

MEETING OF THE PARLIAMENTARY CONSULTATIVE COMMITTEE OF MINISTRY OF DEFENCE AT DRDO



INNOVATION >> p06

MAIDEN FIRING OF LR BRAHMOS LAND-ATTACK MISSILE BY NAVY
BRAHMOS BLOCK 3 SUCCESSFULLY ACCOMPLISH PRECISE HIT

TOT >> p08

COURSES >> p17

VISITS >> p24

CONTENTS

JUNE 2017
VOLUME 37 | ISSUE 6
ISSN: 0971-4391

COVER STORY

04

Meeting of the Parliamentary Consultative Committee of Ministry of Defence at DRDO



INNOVATION

Maiden firing of Long-Range BrahMos land-attack
Supersonic Cruise Missile by Navy
BrahMos Block 3 Successfully accomplish Precise Hit

TOT

HONOUR

T&E FACILITY

EVENTS

CFEES OBSERVES FIRE SERVICE WEEK

06 COURSES/WORKSHOPS 17

HRD ACTIVITIES 21

08 SPORTS ROUND-UP 22

09 SOCIETAL
10 ACTIVITY 23

11 VISITS 24

15 DRDO SERIES 26

Editor-in-Chief: Gopal Bhushan
Senior Editor: B Nityanand
Editor: Manoj Kumar
Asst Editor: Geeta Sharma; Pre-press: Gunjan Bakshi
Multimedia: RK Bhatnagar
Printing: SK Gupta, Hans Kumar
Distribution: Tapeshe Sinha, RP Singh
For feedback, please contact: director@desidoc.drdo.in
Tel: 011-23902403; 23902474; Fax: 011-23819151

LOCAL CORRESPONDENTS

Ahmednagar: Lt Col. AK Singh, Vehicles Research & Development Establishment (VRDE); **Ambarnath:** Dr Susan Titus, Naval Materials Research Laboratory (NMRL); **Balasure/Chandipur:** Shri Santosh Munda, Integrated Test Range (ITR); Dr AK Sannigrahi, Proof & Experimental Establishment (PXE); **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 KM Veerabhadra, Electronics & Radar Development Establishment (LRDE); Dr Vishal Kesari, Microwave Tube Research & Development Centre (MTRDC); **Chandigarh:** Dr HS Gusain, Snow & Avalanche Study Establishment (SASE); Shri Ashok Kumar Dahiya, 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 Rajendra Singh, Centre for Fire, Explosive & Environment Safety (CFEES); Dr KP Mishra, Defence Institute of Physiology & Allied Sciences (DIPAS); Dr Dolly Bansal, Defence Institute of Psychological Research (DIPR); Shri Ram Prakash, Defence Terrain Research Laboratory (DTRL); Shri Navin Soni, Institute of Nuclear Medicine and Allied Sciences (INMAS); Smt Anjana Sharma, Institute for Systems Studies & Analyses (ISSA); Dr Indu Gupta, Laser Science & Technology Centre (LASTEC); Shri Sanjay Pal, Recruitment & Assessment Centre (RAC); 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); Shri JP Singh, 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 N Venkatesh, Research Centre Imarat (RCI); **Jagdalpur:** Dr Gaurav Agnihotri, SF Complex (SFC); **Jodhpur:** Shri Ravindra Kumar, Defence Laboratory (DL); **Kanpur:** Shri Ashok Kumar Gautam, Defence Materials & Stores Research & Development Establishment (DMSRDE); **Kochi:** Shri S Radhakrishnan, 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 Devala, High Energy Materials Research Laboratory (HEMRL); Shri SS Arore, 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)



Defence Research & Development Organisation

FROM THE DESK OF THE CHAIRMAN



Dr S Christopher

CHAIRMAN
Defence Research & Development
Organisation

&

SECRETARY
Department of Defence Research &
Development

Yet another year of Research with TEAM DRDO!

I would like to share with you a story before coming to the actual subject. An American Anthropologist visited a small village in South Africa some time back. He saw the tribal children playing and decided to engage them in a game to teach some lessons. He kept some sweets under a tree and lined up the children about 100 meters away and explained that the one who goes first can take as much sweets as they like. Then he started the game and said ready, steady, go and found to his surprise all the children started reaching out to other children hand and together they ran towards the sweet and picked up the sweets and shared equally and enjoyed themselves. He noticed that while starting to run all of them shouted “Ubuntu”! The Anthropologist was surprised to see their action and asked them, why they did so? The Children answered, “how one can be happy when others are sad.” What a wonderful thought! The literal meaning of “Ubuntu” in their language means, “I am because we are.”

Incidentally, I had the same feeling when received the news to serve DRDO for another year. Let us further deepen our team spirit to take this mighty organization to higher and higher echelon. Let us discuss our core issue the Mission “Make in India” or in our lingo M²I².

DRDO ‘s contribution through indigenous development of defence systems is in-line with “Make in India” mission of Hon’ble PM. The development of defence system in the country has led to exponential growth of R&D and production capabilities of domestic industry and alike. A number of public, private industries and academia are actively involved in their development and production. Some of these industries have matured in association with DRDO to undertake “Build to Specification” or “Build to Requirement” stages. Now these industries are being pitched as Strategic Partners to produce military platform as a recent initiative of Government. It is prudent to say that the ecosystem created by DRDO will not only boost the Make in India drive of the Govt but has helped fostering a very favorable environment for country’s potential growth as the innovation and manufacturing hub of defence systems.

Jai Hind.

MEETING OF THE PARLIAMENTARY CONSULTATIVE COMMITTEE OF MINISTRY OF DEFENCE AT DRDO



Dr Christopher giving presentation on DRDO's achievements

The meeting of the Parliamentary Consultative Committee for the Ministry of Defence was held under the Chairmanship of Hon'ble Raksha Mantri Shri Arun Jaitely at DRDO's Metcalfe House Complex on 1 May 2017.

Hon'ble Raksha Rajya Mantri Dr Subhash Bhamre, Hon'ble Members of the Consultative Committee for the Ministry of Defence attended the meeting. Shri G Mohan Kumar, Defence Secretary, Shri Ashok Kumar Gupta, Secretary, Deptt of Defence Production, Shri Prabhu Dayal Meena Secretary Department of Ex-Servicemen Welfare and other senior officers of DRDO attended the meeting. To apprise the Committee of the products and technologies developed by the

DRDO, an exhibition was organized in the historic Metcalfe House.

Dr Christopher, Chairman, DRDO, gave a detailed presentation



Dr Christopher briefing Raksha Mantri about LCA Navy

on the achievements and the future planning of the DRDO. Hon'ble Raksha Mantri discussed the concerns the Hon'ble members expressed keeping in with our defence preparedness and with the change in the nature of warfare. He praised DRDO for developing products and inducting into services and the paramilitary forces. He encouraged DRDO continuing to serve the Country and Armed Forces.

Shri Arun Jaitley handed over e-Nasika, a handheld Surface Acoustic Wave-based Electronic Chemical Detector developed by Solid State Physics Laboratory (SSPL) to Shri RK Pachnanda, DG National Disaster Response Force (NDRF). The Optical Target Locator-300, a passive/active surveillance device, developed by Laser Science and Technology Centre (LASTEC) was handed over to Shri Sudhir Pratap Singh, DG National Security Guard and Shri Amulya Patnaik, Commissioner Delhi Police. Likewise, Pre-emptor, an explosive identification system, developed by LASTEC was handed over to Shri IB Purohit, Additional Director, Intelligence Bureau.

e-Nasika is a chemical vapor detector, which consists of a tiny surface acoustic wave resonator oscillator whose frequency shifts upon interaction with incoming gas molecules separated by a GC column. e-Nasika has few parts per billion (ppb) detection limit in quick response time and ruggedized to operate in various field conditions uninterrupted with high efficiency.

