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A vertical image of a Brahmos missile being launched. The missile is white with black bands and is ascending vertically against a clear blue sky. A large, bright white plume of smoke and fire trails behind it, indicating a successful test fire.

BRAHMOS WITH MAJOR INDIGENOUS SYSTEMS TEST-FIRED SUCCESSFULLY

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BRAHMOS SUPERSONIC CRUISE MISSILE WITH MAJOR INDIGENOUS SYSTEMS TESTED

BrahMos supersonic cruise missile featuring Indian propulsion system, airframe, power supply and other major indigenous components, was test fired on 30 September 2019 from ITR, Chandipur. DRDO and BrahMos Aerospace jointly tested the missile for its full range of 290 km.

With the testing, the indigenous content in the formidable weapon has reached a high value bolstering India's defence indigenization and the flagship 'Make in India' programme.

Secretary, Department of Defence, R&D and Chairman DRDO, Dr G Satheesh Reddy and DG, Missiles and Strategic Systems, Shri MSR Prasad also congratulated the team DRDO and BrahMos for the successful launch.

DG, BrahMos, Dr Sudhir Kumar Mishra, Director DRDL, Dr Dashrath Ram and Dr BK Das, Director, ITR, coordinated and witnessed the entire mission and termed the flight test a landmark achievement in enhancing India's 'Make in India' capabilities.

Developed by India and Russia, the versatile BrahMos has been operationalised in the Indian Armed Forces with all the three services.


Hon'ble Raksha Mantri Shri Rajnath Singh congratulated team DRDO, BrahMos and industries for the successful mission.




DRDO INKS MOU WITH ISRO FOR GAGANYAAN

Defence Research and Development Organisation and Indian Space Research Organisation (ISRO) joined hands for development of human centric systems for the Human Space Mission to demonstrate ISRO's human space flight capabilities. A delegation of ISRO scientists, led by Director, Human Space Flight Centre (HSFC) Dr S Unnikrishnan Nair, signed a set of MoUs with various DRDO labs on 17 September 2019 for proffer technologies for human centric systems and technologies specific to the Human Space Mission.

The MoUs were signed by Directors of DRDO's Aerial Delivery Research & Development Establishment (ADRDE), Defence Food Research Laboratory (DFRL), Defence Bio-Engineering and Electro Medical Laboratory (DEBEL), Defence Laboratory (DL), Centre for Fire, Explosives and Environment Safety (CFEES), Defence Institute of Physiology & Allied Sciences (DIPAS) and Institute of Nuclear Medicine and Allied Sciences (INMAS) in the



presence of Secretary, Department of Defence R&D and Chairman DRDO, Dr G Satheesh Reddy and DG (LS), DRDO, Dr AK Singh.

Speaking on the occasion, Dr Satheesh Reddy said, the technological capabilities existing in DRDO laboratories for defence applications will be customised to meet the requirements of the human space mission of ISRO. DG (LS) Dr AK Singh in his address said, DRDO is committed

for providing all technological support to ISRO for the human space flight preparation for which has already been initiated to meet the stringent timeline.

Some of the critical technologies, which DRDO would provided to ISRO include: Space food, space crew health monitoring and emergency survival kit, radiation measurement and protection, and parachutes for safe recovery of crew module.

INMAS SIGNS MOU WITH DUVASU

Institute of Nuclear Medicine and Allied Sciences (INMAS), Delhi and Pandit Deen Dayal Upadhyaya Pashu Chikitsa Vigyan Vishwavidyalaya (DUVASU), Mathura, UP, entered a MoU for efficacy and toxicity evaluation of INMAS developed products on animals available at DUVASU. Dr Tarun Sekhri, Director, INMAS and Dr (Prof.) PK Shukla, Registrar, DUVASU signed the MoU documents in the presence of Vice Chancellor Prof. GK Singh and senior faculties of both the institutions.

INMAS and DUVASU will support each other in translational research work in the form of joint projects for evaluation of drug formulations in laboratory animals.



RAKSHA MANTRI LAUDS DRDO'S EFFORTS FOR MAKE IN INDIA DEFENCE TECHNOLOGIES

Raksha Mantri (RM) Shri Rajnath Singh called upon defence scientists to strive for developing cutting-edge technologies indigenously to make India not only self-reliant in defence manufacturing but also global leader in the field. He was speaking at the inaugural session of the 41st DRDO Directors' Conference held during 15-16 October 2019 at DRDO Bhavan, New Delhi. Emphasising that research and maintaining operational superiority is the need of the hour, Shri Rajnath Singh said, the world is changing and advanced and disruptive technologies are emerging at a rapid pace. He called for developing 'indigenous innovation ecosystem' with less dependence on imported systems to achieve self-reliance in critical technologies.

"Development of technology should be cost-effective and time efficient," he added.

Stressing the need to bridge the technology gap for India to become a global leader in research and development, RM urged the scientists to focus on technologies that remain relevant for the next 15 to 20 years. "There are certain limitations in technology and there is a gestation period for development of products. It is possible that during the gestation period of complex systems, new technical requirements emerge. Spiral development should be given priority for such systems," he further said.

Suggesting an intense interaction between DRDO and all stakeholders, Shri Rajnath Singh urged scientists

to devise an action plan for excellence in Defence R&D that can take India to renewed heights in defence capability and said, with concerted efforts, India can become a technology exporter, which will have multi-dimensional benefits.

RM termed scientific knowledge, innovation, advanced technology, industrial infrastructure and workforce as 'currency' of modern times, adding that basic R&D in science and technology identifies new knowledge that can prove to be useful in both civil and military sectors. "Innovation brings investment and at the same time provides better value to investors. It contributes in establishing a win-win situation," he added.



