banking applications and many more.

The hardware optimization for specific application, environmental qualification, radiation testing and certification would be planned based on the application mapping and the trial results, by user labs.

A patent has been filed on “Method and a System for Simulating Single Event Upsets in Digital Logics in Design Stage” through Directorate of ER&IPR DRDO HQ.





# SUCCESSFUL FLIGHT TEST OF LRSAM

Ship launched Long Range Surface-to-Air Missile (LRSAM) was successfully test fired from INS Chennai against an incoming aerial target flying at low altitude on 24 January 2019. The missile destroyed the target with a direct hit. All the mission objectives were successfully met.

LRSAM has been jointly developed by DRDO, and M/s Israel Aerospace



Industries (IAI), Israel for the Indian Navy.

Raksha Mantri Smt Nirmala Sitharaman congratulated DRDO, Indian Navy and associated team members. India achieves a significant milestone with successful flight test of LRSAM on board INS Chennai. The missile directly hit a low flying aerial target, said the twitter handle of Smt Nirmala Sitharaman.

## TOT

# NSTL TRANSFERS TECHNOLOGIES FOR MIST AND MAREECH

Naval Science and Technological Laboratory (NSTL), Vishakapatnam, transferred technology for Mist Based Infra Red Suppression Technology (MIST) System to M/s Decimin Control Systems Pvt Ltd, Pune. NSTL also transferred technology for Maareech Anti Torpedo Decoy System to M/s BEL, Bangalore. Secretary DDR&D and Chairman, DRDO Dr G Satheesh Reddy was present during the event.

The exhaust gas from main propulsion gas turbine engines of ships provides a very high thermal (infrared) signature which is used by the IR seekers in the missile homing systems for passive detection. Water mist injection is used to reduce the infrared signature by reducing the exhaust gas temperature. NSTL has designed Mist based Infrared Suppression Technology (MIST) in which sea water at ambient temperature is injected into the hot exhaust gas as very fine mist to absorb a large amount of heat because of latent heat vaporization. A dedicated control



system has been developed to meter the quantity of sea water to prevent corrosion due to excess un-evaporated sea water being deposited at other parts of the ship.

Mareech, is an advanced version of

the regular decoys used for diverting incoming enemy underwater torpedoes. The technology is useful for counter measuring torpedoes. The system has been inducted into the Indian Navy.



# DRDO ORGANISED WORKSHOP ON FIRE SAFETY TECHNOLOGIES AND SERVICES

**D**r Subhash Bhamre, Raksha Rajya Mantri inaugurated a workshop on 'Fire Safety Technologies and Services', at Prof. Kothari Auditorium, DRDO Bhavan on 21 January 2019. Fire Adviser, Ministry of Home Affairs Shri DK Shami also attended the function. Secretary Department of Defence R&D & Chairman DRDO Dr G Satheesh Reddy was present on the occasion.

Dr Subhash Bhamre in his inaugural address congratulated DRDO for organizing the workshop and said that the best way to minimize the risk of fire is to understand potential threats and put in place preventive measures. Dr Bhamre added that technologies developed by Centre for Fire, Explosive and Environment Safety (CFEES) can have applications for civil sectors also, and needs to be exploited to the fullest.

The workshop was organized by CFEES, with an aim to sensitize the

State Fire Services and users on the use of risk evaluation, mitigation and elimination of fire related accidents and use of technologies developed by DRDO. An exhibition of products and technologies developed by CFEES was also organized on the occasion.

Dr G Satheesh Reddy in his address said that the technologies and products developed by DRDO are finding application not only in defence sector but also have spin-offs for civilian sectors. He further said that we need to look for opportunities and gear up the capacity for indigenous fire safety products and services in India.

Shri DK Shami in his speech highlighted the need for formation of core group for short and long term roadmap for R&D and test facilities in the areas of fire safety, and low cost impact technology for fire safety to be developed by DRDO. He further

said that products and technologies developed by DRDO can be introduced into the State Fire Services.

Dr Chitra Rajagopal, DGI (SAM) DRDO, welcomed the delegates and said that to enhance the fire fighting efficiency, the fire services has to be well equipped with state-of-the-art technologies and equipment. She further said DRDO can play an important role by sensitizing on latest fire safety technologies and products developed by CFEES for the Armed Forces.

The inaugural session of the workshop was followed by technical presentations, panel discussions and product demonstrations. A large number of delegates including Directors General, Directors of the State Fire Services and Fire Chiefs of many States and Union Territories attended the workshop.