The sensor can be employed in various scenarios such as, battlefields, insurgencies, airports, railway stations, bus stands, trains and other vital installations.



Shri Arun Jaitley handing over e-Nasika to the DG, NDRF, Shri RK Pachnanda.



Shri Arun Jaitley handing over OTL-300 to the DG, NSG, Shri Sudhir Pratap Singh

Optical Target Locator (OTL) is used for detection of passive or active surveillance devices like binoculars, day sights, night vision devices, CCD cameras or electronic sensors as in laser range finder. This gives a tactical advantage to the user in deciding defensive or offensive action. OTL has already been tested extensively by the NSG and Northern Command and had been deployed at various strategic

locations and events like Republic Day and Independence Day.

Pre-emptor is an explosive identification system for in-situ screening of explosives in the form of liquid, solid and powder contained in transparent/semi-transparent containers from a standoff distance of 30 cm, extendable up to 5 m. The system is based on two variants for standoff identification in real time and Raman Probe for remote identification.

MAIDEN FIRING OF LONG-RANGE BRAHMOS LAND-ATTACK SUPERSONIC CRUISE MISSILE BY NAVY

Indian Navy successfully undertook the firing of long-range BrahMos land-attack supersonic cruise missile from Indian Naval Ship Teg, a Guided Missile Frigate, on a target on land on Friday 21 April 2017. Antiship variant of BrahMos has already been inducted into the Indian Navy.

Majority of the frontline ships of Indian Navy, like the Kolkata, Ranvir and Teg classes of ships, are capable of firing this missile. Land attack variant of BrahMos provides Indian Naval Ships the capability to precisely neutralise selected targets deep inland, far away from coast, from stand-off ranges at sea.



BRAHMOS BLOCK 3 SUCCESSFULLY ACCOMPLISH PRECISE HIT

Command 'Strike One' successfully carried out the firing of the advanced BrahMos Block 3 land attack cruise missile (LACM) system in Andaman and Nicobar Islands on the 3 May 2017 for the second consecutive day. The successful launches reinforce the formidable weapon's precision strike capability. The long-range tactical weapon was successfully tested from the same location on the 2 May 2017 also.

These successful firings of the supersonic cruise missile were carried out in full operational land-to-land configuration from Mobile Autonomous Launchers (MAL) at its full-range. The test firing met all flight parameters in a copybook manner. Conducting high level and complex

manoeuvres, the multi-role missile successfully hit the land-based target with desired precision, in both the trials demonstrating its accuracy of less than one meter.

This is the fifth consecutive time when the Block III version of BrahMos LACM has been successfully launched and hit the land-based target in "top-attack" mode, an incredible feat not achieved by any other weapon system of its genre. Indian Army, which became the first land force in the world to deploy the BrahMos in 2007, has raised several regiments of this formidable weapon. Jointly developed by India's DRDO and Russia's NPOM, the multi-platform, multi-mission BrahMos is capable of being launched from land, sea, sub-sea and air against surface and sea-based targets.



BrahMos MAL launch: File photo

DFRL TRANSFERS FOOD TECHNOLOGIES

Defence Food Research Laboratory (DFRL), Mysuru, transferred 10 food technologies to three companies namely M/s Arihant Industries, Bengaluru, M/s Schemeken, Agro Food Products, Chennai, and M/s Universal Energy Foods, Mulki, on National Technology Day 11 May 2017.

Dr Rakesh Kumar Sharma, Director, DFRL, exchanged the License Agreement on ToT (LAToT) documents with Shri Vijay Mehta, Proprietor, M/s Arihant Industries for transfer of technologies of millet dosa mix, millet roti mix, millet chapathi mix, millet jamoon mix, spiced millet mix and sweetened

millet mix. Millets are nutritionally valued cereals with high calcium (350-400 µg), dietary fibre (15-18 per cent) content and serve as good source of iron (11-17 µg). The characteristic component slow digestible starch makes it more promising for diabetics and the resistant starch present helps for prevention of colon cancer.

Director, DFRL also exchanged the LAToT documents with Shri GB Rajasekar Director, M/s Schemeken, Agro Food Products for transfer of technologies of Bacterial Cellulose Production & Nata in Juices and Ginger Beverage. Bacterial cellulose also called as Nata is produced by bacteria *Acetobacter xylinum*. Nata, which is rich in

dietary fibre cut into small pieces and added into the fruit juices.

The LAToT of Ashgourd Juice was also signed by Director DFRL and Shri Ramamurthy, M/s Universal Energy Foods, Mulki. Ashgourd juice is a good source of dietary fibre, B-Vitamins and is known for medicinal properties. The product is a ready to drink beverage with a shelf life of six months at ambient conditions.

Inventor scientists and senior officials from DFRL and the industries were present during the occasion. Director DFRL also released the compendium of DFRL's Food Products and Technologies for popularization among the users.





HIGHEST ALTITUDE TERRESTRIAL RESEARCH CENTRE, CHANGLA, ENTERS GUINNESS WORLD RECORD

DRDO established the Highest Altitude Terrestrial Research Centre (HATRC) at Changla as World's Highest Terrestrial Research Centre (17664 ft). It surpassed the Pyramid Laboratory, Sagarmatha National Park, Nepal (16568 ft). The Guinness Book of World Record has verified and recognised the following verification about the altitude and other requisite criteria for the recognition. The station was inaugurated by Dr S Christopher, Chairman, DRDO and Secretary, Department of Defence R&D on 3 October 2015.

Located between Leh and Pangong Tso lakes, it is the only facility of its kind to test the extreme altitude

related technologies for military applications.

This extreme altitude terrestrial centre is presently engaged in frontal areas of life sciences research for the well-being of the soldiers deployed in high altitude cold desert. Various activities being undertaken include human physiology, long-term conservation of plant genetic resources, designing, testing, validation and demonstration of mobile and portable greenhouses, soilless micro-farming technology for fresh food in remote landlocked posts, in-situ conservation and propagation of endangered extreme altitude medicinal plants, bio-digestion of human waste, application of solar

energy for warming the shelter, potability of water, etc.

The centre, besides undertaking the life sciences activities will provide unique opportunities for testing and evaluation of electronics and communication devices, testing of materials for high altitude applications, batteries and fuel cells, UAV's microengines, high altitude clothing, etc. in naturally occurring extreme cold and hypoxic conditions at high altitude. The state-of-the-art test facility will also help to expedite extreme altitude user trials and subsequent induction of equipments and other items in strategic Siachen Sector and other extreme altitude terrains.



PXE GETS A NEW FIRING COMPLEX

Dr PK Mishra, IAS, Additional Principal Secretary to Prime Minister of India, inaugurated the New Firing Complex at Proof and Experimental Establishment (PXE), Chandipur on 7 May 2017. Dr S Christopher, Chairman, DRDO and Secretary, Department of Defence R&D, Shri R Appavuraj, OS and Director,

Proof and Experimental Establishment (PXE), Dr BK Das, OS and Director, Integrated Test Range (ITR), Chandipur and Dr Tessy Thomas, OS and Director, Advanced Systems Laboratory (ASL), Hyderabad, were present on the occasion. Dignitaries witnessed dynamic firing from tank on the firing complex.

PXE regularly conducts dynamic test and evaluation of different armaments and their parts developed by DRDO, manufactured by Ordnance Factories or procured from foreign countries.





DRDO CELEBRATES NATIONAL TECHNOLOGY DAY

National Technology Day (NTD) is celebrated all over India on 11 May to commemorate nuclear tests conducted at Pokharan, Rajasthan in 1998. DRDO celebrated the day by organising NTD oration on “Challenges to India’s National Security—An Agenda for 2030” by Shri Jayant Prasad, DG IDSA and former Ambassador to Afganistan, Algeria and Nepal. Dr Shashi Bala Singh, DS and DG Life Sciences, DRDO was the Chief Guest at the function. In her address she brought out the importance of the day and how S&T can drive the progress of the nation and fulfill the dream of the Hon’ble Prime Minister of empowering the common man.

