DRDO NEWSLETTER

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FROM THE DESK OF THE CHAIRMAN

Dr S Christopher

CHAIRMAN
Defence Research & Development Organisation
&
SECRETARY
Department of Defence Research & Development

Dear Friends,

The importance of 'Brand and Image' building of DRDO is a continuous process. We have seen the brand DRDO touching new horizons in recent times. Maintaining the reputation and enhancing it further would require each one of us to burn midnight oil. This seems to be the right opportunity to obtain what we desire and reach our aim of making DRDO the top brand in the world. Nothing is impossible as inside us there is great strength to face new challenges and come out with flying colours. The entire country is watching us with great hope and it's our moral responsibility to keep that hope alive.

DRDO Initiative of Women Augmenting Services, 'DIWAS-2018', was organized with much fanfare to celebrate the International Women's Day at DIHAR, Leh. Women scientists have contributed immensely in all spheres of development in DRDO and niche a special place for themselves. Incidentally, with no representation in the top DRDO Management Council (DMC) two years back, it's heartening to note that today we have 33 per cent women scientists in DMC as against about 15 per cent of women scientists at all levels in DRDO, showing their tremendous progress and dedication. Well done and keep up the good tempo.

India Science Congress and Pride of India Exhibition-2018 held in Manipur made the North-East states realize the glimpse of our dedication to the nation. It would further nurture the hidden talent in seven sister states to join our esteemed organisation. "DefExpo-2018", being held in Chennai during April, would pave new paths for us to traverse and we are eagerly looking forward to its success.

In DRDO@60, 'DRUSE' has received good response, showcasing the Robotics talent of our country and I am sanguine, the top selected entries would be worth the efforts. This would further give a boost to our commitment for quality research and development in our primary role. It's noteworthy that the entire DRDO@60 events are being designed and organised by the Directorate of Public Interface (DPI), DRDO HQ, and Young Scientists of DRDO at Delhi Zone, showing a perfect professional approach.

Friends, we know the ill effects of global warming. It is our moral obligations to ensure that the lights and other electrical appliances are switched off, when not in use; it could be a great service to the mankind, apart from saving the electricity for use where it may be needed the most. Can we move towards a brighter future? Think...

Jai Hind

DRDO SUCCESSFULLY FLIGHT TESTS RUSTOM-2 IN USER CONFIGURATION

The flight assumes significance due to the fact that this is the first flight in user configuration with higher power engine.

DRDO successfully flew its Rustom-2, a medium altitude long-endurance (MALE) unmanned aerial vehicle, on 25 February 2018 at its Aeronautical Test Range (ATR) at Chalakere at Chitradurga. This flight assumes significance due to the fact that this is the first flight in user configuration with higher power engine. All test parameters were normal.

Rustom-2 is being developed to carry out surveillance and reconnaissance (ISR) roles for the armed forces with an endurance of 24 hours. The UAV is capable of carrying different combinations of payloads like synthetic aperture radar, electronic intelligence systems and situational awareness payloads.

Chairman DRDO and Secretary Department of Defence R&D (DDR&D) Dr S Christopher, Director General (Aeronautical Systems) Dr CP Ramanarayanan, Director General (Electronics and Communication Systems) Ms J Manjula and other senior scientists witnessed the test flight and congratulated the team Rustom.

The UAV has been designed and developed by Aeronautical Development Establishment (ADE), Bengaluru and aerospace major Hindustan Aeronautics Ltd and Bharat Electronics Ltd to fulfil the requirements of the Indian Army, Navy and the Air Force.

NAG READY FOR INDUCTION

Anti Tank Guided Missiles (ATGM), Nag, was successfully flight-tested on 28 February 2018 in desert conditions against two tank targets at different ranges and timings. NAG ATGM has been developed indigenously by DRDO. Flight tests of the missile have once again proved its capability. With this, the developmental trials of the missile have been completed and it is now ready for induction.

Director General (Missiles and Strategic Systems) Dr G Satheesh Reddy, said that with the successful test flights, the technologies pertaining to ATGM to engage targets in different conditions have been established.

Salient Features

- ☑ **Third-generation, fire-and-forget missile**
- ☑ **Advanced passive homing guidance**
- ☑ **High single-shot kill probability**
- ☑ **Day and night operational capabilities**

The anti-tank guided missile can be launched from both land- and air-based platforms. The strike range of the land variant and air variant of the missile is up to 4 km and up to 7 km, respectively. It is equipped with many advanced technologies including the indigenous IIR seeker with integrated avionics, a capability possessed by only few nations in the world.

Nag has 'Top attack' and 'Front Attack' capabilities and can defeat the heaviest type of armour including 'reactive' and 'composite' armour of the futuristic main battle tanks. IIR Seeker of the Missile provides day and night operational capabilities against low silhouette tanks, both static and fast moving.

Chairman, DRDO and Secretary, DDR&D Dr S Christopher, congratulated the team NAG for the achievement.

CHAIRMAN DRDO LAYS FOUNDATION FOR SKILL DEVELOPMENT CENTRE

To promote Hon'ble Prime Minister's Pradhan Mantri Kaushal Vikas Yojana, Chairman DRDO and Secretary DDR&D Dr S Christopher laid the foundation stone of a Skill Development Centre at Pilkhuwa, UP, on 11 February 2018. DRDO's Centre for Fire, Explosive and Environment Safety (CFEES) will manage the Pilkhuwa Centre and impart the training. Dr Chitra Rajagopal, DG (SAM), DRDO HQ, Directors from the DRDO establishments, and Chief Construction Engineer (R&D), North, were present on the occasion.

The centre, spread in an area of 23.8 acres, aims at skill development in the field of integrated safety, fire and disaster management, and allied subjects by adopting state-of-the-art technology. The target group for the skill development are the personnel from the DRDO, Army, Navy, Air Force, Ordnance Factories, Coast Guard and the inter-service organisations.

The training courses would include short- and long-term programmes leading to certificate and PG Diploma in Integrated Safety and Fire Engineering. The curriculum would include extensive practicals and live demonstrations and would be fully residential with appropriate boarding and lodging facilities.

In addition, NABL accredited test and evaluation facilities for Fire Extinguishing Agents and Systems, Real Scale Simulation and Validation, Fire Protection Systems, Fire Protection Suit Evaluation, Water Mist Simulation, Wind Tunnel, and Shock Tube Testing will also be set up for evaluation before acceptance for introduction into the tri-services and other MoD establishments.

DRDO CELEBRATES NATIONAL SCIENCE DAY

National Science Day is celebrated in India on 28 February each year to mark the discovery of the 'Raman Effect' by Indian physicist Sir Chandrashekhara Venkata Raman on 28 February 1928. Dr Raman was awarded the Nobel Prize in Physics in 1930 for his discovery. The objective of celebrating NSD is to spread a message about the importance of science used in the daily life of the people. The event is now celebrated all over the country in schools, colleges, universities and other academic, scientific, technical, medical and research institutions. The theme of this year's NSD was "Science and Technology for a Sustainable Future." DRDO, like every year, celebrated the day with great enthusiasm. Scientific lectures/talks by invited guests and DRDO scientists were organized by the DRDO labs/estts at their respective places.

Defence Science Forum (DSF) in Delhi, organized DRDO National Science Day Oration on 'Bridging Academic R&D with Product Innovation—A Few Case Studies and Way Forward' by Prof. V Ramagopal Rao, Director, IIT Delhi. Dr Chitra Rajgopal, DS and DG (SAM), DRDO, was the Chief Guest of the function. Dr AK Singh, OS and Director, Institute for Nuclear Medicine and Allied Sciences (INMAS) and Convener DSF, and Shri Sanjay Pal, Director, Admin & SQR and Secretary DSF, were present on the occasion.

To mark the occasion, scientific lectures on 'Synthesis of Iron Oxide Coated Hollow Polymethylmetacrylate Microspheres for Removal of Iron from Water' by Shri Dhiraj Dutta, Sc 'C' from Defence Research Laboratory (DRL), Tezpur; 'Development of Functional Materials and Processes for MEMS Devices' by Dr E Varadarajan, Sc 'E' from Research and Innovation Centre, Chennai;

Release of DRDO Science Spectrum

and 'Design and Implementation of Lightweight Cryptographic Algorithm for Secure Transmission of CDT' by Shri CK Rajak, Sc 'D' from Integrated Test Range (ITR), Chandipur, and 'Fluorosurfactants in Fire Fighting Foam: Status and their Environmental Assessment were delivered by the DRDO scientists.

Prof. Ramagopal in his scholarly oration spoke about Sir CV Raman and his discovery and highlighted the current status of the Indian R&D. He praised the Indian researcher for the fact that India ranks 5th in the world in terms of research output. Regretting the lack of commercialisation of research output, he exhorted both research establishments and R&D fraternity to work hard and address the problem. Highlighting the need of a product-oriented research, he praised Indian Institute of Science (IISc), Bengaluru and IIT Mumbai for jointly building a nano fabrication facility. Dr Ramgopal also accentuated on the importance of multi-disciplinary research and presented some of the inventions created as a result.

Dr Chitra Rajgopal, in her speech, described the NSD as a commemoration of the seminal work on 'Raman Effect' and celebration a symbol of our continual quest for scientific and technological excellence. She encouraged scientists to work hard and bring higher laurels for the organisation.

DRDO Science Spectrum—a compilation of the scientific orations delivered by the scientists to celebrate the NSD—brought out by the Defence Scientific Information and Documentation Centre (DESIDOC), Delhi, was released by DG (SAM) and Dr Alka Suri, Director, DESIDOC. DG (SAM) also gave away the NSD Oration Medal and Certificates to the scientists who presented orations at the function and also to the Delhi-based scientists who presented NSD orations at their respective labs.

The following DRDO labs also celebrated the NSD.

ANURAG, HYDERABAD

On this occasion, Prof. D Narayana Rao, School of Physics, University of Hyderabad, and Raja Ramanna Fellow was the Chief Guest and delivered the guest talk on 'New Materials and Techniques for Photonic Applications'.

The programme began with Science Day address by Dr JVR Sagar, Director, ANURAG. Shri M Madhava Kumar, Sc 'F', delivered the NSD Oration on 'Silicon Quantum Photonics'. Prof. Rao presented the NSD Medal and the Certificate to Shri M Madhava Kumar.

ARDE, PUNE

Shri Satyam Swarup, Sc 'C', delivered the NSD Oration on "Development of 30 mm EM Gun Launcher in ARDE". Dr Sundeep Salvi, Director, Chest Research Foundation, Pune, was the Chief Guest for the function. He gave a talk on "The Air we Breathe and its Impact on Our Health." Director ARDE presented the NSD Medal and Certificate to Shri Satyam Swarup. Prizes were given to the winners of the Science Day Quiz, Slogan and Essay Competition.

