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DEFENCE RESEARCH & DEVELOPMENT ORGANISATION

39th DIRECTORS' CONFERENCE

Envisioning Tomorrow
DRDO'S Perspective

23-24 September 2015

D R D O BHAWAN, NEW DELHI



CHIEF OF NAVAL STAFF

SECY DD R&D
& DG DRDO

RAKSHA MANTRI

CAS & CHAIRMAN
COSC

DEFENCE RESEARCH & DEVELOPMENT ORGANISATION
39th DIRECTORS' CONFERENCE
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23-24 September 2015
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Hon'ble Raksha Mantri Shri Manohar Parrikar releasing Compendium of DRDO developed Products with Export Potential

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Hon'ble Raksha Mantri addressing the august gathering

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Cover (from left): Admiral RK Dhowan, Chief of the Naval Staff; Dr S Christopher, Secretary Department of Defence R&D, DG DRDO; Shri Manohar Parrikar, Hon'ble Raksha Mantri; ACM Arup Raha, Chief of the Air Staff and Chairman Chiefs of Staff Committee at the inaugural function of 39th DRDO Directors' Conference

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Raksha Mantri inaugurates 39th DRDO Directors' Conference

Hon'ble Raksha Mantri Shri Manohar Parrikar addressed the inaugural session of 39th DRDO Directors' Conference held at DRDO Bhavan on 23 September 2015 and suggested DRDO scientists to concentrate on core activities factoring the defence technology requirements of the Armed Forces and involve industry in producing technologies developed by it. "Hand-hold the industry to make some products, which you may have developed", he said.

Complimenting DRDO Shri Parrikar said, close interface of DRDO with Navy in developing technology/products is well matured, DRDO should now develop similar level of interface with Army and IAF. Appreciating large scale technical manpower that DRDO has developed over the years, Shri Parrikar said DRDO can play an inspirational role in skill-development in the country across several fields, leading to job creation for the ever expanding youth population of the country. He also asked DRDO to avoid duplication or overlapping of activities for greater economic efficiency and urged scientists not to rest on laurels but seek greater heights in innovation and technology. There is a potential of one billion dollar worth of exports of technology products developed by DRDO in 2-3 years, he added.

The inaugural session was attended among others by Air Chief Marshal Arup Raha, Chief of the Air Staff (CAS) and Chairman Chiefs of Staff Committee, Admiral RK Dhowan, Chief of the Naval Staff (CNS), and Dr G Satheesh Reddy, Scientific Advisor to Raksha Mantri.

Speaking on the occasion, Air Chief Marshal Arup Raha, said our visionary forefathers had conceptualised DRDO as the prime instrument for gaining strategic independence for India through indigenisation and development of core/critical technologies, and DRDO has been able to achieve the objectives of self-reliance to a great extent. Lauding the success stories of missiles and radars, he urged scientists to treat disappointments as challenges and convert them into greater opportunities. Scientists should be driven by passion and that should not allow them to rest till the task is achieved, he added.



Emphasising on user's participation, CAS said, "DRDO has a great role to play in transformation process of the Armed Forces and mentioned that key issues should be jointly addressed by all the stakeholders. There should be a greater involvement of the three services and production agencies and a joint development roadmap. Transformation of Armed Forces into a strategic force with a multi spectrum capability will need to ride on the shoulders of DRDO. They will need to work together in a mission mode with result orientation bringing in more indigenisation through state-of-the-art equipment."

Dr S Christopher, Secretary Department of Defence R&D and DG DRDO, in his address, said the year 2014-15 was marked by a number of achievements in every technology cluster and the current value of production orders or Defence Acquisition Council (DAC) cleared systems from the DRDO stable stands at 1.79 lakh crores, which does not include strategic systems.

Technology for Near Isothermal Forging transferred

High pressure (HP) compressor disc forgings, made of titanium alloy, are critical rotating parts of Adour aero engines of the Jaguar aircraft and requires replacement after specified period of operations or if unacceptable damages take place during/before expiry of the life. The annual requirements of HP compressor disc forgings are high therefore warranted indigenisation. Defence Metallurgical Research Laboratory (DMRL), Hyderabad, in association with Mishra Dhatu Nigam Limited (MIDHANI), Hindustan Aeronautical Ltd (HAL) and Airworthiness Agencies, has developed technology for manufacturing disc forgings of all the five stages. Technology has been transferred to MIDHANI for bulk production. MIDHANI will use the isothermal forging facility at DMRL (on cost basis) for production.

DMRL has long pursued an intensive R&D on Rare Earth Permanent Magnet (REPM) which culminated into establishing process technologies for making three different classes of rare earth magnets, viz., SmCo_5 , $\text{Sm}_2\text{Co}_{17}$ and Nd-Fe-B. These magnets almost entirely cover the total spectrum of application engineering in strategic sectors. In an effort to 'Make in India' and thereby totally indigenise the production from mineral to magnet, the Indian Rare Earths Limited (IREL) plans to reduce the rare earth salts it sources from the beach sand mineral by acquiring the technology established by BARC and use this indigenous raw material to produce



L to R: Dr S Radhakrishnan, Dr Amol A Gokhale and Dr RN Patra signing the licensing agreements for transfer of technology

magnets in large scale by adopting the technologies developed by DMRL. This national efforts will create an indigenous source to meet the requirements of rare earth magnets for the strategic sectors in the first place and then gradually widen it to civilian sectors.

A licensing agreement for ToT for the two technologies was signed on 20 July 2015 by Shri M Narayana Rao, CMD, MIDHANI, Dr RN Patra, MD, IREL, Dr Amol A Gokhale, DS and Director, DMRL and Dr S Radhakrishnan, Director, Directorate of Industrial Interface and Technology Management, DRDO HQ, in the presence of Prof. P Rama Rao, Chairman, Governing Council, International Advanced Research Centre for Powder Metallurgy and New Materials; Dr N Eswara Prasad, Regional Director, Regional Centre for Military Airworthiness (Materials), senior managers and scientists from MIDHANI, IREL and DMRL.

Optical Target Locator deployed for Independence Day Security

The short-range Optical Target Locator, OTL300, developed by Laser Science and Technology Centre (LASTEC), Delhi, was deployed at Red Fort, Delhi, on 15 August 2015. Two units of OTL300 were deployed by Special Protection Group (SPG) and one by National Security Guard (NSG) for Prime Minister's security and area sanitisation during his speech from the rampart of the Red Fort. Users appreciated the performance of the equipment.