In his comprehensive and elucidative oration, Shri Jayant Prasad enunciated the impact of geopolitical, geoeconomic and geostrategic circumstances in Indo-Pacific region and how internal insurgency, terrorism, narcotics and great power rivalry would be the main challenges for the Indian security. He lauded DRDO’s role in developing and maintaining strategic deterrent capacity of the country. Innovation and technology would be the key for India to become a leading nation of the world



by 2030 and for which DRDO has a specific role, which is not just to confine to strengthening our military capacity, he further added.

Dr G Madhusudhan Reddy, OS, DMRL, Hyderabad, Shri Jineesh George, Sc ‘E’, NPOL, Kochi and Shri Mukesh Sadana, Sc ‘D’, SSPL, Delhi presented their papers on “Joining of Advanced Materials for Defence Applications”, “Sonar

Domes for Ships and Submarines”, and “Miniature Rotary Stirling Cryocoolers”, respectively. NTD orators of Delhi-based DRDO labs were presented with NTD Medal and Certificate by Shri Jayant Prasad.

DRDO laboratories/establishments also celebrated NTD by organising technology day orations, special lectures, science exhibitions and other scientific events.



ANURAG, Hyderabad

Advanced Numerical Research and Analysis Group (ANURAG) celebrated its 26th Annual Day and NTD on 11 May 2017. Shri SP Dash, DS and former Director, DLRL, was the Chief Guest on the occasion. Shri CVS Sastry, OS and Director, ANURAG, gave an overview of the progress of various activities of the laboratory for the year 2016. Smt K Sravani, Sc 'C', delivered NTD oration on "A Pragmatic Approach to Linux Vulnerability Analysis and Mitigation". Laboratory-level DRDO Awards and Cash Awards were given away by the Chief Guest to the employees for commendable performance in 2016.



ARDE, Pune

The Chief Guest Dr Yogesh S Shouche, Scientist, National Centre for Cell Sciences, Pune, delivered a talk on "Emerging Technologies in Biological Warfare". Shri KJ Daniel, Offg. Director, ARDE, addressed the gathering and highlighted the significance of the day. The Technology Day Oration was presented by Shri Aishwarya Dixit, Sc 'D', on "Technologies for Air Burst Grenade". The Oration Medal and Certificate were presented to the orator by the Chief Guest.



CABS, Bengaluru

Shri Jawed Qumar, Sc 'E', presented NTD oration on "Maintenance Challenges and High Fidelity Simulation for Airborne Warning and Control System Mission Sensors". He was awarded Technology Day Medal by Smt Suma Varughese, OS and Programme Director AWACS(I).



CEMILAC, Bengaluru

Shri D Pradeesh Kumar, Sc 'E', delivered NTD Oration on "Additive Manufacturing Approach/Application to Aerospace Components". The talk centered on 3D printing technology with a view to apply it to the design, manufacturing and maintenance/repair/salvage of aerospace parts. Certification aspects of the additive manufactured part to prove airworthiness was deliberated upon, and spin-off was brought out with recent examples to appraise its importance in aeronautics.



CVRDE, Chennai

National Technology Day 2017 was celebrated at Combat Vehicles Research and Development Establishment (CVRDE), Avadi on 23 May 2017. Shri Khader Basha, Sc 'G', gave a presentation on "400 hp Electronically Controlled Power Pack" for Unmanned ground Vehicles. He was awarded Oration Medal and Commendation Certificate. Smt Usha Narayana Swamy, Sc 'F' spoke on the "Environmental Simulation Test Chamber Facility for Armoured Fighting Vehicles".

Dr P Sivakumar, DS and Director, CVRDE, in his address recalled the speech of Dr Abdul Kalam emphasizing on the technology of "Internet of Things".



DARE, Bengaluru

Shri M Vengadesh Kumar, Sc 'E' delivered a talk on "Jamming Architecture, Techniques, Technologies - Current Trends". He explained about the various generations of self-protection jammer architectures, the jamming techniques required to counter the conventional and modern radars and also about the technologies involved in jammer namely the DRFM, transmitters and the antennas.





DEAL, Dehradun

Dr RS Pundir, OS and Director, DEAL, inaugurated the programme. Shri Rajendra Singh, Sc 'F', delivered NTD oration on "Resurgence of High Capacity Tactical Digital Troposcatter Communication System". He was conferred NTD Commendation Certificate and Medal.



DESIDOC, Delhi

Shri Gopal Bhushan, Director, Defence Scientific Information and Documentation Centre (DESIDOC), in his inaugural address, described the role of DRDO in the Pokharan nuclear tests and how indigenous S&T benefitted DRDO after technology control regime was enforced by the developed countries. Prof. Mohan, University of Delhi, was the Chief Guest of the function and delivered an invited talk on "Bridging the Communication Gap in Science and Technology using Hindi. Dr Rajeev Vij, Sc 'F', delivered NTD oration on "Application of Technology for Branding of S&T Institutions and Organisations" and highlighted the need of application of new promotional activities.



DIBER, Haldwani

Week-long activities were held at Defence Institute of Bio-Energy Research (DIBER) Field Station Pithoragarh to mark the Technology Day. An agricultural mela was organized to showcase various technologies developed by DIBER to the local farmers who visited the Mela. District Magistrate, Army officers and locals visited the Mela. A brainstorming with the local administration and Army officers led to identification of common areas of interest. Smt Anjali Kumari, Sc 'D' presented NTD oration.



DFRL, Mysuru

Dr A Ramakrishna Sc 'F', Head, delivered the NTD Oration on "Design and Development of Food Engineering System for Armed forces posted at High Altitudes". He spoke about the curd making machine developed using low-level electrical energy for fresh curdling at subzero temperature.

Dr Rakesh Kumar Sharma, Director, DFRL, presented NTD Oration Medal and Certificate to Dr A Ramakrishna.



Office of the DG (Aero), Bengaluru

Dr CP Ramanarayanan, DS and DG (Aero), DRDO, presided over the function. Shri Devendra Singh, Sc 'F', made NTD Oration on "Shore-based Test Facility." He brought out salient features of the state-of-the-art facility established in Goa to undertake Aircraft Carrier Compatibility Tests and for training Naval Pilots in operating environment at sea. He also highlighted the challenges surmounted in dealing techno-management aspects, with the consortia of multiple stake holders, from India and abroad. DG (Aero) presented NTD Medal and Citation to Shri Devendra Singh.



DL, Jodhpur

Dr SR Vadera, OS and Director, DLJ, in his address expressed the need of awareness and confidence in our abilities to cross the technology barriers so as to become technology leader in the world. Shri Rajesh Kumar, Sc 'F', delivered NTD oration on 'NBC Hazards Prediction Software'. He was presented Technology Day Medal and Commendation Certificate. A technical exhibition was organized for the general public featuring technologies developed by DLJ and 30 working science models prepared by 75 students from various schools of Jodhpur. The three best models were awarded.



DMSRDE, Kanpur

Shri PW Ralegankar, Addl DGOF/OEF and Member of Ordnance Factory Board was the Chief Guest on this occasion. The Chief Guest in his address stressed upon mutual cooperation between ordnance factories and DMSRDE. Dr Anurag Srivastava, Sc 'G', gave NTD oration on "Technical Textiles-the Road Ahead." Besides, Shri Raghvesh Misra, Sc 'D', also delivered an oration on "SiC Fiber Technology". An exhibition was organised for school children. Around 700 students from 12 schools visited the exhibition and showed keen interest in DMSRDE products displayed and videos shown.



