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DRDO SUCCESSFULLY TEST-FIRES NUCLEAR CAPABLE SURFACE-TO-SURFACE BALLISTIC MISSILE AGNI-V

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DRDO NEWSLETTER WISHES ITS READERS A VERY HAPPY AND PROSPEROUS NEW YEAR 2019

39th Year of Publication

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NUCLEAR CAPABLE AGNI-V TESTED SUCCESSFULLY

Agni-V, the long-range surface-to-surface nuclear capable ballistic missile, was successfully launched from a canister from a road mobile launcher at the Dr Abdul Kalam Island off the coast of Odisha on 10 December 2018.

The launch operations were carried out and monitored by the Strategic Forces Command (SFC) in presence of scientists from DRDO and other associated officials.

Seventeen metres tall, two metres wide Agni-V is a three stage missile capable of carrying 1.5 tonne of nuclear warheads. Unlike other missiles of the series, Agni-V is the most-advanced in terms of navigation and guidance, warhead and engine.

All the mission objectives were successfully achieved. This launch comes after a series of successful launches of the missile. The missile also has advantages of higher reliability, longer shelf life, less maintenance and enhanced mobility, and would further strengthen the country's deterrence capability developed indigenously by assiduous efforts of DRDO scientists.

DFRL INKED FIVE LATOT WITH INDUSTRY

Defence Food Research Laboratory (DFRL), Mysuru, signed Licensing Agreement for Transfer of Technology (LAToT) for transfer of food technologies with four Micro Small and Medium Enterprises (MSME) and Small and Medium Enterprises (SME) on 16 November 2018. Dr AK Singh, OS and Director General (Life Sciences), handed over the LAToT documents to the representatives of the industries. Dr Anil Dutt Semwal, Director, Defence Food Research Laboratory, Mysuru, was present on the occasion.

In his address Dr AK Singh requested industry partners to make use of DFRL technological know how to provide nutritional security in the country.

The technologies transferred included: Instant Dal Curry by Freeze Thaw Dehydration to Nidhi Food Products, Puttur; Puff and Service Chapaties to Little Chef Cafe, Pune; Edible Cutlery to MRIST Lab Pvt Ltd, Mysuru and Edulis Cutlery Pvt Ltd, Bengaluru.

CAIR HANDS OVER SDPS SOLUTIONS TO CABINET SECRETARIAT

The Secure Desktop Processing System (SDPS) solutions provide immutable and integrity preserving secure editing platform for creating, reading, editing and sharing of sensitive data. Center for Artificial Intelligence and Robotics (CAIR), a Bengaluru-based DRDO laboratory, handed over SDPS solutions to the Cabinet Secretariat for their standalone document processing and for network access including Internet.

The solutions have been architectured and developed by the CAIR team, while the product definition and refinement was done in association with the users in multiple iterations.

The handing over marked the formal release of the product by DRDO to the Cabinet Secretariat.

RAKSHA MANTRI LAUNCHES MISSION RAKSHA GYAN SHAKTI

Raksha Mantri Smt Nirmala Sitharaman formally launched 'Mission Raksha Gyan Shakti', on 27 November 2018. The event showcased salient inventions and innovations achieved by DRDO, Defence Public Sector Undertakings (DPSUs) and Ordnance Factories (OFs), which have resulted in successful filing of Intellectual Property Right (IPR) applications. Smt Sitharaman also felicitated some of the scientists, who invented and innovated useful products for the nation. A panel discussion was held with participation of Chairman and Managing Directors of all DPSUs to formulate a strategy for the future in this regard.

While addressing the audience, Raksha Mantri lauded the efforts of Department of Defence Production and Directorate General Quality Assurance (DGQA) for focused efforts in spreading awareness about IPR, thus promoting a culture of innovation and creation of Intellectual Property. Smt Sitharaman highlighted that while India has always been a knowledge hub since ancient times, however, due to lack of awareness on modern legal framework for protection of IP rights, our knowledge and creativity have often not been utilised to its full potential.

Delivering the keynote address, Secretary Defence Production Dr Ajay Kumar highlighted the need to migrate from the culture of seeking Transfer of Technology (ToT) from foreign sources to generating Intellectual Property in India, to achieve the goal of self-reliance in Defence sector.

The IPR has emerged as a key ingredient of an ecosystem which stimulates innovation and ingenuity. The IP Facilitation Cell in the Department of Defence Production has worked tirelessly to achieve ambitious targets of training 10,000 personnel of OFB and DPSUs on IPR and to facilitate filing of at least 1,000 new IPR applications.

As part of the ongoing initiatives to enhance self-reliance in defence, the Department of Defence Production has instituted a new framework titled 'Mission Raksha Gyan Shakti', which aims to provide a boost to the IPR culture in indigenous defence industry. The Directorate General of Quality Assurance (DGQA) has been entrusted with the responsibility of coordinating and implementing the programme. The event brought out that the end objective of 'Mission Raksha Gyan Shakti' is to inculcate IP culture in Indian defence manufacturing ecosystem.

The event was attended by Secretary, Department of Defence R&D and Chairman DRDO Dr G Satheesh Reddy, senior officers of the three Services, Chairman Ordnance Factories Board and Managing Directors of all DPSUs, amongst a large number of other dignitaries.

MARITIME DOMAIN AWARENESS SYSTEM

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

India's 7,500 km long coastline covers approximately 1200 islands, nine coastal states and four Union territories with an EEZ, which extends up to 200 nm, translates into an area roughly equal to India's continental landmass. With India's economic resurgence, maritime trade and the exploration/exploitation of its marine assets are emerging as the key drivers of India's growth necessitating effective surveillance and monitoring of the coast and blue waters to keep the nation secure and economically strong.

Directorate of Net Centric Operations (DNCO), Indian Navy, envisioned a National Maritime Domain Awareness (MDA) System for collaboration and exchange of information among the security forces and the myriad agencies associated with the maritime domain to achieve greater transparency in marine environment, to eradicate anomalies and irregularities that occur in the domain. The national MDA process operates on the principles of net-centricity integrating all domestic, public and private maritime stake-holders as well as international efforts and stimulates the process of collective response.