CFEES develops High Performance Magazine Structure with Blast Gauges



High Performance Magazine Structure

High performance magazine (HPM) is a concept of storing high capacity (5 ton net explosive content) explosive in a compartment. The concept is realised by incorporating non-propagating sandwich partition walls between adjacent compartments of the explosive storage building, which prevents sympathetic detonation of explosives/ammunition in case of detonation in one compartment. However, the structural integrity of the adjacent compartments is not assured and there is a possibility of delayed detonation. The HPM design addresses the need for ammunition storage in critical locations where land is not available.

Centre for Fire, Explosive and Environment Safety (CFEES), Delhi, has designed and developed specialised partition wall configured as sand-air-sand (2 m sand, 1 m air gap and 2 m sand), which not only reduces the intensity of blast overpressure but also offers significant resistance against the shock and fragmentation effects.

HPM compartments have discontinuous floors which mitigates the propagation of ground shock to adjacent compartments. The design of the non-propagation wall has been validated by blast trials. A broad spectrum of Ordnance (missiles, mines, bombs, torpedoes) can be stowed in the storage building made of HPM compartments. It also provides a better balance between operational requirements, explosive safety regulations, and economic considerations.

Salient Features

- ✘ No sympathetic detonation in adjacent compartments
- ✘ Reduction in QDs for HD 1.1 explosive storage units resulting saving in land
- ✘ Non-compatible ordnance can be stored in same building
- ✘ Improvement in operational storage efficiency

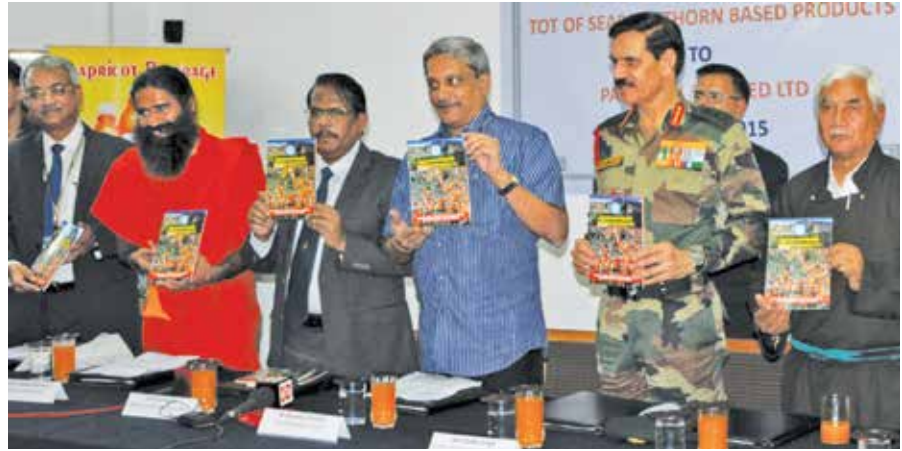
Dr Christopher lays Foundation Stone for the Advanced Laser Research Centre at LASTEC

Dr S Christopher, Secretary, Department of Defence R&D and DG, DRDO, laid foundation stone of Advanced Laser Research Centre at Laser Science and Technology Centre (LASTEC), Delhi, on 28 August 2015. The proposed centre would comprise a clean room and laboratory complex for high power laser, laser spectroscopy and laser counter measure technologies.

Shri GS Malik, OS and Chief Controller (RM & Imp), DRDO, Shri Ajay Singh, Chief Executive (DCWE), Shri Hari Babu Srivastava, Director, LASTEC, were present on the occasion along with the Directors of Metcalfe House-based DRDO laboratories.

Seabuckthorn-based Technologies transferred

Shri Manohar Parrikar, Hon'ble Raksha Mantri visited Defence Institute of High Altitude Research (DIHAR), Leh, on 23 August 2015. He was accompanied by Dr S Christopher, Secretary, Department of Defence R&D and DG DRDO; Gen Dalbir Singh, Chief of Army Staff; Dr Manas K Mandal, DG (Life Sciences); Lt Gen DS Hooda, Army Commander, Northern Command; Lt Gen SK Patyal, GoC 14 Corps and other dignitaries.



Shri Manohar Parrikar releasing technical bulletin on Seabuckthorn-based products

Hon'ble Raksha Mantri evinced interest in R&D activities being carried out for providing fresh food to defence forces and the local population of Ladakh. Five Seabuckthorn-based technologies were transferred

to Patanjali Ayurved Ltd during the visit. Hon'ble Raksha Mantri also released a technical bulletin on Seabuckthorn-based products during transfer of technology.

Ladakhi Kisan-Jawan-Vigyan Mela at DIHAR

Defence Institute of High Altitude Research (DIHAR), Leh, organised Ladakhi Kisan-Jawan-Vigyan Mela on 8 and 9 August 2015 to create awareness about various agro-animal technologies and herbal health supplements developed by DIHAR among local farmers and troops deployed in the region. The Mela was inaugurated by Lt Gen SK Patyal, SM, GOC HQ 14 Corps. Ms Vandana Kumar, IFA (R&D), IDAS, DRDO HQ, was the Guest of Honour of the inaugural function. Various competitions were organised among civilians as well as defence units during the Mela and the winners awarded.



Lt Gen SK Patyal and Ms Vandana Kumar inaugurating the Ladakhi Kisan-Jawan-Vigyan Mela at DIHAR

Over the years, Mela has grown in size and scope and evolved as a platform for interaction among farmers, troops and DIHAR scientists. It also facilitates dissemination of technologies developed by DIHAR in the remote and strategic Ladakh sector. Mela was also organised at

DIHAR Detachment at Partapur in Siachen Sector on 29 August 2015 which was presided over by Brig VMB Krishnan, Commander 102 Inf Bde.



MoU between DTRL and Jiwaji University

Defence Terrain Research Laboratory (DTRL), Delhi, and Jiwaji University, Gwalior, entered into a Memorandum of Understanding (MoU) to explore, extend and strengthen the functional relationship between national laboratories and universities by sharing facilities and expertise available with them.

Dr MR Bhutiyani, Director, DTRL and Prof. Sangeeta Shukla, Vice Chancellor, Jiwaji University signed the MoU on 1 August 2015 at Jiwaji University. The MoU will facilitate the scientific staff and research scholars of DTRL to register for PhD by Jiwaji University. DTRL will provide regular short-term training to the students of Jiwaji University. The MoU will be effective for a period of 10 years.