DRDL Hyderabad

The Technology Day Oration was delivered by Dr Prakash Chand Jain, Sc 'G', on "Missile Structures Technologies: Criticalities and Challenges." The oration discussed transient dynamic simulation of tube launched rockets. Talk focused on critical technologies, methodologies adopted and the resulting robust products and future directions in the area of Missile Structural Design. Invited Talk was delivered by Shri BRK Reddy, Director DRS&S, RCI, on "Radar Seekers and Systems." Technology Day Medal and Commendation Certificate was presented to Dr PC Jain by Shri MSR Prasad, DS and Director DRDL.



HEMRL, Pune

Shri S Sahdev, GM, Ordnance Factory, Itarsi, was the Chief Guest of the function and delivered the keynote address on Narrowing Tolerance for Improvement in the Process. Shri Vijay Kale, Sc 'D' delivered the Technology Day Oration on "Design & Development of Igniter for Torroidal Rocket Motor". A variety of events were conducted during the week to mark the celebration. Competitions like Quiz, Crossword and Essay writing were conducted and the winners were awarded.

An exhibition showcasing the R&D activities of HEMRL, "HEMTECH-2017" was inaugurated by Air Marshal (Retd) BN Gokhale. Shri PK Mehta, DG (ACE), was present during the event. The HEMRL product Information Brochure was released on the occasion.



INMAS, Delhi

Shri Dhruv Kumar Nishad, Sc 'D', delivered NTD oration on "Development of NBC Medical Emergency Kit for Strategic Warfare." Shri Jayant Prasad, DG, IDSA and Dr Shashi Bala Singh, DS and DG Life Sciences presented NTD Medal and Certificate to Shri Dhruv Kumar Nishad, in the function organized by DSF at Bhagvantham Auditorium, Metcalfe House, Delhi.



ITR, Chandipur

Dr M Manickavasagam, Sc 'G', Advanced Systems Laboratory (ASL), Hyderabad, was the Guest of Honour at the function. In his inaugural address Dr BK Das, Outstanding Scientist and Director, ITR highlighted the importance of technology and encouraged scientists to be more creative and innovative in their approach in addition to their normal assignments. Shri Pradipta Roy, Sc 'E', ITR presented NTD oration on "VLSI-Based Real Time Passive Lift-Off Time Detection and Delay Tolerant IDM Tracking" for which he was awarded with a DRDO Commendation Certificate and Medal. Prizes were distributed to the winners of various competitions organized on this occasion.



LRDE, Bengaluru

Shri SS Nagaraj, OS and Director, Electronics and Radar Development Establishment (LRDE) inaugurated the function and brought out the importance of the day. Shri J Senthil Rengarajan, Sc 'F', delivered the Technology Day oration on 'Multi Beam Processing for Rotating Active Phased Array Multi-function Radar'. He was presented Technology Day Medal and Certificate by Director, LRDE.





MTRDC, Bengaluru

Shri Ashok Bansiwal, Sc 'E', delivered an oration on "Broadbanding of Multiple Beam Klystrons". He explained the various techniques used for broadening the bandwidth of the MBKs, followed by the achievements of MTRDC towards the development of compact Ku-band MBKs and scope of enhancement of bandwidth in upcoming MBKs. Dr Sudhir Kamath, OS and Director, MTRDC addressed the gathering and emphasized to work hard to improve the technologies for microwave tube development. He presented Oration Medal and Commendation Certificate to the orator.



NPOL, Kochi

As part of the celebration, an invited talk on "Recent Trends in Wireless Networks and Applications"

by Dr Maneesha Sudheer, Director, Amrita Centre for Wireless Networks and Applications, Amrita University was organized. The enlightening talk focused on the features and applications of advanced network technologies and their applications for societal benefits including health care and disaster management. The talk was followed by an informative and enthusiastic interactive session.

Dr Reji John, Sc 'G' and Dr G Suresh, Sc 'E', were also felicitated on the occasion for receiving Indian patent for their development.



PXE, Chandipur

Shri Sachin Kumar, Sc 'D', delivered lecture on "Demand Side Management for Residential Customer in a Smart Grid." Shri R Appavuraj, OS and Director,

PXE presented NTD Commendation Certificate and Medal to Shri Sachin.

R&DE (E), Pune

Shri VV Parlikar, OS and Director, R&DE (Engrs) elucidated the importance and significance of the day. Dr Kishore M Paknikar, Director, Agharkar Research Institute, Pune, an autonomous institute of DST, Govt of India, was the Chief Guest and delivered a talk on "Biology Inspired Innovation" in which he highlighted the applications of nano-technology in biology, medicine, diagnostics and agriculture.

Shri Akash Verma, Sc 'C', delivered NTD Oration on "Evaluation of Failure Models to Predict Damage Initiation and Progression in Composites subjected to High Velocity Impact". Chief Guest gave the Oration Medal and Certificate to Shri Verma.



CFEES OBSERVES FIRE SERVICE WEEK

The Fire Service Week (FSW) is observed nation-wide during 14-20 April in remembrance of the lives lost in the devastating fire that erupted and the explosions that followed on 14 April 1944 at the Victoria Dock in the Bombay Port and also to prevent such incidents.

Centre for Fire, Explosive and Environment Safety (CFEES), Delhi, observed Fire Service Week by conducting mock fire and rescue drill, and hands on fire-fighting training for the lab employees, demonstration of fire extinguishers, etc. The female participants were also given fire fighting training.



RAISING DAY CELEBRATIONS

DL, Jodhpur

Defence Laboratory, Jodhpur (DLJ) celebrated its 58th Raising day on 16 May 2017. Shri Ravindra Kumar, Sc 'F', and Chairman Works Committee, welcomed the august gathering. A slide show on "Defence Laboratory Jodhpur—A Golden Journey Down the Memory Lane" was shown wherein the growth profile along with the glimpses of the success stories of the laboratory were highlighted during the journey of 58 years.

In his inaugural address, Dr SR Vadera, OS and Director, DLJ, paid tribute to the founder of the lab Dr DS Kothari, and expressed his gratitude to all former Directors, Scientists and Staff for their outstanding contributions. He elaborated upon various achievements in the fields of scientific and technological development, administration, management and sports activities during the year 2016. He also spoke about future technology challenges that laboratory need to work upon.

Director DLJ also gave away various awards for the outstanding contributions made by DRDS, DRTC, Admin and Allied category employees of DLJ. Mementoes were presented to employees who completed 25 years of outstanding service in DRDO.

A cultural programme and dinner for employees and their family members brought end to the celebrations. A large number of retired officers and staff joined the event with great enthusiasm.

LASTEC, Delhi

Laser Science and Technology Centre (LASTEC), Delhi, celebrated its Raising Day on 13 April 2017 with great enthusiasm.



Vice Admiral R Hari Kumar, AVSM, VSM, Controller Personal Services and Shri MH Rahman, DS and DG (HR&TM) graced the function as Chief Guest, and Guest of Honour, respectively.

Various LASTEC products e.g., LORDS 400, LORDS 2000, OTL 300, OTL 1500, Smart Fence, eWARN-Parakh, Pre-emptor, Pre-emptor-RP etc., were demonstrated. LASTEC Newsletter and Hindi Technical Books were released. Chief Guest and Guest

of Honour distributed laboratory-level DRDO Awards to the meritorious employees.

Shri Hari Babu Srivastava, OS and Director, LASTEC, felicitated employees who completed 25 years of service. Cash Awards, Commendation Certificates, Awards to Meritorious Children of employees and to the winners of various sports events were also distributed. The LASTEC employees organized a cultural programme.





WORKSHOP ON ISO 9001:2015

Integrated Test Range (ITR), Chandipur, organised a one-day workshop on “Awareness on ISO 9001:2015” on 5 April 2017 to update the knowledge of the participants on ISO 9001:2015.