ASL, HYDERABAD

Dr Tessy Thomas, DS and Director Advanced Systems Laboratory (ASL), Hyderabad, addressed the gathering. Smt Pummy Ratna, Sc 'E', delivered NSD Oration on "Highly Miniaturized Expendable Multi-octave Full Duplex Active Countermeasure System for Artificial Target Generation". She presented a novel full duplex, miniature, expendable active countermeasure system, which has been designed, fabricated and tested successfully at ASL to facilitate deception, delayed discrimination and target acquisition by long range threat radars, thereby causing reduction in kill probability and enemy resource depletion. Dr Tessy Thomas awarded NSD Medal and Commendation Certificate to Smt Pummy Ratna.

CABS, BENGALURU

Dr Debashish Deb, Sc 'F', Centre for Airborne Systems (CABS), delivered the NSD Oration on "Waveform Diversity of MIMO Radar."

CAIR, BENGALURU

Shri Shibumon Alampatta, Sc 'D', delivered the Science Day oration on "Engineering a Geographical Information System for Military Application." It covered fundamentals of Geographical Information System (GIS) and requirements for engineering a GIS for military application. Smt Manimozhi Theodore, Director, Centre for Artificial Intelligence and Robotics (CAIR) presented the Science Day Medallion and Certificate to Shri Shibumon Alampatta.

DESIDOC, DELHI

Defence Scientific Information and Documentation Centre (DESIDOC), Delhi, organised NSD with scientific spirit. Smt Vinod Kumari Sharma, Sc 'F', delivered the NSD Oration on "Scholarly Communication through Defence Science Journal." She explained various forms of scientific communication, basics and the skills of scholarly writing. Smt Sharma was presented NSD Medal and Certificate by DG (SAM), DRDO, at a function held to commemorate NSD at Bhagvantham Auditorium.

DFRL, MYSURU

Dr Natarajan Gopalan, Sc 'F', delivered the NSD Oration on "Recent Development on Food Technology". In

his talk, he highlighted new processing technologies used for the preservation of food. Dr RK Sharma, Director, DFRL presented NSD Medal and Citation to Dr Natarajan Gopalan.

INMAS, DELHI

Dr Sudhir Chandna, Sc 'G', delivered NSD Oration on "Dousing the Fire Within: Newly Discovered 'Smart' Radioprotective Signaling Mechanisms." In this seminal study presented by him, he and his team have been able to delineate multiple mechanisms of biological radioprotection that were not yet understood. He was presented NSD Medal and Certificate by DG (SAM), DRDO, at Bhagvantham Auditorium.

LASTEC, DELHI

Laser Science and Technology Centre (LASTEC) organized NSD oration on "Optics for Laser-based Systems" by Shri Rahul Bhatt, Sc 'F'. The oration covered a brief history, from design to test and integration with the main system, and various other aspects critical for the performance of the laser-based systems. It also focused on the futuristic needs of optics for high power lasers.

HEMRL, PUNE

High Energy Materials Research Laboratory (HEMRL), celebrated NSD with great enthusiasm and fervour. Prof. INN Namboothiri from IIT, Mumbai, delivered an inspiring keynote address. Shri KPS Murthy, OS and Director, HEMRL, exhorted the scientists to

develop scientific temperament among seniors and juniors. Shri Amitesh Pratap Singh, Sc 'D', delivered the NSD Oration on "Development of TNSTAD." In the run up to the celebration, Science Quiz, Essay Writing, Technical Paper Presentation and Debate were organised during 16-26 February 2018. The best performers in each activity were awarded with cash prizes and certificates.

LRDE, BENGALURU

Shri P Radhakrishna, Officiating Director, Electronics and Radar Development Establishment (LRDE), inaugurated the function and brought out the importance of the Day. Shri S Mani, Sc 'F', delivered the NSD Oration on "Indigenous Realisation of Large Antenna Structures and Critical Mechanical Components for Long Range Radars."

MTRDC, BENGALURU

Shri Santhosh Kumar Kedige, Sc 'D', delivered NSD Oration on 'Explosive Electron Emitters for High Power Microwave Devices'. He explained the science of extracting very

high currents of the order of few kilo Amperes from explosive emitters like velvet and carbon fiber cathodes.

Dr Sudhir Kamath, OS and Director, Microwave Tube Research and Development Centre (MTRDC), addressed the gathering and emphasized the importance of working towards basic science along with technologies for development of futuristic devices. He presented NSD Medal and Certificate to the orator.

NMRL, AMBERNATH

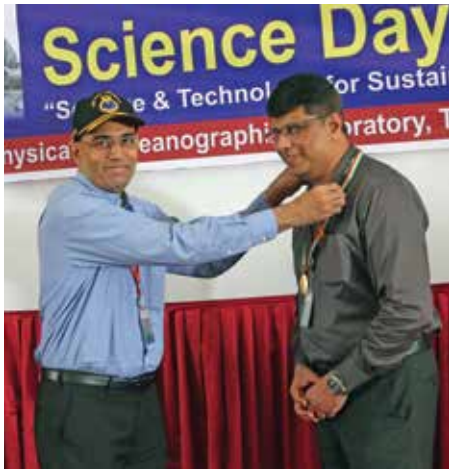
The celebration was marked by the august presence and inspirational words of the Chief Guest, Dr J Narayana Das, to NMRL fraternity. Director, NMRL, Dr M Patri, in his address stressed on the quest for science for technology development. The celebrations also saw lectures delivered by two young NMRL scientists on the prospective research areas. Dr MJ Mendki, Sc 'E', delivered NSD Oration on the topic "An Integrated Approach for Management of Antifouling Agents."

Students from nearby 16 schools participated in the science quiz, oration competition and science exhibition organised as a part of the celebrations.

NPOL, KOCHI

Shri Praveen Naresh, Sc 'F', delivered the NSD Oration on "Role of Microwave Satellites in Detection of Submerged Objects." As part of the celebration, an invited talk on "Recent Trends in Ceramics and Advanced Materials" by Dr K Muraleedharan, Director, Central Glass and Ceramic Research Institute, Kolkata was also organized.

The latest issue of the Techno Managerial Journal of NPOL 'ASWINI' was released on the occasion.

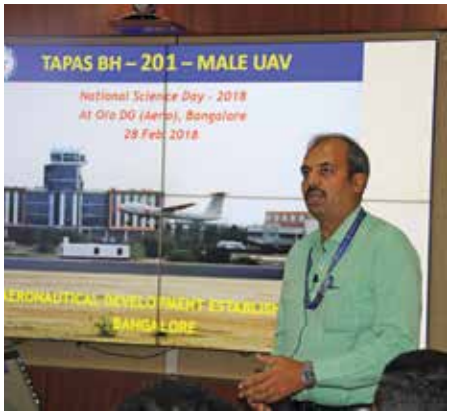


OFFICE OF THE DG (AERO)

The Office of Director General (Aero), Bengaluru, celebrated National Science Day with great ardor on 28 February 2018. Dr P N Tengli, Sc 'G', Director, Admin & SQR, in his opening address emphasized on the need to popularize S&T for human welfare.

Prof. PR Mahapatra, DRDO Chair, in his presentation on 'Deception in Defence', casted light on using deception as a tool for self-protection and to inflict damage to the enemy. Describing nature as the biggest deceptor, he said we need ways to understood science by demystifying nature.

Shri Rajgopal, Sc 'F', ADE, gave an overview on the Medium Altitude Long Endurance Unmanned Air Vehicle "TAPAS BH-201." Sharing his experience, he emphasized on the ever expanding horizon of science to deliver technologies for tomorrow and underlined the test facilities created as an offset of the project.



RCI, HYDERABAD

Shri Jitendra J Jadhav, Director, NAL, was the Chief Guest at the inaugural function and delivered a lecture on "Current Trends in Aircraft Technology." Prof. Ashwin Gumaste, IIT Bombay, was the Guest of Honour. Shri BHVS Narayana Murthy, OS and Director, RCI, in his address, spoke about science and technology for sustainable future. Shri DK Ghosh, Sc 'E', delivered the NSD Oration on "Helicopters and Weapon Delivery."

DRDO ORGANISED DIWAS-2018 TO CELEBRATE INTERNATIONAL WOMEN'S DAY

Minister for Ladakh Affairs and Cooperative, Govt of Jammu and Kashmir Shri Chhering Dorjay, inaugurated the national workshop on "DRDO Initiative of Women Augmenting Services (DIWAS –2018)" organised to celebrate the International Women's Day (IWD) at Defence Institute of High Altitude Research (DIHAR), the Leh-based premier Life Science laboratory of DRDO. Shri Thupstan Tsewang, Member of Parliament, Ladakh; Shri Dorjay Motup, Chief Executive Councillor, LAHDC; Dr S Christopher, Chairman DRDO and Secretary, Department of Defence R&D; Lt Gen SK Upadhyay, GOC Fire & Fury Corps; Dr Tsering Ladol, one of the pioneers of women's health in Ladakh, and Dr OP Chaurasia, Director, DIHAR, were present on this occasion.

In his inaugural address, Shri Chhering Dorjay said that women in DRDO have been tirelessly working with devotion, determination and soldierly dedication and providing technological solutions. He appreciated the R&D efforts of DIHAR to facilitate agro-animal fresh food supply to army deputed at high altitude through civil-military interface. He also appreciated DRDO's efforts in establishing the Extreme Altitude Research Centre (EARC) at Chang La at 17,664 feet altitude.

