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

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

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

LOCAL CORRESPONDENTS

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 Bhuvanawari, 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 N Venkatesh, 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:** 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); **Panagrah:** Shri Anjan Kumar Das, DRDO Integration Centre (DIC); **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 PAYS TRIBUTE TO DR APJ ABDUL KALAM ON HIS BIRTH ANNIVERSARY

DRDO celebrated 87th Birth Anniversary of Dr APJ Abdul Kalam, the former President of India and DRDO Chief at a function in DRDO Bhawan on 15 October 2018. Raksha Mantri Smt Nirmala Sitharaman graced the occasion as the Chief Guest, which also had the presence of Raksha Rajya Mantri Dr Subhash Ramrao Bhamre, and Prof. K Vijay Raghavan Principal Scientific Advisor (PSA) to the Government of India, along with other dignitaries.

Speaking on the occasion Smt Sitharaman shared her experience of meeting with Dr Kalam and said, “He was not only a good scientist but also an excellent administrator who could spot and nurture talent among his team members. That among others

made this ‘missile man’ a great team leader.” Addressing the gathering, Raksha Rajya Mantri said, Dr Kalam believed in a strong nation—one that is scientifically superior and always used to inspire people for putting their total commitment towards the mission in hand. This can be gauged in his words, “If you want to shine like sun, first burn like sun.”

Raksha Mantri also launched a DRDO website dedicated to the theme ‘The Kalam Vision: Dare to Dream’ for engaging young minds in emerging technologies like Artificial intelligence, Cyber security, Robotics, Autonomous Systems, etc. The website (<https://drdo.gov.in/drdo/kalam/kalam.html>) will facilitate open competition for students and start ups.

Hindi version of the book “Incredible Kalam”, brought out by Defence Scientific Information and Documentation Centre (DESIDOC), was released by Dr Bhamre. The book is a compilation of experiences of some distinguished scientists about their association with Kalam. A short film on Dr Kalam and his association with DRDO was also screened on the occasion.

Students of three Delhi-based schools attended the function. These schools have set up Atal Tinkering Lab in their schools under Atal Innovation Mission of Government of India. Students from IIT Delhi also attended the function. The aim of inviting young minds was to motivate them with diverse and great qualities of Dr Kalam.



Hon'ble Raksha Mantri releasing memoirs Incredible Kalam



PRAHAAR TESTED SUCCESSFULLY

DRDO successfully flight tested the indigenously developed surface-to-surface tactical missile Prahaar from Launch Complex-III, Integrated Test Range (ITR), Balasore on 20 September 2018. Range stations and electrooptical systems tracked the missile throughout its flight.

Prahaar is a contemporary weapon system capable of carrying multiple types of warheads and neutralizing a wide variety of targets.

Hon'ble Raksha Mantri Smt Nirmala Sitharaman congratulated DRDO, Army, industries and other team members for the successful mission and said, "Indigenously developed Prahaar will further strengthen our defence capabilities."

Chief of the Army Staff General Bipin Rawat and Dr G Satheesh Reddy, Secretary, Department of Defence R&D and Chairman, DRDO, witnessed the launch and complimented all the team members.



CAIR HANDED OVER SDPS SOLUTION TO IB

DRDO handed over Secure Desktop Processing System (SDPS) Solution to Intelligence Bureau (IB) for their internal usage. The solutions were architected and developed by the Centre for Artificial Intelligence and Robotics (CAIR), Bengaluru, while the product definition and refinement was done with the users in multiple iterations.

SDPS solution provides immutable and integrity preserving secure editing platform for creating, reading, editing and sharing of sensitive data. These SDPS are for standalone document processing and for network access (including Internet). The ceremony was attended by Shri AK Gupta from IB, and Director, CAIR, and her team.





DRDO CONDUCTS SECOND FLIGHT TEST OF MPATGM

DRDO successfully flight tested indigenously developed Man Portable Anti-Tank Guided Missile (MPATGM) second time from the Ahmednagar range in Maharashtra on

16 September 2018 fulfilling all the mission objectives.

The flight missions were conducted on 15 and 16 September 2018 for different ranges and validated its maximum range capability.

Raksha Mantri Smt Nirmala Sitharaman congratulated the team DRDO, Indian Army and associated industries for the twin success of MPATGM weapon system.

Salient Features

- * Fire and forget third-generation anti-tank guided missile
- * Capable of being fired from shoulder
- * Strike range of around 2.5 km
- * Effective against both stationary and moving targets



IAF TEST FIRES ASTRA BVRAAM

Astra, Beyond Visual Range Air-to-Air Missile (BVRAAM), developed indigenously by DRDO was successfully test fired by the Indian Air Force (IAF) from Su-30 aircraft on 26 September 2018 from Air Force Station, Kalaikunda. The missile successfully engaged a manoeuvring target

with high precision meeting the mission objectives.

In the series of trials held to date, Astra has been launched in the complete Su-30 flight envelope. The latest flight test assumes significance as it was part of the series of final pre-induction trials. Astra is the best in class weapon system and has undergone more than 20

developmental trials.

Raksha Mantri Smt Nirmala Sitharaman lauded the efforts of Indian Air Force, DRDO and associated team members involved in the mission and said, India has attained a high level of capability in the indigenous design and development of advanced weapon systems.



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 Nobel Peace Laureate Shri Kailash Satyarthi on 4 September 2018 at Dr Bhagavantham Auditorium, Metcalfe House, Delhi. Dr Hina A Gokhale, OS and DG (HR), DRDO, Dr Alka Suri, Director, DESIDOC, Shri Sunil Sharma, Director Rajbhasha and OM, were present on the occasion.

The Nobel Laureate enriched the audience with his ideas and thoughts.



He talked about his experiences during eradication of child labour and how they are working for rehabilitation of these children. Shri Satyarthi talked about the welfare of child labourers, many of whom are forced to work by their parents and held as bonded labourers.

Dr Hina A Gokhale appreciated relentless humanitarian work being done by Shri Kailash Satyarthi under Bachpan Bachao Andolan. Over 600 personal including Directors of DRDO HQ and DRDO labs/estts of Delhi, officers and staff from various Delhi-based labs attended the oration. Dr Rajeev Vij, Sc 'G', DESIDOC, proposed the vote of thanks.

DIBER PARTICIPATES IN EXHIBITION ORGANISED BY HQ CENTRAL COMMAND

Defence Institute of Bio-Energy Research (DIBER), Haldwani displayed its products in an exhibition and a medical camp organized by HQ Central Command at Dharchula, Distt Pithoragarh on 17 September 2018. Hon'ble Raksha Mantri Smt Nirmala Sitharaman inaugurated the exhibition and the medical camp.

Hon'ble Raksha Mantri was briefed about products developed by DIBER, most notably the novel technologies on phyto-fence and phyto-camouflage, herbal medicines (anti-leucoderma), training modules for the services, ex-service men and local villagers, and hydro-fodder. RM took keen interest in deployable camouflage technique by Botanicals (CHADDAM), which was displayed



Hon'ble Raksha Mantri being explained about DIBER products. Inset: DIBER Stall

by DIBER team for the first time, Jatropha bio-diesel and its successful trials by Army and Navy.

