

DRDO

NEWSLETTER



A Monthly Bulletin of Defence Research and Development Organisation

ISSN: 0971-4391

www.drdo.gov.in

MAY 2020

VOLUME 40

ISSUE 05

RM COMMISSIONS COUNTRY'S FIRST MOBILE TESTING LAB



TOT >> p11

EVENTS >> p11

DRDO SERIES >> p17

VISITS >> p20

CONTENTS

MAY 2020
VOLUME 40 | ISSUE 05
ISSN: 0971-4391

COVER STORY **04**

RM Commissions Mobile Virology Research and Diagnostics Lab for COVID-19 Detection



TOT **11**

DIBER transfers Technologies of Herbal Formulations/Products

Cover: Hon'ble Raksha Mantri Shri Rajnath Singh commissioning country's first Mobile Virology Research and Diagnostics Laboratory through video conferencing (top) and inside view of the mobile lab.

EVENTS

11



DRDO SERIES

17

VISITS

20

40th Year of Publication

Editor-in-Chief: Dr Alka Suri
Associate Editor-in-Chief: B Nityanand
Managing Editor: Manoj Kumar

Editor: Dipti Arora
Editorial Assistance: Biak Tangpua, Raj Kumar
Multimedia: RK Bhatnagar

Printing: SK Gupta
Distribution: Tapesh Sinha, RP Singh



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

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

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

LOCAL CORRESPONDENTS

Ambernath: Dr Susan Titus, Naval Materials Research Laboratory (NMRL); **Bengaluru:** Shri Subbukutti S, Aeronautical Development Establishment (ADE); Smt MR Bhuvaneshwari, Centre for Airborne Systems (CABS); Smt Faheema AGJ, Centre for Artificial Intelligence & Robotics (CAIR); Ms Tripty Rani Bose, Centre for Military Airworthiness & Certification (CEMLAC); Smt Josephine Nirmala M, Defence Avionics Research Establishment (DARE); Smt Anuya Venkatesh, Defence Bioengineering & Electromedical Laboratory (DEBEL); 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); **Chandipur:** Shri PN Panda, Integrated Test Range (ITR); **Chennai:** Smt S Jayasudha, 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 Nidhi Maheshwari, Defence Institute of Psychological Research (DIPR); Shri Navin Soni, Institute of Nuclear Medicine and Allied Sciences (INMAS); Shri Anurag Pathak, Institute for Systems Studies & Analyses (ISSA); Dr Indu Gupta, Laser Science & Technology Centre (LASTEC); Ms Noopur Shrotriya, Scientific Analysis Group (SAG); Dr Rupesh Kumar Chaubey, Solid State Physics Laboratory (SSPL); **Gwalior:** Shri RK Srivastava, Defence R&D Establishment (DRDE); **Haldwani:** Dr Atul Grover, Defence Institute of Bio-Energy Research (DIBER); **Hyderabad:** Shri Hemant Kumar, Advanced Systems Laboratory (ASL); Shri Pramod K Jha, Centre for Advanced Systems (CAS); Dr JK Rai, Advanced Numerical Research & Analysis Group (ANURAG); Ms Bidisha Lahiri, Centre for High Energy Systems & Sciences (CHESS); Shri ARC Murthy, Defence Electronics Research Laboratory (DLRL); Dr Manoj Kumar Jain, Defence Metallurgical Research Laboratory (DMRL); Dr K Nageswara Rao, Defence Research & Development Laboratory (DRDL); Shri Lalith Shankar, Research Centre Imarat (RCI); **Jagdalpur:** Dr Gaurav Agnihotri, SF Complex (SFC); **Jodhpur:** Shri Ravindra Kumar, Defence Laboratory (DL); **Kanpur:** Shri AK Singh, Defence Materials & Stores Research & Development Establishment (DMSRDE); **Kochi:** Smt Letha MM, Naval Physical & Oceanographic Laboratory (NPOL); **Leh:** Dr Dorje Angchok, Defence Institute of High Altitude Research (DIHAR); **Mussoorie:** Dr Gopa B Choudhury, Institute of Technology Management (ITM); **Mysuru:** Dr M Palmurugan, Defence Food Research Laboratory (DFRL); **Pune:** Dr (Mrs) JA Kanetkar, Armament Research and Development Establishment (ARDE); Dr Vijay Pattar, Defence Institute of Advanced Technology (DIAT); Shri AM Devale, High Energy Materials Research Laboratory (HEMRL); Shri SS Arole, Research & Development Establishment (Engrs) [R&DE (E)]; **Tezpur:** Dr Jayshree Das, Defence Research Laboratory (DRL)

DRDO COMBATS COVID-19: RM COMMISSIONS COUNTRY'S FIRST MOBILE TESTING LAB FOR COVID-19 DETECTION

Raksha Mantri Shri Rajnath Singh unveiled via video conference a Mobile Virology Research and Diagnostics Laboratory (MVRDL) developed by DRDO in association with ESIC Hospital, Hyderabad and Private industry.

Speaking on this occasion, Raksha Mantri said the government under the leadership of Prime Minister Shri Narendra Modi has taken several timely decisions because of which the spread of COVID-19 in the country is far less compared to many other countries.

Shri Rajnath Singh appreciated the setting up of this Bio Safety Level 2 and Level 3 lab in a record time of 15 days, which usually takes about six months time. He said this testing facility can process more than 1,000 samples in a day and would enhance country's capabilities in fighting COVID-19.

RM also appreciated Armed Forces for contributing in many ways like setting up of quarantine centres, providing healthcare facilities, evacuating Indian nationals from other countries to fight COVID-19.

The function was also attended by Shri G Kishan Reddy Hon'ble Union Minister of State for Home Affairs, Shri Santosh Kumar Gangwar Hon'ble Union Minister of State for Labour & Employment, Shri KT Rama Rao Hon'ble Minister for IT Industries, Municipal Administration & Urban Development, Govt of Telangana, Shri Ch Malla Reddy, Hon'ble Minister of Labour, Govt of Telangana and Dr G Satheesh Reddy, Secretary DDR&D & Chairman DRDO.

The first of such Mobile Viral Research Lab that will speed up COVID-19 screening and related

R&D activities was developed by Research Centre Imarat (RCI), the Hyderabad-based laboratory of DRDO in consultation with ESIC Hospital, Hyderabad.

The Mobile Viral Research Lab is the combination of a BSL 3 lab and a BSL 2 lab. The labs are built as per WHO and ICMR Bio Safety Standards to meet international guidelines. The system has built in electrical controls, LAN, telephone cabling, and CCTV. The Mobile Lab will be helpful to carry out diagnosis of COVID-19 and also virus culturing for drug screening,

Convalescent plasma derived therapy, comprehensive immune profiling of COVID-19 patients towards vaccine development early clinical trials specific to Indian population. The lab screens 1000-2000 samples per day and can be stationed, as per requirement, anywhere in the country.

DRDO acknowledged the contributions of M/s iCOMM for provision of containers, M/s iClean for design and build of the BSL 2 and BSL 3 labs in a time bound manner, and M/s Hi Tech Hydraulics for providing the base frame.