## NSTL-ACADEMIA MEET 2019

Naval Science and Technological Laboratory (NSTL), Visakhapatnam, organized the NSTL-Academia Meet 2019 (NAM 2019) on 19 January 2019. With the theme “Artificial Intelligence (AI) for Naval Systems”, NAM 2019 provided the ideal platform for deliberation and discussion on the topic and its application to defence systems, with specific emphasis on naval systems. A number of researchers and faculty from 18 Universities, technologists and system developers of six labs of the DRDO, viz., NSTL, Naval Materials Research Laboratory, Centre for Artificial Intelligence and Robotics, Naval Physical Oceanographic Laboratory, Defence Materials Research Laboratory and Defence Electronics Application Laboratory actively

participated in the meet and exchanged views and ideas on the subject.

Speaking on the occasion, Dr OR Nandagopan, OS and Director NSTL, described the academic institutes as fountain heads of innovation and expressed hope that NAM 2019 would help bridge the gap between academia and R&D institutes and bring out a roadmap for futuristic research in AI-enabled naval systems.

The Distinguished Guest at NAM 2019, Dr Samir V Kamath, DS and Director General (NS&M), DRDO, recalled the contributions of academia the world over in fostering a spirit of enquiry and harnessing innovation and creativity to meet social and technological needs of the society at large. He opined that AI would play a major role in the battlefield of the future,

and hoped that the participants would benefit immensely from the interaction.

The Chief Guest Prof. G Nageswara Rao, Vice Chancellor of Andhra University, commended the initiative, calling it ‘timely and apt’, and exhorted researchers to give their creative best towards development of ‘best in class naval systems’.

The keynote address was delivered by Dr Anil Kumar Agarwal, Director ER&IPR, DRDO, followed by expert talks on various topics of contemporary and futuristic relevance by Technology Directors of NSTL, and Professors from Universities. Shri G Ravi Kumar, Technology Director NSTL and Chairman NAM 2019, a large number of researchers, scientists and academicians participated in NAM 2019.







# EXHIBITOR OF THE YEAR AWARD FOR DRDO AT 106TH INDIAN SCIENCE CONGRESS

**D**RDO pavilion received 'Exhibitor of the Year Award' at 106th Indian Science Congress held at Lovely Professional University (LPU), Phagwara, Punjab. The pavilion narrated the saga of self-reliance & national pride with the 'Make in India' spirit was a big attraction among people, especially students visiting the pavilion and getting opportunity to interact with DRDO scientists.

The DRDO Pavilion at the mega science expo was inaugurated on January 03, 2019 by the Governor of Punjab Shri VP Singh Badnore and Union Science and Technology Minister Dr Harsh Vardhan. They took keen interest in DRDO products and technologies displayed. Secretary, Department of Defence R&D and Chairman DRDO Dr G Satheesh Reddy was present during the inaugural function. Later in the day, a special address on the present and future technologies in defence systems and opportunities for the young researchers

was delivered by Dr G Satheesh Reddy.

Director General (Naval Systems and Materials) Dr Samir V Kamat and Director General (Life Sciences) Dr AK Singh delivered lectures on 'Materials Technologies for Future Defence Systems' and 'Evolving Landscape in Life Sciences', respectively. Director General (Production Coordination & Services Interaction) Dr S Guruprasad was also present.

DRDO's outdoor exhibits included surface-to-air missile system Akash; model of BrahMos missile; remotely operated vehicle Daksh; heavy weight torpedo Varunastra; Laser Ordnance Disposal System (LORDS); and Vehicle Mounted Dazzler, etc. Indoor exhibits of DRDO included: models of various missile systems like Prithvi, Astra, Nag, HELINA and LRSAM; Rustom UAV; MBT Arjun Mk1A; Armoured Engineer Recce Vehicle; 155mm Advanced Towed Artillery Gun System; PINAKA Multi Barrel Rocket Launcher; Plastic Bullet; Multi-Mode Hand Grenades; SONAR

systems; Radars; Night Vision Devices; Bullet Proof Jackets and Helmets; Micro Wave Power Module; Integrated and Multi-Function Sight. Life Sciences Products included: Portable Chemical Agent Detector; Individual Underwater Breathing Apparatus for T-90 tank crew; Bukhari; Alocal Cream; and Ready-to-Eat Packaged Foods, etc.

DRDO pavilion also had a dedicated stall on Technology Development Fund (TDF) Scheme for promoting public/private industries especially MSMEs so as to create an eco-system for enhancing cutting edge technology capability for defence application. The pavilion also provided information on 'Kalam's vision: Dare to Dream' the pan India online contest for engaging young minds in emerging technologies namely Artificial intelligence, Cyber security, Robotics, Autonomous Systems, etc. The objective is to unearth disruptive ideas and concepts in emerging technologies identified by DRDO for enhancing defence capabilities.