DRL ORGANIZED KISAN-JAWAN-VIGYAN MELA

Defence Research Laboratory (DRL), Tezpur, organized first DRDO Kisan-Jawan-Vigyan Mela at its detachment in Salari, West Kameng District, Arunachal Pradesh, on 23 September 2018 under the programme Arunodaya with the theme “Technologies for Doubling Farmers’ Income”. Dr Sonal Swaroop, IAS, Deputy Commissioner, West Kameng, graced the event as the Chief Guest. Around 250 farmers/state officials/armed force personal/paramilitary forces participated in the mela.

Exhibition stalls were set-up by National Research Centre on Yak, ICAR, Dirang; State Department of Agriculture, West Kameng, and DRL. Medical and veterinary health camp was conducted by 30th BN SSB. Ten progressive farmers from different villages of West Kameng were felicitated



Dr Sonal Swaroop showing keen interest in DRL products

for their commendable efforts made in various fields of agriculture.

Competition for ‘Best Farm Produce’ was organized where 45 farmers were awarded. Girl students from Kasturba

Gandhi Balika Vidyalaya, Salari, took part in science quiz and youth groups and students presented colourful cultural programme. The mela ended with a community lunch.

RAISING DAY CELEBRATIONS

ARDE, PUNE

Armament Research and Development Establishment (ARDE), Pune, celebrated its 61st Raising Day on 1 September 2018 with great enthusiasm and gaiety. Shri PK Mehta, DS, DG (ACE) was the Chief Guest on this occasion. Shri AM Datar, former DG(ACE) and Director ARDE and Maj Gen D Kapil, former Director ARDE, were special guests. Shri VV Parlikar, OS and Director, R&DE (E), Shri KPS Murthy, OS and Director, HEMRL, Shri Sangam Sinha, General Manager, MSC, and Heads of allied establishments graced the occasion.

To mark the completion of 60 years of existence, 60 trees were planted by the invitees. Dr KM Rajan,



ARDE Raising Day celebration



DS and Director ARDE, delivered the Raising Day speech, covering the major achievements of the establishment over the six decades and laying down the challenges and the roadmap for the coming years. In his address, Shri PK Mehta highlighted the important position occupied by ARDE as one of the largest and most productive establishments under DRDO.

Release of ARDE Memoirs, "Journey through Time: Six Decades of ARDE" and ARDE documentary was done by the dignitaries. Festive balloons in the shape of Guided Pinaka rocket were also released. Adding to the fervour of the Diamond Jubilee celebrations was a resounding performance by the Military Brass Band from National Defence Academy, Pune.

The Annual Award distribution ceremony was conducted on 31 August 2018. The Video Bulletin of Technology Focus on ARDE's work on "Warheads for Missiles, Torpedoes and Rockets" was also screened on the occasion. The Video Bulletin was brought out by Defence Scientific Information and Documentation Centre (DESIDOC), Delhi.

DIPAS, DELHI

Defence Institute of Physiology and Allied Sciences (DIPAS), celebrated its 57th Raising Day on 27 September 2018 with zeal and enthusiasm. Dr G Satheesh Reddy, Secretary DDR&D and Chairman DRDO and Dr Chitra Rajagopal, DS and DG (SAM&LS) graced the occasion as the Chief Guest and the Guest of Honour, respectively. Directors of sister DRDO labs Corporate Directors, DCDA, representatives of DGAFMS, service officers, representatives of estate management unit, former scientists, officers and staff also graced the occasion.

Dr Bhuvnesh Kumar, OS and Director, DIPAS, presented the activities and achievements of DIPAS. Dr Chitra Rajagopal, congratulated the scientists and staff for the good work and urged



Dr Reddy releasing the special issue of Defence Life Science Journal on DIPAS

them to work with more dedication to fulfil the commitments to the services.

Dr Reddy, in his address, lauded the achievements of the lab and stressed the need for synergistic collaboration with academia and industry with special emphasis on nurturing R&D activities to enhance the research capabilities. He suggested DIPAS to focus on space and under water physiology also. Dr Reddy released a special issue of Defence Life Science Journal dedicated to DIPAS and an in-house Hindi magazine "Spandan" and presented various lab-level awards to the meritorious employees.

DIPR, DELHI

Defence Institute of Psychological Research (DIPR), Delhi, celebrated its 70th Raising Day on 7 September 2018. Shri BP Sharma, IAS (Retd), Chairman, Recruitment and Assessment Centre (RAC), was the Chief Guest and Dr Chitra Rajagopal, DS and DG (SAM&LS), was the Guest of Honour, for the occasion. Directors from DRDO HQ, sister labs, former Directors, and scientists and staff of DIPR also graced the occasion. Dr K Ramachandran,



Shri BP Sharma, inaugurating the Raising Day function of DIPR

OS and Director, DIPR, welcomed the august gathering and highlighted the achievements of the establishment during the year 2017. He thanked one and all on the accomplishment.

Shri BP Sharma, in his address, appreciated the effort being made by DIPR. Dr Chitra Rajagopal gave suggestions and areas of work DIPR should look forward to. The Chief Guest and the Guest of Honour also distributed Laboratory Awards, Cash Awards and mementos to the employees who completed 25 years of service in

DRDO. A colorful cultural programme was organized to mark the occasion.

SASE, MANALI

Snow and Avalanche Study Establishment (SASE), Manali, celebrated its 49th Raising Day on 1 October 2018 at HQ Manali and RDC Chandigarh with great zeal and enthusiasm. Shri Naresh Kumar, Director, SASE, conferred the lab-level DRDO and Cash Awards to meritorious personnel for their excellence in the

service and presented mementos to the employees who completed 25 years of service in DRDO.

Director, SASE, highlighted the achievements made during the year and emphasized on taking up new projects to mitigate avalanche hazard in different sectors of the Himalaya. To mark the day, various sports events were organized and prizes were distributed to the winners. A cultural programme was also presented by the children, family members and employees.



Children performing a local dance at SASE's Raising Day

HINDI DIWAS CELEBRATIONS

Hindi Diwas, 14 September, is celebrated every year as Hindi, written in Devnagari, was announced the Official Language of India in the Constituent Assembly of India. The following DRDO laboratories observed 'Hindi Pakhwada' to mark the day.

ADE, BENGALURU

Hindi Pakhwada was organized at Aeronautical Development Establishment (ADE) from 31 August 2018 to 14 September 2018. Various competitions, viz., Hindi handwriting, Hindi dictation, debate, etc, were conducted during the Pakhwada.

Dr Girish S Deodhare, OS and Programme Director (Combat Aircraft), Aeronautical Development Agency

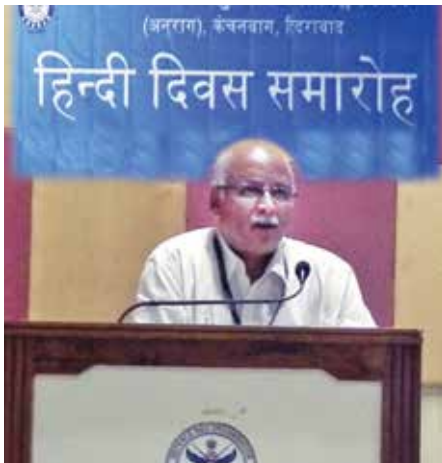


(ADA), Bengaluru, was the Chief Guest of the valedictory function and delivered an inspiring speech. Shri MVKV Prasad, DS and Director, ADE, presided over the function. On this occasion, OLIC Portal, specially designed to facilitate progressive use of Official Language in the Establishment, was released formally by the Chief Guest and Director,

ADE. 'Manthan' a special programme was presented by senior scientists and officers of the establishment wherein views on various subjects in Hindi were expressed. Prizes to the winners of competitions were distributed by the Chief Guest. The function concluded with a cultural programme by ADE cultural society.