Inside view of the MVRDL

DRDO COMBATS COVID-19: PROVIDES MITIGATION EQUIPMENT

The first case of corona virus (COVID-19) pandemic was confirmed in India on 30 January 2020. As the Government of India started taking all necessary steps to ensure that people are prepared well to face the challenge and threat posed by the growing pandemic, DRDO emerged as a critical force-multiplier in combating the virus. It used its years of experience and available technology to develop essential items for mitigation of the wrath of the deadly virus. Since then the organization has come up with combat products for both government and non-government sectors. Eight DRDO laboratories are engaged in meeting the shortfall of ventilators, emergency care facilities and basic personal protection equipment like masks, clothing and gloves. As a result of focused approach, DRDO is ready with the following items and transferred the technology to the industry for mass production for its fight against corona virus.

COVID-19 SAMPLE COLLECTION KIOSK

COVID Sample Collection Kiosk (COVSACK) unit has been developed by Hyderabad-based Defence Research and Development Laboratory in consultation with the doctors of Employees' State Insurance Corporation (ESIC), Hyderabad. The COVSACK is a kiosk for use by healthcare workers for taking COVID-19 samples from suspected infected patients. Patient under test walks into the Kiosk and a nasal or oral swab is taken by health care professional from outside through the built in gloves.

The Kiosk is automatically disinfected without the need for human involvement, making the process free of infection spread. The shielding screen

of kiosk cabin protects the health care worker from the aerosols/droplet transmission while taking the sample. This reduces the requirements of PPE change by health care workers.

After the patient leaves the Kiosk, four nozzle sprayers mounted in the kiosk cabin disinfect the empty chamber by spraying disinfectant mist for a period of 70 seconds. It is further flushed with water & UV light disinfection. The system is ready for next use in less than two minutes. Voice command can be given through two-way communication system integrated with the COVSACK. It is possible to configure COVSACK to be used either from inside or outside as required by the medical professionals.

The COVSACK costs nearly Rs one lakh and the identified industry based at Belgaum, Karnataka can provide 10 units per day. The DRDO has designed and developed two units and handed over these to ESIC Hospital, Hyderabad after successful testing.



COVID Sample Collection Kiosk

M/s Vega Aviation Products Pvt. Ltd., Belgaum, Karnataka is the industrial partner for manufacturing the kiosk.

BIO SUIT

Scientists at various DRDO laboratories have applied their technical know-how and expertise in textile, coating and nanotechnology to develop the Personal Protective Equipment (PPE) having specific type of fabric with coating to keep the medical, paramedical and other personnel engaged in combating COVID-19 safe from the deadly virus. Defence Research and Development Establishment (DRDE), Gwalior has developed Bio Suits, which has been produced by three industry partners namely M/s Shiva Texyarn, Coimbatore, M/s Arvind Mills, Ahmedabad and M/s Aeronav, Noida and is being supplied to MOH&FW, GOI.

Institute of Nuclear Medicine and Allied Sciences (INMAS), Delhi has



Bio Suit

developed a suit for protection against liquid radionuclide. The suit has been tested effectively and being produced through industry partner.

Aerial Delivery Research and Development Establishment (ADRDE), Agra and INMAS, have also developed Bio Suits for protection of medical professionals and paramedics handling COVID-19 patients. The suits are being prepared with the help of the industry after subjected to rigorous testing for textile parameters as well as protection against synthetic blood. Efforts are being made to ramp up production to 15-20 thousand PPEs per day.

DRDO has prepared a special sealant as an alternative to seam sealing tape based on the sealant used in submarine applications. Presently, Bio Suits prepared using this glue for seam sealing by an industry partner has cleared test at Southern India Textile Research Association (SITRA) Coimbatore. This can be a game changer for the textile industry. The DRDO can mass produce this glue through industry to support the seam sealing activity by suit manufacturers.

VENTILATORS

Society for Biomedical Technology (SBMT), a DRDO funded and managed initiative) & Defence Bioengineering and Electromedical Laboratory (DEBEL), Bengaluru, have developed a ventilator by using existing technologies like breath regulators, pressure/flow sensors, etc. DEBEL has undertaken the initiative to develop the critical components of the ventilators which are not available in the country. These will be produced with the help of local industry. Defence PSU, M/s BEL has joined the efforts for large scale production of ventilators. Production can reach a capacity of 10,000 ventilators per month.

DRDO has also developed Multi Patient Ventilation (MPV) Kit, which helps convert single ventilator for providing treatment to multiple patients in the emergency. The MPV kit



Ventilator

has already been tested in two hospitals and working satisfactorily.

FACE MASKS

Defence Research and Development Establishment (DRDE), Gwalior has developed five layered N-99 masks using a nano web filter layer. Manufacturing of the masks is in progress with an aim to produce 2 lakh N-99 masks per week through the industry



N-99 mask

Institute of Nuclear Medicine and Allied Sciences (INMAS), Delhi has also designed a 3-ply surgical mask. Around 40,000 3-ply surgical masks have been supplied to Delhi Police and other agencies.

ENCLOSURE FOR INTUBATION PROCEDURE – AEROSOL CONTAINMENT BOX

Research Centre Imarat (RCI), Hyderabad and Terminal Ballistic Research Laboratory (TBRL), Chandigarh have come up with Enclosure for Intubation Procedure—Aerosol Containment Box to safeguard health care workers. The enclosure prevents spread of viral contamination of COVID-19 to reach the gown, gloves, face mask, eye shield, shoes of the front line workers. The transparent acrylic/ Poly Methyl Meth Acrylate (PMMA) box covers the patient's head up to the chest and acts as a safety barrier against droplets from patients while under treatment.



Aerosol Containment Box

The design of the enclosures has been validated and accepted by a team of doctors at ESI Medical College, Hyderabad and at PGIMER, Chandigarh, respectively.

SANTISER FORMULATION

To address the need for personal and surface decontamination, DRDE, Gwalior and CFEES, Delhi have prepared hand sanitizer compliant to WHO guidelines for local production.

More than 1,50,000 bottles of sanitizer based on Isopropyl Alcohol/ Ethanol has been produced in-house and supplied to: Indian Armed forces, Armed Forces Medical Corps, Defence Security Corps (approx. 5,500 bottles); Ministry of Defence (1,500 bottles); Parliament -(300 bottles); Delhi Police (2500 bottles) and other Security Establishments and High Offices (500 bottles).



Ethyl alcohol base formulation and process has been shared with industries and production in bulk has been initiated. Raw material sourcing can help increase the production. Cost of a litre of the sanitiser is around Rs 120 including GST.

DRDO Laboratories across the country are producing a large amount of hand sanitizers based on DRDE, guidelines and distributing to local administration for fight against the pandemic.



Hand Rub

SANITIZATION EQUIPMENT

DRDO is ready with technologies for sanitizing areas of different sizes. The Centre for Fire, Explosives & Environment Safety (CFEES), Delhi has developed two configurations of sanitizing equipment spin-offs from technologies developed for fire suppression applications.