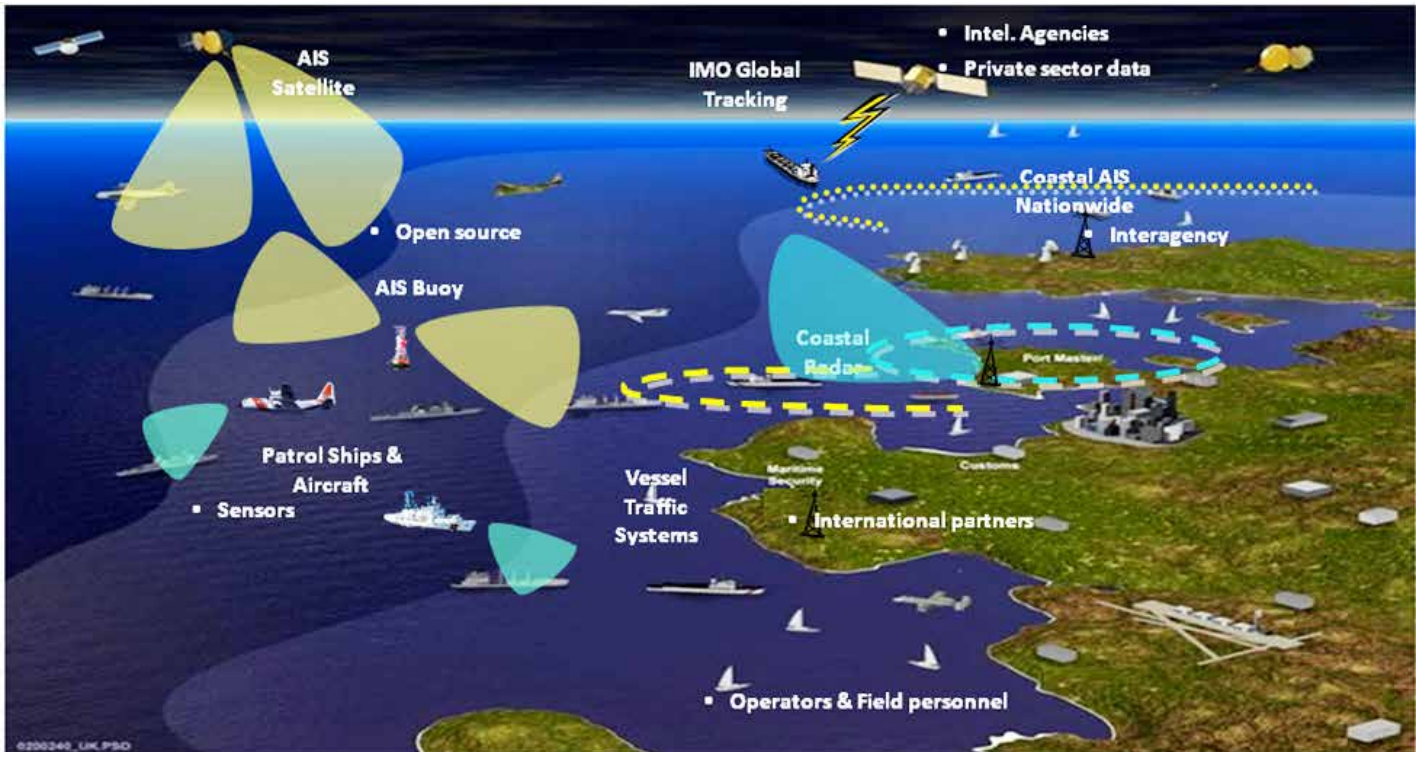
DRDO and Indian Navy are working jointly for the development of MDA in phased manner. The MDA system comprises an automated and integrated information system for naval field forces as the central hub of the Navy's Network Centric Operations (NCO). The objective of the MDA is to provide comprehensive situational picture by collecting, collating and disseminating surveillance and intelligence inputs from various sensors and external systems.

WORK CONTENT

The system integrates all the external systems and sensors available such as GPS, COTS Radars, AIS, ESM, Color Tactical Display (CTD), ELTA, MSIS, BIUS, UAV at establishments on the shore, and onboard sensors of mobile platforms like ships, submarine and aircraft, and other information systems deployed/available with Indian Navy into one common grid. Each and every unit is available online at all the times.

The combined picture created collectively by the geographically dispersed sensors provides the navy with an enhanced awareness of the maritime picture. This picture is further enhanced by integrating the inputs from sensors of other agencies associated with the maritime security.

The Common Operational Picture



Data Collection from Onboard Sensors and External Systems

L-R: Common Operational Picture of Indian Coastline; Ships are colour coded based on the country they are registered with; Detail information of merchant vessel

(COP) displays position of Indian Navy war ships and is used for monitoring of merchant ships (Indian as well as foreign origin), foreign war ships, aircraft and sub-surface tracks with detailed information regarding voyage data. It facilitates the end user to assess the battlefield situation with better appreciation of the operational scenario and enables the commanders for informed decision making. It also provides tools and utilities to facilitate data analysis, tactical operations and naval exercises. System has DSS tools to detect anomalies and irregularities based on the user defined validation criteria and to highlight the same to the user with effective and timely action. The solution provided also caters for communication security and information security in locations where MDA nodes are deployed.

SALIENT FEATURES

- Near real-time Common Operational Picture for the shore units of Indian Navy and mobile platforms spread across the globe.
- High performance algorithms for track transmission, fusion, clustering and compression to handle high volume of tracks.
- Near real-time dissemination of analysed information.
- Custom geographical information system suitable for surveillance, tracking of targets and planning of tactical operations.
- System is developed based on the solution, which ensures rugged, reconfigurable, scalable and maintainable architecture.
- Transmission of classified data in encrypted form for wireless communication using Secure Data Adapter (SDA), which works at application layer to ensure the data confidentiality.
- Transmission of classified data in encrypted form for wired communication using IP layer encryption system, i.e., ISG, which caters for integrity and confidentiality of data at the network layer.
- Developed using in-house or open source components and libraries.

ACHIEVEMENTS VIS–A–VIS INTERNATIONAL COMPARISON

Key features of the system are:

- Comprehensive Common Operational Pictures.
- Data analysis tools like traffic analysis and replay.
- Planning tools for tactical operations like searches, patrols, air plans and anti- submarine warfare.
- Utilities like messaging, track filter, route, intelligence reports, virtual tracks and wind envelope.
- Interfaces with all onboard sensors and external systems of various maritime stakeholders leading to multi sensor correlation.
- Minimum human intervention and self-sufficiency to raise the alarm if any variance is detected from the user defined rules.
- Detailed Geographical Information System (GIS) with S-57 chars.
- Secured communication on wired and wireless channels.
- Data segregation for exercises.

The MDA constitutes the core of the NCO Prototype as envisaged by Indian Navy for its National MDA programme. It enables the various maritime stakeholders a single platform for effective surveillance and monitoring of the coast which is an imperative factor to keep the nation secure and economically strong. These maritime stakeholders include Domestic stake-holders in India, viz., the Ministries of Defence, Home Affairs, External Affairs, Shipping, Agriculture, Petroleum and Natural Gas; and agencies that include the Indian Navy, the Indian Coast Guard, Marine Police, Customs, Intelligence agencies, Fisheries, Port Authorities, DG Shipping, DGLL, DGCA, ISRO, etc.