Prof. Sangeeta Shukla and Dr MR Bhutani signing the MoU

Data Centre Facility at DLRL

Dr CG Balaji, OS and Director, Defence Electronics Research Laboratory (DLRL), Hyderabad, inaugurated TIA 942 Standard Data Centre (DC) facilities at DLRL and ELSEC on 28 August 2015. The aim of establishing Data Centres at 15 km apart is to provide solution for Disaster Recovery Management System (DRMS), which provides recovery and operational continuity solution for the software application services hosted on network across DLRL and ELSEC and storage of information centrally. ELSEC DC will act as a disaster recovery in case of DC at DLRL fails and vice-versa. The centres have features like water leakage detection, smoke detection, fire alarm, rodent control, building management system, network monitoring system, etc.



Dr Balaji inaugurating the Data Centre Facility

KU Limaye Memorial Lecture at MTRDC

Seventh KU Limaye Memorial Lecture in the memory of late Shri KU Limaye, former CC R&D, DRDO, was delivered by Dr RV Narayana, OS and Associate Director, Electronics and Radar Development Establishment (LRDE), Bengaluru, on Radars Past, Present and Future on 17 August 2015. Dr BN Basu, former Head and Professor, Electronics Engineering Department, Institute of Technology, Banaras Hindu University, Varanasi, was the Chief Guest of the function. Shri N Sitaram, former DS and CC R&D (ECS), and Dr NP Ramasubha Rao, former Director, LRDE, were also present on the occasion.



Dr RV Narayana delivering lecture

Raising Day Celebrations

Naval Science and Technological Laboratory

Naval Science and Technological Laboratory (NSTL), Visakhapatnam, celebrated its 46th Lab Raising Day on 20 August 2015. Chief Guest, Dr V Bhujanga Rao, DS and DG (Naval Systems & Materials), DRDO, inaugurated the celebrations and lauded the multi-fold growth of NSTL right from its inception in 1969.

Shri CD Malleswar, OS and Director, NSTL, spoke on the need to change the way one works to adapt to the changing environment. He emphasised on the need for collective and focused efforts to overcome the challenges as the Lab transits from the tactical to strategic domain. The Director gave nutshell details of various successfully completed projects ongoing and new projects.

Laboratory-level DRDO Awards were distributed to meritorious employees. Personnel who completed 25 years of service in DRDO were also presented memento by the Chief Guest. On behalf of NSTL and NSTL Seva Samiti, Smt Kamalamalini Malleswar, first lady of NSTL, donated school bags to children of Wisemen Foundation, Kancharapalem and scholarships to 67 meritorious students who are studying in various schools of Visakhapatnam; A blood donation camp was also organized. Seventy-one employees donated blood on the occasion.



Shri CD Malleswar inaugurating the Raising Day function

Recruitment and Assessment Centre

Recruitment and Assessment Centre (RAC), Delhi, celebrated its 31st Raising Day on 23 July 2015. Prof. (Dr) DN Reddy, Chairman, RAC, showed his satisfaction over the performance of RAC in the past year. Shri Sudhir Gupta, Director, RAC, highlighted the achievements during the year 2014-15 and motivated the RAC family for enhanced continuation of their valuable efforts in the forthcoming year. A mobile-based App on updates for candidates was launched by Director RAC on the occasion. The annual Hindi magazine 'Chayanika' and annual e-Compendium were also released. Various cultural events like quiz, group songs, skit were organised to mark the occasion. Laboratory-level DRDO awards were distributed to the meritorious employees.



Prof. Reddy speaking on the occasion of RAC Raising Day

Research Centre Imarat

Research Centre Imarat (RCI), Hyderabad, celebrated its 27th Annual Day on 27 August 2015. Dr Rajiv Sharma, Chief Secretary, Government of Telangana was the Chief Guest. Shri T Narasimha Rao, Sc G, in his welcome address, highlighted various activities of RCI during the last 27 years. Shri G Krishna Rao, Sc G, Chairman Works Committee, presented various welfare measures carried out during the last one year.

Dr Rajiv Sharma, in his address, complimented RCI scientists and staff for development of various missile



डीआरडीओ न्यूज़लैटर



Release of RCI's women magazine Anmol

projects. He appreciated the immense contributions of RCI towards development of industries in Hyderabad resulting in a multiplier effect on the economy of the region. He emphasised on indigenous production of new and Hyderabad has a great potential for inviting investments, talent and manufacturing capabilities both in R&D as well as in production.

Dr G Satheesh Reddy, Scientific Adviser to Raksha Mantri and Director, RCI, stressed on the need to take

the lead and sustain global competitiveness. He asked to carry forward the legacy of great visionaries of the country and said that collective efforts can transform RCI as the global leader in avionics systems. Let all of us work together and rededicate ourselves in realisation of our future goals, he further added. Dr Reddy also advised to gear up for the next level of futuristic research and

bring in the much needed technological self-reliance in the country.

RCI's women's magazine, Anmol-2015, was released on the occasion. All meritorious employees were honoured by Shri Adalat Ali, OS, and Shri BHVSN Murthy, OS. The merit and welfare scholarships were also given to the children of RCI employees. Shri D Venugopal, Sc G, proposed the vote of thanks.

Raksha Mantri appreciates State-of-the-Art Facilities of TBRL

Hon'ble Raksha Mantri Shri Manohar Parrikar visited Terminal Ballistics Research Laboratory (TBRL) at Ranges Ramgarh, Panchkula, on 25 July 2015. Dr Manjit Singh, OS and Director, TBRL, apprised him of various activities conducted by TBRL. Shri Parrikar lauded the efforts of TBRL scientists in developing the technologies important for the security of the nation.

Raksha Mantri also appreciated the state-of-the-art facilities of the laboratory being used for evaluation of warheads, protective systems and other armament and aerospace systems of the country. He also interacted with the scientists and stressed the need for development of a lightweight bulletproof jacket for soldiers. Shri Parrikar also planted a sapling at the laboratory.



Manpower Development Activities

Conferences/Seminars/Symposia/Training Courses/Meetings

CEP on Embedded System Security

A course on Embedded System Security was organised by Centre for Artificial Intelligence and Robotics (CAIR), Bengaluru, under DRDO's Continuing Education Programme (CEP) during 10-14 August 2015. Smt Anshu Bharadwaj,

Sc E, Course Director, explained the objective of the course, which aimed at providing insight into different aspects of Embedded System Security to DRDO scientists.

The topics covered included: introduction to embedded system and architecture; threats to embedded system; security analysis of FPGAs and ASICs vulnerability and countermeasures; introduction to formal verification, etc.

Faculty for the course comprised experts from ISI Kolkata, IIT Bengaluru and IIT-Madras, Chennai and from Indian industry and scientist from CAIR.