Portable Backpack Area Sanitization Equipment

A portable sanitization equipment has been developed with the help of industry partner for spraying decontamination solution consisting of 1% Hypochlorite (HYPO) solution for sanitization of suspected area. The portable system can be mounted as a backpack. This system incorporates low pressure twin fluid (air & disinfectant liquid) technology to generate very fine mist and is capable of disinfecting an area up to 300 square meter. The application areas can include hospital reception, doctor chambers, office spaces dealing with general public, corridors, pathways, metro and railway stations, bus stations, etc.



Backpack Area Sanitization Equipment

Trolley Mounted Large Area Sanitization Equipment

The higher capacity Trolley Mounted Large Area Sanitization Equipment incorporates low pressure single fluid (disinfectant liquid) technology for generating very fine mist. The system is capable of disinfecting an area up to 3000 square meter. It has a tank capacity of 50 litres and has a lancing (throw) distance of 12-15 meter.

This is useful for disinfecting hospitals, malls, airports, metro stations, isolation areas, quarantine centres and high risk residential areas.

Systems have been provided to Delhi Police for immediate use. These can be made available to other agencies with the help of industry partners.



Large Area Sanitization Equipment

Automatic Mist Based Sanitizer Dispensing Unit

CFEES along with HPO 1, using its expertise in mist technology for fire suppression, has developed automatic mist based sanitiser dispensing unit. It is a contact less sanitiser dispenser which sprays alcohol based hand rub sanitiser solution for sanitisation of hands while entering the buildings/office complexes, etc. It is based on water mist aerator technology, which was developed for water conservation.

The unit operates without contact and is activated through an ultrasonic sensor. A single fluid nozzle with low flow rate is used to generate aerated mist to dispense the hand rub sanitiser. This sanitises the hands with minimum wastage. Using atomiser, only 5-6 ml sanitiser is released for 12 seconds in one operation and it gives the full cone spray over both palms so that disinfection operation of hands is complete.



Automatic Mist Based Sanitizer Dispensing Unit

It is a very compact unit and bulk fill option makes it economical and long lasting product. It is easy to install system as wall-mountable or on a platform. As an indication of operation an LED illuminates the spray. The unit was manufactured with the help of M/s Riot Labz Pvt Ltd, Noida, and one unit has been installed at DRDO Bhawan. The unit can be used for sanitisation of hands at entry and exit to hospitals, malls, office buildings, residential buildings, airports, metro stations, railway stations, bus stations and critical installations. The product is also expected to be very useful for entry/ exit of isolation and quarantine centres.

UV Sanitization Box and Hand-held UV Device

Defence Institute of Physiology & Allied Sciences (DIPAS) and INMAS, have designed & developed ultraviolet C light-based sanitisation box and hand-held UV-C (ultraviolet light with wavelength 254 nanometres) device. The UV-C consists of a shorter, more energetic wavelength of light. It is particularly good at destroying genetic material in COVID-19. The radiation warps the structure RNA which prevents the viral particles from making more copies of themselves. The UV-C kills microbes quickly. Sanitisation of the items by employing UV-C light avoids the harmful effects of the chemicals used for the disinfection. This is environment friendly and is a contact free effective sanitisation method.

The UV-C box is designed for disinfecting personal belongings like mobile phone, tablets, purse, currency,



UV Sanitization Box

cover of office files, etc. COVID-19 virus will be deactivated by using UVC lamps in one minute placed equidistantly in a box with UV dose of 100 mJ/cm². The UV lamps used in the sanitisation box also emits 185 nm that produces ozone and is able to take care of the unexposed area on the surfaces of the objects placed in the box.

The hand-held device having eight watt UV-C lamp disinfects office and household objects like food packets, furniture, etc., with an exposure of 45 second at a 100 mJ/cm² irradiation placed at a distance of less than two inches. This measure can reduce the transmission of Corona virus in office and public places.



Hand-held UV Device

Personnel Sanitization Enclosure

The entry point walk through enclosure for personnel decontamination has been designed by Vehicle Research and Development Establishment (VRDE) and developed by M/s DH Ltd., Ghaziabad. The portable hands-free operation enclosure comprises a wash basin, tissue dispenser, dryer, hand sanitiser and soap at entry point and can be made operational in 3 hours.

A foot operated, Start Pedal and Stop Pedal have been provided at entry and exit points, respectively. An electric pump creates disinfectant mist of Hypo Sodium Chloride inside the canopy. Mist spray stops automatically after 25 seconds so that person knows when to exit the enclosure. Once the person is inside the enclosure he/she needs to keep his/her eyes closed during the period of mist spraying.

Two roof mounted separate tanks containing water and Hypo Sodium Chloride feed wash basin and spray nozzles, respectively through the



Personnel Sanitization Enclosure

pump. The enclosure can be operated continuously for 24 hours as it has been designed for redundancy. See-through glass windows on side walls of the canopy help in monitoring the function. Two lights provided inside the enclosure keeps proper illumination during night time.

Personnel Sanitization Station

VRDE has conceptualised this low pressure mist system for individual sanitization installed in a MS container based cabin. This can be easily mounted on a vehicle, transported and re-fabricated within two hours.



Personnel Sanitization Station

Salient Features

- * Can be operated continuously for 24 hours
- * Roof mounted water tank and side wall mounted control box & pump



- * Glass window on either side of container for monitoring
- * Hands free, sanitizer dispenser at entrance

Low Cost Vehicle Sanitization Enclosure

System is lightweight, portable canopy and can be made operational in three hours to sanitize vehicles at entry points of premises. An electrically operated positive displacement pump creates disinfectant mist inside the tent canopy through which the vehicles are passed. A 500 litre separate tank stores disinfectant, which is sufficient for disinfection of 200 vehicles.



Low Cost Vehicle Sanitization Enclosure

Salient Features

- * Indigenous locally available material utilized
- * Requires less ground preparation
- * Can be operated intermittently for four hours with a break of 10 minutes before subsequent operation.
- * Noise free operation.
- * The system can be utilized at any location including entry location for Sanitization of vehicles.

System is being deployed in local hospitals in Ahmednagar where quarantine facility has been established and at few Army Units where there is a large ingress and egress of personnel. Also certain areas where there is a movement of sizeable number of people, viz., District Collector's Office complex, Ahmednagar.

Quarantine Facility

To fight pandemic COVID-19, VRDE has reorganised one of its buildings to be utilized as 50-bed quarantine facility for Ahmednagar District.

Salient Features

- * Two independent toilets and four toilet-bathroom combo for patients
- * Eight independent beds for nursing staff on 1st/2nd floor with independent toilet bathrooms
- * Independent entry/exist to this facility from separate gate. No civilian contact
- * Patient bus/ambulance can be directly brought to facility
- * Inspection room at entry gate point of facility
- * Isolated building. No residential/technical building within 1.5 km vicinity
- * Standby generator set along with routine electric supply
- * 2000 litres capacity overhead water tank and 4000 litres ground water tanks.
- * Centralized CCTV with control room on 1st floor to monitor patients
- * Centralized fire alarm systems



Quarantine Facility

Protective Face Shield

Research Centre Imarat (RCI) Hyderabad, TBRL, Chandigarh and HPO-1, DRDO HQ, New Delhi has developed face protection shields for health care professionals and security forces handling COVID-19 patients. All the designs are lightweight and having negligible aerosol movement at face to

minimize contamination from direct splash and sneezing.