ANURAG, HYDERABAD

Advanced Numerical Research and Analysis Group (ANURAG), celebrated Hindi Pakhwada during 1-14 September 2018. Various competitions were organised in various categories. Dr JVR Sagar, OS and Director, ANURAG, in his speech, asked all employees to use Hindi in day-to-day official work. Chief Guest Dr SB Gadgil,



OS, RCI, spoke on the effectiveness of Hindi in scientific domain and shared his vast experience of using Hindi. Winners and other participants were given prizes.

CAIR, BENGALURU

Hindi Pakhwada was organized from 31 August 2018 to 14 September 2018. Competitions were organized for Hindi speaking and non-Hindi speaking employees.

The Hindi Diwas was celebrated in a befitting manner on 14 September 2018. Smt Vijayalakshmi Bidari, IAS, Regional Director, Staff Selection Commission (KKR), was the Chief Guest of the function. Smt Manimozhi Theodore, Director, CAIR, in her address underlined the importance of official language. Chief Guest, in her address, emphasized the importance of Hindi as a link language in the country and its relevance in Central Government Offices. Smt TR Usha Kumari, Sc 'E' and Vice Chairperson, OLIC, CAIR, read out the message of Chairman, DRDO and presented Official Language implementation report. Fourteen first, 14 second, 19 third and 24 consolation awards were given to the winners by the Chief Guest and the Director.

DG (AERO), BENGALURU

Hindi Diwas and Hindi Pakhwada concluding ceremony was celebrated at the Office of the Director General (Aero), on 17 September 2018. Dr Tessy Thomas, DS and DG (Aero), presided over the function. Smt Anjali Ellis Shanker, IFA (R&D) Aero, was the

Guest of Honour. Smt Ellis Shanker, in her address, highlighted the need of a common language for communication. She mentioned that everyone should put conscious effort to improve their Hindi communication skills.

Dr Tessy Thomas, in her address, said that language plays a vital role in connecting people and building a stronger nation; Hindi is one such language, which must be promoted in office work. Shri AK Goel, Sc 'G', delivered a talk on "Flight Simulators" in Hindi. The winners of various Hindi competitions were awarded.



DRL, TEZPUR

Defence Research Laboratory (DRL), organized Hindi Pakhwada from 4 to 14 September 2018. Prof. Vinod Kumar Jain, Vice Chancellor, Tezpur University, graced the inaugural function as the Chief Guest. In his address, Prof. Jain expressed his views on Hindi language in a broader way and highlighted the relevance of quality scientific journals in Hindi. Dr Sanjai Kumar Dwivedi, Director, DRL, delivered welcome address, emphasized on working the office related activities in Hindi. Dr Rama Dubey, Deputy Director, spoke about the R&D activities



of DRDO and DRL and Shri Pranab Kumar Bordoloi, Assistant Director, OL, briefed about the Hindi activities of the lab. DRL employees actively participated in various competitions like poem recitation, essay writing, translation, debate, quiz, typing, slogan etc. The winners of the competitions were awarded with certificates and prizes.

RCI, HYDERABAD

Research Centre Imarat (RCI), organised Hindi Diwas on 10 October 2018. Shri MK Gupta, Sc 'F', Member OLIC, presented Hindi Cell activities during the last one year. Shri T Narasimha Rao, Sc 'G', Vice Chairman, OLIC, appreciated efforts of RCI Hindi Cell for conducting various Hindi Programme in time. Shri BHVS Narayana Murthy, DS & Director, RCI, in his address advised better implementation of Hindi in all Directorates of the centre. Shri Dharam Pal Peehal, Former DEAN, Faculty of Arts, OU, Hyderabad suggested implementation of Rajbhasha in a simplified manner. RCI Hindi Magazine 'Imarat 2018-19' and CD of 'RCI Hindi Song' were released to mark the occasion.



COURSE ON QUANTUM COMPUTING AND QUANTUM COMMUNICATION

Advanced Numerical Research and Analysis Group (ANURAG), Hyderabad, conducted a five-day course on “An Introduction to Quantum Computing and Quantum Communication” under Continuing Education Program (CEP) of DRDO during 27-31 August 2018.

The programme began with inaugural address by Dr JVR Sagar, OS and Director, ANURAG. Dr G Atithan, DS and DG (MED&CS), the Chief Guest, delivered the Keynote Address on “Quantum Technologies”.

Lectures on Complex Linear Algebra, Essential Quantum

Mechanics for Quantum Computing and Communications and Classical Cryptography were covered during the course. Twenty-seven participants attended the course.

Shri Amit Srivastava, Sc `F`, was the Course Director and Shri Rohit Sharma, Sc `D` was the Deputy Course Director.



COURSE ON PERFORMANCE ACCELERATION TECHNOLOGIES FOR WIDE AREA NETWORKS

A three-day CEP course on “Performance Acceleration Technologies for Wide Area Networks” was held during 5-7 September 2018 at Centre for Artificial Intelligence and Robotics (CAIR), Bengaluru. The objective of the course was to give the participants an exposure and understanding about

various technologies and concepts in the field of Performance Acceleration in Wide Area Networks (WAN). To ensure this, some of the best experts in the respective fields were roped in. The faculty consisted of scientists of CAIR, user representatives, experts from academia and industry.

The course covered various

aspects of the topic from the basics of Performance Acceleration Techniques to Military WANs in the Indian context, Traffic Profiling, SDWAN, Protocol Optimization Solutions, WAN Performance Analysis using Simulation, Industry Trends on Performance Accelerators, etc.



COURSE ON SCIENCE COMMUNICATION

Defence Scientific Information and Documentation Centre (DESIDOC), Delhi, organised a CEP on “Enhancing Science Communication through Publishing” during 17-19 September 2018. The basic aim of the programme was to train the DRDO personnel about science

publishing. Dr Rajeev Vij, Sc ‘G’, briefed the participants about the objectives and purpose of the programme. Smt Alka Bansal, Sc ‘F’, DESIDOC, highlighted the contents and schedule of the course.

Dr Alka Suri, Director, DESIDOC, inaugurated the CEP and elucidated the need for learning tools and techniques

of both print and publishing. Twenty-two participants participated in the training programme.

A quiz was organised to assess the knowledge acquired by the participants. The top three participants were awarded.



COURSE ON BIBLIOMETRICS AND RESEARCH OUTPUT ANALYSIS

DESIDOC organised a CEP course on ‘Bibliometrics and Research Output Analysis’ during 24-26 September 2018. Dr Rajeev Vij, Sc ‘G’, Course Coordinator, briefed the participants about the purpose of the course. Shri Sudhanshu Bhushan, Sc ‘E’, DESIDOC, highlighted the contents and schedule of the course.

Dr Alka Suri, Director, DESIDOC, inaugurated the course and stressed on the need of Bibliometric Indicators and Rankings of Research Performance. The course comprised lectures, demonstrations and hands-on training. Presentation on Web of Science Database was also made.



DFRL CONDUCTS TRAININGS IN TOMATO PROCESSING

Defence Food Research Laboratory (DFRL), Mysuru, conducted a one-day Tomato Processing Training Camp for rural farmers at Gundlupete, Mysuru on 22 September 2018 during Annual General body Meeting of Gundlupete Farmer

Producer Company Ltd, in collaboration with local horticulture and agriculture bodies. Value added products from tomatoes was demonstrated to the farmers group of Farmer Producer Organisation (FPO). DFRL processed food samples based on horticulture

produce were also exhibited during the demonstration.