Participants of course on Embedded System Security

The training covered the elements of process safety management, statutory provisions, methodologies and standards for an effective safety management system, safety audit and its components, tools like checklists and techniques for effective audit report writing. The course was participatory and entailed extensive mock audits by the participants.

Dr Chitra Rajagopal, OS and Director, CFEES, felt that implementation of knowledge gained in the domain area of process safety audit will lead to strengthening of safety management systems in the DRDO laboratories.

Training on Process Safety Audit

A training programme on Process Safety Audit was organised by Centre for Fire, Explosive and Environment Safety (CFEES), Delhi, during 28-30 July 2015 to train the participants for conducting an effective process safety audit. The faculty comprised members of expert panel from National Safety Council of India, Mumbai.



Training Programme on Process Safety Audit at CFEES



Workshop on Think Innovate and Make in India

Combat Vehicles Research and Development Establishment (CVRDE), Chennai, conducted a workshop on Think Innovate and Make in India to bring in new thoughts, concepts and innovations to nurture lateral and out-of-the-box solutions. Twenty-six technical papers were presented in the workshop. Poster, model and quiz competitions were also conducted.

Dr P Sivakumar, OS and Director, CVRDE, stressed the importance of pathbreaking research and the challenges faced in technological developments. Shri S Ramesh, Sc G, and Chairman of the Workshop described the workshop as initiative of its kind and need to organised more such workshops.



Dr P Sivakumar (second from right) releasing souvenir of the workshop

Hindi Workshop

Rajbhasha Co-ordination Committee of Defence Electronics Applications Laboratory (DEAL) Dehradun, organised a Hindi Workshop on *Vaigyanik Prarup me*



Dr (Ms) Vidya Singh conducting the Hindi workshop

Paribhashik Shabdawali ki Samasya on 28 August 2015. Dr (Ms) Vidya Singh, HoD, Hindi Department, MKP Mahavidyalaya, Dehradun, conducted the workshop.

Tamhankar Memorial Lecture

Indian Institute of Metals (IIM), Hyderabad Chapter, and Defence Metallurgical Research Laboratory (DMRL), Hyderabad, organised the 22nd Tamhankar Memorial Lecture on 29 July 2015. Shri S Ramakrishnan, Vikram Sarabhai Distinguished Professor and former Director, Vikram Sarabhai Space Centre, ISRO, delivered the lecture on MOM: Indian Foray into Planetary Exploration and Global Perspective.

Dr Amol A Gokhale, DS and Director, DMRL, and Chairman, IIM Hyderabad Chapter, presented a brief introduction of Dr RV Tamhankar. Shri Bapi Saha, Sc G, RCMA (Materials) and Secretary, IIM Hyderabad Chapter, introduced the speaker.

Shri Ramakrishnan gave an overview of the systems involved for the journey into the space stressing on the strategic importance of the Launch Vehicle System and its components. He recounted challenges faced during mission planning, launch vehicle and spacecraft production, and readying the support systems. He also shared the progress and current status of the mission. He went on to chronicle the growth of ISRO in developing world-class launch vehicle systems including Geo Synchronise Launch Vehicle (GSLV), Polar Satellite Launch Vehicle (PSLV), etc.



Shri S Ramakrishnan delivering lecture on Indian foray into Planetary Exploration and Global Perspective

Corporate Review of GTRE

An eight member committee under the Chairmanship of Dr CP Ramanarayanan, OS and CC R&D (HR), visited Gas Turbine Research Establishment (GTRE), Bengaluru, for the Corporate Review. Shri MZ Siddique, OS and Director, GTRE, gave an overview about the latest achievements in various ongoing projects and GTRE's performances on various corporate issues.

A detailed deliberation on various issues and requirements were made to the committee. Dr K Tamilmani, DS and DG (Aero), was also present on this occasion.



Shri MZ Siddique, Dr CP Ramnarayanan and Dr K Tamilmani at the Corporate Review of GTRE

Programme on Recent Advances in Breast Imaging

Institute of Nuclear Medicine and Allied Science (INMAS), Delhi organised a programme on Recent Advances in Breast Imaging on 4 September 2015 under the chairmanship of Dr RP Tripathi, OS and Director, INMAS. Dr CS Pant, founder and President of the Breast Imaging Society of India and Director Col. Pant's Imaging Centre was the Chief Guest for the programme. Dr Arvind Chaturvedi, Director Radiology, Rajiv Gandhi Cancer Institute and Research Centre was the Guest of Honour.

The aim of the programme was to focus on the latest developments in the field of breast imaging, which would be of immense value to both veterans in the arena as well as to the budding radiologists. This was presented by experts in the field of breast imaging from leading medical colleges and hospitals of Delhi.



Inaugural of the Programme on Breast Imaging

The CME was structured in an organized, step-by-step manner, beginning with the most basic topics pertaining to breast imaging such as mammography and ultrasonography and moving on to more complex areas such as elastography, tomosynthesis, image-guided interventions, MR, PET and quality assurance. The concluding session included a panel discussion, which highlighted key issues in breast cancer screening and evaluation.

Ninety-eight radiologists and radiology residents from leading medical colleges and hospitals of Delhi participated in the programme. Dr Rajeev Vij, Head HRD, Library, BFA and PRO, INMAS, coordinated the event and proposed the vote of thanks.

Course on Risk Management

Institute of Technology Management (ITM), Mussoorie, conducted a course on Risk Management in Projects from 10-13 August 2015 for senior level scientists of DRDO. The objective of the course was to acquaint scientists with fundamentals of risk management with emphasis on planning, identification, analyses, elimination and control of risk factors in system development projects.

Key areas of the course included risk handling in procurement management, risk breakdown structure, risk forecasting techniques, risk measurement and risk framework, etc. The course incorporated objective test, management games and outbound activity. Seventeen scientists from various DRDO laboratories attended the course.



Participants of course on Risk Management

CEP on Recent Trends in Signal Processing

Naval Physical and Oceanographic Laboratory (NPOL), Kochi, conducted a course on Recent Trends in Signal Processing under Continuing Education Programme (CEP) of DRDO during 27-31 July 2015. The course was aimed to update the knowledge of the participants on the latest trends and techniques in signal processing. Twenty-six participants from various DRDO establishments including NPOL, and BrahMos Aerospace, Hyderabad, attended the course.

The topics covered included: sparse signal processing, sensor array processing, multirate signal processing, radar signal processing, information theory and statistics, deep learning, computer vision, subnyquist approach in ultrasound imaging, DIFAR and AVS processing.