RM PAYS TRIBUTES TO DR KALAM

Hon'ble RM paid glowing tributes to former President Dr APJ Abdul Kalam on his 85th birth anniversary and elucidated former President's contributions to the Space Research & Missile Development Programme, which helped India among top countries in the world with cutting-edge technical capabilities. Shri Rajnath Singh garlanded the statue of Dr Kalam in the DRDO premises along with other dignitaries.

Echoing the words of Dr Kalam, "If you want to shine like a sun, first burn like a sun", RM exhorted DRDO scientists to strive for excellence in all their endeavours.



DIRECTORS' CONFERENCE

15-16TH OCTOBER 2019

DRDO BHAWAN, NEW DELHI

द्वारा भारत का सशक्तिकरण
LEADERSHIP FOR EMPOWERING INDIA



41^{वाँ} निदेशक सम्मेलन

15-16 अक्टूबर 2019
डीआरडी भवन, नई दिल्ली

41ST DIRECTORS' CONFERENCE

15th - 16th October 2019



L to R: NSA Shri Ajit Doval, COAS General Bipin Rawat, CNS Admiral Karambir Singh, CAS Air Chief Marshal RKS Bhadauria, and Secretary DDR&D and Chairman DRDO at the inaugural session of 41st DRDO Directors' Conference

Shri Rajnath Singh added that through initiatives such as 'Make in India', investment facilitation, skills enhancement, intellectual property protection and manufacturing infrastructure, the Government is leaving no stone unturned to make India a global manufacturing hub in near future.

Describing DRDO as the main centre for indigenous R&D, Raksha Mantri said, DRDO is committed to progressive enhancement of self-sufficiency in strategic defence systems and infrastructure. Raksha Mantri congratulated DRDO for achieving targets earmarked for 100 days and lauded the organisation for setting target to become fully self-reliant in the next five years. He commended DRDO for its vast contribution in providing direct and indirect employment and helping the people as well as Armed Forces personnel in far flung areas such as Ladakh.

National Security Advisor Shri Ajit Doval, Chief of the Army Staff General Bipin Rawat, Chief of the Naval Staff Admiral Karambir Singh, Chief of the Air Staff Air Chief Marshal RKS Bhadauria, Secretary Department of Defence R&D & Chairman DRDO Dr G Satheesh Reddy also addressed the august gathering. Raksha Mantri also launched new website of DRDO and released document on 'Policy on DRDO Patents' and three compendia on the occasion.

Secretary (Defence Production) Shri Subhash Chandra, eminent scientists and senior officials of Ministry of Defence were present on the occasion.

DARE TO DREAM INNOVATION AWARDS

Shri Rajnath Singh also gave away awards to winners of 'Dare to Dream' innovation contest organised by DRDO at the inaugural session of the conference. The objective of the contest was to unearth disruptive ideas and concepts in emerging technologies identified by DRDO for enhancing

defence capabilities. The award was in two categories, individuals and start-ups and carried 1st Prize of ₹ 5 lakhs, 2nd Prize of ₹ 4 lakhs and 3rd Prize of ₹ 3 lakhs for individuals and 1st Prize of ₹ 10 lakhs, 2nd Prize of ₹ 8 lakhs and 3rd Prize of ₹ 6 lakhs for start-ups, respectively.



PILOT-IN-LOOP TESTING OF ON-BOARD OXYGEN GENERATING SYSTEM CENTRIC INTEGRATED LIFE SUPPORT SYSTEM

Defence Bio-Engineering and Electro Medical Laboratory (DEBEL), Bengaluru has developed On-Board Oxygen Generating System (OBOGS) centric Integrated Life Support System to provide enhanced physiology protection to aircrew of fighter aircraft flying at high altitude. OBOGS replaces liquid oxygen system by utilizing bleed air from the aircraft engine and separating its components using molecular sieve (Zeolite) Pressure Swing Adsorption

(PSA) technology. The system consists of two molecular sieve beds with oxygen plenum to continuously provide breathing gas to aircrew. Use of OBOGS technology eliminates the logistic tail associated with liquid oxygen system, improves safety, reduces aircraft turn-around time, extends mission duration and significantly lowers operational cost.

DEBEL carried out the Pilot-in-Loop testing of ILSS in High Altitude Decompression Chamber

under simulated altitudes with test pilot of Tejas as the subject from 15 August 2019 to 6 September 2019. Performance of the system has been found at par with conventional oxygen system in use. The Pilot-in-Loop test has been demonstrated to Programme Director (CA) & Director, ADA in the presence of CE (A), CEMILAC, and representatives of RCMA(A/C), ARDC-HAL, DGAQA and ADA. The flight trials of the system will be carried out on Tejas PV-3 aircraft by the middle of next year.



Team ILSS with Programme Director (CA) & Director ADA

HINDI PAKHWADA CELEBRATIONS

CAS, HYDERABAD

Rajbhasha Pakhwada was celebrated at Centre for Advanced Systems (CAS) during 3-18 September 2019. Various competitions in Hindi were conducted by Rajbhasha Cell to mark the occasion. Employees from CAS, SSQAG and DSC participated in the competitions held in different categories. Hindi Day celebration was held on 17 September 2019. Shri Sanjay Khalane, Sc 'G', Hindi Officer, ASL graced the occasion as the Chief Guest. Shri Arvind Kushwaha, Sc 'D' and Shri Pramod Kumar Jha, Sc 'F', CAS conducted an informative workshop on how to use IT tools in Rajbhasha Implementation and Cyber security. Prizes were distributed to the winners of competitions by Director, CAS.