The designs use various types of visors/sheets. While RCI & TBRL designs use commonly available A4 size OHP sheet for face protection, the two designs made by HPO-1 (self and jointly developed with WIPRO-3D) uses ear to ear length FDA approved 21CFR10/2011 compliance coated polyesters films and PVC/PC for better optical visibility. The harness, the holding frame is initially prototyped using Fused Deposition Modelling (additive manufacturing). Polylactic acid filament has been used for 3D printing of the frame. The thermoplastic is derived from renewable resources such as corn starch or sugarcane and is biodegradable.

The face mask is being mass produced using injection moulding technique at Delhi, Chandigarh, Hyderabad and Bengaluru. A total capacity of approximately 2 lakh units of face shields per day has been created within short span of time to meet urgent requirements. Approximately, 30, 000 units of face shields have already been distributed to AIIMS, RML, Safdarjang Hospital, Delhi Police, Punjab Police, PGIMER, Chandigarh & ESIC and DRDO Apollo Hospital in Hyderabad. The industries thus developed by DRDO have till date catered approximately more than 70,000 face shield requirements pan India.



Protective Face Shield

COMBAT AGAINST COVID-19

DRDO LABS HELPS IN TESTING & DIAGNOSTIC OF COVID-19

DIBER JOINS NATIONAL HEALTH MISSION

In view of recent rise in the COVID-19 cases in Uttarakhand, a call was given by National Health Mission Uttarakhand to strengthen the existing diagnostic medical facilities at Govt Medical College, Haldwani. Defence Institute of Bio-Energy Research (DIBER), Haldwani, promptly rose to the occasion and is working 24x7 with the team of VRD Lab of Govt Medical College since 26 March 2020. All the tests are being carried out as per SOPs of Indian Council of Medical Research (ICMR). DIBER has also extended the infrastructure support by providing its calibrated functional CFX-96 RT-PCR machine and necessary peripherals to the Govt Medical College.



DIBER scientists at work for detection of COVID-19 at Govt Medical College, Haldwani

DRDE CHIPS IN AS DETECTION CENTRE

DRDE, Gwalior is functioning as a Centre for Detection of COVID 19 positive cases from samples provided by Madhya Pradesh Health Service. DRDE has potential to perform confirmatory test akin to NIV, Pune.



COVID-19 testing at DRDE

NPOL DISTRIBUTES HAND SANITIZERS & READY-TO-EAT FOOD

Naval Physical and Oceanographic Laboratory (NPOL), Kochi, distributed 1500 litres of sanitizers packed in 100 ml bottles to various agencies in Kochi including Kochi Police, Southern Naval Command, District Collectorate and Excise Division for their personnel deployed on field. Alcohol-based hand rubs/sanitizers were prepared in-house at NPOL in accordance with WHO guidelines.

Shri S Vijayan Pillai, Director, NPOL, handed over around 4000 Ready-to-Eat food packets, developed by sister DRDO laboratory, DFRL, Mysuru, to Hon'ble Minister for Agriculture, Kerala. These are specially made, high nutrition, long shelf-life food packets of various types, and will be useful for personnel working continuously on field with little time to spare.



Shri S Vijayan Pillai, Director, NPOL, handing over Ready-to-Eat food packet to Hon'ble Minister for Agriculture, Kerala (right)

DIBER TRANSFERS TECHNOLOGIES OF HERBAL FORMULATIONS/PRODUCTS AND IN VITRO CULTURE OF *OPHIOCORDYCEPS SINENSIS*

Defence Institute of Bio-Energy Research (DIBER), Haldwani signed Licence Agreement for Transfer of Technology (LATOT) of anti leucoderma herbal formulation, anti toothache herbal solution, anti eczema herbal product and in vitro culture technology of *Ophiocordyceps sinensis* to SRB Agrotech, Anand, Gujarat. Dr Madhu Bala, Director, DIBER, handed over the LATOT document to Shri Vaibhav Patel, CEO, SRB Agrotech during a ceremony attended by technology developers and other scientists at DIBER on 10 February 2020.

The ToT of anti leucoderma herbal formulation, anti toothache herbal solution, anti eczema herbal product and in vitro culture technology of *Ophiocordyceps sinensis* is non exclusive in nature and have been earlier transferred to M/s International



Dr Madhu Bala, Director, DIBER, handing over LATOT to Shri Vaibhav Patel, CEO, SRB Agrotech

Herbal Corp., Haridwar and BIPHA Drug Laboratories, Kottayam. All four products are unique in nature. The anti leucoderma herbal formulation and anti eczema are the only known treatments for rare pathologies of leucoderma and

eczema, respectively. Anti toothache herbal solution has shown promise over other competent remedies for toothache already available in market. Technology for in vitro culture of *Ophiocordyceps sinensis* is also one of its kind currently in Indian market.

EVENTS

INTERNATIONAL WOMEN'S DAY CELEBRATION

DRL, TEJPUR

Mrs Simmi Dayal, Zonal President, Army Wives Welfare Association, Gajraj Corps, graced the event as the Chief Guest. She encouraged the scientists, particularly women researchers, to take up challenging R&D activities for the users and the nation. Dr SK Dwivedi, Director, Defence Research Laboratory (DRL) welcomed the guest and emphasized the importance of women in research especially for Defence Sector. Dr YD Bhutia, Sc 'D'



Dr SK Dwivedi, Director, DRL, presenting memento to the Chief Guest Mrs Simmi Dayal

briefed about the function. Dr Rama Dubey, Sc 'E' presented an overview of ongoing research activities at DRL and highlighted the role of women scientists leading to the significant contributions of DRL. The event was followed by a visit to the DRL Exhibition Hall where DRL Products and Technologies were showcased. Chief Guest also visited the laboratory facilities and took keen interest on the recent advancement of technologies of DRL.

LRDE, BENGALURU

International Women's Day was celebrated in Electronics and Radar Development Establishment (LRDE) on 11 March 2020. Ms Pamela Kumar, DG, TSDSI and Dr Smita Premchander, Founder and Secretary, SAMPARK (NGO) were the Chief Guests for the programme. Shri SS Nagaraj, Director, LRDE, presided over the function. The Chief Guests spoke on the achievements of women across the world. Director, LRDE, distributed prizes to the women employees who



IWD celebration at LRDE

won in various competitions organized as part of Women's Day Celebrations. The function concluded with cultural events by women of LRDE.