Course on Radar and Sonar Signal Processing

A CEP course on Radar and Sonar Signal Processing was conducted by Naval Science and Technological Laboratory (NSTL), Visakhapatnam, during 17-21 August 2015. The objective of the course was to appraise the participants about signal processing techniques used in a varied applications so that the participants can utilise the techniques in their own field of work.

Shri CD Malleswar, OS and Director, NSTL, inaugurated the course. Shri SM Bhawe, Sc G, Dr Arun Pachai, IIT Madras, Smt. M Vijaya, Sc F and Course Director and other senior scientists of NSTL were also present during the inaugural function.

Faculty from IITs, GITAM University, Electronics and Radar Development Establishment (LRDE), Bengaluru, NPOL, Defence Research and Development Laboratory (DRDL), Teknosarus Embedded Pvt Ltd., Bitmapper Technologies Pvt. Ltd., Mathworks Pvt. Ltd., and from NSTL delivered lectures on radar and sonar signal processing, compressive sampling, seeker signal processing, detection, estimation and post-detection processing, sonar signal simulator, image processing,

embedded system, etc.



Inaugural of course on Radar and Signal Processing

Course on Radar and Laser Cross-Section in Stealth Technology

A CEP course on Radar and Laser Cross-Section in Stealth Technology was conducted by NSTL from 31 August to 4 September 2015. The objective of the course was to share the knowledge and experience of scientists working in the field of Radar and Laser Cross-Section. Shri CD Malleswar, OS and Director, NSTL inaugurated the Course. Shri Debasish Chakraborti, Principal Associate Director, Shri PVS Ganesh Kumar, Sc G, Course Director and other senior scientists participated in the inaugural function.

The keynote address was delivered by Cdr K Kanagath (Retd), on RCS Signature Management for

Naval Ships. Experts from IIT-Delhi, Andhra University, NMRL, DMSRDE, LRDE, Bengaluru, Defence Laboratory, Jodhpur; LASTEC, Delhi; ADE, Bengaluru, National Aerospace Laboratories, Bengaluru and NSTL delivered lectures on electro-magnetics, computational electro-magnetics, radar absorbing materials, radar absorbing structures, rcs measurements, prediction, reduction studies and laser cross-section in stealth.

CEP course on Continuum Mechanics

Research and Development Establishment (Engineers) [R&DE (E)], Pune, organised a five-day CEP course on Continuum Mechanics during 24-28 August 2015. Twenty-seven participants attended the course. The course was inaugurated by Shri UR Gautam, Associate Director, Integrated Management Systems Group and Dr Makarand Joshi, Sc G, Head, Composites Research Centre, R&DE(E). Overview of the course was brought out during the inauguration. Topics covered during the course included tensor algebra, kinematics



CEP on Continuum Mechanics

of continuum, stress measures, balance laws, objectivity and constitutive modelling. The topics were covered in detail in tensorial frame work and physical interpretation of various objects. Dr S Guruprasad, Director, R&DE(E) highlighted the importance of the course in design and analysis applications.

Yoga Classes at Defence Electronics Research Laboratory



Lady employees of DLRL attending yoga class

Works Committee, Defence Electronics Research Laboratory (DLRL), Hyderabad, organised Yoga Classes from 13 July 2015 to 12 August 2015. Large number of employees attended the classes. Dr CG Balaji, OS and Director, DLRL, Dr B Ramakrishna Rao, Sc G, Chairman, Works Committee and Mr Qader Subhani, Vice Chairman, Works Committee, felicitated Ms Savitha Soni, Yoga Ratna, for conducting classes and bringing awareness about benefits of Yoga.

Swachh Bharat Abhiyan at Combat Vehicles Research & Development Establishment

Combat Vehicles Research and Development Establishment (CVRDE), Chennai, organised a programme on 7 August 2015 to plant saplings in CVRDE and residential areas of the establishment as part of the Swachh Bharat Abhiyan. Shri AM Datar, DG (ACE), DRDO, Dr CP Ramanarayanan, OS and CC R&D (HR), Dr P Sivakumar, OS and Director, CVRDE, and members of DRDO Corporate Body also planted the saplings.



Shri AM Datar planting sapling in CVRDE

Librarians Day Celebrations

Advanced Systems Laboratory

Advanced Systems Laboratory (ASL), Hyderabad, organised a one-day seminar on Library Services and Empowered Users to celebrate Librarians Day on 22 August 2015. Dr Tessy Thomas, OS and Director, ASL was the Chief Guest of the inaugural session. Dr SS Murthy former Director, Defence Scientific Information and Documentation Centre (DESIDOC), Delhi, and Dr Nitai Roychoudhury, Treasurer, Indian Association of Special Libraries and Information Centres, were Guests of Honour on this occasion. Shri J Ram Mohan, OS, Shri PVG Brahmanandam, Sc G and Shri Arun Kumar, Scientist 'G' of ASL were Special Invitees.

Shri Hemant Kumar, Head, Technical Information Centre, ASL, briefed about the seminar. Prof. LS Ramaiah, Librarian, Central Institute of English and Foreign Languages, Hyderabad, and Prof. S Sudarshan Rao, Emeritus Professor, Osmania University, enlightened the library professionals with the life and achievements of Dr SR Ranganathan.

Dr Tessy Thomas emphasised on the importance of Dr SR Ranganathan's five laws of library science even in the age of net-based services. She felt that the fifth law has led to new world of empowered library users and digital libraries can support to promote usage of

information technologies and Digital India Programme. She also emphasised that confidence, courage and innovation makes us to grow from strength to strength. Dr SS Murthy, in his address, said that the convergence of information technologies has given rise to empowered library users in all area of R&D.

As part of the seminar five papers were presented on various areas of library services, empowered users, Digital India Programme, etc. A Panel Discussion, chaired by Dr SS Murthy, Dr JN Satpathi, former President, IASLIC and Prof. V Chandrasekhar Rao, Dean (R), Dr BR Ambedkar Open University (BRAOU), was also held. Around 95 delegates attended the seminar. Shri Manoj Kumar Sahu, TO A, ASL, presented the vote of thanks.

Institute of Nuclear Medicine and Allied Sciences

Institute of Nuclear Medicine and Allied Sciences (INMAS), Delhi, jointly organised Librarians Day with Bharathidasan University, Tiruchirapalli, on 12 August 2015. In his keynote address, Dr Rajeev Vij, Sc F, INMAS, highlighted the contributions of Prof. Ranganathan to the library science and how his (Prof. Ranganathan) five laws of library science are still being followed.