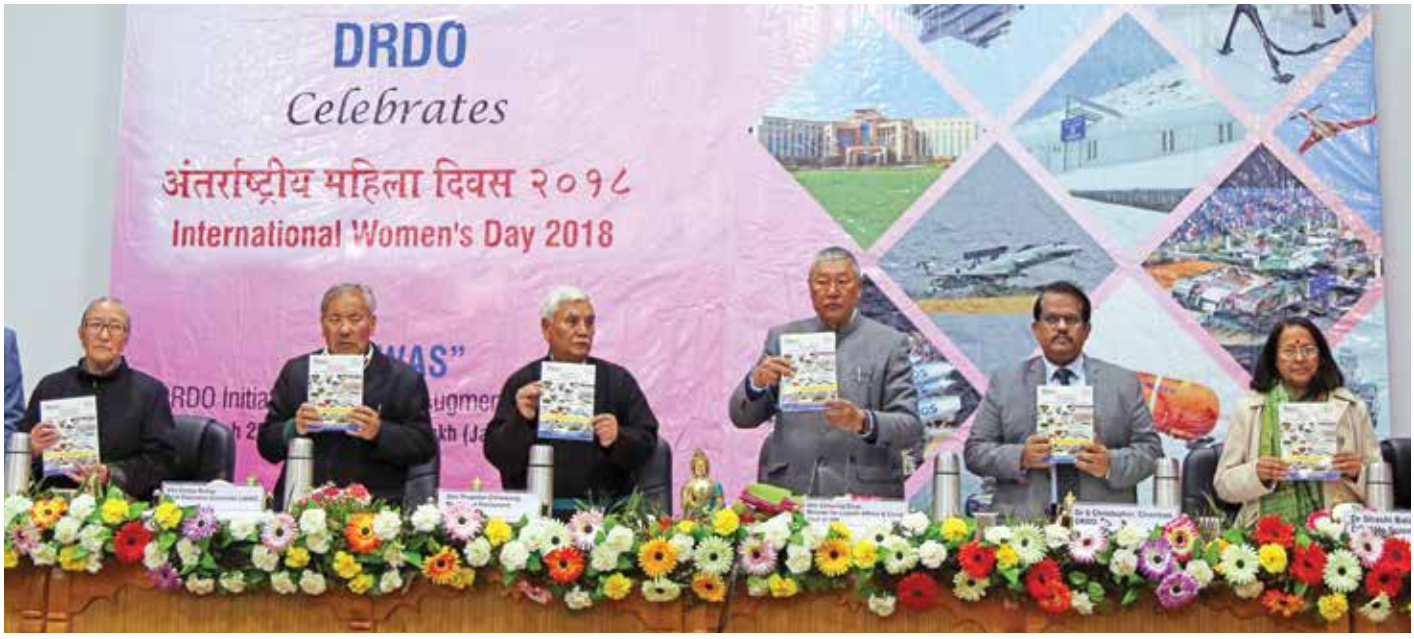
Dr S Christopher, in his address, complimented the DRDO's women scientists for their glorious work and dedicated service to the nation. He appreciated that Indian women are shining in all spheres at national and international arena and expressed hope that the trend would see better achievements in times to come. Dr S Christopher also released Life Science Journal, brought out by Defence Scientific Information and Documentation Centre (DESDIOC), Delhi, and visited a technical exhibition organised to showcase the R&D achievements of Life Sciences Cluster to facilitate operational support at high altitude.

Dr Shashi Bala Singh, DS and DG Life Sciences, DRDO, and Chairperson of "DIWAS-2018", in her address, congratulated the participants and ushered them for a brighter India, where larger number of women would be playing leadership roles.

The aim of the workshop was to celebrate the role of women in nation building and commitment to create a gender neutral work environment to facilitate skill development and enhancement among women across the globe. Around 300 delegates from diverse backgrounds attended the workshop. Ms Aparna Kumar, DIG, ITBP; Ms Chitra Ramakrishna, Former MD and CEO, NSE and Dr Pratibha Jolly, Principal, Miranda College, Delhi University were prominent among others who graced the occasion. The following DRDO labs/estts also celebrated IWD at their respective places.

ASL, HYDERABAD

Smt Sheena Rani, Sc 'G', Vice Chairperson, Advanced Systems Laboratory (ASL) Women Cell, delivered the welcome address. Dr Tessy Thomas, DS and Director, ASL, in her address, emphasized on the importance of gender equality and



said that every child should be treated equally and should be provided with equal opportunities. Chief Guest Dr P Raghu Ram, Director and Consultant Surgeon, KIMS-USHA Lakshmi Centre, gave an awareness talk on "ABC of Breast Health" and elucidated that women should be aware of their health and must remain updated with the latest technologies available for treating any health issues. All the women employees actively participated in the interactive game session conducted by the Women Cell.

DL, JODHPUR

Smt Vandana Singhvi, Additional Divisional Commissioner, Jodhpur, was the Chief Guest of the IWD celebration function at Defence Laboratory Jodhpur (DLJ). Dr Anuradha Bera, Sc 'E', OiC DLJ Women Cell, presented history and significance of IWD. Dr SR Vadera, Director, DLJ, in his address, described education, awareness, self-realization and yearning as the four pillars for the development of women. The Chief Guest called for giving equal importance to the girl child in terms of food, job selection, social equality, etc. Presentations and poems were recited by the women employees on different aspects of women. Mementoes were presented to all the participants by the Chief Guest.

NMRL, AMBERNATH

The day-long celebration commenced with an address by Director, NMRL, Dr M Patri, wherein he congratulated the entire female workforce of NMRL and encouraged them to bring more laurels to the laboratory. Chief Guest, Ms Bithika Basu, Senior. DGM, L&T Defence, enlightened the audience with the great strides that women have taken in every walk of life. She laid emphasis on the utilization of women power for complete and fast national growth. A booklet on "Sexual Harassment of Women in Workplace" was released for creating awareness for safe and secure environment. An interactive talk was delivered by Dr Sarita Patil on "Health, Diet and Naturopathy".

RCI, HYDERABAD

Smt Sailaja Kiran, MD, Margadarsi Chit Fund was the Chief Guest and Dr Lakshmi Newton, Founder, Life Research Academy and Smt Kaumudi Nagaraju, Founder Director, Learning Space Move the Wheel Foundation were Guest of Honour and Special Guest, respectively, at the IWD celebration at Research Centre Imarat (RCI). Distinguished guests appreciated RCI Women's contributions in the area of missile R&D. Smt Shashikala Sinha, Project Director, AAD Missile, was felicitated for her significant contributions towards BMD programme. Speaking on the occasion, Shri BHVS Narayana Murthy, Director, RCI, complimented the stellar contributions of women employees at RCI and urged them to motivate young girls at various academic institutes to pursue careers in science and technology.

Clockwise from top left: IWD celebrations at ASL, Hyderabad; DL Jodhpur; NMRL, Ambernath and at RCI, Hyderabad.

11TH INTERNATIONAL CONFERENCE ON HIGH ENERGY MATERIALS

Eleventh International High Energy Materials Conference and Exhibition on "Emerging Trends in High Performance HEMs —Insensitivity and Green Energetic Materials" held at Dr APJ Abdul Kalam Golden Jubilee Auditorium, Armament Estate, NDA Road, Pashan, Pune, was inaugurated by Dr G Satheesh Reddy, Scientific Advisor to Raksha Mantri and Director General (MSS), DRDO. Shri V Udaya Bhaskar, Chairman, Bharat Dynamics Limited (BDL), Hyderabad, was the Guest of Honour at the inaugural function. Shri PK Mehta, DS and Director General (ACE), DRDO, delivered the keynote address. The conference was organized under the aegis of High Energy Materials Society of India (HEMSI).

Dr RK Pandey, Sc 'G', Convener of the conference, welcomed the august gathering and emphasised on effective utilization of the platform among researchers, industry, academic institutions and scholars.

Delivering presidential address, Shri KPS Murthy, OS and Director HEMRL and President HEMSI, brought out the genesis and the charter of duties of the HEM Society. He presented a brief on progress made especially in the areas of explosives, pyrotechnics and propellants. He also brought out important research work going all over the world in the area of green synthesis, green propellant ingredients and insensitive explosive molecules. He appreciated the participation of industry, academia and R&D institutes for the development of systems and technologies of HEMs and added on Globalisation coupled with "Make in India" initiatives have indeed promoted the Public Sector and Private Industry to participate, not only in the development but also in research activities, especially in the areas of High Energy Materials and associated systems.

In his inaugural speech, Dr G Satheesh Reddy spoke about the evolution of HEMs and the need of high specific impulse propellants. He asked participants to take up the challenge and work out a roadmap. Dr Reddy also stressed on the need of self-reliance in the vital field of HEMs and cohesive efforts for the development of novel technologies through international collaboration and co-development. He also asked industries to develop various process equipment and facilities for bulk as well as mass production of propellants and explosives.

Speaking on the occasion, Shri V Udaya Bhaskar, stressed the need for leveraging indigenization efforts in the area of propellants, explosives and pyrotechnics for missile applications. He briefed about the role of BDL in serving the nation through development, integration and production of the missiles. He stressed the need for a closer interaction between DRDO and BDL to meet the requirements of advanced weapons and platforms for Indian armed forces.

The keynote address by Shri PK Mehta elucidated various utilities of HEMs in missiles, armaments, naval and aeronautical systems. He brought out various high performance-high energy materials developed and the need to develop advanced molecules, in future. He also expressed the need of triangular interaction among academia, industry and DRDO and the work on eco-friendly propellants based on HAN and ADN to reduce carbon footprint.

Abstract proceedings, Souvenir, Proceedings of Full paper were released. Two foreign nationals and four Indians, who have contributed significantly for the growth of HEMs, were conferred with Honorary Fellowship. Various HEM Awards were also distributed.

Release of Conference Proceedings

During the three-days conference, HEM-fraternity from all over the world discussed the current and future trends in the area of propellants, explosives and pyrotechnics. A total of 272 papers were presented in oral and poster sessions. The conference also provided a platform to various Indian industries to showcase their products, capabilities, facilities and technologies related to HEMs. More than 30 industries exhibited their core-competences.

INTERNATIONAL CONFERENCE ON ADVANCES IN CONTROL & OPTIMIZATION OF DYNAMICAL SYSTEMS

DRDO organized the 3rd International Federation of Automatic Control (IFAC) 'International Conference on Advances in Control and Optimization of Dynamical Systems (ACODS-2018)' in collaboration with ACDOS, the national member organization of IFAC at Hyderabad, on 18 February 2018. Dr S Christopher, Chairman, DRDO and Secretary, DDR&D; Dr G Satheesh Reddy, Scientific Adviser to Raksha Mantri and DG, Missiles and Strategic Systems, DRDO; Prof. Frank Allgower, IFAC President; Dr BN Suresh, President Indian National Academy of Engineering; Shri MSR Prasad, Director, DRDL; Dr Tessy Thomas, Director, ASL; Shri BHVS Narayana Murthy, Director RCI; Prof Ramkalyan Ayyagari, President ACDOS, India along with other eminent academicians, scientists, industry partners were present during the inaugural session of the event. More than 500 students, engineers, academicians and industry representatives participated in the conference.

Speaking on the occasion, Dr Christopher emphasized on the importance of control and guidance technologies in both civil as well as defence sectors. Underlining the developments in the areas of Control, Guidance and Dynamical Systems, Chairman DRDO articulated paradigm shift in Defence R&D capabilities of the India and said, "Futuristic weapon systems will be smart, intelligent, complex and technologically advanced. To meet the requirements of several aerospace and defence programmes of national significance, need of the hour is the development of innovative guidance schemes and control algorithms."

Dr Satheesh Reddy in his address said, "Synergetic efforts of R&D institutes, academia and industries have enabled our country to achieve self-reliance on many technological fronts. Technologies have been evolving quickly and focus on smart, adaptive and learning systems to make our aerospace vehicles cost-effective and state-of-the-art. Integrated, miniaturized avionics and smart sensors will be the backbone for futuristic aerospace and defence systems."

Prof. Frank Allgower, President, IFAC Austria, highlighted the activities of the IFAC and complimented the contributions of ACDOS India. Prof. Ramkalyan Ayyagari, President, ACDOS India, said that it has been a continuous endeavour of the society to nurture the controls community in our country to align it with the international standards.

Many globally renowned control and guidance experts including Dr PK Menon, Chairman & CEO, Optimal Synthesis Inc., Prof Reza Moheimani, University of Texas, Prof Sarah Spurgeon, University College of London, Prof Min-JeaTahk, Korea Advanced Institute of S&T delivered the Plenary and the Invited talks during the conference.