## DRDO DIAMOND JUBILEE ORATION

Directorate of Rajbhasha and OM, DRDO HQ, and Defence Scientific Information and Documentation Centre (DESIDOC), Delhi, jointly organised DRDO Diamond Jubilee Oration by Prof. Randeep Guleria, Director, AIIMS, Delhi, on

21 December 2018 at Dr Bhagavantham Auditorium, Metcalfe House, Delhi. Shri Hari Babu Srivastava, OS and Director LASTEC, Dr Alka Suri, Director, DESIDOC, and Dr Rajeev Vij, Associate Director, DESIDOC, were present on the occasion.

Prof. Guleria enriched the audience with his ideas and thoughts. He talked about how to stay healthy in present day polluted environment. He spoke about the impact of lifestyle and technology developments on sleep disorders. Dr Vij, proposed the vote of thanks.



## TALK ON PURSUIT OF HAPPINESS

Laser Science and Technology Centre (LASTEC), Delhi, organized a lecture on "Pursuit of Happiness" through physical-mental well being by Shri Deepak Sharma, Professional Life Coach, on 21 December 2018 at Circular Hall, Metcalfe House.

Deepak Sharma motivated people by stressing upon the importance of how to keep themselves happy and stress free. He mentioned that it could also be achieved by just a little bit of laughing in our daily lives. Importance of yoga for physical fitness was discussed and some simple yoga exercises were practiced. For mental health, the importance of meditation with sufiana meditation practical was carried out.

He also told about the importance of Ayurveda, in our daily life. He also explained the benefits of getting up



early in the morning and sleeping early at night along with details of right time to eat food.

The lecture ended with a huge smile on everyone's face and lots of questions to the orator.



# WORLD QUALITY DAY

## ASL, HYDERABAD

**S**ystems Analysis, Quality and Reliability (SQR) Vertical, Office of DG (MSS), celebrated World Quality Day on 15 December 2018 at Advanced Systems Laboratory (ASL), Hyderabad. Shri MSR Prasad, DS and DG (MSS), graced the occasion as the Chief Guest. Dr M Manickavasagan, OS and Director, SQR, exhorted employees of missile complex to follow “Quality Centric Development” in letter and spirit. DG (MSS) in his address, emphasized the need of quality to maintain credibility of products and suggested that quality should be perceived as a way of life. Shri Dasarath Ram Yadav, DS and Director, DRDL, Shri BHVS Narayana Murthy, DS and Director, RCI, and Dr MRM Babu, DS and Director, ASL, addressed the gathering.

R Adm Sanjay Mishra, DG, NAI, in his keynote address highlighted the challenges in implementation of quality policy. He suggested that quality should not be considered as a check point but should be implemented as a package of resilience, integrity and trust to improve effectiveness of quality agencies. Invited talks on Identification of Counterfeit Components by Capt Satyanarayana SP, IN (Retd), and Implementation of Quality in Management by Shri R Vasu, Vice President, Brakes India Pvt. Ltd provided an opportunity to the participants to interact with industry experts. Shri S Giridhar Rao, PD A1&A2 proposed the vote of thanks.

## DMRL, HYDERABAD

**T**he World Quality Day was observed in Defence Metallurgical Research Laboratory (DMRL), Hyderabad at Tamahankar Auditorium. Dr AK Mukhopadhyay, OS & Associate Director and Head, Aeronautical Materials Division, chaired the occasion.



Two distinguished Speakers, Shri Amol K Chakraborty, former Director, DRDL, and Vice Admiral (Retd) NN Kumar, PVSM, AVSM, ASM and Executive Director (Production), BrahMos Aerospace, graced the occasion.

Shri Chakraborty outlined the philosophy and practices in quality with a talk on World Quality Movement. He elaborated evolution of Quality in DRDO's missile programmes. Vice Admiral (Retd) NN Kumar delivered his lecture on BrahMos Missile

Development Programme and its evolution as a lethal weapon in India's weaponry. He explained how the missile program evolved as a joint venture between Russia & India followed by the materials used in the missile. He emphasized DMRL's immense contributions towards indigenization of aluminium materials. Shri PRV Ramana Murthy, Sc 'F', Head, Reliability and Quality Assurance Group, proposed the vote of thanks.



# LAB RAISING DAY

## CAIR, BENGALURU

Center for Artificial Intelligence and Robotics (CAIR) celebrated its Lab Raising Day and Karnataka Rajyotsava Day with a lot of enthusiasm and gaiety on 22nd December 2018. Dr S Kamath, DG (MCC) and Dr G Athithan, former DG, MCC Cluster, were the Chief guest and the Guest of Honour, respectively. The function was attended by many dignitaries including Director's from various labs, representatives from development partners and retired scientists of CAIR. The function started with welcome address by Smt Manimozhi Theodore, Director, CAIR. Chief Guest and the Guest of Honour complemented the efforts of CAIR put in the area of AI, Robotics, Command and Control and Cyber Security. DRDO lab-level awards were distributed to the meritorious employees for the year 2017. The function concluded with technical exhibition and lunch.