Dr Tessy Thomas inaugurating the seminar on Library Services and Empowered Users



Dr Rajeev Vij delivering keynote address on Librarians Day

EMU R&D outshine in Mysore Horticultural and Flower Show



Dr Christopher with trophies won by EMU

Estate Management Unit (EMU) R&D, Bengaluru, participated in 55 categories in Mysore Horticultural and Flower Show conducted by Government of Karnataka and created history by bagging first prize in all the categories along with four Rolling Shields. EMU was awarded Special Outstanding Silver Mementos for the outstanding and brilliant show by sweeping all 55 first prizes.

EMU participated in 51 Ornamental and Vegetable Gardens and four Glass House events and received the

prizes in a function held at Lalbagh, Bengaluru.

Dr S Christopher, Secretary, Department of Defence R&D and DG, DRDO, in an event congratulated Shri Ajay Singh, Chief Executive, Directorate of Civil Works and Estates and Shri MVL Narasimha Rao, Estate Manager, and his team for the excellent achievement. The event was graced by DG (Aero), DG (ECS), Chief Executive (CW&E), CCE (R&D) South and Directors of Bengaluru-based DRDO laboratories.

Dr S Christopher lays foundation Stone for the new Aircraft Hangar

Dr S Christopher, Secretary, Department of Defence R&D and DG DRDO, laid the foundation stone for the new Aircraft Hangar for Airborne Warning and Control Systems (AWACS) at the Centre for Airborne Systems (CABS), Bengaluru, on 31 August 2015. Dr K Tamilmani, DS and DG (Aero) also graced the occasion.



Dr Christopher laying foundation stone for Aircraft Hangar for AWACS



Personnel News

Appointments

Director, DEAL



Dr RS Pundir has been appointed as Director, Defence Electronics Applications Laboratory (DEAL), Dehradun, wef 1 July 2015. Dr Pundhir joined DEAL in November 1983 as Sc B and rose to the level of Sc G in July 2008. Before joining as Director, he was heading RF Systems Group in the capacity of Group Director, responsible for development of RF systems for various projects. As Project Director, he lead a number of state-of-the-art projects like Development of Software Defined Radio (SDR) for Indian Navy (INDE-SDR), VLF Modulator and Receiver, Software Radio Development Programme (SRDP), and Secure High Data Rate VLF Receiver.

Dr Pundir obtained his postgraduation from the Meerut University in 1979 and was awarded Gold Medal for securing first rank. He completed his PhD from the University of Roorkee (now IIT Roorkee).

Dr Pundir has played a vital role in taking the DEAL to new heights in radio communication area to meet the requirements of the services. He was instrumental in design and development of Combat Net Radio for Armoured Fighting Vehicles CNR-AFV. This product was inducted into the services and was compared at par with the radios procured from foreign vendors.

He started his career as designer for Digital Tropo System, Meteor Burst Communication System and HF COMNET System under Integrated Guided Missile Development Programme (IGMDP). He has been responsible for design and development of different form factors of radios under SRDP. Using this elevated platform, a staff project for Integrated Development of INDE-SDR was undertaken. As Project Director, he was instrumental in design, development and user trials

of different form factors developed under this project. Under his leadership, Advance VLF receiver and modulator was not only designed but successful trials were also conducted. The product is under process of procurement by the services. He also got sanctioned a Secure High Data Rate VLF Receiver recently.

Dr Pundir has been Co-Coordinator for Low Intensity Conflict (LIC) activities at DEAL. Under LIC S-Band Satellite Terminal (MSS) has been developed and demonstrated to paramilitary forces. He is also heading Quality and Reliability Group and ensuring development of high quality products. He is ensuring that quality is imbibed in the product at the design level itself.

Dr Pundir has received many DRDO awards in recognition of his contributions towards design and development of various projects including Technology Group Award (2011) for development of VLF Receiver, DRDO Performance Excellence Award (2006) for development of Combat Net Radio for AFV Role, DRDO Technology Award (1996) for implementing ISO: 9001 in DEAL. He was also awarded a Commendation Certificate from SA to RM for the contribution in IGMDP in the year 1989.

He has to his credit a number of research papers published in international journals and in various conferences and symposia. He is a lifetime Fellow of IETE.

Director, DMRL



Dr Samir V Kamat, OS, Defence Metallurgical Research Laboratory (DMRL), Hyderabad, has taken charge as Director, DMRL wef 17 August 2015. Dr Kamat obtained BTech (Hons) in Metallurgical Engineering from IIT Kharagpur in 1985 and PhD in Materials Science and Engineering from the Ohio State University, USA in 1988 specialising in the area of mechanical behaviour of materials.



Dr Kamat joined DRDO at DMRL, as Sc C in 1989 and rose to the position of OS in October 2013. He has made significant contributions in the area of microstructure–mechanical property correlations in advanced materials such as particulate reinforced metal matrix composites, ceramic matrix composites, aluminium-lithium alloys, high strength aluminium alloys and titanium alloys which led to their development for various defence applications. His work on stress corrosion cracking (SCC) behaviour of ultrahigh strength 250 grade maraging and DMR 1700 steels resulted in the development of three layer coating system for protection of these steels against SCC failure in marine environment. The coating system has been implemented for protection of all rocket motor casings made out of 250 grade maraging steel used in various missiles being developed in DRDO.

Dr Kamat has also been instrumental in setting up state-of-the-art experimental facilities and expertise for characterization of mechanical behaviour of materials in small volumes, especially for materials used in MEMS. In recent times, Dr Kamat has made significant contributions to the development of Rare Earth Permanent Magnet (REPM) Technology in DMRL. Under his leadership, his team has developed high energy product $\text{Sm}_2\text{Co}_{17}$ magnets, ultrahigh temperature $\text{Sm}_2\text{Co}_{17}$ magnets and Gd substituted $\text{Sm}_2\text{Co}_{17}$ magnets with low temperature coefficient of remanence. These magnets are being supplied to various sister DRDO laboratories. A licensing agreement for ToT has been recently signed with IREL for transferring the REPM technology to Indian Rare Earths Limited (IREL) to set-up a 3000 kg per year plant to produce these magnets.

Dr Kamat has also been instrumental in initiating an MoU between DMRL, BARC, IREL and ARCI to launch a Mineral-to-Magnet programme to make the country totally self-reliant in this critical REPM technology. Several other advanced magnetic, ferroelectric and multiferroic materials, both in bulk and thin film form have also been developed under his leadership for the next generation sensor and actuator applications.