Dr BK Das, OS and Director, ITR, inaugurated the workshop and emphasised on the necessity of good quality of work for the growth of the organisation. Various topics related to ISO 9001:2015 were covered in the

workshop. Experts from Electronics Regional Testing Laboratory (East), Kolkata, delivered the lectures.



WORKSHOP ON MUSHROOM CULTIVATION

A training workshop-cum-interaction was organised by Defence Institute of Bio-Energy Research (DIBER), Haldwani, on 11 April 2017 at Indo-Nepal border town Dharchula for the troops as well as for civilian farmers of the town and adjoining villages. The aim of the workshop was to conduct an initial study for feasibility of dissemination of DIBER technologies in border areas and troop welfare, and border area management.

Twenty JCOs and OR's of four different units located in Dharchula were trained on cultivation of edible

mushroom. The bags prepared for mushroom cultivation during the training were handed over to the unit reps for further growth and use by troops.

Units were imparted technical knowhow and guidance on vegetable cultivation and construction of low cost polyhouses. Seeds and seedlings of seasonal vegetables were also distributed to the units.



DIBER team made a visit to all the units for rendering on ground advice.

AGRICULTURE TRAINING PROGRAMMES IN CENTRAL & NORTH EASTERN HIMALAYAS

Defence Institute of Bio-Energy Research (DIBER), Haldwani, organized a series of training programmes on agricultural practices for locals as well as troops deployed in the Central and North-Eastern Himalayan regions like Tawang Auli, Joshimath Units of 119 (1) Inf. Bde, viz, Kumaon Scouts, RVC unit, etc. Sister

laboratories, i.e., Defence Institute of High Altitude Research (DIHAR), Leh and Defence Research Laboratory (DRL), Tezpur joined in to educate the locals on suitable technologies for topographical and meteorological conditions in these areas.

An extension programme was carried out for the farmers as well through the

Block Office, Dharchula. During these training and extension programmes, technology for mushroom cultivation was disseminated, and vegetable seedlings were distributed. A training programme for raising biofence was also conducted for jawans of 28 Punjab in Dharchula Block of Pithoragarh District.



INVITED TALK ON COATINGS FOR CORROSION RESISTANCE & HIGH TEMPERATURE APPLICATIONS

Research Centre Imarat (RCI), Hyderabad, organised a special lecture on “Coatings for Corrosion Resistance and High Temperature Applications Specific to Silos” by Dr Narla Murty of M/S

Sanray Laboratories, Hyderabad on 21 April 2017. Dr Murty highlighted Graphene coating on metallic surfaces including surface preparation, application process, etc. He also shared knowledge on possible coatings for RCS

reduction, coatings for Radome and other interesting topics of generation of potable water from moisture available in atmosphere.

WORKSHOP ON NETWORK BASED GEO-SPATIAL DATA ACCESS & ANALYSIS SYSTEM

Defence Electronics Applications Laboratory (DEAL), Dehradun, organized a one-day workshop on “Network Based Geo-spatial Data Access and Analysis System for DRDO Labs” on 24 April 2017. The workshop was attended by scientists across clusters representing user groups using

geo-spatial data. Dr RS Pundir, OS and Director, DEAL inaugurated the workshop. DEAL has been catering to geo-spatial data requirements of DRDO labs through its earth station facility, which downloads satellite images from Indian sensors. Participants discussed the Dataset Distribution Solution

through deploying Enterprise Wide Web-based Geo-spatial Data Access and Analysis System at DEAL enabling users to access and download in a fast, efficient and secure manner through DRONA network.

WORKSHOP ON QUALITY, RELIABILITY & SAFETY

A one-day workshop on Quality, Reliability and Safety was jointly organized by the Office of Director General (Aero), Bengaluru and Directorate of Quality, Reliability and Safety, DRDO HQ, Delhi, on 5 May 2017. Fifty participants from Aero and ECS Cluster Labs, attended the workshop.

Dr CP Ramanarayanan, DS and DG (Aero), presided over the function. In his opening remarks, Dr Ramanarayanan described Quality, Reliability and Safety as the foundation for any venture to be successful. He laid specific stress on the need to have certified professionals in these areas.

Dr S Guruprasad, OS and DG (PC&SI), in his inaugural address laid accent upon the inescapable need to provide impetus to meet Military requirements. Later, Shri Suryanarayana Nandula, Director,



QR&S, gave an overview of DRDO Quality Policy.

Dr PN Tengli, Director, SQR (Aero), and Shri A Vengadarajan, Director, SQR (ECS), gave an update on the initiatives taken to

implement practices related to Quality, Reliability and Safety in their Clusters.

Shri Devendra Singh, Sc 'F' and Convener of the Workshop summarized the take-away from the workshop.

CEP ON BIODOSIMETRY PREPAREDNESS FOR RADIATION EMERGENCY

Institute of Nuclear Medicine and Allied Sciences (INMAS), Delhi, is a accredited laboratory by Atomic Energy Regulatory Board (AERB), Govt of India, for Biodosimetry services. In the event of any radiation emergency, a single laboratory can handle only limited samples and therefore there is an urgent necessity to increase the capacity for Biodosimetry services. To create a pool of trained persons for Biodiversity Services, INMAS organized a five-day CEP course on “Biodosimetry Preparedness for Radiation Emergency for Defence Personnel” during 8-12 May 2017.

Lt Gen CS Narayan, VSM, Col Commandant, Dy CIDS (Med), IDS HQ inaugurated the course and emphasized on the need for enhancing medical preparedness in the event



of radiological emergencies among defence forces. He complimented INMAS for the directional efforts to expand the network of biodosimetry labs with participation of Command Hospitals.

The participants were sensitized

on the scope and need of biodosimetry in medical management of nuclear emergency and were provided hands on training on dicentric chromosomal assay (Gold standard) with necessary basic theory.

FOUNDATION COURSE IN TECHNOLOGY MANAGEMENT-1

Institute of Technology Management, Mussoorie conducted a five-day Basic/Foundation Course in Technology Management-1 for Scientists ‘B’, ‘C’, ‘D’ and equivalent during 15-19 May 2017.

The course was aimed at creating awareness about fundamental aspects of Technology Management. To impart this knowledge 17 sessions on various topics related to Technology Management were conducted including theory as well as case studies. Entry behaviour test and brainstorming session were conducted on the first day to assess the prior subject knowledge of participants. Besides, extracurricular activities like yoga sessions, stress relieving exercises



and sports events were incorporated in the programme.

Shri Sanjay Tandon, Director ITM in his valedictory address deliberated

upon the importance of Technology Management and addressed the valuable feedback given by the participants.



LTPP REVIEW MEETING

Advanced Numerical Research and Analysis Group (ANURAG), Hyderabad, conducted its Long Term Technology Perspective Plan (LTPP) Review Meeting on 16 May 2017.

The meeting was chaired by Vice Admiral (Retd) Raman Puri.

The technical activities and achievements of ANURAG were presented during the meeting and areas

for R&D initiatives were discussed. The committee visited VLSI, System Software, Analog and RF design, Data Visualization, and High Performance Computing wings of ANURAG.



HIGHER QUALIFICATIONS ACQUIRED

ISSA, Delhi



Shri Arun Kumar Tyagi, Sc 'D', Institute for Systems Studies and Analyses (ISSA), Delhi, was awarded PhD in Operational Research by the University of Delhi, for the thesis entitled "A Study for Coordinating Inventory and Credit Decisions."

NPOL, Kochi

Shri K Ajith Kumar, Sc 'G', Naval Physical and Oceanographic Laboratory (NPOL), Kochi, has been awarded



PhD by Anna University, Chennai for the thesis entitled "Systems Engineering Based Feasibility Rating Model for Defence Research Projects."