NMRL, AMBERNATH

International Women's Day was celebrated at Naval Materials Research Laboratory (NMRL) on 6 March 2020. Dr Hina Gokhale, former DG (HR), DRDO, graced the occasion as the Chief Guest. Dr M Patri, OS & Director,

NMRL, in his address highlighted the contribution of women employee of NMRL. Dr Hina Gokhale shared her thoughts and life experiences with the gathering. She laid a strong emphasis on gender equality, punctuality and ethics in her talk. On this occasion, poetry recitation and skit were presented with the theme of "Nari Shakti" by in-house talented women employees. First lady of NMRL distributed gifts to ladies working at canteen and NMRL garden.



Chief Guest Dr Hina Gokhale with Director NMRL and women employees at NMRL IWD celebration

NATIONAL SAFETY WEEK/DAY

CFEES, DELHI

National Safety Week was celebrated at Centre for Fire, Explosives and Environment Safety (CFEES) from 4 March to 10 March 2020 to create awareness, preventive culture, scientific mindset and a constructive approach to safety issues while working in chemical lab/hazardous atmosphere. Shri Rajiv Narang, OS & Director, CFEES, brought out the importance of celebration of safety week. He emphasized on integrating safety with all hazardous activities in the lab, SOPs for safe operation, disposal issues related to chemical waste and building a safety culture in the laboratory.

The activities conducted during the Safety Week included Safety Oath by all employees. Various competitions such as safety slogan, presentation by safety co-ordinators of various technical groups on safety initiatives in their groups/work places were conducted during the week.

Shri Lalit Gabhane, DG, NSC, Mumbai, delivered a lecture on "Mitigating Health & Safety Risks through Effective Leadership". Scientists from CFEES also gave lecture on "Occupational Safety" and "Safety Practices at Workplace".

The awards were also announced for the various competitions held in the Safety week. The week long celebrations were focused on sensitizing the employees on safe practices at work place, at all working levels for accident prevention. The celebration ended with a mock fire drill and demonstration of portable fire fighting equipment.

NMRL, AMBERNATH

49th National Safety Day was celebrated at NMRL on 5 March 2020. On this occasion, Director NMRL and employees took the pledge to maintain safety and healthy environment during and beyond the office hours.



Mock fire drill during National Safety Week at CFEES

Demonstration of fire safety gadgets and a mock drill for emergency fire extinguishing was also a part of the safety week. All departments were assessed for their preparedness towards safety and a trophy was given to Marine Biotechnology Department. A talk on "Laboratory Safety" was delivered by the guest speaker Shri JD Sharma, Scientific Officer 'F', BARC, Mumbai.

Exhibition of Personal Protective Equipment was the highlight of the celebration. Fire Standing Order Booklet was released on this occasion. A safety quiz competition was also organised to appraise the employees about the safety. The celebration ended with distribution of prizes to the winners of quiz competition.



Release of Fire Standing Order Booklet on National Safety day at NMRL

NATIONAL SCIENCE DAY CELEBRATIONS

ADE, BENGALURU

Dr S Venugopal, OS & Director, Aeronautical Development Establishment (ADE) presided over the programme. Shri Jagadish S, Sc 'F', presented NSD oration on "Multicore for Flight Control and Avionics: Need and Challenges". He covered the aspects of increased demands for computational power in Flight Control & Avionics Systems and hence the need for multicore. He brought out various challenges in terms of meeting stringent safety standards, available guidance for certification and industry support. He concluded by giving a brief description of Flight Control Architecture with Dual Core Processor and full-fledged Integrated Modular Avionics with Multi Core Processor.

Shri Jagadish was presented NSD Oration Medal and Certificate. Shri Sudhakara M, Sc 'F', Head (HR) presented the vote of thanks.



ASL, HYDERABAD

Advanced Systems Laboratory (ASL), celebrated National Science Day on 28 February 2020. Dr M Rama Manohara Babu, DS & Director, ASL addressed the gathering and stressed upon emerging technologies and recent developments in science & technologies.

Smt R Sheena Rani, OS, ASL delivered a talk on "Women in Science". She briefed about eminent

women in various field across the world. Dr S Rajesh Kumar, Sc 'E' delivered National Science Day Oration on the topic "Development of High Performance Polymers". Dr Kumar spoke on indigenous development of novel high performance polymeric materials for realization of high temperature airframes, radome and canisters for defence applications. The development of these novel high performance materials in India has helped in overcoming the problems of dependency, high cost and made us self-sustained and has met the objective of "Make in India".



CFEES, DELHI

Dr Amit Saxena, Sc 'E', delivered the National Science Day Oration on "Condensed Aerosol-based Fire Extinguishing Technology: A Promising Approach". His presentation was among the best three National Science Day Orations.

DMRL, HYDERABAD

Dr N Srinivasan, Sc 'G' delivered National Science Day Oration on "Dynamic Materials Modelling (DMM) in the Perspective of Deformation Science to Product Technology" at Tamhankar Auditorium on 28 February 2020. He presented a review of DMM, which proves it an efficient and alternative technique to expensive and time consuming experimental trail-and-

error techniques. As a part of technology development, the Thermo-Mechanical Processing (TMP) schemes based on DMM for the isothermal forging of Titanium 685 aero engine disc and for the grain refinement in nickel base super alloy 718 were presented along with their validation through industrial scale forging.



NMRL, AMBERNATH

National Science Day was celebrated at Naval Materials Research Laboratory (NMRL) with great zeal and ardour. Director, NMRL, Dr M Patri, addressed the NMRL community to pursue innovative and advanced science and technology work for the organizational empowerment. Science Day Oration medal was bestowed upon shri Vaibhav Verma, Sc 'E', for his talk on "Flow Battery for GWh Energy Storage for Defence Application". The afternoon session was arranged with various activities for students from nearby schools, viz., oration, science quiz and science project exhibit competitions. Seventeen schools participated in the events. All students were given participation certificate and the winners were awarded medals.



HEMRL CELEBRATES DIAMOND JUBILEE

High Energy Materials Research Laboratory (HEMRL), Pune celebrated its Diamond Jubilee on 1 March 2020. Dr G Satheesh Reddy, Secretary DDR&D and Chairman, DRDO was the Chief Guest and Shri MSR Prasad, DS & DG (MSS), DRDO, was the Guest of Honour at the function.