At DMRL, Dr Kamat has led the Advanced Magnetics Group, the Functional Materials Division, the

Materials Science-II Division, Research Council and Patent Examination Committee. At the national level, he has served as Chairman of Defence Technology Vision-2050 Materials Committee and Member of AR&DB Structures Panel; DST (SERB) Materials and Mining Panel; Committee on National Strategy for Rare Earths, National Security Council and National Task Force on Wind Energy, Planning Commission. He is currently, member of the Editorial Board of Defence Science Journal.

Dr Kamat has received the Indranil Medal by the Mining, Geological and Metallurgical Institute of India in 1986; DRDO Young Scientist Award in 1998; Binani Gold Medal (jointly) of the Indian Institute of Metals in 2006; the National Metallurgists' Day Metallurgist of the Year Award by the Ministry of Steel in 2008; the National Science Day Oration Silicon Medal in 2009 and the DRDO Scientist of the Year award in 2012.

Dr Kamat is a Fellow of the Indian National Academy of Engineering (INAE) and Institution of Engineers India (IEI), Life member of the Indian Institute of Metals, Materials Research Society of India, Magnetics Society of India, Society for Failure Analysis (and Chairman of the Hyderabad Chapter) and Indian Society for Structural Integrity. He has guided four PhD theses, and has more than 160 peer reviewed journal publications and as well as 35 technical reports to his credit.

Director, GTRE



Shri MZ Siddique, Outstanding Scientist has assumed the charge of Director, Gas Turbine Research Establishment (GTRE), Bengaluru wef 11 August 2015. Shri Siddique, is a Mechanical Engineer from Annamalai University. He joined GTRE, Bengaluru, as Sc B in the year 1988 after completion of one year fellowship programme on 'Gas Turbine Technology' from Institute of Armament Technology (IAT), Pune. He has also undergone one-year training programme at M/s General Electric, USA, during 1992-1993 on aero gas turbine engines.



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In his early career he was involved in design and testing of axial flow compressor systems. In the year 2007, he was appointed as Project Director, Kaveri engine. Under his able leadership Kaveri engine was successfully tested for simulated altitude conditions at Central Institute of Aviation Motors (CIAM), Russia. In the year 2010 Kaveri engine was successfully flight tested in the Flying Test Bed (FTB) at Gromov Flight Research Institute (GFRI), Russia. For this achievement, he was awarded DRDO Agni award for excellence in Self-reliance.

Director, HEMRL



Shri KPS Murthy has assumed the charge as the Director, High Energy Materials Research Laboratory (HEMRL), Pune, wef 1 August 2015. Prior to his appointment as Director HEMRL, he served as Associate

Director of Armament Research & Development Establishment (ARDE), Pune and successfully steered the design and development of warheads and fuze projects for rockets, missiles, torpedoes and bombs.

An IIT Kharagpur alumnus, Shri Murthy started his scientific journey with ARDE and made outstanding contributions in the design & development of warhead sub-system of various missiles such as Prithvi, Akash, Nag, Air Defence, Nirbhay, etc. He was instrumental in developing many advanced warhead technologies like detonation wave aiming, deep penetration, thermobaric warheads and high performance shaped charges.

He has successfully spearheaded several ToTs to Ordnance Factories and encouraged private participation in development and production activities. In his career spanning 27 years, he has pioneered and innovated Variable Mass Preformed Fragmentation concept for developing fragmentation warheads, tandem warheads for 3rd generation anti-tank missile system, penetration-cum-blast submunition warheads, fragment generator for ballistic missile defence (BMD) applications, directional blast and shaped charges for underwater application, novel pcb and TB ammunition

for MBT Arjun, 500 kg general purpose and pre-fragmented bombs, submunition warheads for rockets, pyro operated safety arming mechanisms, impact delay fuzes for various weapon system.

He has published more than 30 technical papers in reputed national and international journals, seminars and symposiums. There are four patents to his credit.

He is the recipient of many prestigious awards including: DRDO Award for Performance Excellence in 2012, DRDO Agni Award for Excellence in Self Reliance in 2009, DRDO Award for Path-Breaking Research/ Outstanding Technology Development in 2008, DRDO Scientist of the year Award in 2008, Dr Biren Roy Trust Award (AeSI) in 2007, DRDO Lab Level Technology Group Award in 2006, DRDO Agni Award for Excellence in Self Reliance in 2005.

He is a life member of Aeronautical Society of India (AeSI), High Energy Material Society of India (HEMSI) and Indian National Society for Aerospace and related mechanisms (INSARM). At present, he is leading the INSARM Pune Chapter as President and as Vice Chairman at the national level.

Technical Presentation

Dr D Vijay Rao, Sc F, Institute for System Studies and Analyses (ISSA), Delhi, made a technical presentation on Scientific Methods for Defence Assessment and Planning in the 2015 Defence Science and Technology



Lt Gen Takerngkarn Sri-am-pai, DG, DSTD presenting memento to Dr D Vijay Rao

Conference conducted by the Defence Science and Technology Department (DSDT), Bangkok, Thailand, on 18 August 2015.

Higher Qualification Acquired

DLRL, Hyderabad



Shri G Gopal, Sc D, has been awarded PhD in Mechanical Engineering by the IIT Madras, Chennai, for the thesis titled Shape Reconstruction of Metallic Pipes with Limited View Backscattered Data in Frequency Domain.

NPOL, Kochi



Shri Sanjeev Naithani, Sc F, Naval Physical and Oceanographic Laboratory (NPOL), Kochi, has been awarded PhD from the Cochin University of Science and Technology for the thesis titled Inversion Technique to Estimate Geoacoustic Parameters of the Seafloor Sediments based on Matched Field Processing and Beamforming.

RCI pays tribute to Dr Kalam

Research Centre Imarat (RCI), Hyderabad, paid reach tribute to Dr APJ Abdul Kalam by organising scientific assembly on 10 August 2015. Prof. D Balasubramanian, Director, LV Prasad Eye Institute, Hyderabad, delivered a talk on Biology of Music on the occasion. Eminent scientists and former Project Directors of Integrated Guided Missile Development Programme (IGMDP) including Shri RN Agarwal, Lt Gen (Dr) VK Sundaram, Dr VK Saraswat, Dr Prahlada, Rear Admiral (Retd) SR Mohan, Dr SK Salwan and many other close associates of Dr Kalam right from 1982 were present on the occasion and recalled their memoirs of Dr Kalam.