SASE, Chandigarh



Shri Amreek Singh, Sc 'F', Snow and Avalanche Study Establishment (SASE), Chandigarh, has been awarded PhD by IIT Roorkee,

for the thesis entitled 'An Improved ABC Algorithm and its GPU Aided Application for Avalanche Forecasting'.

SSPL, Delhi



Shri Rupesh Kumar Chaubey, Sc 'E', Solid State Physics Laboratory (SSPL), has been awarded PhD by Banaras Hindu University, Varanasi

for the thesis entitled "A Study on Reliability of III-V HEMT Materials and Devices".

AWARDS

7th National Awards for Technology Innovation

Prof. Balasubramanian K, Dean and Head, Materials Engineering Department, Defence Institute of Advanced Technology (DIAT), Pune, has been awarded 7th National



Awards for Technology Innovation in Petrochemicals and Downstream Plastics Processing Industry by Ministry of Chemicals and Fertilizers, Govt of India, in the category of Innovation in Polymeric Material for the Innovation in Carbon-based Nano-structured Environmentally Benign Superhydrophobic Composite Surface.

Dr Kumresh Kumar Gaur, Sc 'E', Office of DG R&D (RM & Impl), DRDO HQ, was also conferred with 7th National Award for Technology Innovation for the year 2016-17 in the category of Polymers in Public Health Care for the innovation of Injection Moulded Microcellular Thermoplastic Hip Protection Device.

The awards were presented by Shri Ananth Kumar, Hon'ble Minister



for Parliamentary Affairs and Chemical and Fertilizers, Govt of India in the presence of Shri Mansukh L Mandaviya, Hon'ble Minister of State for Chemicals and Fertilizers, Shipping, Road Transport and Highways, Govt of India.

SPORTS ROUND-UP

DMSRDE CONDUCTS KANPUR OPEN TABLE TENNIS TOURNAMENT

Defence Materials and Stores Research and Development Establishment (DMSRDE), Kanpur, conducted under 15 and 18 girls and boys students Kanpur Open Table Tennis Tournament under the banner of Kanpur District Table Tennis Association (KDTTA) during 5-6 May 2017. More than 120 students from 12 schools participated in the tournament. Shri Sanjeev Pathak, Vice President of UPTTA and selector of KDTTA was present during the tournament. The idea, an initiative of Director DMSRDE, was to promote the games and spread the awareness about health consciousness among the young generation.





KISHAN SANGOSTHI

A Kisan Sangosthi was organised by Defence Institute of Bio-Energy Research (DIBER), Haldwani at Dharchula Block Office, Distt Pithoragarh, to ascertain the potential enthusiastic progressive farmers who can adopt to new

programmes. State Agriculture Authorities and 30 farmers attended the meeting. The main impetus was given to vegetable cultivation in region. The farmers also discussed their problems and requested for possible assistance from DIBER.

The interaction was fruitful in an effort to draw a roadmap for undertaking useful projects both for Army as well as civil populace of border areas. Quality seeds of seasonal vegetable were distributed to farmers.

ITR ORGANISED NEURO & NEPHROLOGY CHECK-UP CAMP

Integrated Test Range (ITR), Chandipur organised free Neuro and Nephrology Check-up Camp on 15 April 2017 at Range Staff Mess and Institute (RASMI), ITR Colony, Balasore, in collaboration with

Continental Hospital, Hyderabad. Dr BK Das, OS and Director, ITR, inaugurated the camp. Dr Rajasekhar Reddy K (Neuro) and Dr Sashi Kiran A (Nephrology and Renal Transplant) checked 75 persons

and gave them consultations. The camp was coordinated by Shri CR Ojha, GD (HR, PL & RM) and his team with able support of Health Care Centre of ITR.



VISITORS TO DRDO LABS/ESTTS

DIHAR, Leh

Dr Shashi Bala Singh, DS and DG (LS), DRDO, visited the army units and nomadic population in Demchok and Fuktse in the eastern sector of Ladakh bordering China on 15 and 16 April 2017. She interacted with the army personnel and assured them of all help by means of extreme high altitude farming techniques with regard to improving the fresh food availability in their respective locations. The local nomadic pastoralist also interacted with her and brought about various problems they are facing, to which she directed DIHAR to take appropriate measures on priority.



NPOL, Kochi

Rear Admiral RJ Nadkarni VSM, Chief of Staff, Southern Naval Command, visited Naval Physical and Oceanographic Laboratory (NPOL) on 24 April 2017. He was briefed about the ongoing projects at NPOL.



HEMRL, Pune

Lt Gen SK Patyal, UYSM, SM, PHD, Deputy Chief of Army Staff (P&S) visited High Energy Materials Research Laboratory (HEMRL), Pune on 25 April 2017.

Shri KPS Murthy, OS and Director, HEMRL, presented overview on the activities of HEMRL. Presentations on the projects related to HEMS were given by the senior scientists to the visitors. Lt Gen SK Patyal showed keen interest in the activities of HEMRL.





VRDE, Ahmednagar

Lt Gen SK Patyal, UYSM, SM, PhD, DCOAS (P&S), visited Vehicles Research and Development Establishment (VRDE), Ahmednagar on 26 April 2017.

He was given a briefing on overall activities of VRDE and demonstration on VRDE developed products like AP-II Wheeled Armoured Platform 8X8 (WhAP), Rotary engine, CBRN-UGV, Unit Maintenance Vehicle (UMV) and Unit Repair Vehicle (URV) for MBT (Arjun). DCOAS (P&S) expressed satisfaction over development of WhAP and its capabilities.



DEAL, Dehradun

Air Vice Marshal SJ Nanodkar, VM, VSM, ACAS OPS visited Defence Electronics Applications Laboratory (DEAL), Dehradun on 11 May 2017. Dr RS Pundir, Director, DEAL apprised Air Vice Marshal of various projects e.g. Rustom-2, Software Defined Radio (SDR), GSAT-6 Integrated Coastal Surveillance System (ICSS), Tropo-scatter communication, VLF communication, Satellite imagery software exploitation development etc.



DL, Jodhpur

Lt Gen PS Rajeshwar, AVSM, VSM, GOC HQ 12 Corps, visited Defence Laboratory, Jodhpur on 17 May 2017. Director DLJ briefed Lt Gen Rajeshwar about the Charter of Duties, Core Competence, Technical Infrastructure, Technical Activities and Achievements of the laboratory.

Lt Gen PS Rajeshwar discussed Corps specific requirements related to water purification & desalination, soil stabilisation, camouflage patterns software and PCM cool vest technologies developed by DLJ. He visited various technical facilities of the laboratory and was briefed about the technical activities.



DRDO HARNESSING SCIENCE FOR PEACE AND SECURITY- XVI

CHAPTER 2: TRANSFORMATION—DEFENCE RESEARCH & DEVELOPMENT ORGANISATION (1958-1969)

The article is Sixteenth 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).

THE EARLY YEARS OF DRDO

Further Expansion of DRDO

START-UP HICCUPS

R&D & Government Set Up

The DRDO was the only S&T organization to which every rule of the government was applicable. Many of the rules had been framed for governing India by the British and the process of changing the rules to suit an independent sovereign nation with democratically elected government were by no means complete by the time DRDO came into existence in 1958.

These rules did not suit research and development activities because R&D by its nature is a change agent whereas in the government, laid down procedures are essential and departures from laid down procedures were discouraged. So each of the changes brought about by DRDO without any earlier precedence was a long and time consuming process that required patience and skill for navigating the files through the departments within the Defence Ministry and some times through other ministries.