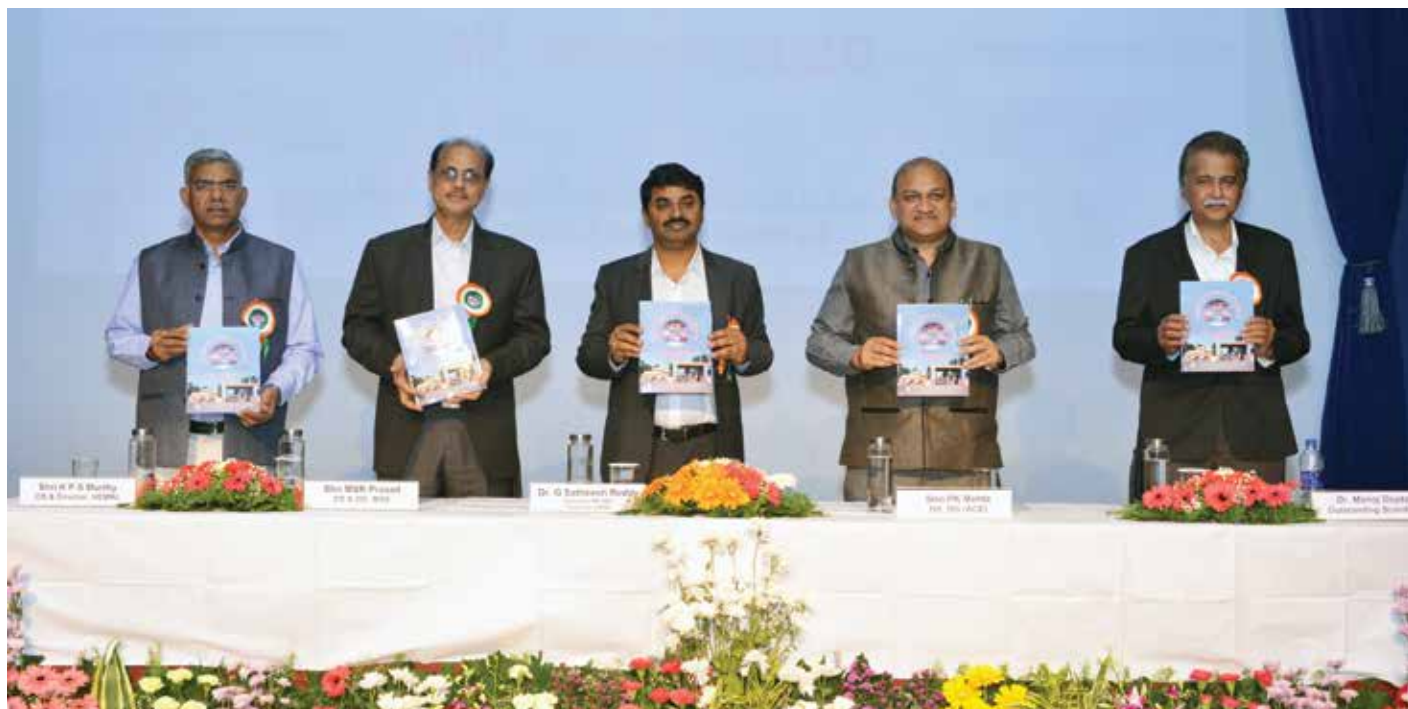
Dr Satheesh Reddy expressed his deep satisfaction on the achievements made by the laboratory during the 60 years and congratulated all the employees of HEMRL. In his address, Dr Reddy stressed upon the need for development of cutting edge technologies in the area of HEMs. He mentioned that merely the delivery of technology is not important but it is the timely delivery that is actually the need of the hour and the main requirement of the users. He also conveyed the faith bestowed by the Honourable Prime Minister of India on the capabilities of DRDO. He stated that it is the time to not only fulfil the requirements of the users today but to foresee the requirements

of the future and start working on its development today, so as to timely fulfil the same.

DG (MSS) in his address congratulated the employees and said that HEMRL has always fulfilled and surpassed in the performance demanded from its propellants, explosives and pyro devices. He recalled his long association with HEMRL during various developments which were technically challenging and at times seemingly impossible.

Shri PK Mehta, DS & DG (ACE) congratulated all the employees of HEMRL and appreciated the contributions made by HEMRL. He stated that having achieved self-reliance in the area of high energy and allied materials and technologies, HEMRL now should strive for becoming leader in this area. He has also appreciated the efforts made by the laboratory in the recent past to enhance its infrastructure and development of High performance gun and rocket propellants.

Shri KPS Murthy, OS & Director HEMRL, in his address recalled the vision of legendary scientist and former President of India, late Dr APJ Abdul Kalam of achieving self-reliance in critical defence areas by 2020. Paying homage to the legend, Shri Murthy stated that today HEMRL claims absolute self-reliance in the area of high energy & allied materials, by establishing production and processing technologies for various High energy systems and undiminished continuous support to the development of advanced armament systems. This puts HEMRL in the league of very few establishments that design, develop and produce High Energy Materials and all the allied substances within the country. To pay tribute to the chief architect of DRDO, his statue was unveiled by the Chairman, DRDO. On this occasion, several events like technical competitions & sports were organized. An open exhibition of HEMRL products & technologies was also organized.