However the system can be customized for export to meet the user requirement of specific nation having similar operational requirements of monitoring their maritime domain and achieving maritime surveillance.

TIMELINE/MAJOR MILESTONES

The system is deployed at 50+ shore nodes and 200+ mobile units of Indian Navy. It is being used for day-to-day operational activities of the navy, and to conduct navy's tactical and operational exercises since 2012.

CURRENT STATUS

CAIR is working on the development of Indian Maritime Situational Awareness System under Phase 2 of the MDA programme. The system aims at generating a combined synthetic operational picture with feeds from various sensors and external systems with higher data rates and better performance. The system will reduce continuous human monitoring. It will also make use of data compression algorithms to optimally use the various RF data channels. It will employ various correlation and clustering algorithms for intuitive data visualization.

WAY FORWARD

In Phase 3 CAIR would provide various DSS tools to achieve Net Centric Operations along with Integrated Coastal Surveillance. AI-based DSS tools will be able to detect any anomalies and irregularities that occur in the domain and would highlight the same to the user for timely action. System will also explore image analysis techniques to analyse the feed received from various sensors and intelligence agencies to verify the same against the information available in the database. It will also ensure minimum human intervention and will be self-sufficient to raise the alarm if any variance is detected from the regular patterns. The precision for the alarms raised will be improved using the information extracted by investigating the behaviour over both space and time for individual objects.

PARTNERS IN DEVELOPMENT

Development Partner :	M/s Tech Mahindra
IV&V Partner:	Standardization Testing & Quality Certification Bharat Electronics Ltd, Bengaluru
Production Partner:	Bharat Electronics Ltd, Panchkula

EVENTS

CVRDE OBSERVES WORLD QUALITY DAY

World Quality Day is celebrated every year around the world in the month of November to increase worldwide awareness of the important contribution that quality makes towards both organisational and national growth and prosperity. Combat Vehicles Research and Development Establishment (CVRDE), Chennai, observed World Quality Day 2018 on 28 November 2018 as per the suggestion of DQRS, DRDO HQ.

Reliability and Quality Assurance Division of CVRDE organised a Lecture on "Quality as a Way of Life" to promote awareness among scientific community. The lecture was delivered by Shri R Vasu, Vice President and Head Corporate Quality, Health, Safety & Environmental Systems, Brakes India Ltd., Chennai. In his lecture, he emphasised about the implementation of Six Sigma to solve design/manufacturing problems in R&D establishments. He also presented a case study in implementing Define, Measure, Analyse, Improve and Control (DMAIC) concept at Brakes India Ltd.

Smt Jayashree Varadhan, OS, CVRDE felicitating Shri R Vasu, Vice President, Brakes India Ltd during World Quality Day 2018 at CVRDE

RAISING DAY CELEBRATIONS

DLRL, HYDERABAD

Defence Electronics Research Laboratory (DLRL), celebrated its 57th Annual Day on 18 November 2018. Dr G Satheesh Reddy, Secretary, Department of Defence R&D and Chairman DRDO, graced the occasion as the Chief Guest. The event was attended by Directors from sister DRDO labs, former DG (ECS), CC R&D (ECS), and Directors, and CMD-ECIL, GM (BEL), senior officials from various associated organizations, DLRL fraternity and their families.

Dr Ashwani Kumar, Sc 'G', Chairman, Central Organising Committee welcomed the gathering. The Chairman, Works Committee, Shri CVH Prasad, Sc 'G', briefed on the several welfare measures taken by the Works Committee for the benefit of employees. Dr Anil Kumar Singh, OS and Director, DLRL highlighted the achievements and progress of DLRL made in the field of electronic warfare systems. He brought out the details of EW Systems inducted by Armed Forces in the year 2018 and likely to be inducted in coming years.

Dr G Satheesh Reddy, emphasized on the importance of "Make in India". He said that DLRL should set their goal to develop state-of-the-art technologies and become an exporter of EW systems in coming years. He stressed on the need for involving private partners and academic institutions for faster realization of products. He also cautioned the DRDO scientific community to be vigilant in sharing any info on social media.

Lab-level DRDO Awards were conferred upon the meritorious employees and merit-cum-means scholarships were distributed. Employees who completed 20 years of service were honoured with mementos.

Dr G Satheesh Reddy speaking on the occasion of DLRL Raising Day

ISSA, DELHI

Institute for Systems Studies and Analyses (ISSA) celebrated its 59th Raising Day on 23 October 2018. Dr Chitra Rajagopal DS, DG (SAM) was the Chief Guest and Maj Gen G Jaishankar, VSM, ADG (IC), was the Guest of Honour. Dr Chitra Rajagopal inaugurated the event along with Shri SB Taneja, Director, ISSA. The Director ISSA highlighted the current and future initiatives being undertaken by ISSA. DG (SAM) appreciated the efforts made by ISSA in the field of Systems Analysis, Wargaming and Modelling and Simulation. Lab-level DRDO Awards for excellence in various scientific fields were given to deserving scientists, DRTC and Admin and Allied personnel.

Formal handing over of, "Systems Analysis Study of Long Range Vector Against Land Targets (BRAHMOS)" to Artillery Directorate, Indian Army and "Air Defence Asset Planning Tool (ADAPT)" to Indian Air Force were carried out.

Inaugural of ISSA Raising Day

DRL, TEZPUR

Defence Research Laboratory (DRL), celebrated its 57th Raising Day on 21 November 2018. Prof. D Bora, Vice Chancellor, Assam Science and Technology University, Guwahati, graced the function as the Chief Guest and Dr K Santhanam, former Director, DRL was the Guest of Honour. Dr SK Dwivedi, Director, DRL, delivered the welcome address, highlighting the achievements of the laboratory. Laboratory-level Awards and 'SN Dube Publication Award' for the best paper were distributed. Awards in other categories like Sports, Director's appreciation and Swachhata Hi Seva were also given. A colourful cultural function and community lunch were organised. All members of the DRL family including the retired employees participated with full zeal and enthusiasm.

Spoon race at DRL Raising Day Celebration

VIGILANCE AWARENESS WEEK

ITR, CHANDIPUR

Vigilance Awareness Week was observed in ITR, Chandipur, from 29 October 2018 to 3 November 2018. Banners promoting vigilance awareness were displayed inside and outside of the office premises. Dr BK Das, OS and Director, ITR, administered the pledge on vigilance awareness. Various competitions, viz., essay writing, poster presentation and written quiz were conducted and prizes were distributed among the participants. Director, ITR, encouraged all to upkeep honesty and integrity in every sphere of life and asked all to eradicate corruption in all activities.