RAISING DAY CELEBRATIONS

DEAL, DEHRADUN

Defence Electronics Applications Laboratory (DEAL) celebrated its Annual Day on 23 February 2018 with great enthusiasm and fervour. Laboratory-level DRDO Awards were conferred to the employees by Dr RS Pundir, Director, DEAL, on this occasion.

As a part of the Annual Day celebration, various sports events were organised. The day culminated with a cultural programme presented by the DEAL employees in the evening. It was inaugurated by Mrs and Dr Pundir. The talent of the DEAL was at full bloom during the function. The programme included classical dances, Garhwali dance and songs, Kavi Sammelan, etc.

INMAS, DELHI

Institute of Nuclear Medicine and Allied Sciences (INMAS), Delhi, celebrated its 57th Annual Day on 13 February 2018. Lt Gen Sarath Chand, PVSM, UYSM, AVSM, VSM, Vice Chief of the Army Staff, was the Chief Guest and Shri RK Jain, Member Secretary NDMA, was the Guest of Honour on the occasion. Directors from DRDO HQ and various labs, INMAS ex-employees and family members were present during the function. The function saw the culmination of a fortnight long scientific, societal, sporting and cultural activities held at the institute. Dr AK Singh, OS and Director, INMAS, welcomed the guests and highlighted the recent achievements of the laboratory and shared its future vision especially in the areas of combat casualty, CBRN research, radiation biology and molecular imaging.

Lt Gen Sarath Chand, in his address, appreciated the contribution of INMAS and stressed on strengthening CBRNE training facilities for Armed Force as well as other security agencies. Shri RK Jain appreciated the efforts of INMAS in imparting training to military and paramilitary forces in field of CBRN Defence. The Chief Guest presented Laboratory-level DRDO Awards and Cash Awards to meritorious employees.

Various employee engagement and team building activities were organised for the INMAS employees and their families. A colourful cultural programme was also presented by the team INMAS.

R&DE (E), PUNE

Research and Development Establishment (Engineers) [R&DE (E)], Pune, celebrated its 56th Annual Day on 9 February 2018. Dr S Christopher, Chairman, DRDO and Secretary Department of Defence R&D, was the Chief Guest of the function. Shri PK Mehta, DS and DG (ACE), DRDO, was also present on the occasion.

As a part of the Annual Day celebrations, Aga Memorial Lecture on 'ISRO Challenges in Space Transportation' by Dr Suresh Naik, former Group Director, SAC-Ahmedabad, was organised in honour of Brig. Aga, the founder Director of R&DE (E).

Dr Christopher inaugurated Engineers' Edifice—an exhibition hall to display the development carried out in R&DE (E) for more than 50 years. To mark the day, various events like walk for Swachh Bharat, Art Exhibition, Photograph Exhibition, sports activities and open day for families of employees were organised.

HEMRL, PUNE

High Energy Materials Research Laboratory (HEMRL), Pune, celebrated its 110th Lab Raising Day on 1 March 2018 in a befitting manner. Dr KM Rajan, DS and Director, ARDE, Pune, Shri Sangam Sinha, GM, MSC, Begdewadi, and Smt Y Sobha, IDAS, JCDA, graced the function.

As a part of Annual Day celebrations, tricolour balloons were released by the Shri KPS Murthy, OS and Director, HEMRL, and guests. Shri Murthy, in his address, highlighted the various achievements of HEMRL during the past year and motivated the employees to work hard and take HEMRL to new heights. He also distributed Laboratory–level DRDO Awards to meritorious employees. Employees who completed 25 years of service were also felicitated by the Director.

In addition, Cash Awards and Commendation Certificates were also distributed to the employees for their outstanding performance by Dr Manoj Gupta, OS and Shri DK Kankane, Sc 'G'. Prizes were also given to winners and runners-up of sports events by Dr RK Pandey, Sc 'G'.

To mark the occasion, HEMRL contributed a cheque of Rs. 50000 to the Dean of Queen Mary's Technical Institute for disabled soldiers.

CFEES EXHIBITS SAFETY PRODUCTS AT MORENA IN MADHYA PRADESH

DRDO organised an exhibition of its products developed indigenously at district Morena in Madhya Pradesh on 26 February 2018. The exhibition was inaugurated by Hon'ble Raksha Mantri Smt Nirmala Sitaraman. Shri Shivraj Singh Chauhan, Hon'ble Chief Minister of Madhya Pradesh, and Shri Narendra Singh Tomar, Minister of Rural Development, Panchayati Raj and Mines, Govt of India, were present during the inaugural function.

Centre for Fire, Explosives and Environment Safety (CFEES), Defence Research and Development Establishment (DRDE), Gwalior, and Aerial Delivery Research and Development Establishment (ADRDE), Agra, participated in the exhibition. CFEES highlighted the research and development activities as well as products developed for fire, explosive and environment safety.

The exhibits in the area of fire safety included posters and models on Low Pressure Twin Fluid Water Mist Fire Suppression System, Fire Suppression Gel, Portable Hand-held and Backpack Water Mist System, Emergency Escape Chute, Aluminised Fire Approach and Fire Proximity Suit and Lightweight Fire Proximity Suit.

The exhibits in the area of explosive safety included posters having details of Laced Reinforced Concrete (LRC) IGLOO, Unit Risk Principle (URP) based HD 1.1 Storage Structure, High Performance Magazine (HPM), Underground Explosive Storage Structure, Unit Risk Principle-based HD 1.3 Storage Structure, Polymeric Coating for Mitigation of Blast Effect, Master Ammunition Storage Plan and Demilitarisation Plant for Disposal of Unserviceable Ammunition.

The exhibits in the area of environment safety included posters as well samples on metal oxide nano-particles for removal of hazardous and toxic contaminants, Photo-degradable Polymers for use as packaging materials at high altitude, new organic molecules to be used as HALON alternatives and National Halon Banking and Management and a working model of Water Mist Aerator for water conservation. Videos of activities like fire suppression using foam, rescue using Fire Escape Chute, field trials of different types of Explosive Storage Structures were also displayed on the occasion.

The Hon'ble Raksha Mantri evinced keen interest in the products and technologies of DRDO.

ADVANCED TOWED ARTILLERY GUN SYSTEM

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

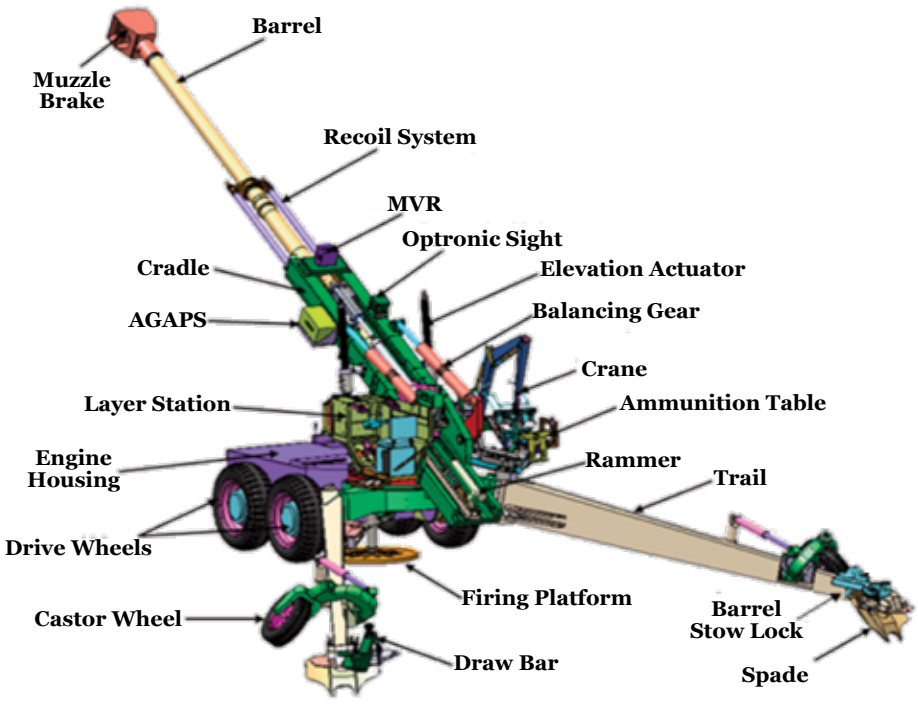
Indian Army has a long standing requirement of replacing the existing fleet of 105 mm, 130 mm and 155 mm FH77B 39 calibre gun with 155 mm x 52 calibre gun to keep pace with the worldwide trend of artillery guns. Advanced Towed Artillery Gun System (ATAGS) is a fully indigenous 155 mm x 52 calibre towed artillery gun system developed in mission mode by DRDO as a part of Artillery Modernization programme of Indian Army. The project commenced in September 2012. Pune-based premier R&D establishment of DRDO, Armament Research and Development Establishment (ARDE) is the nodal agency for design and development of the ATAGS. OFB, IRDE, VRDE, CAIR, DEAL, DMRL and PXE are development partners to provide solution in specific areas.

The ATAGS is the maiden initiative by DRDO in the development of long-range artillery guns for the Indian Army by completely indigenous development efforts. Development of ATAGS is a mission to build capability and infrastructure for Modern Gun system and create a national resource for capacity to build the most advanced gun system worldwide.

With faster pace of development and synergized efforts by DRDO and private industry partners, a well-proven technologically superior gun has emerged, which is expected to be the mainstay of Indian Artillery and in true sense a "Make in India" product having potential to overshadow the worldwide Artillery Guns.

Work Content & Technological Achievements

ATAGS is a good example of synergised efforts resulting in a successful product 'right first time' in a record time. Many sister DRDO labs contributed in the successful realization of the ATAGS. Technological strengths and expertise of each lab was used to the fullest extent to develop various critical technologies.



ATAGS Schematic

The system is configured with All Electric Drive technology, for the first time in the world, that will ensure maintenance free and reliable operation over longer periods of time. The automation will enable five-round Auto Multiple Round Simultaneous Impact (MRSI), automatic shell and charge loading, ramming with automatic gun deployment. The automation of these operations also facilitate higher rate of fire, fast coming into/out of action in the war scenario. It is equipped with an Integrated Fire Control System consisting of inertial land navigation-based Automatic Gun Alignment and Positioning System, Muzzle Velocity Radar and a Ballistic Computer to carry out online computation. Gun system is also integrated with a Thermal Imager to impart night firing capability in direct fire mode.

The system is configured with a Battery Command Post (BCP) that will command and control a battery of six to eight Guns over radio and line. The integration of the Gun battery with BCP would be as per existing ACCCS Shakti network with Indian Artillery.