Shri Prakash Patki, Sc 'G', and his team conducted the training camp. Around 300 progressive farmers participated in the camp.

WORKSHOP ON GENOMICS-BASED TRANSLATIONAL APPROACHES FOR HIGH ALTITUDE MALADIES

Defence Institute of Physiology and Allied Sciences (DIPAS), Delhi, organised an interactive two-day workshop on "Genomics-based Translational Approaches for High Altitude Induced Maladies: Special Reference to Thromboembolic Disorders" during 4-5 October 2018. The workshop included technical sessions comprising eight invited talks along with four demo sessions on cutting-edge technologies. It broadly included; overview to translational genomics, gene biomarkers in translational medicine, guideline for clinical trials and diagnostic kits, high throughput sequencing, advances in translational medicine, high altitude and venous Thrombosis: clinical and molecular aspects, focus areas and future

prospects with the demo sessions on various technologies.

Dr Bhuvnesh Kumar, OS and Director, DIPAS, welcomed the participants and gave an overview of the on-going R&D programmes at DIPAS and emphasised on physiological acclimatization to extremes of environment, and human adaptation for effective man-machine interface. He also highlighted the thrust areas and research going on in the field of physiology, genomics, proteomics, biochemistry and nutrition with a goal to improve the operational efficiency of our soldiers in relation to micro and macro environments.

Keynote talk was given by Dr (Col) Jyoti Kotwal, Senior Consultant, Shri Ganga Ram Hospital, Delhi. Hands on

demo sessions were also conducted on technologies like Automated Coagulation Analyzer, Next Generation Sequencing, Flow Cytometry and Pocket Sequencer.

The extensive deliberations during the workshop provided key inputs in the area of high altitude induced maladies specially Thromboembolic disorders and provided new insights for development of futuristic detection and diagnostic technologies. Over 30 participants from ITBP, R&R Hospital, FHQ BSF, scientist and technical officers from sister laboratories of DRDO and DIPAS participated in the workshop. Dr Iti Garg, Sc 'D', was the Course Director and Dr Swati Srivastava, Sc 'D', was the Course Coordinator of the workshop.





COURSE ON ADVANCED MAGNETIC MATERIALS

A CEP course on “Advanced Magnetic Materials: Processing and Characterization” was conducted by Defence Metallurgical Research Laboratory (DMRL), Hyderabad during 6-10 August 2018. The lectures on a variety of topics such as spintronics, magnetoelastic, multiferroics, magnetocaloric, giant magneto resistance along with the overview of conventional hard and soft magnetic materials were delivered by the eminent researchers from academics, research institutes, sister DRDO labs and DMRL.

Prof. SN Kaul, Emeritus Professor, University of Hyderabad, delivered the keynote address. Characterization techniques like Transmission Electron Microscopy, Lorentz Microscopy, Electron Back Scattered Diffraction Technique, Magnetic Force Microscopy,



Super Conducting Quantum Interference Device and Vibrating Sample Magnetometer were also covered in the course.

Lab visit for the participants was also

organised to highlight the processing and characterization of advanced magnetic materials in DMRL. A total of 30 DRDO scientists and officers participated in the course.

TARGETED TRAINING ON TECHNOLOGIES FOR REMAINING LIFE ASSESSMENT OF AERO ENGINE GAS TURBINES

A targeted training programme on “Technologies for Remaining Life Assessment of Aero Engine Gas Turbines” was organized at DMRL during 28-30 August 2018 to create awareness about the design, manufacturing, certification and maintenance of gas turbine aero engines. The eminent speakers from academia, R&D labs and industries delivered the lectures covering a wide spectrum of topics related to the course. Discussions were held among faculty and the participants, resulting in knowledge sharing and clarification of the theoretical and practical issues on the life assessment of gas turbine aero engines. The participants included scientists and engineers from DMRL, IAF, GTRE, CEMILAC, RCMA (E) Koraput, NAL, HAL, and IITs.



COURSE ON MISSILE STRUCTURAL DYNAMICS

A five-day CEP on “Missile Structural Dynamics” was conducted at Defence Research and Development Laboratory (DRDL), Hyderabad from 3 September 2018 to 7 September 2018 by the Directorate of Flight Structures. Scientists from various DRDO laboratories participated in the CEP.

Shri MSR Prasad, DS and Director, DRDL, inaugurated the CEP and emphasized the need and importance of the topic of the course and its contents. Dr PC Jain, Sc ‘G’ and Course Director, briefed about the topics to be covered.

Various topics on Missile Structural Dynamics, Vibration Isolation, Aero Elasticity, Weight Optimization of Dynamic Systems, Frequency and Time Domain Structural Response Computation, etc., were discussed.



DRDO-USER WORKSHOP

Defence Research Laboratory (DRL), Tezpur, conducted “DRDO Users’ Workshop” at HQ 71 Inf Div, Missamari under DRDO TD Programme, Arunodaya. Dr Rama Dubey, spoke about the importance of the Programme Arunodaya. Talks on installation and

maintenance of Iron Removal Unit and Water Quality Analysis by using DRDO’s Water Testing Kit; Green Houses and their Management and DRDO Biotoilet, respectively, were delivered by DRDO scientists.

An exhibition of DRL products was

also organised during the event. Forty-one Army officers participated in the workshop. Col R Sharma coordinated the event from the user side. DRL team also interacted with Maj Gen PGK Menon, GOC, 71 Inf Div, Missamari.





TRAINING COURSES ON MITIGATION OF CBRN EMERGENCIES

Institute of Nuclear Medicine and Allied Sciences (INMAS), Delhi, organised three five-days “Specialized Training Courses on Mitigation of CBRN Emergencies: Hands on Training Exercise” during 20-24 August 2018 for National Security Guard, Central Industrial Security Force, and Delhi Fire Services; during 10-12 September 2018 for National Investigation Agency and during 10-14 September 2018 for National

Disaster Response Force. More than 100 participants from the stakeholders attended the course. Experts in the field of CBRN area from DRDO and from non-DRDO institutions delivered lectures and demos during the course.

The objective of conducting the course was to sensitize, impart necessary knowledge and technical expertise, and to enhance preparedness of First Response Teams for any CBRN emergency scenario.

The broad areas covered during the courses included: CBRN Preparedness, CBRN Protection, Detection and Decontamination, Interactive Discussions, CBRN Technology Demonstrations, Radioactive Sources Search Exercise, ROVS/UAVs Training, Triage and Communication Protocol Exercise, Inter-Responder Coordination Exercise, Psychological Aspects: Media Management and new R&D updates in the areas on CBRN Mitigation.



COURSE ON SOFT SKILLS FOR ENHANCING INTERPERSONAL EFFECTIVENESS

Institute of Technology Management (ITM), Mussoorie, conducted a five-day course on “Soft Skills for Enhancing Interpersonal Effectiveness” from 27 August 2018 to 31 August 2018. The objective of the course was to emphasise on the various aspects

of soft-skills in professional and personal environment and strategies to fine-tune attitudes, values, beliefs, motivation, desires, feelings, eagerness to learn, willingness to share and embrace new ideas for goal orientation. Shri Sanjay Tandon, OS and Director,

ITM, inaugurated the course and deliberated upon the importance of soft skills in our routine life and in effective interpersonal relation.