DEBEL, BENGALURU

Defence Bio-Engineering & Electro Medical Laboratory (DEBEL) celebrated Hindi Pakhwada from 29 August 2019 to 12 September 2019. Hindi Diwas celebrations and valedictory function was held on 16 September 2019. Shri Vikas Suryawanshi, IRS, Addl Commissioner of Income Tax, Bengaluru was the Chief Guest for the occasion. Dr Alka Chatterjee, Vice Chairperson, Rajbhasha in her welcome address highlighted the accomplishments of DEBEL on implementation of Hindi in official work. The Chief Guest spoke about the significance of learning Hindi and using simple Hindi in day-to-day work. Director, DEBEL and Chief Guest distributed the awards to the winners of

competitions held during the pakhwada and rolling trophies to the technical divisions who have done commendable work in Rajabhasha.



DESIDOC, DELHI

Defence Scientific Information and Documentation Centre (DESIDOC) organised Hindi Pakhwada 2019 during 13-27 September 2019. Various events in Hindi were organised during the Pakhwada. Dr Alka Suri, Director, DESIDOC, was the Chief Guest of the inaugural function. Smt Sumati Sharma, Sc 'G', Vice Chairperson, Rajbhasha, highlighted the accomplishments of DESIDOC on implementation of Hindi in official work. Dr Alka Suri spoke about the significance of using simple Hindi in routine work. Poem recital, essay writing, Hindi typing, debate, story telling, translation, speech to writing, poster making and extempore speech were organised. Awards and Certificates were distributed to the winners of the competitions organised during the pakhwada. Protsahan Yojna awards and certificates were also distributed.



DRL, TEZPUR

Defence Research Laboratory (DRL) observed closing ceremony of Hindi Pakhwada on 18 September 2019. Air Commodore Tejpal Singh, VM, AOC, Indian Air Force, was the Chief Guest on the occasion. Dr SK Dwivedi, Director, DRL, briefed about the R&D activities of the laboratory including the activities carried out by DRL at Air Force Station, Tezpur. Shri Pranab Kr Bordoloi, Assistant Director (Hindi), briefed about various competitions organised to celebrate Hindi Pakhwara. Chief Guest expressed his pleasure and wished that DRL would work with Air Force. He presented awards to the winners and inspired everyone to use Hindi in day-to-day official work.



ITR, CHANDIPUR

Hindi Day was celebrated in Integrated Test Range (ITR) on 16 September 2019. The programme was inaugurated by Dr BK Das, Director, ITR. In his inaugural address, Dr Das encouraged all to promote Hindi in every field and participate in large numbers in various competitions like essay writing, noting drafting, memoir, poem recitation, Hindi elocution, Hindi speech, knowledge in OL, Hindi slogan writing, etc. .

The closing day and prize distribution ceremony was organised on 1 October 2019. Dr Sushant Kumar Biswal, Assistant Professor (Hindi) Shailabala Womens' (Auto) College, Cuttack graced the occasion as a Guest



of Honour. He delivered a talk on the importance of the language Hindi and its use in Official purposes. Winners in the competitions and participants were awarded with prizes. On this occasion 'Pareekshan', a half yearly Hindi news bulletin of the Range, was released.



MTRDC, BENGALURU

Hindi pakhwada was celebrated during 10-25 September 2019 at Microwave Tube Research and Development Centre (MTRDC) for promoting use of Hindi in day-to-day official work. Hindi essay, Hindi extempore speech, noting, dictation and quiz competitions were organised separately for Hindi speaking and non-Hindi speaking category. Shri RN Bagdalkar, former Director (HR), Bharat Electronics, Bengaluru graced the valedictory ceremony as the Chief Guest and gave away prizes to the winners of Hindi competitions. Shri Bagdalkar, in his address asked everybody to follow Dhara 3(3) of Official Language Act. Dr SUM Reddy, Director, MTRDC, in his address congratulated all the participants and award winners. He said we should use Rajbhasha Hindi in our day-to-day activities. Dr R Seshadri, Vice Chairman OLIC, presented vote of thanks.



NPOL, KOCHI

Shri S Vijayan Pillai, Director, Naval Physical and Oceanographic Laboratory (NPOL) inaugurated the celebration on 16 September 2019. Various competitions like Hindi noting, drafting, translation and terminology, poem writing, essay writing, extempore speech, official language awareness test, Hindi typing, jam, quiz, 'Antakshari' and Hindi songs were conducted for the employees to promote wider usage of Rajbhasha in the laboratory. For employees of Underwater Acoustic Research Facility (UARF) of NPOL, Hindi handwriting competition was conducted at UARF campus Idukki. As part of the celebrations, an Official Language Exhibition, which displayed the activities and achievements of Rajbhasha implementation in NPOL and display of latest Hindi books and photo gallery of Rajbhasha activities held at NPOL were also organized. A speech competition was also conducted for students of class 8th and 9th of Bhavan's Varuna Vidyalaya, a joint venture of NPOL and Bharatiya Vidya Bhavan.

Winners of the competitions were awarded by Director, NPOL. 'Hindi Fortnight Rolling Trophy' was presented to the 'P' House. This was followed by the distribution of prizes with certificates to the children of the employees of NPOL who scored highest marks in Hindi language in CBSE examinations conducted in the year.



NSTL, VISAKHAPATNAM

Dr OR Nandagopan, Director, Naval Science and Technological Laboratory

(NSTL) said that Hindi is not the language of any particular state but is the language of the entire nation and therefore is the responsibility of every citizen to respect the national language. He urged scientists to present technical papers in Hindi as well. Various competitions like debate, dictation, essay writing, paper presentation, quiz, story-writing, translation, typing and poster making in Hindi were conducted in which 210 employees of NSTL participated.