Director, ITR, delivering his talk on the vigilance awareness

NMRL, AMBERNATH

Vigilance Awareness Week commenced with OS and Director NMRL, Dr M Patil, administrating the Vigilance/Integrity Pledge to NMRL fraternity. During the week-long celebrations posters on ways to eradicate corruption were displayed. An essay competition in Hindi was conducted for all NMRL employees. A Vigilance Sensitization Programme was also organized. Invited lecture was delivered by Colonel Kurup K Raghavan (Retd) on corruption in work places and ways to eradicate it.

Vigilance awareness week at NMRL

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 Ms Arunima Sinha on 13 November 2018 at Dr Bhagavantham Auditorium, Metcalfe House, Delhi. Shri KS Varaprasad, OS and Director General (HR), DRDO, Dr Alka Suri, Director, DESIDOC, and Dr Rajiv Vij, Associate Director, DESIDOC, were present on the occasion. Ms Arunima Sinha is the first female amputee to climb the Mount Everest. She was a national level volleyball player who was pushed from a running train by robbers in 2011 resulting in amputation of one of her legs below the knee. Besides the Mount Everest, Ms Sinha has also climbed other summits like Kilimanjaro in Africa, Elbrus in Europe, Kosciuszko

in Australia, Aconcagua in Argentina and Carstensz Pyramid (Puncak Jaya) in Indonesia.

The Padma Shree awardee enriched the audience with her ideas and thoughts. She talked about her tragic accident and how circumstances made her strong to achieve the non-achievable. She spoke about the welfare of disabled persons, many of whom are forced to humiliation by society. Shri KS Varaprasad appreciated the achievements made by Ms Sinha despite heavy odds and said that she is a source of inspiration for the society. Dr Rajiv Vij, proposed the vote of thanks.

HRD ACTIVITIES

NATIONAL CONFERENCE ON AEROSPACE & DEFENCE RELATED MECHANISMS 2018

Eleventh National Conference and Exhibition on Aerospace and Defence Related Mechanisms (ARMS-2018) was organized by DRDO and ISRO in association with Indian National Society for Aerospace and Related Mechanism (INSARM), Hyderabad Chapter, and BITS Pilani, Hyderabad Campus, during 16-17 November 2018 at BITS Pilani, Hyderabad Campus. The theme of the conference was "Advances and Challenges in Aerospace and Defence Related Mechanisms." Dr Tessy Thomas, DS and DG (Aero), DRDO, was the Chief Guest and delivered the theme address. Shri S Somanath, DS and Director, Vikram Sarabhai Space Centre, the Guest of Honour, delivered the keynote address on the topic "Launch Vehicle Mechanisms." Dr KM Rajan, DS and Director, ARDE, delivered plenary talk on "Mechanisms in Armament."

The conference focused on recent advances in design, development, fabrication, testing and analysis as well as future concepts of various aerospace and defence-related mechanisms. It served as a forum for information exchange among engineers on their operational experiences of design and development of critical mechanisms. Experts, from industry and academia shared their experiences with the audience.

An exhibition of products related to Aerospace Mechanisms was organised on the occasion. Dr MRM Babu, DS and Director, ASL and Dr V Venkateswara Rao, OS and Director, CAS, inaugurated the exhibition.

More than 500 delegates and invitees, comprising academician, scientists, researchers, and students from various R&D labs, academic institutes and industries involved in aerospace mechanisms design and development attended the conference.

Eight invited talks were delivered by eminent scholars working in the area of Aerospace Mechanisms. Invited Talks were delivered by Dr CD Sridhara, former Deputy Director, URSC,

ISRO; Prof. Prasanna Gandhi, IITB, Mumbai; Shri V Krishna Prasad, ADA; Dr S Karunanidhi, Director, CSL, RCI; Dr A Subhananda Rao, former CC (R&D) Aero, DRDO; Shri VV Parlikar, Director, R&D(E); Shri AK Saxena, Director, ADRDE; and Dr Niladri Sarkar, BITS Pilani.

Fifty-five oral presentations were made during the technical sessions. Dr V Venkateswara Rao, OS and Director, Centre for Advanced Systems (CAS) and Chairman, Organizing Committee, ARMS-2018, summarized the complete activities of the conference. Dr R Srinivasan, Sc 'G', ASL, was the Organizing Secretary of the conference.

Release of Conference Proceedings

WORKSHOP OF DRDO TIRC HEADS 2018

DESIDOC organised annual 'Workshop of DRDO TIRC Heads' during 29-30 November 2018 at Armaments Research and Development Establishment (ARDE), Pune. Dr KM Rajan, DS and Director, ARDE, inaugurated the workshop. Dr Alka Suri, Director, DESIDOC, welcomed the participants and briefed about the central role of DESIDOC in DRDO Library System and the future plans, which will be taken up by the DESIDOC. Smt Sumati Sharma, Sc 'G', DESIDOC, explained the significance of the yearly event and deliberated on the schedule of the two-day workshop.

Dr KM Rajan, gave an enlightening inaugural talk on the importance of libraries in research and development and a detailed presentation on products developed by ARDE. Dr SS Murthy, former Director, DESIDOC, gave the keynote address on the 'Genesis of DRDO Libraries.'

Inaugural session of Workshop of DRDO TIRC Heads

Lectures on various topics pertaining to the stream were organised during the workshop. A visit to state-of-the-art World Peace Library was also organised.

COURSE ON LATEST TRENDS IN PRINTING TECHNOLOGY

DESIDOC organised a three-day course on 'Latest Trends in Printing Technology' under the Continuing Education Programme (CEP) of DRDO, during 3-5 December 2018. Dr Rajeev Vij, Sc 'G', Course Coordinator, in his welcome address, explained the need and purpose of the CEP and asked participants to be interactive. Shri B Nityanand, Course Director, briefed about the schedule of the course.

Dr Alka Suri, Director, DESIDOC, inaugurated the CEP and elucidated the importance of such need-based courses and informed that DESIDOC will soon venture into 3D Printing. Topics covered during the course included: Overview of Developments in Printing, 3D Printing and Digital Fabrication, QMS for Printing Technology, Post-Press requirements for Printing, Offset Printing, Pre-Press Concepts, Future Trends in Printing Technology, etc. Twenty-five participants attended the course. A quiz was organised to assess the knowledge acquired by the participants.

NATIONAL SCIENTIFIC AND TECHNICAL SEMINAR - 2018

Under the DRDO Chandigarh Cluster, a two-day "National Scientific and Technical Seminar - 2018" was organized by Defence Institute of High Altitude Research (DIHAR) during 6-7 December 2018. The seminar was inaugurated by Mrs Kirron Kher, Hon'ble MP Chandigarh, in the presence of the Directors of the Chandigarh-based DRDO laboratories. The Chief Guest appreciated the organizers for conducting seminar on Science and Technology in Official Language Hindi. One hundred and fifty participants attended the seminar and 72 abstracts were compiled. Oral research papers were presented on six subjects and a poster presentation was organized.