The ordnance and recoil system of the gun is designed by ARDE, wherein Recoil System, Breech Mechanism and Muzzle Brake have been manufactured as per ARDE design by the private industrial partners. Ordnance and Recoil System is designed keeping in view the advanced requirements of the gun system of firing Zone-7 with higher pressure than existing gun systems worldwide. In January 2016, ARDE

ATAGS—THE TIMELINE

September 2012	**Sanction of ATAGS Project**
August 2014	**Manufacturing of First Gun barrel of ATAGS**
February 2016	**Commissioning & proofing of Ordnance & Recoil System from Fixed Firing Stand Facility at PXE**
December 2016	**First Strength of Design Trials of ATAGS at PXE**
July 2017	**Ballistic Confirmatory Trials at PXE**
September 2017	**Summer Technical Trials at PFFR, Pokhran**
January 2018	**Mobility and High Altitude Trials at SFFR, Sikkim**

developed and commissioned a highly specialized, robust Fixed Firing Mount for carrying out critical dynamic tests as per the QR at Proof and Experimental Establishment (PXE), Balasore. With the active participation of leading private Indian industry, the armament system for ATAGS was test fired and proved successfully on 17 June 2016.

Gun Structure and Automotive System (GSA) and Gun Automation and Control System (GAC) have been developed by industrial partners Ex-BFL and TPSED. ARDE helped in the integration of the system. This resulted in a robust gun, which proved its design strength in December 2016 trials at PXE.

Vehicle Research and Development Establishment (VRDE), Ahmednagar, with its long experience in automotive evolved the automotive system and undercarriage for the gun that comprises a power pack, drive system, suspension system, braking system, cooling system, traction system. It was imperative for ATAGS to adopt a new strategy for automotive system for enhancing the mobility, deployability and powering the complete drive system including the gun automation. A compact high efficiency customized 110 kW Diesel Engine fitting to the stringent emission norms have been successfully realized. This is followed by a compact, high rigidity Power Take Off (PTO) for powering the wheel transmission, driving the 12 kW alternator, Charging of Battery Bank, and power the hydraulic drive for auxiliary operations such as

ATAGS G2

ATAGS—Strength of Design trials at PXE

cooling system, caster wheel operation, deployment of Trails, Central Platform, draw bar actuation. The unique technology incorporated by the team is the use of walking beam suspension as against the conventional hydro gas suspension as well as independent drive to all four wheels. As a result of development and incorporation of all these technologies, Self Propelled mobility 18 km/hr, 360 degree pivotal turning, turning radius of less than 25 m and climbing at 18 degree gradient could be achieved.

Instruments Research and Development Establishment (IRDE) provided support in designing and development of sighting system for ATAGS. Three critical sub-systems could be realized through the focused efforts of IRDE. The indigenous development of optronic sight, dial sight, and telescope and muzzle bore sight was a big task but the incorporation of these technologies was important for enabling the gun for direct fire role. The complete optronic sight consists of Cooled Thermal Imager, Laser Range Finder, and CCD-based Daylight Camera. This has a identification range of up to 2 km and detection range of up to 10 km. All these have been designed, developed and implemented through indigenously available sources.

Centre for Artificial Intelligence and Robotics (CAIR) and Defence Electronics Application Laboratory (DEAL) are responsible for design and development of advanced communication and Fire Control System for ATAGS. The communication system comprises a complete package solution incorporating Tactical Computer (TC), Voice and Data Communication Unit (VDCU), and Software Defined Radio (SDR). All the hardware and software have been designed and developed through indigenous sources. All these communication equipment have been tested with the gun system and has a standoff distance of 5 km as per user's requirements. The fire control software (TCM.DLL) for ATAGS including trajectory computation module has been designed, developed and integrated in the tactical computer. The complete development has followed ACCCS Shakti Protocols for seamless integration and induction of the ATAGS in the Armed Forces.

PXE is the sole agency for complete testing and evaluation of the ATAGS and its sub-systems. The all round support during the trials expedited the development and many systems could be realised in time. The instrumented support and the analysis of the critical data for the design were provided by PXE.

Private industries also played a vital role in realisation of the system and emerged as strong development partners of DRDO. Various private industries strengthened their resources for future requirements and enhanced their capabilities also.

ATAGS will be a game changer and basis for future artillery development programmes. It will lead the way to the development of its variants such as Tracked and Wheeled Mounted Gun System (MGS) and Self-Propelled (SP) Artillery Gun Systems. The establishment of manufacturing and integration facility for large calibre artillery gun, foreseen during the

development of ATAGS, will be the most significant task to move closer to the self-reliance in this area. All these efforts will bring India in the league of few nations having fully indigenous artillery gun system.

ACHIEVEMENTS VIS-A-VIS INTERNATIONAL COMPARISONS

Internationally, the ATAGS is not only at par but also excels in many areas. The development time for realizing the first two prototypes is the fastest in the world. Within first four years of the project the integrated gun system could be realised from the drawing board to the field level. The range achieved by ATAGS is highest ever range achieved by any artillery gun in this category. The 48 km range achievable by in-service ammunition is possible by ATAGS. The all electric drives in the gun system is the first used and demonstrated in any ATAGS and tried nowhere till date. Mobility of 20 km/hr is comparable with the guns available in this category world-over. The firing of zone 7 Bi-Modular Charge System (BMCS) is possible only in ATAGS as compared to firing up to zone 5 by M777 and zone 6 by other international contenders. Most of the specifications such as range, mobility, fire control system, sighting system, etc., from the draft PSQR have been achieved or exceeded by the ATAGS.

The two integrated ATAGS systems (G1 & G2) after the successfully dynamic strength trials have undergone series of Ballistics Confirmatory Trials at PXE and Technical Trials at PFFR, Pokhran. During the Pokhran trial, ATAGS achieved the milestone of attaining highest ever range of 38.5 km and 48 km with in-service ammunitions as compared to 30 km and 40 km being achieved by the contemporary artillery guns worldwide. Recently, these gun systems have also successfully undergone mobility and firing trials at High Altitude Area, Sikkim Field Firing Range (SFFR), during January 2018. Both the gun systems were taken in towed and self-propelled mode till the firing point at Menla. The systems fired excellently well in cold climatic conditions.

CURRENT STATUS & WAY FORWARD

Both the ATAGS Gun Systems would be subjected to PSQR compliance trial at PFFR, Pokhran, during June 2018. Apart from the two systems, orders have been placed for realisation of two more Gun Systems G3 and G4, from each development partners. Parallel to this, proof of ordnance and recoil systems is also being carried out. Results of trial outcomes of G1 and G2 are being imparted continuously for system refinements of G3 and G4, which would undergo User Assisted Technical Trials (UATT) and consequently User Trials (UT) in September 2018. Additionally, an order for realisation of three guns each from development partners, has been placed. These gun systems will be utilized for user exploitation in different terrains.

ATAGS at Republic Day Parade 2017

COURSE ON DESIGNING SUB-SYSTEM FOR SPACE

A Course on "Designing Sub-System for Space" was conducted by Defence Electronics Research Laboratory (DLRL), Hyderabad, during 23-25 January 2018 under the Continuing Education Programme (CEP) of DRDO. The course was inaugurated by Dr Surendra Pal, Vice Chancellor, DIAT Pune, in presence of Dr Anil Kumar Singh, OS and Director DLRL. Dr Surendra Pal delivered a keynote address and elucidated the important issues related to qualification for space-based system. He covered the journey of space technologies from past to the present scenario.

Dr Anil Kumar Singh, in his addressed, emphasized the importance of the course for Electronic Warfare (EW) prospective. Shri Anupam Sharma, Sc 'G', gave an overview followed by a roadmap for EW in space.

The topics covered during the course included: Introduction to Space Electronic Warfare, Challenges in Realization of Space- based Electronics for EW Applications, Design and Development of Sub-systems for Space Applications, Ground Control Station for EW, etc. Thirty-five participants from DLRL, Brahmos, BEL and other DRDO labs attended the course. Dr AK Singh, Sc 'F', was the Course Director.

SPECIALIZED TRAINING PROGRAMME ON CBRN EMERGENCY MANAGEMENT FOR NDRF

A Specialized Training Programme on Chemical Biological Radiological and Nuclear (CBRN) Emergency Management for National Disaster Response Force (NDRF) was conducted at Institute of Nuclear Medicine and Allied Sciences (INMAS), Delhi, during 5-9 February 2018. Seventy-two NDRF Officers and personnel participated in the five-day training programme.

The lecture-based training programme was specifically designed for the NDRF and was conducted with demonstrations and hands on training. Topics like awareness, decontamination and decorporation, chemical and biological warfare agents, nuclear and radiological incidents, biodosimetry and incident site response, etc., were discussed. INMAS developed CBRN products like Shudhika Decontamination Kit and Remocon Wipes were displayed to the participants.

Hazmat Team from Delhi Fire Service gave the practical training to the participants. The programme also included a lecture each by Delhi Airport Safety Manager, MAMC and NDMA faculty members. A lecture on media management during CBRN emergencies and a visit to the virtual reality facility at INMAS were also conducted.

COURSE ON PRESENT & FUTURE SCENARIO OF SOLID ROCKET PROPELLANTS

A CEP course on "Present and Future Scenario of Solid Rocket Propellants" was conducted during 19-23 February 2018 at High Energy Materials Research Laboratory (HEMRL), Pune. The course was inaugurated by Dr SN Asthana, former Sc 'G', HEMRL. Twenty-nine participants attended the course.

The course was designed to update the knowledge of scientists and engineers working in the area of solid rocket propellants and related areas in various laboratories and establishments. Lectures on basic principles, applications and related technology and also on futuristic technological developments in the field of processing and testing of solid rocket propellants were delivered during the course. Visit to different facilities of HEMRL were also arranged for the participants.

Shri MC Uttam, Director, ISRO-UoP Technology Cell, SPPU, was the Chief Guest of the valedictory programme.

RAJBHASHA WORKSHOP/S&T SEMINAR

Defence Scientific Information and Documentation Centre (DESIDOC), Delhi, organized a one-day Hindi workshop on 1 March 2018. Smt Nisha Sharma, Sc 'F', Defence Institute of Psychological Research (DIPR), Delhi, delivered a lecture on "Stress Management". Dr Rajeev Vij, Sc G, who organised the workshop, briefed the participants about the purpose and the need of a stress-free life for a happier, healthier, and a more productive environment.

Dr Alka Suri, Director, DESIDOC, inaugurated the workshop and spoke about the various initiatives being followed at DESIDOC to encourage use of the Rajbhasha in day-to-day working.

Smt Nisha Sharma, in her informative lecture studded with examples, elucidated how to cope with the day-to-day stress to manage the veracity of the life. Ninety-five participants attended the workshop.

Laser Science and Technology Centre (LASTEC), Delhi, organised a Rajbhasha Scientific and Technical Seminar on "Nav Bharat Nirman mein Vighyan avam Rajbhasha ka Yogdan" on 23 February 2018 jointly with Centre for Personnel Talent Management (CEPTAM), DESIDOC, Defence Terrain Research laboratory (DTRL), Institute for Systems Studies and Analyses (ISSA) and Scientific Analysis Group (SAG) .