O&M (AD RADARS) UNIT, BHUBANESWAR

O&M (AD Radars) Unit, celebrated Hindi Diwas and Hindi pakhwada from 14-29 September 2019. Various competitions were organized for Hindi speaking and non-Hindi speaking employees. Shri Niladri Roy, Sc 'G' & Chief System Engineer (CSE), O&M (AD Radars) spoke about the significance of Hindi Divas and urged all employees to use Rajbhasha in routine official work. He emphasized that everyone should try to communicate in Hindi as it plays a vital role in uniting people. Winners of various Hindi competitions were awarded during the occasion.



SASE CELEBRATE GOLDEN JUBILEE DAY

Snow and Avalanche Study Establishment (SASE), Chandigarh celebrated its Golden Jubilee on 1 October 2019 with great zeal and fervour. Shri Naresh Kumar, Director, SASE highlighted the major achievements of the Establishment during the past 50 years and briefed about the future goals. He conferred the lab-level DRDO and Cash Awards to meritorious personnel for their excellence in the service. Former Directors of SASE attended the function. They shared their experiences at SASE. Various sports events were organized and a cultural programme was presented by the employees and their families.



SILVER JUBILEE CELEBRATIONS OF BALLISTICS VIDYALAYA

Ballistics Vidyalaya completed 25 years of glorious existence. The school was established in Terminal Ballistics Research Laboratory, Residential Colony, Ramgarh in year 1994. Since then the Vidyalaya has been providing quality education to the wards of DRDO employees and residents of nearby villages. The school has always maintained 100 per cent pass percentage in CBSE Class 10th examinations since its inception, which is a testimony to its modern teaching system and congenial leaning environment.

Shri M Balakrishnan, former Director, TBRL and founder President of DRDO Educational Society was the Chief Guest of the occasion. The function was also graced by the Guest of Honour, Shri VS Sethi, former Director, TBRL. Mrs Harvinder Batra, Principal Ballistics Vidyalaya, highlighted the major achievements of the Vidyalaya.



The meritorious students and teachers were honoured with academic excellence awards by Dr Manjit Singh, Director, TBRL and President DRDO Educational

Society. A souvenir describing the inspiring journey of Ballistics Vidyalaya was released by the dignitaries.

52ND ENGINEERS' DAY CELEBRATION

ARDE, PUNE

Engineers' Day is celebrated on 15 September to commemorate the birth anniversary of Sir Mokshagundam Visvesvaraya, engineer par excellence and Bharat Ratna awardee. To commemorate the day, Armament Research and Development Establishment (ARDE), arranged a lecture by Dr BB Ahuja, Director, College of Engineering Pune on 16 September 2019. Dr Ahuja enthralled the audience with his talk on "Engineering for Change." A documentary film on Sir Visvesvaraya was also screened on this occasion. Dr V Venkateswara Rao, Director, ARDE, senior scientists, officers and staff attended the function.



Dr BB Ahuja delivering Engineers' Day talk at ARDE

ITR, CHANDIPUR

Dr BK Das, Director, Integrated Test Range (ITR) inaugurated the programme. In his inaugural address, he highlighted the contributions of the engineers towards the development of the nation and the world. A talk on "Artificial Intelligence: Engineering for Change" by Prof. SK Mohapatra, XIMB, Bhubaneswar was organised during the occasion. A souvenir containing articles written



Release of Souvenir on Engineers' Day at ITR

by ITR fraternity was also released. team organised the Engineers' Day Shri RK Behera, Sc 'G' and his programme.

BOOK EXHIBITION AT HEMRL

High Energy Materials Research Laboratory (HEMRL), Pune, Knowledge Centre organized a Book Exhibition during 25-26 September 2019 for scientific, technical, management and allied subject books. The Exhibition was inaugurated by Dr Manoj Gupta, OS. He expressed the importance of Digital Library and Librarian's role in digital age. The exhibition got overwhelming response and around 200 books were suggested by the users.



IEEE DAY CELEBRATION

Institute of Electrical and Electronics (IEEE) Day 2019 was celebrated in ITR, Chandipur on 1 October 2019. Dr BK Das, Director, ITR inaugurated the programme. Prof. RN Mohapatra, Texas A&M University was Guest of Honour on the occasion. He also delivered a talk on “Cognitive IoT” to the ITR fraternity. A membership drive for IEEE was carried out during the occasion. More than 150 Scientists and Technical Officers attended the program. The program was organised by Shri HK Ratha, Sc ‘G’, Shri PN Panda, Sc ‘F’ and Rajesh Kumar Sc ‘D’.



SWATCHH BHARAT ABHIYAN

ITR, CHANDIPUR

Swatchh Bharat Abhiyan was carried out at ITR on the occasion of 150th Birth Anniversary of Mahatma Gandhi with a motto of “Clean and Green ITR.” Dr BK Das, Director, ITR, briefed employees about the objective of the campaign and importance of maintaining a clean environment at the workplace. The cleanliness programme started with three teams with brooms, spades and dustbins. Waste material such as metallic wastes from fabrication activity, plastic materials, and other biodegradable wastes were isolated and collected at separate locations. Cleaning of wild vegetation was carried out around the identified building complexes. Bleaching powder was spread at places where water logging was observed to prevent growth of mosquitoes.

The cleaning activity was followed by a plantation programme. All employees took part in the activity. Saplings of fruit bearing plants were planted near the ITR Knowledge Centre.