Earlier, before Dr Bhagavantam had accepted the post of Scientific Adviser and later had moved to Delhi in September 1962, he had sounded the Defence Minister about vesting the post of Scientific Adviser with the financial and administrative powers of a Secretary

to the Government of India but Shri Krishna Menon during his several visits to Bangalore, had used all his persuasive powers to make him accept the post without insisting on these powers and also assured him of full support. The lack of administrative power and not being a Secretary to the Government of India did not really affect him as long as Shri Krishna Menon was the Defence Minister. Dr V Ranganathan, former Deputy Chief Scientist recalled that there was complete rapport between the Minister and the Scientific Adviser and there were several occasions, when Shri Krishna Menon had walked into the Scientific Adviser's office for his opinion. Further, whenever he sensed delays on matters concerning the DRDO, the Minister would call for the relevant files and papers and record his decisions before sending the papers down the bureaucratic channel. These acts did not go well with the bureaucrats of the Ministry. As ill luck would have it, within a few months of Dr Bhagavantam's move to Delhi, Shri VK Krishna Menon was forced out of office by his party men and Shri YB Chavan who was former Chief Minister of Maharashtra took over the stewardship of the Defence Ministry. Professor Bhagavantam had to start all over again with the new Defence Minister. The relationship did not have the same warmth that he enjoyed with Shri Krishna Menon.

In the new set up the Scientific Adviser could not follow up with the same pace

for improved infrastructure for DRDO in terms of increased resources in men, plant and equipment to consolidate the benefits of expansion. His administrative experience as Vice-Chancellor or as Director of the Indian Institute of Science had not prepared him for the bureaucratic mind-set which required even minor aspects concerning the Scientific Adviser or the DRDO to be sent to the department for prior clearance and approval. A glimpse of what he would have faced at that time was evident in a lecture delivered by him in 1970. He stated, "the administrator talks of hierarchy, beaten channels as being essential prerequisites for an orderly progress in any endeavour. Freedom to pursue problems that is assigned to him, unhampered and in his own way, is to a scientist his life blood. It is like the freedom of an individual when the latter asserts his inalienable right to go to hell along his chosen path. In a government even if an individual decides to go to hell, he cannot do so along his chosen path. He should go through the proper channel. A path already laid out and proven by others, is the safest to follow in routine matters but will lead to no new results in innovative science, and should be avoided. Lack of understanding and lack of a dialogue between these two groups of people often results in productive projects being dropped, wrong projects being supported and the targets in many cases being ill conceived or inadequately estimated".

He earned the respect of the politicians who were in charge of the



Defence Ministry during his tenure as Scientific Adviser and found them responsive to the idea of forming an autonomous body for DRDO similar to the Atomic Energy Commission and the CSIR. In this context, Shri AM Thomas who was the Minister for Defence Production stated at the 8th Annual R&D Conference in 1965 that, "The only major research organisation in the country which still functions under the normal Government procedure is the Defence R&D Organisation. I feel that with the resources at our disposal, if we want to achieve the objectives set in the shortest possible time, a measure of autonomy should be vested with the Defence R&D. Such an autonomous body should, however, operate in close collaboration with the three Services, the production and the inspection organisation so that the requirements of the users are always kept uppermost in mind while formulating the programmes of research and development work. It will be my endeavour to work towards this end and it is this point that I want to stress".

Even though the move to form an autonomous body ultimately did not take place, the fact that at the political level the question of autonomy to DRDO was being considered, might have somewhat eased the problems posed by bureaucracy in providing the DRDO with resources and reducing the delays. Over the long term a working relationship appeared to have been established with the bureaucrats. Dr S Bhagavantam would be the Scientific Adviser for about four more years until the last quarter of 1969.

Dissensions Within

After the initial transition period, the clash of cultures between the diverse elements that now constituted the DRDO, began to surface up mostly in the laboratories primarily dealing with application of technology and engineering. The laboratories involved in science and research were spared of the tensions because they had personnel with similar views, qualifications and experience. The first group was mostly populated by the Army Officers and some civilian scientists who had come

into the DRDO through the TDE route and the second group by almost all of the civilian scientists, some uniformed officers of the erstwhile Defence Science Organisation, and the newly appointed qualified scientists and engineers. By virtue of their work, experience and professional backgrounds, the two groups had differences of opinion regarding the role of DRDO vis-a-vis the Services. The erstwhile TDE personnel mostly concentrated in the newly formed R&D Establishments and Headquarters Directorates of the DRDO strongly believed that DRDO should look into the immediate needs of the Services and build up their confidence by taking on equipment or weapon system development only after the Services spelt out their requirement in the form of Qualitative Requirement/Operational Requirement (QR/OR). According to them, the Services are the best judges of what they need and the scientist who has no combat experience can not presume to know the needs of the Services better than the Services themselves. On the other hand, the other group consisting mostly of personnel whose earlier experience was mostly in the Defence Science Organisation, had equally strong convictions that any R&D activity initiated after the Services had brought out their QR/OR was bound to fail because by the time the equipment was developed by DRDO and was produced by the public sector/departmental undertaking, the companies abroad would have produced a version more advanced than ours. Therefore, according to them the only way out of this situation was for the scientist to initiate R&D work ahead of the Services and based on his perception of how the new scientific and technical advance would benefit the Services. The first group had their feet firmly rooted in the present and on the Services being able to guide the DRDO on development, based on what they need, whereas the second group had their eyes focused on the future and the scientist being the best judge of what the future will unfold. The antipathy between the two groups was heightened by the fact the civilian scientists considered that their

military counterparts did not have either the academic qualifications, knowledge and experience in R&D to direct R&D effort. The military officers on their part considered the civilian counterparts as theoreticians who lacked administrative skills for managing laboratories and also understanding of weapon system deployment in combat which was considered by them as essential for successful hardware development.

Soon after Dr Bhagavantam took over as full-time Scientific Adviser, apparently differences between the full-time Scientific Adviser and his senior deputy, the CCR&D came to the fore and strengthened the divisive forces. The Scientific Adviser was faced with the prospect of the breakup of the Defence R&D Organisation and of separating the functions of the Director General of DRDO from the post of the Scientific Adviser. Major General BD Kapur, the CCR&D put up a proposal for divesting the Scientific Adviser of the direct control of the equipment oriented laboratories. He proposed that these laboratories and the corresponding Technical Directorates be made part of the CGDP, and the CCR&D becoming Additional CGDP. According to him, this would have led to quicker decisions in production and supply and also would have enabled economy in technical manpower. In his proposal the other laboratories in the DRDO would function under the control of the Chief Scientist and the Scientific Adviser would exercise over all jurisdiction. According to General Kapur, his proposal got the approval of the government in principle but it did not become a reality because Dr Bhagavantam opposed it. The subsequent actions of the Government of India in 1963 in abolishing the post of CGDP and in creating instead, the post of Director General of Inspection and making him responsible for the activities of inspection carried out by the remnants of TDEs, effectively put an end to all efforts for dismembering of the DRDO. Soon after when Major General BD Kapur left the DRDO, another able and competent military officer, Major General JR Samson was appointed as CCR&D.

To be continued...

Thu, 04 May, 2017

Advanced Brahmos test-fired successfully

India on Wednesday successfully test-fired advanced BRAHMOS Block III Land Attack Cruise Missile (LACM) system in the Andaman and Nicobar Islands for the second consecutive day. The test was carried out by South Western Command's Corps 'Strike One', reinforcing the formidable weapon's precision strike capability. The long-range tactical weapon was successfully tested from the same location on Tuesday.

These successful firings of the supersonic cruise missile were carried out in full operational land-to-land configurations from Mobile Autonomous Launchers (MAL) at its full-range. Meeting all flight parameters in a copybook manner while conducting high-level and complex manoeuvres, the multi-role missile successfully hit the land-based target with desired precision, in both the trials demonstrating its accuracy of less than one metre. This is the fifth consecutive time when the Block-III version of BRAHMOS LACM has been successfully launched and hit the land-based target in "top-attack" mode, a feat not achieved by any other weapon system of its genre.