## DFRL, MYSURU

Defence Food Research Laboratory (DFRL) celebrated its 58th Raising Day with grandeur on 28 December 2018. Chief Guest, Dr VC Padaki, Raja Ramanna Fellow and former Director, DEBEL, Bengaluru, inaugurated the event. Dr GK Sharma, Sc 'G', welcomed the dignitaries, retired personal and staff of DFRL.

Dr Anil Dutt Semwal, Director, DFRL, spoke about the R&D achievements of DFRL in the year 2018 and requested the staff to strive hard to make landmarks in their area of research work.

Dr VC Padaki, appreciated DFRL for its yeomen service to the Armed forces and to civilian population during natural disasters. Various DRDO Laboratory-level Awards, Cash Awards, Foundation Day Awards, Rolling Trophies and Best Research Paper Award were distributed by the Chief Guest and Director to the



Inaugural session of CAIR Raising Day

meritorious employees. Sports activities were organized to celebrate the Raising Day and prizes were distributed to the winners. The day ended with a colourful cultural programme.

## ITR, CHANDIPUR

Integrated Test Range, Chandipur, observed its 36th Lab Raising Day on 16 December 2018. Shri MSR Prasad, Director General (MSS), DRDO, was the Chief Guest of the function.

Shri BHVS Narayana Murty, Director, RCI, and Shri AK Checker, former Director, ITR, were present as the Guest of Honour, and the Chief Speaker, respectively. Shri MK Srivastava, Chairman, Raising Day Committee, briefed about the events conducted to celebrate the Raising Day.

Dr BK Das, Director, ITR, highlighted the achievements of ITR during the year 2018 and appreciated the efforts of the employees in realising the goals. He articulated special appreciation towards



Inauguration of DFRL Lab Raising Day



Inaugural function of ITR Lab Raising Day

the children who participated during various events and showcased their talents, and appreciated employees, their family members and members of ITR Cultural and Environmental Club, Ladies Wing, for organising various societal missions.

Shri BHVS Narayan Murty lauded the growth of ITR in terms of technology and infrastructure development. Shri AK Checker appreciated the transformation of ITR in terms of various developmental activities. Shri MSR Prasad highlighted his association with the range and appreciated ITR's journey as a world class test range.

Hindi Magazine 'Arohi' was released on the occasion and meritorious employees were awarded for their

excellent services in various fields. The function ended with a cultural programme performed by the employees and their family members.

### LRDE, BENGALURU

Electronics and Radar Development Establishment (LRDE), Bengaluru, celebrated its Lab Raising Day with great enthusiasm on 1 January 2019. Shri SS Nagaraj, OS and Director, presided over the function and spoke on achievements of LRDE in 2018 and goals for 2019. He presented Lab-Level DRDO Awards and Cash Awards to the employees and presented Educational Awards to the meritorious students. A video on LRDE

achievements during the year 2018 was screened.

### NPOL, KOCHI

Naval Physical Oceanographic Laboratory (NPOL), Kochi, celebrated its 66th Annual Day on 15 December 2018 at its Thrikkakara Campus. Dr Samir V Kamat, Director General (NS&M), DRDO, was the Chief Guest for the event. Shri M Gopakumar, Sc 'G' and Chairman NPOL Annual Day Organising Committee, welcomed the gathering and presented an overview of the function. Shri S Kedarnath Shenoy, Director, NPOL, presented the achievements of the laboratory.

In his inaugural address, Dr Kamat lauded NPOL for successful delivery of a steady stream of underwater surveillance systems to the Indian Navy. The Chairman and Secretary of Works Committee and General Secretaries of NPOL's Civilian Employees union and NPOL's R&D Employees union also spoke on the occasion. The employees who made outstanding contributions were honoured with various awards by the Chief Guest. Prizes were also distributed to the winners of sports competitions. A technical exhibition, was organized for the family members of NPOL employees.

A dance ensemble by 'Dharani School of Performing Arts' and Sand Art by Shri Udayan Edappal were other highlights of the event.



Award distribution at LRDE Lab Raising Day



Inauguration of NPOL Lab Raising Day

# 1ST NATIONAL WORKSHOP ON EXPLOSIVE DETECTION

The first National Workshop on Explosives Detection was held on 14 and 15 December 2018 at the High Energy Materials Research Laboratory (HEMRL), Pune, with the basic objective to bring all the stakeholders on a common platform to discuss the challenges faced by the users, need for the continuous up gradation of the detection technologies, and to have better understanding for the researchers to innovate newer sensors, materials for effective and efficient detection of trace and bulk explosives. A total of 200 delegates from different DRDO labs, Army, Navy, CRPF, NSG, Bureau of Police Research, Maharashtra State Police, Telangana Police, Academic Institutes, and Industry attended the workshop.