Dr Manjeet Singh, DS and Director, TBRL, was the Chief Guest of the closing ceremony. Shri Naresh Kumar, OS and Director, SASE; Dr OP Chaurasia, Director, DIHAR, and Dr PS Kohli, Regional Director, RCMA, expressed their views in context of the official languages and scientific lectures presented during the seminar. The Chief Guest appreciated the importance, quality and level of the seminar. Convener of the Joint Seminar Dr Narendra Singh, Additional Director, DIHAR, proposed the vote of thanks.

STEERING COMMITTEE MEETING ON INDO-US TRAUMATIC BRAIN INJURY PROJECT

Blast-induced traumatic brain injury (TBI) is one of the most common injuries to Armed Forces personnel. Current understanding of the pathophysiological changes induced in blast-related brain injury is very limited. The problem is often compounded by the co-existence of blast and blunt injury. Currently there are no validated animal or computational models of blast-related TBI. An Indo-US Project Agreement has been undertaken to understand injury mechanisms using a computational modelling, experimental and clinical approach with a view to enhance preventive and therapeutic strategies.

The 4th Steering Committee Meeting, Workshop and Project Review of the Indo-US Project Agreement titled, "Experimental and Computational Studies of Blast and Blunt TBI" was held at INMAS. The meeting was co-chaired by Dr AK Singh, OS and DG (LS), DRDO and Dr Raj Gupta, Deputy Director, Blast Injury Research Programme, USAMRMC. The five-day programme was attended by a 12 member delegation from various US Department of Defence laboratories including NRL, WRAIR, ARL; Academia namely NJIT and members of the US Embassy, as well as scientists from INMAS.

Dr AK Singh, emphasized the need for advanced research in blast TBI and apprised about the advances made in the project, particularly the commissioning of the Shock Tube for performing animal studies on blast TBI. He expressed satisfaction on the strength of the mutual collaboration between the two nations and stressed on the need to carry forward the work to fruition. His sentiments were shared by Dr Raj Gupta.

COURSE ON ORGANISATIONAL EXCELLENCE

A three-day course on 'Organisational Excellence' was conducted by Institute of Technology Management (ITM), Mussoorie, from 12 to 14 November 2018. The objective of the course was to emphasise on organisational excellence and its ingredients in achieving excellence through better use of human resources. It also aimed to evolve leadership strategies in creating an organisational environment that allows and generates creativity and innovation by exploring tacit knowledge. Shri Sanjay Tandon, OS and Director, ITM, inaugurated the course and deliberated upon factors involved in developing Organisational Excellence (OE).

Lectures on various topics, viz., An Overview to OE Models, OE through Creativity and Innovation, Enablers and Drivers of OE, Role of Leadership in Achieving OE, Creating and Managing Organisational Change, Balance Between Stress and Excellence, Building Organisational Culture for R&D Excellence, Roadmap and Methodology for Planning, Preparing for Introducing OE and Achieving OE from CEO Perspective were delivered during the course. Case Studies on OE were also discussed during the course.

COURSE ON FLIGHT TERMINATION SYSTEM IN TEST RANGE

ACEP course on 'Flight Termination System in Test Range' was organized at Integrated Test Range (ITR), Chandipur, from 29 October to 2 November 2018. Dr BK Das, OS and Director, ITR, inaugurated the course. The course aimed at imparting knowledge and practical exposure about Flight Termination System.

Various topics related to Flight Termination System, e.g., Overview, Power Amplifier, Design and Development of LDMOS and GaN-based Power Amplifier, Introduction to SDR (Software Defined radio) and its implementation, Flight Termination System of SDSC, SHAR, etc., were covered during the course.

Twenty-seven participants from ITR and other labs of DRDO attended the course. The course was organised by Shri AK Shrivastava, Sc 'F', and his team.

HINDI WORKSHOP

Research Centre Imarat (RCI), Hyderabad, organised 3rd Hindi workshop on 15 November 2018. Shri GDG Prasad Raju, Sc 'F', Vice Chairman, Official Language Implementation Committee (OLIC), inaugurated the workshop. Shri MK Gupta, Sc 'F', Member Secretary, OLIC briefed about various activities of Hindi Cell. Dr RN Awasthi, Hindi Officer, ECIL, Hyderabad delivered a lecture on importance and use of technical translation in R&D Organisations and Shri Kazim Ahmed , Senior translator delivered a lecture on official language policy and rules.

Twenty-five employees from various Directorates of RCI participated in the workshop.

COURSE ON POST QUANTUM CRYPTOGRAPHY

A CEP course on "Post Quantum Cryptography" was conducted by Scientific Analysis Group (SAG), Delhi, during 28-30 November 2018. The objective of the course was to acquaint the participants with Post Quantum Cryptography (PQC).

Ms Anu Khosla, OS and Director SAG, in her inaugural keynote address deliberated upon the importance of the PQC. She emphasized on the need of updating the skills on PQC techniques as the current public key cryptography will no longer be secure in post quantum era. Dr Dhananjoy Dey, Sc 'F', Course Director, summarized the contents of the three days course and presented brief overview on classification of cryptography and briefly discussed five important families of PQC.

The topics covered during the course included: Code-based Cryptography, Multivariate Public-key Cryptography, Isogeny-based Cryptography, Lattice-based Cryptography and Hash-based Signature Schemes and their underlying hard problems in detail. Interactive talks were delivered by scientists from SAG and invited speakers from IISc Bangalore and Ashoka University Sonipat. A short demonstration of New Hope Crypto System was presented. In total, 41 participants from various DRDO labs, Army, Navy and Air force attended the course.

COURSE ON SAFETY & INFRASTRUCTURE ISSUES AT WORKPLACE

Solid State Physics Laboratory (SSPL), Delhi, organized a three-day CEP course on 'Safety and Infrastructure Issues at Workplace' during 5-7 December 2018. The inaugural ceremony was graced by Dr RK Sharma, DS and Director SSPL, and Col JK Satpathy, Sc 'G', DCW&E. Participants from several DRDO labs and Indian Navy attended the course.

Talks on safe work practices and procedures to avoid accidents and accident like situations were organised. Emerging issues like Nano-Safety, E-waste Management, and Data Safety were also covered. Informal discussions were held where the participants shared their safety related issues and experiences. Jaya Lohani, Sc 'E' and Abhishek Sharma, Sc 'D' were the Course Coordinators. Hasya Yoga was also practiced for rejuvenation of the mind, body and soul. Dr RK Sharma handed over the certificates to the participants after an interactive feedback session.