Diamond Jubilee Celebrations—Release of book Trajectory of Technology Evolution

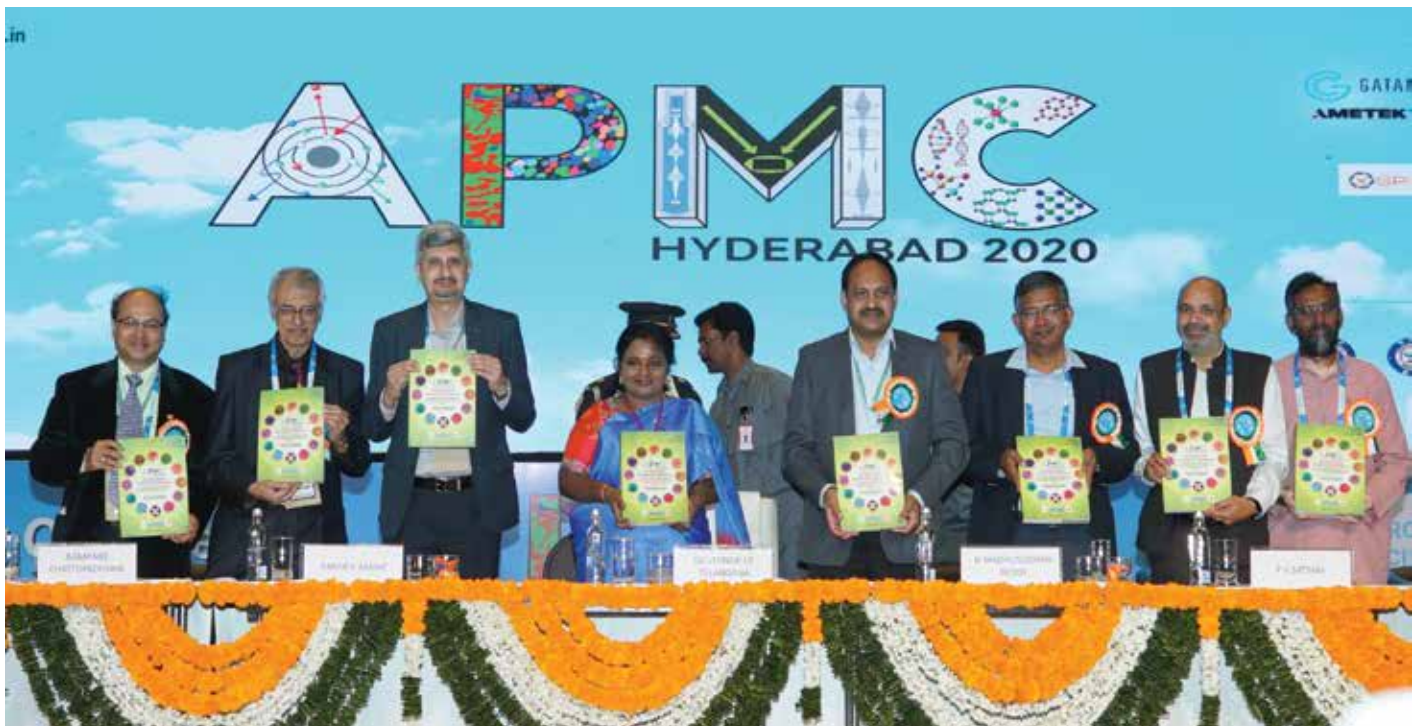
ASIA PACIFIC MICROSCOPY CONFERENCE 2020

Defence Metallurgical Research Laboratory (DMRL), Hyderabad organised the 12th Asia Pacific Microscopy Conference (APMC-2020) at Hyderabad International Convention Centre (HICC) during 3-7 February 2020 in conjunction with the 40th Annual General Meeting (AGM) of Electron Microscopy Society of India (EMSI). The conference was inaugurated by Her Excellency, Hon'ble Governor of Telangana, Dr (Smt) TAMILISAI SUNDARARAJAN. Dr Partha Ghosal, Sc 'G', DMRL and Chairman, APMC-2020, in his opening remarks

expressed that it was a rare opportunity for Indian scientists, researchers and especially students to interact with the world renowned experts in field of microscopy coming from over 18 countries around the world.

Dr Samir V Kamat, DS & DG (NS&M), DRDO, was the Guest of Honour. He gave a thought provoking speech and stressed about the usage of the microscope and its importance in the world of materials science. Dr G Madhusudhan Reddy, OS & Director, DMRL in his address stressed that any characterization and any invention

involves microscopy and DMRL is fortunate to take the lead role in organizing this mega event. Around 650 papers, 150 posters and numerous metallographs were presented by scientists, professors, researchers and students in the conference. Poster presentations and metallography contests were also organised as a part of the conference. The conference included a large scale industrial exhibition in which 70 different suppliers of Microscopes and Allied Techniques had participated.



Release of Conference Souvenir

READERS' VIEW

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

*The Editor, DRDO Newsletter
DESIDOC, DRDO, Ministry of Defence
Metcalfe House, Delhi-110054*



DRDO HARNESSING SCIENCE FOR PEACE & SECURITY

CHAPTER 4: MARCHING FORWARD

The article is 50th 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).

MATERIALS

Defence Materials, Stores Research & Development Establishment (DMSR&DE)

In the areas of fuels and lubricants, DMSR&DE focussed on developing synthetic oil-based lubricants and greases for use in land-based, sea and airborne systems over a wide range of temperatures. In electrochemistry, the activities of the laboratory resulted in the development of a large number of anti-corrosive materials for different kinds of recoil fluids for guns, coolants for vehicles, rust converters, corrosion inhibitors for submarine engine, and for ferrous and nonferrous components of diesel engine cooling systems of the Navy. A stop-off phosphating technique was developed for ambient temperature phosphatisation of small arms, which could be carried out by troops at the field workshop level.

In the area of textiles, DMSR&DE was responsible for the development of complete range of textile stores, including footwear for the Services. A major step was the introduction of cotton and polyester-wool blends for combat uniforms for comfort during extreme summer months and during the rest of the year, respectively. For combat duties, camouflage for green belt as well as for desert terrains in the form of disruptive printing in four shades or colours using dyes with high light fastness and wash fastness properties was prescribed.

The Laboratory's approach to Service materials preservation is multi-disciplinary for identification of the causes of deterioration and in the formulation of preventive measures.

A suitable preservative was developed for the prevention of microbial degradation of foam compounds used in extinguishing fires, an inhibitor compatible with aviation turbine fuel was developed after the contaminant microorganisms were identified, and microbiological tests were evolved for assessing the biodegradation of electronic components.

Anti-G suit – The Aero Bio-engineering Unit – This unit, later merged with DEBEL, took up in the 1970s, the import substitution of anti-G suit, which was being imported. The anti-G suit was a critical life saving for the pilots of combat aircraft. It protected them from the ill effects of G forces which they were subjected to during the manoeuvring of aircraft at high altitudes. These G forces tend to drain the blood from the brain to the stomach and to the legs, which resulted in the gradual loss of vision of the pilot and eventual blackout as well as mental and physical fatigue. The anti-G suit had to be designed to automatically apply pressure to the abdomen, thigh and calves in proportion to the forces experienced by the pilot and thus avoid the ill-effects. The Unit developed an indigenous anti-G suit that was similar to that imported by IAF but scored over the import in providing better comfort to the wearer in the hot and humid conditions prevailing in our country. The basic fabric in indigenous design was terycotton which had higher permeability and better water vapour diffusion properties than the nylon fabric used in the imported suits. After extensive physical evaluation in a human centrifuge, the item was accepted for introduction into the

Service. Subsequently, four versions of the anti G suit in five different sizes were developed to suit our air crew.

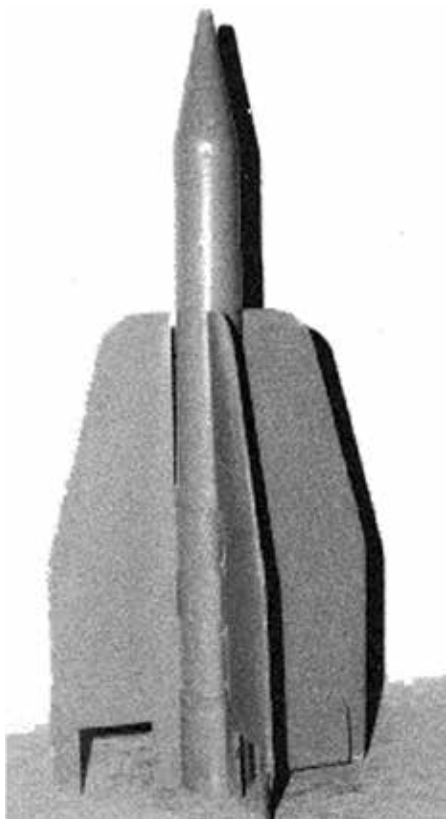
MISSILES

Defence Research & Development Laboratory

Defence Research & Development Laboratory (DRDL) is the nodal laboratory in DRDO for the development of rockets and missiles for defence. In 1956, a small team known as Special Weapons Development Team (SWDT) came into existence in the Defence Science Organisation with a complement of eight scientists and a few technicians to study the science and technology of rockets and missiles. In 1960, the Government of India approved the expansion of the team into a full-fledged laboratory and by 1961 the present laboratory, viz., Defence Research and Development Laboratory came into existence within the campus of the Defence Science Laboratory at Delhi. In 1962, the Laboratory was moved to Hyderabad where it was located in barracks and in rented accommodation.