NPOL, KOCHI

Naval Physical and Oceanographic Laboratory (NPOL) organized the “Swachh Bharat Abhiyan” on 2 October 2019 in accordance with the nationwide sanitation campaign towards ‘Clean India’ on the occasion of the 150th anniversary of Mahatma Gandhi.

Cleanliness drive was carried out at the premises outside the technical area mainly near the entrance and in ‘Varuna’ residential area under the auspices of the Works Committee.

In his inaugural address, Shri S Vijayan Pillai, Director, NPOL, highlighted the relevance of Mahatma

Gandhiji's dream of clean India and stressed that cleanliness drive is not to be treated as a drive for any particular day. Quoting the popular saying 'prevention is better than cure' he urged the need to adapt cleanliness throughout life and insisted all to try to avoid creating waste and the problems created because of uncleanness. Director also emphasized that cleanliness is our duty and responsibility to the larger community we belong to and to the nature as a whole. NPOL fraternity and their family members participated with great enthusiasm and team spirit.



WORLD STANDARD DAY CELEBRATION

World Standard Day 2019 was celebrated at ITR, on 14 October 2019. Shri PC Routray, OS, ITR inaugurated the programme. Shri Routray emphasised on the importance of standards not only in technology but in every sphere of life. Shri Subrat Panigrahi, Director, EQMS Bhubaneswar, was the invited speaker on the occasion and delivered a talk on smart living solutions. He covered various dimensions and their smart use in our lives. More than 100 officers and staff attended the programme.



BOOK RELEASE

Three monographs namely, "From Temples to Turbines: An Adventure in Two Worlds" by Dr VS Arunachalam; "Ultrahigh Strength, High Fracture Toughness Low-Alloy Steel: DMR-1700" by Dr G Malakondaiah & Dr P Rama Rao; and "Avionics Systems: Design, Development and Integration" by Shri PNAP Rao were released on inaugural day of International Conference ADMAT-2019 organised by DMRL Hyderabad during 23-25 September 2019. The Monographs have been brought out by DESIDOC, Delhi.



VENDOR INTERACTION WORKSHOP FOR GEM PROCUREMENT

Government e-Marketplace (GeM) is being used at the government offices to procure various items required for project activities and for reducing the lead time from Demand to Supply order. Creating awareness on the importance and advantages of procurement through GeM for both vendors and end users is of primary importance. As per GFR Rule 150, registered suppliers shall be boarded on GeM as and when the item or service gets listed. Many of the registered vendors with DEBEL are not aware of GeM procurement. To apprise vendors and facilitate them with GeM on-boarding, a One-day Workshop for Vendor Interaction on GeM



Procurement” was conducted by DEBEL on 4 October 2019. Shri HS Gowthama, Business Facilitator for Karnataka and Goa Region was the resource person for the workshop. Hundred and fifteen

representatives from various firms from Karnataka and other states participated in the workshop, which help them familiarize about procedure of GeM procurement and related issues.

WORKSHOP ON RESEARCH PUBLICATION IMPACT, DATA SCIENCE & R PROGRAMMING

Defence Scientific Information and Documentation Centre (DESIDOC), Delhi organised a two-day Workshop on “Research Publication Impact, Data Science & R Programming” during 12-13 September 2019. The workshop was a part of the ongoing Project, “Assessment of DRDO’s Research Publications Output.” The aim of the workshop was to address the different aspects of the bibliometrics tools, citation metrics, and analysis of the data with the help of R Programming language.

Dr Rajeev Vij, Sc ‘G’ welcomed the participants and briefed about the relevance of the workshop. Dr Alka Suri, Director, DESIDOC discussed different aspect of data and data science in R&D context. Prof. (Dr) Sujit Bhattacharya, Chief Scientist, CSIR-NISTAD was the



invited speaker. Live demonstration of Tableau, WoS, and R Programming was done. Twenty-five participants

attended the workshop. Shri Sudhanshu Bhushan, Sc ‘E’ and Shri Yogesh Modi, Sc ‘D’, conducted the programme.



SEMINAR ON APPLICATION OF AI IN DEFENCE MODELLING AND SIMULATION

Institute for Systems Studies and Analyses (ISSA), Delhi, as part of its Diamond Jubilee Celebrations organized one-day seminar on “Application of AI in Defence Modelling and Simulation” at Metcalfe House, on 9 September 2019. Officers from Indian Army, Air Force, Navy and DRDO labs/ests participated in the seminar.

The objective of the seminar was two-fold: to understand user’s perspective on role of AI in wargaming simulation and to explore how AI technologies can be used in defence modelling and simulation in general and in computerised wargaming in particular.

Dr Chitra Rajagopal, DG (SAM and R&M), inaugurated the seminar. Keynote Address was delivered by Lt Gen (Dr) RS Panwar (Retd). Director,



ISSA Shri SB Taneja gave an overview of the application potential of AI in wargaming domain. Lt Gen Panwar and

Dr UK Singh, Director, CAIR, chaired two panel discussions, respectively.

PROGRAMME ON NAVAL OPERATIONAL AND TACTICAL DOMAIN

Institute for Systems Studies and Analyses (ISSA), Delhi in collaboration with National Maritime Foundation (NMF), New Delhi organized a three-day training programme on Naval Operational and Tactical domain for Systems Analysis, Modelling and Simulation at NMF. Twenty participants from ISSA and DRDO sister labs attended the training programme.



COURSE ON RADIATION SAFETY

Institute of Nuclear Medicine and Allied Sciences (INMAS), Delhi organized a three-day Continuing Education Programme (CEP) Course

on “Radiation Safety in the Use of Radioactivity in Animals” during 2-4 September 2019. Dr Tarun Sekhri, Director, INMAS inaugurated the

course. The introduction to the course content was provided by the Course Director, Dr Aruna Kaushik. A total of 23 participants from DRDO Life

Sciences laboratories who are actively involved in carrying out research using radioactive sources/ionizing radiation for various animal experiments were trained in the radiation safety aspects.