Dr Kalam's bust was unveiled at the residential campus near the faculty house of RCI where he used



Eminent missile and aerospace scientists and associates of Dr APJ Abdul Kalam on the occasion of unveiling of his bust at RCI

to stay as Director. Speaking on the occasion Dr G Satheesh Reddy, SA to RM and Director RCI said: "The great visionary's reminiscence and inspirational words will always remain green in hearts and will keep motivating scientific community for aspiring great heights and set new benchmarks in the years to come. The greatest tribute that we can pay to him is to fulfill his dreams and realise the vision he set for the country."



Sadbhavana Diwas

Integrated Test Range

On the eve of birth anniversary of late Prime Minister Rajiv Gandhi, Sadbhavana Pledge was administered to the employees of Integrated Test Range (ITR), Chandipur, on 20 August 2015. Shri MV Bhaskarachary, Officiating Director, ITR inaugurated the Communal



Harmony Fortnight. Debate, Essay, Drawing, Quiz, competitions were organised during 20 August 2015 to 3 September 2015. Prizes were distributed to winners in the valedictory function.

Proof and Experimental Establishment

Proof and Experimental Establishment (PXE), Chandipur, observed Sadbhavana Diwas on 20 August 2015 to promote national integration and communal harmony among all religions. Sadbhavana Pledge, both in Hindi and English, was administered to all employees. Shri R Appavuraj, OS and Director, Dr AK Sannigrahi, Additional Director, Shri KK Chand, Joint Director, Lt Col RK Nanda, Security Officer, and Smt Sushama Patra, Technical Officer C, spoke about the importance of Sadbhavana in human life. A video show and a debate on Sadbhavana was also organised

OBITUARY

Dr N Prabhakar, Distinguished Scientist, Chief Controller R&D, System Analysis and Modelling (SAM), DRDO, passed away in Bengaluru after a long illness. He is survived by his wife Uma and son Karthik.



Dr N Prabhakar
18 April 1954–15 August 2015

Dr N Prabhakar had been a Project Director AD (Mission), Programme Director Astra and Associate Director at DRDL. His contributions towards the indigenous Missile Programme were recognised by DRDO through the following awards: DRDO Scientist of the Year Award in 2001; Pathbreaking Technology Award in 2007; and

DRDO Performance Excellence Award in 2009. Besides, Dr Prabhakar was honoured with Astronautical Society of India Award for the year 2009 in Rocket and Related Technologies and National Aeronautical Prize for the year 2013. He was also awarded Padma Shri in 2015.

Dr N Prabhakar was the Fellow of Institution of Engineers (India), Operations Research Society (UK), and Aeronautical Society of India.

DRDO Newsletter pays it homage to Dr N Prabhakar for serving DRDO with great dedication and devotion.

Visitors to DRDO Labs/Estts

Centre for High Energy Systems & Sciences

Dr S Christopher, Secretary, Department of Defence R&D and DG, DRDO along with Dr Satish Kumar, DS and DG (MSS), DRDO, visited outdoor facilities of Centre for High Energy Systems and Sciences (CHESS), Hyderabad, on 25 July 2015. Shri Suranjan Pal, OS and Director, CHESS briefed Dr Christopher about Directed Energy Laser Systems and appraised him about technical achievements as well as various infrastructural facilities of the laboratory.

Dr Christopher also witnessed the live demonstration of the active imaging and precision beam pointing capabilities of an indigenously developed Brass Board module of 1 kW Fiber Laser-based Beam Director System onto a remote rotating UAV structural Panel (GFRP).



Maj Gen Sengar evincing keen interest in DEAL's product

achievements and infrastructure of the laboratory and appraised him about ongoing projects. Maj Gen Sengar appreciated high-end communication and surveillance systems developed by DEAL.



Dr Christopher being briefed about activities of CHESS

Defence Avionics Research Establishment

Dr S Christopher, Secretary Department of Defence R&D and DG DRDO visited DARE on 19 July 2015. Ms J Manjula, OS and Director, DARE, explained about the activities of DARE to Dr Christopher.

Defence Electronics Application Laboratory

Maj Gen AKS Sengar, YSM, VSM, Officiating DG MF, visited Defence Electronics Application Laboratory (DEAL), Dehradun, on 27 August 2015. Dr RS Pundir, Director, DEAL, briefed him about the technical activities,

Defence Electronics Research Laboratory

Ms J Manjula, DG (ECS), DRDO, visited Defence Electronics Research Laboratory (DLRL), Hyderabad, on 11 September 2015. Dr CG Balaji, DS and Director, DLRL, briefed her about the activities at DLRL. Shri OK Singh, Sc G alongwith project teams demonstrated technologies developed by DLRL to DG (ECS).



Ms J Manjula being welcomed at DLRL

Gas Turbine Research Establishment

Dr S Christopher, Secretary, Department of Defence R&D and DG, DRDO, visited Gas Turbine Research Establishment (GTRE), Bengaluru, on 31 August 2015. Dr K Tamilmani, DS and DG (Aero), DRDO,



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and MZ Siddique, OS and Director, GTRE, briefed Dr Christopher about the latest achievements in the engine development programmes. Dr Christopher witnessed the autonomous test run demonstration of the Kaveri engine and later visited the engine test cell.



Dr Christopher witnessing demonstration of autonomous test run at GTRE

Instruments Research & Development Establishment

Prof. PK Garg, Vice Chancellor, Uttarakhand Technical University, visited Instrument Research and Development Establishment (IRDE), Dehradun, on 4 August 2015. Prof. Garg was briefed about the activities of IRDE. Stabilized Electro-Optical System (SEOS) developed by IRDE was also demonstrated to the visitor.



Prof. Garg being demonstrated Stabilised Electro-Optical System developed by IRDE

Naval Physical Oceanographic Laboratory

Vice Admiral Sunil Lanba, PVSM, AVSM, FOC-in-C, Southern Naval Command visited Naval Physical

Oceanographic Laboratory (NPOL), Kochi, on 30 July 2015. Shri SK Shenoy, Director, NPOL, briefed the visitor about the project activities and products developed by the laboratory.



Vice Admiral Sunil Lanba being briefed about NPOL product

Recruitment and Assessment Centre

A group of 30 newly recruited Senior Technical Assistants (STAs) visited DARPAN Exhibition at Research and Assessment Centre (RAC), Delhi, on 29 July 2015 under two-week Orientation Programme organised by Centre for Personnel Talent Management (CEPTAM). A movie on DRDO's history and major achievements was shown to the visitors. They were also introduced with various career progress opportunities and entry level schemes for induction into Defence Research and Development Services (DRDS). Various queries by the visitors in this regard were addressed by senior RAC officials.



Visitors being briefed about the DRDO