Shri KPS Murthy, Director, HEMRL, delivered the welcome address and stressed on the need of equipping security agencies with updated explosive detection technologies. He also brought out that significant research work being carried out by DRDO in this field.

Shri Atul Chandra Kulkarni, Addl. DGP and Chief ATS, Maharashtra, the Chief Guest, inaugurated the workshop. In his address, he highlighted the need of detection of explosives as the use of explosives and improvised explosives devices (IEDs) are being increasingly used for the destruction activities all over the globe. A souvenir comprising abstracts was released by the Chief Guest.

The Guest of Honour, Shri PK Mehta, DS and DG (ACE), deliberated on the need to deal with the two-fold threats of terrorism and insurgency to ensure homeland security.

Dr Umamathy, Director, IISER, Bhopal, in his keynote address, emphasized on the concerted efforts to bring out detection devices based on the requirement of security agencies and also to form a roadmap for research in this area.

During the inaugural function, an Optronic-based hand-held trace explosive detector OPX-Revilator developed by HEMRL was released

by the Chief Guest. Various explosive detector units were exhibited during the workshop by HEMRL, Laser Science and Technology Centre (LASTEC), IIT Bombay and the private firms; M/s MSPL, M/s Vehant Technology.

Lt Gen Michael Mathews, VSM, Commandant CME; Shri Jamal Khan, Director, NBDC, NSG; Col. Madhu Nair, CME, and Shri Dherendra Verma, IIM, Talegaon, delivered talks in the plenary session and shared their views from user's perspective regarding difficult scenarios faced by the security agencies and the need for indigenous development of various explosive detectors.

In the technical sessions spread over two days, 13 speakers delivered talks on various explosive detection technologies and the advances made in these area.

A road map for futuristic development of detection technologies was discussed in the concluding session. Shri DK Kankane, Sc 'G', was the convener and Shri Bikash Ghose, Sc 'F', was the co-convener of the workshop.



Release of Workshop Souvenir by the Chief Guests



# JOINT STEERING COMMITTEE MEETING

A Joint Screening Committee and a Joint Working Group meeting was held at ADTeC, ATLA, Japan, to discuss and finalize Project Plans. Smt Manimozhi Theodore, Director, Centre for Artificial Intelligence and Robotics (CAIR), Head Project Screening Committee, and Toshiya Mizuta, Director, ADTeC, signed Project Plan and Project Security Instructions. Both sides agreed for further research cooperation between India and Japan.

Sartaj Singh, Project Officer; Sumit Veerawal and Shine P Sunny, Members, Project Working Group, and Atul Rane, DIC, DRDO HQ, were present during the occasion.



## WORKSHOPS ON RTI

Right to Information (RTI) Cell, DRDO HQ, organized three RTI Workshops in Pune, Hyderabad and Bengaluru regions for

the benefit of CPIOs/CAPIOs, Admin Officers, Grievance Cell Officer and other officials.



## HINDI WORKSHOP

A one-day Hindi Workshop was organized on 11 December 2018 at Centre for Artificial Intelligence and Robotics (CAIR), Bengaluru, wherein 25 officer/staff from various Divisions of CAIR participated. Dr Shyam Singh, Assistant Director, National Assessment and Accreditation Council, Bengaluru, delivered a lecture on "Effective Implementation of Official Language." Interactive and practice session was held to facilitate staff for effective implementation of Official Language and meet the targets prescribed by Department of Official Language.

### READERS' FEEDBACK

Your feedback is important to us as it gives scope for improvement and serve the Organisation in a better way. Please send your suggestions to:

*The Editor  
DRDO Newsletter  
DESIDOC, Metcalfe House  
Delhi-11 0054*



# DRDO USERS' WORKSHOP CONDUCTED AT TAWANG

**D**efence Research Laboratory (DRL), Tezpur, conducted DRDO-Users Workshop on 1 December 2018 at Tawang, Arunachal Pradesh, under the ongoing DRDO TD Programme Arunodaya. Dr SK Dwivedi, Director, DRL, in his welcome address spoke about the Arunodaya programme and how the programme is helping in addressing the day-to-day problems faced by the soldiers in the inhospitable terrain of the region through DRDO developed products and technologies.

The Chief Guest, Brig Zubeen Bhatnagar, Cdr, 190 Mtn Bde, appreciated the initiatives taken by DRDO Life Sciences Labs under Arunodaya programme to serve the troops stationed in high altitude areas. Talks on Overview of DRDO and DRL; Greenhouse and its Management; Human Waste Management at High Altitude; Transborder Bio-threat;



Mitigation and Mushroom Cultivation; and Vermi-composting at High Altitude were delivered by the DRL scientists. Fifty-five Army Officers, JCO's and OR's

from different Units participated in the workshop. Dr BJ Gogoi, Sc 'E', DRL, coordinated the event.