The purpose of the course was to provide training on the safe handling of radioisotopes while working with radioactive sources for their research work. The participants were sensitized on the scope and need of safe work practices while handling radioactive sources. The course had number of practical sessions, demonstrations, interactive sessions and discussions.

The lectures were delivered by internal and invited external faculty from AIIMS, Delhi; Army Hospital R&R, Delhi; Defence Laboratory, Jodhpur and Regional Centre, BRIT,



Delhi. The course ended with a panel discussion on handling of animals exposed to radiation. The valedictory

address was delivered by Dr Anil K Mishra, Head, Division of Cyclotron and Radiopharmaceutical Sciences, INMAS.

COURSE ON COMBATING NEUROLOGICAL DISORDERS: APPROACHES AND METHOD

The armed forces all over the world are combating a spectrum of neurological disorders which significantly impact psychological and psychiatric dimensions leading to the cognitive and behavioural abnormalities. The burden of these neurological diseases becomes substantially higher in developing countries due to the lack

of awareness about the nature of these ailments. INMAS organised a three-day CEP course entitled “Combating Neurological Disorders: Approaches and Methods” during 17-19 September 2019 to provide comprehensive information about neurological disorders with a focus on the perspective of defence personnel.

The course sensitized the concept of ‘Track-Treat-Train-Educate’ about neurological diseases. The course was attended by 23 participants from different DRDO labs attended the course.

Dr Anupama Datta, was the Course Director and Dr Ankur Kaul was the Deputy Course Director.





COURSE ON LATEST TRENDS IN VIDEO & PHOTOGRAPHY

A CEP course on “Latest Trends in Video and Photography” was organised by Integrated Test Range (ITR), Chandipur, during 16-20 September 2019. Dr BK Das, Director, ITR inaugurated the course. Prof. SK Sahu (Retd), BPFT Institute, Cuttack was the Guest of Honour at the inaugural function.

The course aimed at imparting knowledge and practical exposure on latest trends in video and still photography. Various topics related to the course such as metamorphosis of images, image sensor for digital cameras, latest technology in DSLR Camera, HD to 4k migration, professional display technology, codec and media–recording

and archiving, etc., were covered during the course. Distinguished faculties and experts from KIIT, BBSR, Nikon, India, Sony India, Camixel Technology and ITR, DRDO delivered the lectures and the practical demonstrations. Thirty-nine participants attended the course. The course was organised by Shri RK Dey, Sc ‘F’ and his team.



SOCIETAL ACTIVITIES

ORTHOPAEDIC CAMP

Gas Turbine Research Establishment (GTRE), Bengaluru organised an in-house Orthopaedic camp in collaboration with Hosmat Hospital, a renowned CGHS recognised orthopaedic hospital in Bengaluru for the benefit of its employees including contract employees. Services provided in the camp included: random blood sugar, blood pressure, bone mineral densitometry, orthopaedic consultation with spine and joint specialists and services of physiotherapist. Screening was done for insidious bone diseases like osteoporosis, osteoarthritis,



osteopenia, etc. Around 320 employees were benefited and many new cases were

diagnosed, early intervention and timely treatment were started.

READERS' VIEWS

(Your feedback is important to us as it gives scope for improvement and serve the organisation in a better way)

1. Name of the Establishment: _____

2. How would you rate the *DRDO Newsletter* as a medium to adequately present DRDO developments?

Excellent Very Good Good Fair Satisfactory

3. How would you rate the technical contents of the *Newsletter*?

Excellent Very Good Good Fair Satisfactory

4. How would you rate the quality of photographs in the *Newsletter*?

Excellent Very Good Good Fair Satisfactory

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The Editor, DRDO Newsletter, DESIDOC, DRDO, Metcalfe House, Delhi - 110 054





DRDO HARNESSING SCIENCE FOR PEACE & SECURITY

CHAPTER 4: MARCHING FORWARD

The article is 44th 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).

ENGINEERING

Research & Development Establishment (Engineers)

In 1971, the Army floated a GSQR for a universal assault boat (BAUT) with capability to carry 16 fully armed men, 2 crew and a cargo of 2000 kg. The GSQR also specified the load that two coupled boats and six to eight coupled boats would have to carry. The intention of the Army was to replace the current multiplicity of floating equipment used during the initial stages of an assault river crossing with one standard system. Accordingly, the BAUT was designed and fabricated using aluminium alloy sheets and extrusions in riveted/welded construction. Detachable links were provided for coupling the boats and suitable ramps with anti-skid surface were also developed for loading and unloading. Splash panels were attached to prevent water entering the boat when it was travelling at high speed. The boats could be propelled manually or by an onboard motor. The BAUT was accepted for introduction into service by the Army and a few thousands were manufactured.

Besides BAUT, R&DE (Engrs) had also designed other boats such as the Boat Reconnaissance 3 Men 2A which was a pneumatic rubber dinghy made of nylon fabric with neoprene coating on both sides. The boat could carry 3 fully armed men with stores or a distributed load of 340 kg at a free board of 254 mm. It could be propelled manually by one person with a pair of folding oars and collapsible rowlocks, or by an outboard machine of 6.5 HP power. The boat was provided with double nozzle foot pump

that could inflate it in about 7 minutes. The hull was cylindrical in shape with four buoyancy compartments and could retain buoyancy even with two (one on either side) punctured. The boat with accessories weighed less than 46 kg and in deflated condition, could be packed in 3 canvas bags. The boat had been introduced in service by the Army.