Lectures on topics like An Overview and Importance of Soft Skills, Stress Management, Organization Citizenship



Behaviour, Developing Effective Leadership Skills, etc., were delivered. Besides, Dr Gurpreet Kaur, Sc 'E', the

Guest Speaker from DIPR, delivered a lecture on 'Transactional Analysis.' Trainers from DISHA, Haridwar,

conducted sessions on 'Soft Skills in Enhancing Team Synergy' and 'Work Place Issues'.



COURSE ON NEGOTIATION AND CONTRACT DRAFTING

A three-day course on 'Negotiation and Contract Drafting' was conducted by ITM, Mussoorie during 5-7 September 2018. The objective of the course was to acquaint the officers with various aspects related to drafting and finalisation of contracts along with role of negotiations which plays an important part in this activity of procurement process.

Shri Sanjay Tandon, OS and Director, ITM, inaugurated the course and highlighted the importance of materials management and various aspects of procurement procedures which play an important role in day-to-day functioning of the labs in carrying out various projects. He also stressed upon the need of drafting, finalizing a contract and negotiations involved

during finalization of contracts.

Sessions on various topics, viz., Overview of Procurements, Importance of RFP, Types of Contracts, PA and RC, Salient Aspects in Drafting a Contract, Art and Science of Negotiations including Cross Cultural Negotiations and Contract Negotiations were organised during the course.





COURSE ON DEEP LEARNING TECHNOLOGIES AND APPLICATIONS IN DEFENCE

Research Centre Imarat (RCI), Hyderabad, organised a course on “Deep Learning Technologies and Applications in Defence” during 17-21 September 2018. Shri BHVS

Narayanamurthy, DS and Director, RCI, welcomed the participants from 27 DRDO laboratories and emphasized the importance of deep learning and artificial intelligence.

Dr JV Satyanarayana, Sc ‘G’, was the Course Director. INSA Senior Scientist Prof. B Yegnanarayana gave the conclusion talk on the closing day.



TRAINING PROGRAMME ON FINANCE & MATERIAL MANAGEMENT

RCI and Directorate of Finance and Material Management (DF&MM), DRDO HQ, jointly organized a training programme on “Finance and Material Management” during 24-28 September 2018. Shri Maiya Din, Sc ‘G’, DF&MM, and Course Director briefed about the programme.

Dr G Athithan, DS and DG (MSS), inaugurated the programme and addressed the participants about the importance of the course. Shri BHVS Narayana Murthy, DS and Director, RCI, Dr AK Bhateja, OS and Director, DF&MM, also addressed the participants. The major topics covered in the course included: Introduction to Finance and Material Management, Contract Management, Procurement Manual, GST, Audit Relations, Freight



Clearance, Internal Audit, IFA System in DRDO, Store Management, GST Implementation in DRDO, GFR,

etc. Shri MA Lincoln, IDAS, PCDA (R&D), Hyderabad, presided over the valedictory function.

TRAINING PROGRAMME ON CIS

A special training programme on Cryptology and Information Security (CIS) was conducted by Scientific Analysis Group (SAG), Delhi, from 30 July 2018 to 10 August 2018. The course aimed at refreshing the knowledge of the participants in the field of cryptology and to make them aware about the various information security issues and cryptographic solutions to protect vital information and network infrastructure.

Ms Pratibha Yadav, Sc 'G', in her inaugural address deliberated upon the importance of information security. Ms Anu Khosla, OS and Director, SAG, interacted with participants during the session and emphasized on the need of updating the knowledge for IT professionals. Dr Gurjit Singh Walia, Sc 'E', Course Director, summarized the content of the two week course.

The topics covered during the course included: Block/Stream Cipher, Quantum Cryptography,



PKI and Digital Signatures, Mobile Security, and Block Chain. In addition, application of advanced topics in the field of information security such as machine learning, artificial intelligence, soft computing, high performance computing were covered during the course. Practical demonstrations of in-

house information security tools were arranged.

Ms Neelam Verma, Sc 'G', in her valedictory address highlighted various challenges in the field of cryptology. Forty-four participants from various DRDO labs, Army, Navy and Air Force attended the course.

PERSONNEL NEWS

APPOINTMENT

VC, DIAT

Dr CP Ramanarayanan, former Distinguish Scientist and DG, Aeronautical Systems, DRDO, has assumed the charge of Vice Chancellor of Defence Institute of Advanced Technology (DIAT), Deemed to be University, Pune, wef 12 September 2018.

Dr Ramanarayanan graduated in Mechanical Engineering from Regional Engineering College, Calicut, and did his Masters from Indian Institute of Science, Bangalore. He completed his doctoral programme from Department of Energy Systems, Jawaharlal Nehru Technological University (JNTU),



Hyderabad, in the domain of two-phase flows.

He has an illustrious career profile of more than 36 years in Defence Research and Development and Technology Management. He has actively contributed to underwater propulsion systems, land propulsion systems and fighter aircraft propulsion systems

during the span of his service. Prior to that he had enviable assignments like Chief Controller (Research and Development) in HR; Director, Gas Turbine Research Establishment, Bengaluru; Director, Vehicle Research and Development Establishment, Ahmednagar; and Project Director for heavy-weight and lightweight torpedo propulsion projects.

He is the recipient of the DRDO Scientist of the Year Award (2005) from the then Hon'ble Prime Minister, Dr Manmohan Singh and the Technology Leadership Award (2015) from the then Hon'ble Defence Minister of India. Besides, he has also received many other awards and citations from various professional societies and academic institutions.



Dr Ramanarayanan had served on the Board of Director and India's nominee in International Society for Air Breathing Engines. He was also President/Chairman of the Society of Aerospace Quality and Reliability and the Aeronautical Society of India, Bengaluru.

He is a Fellow of the Indian National Academy of Engineers, Fellow of Aeronautical Society of India and the Fellow of Institution of Engineers. He has to his credit many papers published in reputed journals and has guided two doctoral students and many postgraduate students.

AWARDS

NBE GOLD MEDAL

Dr Reena Wilfred, Sc 'E', Institute of Nuclear Medicine and Allied Sciences (INMAS), Delhi, was awarded President National Board of Examination (NBE)



Gold Medal for securing highest marks in the field of Epidemiology at a function held in Vigyan Bhawan on 21 September 2018.

FAKHRUDDIN ALI AHMED AWARD



Dr Narendra Singh, Sc 'F', and his team comprising Dr Dorje Angchok, Shri Sarfaraj, and Ms Suman Tiga of Defence Institute of High Altitude Research (DIHAR), Leh, received Fakhruddin Ali Ahmed Award 2017 for their outstanding research and contribution for diversification in farming system in Ladakh for livelihood of tribal farmers as well as ensuring food security of armed forces deployed

in the region. Hon'ble Union Minister of Agriculture and Farmers' Welfare Shri Radha Mohan Singh, distributed the awards during the award ceremony function organized by Indian Council of Agricultural Research (ICAR) at NASC Complex, New Delhi.

ENGINEER OF THE YEAR AWARD



Dr J John Rozario Jegaraj, Sc 'F', Defence Research and Development Laboratory (DRDL), Hyderabad, has been awarded Engineer of the Year Award 2018 in recognition of his outstanding contributions towards research and development of missile systems. The Institution of Engineers (India), Telangana State Centre, Hyderabad, presented the award on the occasion of 51st Engineers' Day.