Around 150 participants from Metcalfe House-based DRDO labs/estts and institutes associated with Town Official Language Implementation Committee (TOLIC) took part in the seminar. Forty-five technical articles were presented during the seminar.

Dr RK Sharma, DS and Director, Solid State Physics Laboratory (SSPL), Delhi, was the Chief Guest of the inaugural function.

DESIDOC Delhi, organized a Hindi workshop on 5 March 2018. Dr Rajeev Vij, Sc G, delivered the welcome address and gave an overview of the Hindi Cell activities during the year.

Dr Alka Suri, Director, DESIDOC, inaugurated the workshop and encouraged participants to work in Hindi. Prof. Pamela Singla, Department of Social Work, University of Delhi, delivered an informative lecture on "Gender Sensitization."

WORKSHOP ON ADMINISTRATIVE RULES & PROCEDURES-III

Defence Laboratory, Jodhpur (DLJ), organised a workshop on "Administrative Rules and Procedures-III" during 16-17 February 2018 in collaboration with Directorate of Personnel (DoP), DRDO HQ.

The objective of the workshop was to sensitize the administrative officers about the rules and procedures being followed in the Central Government offices specifically in DRDO. Shri Alok Mall, Sc 'G', DoP, welcomed the participants and briefed them about the curriculum of the workshop.

Shri Gopal Bhushan, OS and Director DoP, and Dr SR Vadera, OS and Director, DLJ, jointly inaugurated the workshop. Shri Gopal Bhushan delivered the inaugural address. Dr SR Vadera, delivered the keynote address. Significance of the Administrative Rules and Procedures related to DPC, service matters, handling of legal issues, vigilance and security, etc., were discussed during the workshop by the faculty from DRDO HQ and Defence HQ Training Institute.

WORKSHOP ON APPLIED IMPACT MECHANICS

Research Centre Imarat (RCI), Hyderabad, orgnised a two-day workshop on "Applied Impact Mechanics" under the aegis of DRDO and Indian Society for Applied Mechanics (ISAM), during 15-16 February 2018. The objective of the workshop was to disseminate the fundamental concepts of applied impact mechanics, create awareness about the practical applications and opportunities, and to expose different modelling, simulation and test methods. Prof. Shanta S Mantha, NIAS, Bangalore and Former Chairman, AICTE, was the Chief Guest of the inaugural function. Shri BHVSN Murthy, OS and Director, RCI; Prof. KRY Simha, IISc, Bangalore and President ISAM; Shri S Gopinath, OS and Technology Director, RCI were present during the inaugural function.

The workshop comprised 11 lectures covering theoretical, computational and experimental impact mechanics, vehicle collisions, blast effect on structures, ballistic impact, etc. The workshop was attended by 95 participants from DRDO, private research laboratories, 40 research scholars and from various IITs and State Universities. Shri S Gopinath, and Dr Vijayabaskar, N, Sc 'E', were the Organising Chairman and Organizing Secretary, respectively.

WORKSHOP ON SYSTEMS ENGINEERING

A workshop on Systems Engineering—Pains and Gains was organised on 24 January 2018 at Research and Development Establishment (Engrs) [R&DE(E)], Pune, to capture the tacit knowledge of the officers who worked on major Defence Engineering Projects to understand the efforts put on during the development of projects and their testing and trials phases and the methods adopted to overcome failures and the gains/success achieved. Dr SC Sati, DRDO Chair, was the Chief Guest of the inaugural function. In his inaugural address, he emphasized on the adoption of system engineering approach for every project. Director CAIR, and Director NMRL were present during the inaugural function. Fourteen officers shared their experience during the workshop. Shri AK Patel, Sc 'G', chaired the workshop.

PERSONNEL NEWS

APPOINTMENT

Director, ANURAG

Dr JVR Sagar, Sc 'G', has assumed the Charge as Director, Advanced Numerical Research and Analysis Group (ANURAG), Hyderabad. He obtained his BTech (Electronics and Communication Engineering) from NIT, Warangal, MTech (Digital Systems and Computer Electronics) from JNTU, Hyderabad, MS (Software Systems) from BITS, Pilani and PhD (Computer Science) from University of Hyderabad.

He started his career with DRDO in 1987 as Sc 'B' in Defence Research and Development Laboratory (DRDL) in Systems Integration Group of Agni missile and was a member of the electrical integration team of first Agni missile. From 1989 to 2003, as System Manager, Project Akash Surface-to-Air (SAM) missile at RCI, Dr Sagar was responsible for the design, development and realization of onboard electronic sub-systems, electrical integration and checkout hardware and software of Akash and the associated ground stations including Akash Self Propelled Launcher and Mobile Station for Missile Checkout. In 2004, he was appointed the Deputy Project Director of Astra Beyond Visual Range Air-to-Air Missile, and was responsible for the design, development and realization of its airworthy onboard electronic sub-systems and air launcher, electrical integration of the missile, checkout hardware and software development and avionics interfacing of the missile with the SU 30 aircraft. In 2017, he was appointed the Project Director of Astra.

Dr Sagar is the recipient of many prestigious awards including DRDO Team Award for significant contributions to the IGMDP; DRDO team award for Path Breaking Research/Outstanding Technology Development for successfully configuration of the Akash; R&D Award from FTAPCCI, Telangana Govt in recognition of contributions made in guiding MSME industries leading to production and induction of Akash Weapon System; DRDO team award for Path Breaking Research/Outstanding Technology Development for making significant contributions towards design and development of Astra; and DRDL Laboratory Innovation Award in 2013 and 2017. He has published papers on avionics interfacing and image processing in National and International Conferences and is a member of the ACM, IEEE and CSI.

AWARDS

Best Performance Award

DRDO has been awarded Best Performance Award based on e-tendering for the year 2016-2017 under Central Procuring Category. The award was received by Dr AK Bhateja, OS and Director, Directorate of Finance and Material Management (DFMM), DRDO HQ, on behalf of DRDO. DFMM is nodal centre for implementation of e-procurement in DRDO. Till now 9193 tenders have been published using Central Public Procurement (CPP) Portal.

Dr AK Bhateja (right) receiving the Best Performance Award

Academic Brilliance Award-2018

Dr Jubilee Purkayastha, Sc 'D', INMAS, received the 6th Academic Brilliance Award-2018 under the category Award for Excellence in Research (Special Mention Certificate) by Education Expo TV (EET), CRS.

Commendation Certificate

Smt Arti Bhatnagar, Section Officer, Office of the SA to CNS has been awarded the Vice Chief of Naval Staff, Integrated HQ (Navy) Commendation Certificate for displaying utmost dedication, commitment and professional competence of a very high order.

DRDO NORTH ZONE CAROM TOURNAMENT

Institute of Nuclear Medicine and Allied Sciences (INMAS), Delhi, organised DRDO North Zone Carom Tournament during 20-23 February 2018.

Dr AK Singh, OS and Director, INMAS, inaugurated the tournament. Ninety participants from 13 DRDO labs participated in the tournament. Team Solid State Physical Laboratory (SSPL), Delhi, won the Championship. Team Joint Cypher Bureau, Delhi, was the runner-up.

SOCIETAL ACTIVITY

DEAL ORGANISED BLOOD DONATION CAMP

Defence Electronics Application Laboratory (DEAL), Dehradun, organised a voluntary blood donation camp on 9 March 2018 under the aegis of IMA Blood Bank, Dehradun.

The camp was inaugurated by Dr RS Pundir, Director, DEAL. Dr JC Arora and Dr Swati Nigot conducted the blood collection activities at the camp. Highly motivated DEAL employees participated in the camp with great zeal and enthusiasm. Overall 40 units of blood was donated.

VISITORS TO THE DRDO LABS/ESTTS

ANURAG, HYDERABAD

Brig. K Shankar, DDG (MO), and a team from the DGMO visited Advanced Numerical Research and Analysis Group (ANURAG) on 27 February 2018. Dr JVR Sagar, Director, ANURAG, briefed the guests about the activities of ANURAG. Shri Amit Shrivastava, Sc 'F', presented an overview on project "Quantum-Communication for Metropolitan Area Network". The guests expressed keen interest on the applicability of Quantum Technologies in the Defence. All Wing Heads also presented their current projects/activities. The visit concluded with the demonstration of ANURAG's products to the guests.

Brig. K Shankar, DDG (MO), being presented the activities of ANURAG

CAIR, BENGALURU

Lt Gen KK Agarwal, SM, VSM, DGREME and Sr Colonel Commandant visited Centre for Artificial Intelligence and Robotics (CAIR), on 19 January 2018. He was given a presentation about the activities of the CAIR and demonstrated the technologies developed by CAIR in the area of secure systems, intelligent systems and robotics and command control systems.

Chairman RAC being briefed about Explosive Detection Kit

HEMRL, PUNE

Shri BP Sharma, IAS (Retd.), Chairman RAC, Delhi visited HEMRL on 5 February 2018. During the visit, Shri KPS Murthy, OS & Director, High Energy Materials Research Laboratory, presented overview and apprised him about the activities of HEMRL.

SFC, JAGDALPUR

Air Marshal Jasbir Waliya, PVSM, VM, VSM, ADC, C-in-C SFC, visited SFC, Jagdalpur, on 13 February 2018. Shri JC Choudhary, GM, SFC, briefed the visitor about the activities and achievements of the centre. Air Marshal Waliya interacted with the scientists and applauded the targets achieved by them.

Air Marshal Jasbir Waliya interacting with scientists at SFC

DRDO HARNESSING SCIENCE FOR PEACE & SECURITY- XXVI

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

The article is 26th 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).

THE DIRECTORS' ANNUAL CONFERENCE

The 14th Annual Defence R&D Conference held at the Proof and Experimental Establishment (PEE), Balasore, in April 1971, was the first occasion for Dr Nag Chaudhuri to interact with and address the group of senior scientists and Service officers of the DRDO manning the 35 institutions and the Headquarters. The Conference was inaugurated by the Defence Minister, Shri Jagjivan Ram, who pointed out that DRDO was "yet to make a distinct and powerful impact in our overall defence capability.... The contribution of R&D has therefore to increase considerably. The Defence R&D should endeavour to develop indigenous system in our Country so that we may become increasingly self-reliant in all of our defence capability". He further stated that, "There are certain areas of technology, such as aeronautics, rockets and missiles and electronics which are sophisticated and predominantly of defence interest. They need high priority in our national development programme". The Defence Minister's address put the seal of approval to the changes that were already taking place in the DRDO and his emphasis on systems development coupled with the remark that DRDO was yet to make a powerful impact, was a total endorsement of Dr Nag Chaudhuri's drive to shift the emphasis towards systems development by the evolutionary route.