The Army, which became the first land force in the world to deploy the BRAHMOS in 2007, has raised several regiments of the weapon. It has been jointly developed by India's DRDO and Russia's NPOM. The multi-platform, multi-mission BRAHMOS is capable of being launched from land, sea, sub-sea and air against surface and sea-based targets.

Thu, 11 May, 2017
(Online)

India floats repeat tender for homemade rocket launchers valued at \$2B

New Delhi — In a move aimed at becoming more self-sufficient with multi-barrel rocket launchers, the Indian Ministry of Defence has floated a big-ticket bid to buy six regiments of homemade Pinaka multi-barrel rocket launchers for \$2 billion. The order for the acquisition is expected to be placed within 18 months.

Last December, the ministry placed an order for two regiments — one regiment is 18 systems — totaling a \$350 million order for the Pinaka rocket launchers. Industry sources say India is now contemplating exporting the Pinaka.

The order will be split between the prime state-owned contractors Bharat Earth Movers Limited and the Ordnance Factories Board, or OFB, and private sector defense companies Larsen & Toubro and Tata Power SED. Under the contract, BEML will supply the vehicles for the rocket launchers; L&T and Tata Power SED will supply the launcher systems; and OFB will supply the rocket ammunition.

L&T and Tata Power SED have designed and developed the Pinaka system with the Defence Research and Development Organisation or DRDO. The Indian Army currently operates two regiments of the Pinaka systems. "The indigenous operational necessities and also to reduce dependence on foreign Smerch rocket systems," an Indian Army official said. The Army last year, the official added, "however, the latest order is for Pinaka Mark-II, which has a range of up to 150 km."

MAIL TODAY

Sun, 28 May, 2017

Jaitley favours Indian over foreign for missile deal

By Ajit K Dubey in New Delhi

IN LINE with Prime Minister Narendra Modi's direction to promote Make in India in the defence sector and avoid imports, the defence ministry has decided to award an army missile contract worth around ₹18,000 crore to the DRDO over a foreign vendor.

The decision was taken by defence minister Arun Jaitley in the crucial meeting of the Defence Acquisition Council held last week, top government sources told MAIL TODAY.

The case for acquiring Short Range Surface to Air Missiles (SR-SAMs) was taken up for discussion during the DAC meeting where the government had to decide whether to go for a foreign missile system or the Akash surface to air missile systems. Jaitley went on for the indigenous option, sources said.

Top army sources confirmed that the force would be utilising the Akash missiles for protection against the incoming aircraft and unmanned aerial vehicles of the adversaries as the system would be deployed on both the Pakistan and China border. Sources said there were a few specific systems and equipment available on the foreign system that were asked for by the army for the missile system which DRDO assured would be provided.

Akash missile systems are proving their worth in the recent times as they have been chosen by the IAF for its requirement.

The DRDO may have lagged behind in the indigenous development of aircraft and land warfare systems but it has helped India to become self-reliant in the strategic missile systems helping in giving advance capability to the armed forces while saving in precious foreign currency.

It is learnt that three foreign vendors — Israel, Sweden and Russia — were in the race for bagging the contract for which the process was initiated in 2014, and trials were held in 2014.

One of the three contenders had to be chosen for the contract as the force wanted the two regiments of the missile system to be provided to the army air defence. The army air defence has been operating with obsolete equipment for a long time with the government recently saying around 98 per cent of it was outdated.

However, under the Modi regime, the force recently received a boost when the cabinet committee on security cleared the ₹17,000 crore Medium Range Surface to Air Missile project with Israel.

Sat, 13 May, 2017

DFRL develops food warmer for soldiers

In a major initiative, the Mysuru-based Defence Food Research Laboratory (DFRL) has invented re-usable food warmer pouches and fresh curd maker that guarantees fresh and hygienic food for the soldiers.

DFRL comes under DRDO and the food warmer and curd maker would certainly help forces serving in the high altitudes of Siachen, Ladakh and other places.

According to senior scientist Ramakrishna who briefed the media in Mysuru, Army use ponies at present for food supply. The new inventions would help them keep their food warmer at their posts.

He said, "At present, the Army is dependent on ponies to supply food. It takes hours for the ponies to reach Army posts from the bottom and by that time the food will become solid due to the cold temperatures that reach upto minus 20 degrees Celsius."

Soldiers need to dip the food pouches in boiling water to consume the food, but lighting a fire will give away their position, he added.

According to scientists at DFRL, the re-usable food warmers, having encapsulated constant watt heaters as source of heating, provide pouch-to-product uniform and effective heat transfer without overcooking the product.

The warmers weigh around 2.5 kg and can be easily carried by armed personnel in their backpacks. Food packets can be warmed at sub-zero temperatures just by placing them inside the pouches for 15-20 minutes before eating," said S Naveen, Technical Officer.

Another product, the fresh curd maker works at high altitudes and at sub-zero temperatures. The new equipment is easy to carry and it can prepare 5-10 litres of fresh curd within four hours.

Ramakrishna said both the products have completed field trials in parts of North-East, J&K and Udhampur and soldiers are impressed with it.

The Defence Food Research Laboratory conducts research and development of technologies and products in the area of food science and technology to cater to the varied food challenges for the Indian Armed Forces.

Fri, 12 May, 2017
(Online)

In Arm's Way

By Anupriya Chatterjee

The city feted National Technology Day on Thursday with a stunning display of weapons tech at the DRDO as well as Ferguson College campuses. Mirror brings you the top picks

Brahmos Missile

This much-talked about Brahmos missile has been an important part of Indo-Russian ties in history. A short-range supersonic cruise missile developed for the Navy, it requires on-board power supply in the form of a primary battery for various electronic systems and functioning of pyro-devices; it is presently the world's fastest anti-air cruise missile. Brahmos Corp. is currently the only arm of the DRDO that has considered launching itself into the global market, after more than a decade of its inception. India and Russia continue to be in talks to develop a new generation of Brahmos missiles.

■ At HEMRL, DRDO

▶ Pinaka MK-II

This multi-barrel rocket launcher produced in India by the DRDO was in service during Kargil war, so has been developed for hilly terrains, too. This technology has gone through multiple changes since the 1990s. It is a joint venture with Israel, India decided to implement a new Trajectory Correction System on Pinaka. In April this year, the Indian Army planned to induct eight indigenously developed Pinaka rocket launchers, for which two private entities (Tata and Larsen & Toubro) were roped in for production. Earlier this year, in January, the MK-II version of the rocket was successfully test fired from a defence test facility off the coast of Odisha.

▶ Explosive Reactive Armour (ERA)

Developed by the HEMRL (High Energy Material Research Laboratory on the DRDO campus), the ERA MK-II is a technology used to provide protection to tanks against anti-tank missiles and kinetic energy projectiles. It is adaptable to all the three tanks currently used by the Indian Army — T-72, T-90 and Arjun MK-II. An indigenous technology, ERA MK-II has been successfully proven in user trials during 2016, and is capable of detecting anti-tank missiles without affecting other performance parameters of a tank. While its performance in detecting anti-tank missiles is also considered to be a very cost-effective and weight-effective armour that will significantly enhance the protection level of Indian Army tanks, come 2018.

Mon, 01 May, 2017
(Online)

Defence Minister Arun Jaitley hands over DRDO developed devices to forces

New Delhi: Defence Minister Arun Jaitley today handed over a number of devices developed by the DRDO to National Security Guard (NSG), Delhi Police and National Disaster Response Force (NDRF).

The devices handed over to NDRF included 'E-Nasika', a hand-held equipment which is capable of rapid detection of chemical agents well below their toxic limits. Jaitley also handed over to NSG an equipment called 'OTL-300'. It can instantly detect partially camouflaged optical elements, such as telescopes, binoculars and night vision devices. The 'OTL-300' was given to Delhi Police also.

Other portable equipment, capable of remotely identifying explosives, was handed over to P S Purohit, additional director in Intelligence Bureau.