WORKSHOP ON ADVANCES IN PROCESSING OF HIGH ENERGY MATERIALS

SFC Jagdalpur along with High Energy Materials Society of India Jagdalpur Chapter (HEMSI-JC), organized a one-day workshop at SFC Jagdalpur on 2 November 2018 focusing on the latest developments on processing of high energy materials and propulsion systems. The theme of the workshop was 'Advances in Processing of High Energy Materials.' Shri JC Choudhary, General Manager, SFC, inaugurated the workshop. Dr V Venkateswara Rao, Director CAS, presided over the function and highlighted the failures, latest developments and emerging trends in HEM processing. Delegates from ISRO, IIT Chennai, and DRDO labs attended the workshop.

PERSONNEL NEWS

APPOINTMENTS

Director, INMAS

Dr Tarun Sekhri, Sc 'G', has assumed the charge of Director, Institute of Nuclear Medicine and Allied Sciences (INMAS), Delhi. Dr Sekhri obtained MBBS degree from University College of Medical Sciences, University of Delhi in 1982 and MD in Internal Medicine from LLRM Medical College, Meerut University in 1992. He has also done Post Graduate Diploma in Radiation Medicine (DRM) from (INMAS), University of Delhi in 1986, and Post Graduate Diploma in Tuberculosis & Chest Diseases (DTCD) from Vallabhbhai Patel Chest Institute, University of Delhi in 1987.

Dr Sekhri joined DRDO on 10 September 1996 as Sc 'D' at INMAS. Since then, he has made significant contributions to several research projects and towards the development of technology, processes and products. He has to his credit the DRDO Health Project for the Study of the Health Profile of DRDO Employees with Special Emphasis on Coronary Risk Factors, which included health check-up of almost three-fourth of DRDO population across the country. He was the Principal Investigator for project on: Thyroid Disorders during Pregnancy and Post Partum Period, and Co-Investigator for projects like Study to Determine Factors that could Predict Remission with Carbimazole Therapy in Grave Diseases and Clinical, Biochemical, Ultrasonological and Cytomorphological Studies in Chronic Lymphocytic Thyroiditis. He has steered another very important project for assessing the Vitamin D status in soldiers posted at high altitude and muscle performance after supplementation, and had played a key role to address this issue in a better way. He has also been instrumental and taken a lead for various CBRN Medical Management Training and Clinical Trial Programmes in the Institute.

He has been awarded Lab-Level DRDO Technology Group Award for the outstanding contributions in various fields of medical research. He was the Chairman, Project Advisory Committee on Science of Health Communication (PAC-Health Comm), National Council for Science & Technology Communication (NCSTC), Department of Science & Technology (DST) for three years. He has also been awarded in several science and technology forums like DST, Endocrine Society and Indian Public Health Association (Best Paper Award) to name a few.

Associated with thyroidology for more than two decades, Dr Sekhri has more than 50 publications in peer reviewed national and international journals of repute. He has delivered 35

invited talks and various conferences on different scientific and medical platforms. He has also delivered public awareness sessions at more than 15 DRDO labs, Delhi Doordarshan and All India Radio. He is also a reviewer for several national indexed journals.

He is a member and expert panellist for the Technical Committee on 'Implementation of National Iodine Deficiency Disorders Control Programme (NIDDCP); Ministry of Health and is instrumental in formulating the revised recommendations for NIDDCP. He is a recognised PG Teacher and Supervisor and has trained 24 PG DRM students, five MD/MS students of Faculty of Medical Sciences, University of Delhi, and two PhD students. He is also a life member of different prestigious Medical and Scientific societies like Association of Physicians of India, National College of Chest Physicians (India), Endocrine Society of India, Research Society of Studies in Diabetes Mellitus, Indian Medical Association and Indian Thyroid Society.

Director, MTRDC

Dr SUM Reddy, Sc 'G', has been appointed Director of Microwave Tube Research and Development Centre (MTRDC), Bengaluru, with effect from 30 November 2018.

Dr Reddy holds an MTech in Electronics from Osmania University and PhD specializing in microwave tubes from the Institute of Technology, Banaras Hindu University. At MTRDC, he has contributed to projects and technologies for developing microwave tubes, modules, transmitters and systems that are used in radars and electronic warfare equipment.

HIGHER QUALIFICATION ACQUIRED

Shri Narendra Kumar Arya, SA to CAS, has been conferred the degree of Doctor of Philosophy by IIT Delhi for the thesis entitled "Effect of Heartfulness Spiritual Practice Based Programs and Processes on Mental and Physiological Health Indicators."

Shri Harish Kumar Sahu, Sc 'D', Scientific Analysis Group (SAG), Delhi, has been awarded PhD from IIT Delhi in the area of cryptanalysis, for the thesis entitled "Cryptanalysis of Symmetric Ciphers using ROBDDs and SMT Solvers."

Shri Yogesh Kumar, Sc 'E', SAG, has been awarded PhD from IIT Delhi in the area of Cryptology for the thesis entitled "Properties of Cryptographic Primitives: Integer Recurrence Relations & Permutations."

Shri Ambrish Awasthi, Sc 'E', SAG, Delhi, has been awarded PhD from the Department of Mathematics, IIT Delhi for the thesis entitled "Primitive transformation shift registers and primitive elements over finite fields."

Shri Sharwan Kumar Tiwari, Sc 'E', SAG, has been awarded PhD from the Department of Mathematics, University of Kaiserslautern, Germany, for the thesis entitled "Algorithms in Noncommutaive Algebras: Groebner Bases and Hilbert Series."

AWARDS

IETE - Flt Lt Tanmaya Singh Dandass Memorial Award

Shri BP Shashidhara, Sc 'G', Aeronautical Development Establishment (ADE), Bengaluru, has been conferred IETE - Flt Lt Tanmaya Singh Dandass Memorial Award (2018) for his significant contribution towards indigenous development of avionics sub-systems using COTS and Embedded Systems for Avionics Part Task Trainer for Training of Pilots of MiG 27 by 'The Institution of Electronics and Telecommunication Engineers' during the 61st Annual General Body Meeting held at Amaravati .

DN Mullick Memorial Award

Dr Vijay K Bharti, Sc 'D', Defence Institute of High Altitude Research (DIHAR) was conferred DN Mullick Memorial Award on 27 November 2018 during 24th Annual Conference of Society of Animal Physiologists of India and National Symposium for his outstanding R&D works on High Altitude Animal Physiology. This is a mid carrier award for research works in the areas of Animal Physiology in India.

Golden Reviewer IEEE





Dr SK Datta, Sc 'G', Shri Sushil Raina, Sc 'G', Dr M Sumathy, Sc 'F', Dr S Chhotray, Sc 'E' and Dr Vishal Kesari, Sc 'E', from Microwave Tube Research and Development Centre (MTRDC), Bengaluru, received the recognition of Golden Reviewer in the list of reviewers for the year 2018 in IEEE Transactions on Electron Devices (TED), Vol. 65, No. 12, 2018, by IEEE Electron Devices Society (USA). Dr Vishal Kesari, Sc 'E' also received the recognition of Golden Reviewer in the list of reviewers for the year 2018 in IEEE Electron Device Letters (EDL), Vol. 39, No. 12, 2018, by IEEE Electron Devices Society (USA).