SOCIAL ACTIVITY

DRDO ORGANISED SWACHHTA HI SEVA CAMPAIGN

Dr G Sathesh Reddy, Secretary DDR&D and Chairman DRDO launched Swachhata hi Seva campaign at CV Raman Nagar, Bengaluru on 15 September 2018. DRDO, driving itself with cleanliness campaign initiated by Hon'ble Prime Minister Shri Narendra Modi, conducted cleanness drive with more than 200 volunteers enthusiastically participated in cleaning Kaggadasapura Main Road, CV Raman Nagar, Bus stand and surrounding areas. The campaign provided impetus towards a cleaner environment and an initiation to fulfil Mahatma Gandhi's dream of a clean and hygienic India.

The main aim of the campaign was to sensitise the society to keep their surroundings space and living area clean thereby ensuring the overall health and



Swachhata hi Seva campaign at CV Raman Nagar



cleanliness of the country. The various activities such as cleaning of streets, drains and back yards, waste collection from households and common areas, awareness campaign, wall paintings, etc., were carried out.

Ms J Manjula, DG (ECS), Dr Tessy Thomas, DG (Aero), Dr G Athithan, DG (MED & COS), Dr S Guruprasad, DG (PC & SI), Mr Sudhir Malik, Addl Financial Advisor, MoD, Directors of Bengaluru-based labs, Estate Manager, Officers, Scientists and employees took part in the event.

Swachhta hi Seva campaign was also conducted at High Energy Materials Research Laboratory (HEMRL), Pune, from 17 September to 2 October 2018. Proactive messages and articles to create awareness about cleanness and to motivate employees were published on HEMNET. Invited lectures emphasising the importance of waste management was conducted wherein various innovative ideas yet simple techniques,



Swachhta hi Seva campaign at HEMRL

which can be easily adopted were explained and demonstrated. Reduce, reuse and recycle techniques, which can be implemented at homes were deliberated upon. Waste Management on how day-to-day kitchen waste can be converted to manure, which can be used

for arboriculture and vegetable gardens, was demonstrated.

Cleanliness drive through shramdaan was carried out at HEMRL on 1 October 2018. All employees of HEMRL took active part in the drive.

SPORTS ROUNDUP

DRDO SOUTH ZONE KABADDI TOURNAMENT

Naval Physical Oceanographic Laboratory (NPOL), Kochi, organised DRDO South Zone Kabaddi Tournament during 26-28 September 2018. Fifty-seven players representing four laboratories, viz., Combat Vehicles Research and Development Establishment (CVRDE), Electronics and Radar Development Establishment (LRDE), Aeronautical Development Establishment (ADE) and NPOL participated in the event.

Shri S Kedarnath Shenoy, OS and Director, NPOL, presented trophies, medals and certificates to the champion ADE and runner-up NPOL.





MAN PORTABLE ANTI-TANK GUIDED MISSILE

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

The Special Forces and Infantry Battalions of Army while operating in an environment characterized by a high density of mechanized threats need an effective antitank guided missile (ATGM) platform to counter the prevailing threat. To cater for the above need, Indian Army specified the qualitative requirements to design, develop and demonstrate the third generation Man Portable Anti-Tank Guided Missile (MPATGM).

Project MPATGM was sanctioned to DRDO on 27 January 2015 with the scope work that included design and development of a third generation ATGM with a Launch Tube (LT) and Launcher and a Command Launch Unit (CLU), and demonstration of the system performance through ground testing and flight testing. DRDO entrusted the developmental work to Defence Research and Development Laboratory (DRDL)—one of its Hyderabad-based laboratories—as the nodal agency with the support of sister DRDO laboratories; RCI, HEMRL, TBRL, ARDE and IRDE.

MPATGM WEAPON SYSTEM

MPATGM Weapon System consists of three major separate elements: (i) Missile in a LT called the weapon round, (ii) the CLU including Thermal Sight (TS), Gunner Display, Command Control Unit and Battery and (iii) the Launcher or Tripod. Launcher System was specified to be light and user-friendly with following functionalities: System power and health checks; missile seeker cooling; provision to display TAS and missile seeker images;



MPATGM Weapon System

display controls; target acquisition through thermal/day sight; and thermal battery and launch motor firing.

A preliminary design of the MPATGM was carried out to arrive at an aerodynamic configuration along with different sub-systems specifications and salient features. The guidance and control system designing was carried out to meet the mission performance and robustness. The design was reviewed by an expert committee chaired by Shri SK Roy, former Director RCI, and cleared for flight implementation.

TECHNOLOGICAL CHALLENGES

Some of the critical technologies realized during the project are:

IIR Seeker

The third-generation ATGM having fire and forget capability works on the homing signal provided by a miniature Image Infrared Seeker (IIR) housed in its front end for guidance. Configuring the optical module to focus the image on

the detector and realization of the signal processing electronics to achieve the 2.5 km range with the available space within a missile of 120 mm diameter was really a challenging task.

Propulsion System

The propulsion system for the missile necessitated the design of a complex system with a launch motor for 'soft launch' of the missile from the launch tube followed by firing of the main motor in flight at a safe distance of around 10 meters from the launcher to provide safety to the operator. To arrest the large roll rates experienced by the missile while coming out of the launch tube, a jet vane mechanism has been configured in the nozzle end of the blast tube to exercise the thrust vector control in the launch phase.

Main motor of this miniaturized missile comprises a dual thrust rocket motor with a boost phase and a sustainer phase to achieve top attack capability against a maximum range trajectory of 2.5 km.

Control Actuation System

The jet vane mechanism was driven by the precision servo control actuation system, which drives the tail fins of the missile for exercising aerodynamic control through the rest of the trajectory. This demanded the design of a precision servo mechanism consisting of miniature electromechanical actuators and the digital servo controllers to house the space around the blast tube to drive each fins. Fins in turn drive the jet vanes through a linkage mechanism having 1:1 transmission ratio with sufficient linear operating range.

Tandem Warhead

In the available small volume inside a missile of man portable class, to design a tandem warhead with a precursor warhead and a main warhead with a RHA penetration > 650 mm was also one of the challenging tasks.

DEVELOPMENT PARTNERS

Missile system studies, control and guidance design and the aerodynamic and structural design and testing, etc., for the MPATGM were carried out in DRDL. The design of blast tube-based dual thrust propulsion system with jet vane mechanism for thrust vectoring was also carried out in DRDL. The propellant for Launch Motor and Flight Motor was carried out by HEMRL.

Design and development of most of the electronic sub-systems such as IIR Seeker and associated Integral Electronics (INEL), electromechanical actuation system and onboard signal conditioning package and telemetry transmitter, etc., was undertaken by RCI.

The missile being developed by DRDO will be comparable to the best ATGM systems in the world.

The Target Acquisition System (TAS) based on thermal sighting principle is part of the launcher and is being developed by IRDE. Preliminary design review of TAS has already been completed and a prototype unit is ready. The mechanical parts of the tripod launcher are being designed at DRDL. Its preliminary design is complete and fabrication is under progress. Tandem Warhead of the missile is being developed at TBRL and is in final stages of realisation and testing. Bharat Dynamics Ltd (BDL) is the industrial development partner.