## SPORTS ROUND-UP

### CAIR, BENGALURU

**C**entre for Artificial Intelligence and Robotics (CAIR), Bengaluru, organized DRDO South Zone throw Ball tournament during 5-7 December 2018. CAIR, ADE, DARE, CVRDE and LRDE participated in the tournament. Smt Manimozhi Theodore, Director, CAIR, inaugurated the tournament. CAIR, Bengaluru emerged as champions whereas LRDE, Bengaluru was the runner-up in the tournament.

### ITR, CHANDIPUR

**I**ntegrated Test Range (ITR), Chandipur, organised the DRDO Central Zone Football Tournament

2018-19. Dr BK Das, OS and Director ITR, inaugurated the tournament. Nine teams participated in the tournament from Central Zone. Proof and Experimental Establishment (PXE),

Chandipur, won the Trophy with a win over ITR. Dr Das presented Trophies and medals to both Winners and the Runners up team and announced the Central Zone Football Team.







# PERSONNEL NEWS

## APPOINTMENT

### Director, DFRL



Dr Anil Dutt Semwal, Sc 'G', has been appointed Director, Defence Food Research Laboratory (DFRL), DRDO, Mysuru.

Dr Semwal obtained his MSc in Chemistry from Hemvati Nandan Bahuguna Garhwal University, Uttarakhand and Doctorate from University of Mysore, Mysuru, Karnataka in Chemistry.

He started his career as Sc 'B' in DFRL in the year 1987 and actively contributed in development of protective packaging systems for transportation of edible oil in tin and enhancing shelf stability of refined and blended edible oils for their induction in Services. His studies on factors influencing lipid peroxidation and their control mechanism, to enhance shelf life of processed foods and development of Ready-to-Eat (RTE) foods using various processing technologies resulted in the development of more than 100 nutritious energy dense food products for the Armed Forces.

Dr Semwal has made significant contributions towards the development of various operational rations such as emergency flying ration, survival ration, Meals Ready-to-Eat (MRE) ration, MBT ration, submarine crew ration and comp-pack ration and their induction to services as well indigenization of low cost food processing equipment such as automatic chapati making machine, bar making machine, etc., to meet the requirement of Armed Forces and Paramilitary Forces. He is instrumental

for the development of novel innovative food processing technologies such as cold shock dehydration technologies for instantiation of foods, Infra Red and Microwave processing technologies and combination processing technologies for development of Jiffy food products.

As a propagator of self-reliance, he has successfully motivated entrepreneurs and industries for adoption of modern food processing technologies developed by DFRL, which resulted in transfer of more than 321 technologies to 214 industries for production and supply of safe and nutritious food products to civilian population. He also contributed to the nation during OP Vijay, OP Sahayata, National Disaster Relief Operations (Uttarakhand, Jammu and Kashmir, Chennai, Kerala and Karnataka) and Antarctica Mission by supplying large quantities of processed food for the needy people within a short period of time.

He has published more than 130 Research papers in National/International journals and presented 170 papers in National/International Conferences. He has 11 patents on food processing technologies. He is the recipient of various awards such as NN Mohan Memorial Award, Kejriwal Award, Technology Group Award (DRDO), Scientist of the Year Award (DRDO-Lab Level), Best Research paper Award, etc. He is Vice-Chairman and life member of the Association of Food Scientists and Technologists (AFSTI), India and life member of Indian Science Congress Association, Founder Member of Afro Asian Food Scientist and Technologists Institutions (AAFOSTI) and Principal member of Bureau of Indian Standards (BIS) for Food Grains and Starches.

## AWARDS

### AFSTI –Fellow Award

Dr Gopal Kumar Sharma, Sc 'G', DFRL, Mysuru, was conferred Fellow of Association of Food Scientists and Technologists (India)" award in recognition of his multifaceted contribution to Food Science Technology at 8th International Food Convention held at CSIR-Central Food Technological Research Institute (CFTRI), Mysuru, on 12 December 2018.



### Low Cost Technology Development Award

Shri Dev Kumar Yadav, Sc 'D', and Smt Neera, Sc 'D', of DFRL, were awarded 'Low Cost Technology Development Award' for their technology of Modular Silo—a customized storage solution for perishable food products at extreme low temperature, by Association of Food Scientists and Technologist of India, Mysuru, on 12 December 2018 during 8th International Food Convention.





# DRDO HARNESSING SCIENCE FOR PEACE & SECURITY

## CHAPTER 4: MARCHING FORWARD

The article is 35<sup>th</sup> 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).

### AERONAUTICS

#### Light Combat Aircraft

By 1980, it was evident that aircraft industry in the country was maintained by importing technologies and products for manufacture. The best talents in the field of aeronautics in the country were looking for challenges outside our borders and with the induction of Jaguar and MiG-23 aircraft in the Indian Air Force fleet there was scope for indigenous development in only one class of military aircraft namely the light combat fighter aircraft to replace the ageing fleet of Ajeets.