The SA in his address to the senior scientists and Service officers of DRDO gave his perception of DRDO and expectations for the future and stated:

(a) The expenditure on DRDO was too low in comparison to the expenditure on defence R&D of any developed Country. For example Sweden, which was not even involved in the Cold War, spent 1. 23 per cent of their GNP in research and development related to defence while the Government of India spent only about 0.056 per cent of the GNP on DRDO. The budget for the financial year 1970-71 was Rs. 17.52 crore, which was spread over 35 institutions and on 1186 projects. There were practically no multi-laboratory projects. Thus, the effort was either too insignificant on problems/projects of importance to the Services or the Organisation was preoccupied with trivial problems.

(b) The DRDO would have to redirect its efforts so that the major focus would be toward development of new and future products based on evolutionary development, current technology and concepts. In view of limited manpower and finances, thrust areas with a clear sense of priorities were missile, electronics/radar, aircraft systems and submarine technologies.

(c) The personnel at the technical headquarters situated in Delhi were to re- orient their work to have more technical and scientific content in bringing the Services and the laboratories closer and also reduce the current administrative burden at Delhi. To this end the powers delegated to the laboratories would be enhanced and this would cut down delays in taking decisions.

(d) There was a need to observe a strict balance between the two main streams, namely the civilian scientists and the scientists in uniform by using the yardstick of competence and performance. Seniority should be counted, but only after full credit has been given to competence and performance. Therefore, the present annual confidence reports would have to be suitably amended.

Setting a Strategic Goal

Dr Nag Chaudhuri set the strategic direction for the organisation as contemporary system development, but left the pace of implementation to the laboratories as the engineering/ hardware oriented laboratories in the Organisation were at different states of preparedness depending on the rate of change in each technology, quality and capacity of industrial infrastructure of the Country and the quality of manpower of the laboratory. Some, like the electronics group of laboratories had already moved into contemporary system development in view of their active participation in the Plan AREN of the Indian Army and Plan ADGES of the Indian Air Force.

The interaction between the senior scientists, Service officers at the helm of the laboratories on the one side and the Scientific Adviser with the Chief Controller, Chief Scientist and the Technical Directors at the Headquarters on the other side, was free, frank, thorough, and detailed during the 14th and 15th Annual R&D Conferences. The discussions covered all important issues, such as the type of activities to be undertaken by the laboratories, the role of technical directors at the headquarters, delays in the development-production cycle, delegation of powers to the heads of the laboratories, personnel policies including recruitment and promotion,

governing councils, R&D panels and their effectiveness, stores procurement procedures, and civil works services.

In particular, the Scientific Adviser's directive that laboratories should move away from import substitution tasks to contemporary systems development, was the subject of intense discussion and after considerable exchange of views, the consensus emerged that while DRDO would build credibility with the Users by delivering hardware which meets their immediate needs, the Organisation should not set itself at a technologically lower level by merely reproducing the existing hardware in the name of import substitution. In addition, it should take up technology development tasks, leading to design of contemporary systems with infrastructure building and acquisition of competence preceding actual system development. The difficulties faced earlier to get approval for technology development tasks with large financial outlay would be very much reduced if the activity was related to a known or anticipated requirement of the Services. Over the years it was found that if the technology development programme was linked to a known or anticipated need of the Users, or if it was part of a national investment plan/policy, or if the track record of the laboratory/ senior scientists was outstanding, the programme would find a place.

Measures to Step Up Activities

The Scientific Adviser was able to persuade the Ministry of Defence to examine the proposed switch in the activities of DRDO from their perspective. The Ministry concurred with Dr Nag Chaudhuri that, "product development as well as product improvement where quantum jump in the performance characteristics was required involving major redesign and development activity would be the responsibility of the Defence R&D Organisation". In the case of military stores that were in service, the responsibility for product improvement, for giving better performance and tasks of indigenisation of equipment produced under license, would not be that of the DRDO but of the production agencies. Thus, the decks were cleared for DRDO to move away from import substitution activities to technology development and contemporary military systems design.

At the instance of DRDO, two other measures were introduced by the Ministry of Defence to facilitate and speed up the introduction of military stores (equipment/systems) developed by DRDO into Service. The first one was to streamline the procedure for encouraging private sector firms to work with DRDO in the development of military stores. It was decided that any firm in the private sector, which participated with DRDO in the successful development of military stores, would get the first order for bulk production. Subsequent orders for manufacture of the same stores would follow the procedure laid down by the Ministry of Defence. The second measure was about the advance action to be taken by the User Services before the requirement was reflected to the DRDO for development.

The Ministry stipulated that, "The User Services will concretise their futuristic requirements and get financial approval in principle for all overall outlays involved for the development and quantity production of the equipment." It was also decided that a procedure for design, development, production and inspection of the military stores in each technical sector like armaments, aeronautics etc., would be drawn up on the lines similar to that already in use in the electronics sector (DDPIL-69) so that the respective agencies can initiate advance action for speedy transition from one stage to another.

On his part, the Scientific Adviser adopted a three-pronged approach to accelerate the movement of the DRDO towards the strategic goal. Firstly, priorities were set and enhanced resources were allocated for building up infrastructure and competence in four specific technology sectors namely, aeronautics, missiles, electronics and naval science and technology. Secondly, he persuaded the Government to enhance the DRDO budget as a percentage of the defence budget from 1.31 per cent in 1969-70 to 2.05 per cent by 1973-74 and in absolute value from Rs 14.43 crore in 1969-70 to Rs 34.39 crore in 1973-74. Those laboratories, which were in associated technology sectors, were assured of enhanced resources when these moved toward the strategic direction. Thirdly he selectively placed research-minded persons of proven ability and proficiency in their fields as heads of laboratories when the posts fell vacant due to retirement or by transfer. His address at the Indian Institute of Administration, Mussoorie, would reveal his thought process in making such changes. In that address he stated that, "management functions cannot be carried out without an understanding of the relevant technologies and their role in the enterprise. This understanding involves some knowledge of the science and technology that is involved..... A generalist administrator without a feel of the problem he is dealing with, without an adequate knowledge of the facts and techniques which are crucial and an appreciation of relative importance of these can be now misled into wrong decisions. In our Country there have been a number of instances in the past of such bad management decisions because of inadequate appreciation of relative importance (Kolar, Zinc mines). This does not mean that one has necessarily to know in great detail the technology or whatever discipline of science is involved..... But a poor knowledge of technology of his industry is dangerous to his enterprise. What is needed in his appreciation of the subject, ability to discriminate between what is crucial, what is relevant and what is peripheral. To this extent he must not only know but able to understand the expert's view and use his own judgment. He needs a fairly clear and systematic understanding of what he is dealing with and not just a superficial knowledge of the terminology used..."

To be continued...

दैनिक जागरण

Sat, 10 March, 2018

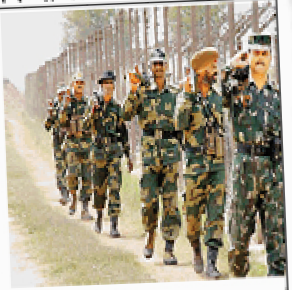
जल्द ही सेंसर तकनीक से लैस होंगी हमारी सरहदें

जागरण विशेष

शशिभूषण • धनबाद

इजरायल के बाद भारत जल्द ही दुनिया का दूसरा ऐसा देश हो जाएगा, जिसकी सीमाएं अत्याधुनिक सेंसर तकनीकों से लैस होंगी। घुसपैठ तो दूर की बात है परिंदा भी पर न मार सके, ऐसी है इस तकनीक की खूबी। इसी के बूते इजरायल ने खुद को अभेद्य बनाने में सफलता पाई है। इजरायल ने पिछले दिनों भारत को यह तकनीक उपलब्ध कराने की बात कही थी। दोनों देशों में इस पर बात भी हुई। इधर, भारतीय रक्षा अनुसंधान संगठन (डीआरडीओ) की पहल पर आइआइटी आइएसएम धनबाद के वैज्ञानिकों ने इस तकनीक को विकसित करने में एक बड़ी सफलता पाई है।

दुनिया में वायरलेस सेंसर नेटवर्क (डब्ल्यूएसएन) एक अत्याधुनिक निगरानी व्यवस्था है। फिलहाल दुनिया में सिर्फ इजरायल ही इस सेंसर तकनीक से अपनी सीमाओं की निगरानी कर रहा है। इस तकनीक के सीमा पर लग जाने के बाद न केवल घुसपैठ पर लगाम लगाई जा सकेगी बल्कि सीमा पड़ोसी देश की सेना की तमाम गतिविधियों पर भी नजर रखना आसान होगा। डीआरडीओ ने यह प्रोजेक्ट आइएसएम (भारतीय खनिज विद्यापीठ) के कंप्यूटर साइंस इंजीनियरिंग विभाग को सौंपा था। जिसमें वैज्ञानिकों को सफलता मिली



- इजरायल के पास ही है सीमाओं की रक्षा की यह विशेष युक्ति
- भारतीय वैज्ञानिकों ने किया सफल परीक्षण

ऐसे करता है डब्ल्यूएसएन काम

प्रो. चिरंजीव कुमार के अनुसार डब्ल्यूएसएन प्रणाली में सेंसर सीमा पर होनेवाली हर हलचल की सूचनाओं को बेस स्टेशन (फेन डाटा एकत्रीकरण प्वाइंट और यंत्र) तक पहुंचाता है। बेस स्टेशन से जानकारी नेटवर्क की सहायता से सीधे सीमा पर तैनात जवानों तक पहुंच जाती है। कुछ ऐसे सीमावर्ती इलाके जहां चौकसी संभव नहीं है, वहां तैनात जवानों के लिए वायरलेस सेंसर नेटवर्क से बेहतरीन विकल्प और कोई नहीं हो सकता।

यह प्रोजेक्ट जुलाई में पूरा हो जाएगा। आइएसएम ने कई चरणों में इसका सफल परीक्षण कर बड़ी उपलब्धि हासिल की है। प्रोजेक्ट पर आइएसएम के प्रो. चिरंजीव कुमार व प्रो. हरि ओम तथा कंप्यूटर इंजीनियरिंग के छात्र हिमांशु रंजन सेठ काम कर रहे हैं। प्रो. चिरंजीव ने बताया कि वायरलेस सेंसर नेटवर्क आधुनिक

से कई संस्थान शोध कर रहे हैं। उन्होंने बताया कि सरहद पर होने वाली घुसपैठ व घुसपैठ को रोकने में तकनीक मददगार साबित

THE TIMES OF INDIA

Wed, 07 March, 2018

DRDO develops underwater drone prototype

Kochi: Even as the Indian Navy's ships and submarines are being equipped with different kinds of sonars, defence scientists are looking at newer technologies to equip services to protect the territorial and the exclusive economic zone waters.

Naval research has turned to development of unmanned vehicles for defence applications. "This will be for surveillance purposes. We have developed a low endurance prototype and it has been tested in many waters," said Samir V Kamat, director general, Naval systems and Materials, DRDO.