DRDO HARNESSING SCIENCE FOR PEACE & SECURITY

CHAPTER 4: MARCHING FORWARD

The article is 34th in the Series of extracts of the monograph, "Defence Research & Development Organisation: 1958-1982", by Shri RP Shenoy, former Director of Electronics and Radar Development Establishment (LRDE).

AERONAUTICS

Gas Turbine Research Establishment

Hardware-wise, in the area of compressors, design studies had been carried out in the 1960's of a seven-stage subsonic compressor. This would form the basic core compressor for the proposed engine to be built. As mentioned earlier, the design and testing in the early 1970's of a transonic compressor ahead of the multi-stage subsonic compressor on the Orpheus 703 engine provided valuable design inputs for resolving matching problems. The single stage transonic compressor which developed a pressure ratio of 6.5 :1 had the variable stators carefully designed to provide better stage matching. The success of the design showed the way in the 1960's for the design of the six-stage transonic compressor which would form the core compressor for future engines. In the area of combustors, since the combustion phenomena was complex function of fuel spray droplet dynamics and evaporation, air flow pattern, and chemical kinetics, it was not readily amenable for analysis. Hence for progress in the design and development of combustors, analysis had to be augmented with experiments involving water flow visualization and combustor model tests. In addition, testing methods and test rigs were set up in order to realize viable and efficient combustors. Analysis backed up by experimentation and testing in the 1970's led to optimization of the design of the annular combustor for the proposed GTX engine, with an L/D ratio of 3 and an exit temperature of 1500 K. The atomiser for the GTX-17U combustor was pressure jet type, the diffuser was aerodynamic and dumps type and the material used was Nimonic 75. Close interaction was maintained with Mishra Dhatu Nigam (MIDHANI) for development, evaluation of specification and type test schedules of a number of alloys needed for gas turbine materials. Type approval was also accorded to an alloy – MDN 3214 developed by MIDHANI.

The turbine was axial flow type and the design was based on free vortex models for the GTX. The performance analysis of turbine stages being crucial for engine operation as a whole, the criticality of operation was due to the vane and blade throat area which controlled the swallowing capacity as well as the operating line of the engine. This necessitated setting up of a full-scale model test rig of capacity 2250 kW for conducting the experiments. The initial design of the turbine blade elements accommodated five holes and subsequently increased to eight holes which were drilled radially for the coolant to pass through the blade span from root to lip. This arrangement proved inadequate from the point of view of creep and fatigue and would be replaced in the early 1980s by a better mechanism, which would provide a good creep and fatigue life.

The aero gas turbine engine, being a high speed rotating machine with a heavy weight rotor, rotor dynamics, secondary flows and the lubricating system required attention right from the beginning for the reliable operation of the engine. The rotor dynamics was mainly carried out using conventional single shaft analysis procedure for prediction of critical speeds even though the shafting was essentially a two spool configuration supported on rolling element bearings with shaft interconnection at intershaft bearing location. This would be replaced in the next decade by sophisticated dynamic analysis codes. The vibration behaviour of the rotor, being a direct consequence of quality of manufacture of the rotor, balancing of the rotor and alignment of rotor components during assembly had to be built into hardware design. Vibration problems were experienced in the GTX engine and were solved by introducing uncentralised squeeze film dampers. The secondary flow system required modification since there was leakage of hot air from the gas flow path into the cooling and sealing system. Three technology development programmes were proposed to address the problem. In effect by the end of the 1970's, the technology status of the core turbine was axial flow turbine engine GTX-37U, stage loading factor of 1.4, TET of 1400 K with convective cooling.

GTX incorporated all components/ sub-systems, such as transonic compressor, annular combustor, shrouded cooled turbines, fully variable exhaust nozzle, digital control system and sophisticated materials and metal-forming techniques. The engine was test run successfully bringing to an

end the demonstrator phase of engine development. In 1980, discussions were held between GTRE and M/s Rolls Royce of UK to examine the feasibility of developing a viable engine designated GTX-Adour which would integrate the core of the Adour engine used in the Jaguar with the components of GTX design. The collaboration did not materialise and it was decided to go ahead with the full-scale development of the GTX engine. This engine would serve as a highly effective and useful test vehicle for validating advanced technology design features.

Aeronautical Development Establishment

The major activities of Aeronautical Development Establishment (ADE) in the 1960's was to provide support to on-going acquisition of equipment for the Indian Air Force and carrying out type approval of aeronautical equipment/ components offered by the industry. In addition, ADE carried out design and development studies on Hovercraft, Dart Target System and Stall Warning System. The Hovercraft lifted-off the ground supported by a cushion of air formed by forcing a large volume of air through ducts in the lower periphery of the craft. The Hovercraft was able to negotiate obstacles of 120 cm to 150 cm height easily and held forth promise as a good negotiating vehicle in swampy or otherwise impassable terrain.

The Dart Target system consisting of a target of composite construction, a hit recorder and a para recovery device, was aimed to provide a realistic target for air armament practice. The Stall Warning System provided warning to the pilot through shaking or buffeting of the control column of an impending stall condition with a predetermined margin of safety.

The Subramanian Committee Report on Aeronautics, which was made public in 1969, had made the Ministry of Defence as the nodal ministry for aeronautics. As far as ADE was concerned, the recommendation about the high priority to be accorded to develop a new ground attack fighter for the Indian Air Force did not translate into a major project activity. Thus, in the beginning of the 1970's ADE found itself to be one of the few system-oriented laboratories of DRDO which had no major project activity, current or planned even though aeronautics was a thrust area for the Organisation. As the uncertainty about the ground attack fighter continued, it was decided that ADE would get into the area of flight simulation and develop flight simulators that would help the IAF in their training of pilots. In 1972, DRDO tasked ADE to plan a flight simulator centre which would be the first of its kind in the country.

The Flight Simulation Centre was envisaged to aid at the system definition phase, the performance and acceptability of a complete flight vehicle or its systems/ subsystems 6. The facility would help the designer to evaluate and optimise the performance of the aircraft and thus reduce the time and effort that would be spent in assessment of hardware at a later stage. The heart of the facility was an analogue-cum-digital hybrid computer which would be coupled to a cockpit capable of free movement for simulating a flying aircraft. The computer would also be coupled to a visual system to provide visual cues to the pilot seated in the cockpit. This facility would simulate aerodynamic configuration, control layout, stability augmentation systems and so on. The Centre was commissioned by the end of 1977. Subsequently, ADE initiated design, development and fabrication of simulators for Ajeet and Kiran aircraft of the IAF. These would be used to train pilots on ground without actually flying the aircraft on various flight exercises. Development work for various subsystems of the prototype simulator, such as the motion system, instrumentation, data generation, weapon system, navigation and communication system and software development system was progressed as the decade came to an end. ADE's plans envisaged to have the prototypes of the simulators to be ready by December 1980 for evaluation.