Since the Indian Air Force indicated that they would need the new light combat fighter aircraft in the 1990, in his capacity as Scientific Adviser, Dr Raja Ramanna, took the lead in February 1980 by communicating to the Prime Minister of India that he was forming an internal group of scientists to conduct a detailed study of the various aspects of the light combat aircraft and related engine development programmes. The study would also include the assessment of the resources and technologies from within the country. Further, the report would bring out the technology areas for which input from abroad would be necessary. He concluded his communication with the information that DRDO was examining a joint proposal from two companies namely an aircraft manufacturer and an aero engine manufacturer for a combined feasibility study with DRDO on the aircraft and the engine development programmes.

Nearly 18 months later, Dr Ramanna, in his second communication to the Prime Minister, detailed the progress that had taken place in advancing the

cause of indigenous development of the light combat aircraft. He informed the Prime Minister that preliminary design configuration studies based on a number of available engines including the indigenous GTX of GTRE, were completed. The light combat aircraft as envisaged by the Committee of Internal Experts would be a highly manoeuvrable high speed lightweight multi-mission aircraft powered by an advanced technology engine with adequate growth potential. It would incorporate design provisions to adopt advanced technologies like fly-by-wire, modern avionics and weapon systems. The aircraft would be initially developed around a proven engine which would be replaced by the indigenous GTX variant when the latter would be available. The estimated cost and the time frame were also indicated but with a remark that a realistic estimate would be possible only after further discussions with aircraft designers from abroad and subsequent studies. The note concluded with a draft paper for approval of the Cabinet Committee for Political Affairs (CCPA) of the proposed plan of action. It specifically mentioned that the country had taken no major aircraft development programme for the last two decades and since vast advancements in the field have taken place, input from abroad on selected areas of technology would be necessary. The seeds of the LCA programme which would be taken up a few years later were sown.

### ARMAMENTS

The Armaments group of laboratories comprise of ARDE, HEMRL, PEE and TBRL. ARDE was formed out of the erstwhile Technical Development

Establishments of Weapons at Jabalpur and of Armaments at Khadki in September 1958. PEE, Balasore was also set up at the same time as ARDE but Explosives Research and Development Laboratory (later renamed as HEMRL) as a full-fledged laboratory came into being in 1963 though its antecedents can be traced as far back as 1908 to the Chemical Examiner's Office in Nainital.

#### Armament Research & Development Establishment

In the early years, ARDE was located within the campus of the Ammunition Factory, Khadki with rudimentary facilities for R&D. Even though the ordnance factories (OFs) had been in the business of manufacturing ammunition for the Indian Armed Forces since the early days of the British empire, the drawings and designs of their products were of British origin. A primitive manufacturing base was available for conventional high explosive projectiles at the time of Independence. The TDE personnel were entrusted with the inspection of finished product, which included proof firing, defect investigations, as well as substitution of imported raw materials with those of Indian origin without altering the original specifications issued out of the UK. In the period 1958-69, the development efforts were reverse engineering of ammunition and warheads in production, to reduce the dependency on imports. A large number of small projects with limited scope were undertaken to graduate from import substitution of materials and components to that of



import substitution of ammunition and warheads. Through this time-consuming and laborious process, the knowledge base was built and expertise was acquired for design and building up of test facilities. In the case of weapons, a modest production base for production of howitzers, mortars and small arms existed at the time of Independence but the technological base was practically absent.

The period 1958-62 was a period of transition for change of mind set from inspection activities to design and development and organising the laboratory with recruitment of personnel and establishing basic facilities. The progress was slow due to the marginal design capability at system's level, little or no access to knowledge bases available abroad with respect to armaments development and poor infrastructure in both defence and non-defence industrial sectors of the country. However, with the concluding of several projects for ToT and license production of complete equipment from overseas sources in the early 1960s, notably the 40 mm L-70 Air Defence Gun, 81 and 120 mm Mortars and later the battle tank Vijayanta, including its 105 mm Gun and Ammunition, the tempo of activities of the laboratories in the Armaments Group picked up mainly because these were involved in the evaluation and later technology absorption.