PERFORMANCE EVALUATION

The missile has undergone the following stringent laboratory- and ground-level tests during realization of the various sub-systems prior to flight testing: Control and guidance design testing in wind tunnel; aerodynamic data and performance were evaluated by six DOF simulation study; propulsion system performance was evaluated in number of static tests conducted at 100 t test bed at DRDL; five POP out tests were carried out at DRDL to evaluate

launch phase dynamics and safety where in propulsion system consistent performance is achieved; integrated mode testing of the propulsion system along with jet vane mechanism and control actuation system at 100 t test bed at DRDL and Hardware-in-Loop testing and evaluation of control algorithm incorporating sensor package, control actuation system and integrated electronics hardware at RCI.

The missile being developed by DRDO will be comparable to the best ATGM systems in the world, viz., Javelin by US and Spike-MR by Israel.

MILESTONES

Two pre-programmed control missions have been executed to prove vehicle controllability as well as manoeuvrability with realistic guidance command. The missile was successfully tested at KK Ranges, Ahmednagar for maximum range trajectory in top attack mode on 15 September 2018 and for minimum range trajectory in top attack mode on 16 September 2018. The successful missions proved the controllability of the missile aero-configuration along with major sub-systems, viz., propulsion, control system and onboard integrated electronics hardware.

WAY AHEAD

All the DRDO workcentres are geared up for realization of further units for forthcoming guidance mission with IIR Seekers. Guidance missions with IIR Seekers have been planned for November 2018 to prove the final configuration with seeker hardware. The missiles in final configuration could be offered for user assisted flight trials in the first quarter of 2019.

VISITORS TO DRDO LABS/ESTTS

ARDE, PUNE

Dr G Satheesh Reddy, Secretary, Department of Defence R&D and Chairman DRDO, visited Armament Research and Development Establishment (ARDE), on 8 September 2018 to review ongoing projects at ARDE. He was accompanied by Dr S Guruprasad, OS and DG (PC&SI), and Smt Nabanita R Krishnan, OS and Director (P&C). Shri PK Mehta, DG (ACE), welcomed Dr Reddy and the other officials. Dr KM Rajan, DS and Director, ARDE, and Shri VV Parlikar, OS and Director, R&DE (E) were also present. Chairman DRDO held in-depth discussions and asked the Directors to prepare short- and long-term project plans. Dr Reddy also had an open discussion with young scientists from the ACE cluster.

DIBER, HALDWANI

A group of 25 students of BSc (Biofuel) of Uttarakhand Residential University, Almora, visited Defence Institute of Bio-Energy Research (DIBER) along with their teachers for exposure to Biofuel and Bio-energy technologies. Students were briefed about the activities of DIBER, and were given a guided tour to relevant laboratories and field.

HEMRL, PUNE

Major General AK Channan, SM, ADG PP 'B' visited HEMRL on 5 October 2018. During the visit, Shri KPS Murthy, OS and Director HEMRL presented overview and apprised him on the activities of HEMRL. Presentations on the projects related to ERA, High Explosives, Gun Propellants/ Ammunitions and Solid Rocket Propellant were given by the senior scientists. General Channan took keen interest in the activities of HEMRL.



Dr Reddy being felicitated by Director ARDE



Students being explained *Jatropha* germ plasm collection at DIBER



Major General AK Channan being briefed about HEMRL activities by Director HEMRL



DRDO HARNESSING SCIENCE FOR PEACE & SECURITY

CHAPTER 3: OVER TO SYSTEMS DEVELOPMENT (1970–1982)

The article is 32nd 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).

DEPARTMENT OF DEFENCE RESEARCH & DEVELOPMENT

Even though the Scientific Adviser enjoyed the status of the Secretary to the Government of India, DRDO was put under the Department of Defence Production from the days of Dr Nag Chaudhuri. Dr Raja Ramanna took the step of creating the Department of Defence Research & Development so that the important papers requiring approval/concurrence from the Cabinet, the Prime Minister, Raksha Mantri or Raksha Utpadan Mantri or other Ministers could be sent straight to the destination. In all cases of development of major weapon systems, direct communication with the political head of the Government would be necessary because it involved strategic decision-making. If such important papers were to be routed through channels who had no immediate interest in the matter and who were not aware of the strategic nature of the issues, they would in all probability introduce delays with queries of short-term nature which would clutter the picture and more often than not stifle the creative process. The creation of a separate department helped in reducing the paper work on important issues and the corresponding delays for DRDO. The enormous prestige Dr Ramanna enjoyed with the political establishment of the Country as the prime architect of the peaceful nuclear explosion stilled any action to stall the creation of a separate department for research and development. The main areas of responsibility for the department were rendering advice to the Defence Minister and the three Services on all scientific aspects of military operations, equipment and logistics, formulation of research and development plans, administration of DRDS Rules, framing of personnel

policies and providing the backup for the Defence Research & Development Council.

STREAMLINING THE OPERATIONS WITHIN

Dr Ramanna demanded and got from Headquarters the type of service that he needed, namely data about the projects undertaken, their discipline wise distribution, the financial resources required for the projects in each discipline, the distribution of minor, R&D and staff projects, the number of projects and the financial liability for each Service and so on, for streamlining the operations inside the Organisation and to decide on further action.

The analysis revealed that the laboratories of DRDO in major disciplines had reached a stage where the Organisation was confident of taking on development of major systems for the Services. He found that the cost of Navy's projects was a distant third to the other two Services as Navy did not have any major weapon system or sensor system projects at the laboratories dedicated exclusively to meet their needs. He decided to increase the budget for NSTL so that the laboratory could accelerate the process of building infrastructure and test facilities for development of naval weapon systems. He supported the Director NPOL in improving the laboratory facilities for signal processing activities which were essential for developing modern sonar systems. In addition, when Dr VK Aatre, an electronics engineer with specialisation in signal processing expressed a desire to return to India after a long stay abroad, the Scientific Adviser encouraged him by offering him a senior scientist's position at NPOL.

He then turned his attention to laboratories in the Armament, and Materials & General Stores groups. These had the largest number of smaller

projects. He conferred with by Mr NS Venkatesan, Director, ARDE, and his senior scientists after which ARDE agreed to change from the reactive mode of response to a more pro-active mode so that ARDE in future would have a small number of larger projects. The laboratory would also take up technology development so as to be ahead of the User's needs in armament and guns. In the Materials Group, he found that DMRL was already very active and interacting with other laboratories in respect of their needs and had very good interaction with the production agencies. With the other laboratories in the Materials Group, he urged them to drop smaller projects, which could be handled by institutions other than DRDO and try to focus on bigger issues.

In the case of the Aeronautics Group, he got ADE to switch over to work on a major programme of developing Pilotless Target Aircraft (PTA) for meeting the Services requirements. He found that the inter-laboratory collaboration between CVRDE, the nodal laboratory for development of tank and IRDE the specialist laboratory for weapon sights, required to be improved. Therefore, he got the activity of development of sights taken up by CVRDE to be transferred to IRDE which had the expertise and knowledge for such development. Director, CVRDE was asked to focus on the in-house development effort for the engine, transmission heat transfer and suspension systems besides improving the coordination.

He was not happy with the missile development activities at DRDL because he found that the emphasis was towards the building of infrastructure without a clear cut technology development and missile system programmes. As a result of the serious differences of opinion, the incumbent Director DRDL parted



company with DRDO in March 1980.

Even though a senior scientist within the Organisation was made head of the laboratory, Dr Ramanna was on the lookout for a scientist who had a good track record and who was dedicated and committed to his work and profession. He found his man in Dr APJ Abdul Kalam who was at the Department of Space and persuaded him to take up the challenge of building the missiles for the country.