In response to the development of non-detectable mine and bar mine at ARDE in the 1970s, R&DE (Engrs) initiated activities for the development of a Mechanical Mine Layer (Fig. 4.23). It would provide mechanised laying of round non-detectable Mk I mines as well as bar mines in mine fields, which were the most vital and efficient obstacles against enemy armoured attack. The Mine Layer could lay mines on any type of terrain ranging from soft sandy or desert terrain to hardest soil of plains. The mines could be armed automatically and laid as fast as any other contemporary system available. These could be laid on the surface or at any mine depth not exceeding 250 mm below the surface. The average rate of laying was several hundreds per hour with a crew of four. It was simple to fabricate and simpler to operate and had a safety device in case of buried boulders in the soil. It was a pure mechanical contrivance with no hydraulic, pneumatic, or electric components. It was accepted by the Army for introduction into service and was manufactured.

Another important activity was the development of prefabricated shelters to provide living, storage and workshop accommodation in the plains, semi-mountainous regions, high altitude

and snowbound areas. The shelter was semi-cylindrical with a base width of 5 m, height of 4.6 m at the centre and a length of 10 m. The shelter was designed to withstand wind velocities up to 135 kmph and snow loading up to 60 mm depth over the roofing. The shelter could accommodate one 3-ton (4 x 4) lorry, one Amx tank or one 25 Pounder gun at a time.

For training of divers, a re-compression chamber was developed and transferred to Navy for use. The chamber was a single-compartment surface-type gas tight chamber which could accommodate 7 to 8 men at a time. The internal pressure could be increased or controlled to the working pressure of 7 kg/cm². Intercommunication facilities from inside the chamber to the outside, safety relief valves for emergency release of pressure and a chamber control panel with depth pressure gauges, control valves and external loudspeaker were also provided. For the Air Force, a chamber for high altitude indoctrination of pilots and aircrew was successfully developed and handed over to them for installation.

In the area of fire fighting equipment, a mechanical foam extinguisher was developed successfully. For combating fires involving reactive metals, a dry powder of special composition was developed and its commercial production was organised to meet the requirement of Defence Services. An indigenously developed fire extinguisher for use at high altitudes was developed. It was accepted for Service use. To meet the urgent requirement of the IAF and Civil Aviation, a fire crash tender was

successfully developed and cleared for bulk production. A number of other items of equipment developed by the laboratory to meet the requirements of Armed Forces personnel in difficult terrain and forward areas, were, pillow-type portable water tank, water purification set with a capacity of 13,500 litres which could deliver filtered and chlorinated water to troops from any natural source and survival kit for extraction of water.

Snow & Avalanche Study Establishment

Immediately after the formation of the Snow and Avalanche Study Establishment (SASE), Manali in 1969, the Establishment undertook systematic surveys on the Manali-Leh axis and later during winter of 1971, on the Srinagar-Leh axis. These studies culminated in a report recommending control measures to mitigate avalanche hazard along these two highways and kept these open for most times of the year. From 1971 to 1977, the Establishment steadily grew in terms of manpower, infrastructure and other facilities based on the recommendations of an Advisory Committee with the Engineer-in-Chief, Corps of Engineers, Indian Army as the Chairman. Some of the activities of this period include, avalanche forecasting based on simple and effective methods; artificial triggering of avalanches using weapons; de-icing of roads with common salt and calcium chloride; convening the First International Workshop on Snow and Avalanche in 1976 and organising the First Regional Training Seminar in 1978. Avalanche prediction initiated earlier on an experimental basis was expanded in 1981 to include areas of Jammu and Kashmir, Himachal Pradesh, Uttar Pradesh and a network of manned observatories up to a height of 6500 m were set up covering most of the areas in these three states to make avalanche forecasting more precise and timely. To encourage personnel to join these activities, Avalanche Pay was granted from 1978 to the personnel participating in this activity. Avalanche forecasting proved very useful in saving valuable human lives and by end of 1982, arrangements were made for broadcasting warning bulletins by AIR.

FOOD & AGRICULTURE

Defence Food Research Laboratory (DFRL) at Mysore, the Field Research Laboratory (FRL), at Leh, Defence Agricultural Research Laboratory (DARL) at Pithoragarh and the Defence Laboratory (DL) at Tezpur are the institutions in DRDO that are concerned with food and agricultural products.

Defence Food Research Laboratory

The activities of the Defence Food Research Laboratory (DFRL) are aimed primarily at developing operational and non-operational food and rations for the Armed Forces. The operational food and rations require special attention because these have to be provided both in bulk and in packs tailored to meet specific types of military operations, land-based and spaceborne, high altitude and extreme cold conditions. These have to be partially or wholly processed items requiring very little preparation before eating. The scientists had to bear in mind that the infrastructure relating to preservation of food in India for hostile environments was primitive in 1960s and unless the industry was upgraded, production of the processed foods developed by the Laboratory could not be manufactured and the benefit of their labour would not be available to the Services. Hence, side by side, with the development, upgrading of the plant, processes and hygiene at the producers had to be attended to.

Some of the early attempts of DFRL scientists were the development of lightweight 5-man composite pack rations with indigenous items of food, cocoa-based soft bar with coconut and banana flavours, lightweight flexible packs using paper/aluminium foil/polythene laminates for accelerated freeze-dried foodstuffs instead of tins. It was not a surprise that DRDO food scientists had the unique honour of supplying processed items of Indian dietary for the first successful Indian Everest Expedition led by Lieutenant Commander MS Kohli in 1964. Since then, the Laboratory has been supplying food items to nearly every expedition.