The first challenge to the scientists of ARDE in the field of Conventional Armament Technology came in the wake of the 1962 Chinese Operations, especially when Indian Army was faced with an acute need for modern replacement for its mostly World War II vintage weapons and equipment. The need for the development of a mountain gun and that of the self-loading rifle became inescapable. The development of the mountain gun, the 75/24 Pack Howitzer, with an investment of about Rs 70 lakh, was a major activity ranging from the development of the weapon, different types of ammunition, as well as the preparation of the range tables. It was the first venture of ARDE into large-calibre weapon development, even

though it was not an ab-initio project. It was based on initial design carried out for the British Army by Canadian Armament R&D Establishment (CARDE). While the original contract for development between UK and Canada was cancelled, the sketches and drawings of the incomplete design were passed on to DRDO who pursued it to the logical conclusion, namely development of the Mk I version, which met the basic requirements laid down in the GSQR by the Army. This was manufactured at the ordnance factories to equip the mountain divisions of the Army. Based on the experience gained by the DGOF during technology transfer and production of the Mk I, a Gun Development Team (GDT) was constituted in July 1964 for further improvements at the Gun Carriage Factory, Jabalpur, which was the nodal factory for the final assembly of that equipment. This was the first-ever interdisciplinary team with specialists drawn from DRDO, Ordnance Factories, Directorate General of Inspection (DGI) and the Users—in fact GDT was headed by a veteran Gunner Officer—to minimise the lead-time and for seamless technology transfer. We were ahead of the global trend by at least two decades in implementing concurrent engineering, and cross-functional team concepts and it bears testimony to the readiness of DRDO to try novel methods for speeding up the development process. The Mk II had to be designed for towing by a vehicle and it was required to be disassembled and carried on mule backs without difficulty. The design and development included among other activities, complete new design of carriage and the recoil system, new types of muzzle brakes, breech and firing mechanism and design of accessories for pack role. It was successfully developed and the first prototype was user tried in November 1965 and was accepted for introduction into the Services. As part of the development process, special range and instrumentation facilities were also established for full-scale range, accuracy as well as for endurance trials. The 75/24 Pack Howitzer would remain

in service for nearly 25 years.

The 1962 Chinese conflict also highlighted the inadequacy of the Lee Enfield bolt action rifle as an infantry weapon. The Army's decision to replace it with self-loading rifle on a priority basis triggered ARDE to develop jointly with ordnance factories the 7.62 mm self-loading rifle which came to be known as the Ishapore rifle. Ammunition for the rifle was also developed simultaneously. The gamut of activities ranging from design, development, trials and establishing bulk production were completed in the shortest possible time as a result of high degree of coordination between ARDE and the OFs. More than one million rifles have been produced and these have been put to good use during the 1965 and 1971 conflicts with Pakistan.

In the areas of ammunition and warheads, the contributions of ARDE were, non-detectable antitank mine, tracer ammunition for 7.62 mm calibre weapons, 105 mm antitank ammunition, smoke ammunition for mortars, drill mines for the Navy, drill and practice version of antitank and anti-personnel mines, indigenous propellants for light and heavy mortars, ammunition for defeating armour for different types of gun, air-to-air and air-to-ground rockets. Most of these development activities were aimed to reduce our dependence on import from abroad for our Armed Forces. These were not simple substitutions but also required the study of high energy materials, the interaction between gun and the projectile, the ballistics of projectiles with shape explosive charge and so on. In addition, incorporation of maintainability, durability and reliability required the designer to relate technology at the design stage to operations so as to build the confidence of the User. The experience gained and the knowledge base built in this period enabled ARDE to take up more sophisticated projects in the succeeding decades.

*To be continued...*

# DR G SATHEESH REDDY INAUGURATES HIGH DEFINITION VIDEO CONFERENCING SYSTEM

A High Definition Video Conferencing System was inaugurated by Dr G Satheesh Reddy, Secretary DDR&D and Chairman, DRDO, at Institute of Technology Management (ITM) through Video Conferencing from DRDO HQ on 20 December 2018. Secretary DDR&D interacted with the course participants of Advance Work Study, one of the flag ship course of ITM. The participants from Indian Armed Forces, DGQA, DGOF and DRDO shared their experience and feedback about the course. Dr Reddy appreciated ITM for installing the system.



Inauguration of HD Video Conferencing System by Dr G Satheesh Reddy

## VISITS

### DIHAR, LEH

Lt Gen YK Joshi, AVSM, VrC, SM, GOC 14 Corps visited Defence Institute of High Altitude Research (DIHAR), Leh, on 16 January 2018. He was briefed about the various R&D activities and services being extended by DIHAR to the troops of 14 Corps. He also visited the experimental fields of DIHAR. He congratulated DIHAR for the yeomen services being provided to the Army and the people of Ladakh.



Lt Gen YK Joshi at DIHAR

### LRDE, BENGALURU

Air Marshal B Suresh, AVSM, VM, Air Officer Commanding-in-Chief, Southern Air Command, IAF visited Electronics and Radar Development Establishment (LRDE) on 18 December 2018. Shri Nagaraj, OS and Director, LRDE, appraised him the activities of LRDE. Shri P Radhakrishna, OS and Associate Director, made presentation on the Radars developed by LRDE and future projects. Air Marshal B Suresh also witnessed the AESAR and ASLESHA Mk-II radars in operation.



Air Marshal B Suresh being briefed about LRDE activities