He said that the DRDO management council had given sanction for the project and was likely to commence in a few months. "Countries like the US and China are working on underwater drones which will fire torpedos. As of now, this is our immediate project. But it is not on a mission mode. It is being taken as a technology demonstrator which can then be tailor-made for the navy depending on their needs," he said.

The Autonomous Underwater Vehicles (AUV) can be used for different roles including working as a courier between the navy and the submarine, situation assessment for the subsea, surface and air units for coordinated action, defensive and offensive roles etc. The AUV can play an active role in the oil and gas industries for seabed surveys as well as in search and rescue operations.

दैनिक जागरण

Mon, 05 March, 2018

भारत पहली बार दुनिया को दिखाएगा अपनी रक्षा उत्पादन क्षमता

नई दिल्ली, प्रेट्र : आगामी रक्षा प्रदर्शनी (डिफेंस एक्सपो) में पहली बार भारत दुनिया के समक्ष अपनी रक्षा उत्पादन क्षमता और सैन्य उपकरणों का बड़ा निर्यातक बनने की अपनी सामर्थ्य प्रदर्शित करेगा। चेन्नई में 11 से 14 अप्रैल तक आयोजित होने वाले इस एक्सपो में हिस्सा लेने के लिए करीब 50 देश अपनी मंजूरी दे चुके हैं।

रक्षा मंत्रालय के अधिकारियों ने बताया कि भारत इस डिफेंस एक्सपो में देश में विकसित हेलीकॉप्टरों, विमानों, मिसाइलों

चेन्नई में 11 से 14 अप्रैल तक आयोजित होने वाले इस एक्सपो में हिस्सा लेने के लिए करीब 50 देश दे चुके हैं अपनी मंजूरी

प्रदर्शित होने वाले प्रमुख भारतीय रक्षा उत्पाद

- हल्का लड़ाकू विमान तेजस
- अत्याधुनिक हल्का हेलीकॉप्टर ध्रुव
- डॉर्नियर विमान
- 155 मिमी एडवांस टोड आर्टिलरी गन
- अर्जुन टैंक
- टी-90 टैंक
- टी-72 टैंक

INDIAN DEFENCE NEWS
Global Defence, Aerospace & Security

Wed, 07 March, 2018

25 industries from Kerala assisting Drdo in developing indigenous sonar

By Sudha Nambudiri

Kochi: Of the 100 industries, both large and small, that are playing a role in making navigation and communication systems as part of anti-submarine warfare for the Indian naval warships, 25 are from Kerala. And they are working with the scientists of defence research and development organization, (DRDO) to develop what is exclusively and uniquely Indian Sonar (sound navigation and ranging) system.

These industries get orders from the Kochi-based Naval physical and oceanographic laboratory (NPOL) under the DRDO which designs and develops the sonar systems exclusively for the navy's warships and submarines.

The Tribune

Sun, 04 Marc

Be determined to succeed, says DG of DRDO

An annual convocation was organised at the DAV College, in which 833 students secured degr professors of the college were honoured on receiving their research and PhD degree. Dr Sudhir Director General (BrahMos) DRDO, was the chief guest and Dr Satish Sharma (Director, college CMC, New Delhi) was the guest of honour.

Sudhir Mishra, while addressing the students, said "It is very necessary to be determined to suc life, to achieve goals, we should keep the craving for success". And everyone should remember th success today is the result of your patience, support and commitment of your parents and dedica commitment of your teachers and faculty." Principal Dr SK Arora welcomed all the dignitaries wh here. He said it was a matter of great pride for us to find Dr Sudhir Mishra as the chief guest convocation ceremony. Describing Dr Sudhir, he said Dr. Mishra was a reputed scientific and Director (BrahMos) DRDO, Ministry of Defence.

THE ASIAN AGE

Sun, 04 March, 2018

No proposal to 'shelve' Tejas project, says Nirmala Sitharaman

By Sanjib Kr Baruah

The Tejas is a supersonic, lightweight, all-weather, multi-role fighter designed for air-to-air, air-to-ground and air-to-sea combat roles.

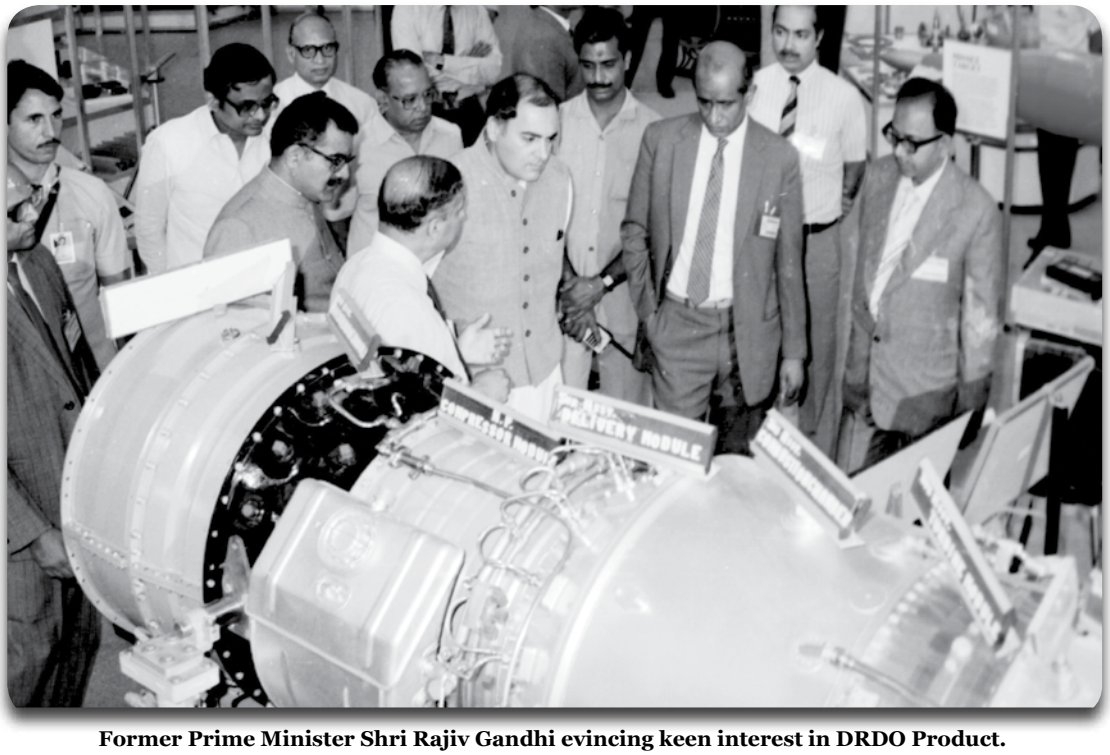
New Delhi: Scotching recent media reports that the government has "shelved" the plan to acquire the homemade Tejas Light Combat Aircraft (LCA) fighter, defence minister Nirmala Sitharaman said during an informal interaction on Saturday that the Tejas plan is "on" and the government has not "ditched" it.

"We are not ditching it, not shutting it down. On the contrary, we are looking at an upgraded and strengthened version of the Tejas. The IAF will have a combination of single engine fighters and India's Tejas will hold importance. I reject the idea that Tejas has been ignored by us. We want Tejas's Mk-II version," the minister said, adding that the Hindustan Aeronautics Limited (HAL), which makes the Tejas, has been asked to produce more aircraft at a faster rate. "We want them to produce much more. We have to increase production from the 6-8 that we make a year."

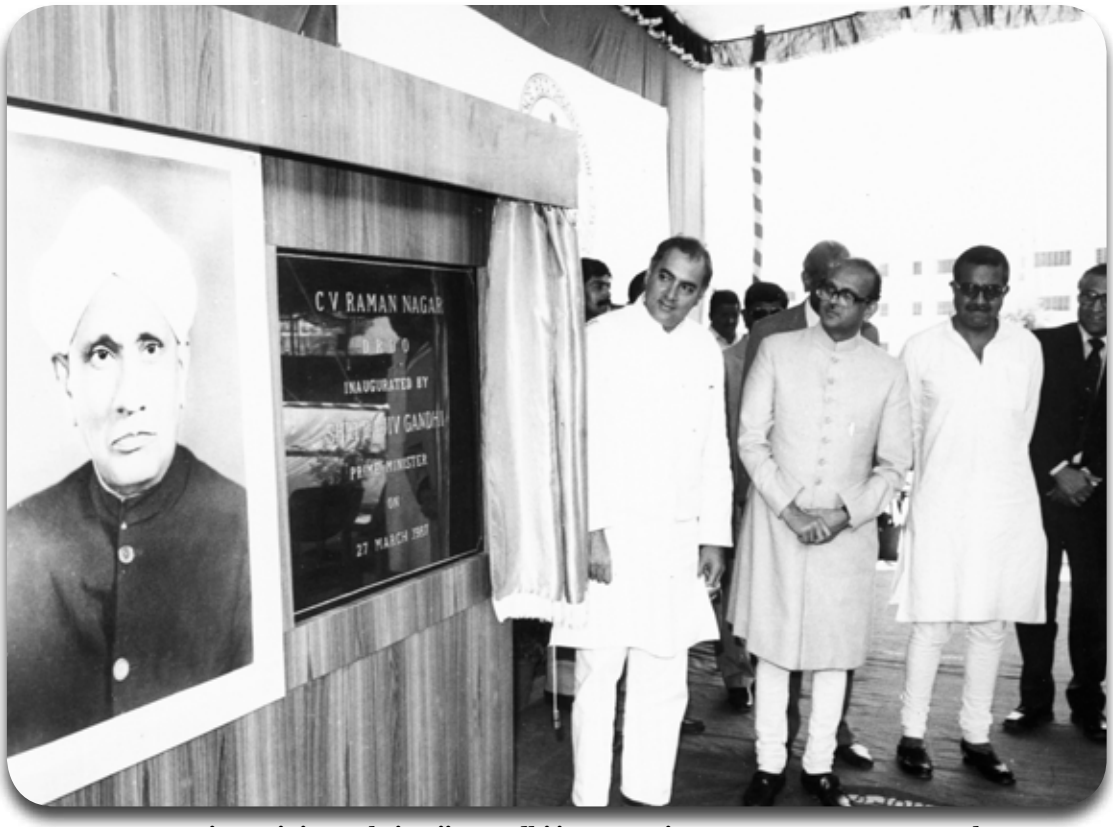
The Tejas is a supersonic, lightweight, all-weather, multi-role fighter designed for air-to-air, air-to-ground and air-to-sea combat roles. It is expected to plug a vital gap in IAF's might that is suffering from a critical shortage of fighter squadrons. The government had already ordered for 83 HAL-made Tejas fighters.

At present, about 70 per cent of the LCA components are manufactured in India.

DOWN THE MEMORY LANE



Former Prime Minister Shri Rajiv Gandhi evincing keen interest in DRDO Product.



Former Prime Minister Shri Rajiv Gandhi inaugurating CV Raman Nagar, Bengaluru.