The activities of the Laboratory in 1970s were principally directed into three areas of processed foods, namely

frozen foods, dehydrated foods and ready-to-eat or retort process foods. As pre-cooked AFD meat was reported to have low acceptability in view of its woody texture, DFRL evolved a process to improve the quality of the freeze dried mutton. In the new process, the mutton was first deboned and defatted with a solution containing 10 per cent sodium tripolyphosphate with or without 1 per cent sodium chloride for two hours. Subsequently, it was cooked at 60 °C for three hours and then freeze dried in the normal manner. This was found to have better rehydration capacity, juiciness and acceptability. It was also observed that pretreatment with additives, such as agar-agar, native potato starch and a mixture of wheat gluten-autolysed yeast improved the quality and texture of pre-cooked AFD mutton. The second aspect was the developing of suitable flexible packaging to replace the tin containers which were expensive and heavy. A systematic evaluation of the suitability of various flexible packaging materials for packaging processed foods was undertaken. Out of the several materials selected and tested, a lightweight flexible pack, consisting of maplitho/aluminium foil/polythene with casein latex as laminating adhesive was found quite suitable for packing. The container had three components namely, a flexible pouch made of maplitho/aluminium foil/polythene to prevent entry of moisture and air, an inner liner to protect the pouch from damage by sharp edges of meat chunks, and an outer carton to protect the pouch from external damage. The shelf life of the flexible pack was the same as that of the tin container, i.e., 9 months but it was 25 per cent less expensive and 33 per cent lighter in weight. After extensive large-scale transportation trials including air dropping as well as User trials, it was accepted for introduction into the Services. DFRL also collaborated with a firm in the private sector to manufacture the flexible containers.

To be continued...



AWARDS

Information Scientist of the Year Award

Dr Rajeev Vij, Sc 'G', DESIDOC, Delhi, was awarded "Information Scientist of the Year Award" in recognition of his outstanding contribution to national and international academic research on librarianship and library profession development. He received the award during "International Conference on Knowledge Organisation in Academic



Libraries on Building Smart Libraries: Challenges and Discovery Tools" held during 12-13 September 2019 at Sardar Patel University, Anand, Gujarat.

HIGHER QUALIFICATION ACQUIRED



Smt Nishamol PA, Sc 'E', NPOL, Kochi, has been awarded PhD from Cochin University of Science and Technology in the area of Applied

Mathematics, for the thesis titled, "Exact Series Model of Transducers with a Stack of Solid or Hollow Axially Polarized Piezoelectric and Elastic Cylinders."

VISITS

DRDE, GWALIOR

Shri Rajnath Singh, Hon'ble Raksha Mantri (RM), visited Defence Research and Development Establishment (DRDE) on 20 September 2019. He was accompanied by Dr G Satheesh Reddy, Secretary, Department of Defence R&D and Chairman, DRDO and Dr AK Singh, DG (LS), DRDO. Dr DK Dubey, Director, DRDE, briefed the RM about the research activities, technologies and products developed and IPR generated as well as the future plans of the establishment.

RM visited the Chemical Facility of the establishment and was explained about its utility in synthesis of chemical warfare agents permitted for research purposes under the Chemical Warfare Convention (CWC). RM appreciated DRDE for the internationally recognised (OPCW designated) Vertox Laboratory for the verification of chemical warfare agents and toxins from environmental, biomedical and trace analysis.

DRDE developed and inducted into the Services products of chemical and biological defence were displayed to the RM. He was also demonstrated chemical agent detectors CAM and ACADA and their networking capabilities with CW stimulants. The oleoresin-based grenade used for riot control by security forces was also demonstrated.



RM being felicitated (top) and briefed about CW decontaminants at DRDE

DEBEL, BENGALURU

Dr G Satheesh Reddy, Secretary, Department of Defence R&D and Chairman, DRDO, visited the laboratory on 7 September 2019. Dr Guruprasad, DG (PC&SI), Dr AK Singh, DG (LS), Dr Sudhir Kamath, DG (MED&CoS) and Dr UK Singh, Director, CAIR, Bengaluru accompanied him during the visit. Dr Reddy reviewed the ongoing projects/activities of the lab. He emphasised on research in critical technologies and delivering state-of-the-art products to the Armed Forces.

DESIDOC, DELHI

Forty CRPF Officers from 1 Signal Bn CRPF, Jharoda Kalan, New Delhi visited Defence Scientific Information and Documentation Centre (DESIDOC) on 27 September 2019. They were briefed about the R&D activities and achievements of DRDO through video films. They were also briefed about the activities of DESIDOC and were taken around the centre to see different facilities available at DESIDOC.

ITR, CHANDIPUR

Shri KS Subramanian, Director General (Audit), CA&G of India, visited Integrated Test Range (ITR), on 23 September 2019. In his keynote address he emphasized on the audit cycle to be followed meticulously starting from planning, execution, reporting and follow-up action which should be carried out stringently so as to avoid any lapses on Audit point of view. Dr BK Das, Director, ITR, highlighted the need of awareness on audit in day to day official activities to avoid any lapse at proceedings. Shri DK Joshi, Director PXE, Chandipur and Dr BV Rao, Director ARDE, Pune were also present on this occasion. Dr BK Das felicitated Shri KS Subramanian with a memento. About 100 senior scientists and technical officers of both ITR and PXE laboratories of DRDO attended the programme.



Secretary, DDR&D and Chairman, DRDO being briefed about DEBEL technologies



Personnel of 1 Signal Bn CRPF at DESIDOC



Director General (Audit) delivering talk at ITR