In addition, the development of a reusable rocket pod, missile target, and a technology development project on Head Up Display were also taken up. The reusable rocket pod was an under wing rocket launcher developed for air-to-ground roles and was expected to be reused for about 100 firing sorties. It was designed to have universal adaptability to fighter aircraft of Soviet and western origin. By the end of the decade, reusable rocket pods for all current aircraft of IAF were designed and were cleared for introduction into Service after a series of static, ground firing, flight carriage and firing/ jettisoning trials from aircraft.

HAL was the production agency for the reusable rocket pod. Work on Head up Display system, which would enable an aircraft pilot to have a visual view of the important flight parameters of a flying aircraft like altitude, speed, etc., continued into the 1980's. IRDE was associated with ADE for the development of the optics module for the Head Up Display. As the 1980's dawned, ADE initiated a major programme for development of Pilotless Target Aircraft (PTA) for meeting Services requirements. In view of the high attrition rates, and high cost of military aircraft, ADE scientists visualised that PTA would play a very useful role, particularly in training activities.

To be continued...

SWACHHATA DIWAS

DESIDOC along with Metcalfe House-based DRDO laboratories celebrated Swachhata Diwas on 12 December 2018. Three lectures dwelling on the importance of cleanliness were organised. The vital role of three R's of cleanliness—Reduce, Reuse, and Recycle—was discussed. Smt Sumati Sharma, Sc 'G', DESIDOC, urged everyone to maintain cleanliness and encourage at least five more people to create awareness. During the campaign, posters highlighting the importance of cleanliness were distributed. Ms Kavita Narwal, Sc 'D', DESIDOC, coordinated the programme.

WORKSHOP ON WOMEN'S HEALTH & NUTRITION

DRL, Tezpur, conducted an "Awareness Workshop on Women's Health, Hygiene and Nutrition" under Programme Arunodaya on the 9 November 2018 at Salari Village, Arunachal Pradesh. Awareness on hand-washing, lice infestation, de-worming in children, hygiene during menstruation, zoonotic diseases, balanced diet and first aid was given. Around 100 women of all ages participated actively. Personal hygiene kits consisting of anti-lice shampoo, antibacterial cream, band-aids, comb and disposable sanitary pads, tooth paste and tooth brush were distributed to the participants.

BLOOD DONATION CAMP AT DEAL

A blood donation camp was organized at DEAL, Dehradun on 28 November 2018, under the aegis of IMA Blood Bank, Dehradun. The camp was inaugurated by Shri PK Sharma, Sc 'H' and was conducted by Dr JC Arora and Dr Swati Nigot. DEAL employees participated in the camp with great zeal and donated 46 units of blood.

VISITORS TO DRDO LABS/ESTTS

CVRDE, CHENNAI

Dr G Satheesh Reddy, Secretary DDR&D and Chairman DRDO, visited Combat Vehicles Research & Development Establishment (CVRDE) on 24 November 2018. Dr Reddy reviewed the ongoing projects of CVRDE and offered valuable suggestions. Shri NB Vijayakumar, Director (PM), O/o DG (ACE), Ms Nabanita R Krishnan, OS and Director (DP&C) and Dr Chandrika Kaushik, Director, DISB, also participated in the review meeting. Chairman DRDO, took keen interest in Armoured Fighting Vehicles.

Dr G Satheesh Reddy, Chairman DRDO at CVRDE

DEAL, DEHRADUN

Air Vice Marshal SK Mohlah, VM, ACIDS (Tech Int.), visited Defence Electronics Applications Laboratory (DEAL), on 26 November 2018. He was briefed about the different ongoing projects, viz., Software Defined Radio, GSAT-6 Integrated Coastal Surveillance System, Tropo-scatter Communication, VLF Communication, etc., by Dr RS Pundir, Director, DEAL. Demonstration of the software developed by DEAL related to image processing and exploitation was also given to the visitor.

Air Vice Marshal SK Mohlah being briefed about DEAL activities

DEBEL, BENGALURU

Dr G Satheesh Reddy, visited Defence Bioengineering and Electro-medical Laboratory (DEBEL), on 4 November 2018. He was accompanied by Dr AK Singh, OS and DG (LS), DRDO. A presentation on the Society for Biomedical Technology (SBMT), driven by DEBEL, was given and programme on Indigenous Cochlear Implant was discussed. Chairman DRDO was also briefed on DEBEL developed products and ongoing projects and achievements of the lab in the field of life support systems, protective clothing and equipment and biomedical instrumentation.

Dr G Satheesh Reddy, Chairman DRDO addressing DEBEL employees

DIPR, DELHI

Air Vice Marshal S Raj, VM, Assistant Chief of Air Staff–Training, and Wg Cdr Rakesh Kumar (PO 3 B) visited Defence Institute of Psychological Research (DIPR) on 10 November 2018. Air Vice Marshal overviewed Cognitive Battery for Officers Selection (CBOS) and witnessed the Computerized Pilot Selection System (CPSS).

DIHAR, LEH

One hundred and fifteen students from the Ladakh region selected by Innovation in Science Pursuit for Inspired Research (INSPIRE), an innovative programme sponsored and managed by the Department of Science & Technology, visited Defence Institute of High Altitude Research (DIHAR), on 28 November 2018. The students along with the faculty members were informed about the relevance of DIHAR and the various agro-animal R&D activities being carried out by the laboratory.

LASTEC, DELHI

Dr G Satheesh Reddy, Secretary DDR&D and Chairman DRDO, visited Laser Science & Technology Centre (LASTEC). He was accompanied by Ms J Manjula, DS and DG (ECS), and Smt Nabanita R Krishnan, OS and Director (P&C). Shri Hari Babu Srivastava, OS and Director, LASTEC, briefed the Secretary about LASTEC's technical activities. Demonstration of LASTEC Products was also given to the visitors.

NMRL, AMBERNATH

Dr G Satheesh Reddy, visited Naval Materials Research Laboratory (NMRL), on 21 November 2018. Dr SV Kamat, DS and DG (NS&M); Ms Nabanita R Krishnan, OS and Director, P&C; Shri VV Parlikar, OS and Director, R&DE (Engrs) were also present during the visit. Dr M Patri, OS and Director, NMRL, briefed about the laboratory activities. Chairman, DRDO, reviewed the AIP Programme.

AVM S Raj being briefed about Computerized Pilot Selection System at DIPR

Chairman DRDO being briefed about LASTEC product

Chairman DRDO being briefed about NMRL research activity

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