Way back in 1973, three laboratories set-up under DRDO, namely INMAS, DIPAS and DIPR had been transferred out of the Organisation to Director General Armed Forces Medical Services since they needed very close interaction with the Armed Forces and the activities were in science and technology areas related to medical sciences. However, since the emphasis in the DGAFMS organisation is towards operational issues and short-term solutions, the culture of R&D would not be robust and the research aspect would have taken a second place. Further, since the promotion in DGAFMS organisation is vacancy limited, and DRDO was opting for flexible complementing, there would have been difficulties in retaining scientists promoted by DRDS in the DGAFMS organisation. Hence on two counts the transfer of INMAS, DIPAS and DIPR back to DRDO was accepted by Dr Ramanna in 1980.

LIGHT COMBAT AIRCRAFT

The aircraft industry in India were devoid of any major aircraft development programme. The Indian Air Force, a major customer in India for aircraft industry, was buying aircraft from Russia and West European countries to meet their requirements. However, when the Indian Air Force indicated that they would need replacements in 1990s for the ageing fighter fleet, Dr Raja Ramanna in his capacity as the Scientific Adviser, 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 (LCA) 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 inputs from abroad would be necessary. 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 concept as envisaged by the committee of the future fighter aircraft and the new advancements likely to find a place in the proposed solution to the Air Force's needs were enumerated. He also mentioned that any estimate of time and resources would only be in exact as the country had no expertise in the new technologies that would find place in future aircraft. The note concluded with a draft paper for approval of the Cabinet Committee for Political Affairs (CCPA) of the proposed plan of action. The seeds of the LCA programme, which would be taken up a few years later were sown.

FOSTERING INTER-LAB INTERACTION

Dr Ramanna was surprised at the low inter-laboratory collaboration among the DRDO laboratories. His own experience of the peaceful nuclear explosion had brought home to him the interdisciplinary nature of modern weapon systems. Therefore, he set about in improving the collaboration among the laboratories in a three-pronged manner. First, he setup Advisory Committees for each group of laboratories with Chief Controllers in the chair to bring interdisciplinary perspective on the activities of each laboratory. Second, he discouraged nodal systems laboratories, such as CVRDE, DRDL, and others from setting up specialist groups and facilities in areas for which expertise already exists within DRDO. It is in this context that on the MBT-80 project, he transferred the weapon sighting development activities undertaken by CVRDE to IRDE. Third, he fostered the concept of laboratory complexes in Bangalore, Delhi, Hyderabad and Pune so that optimum use of the facilities and sharing of expertise would be possible among the laboratories. Therefore, when he took over as the Scientific Adviser, he stopped the permanent building project of LRDE at High Grounds in Bangalore. Instead, he wanted the permanent location of the laboratory to be shifted to the area where the other two laboratories, namely ADE and

GTRE were situated (presently called CV Raman Nagar). With this in view, he obtained additional land from the Karnataka Government adjacent to GTRE and permitted LRDE to have its laboratories situated on that site. On the land contiguous to LRDE, he allowed the present residential complex for all DRDO institutions of Bangalore to be constructed.

IMPACT ON THE ORGANISATION

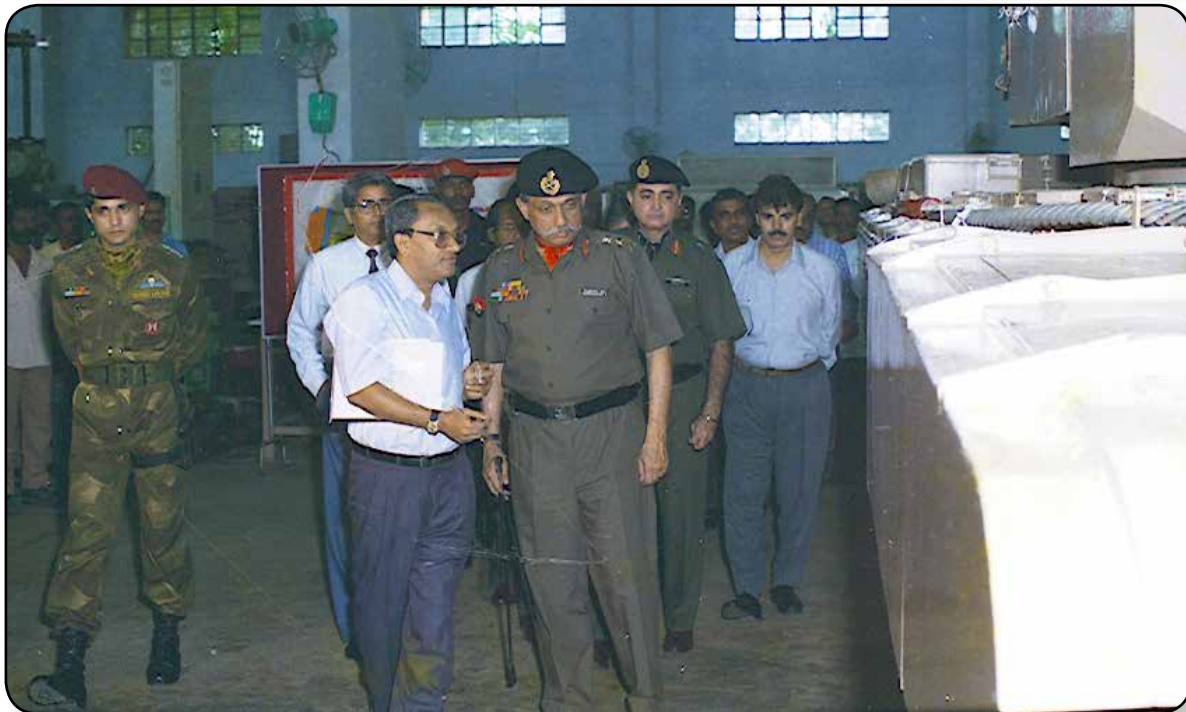
Dr Raja Ramanna brought home to us three important aspects of leadership. First, use analysis or analytical power of the intellect as a tool for timely and decisive action. Second, it is important to keep channels of communication open with the decision makers at user end and with those in the political establishment. Third, team building across the Organisation is necessary and nodal laboratories in major systems development must reach across to other laboratories in the organisation. When it was known that he would be shortly moving out of DRDO because of his being appointed as Chairman of Atomic Energy Commission, Dr Raja Ramanna persuaded the Government not to look outside the Organisation for his successor. He considered that there was more than one senior scientist within the DRDO who could head the Organisation.

SUMMING UP

In these twelve years, DRDO was transformed into a more challenging workplace. The predominant activity of catering to the short-term requirements of the Services was replaced by technical activities, leading to contemporary systems development. Thrust areas were clearly identified and prioritisation of the resources was accordingly carried out. A programme for the development of next generation tank weapon system was initiated. The personnel policy was also changed to conform to the "flexible complementing" policy adopted by other S&T departments. Steps were taken to promote inter-laboratory interaction and cooperation for better utilisation of resources. Dr VS Arunachalam became the first DRDO scientist to head the DRDO and also to assume the office of the Scientific Adviser. In the next decade, under his leadership, the Organisation would expand and excel.

To be continued...

DOWN THE MEMORY LANE



The then Raksha Mantri Shri George Fernandes (top) and then COAS General Shankar Roy Chowdhury at Combat Vehicles Research and Development Establishment (CVRDE), Chennai.