During the 1960s, DRDL, which had a complement of 300 personnel that included 100 scientists and Service Officers, attempted the development of an antitank missile to meet the requirements of the Indian Army. A wire-guided antitank missile was developed and a total of 373 guided flights were carried out. In addition, 100 flight tests were conducted as part of user trials intended for evaluation by the Army. The development however, did not go into production. Apart from missiles, the laboratory also developed

indigenous rockets of diameter up to five inches and proved them in flight. Besides rockets and missiles, the laboratory undertook the development of missile components like gyroscopes and accelerometers.



Wire-guided anti-tank missile

In 1968, it was proposed to the Government of India that a study needed to be made by DRDO for indigenous support and replacement of the SA-75 medium range surface-to-air-missile system to progressively reduce the country's dependence on import from USSR. The study was conducted by DRDO and its findings were that indigenization was feasible, but in view of the very early stages of missile development in the country, indigenization without foreign assistance would have better chance of success with one-to-one substitution. The study further concluded that by such a step, detailed knowledge of all the design parameters of a proven missile would be available and in the process of development, the necessary infrastructure would also be built. In

the mean time, a consensus emerged that before actually embarking on the development programme of indigenising the SA-75 missile system, effort should be made to acquire technical know-how from other countries so that DRDO would start from a higher level.

There was more than eight month's gap between the time Dr Bhagavantam retired as Scientific Adviser and Dr BD Nag Chaudhuri assumed the office. Since he had already perceived missile as a force multiplier of high order and as a cost-effective weapon system, Dr Nag Chaudhuri identified it as one of the thrust areas for DRDO. On retirement of the incumbent Director of DRDL, the Scientific Adviser appointed a serving officer of the Indian Air Force as the Director. The newly appointed Director of the laboratory took as his immediate objectives, the massive task of building the infrastructure, technology development in two areas namely liquid propulsion and inertial navigation, and the development of the SA-75 surface-to-air missile system on a one-to-one substitution basis to improve our self-reliance.

Infrastructure Building: In establishing the infrastructural facilities, DRDO was guided by the engineering and technology involved in the current system, as well as those which were known to be under development and about which details were available. In the course of the next 10 years, DRDL would establish test facilities for aerodynamics, structures, electronics, telemetry, propulsion, control, fabrication of metal, rubber and fibre-reinforced plastics components, forging, non-destructive testing, and a computer centre. In the context of small budgets and limited free foreign exchange, such a tilt in diversion of resources from other disciplines attracted criticism within the Organisation about the wisdom of these investments when the current workload of the Laboratory did not warrant these. However, the Integrated Guided Missile Programme (IGMDP) that was launched in the 1980s and the quick start it got, justified the earlier investments. Liquid Propulsion

– The competence building activities on liquid propulsion were initiated in the 1960s. The development of liquid-fuelled engines for missiles continued throughout the 60s. However, with the sanction of the project for the development of SA-75 code named Devil, the activities got a boost with the surfacing of requirements for liquid fuel motors.

Simultaneously, a programme was initiated at Defence Science Laboratory (DSL) by Dr Nag Chaudhuri for the development of fuels for liquid propulsion. The first one was Unsymmetric DiMethyl Hydroxide (UDMH), the development of which was taken up as a challenge by the group of competent chemists of DSL. The Director, DSL, a physicist by profession, also relished the challenge and plunged forthwith into the programme. The chemists who worked in the programme even after 30 years recall with a sense of nostalgia, the leadership provided by Dr Bannerjee. The process was developed, initial laboratory testing was carried out on a small scale, after which a pilot plant for 20 kg was set up. It was later transferred to DRDL, Hyderabad where further work had to be carried out to improve the efficiency of the process and to reduce the pollution. The same group at DSL was entrusted in 1976 with the development of G-fuel for the missiles. In this case, a high explosives factory of the Ordnance Group was closely associated with DSL so that after proving the process at the laboratory scale, know-how was transferred. According to one chemist, who was involved in the development, the process of scaling up of the plant for operation by relatively less skilled personnel, was an eye opener and the scientists learned a good about the problems faced in the transfer of know-how. In this case, these were successfully resolved and regular production was established. The technology developed by the liquid propulsion group of DRDO paid handsome dividends in the IGMDP programme.

To be continued...



COURSE ON ENVIRONMENT AND NANO SAFETY

Centre for Fire, Explosive and Environment Safety (CFEES) organised a course on 'Environment and Nano Safety in DRDO Laboratories' under Continuing Education Programme (CEP) of DRDO during 17-19 February 2020. Eighteen participants from various DRDO labs including CFEES attended the course. The CEP provided an insight into associated risks and safety concerns in nano enabling technologies.

Starting with the understanding of environment safety in DRDO, the sessions covered the very important areas on 'safety evaluations of nanomaterials such as, regulatory challenges, nanomaterial in medicinal applications and risk in biological systems, toxicity concerns of nanomaterials, strategies for



environmental risk screening of engineered nanomaterials, nanomaterials synthesis challenges and safety concerns, safety concerns of fire and dust explosions, nano emission monitoring, fabrication of biotemplated

nanomaterials, risk assessment strategies for nanomaterials.

The participants found the talk and course content very useful for their R&D work at Labs in enhancing safety practices and preparedness.

COURSE ON PROCESSING AND APPLICATIONS OF ADVANCED CERAMICS AND COMPOSITES

A CEP course on "Processing and Applications of Advanced Ceramics and Composites" was organised at Defence Materials Research Laboratory (DMRL) during 18-20 February 2020. Dr Sarabjit Singh, Sc 'E', Course Director, welcomed the participants. Dr G Madhusudhan Reddy, OS & Director, DMRL delivered the inaugural address. Dr BVS Subba Rao, former Deputy Director, DMRL, delivered the keynote lecture on "Advance Ceramics for Defence Applications".

A total of 33 participants attended the CEP Course from DRDO laboratories namely DMRL, RCMA (Materials), DRDL, ASL, RCI, ARCI, DYSL-SM, GTRE, DFRL, NMRL and



ARDE. The lectures were delivered by eminent faculty from DRDO and ARCI, Hyderabad on a variety of topics like ceramics matrix composites, silicon

carbide single crystals for electronic applications, non-destructive testing, use of ceramics for investment casting process, applications of ceramics in

armour, etc. Visits to DMRL facilities were also organized to familiarize the participants about the lab scale processing of ceramics and composites.

VISITS

CFEES, DELHI

Dr G Satheesh Reddy, Secretary, Department of Defence R&D and Chairman, DRDO, visited Centre for Fire, Explosives and Environment Safety (CFEES), Delhi on 15 February 2020. Smt Nabanita R Krishnan, DG (SAM), DRDO, was also present during the visit. Dr Reddy reviewed various activities of CFEES as well as interacted with CFEES young scientists and DRTC personnels. CFEES Annual Report-2019 was released by Dr Satheesh Reddy and DG (SAM).

Dr G Satheesh Reddy being briefed about CFEES technology 



DMRL, HYDERABAD

Vice Admiral N Sreenivas visited Defence Metallurgical Research Laboratory (DMRL) on 25 February 2020. He was briefed about the activities and the current R&D projects going on in the laboratory.

Vice Admiral N Sreenivas (left) being presented memento by **Dr G Madhusudhan Reddy**, Director, DMRL 