

DRDO

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DRDO FLIGHT TESTS SMART

DRDO successfully tested Supersonic Missile Assisted Release of Torpedo (SMART) on 5 October 2020 from Wheeler Island off the coast of Odisha. All the mission objectives including missile flight range and altitude, separation of the nose cone, release of torpedo and deployment of Velocity Reduction Mechanism (VRM) were achieved perfectly. The test was tracked by Radars and Electro Optical Systems along the coast and the telemetry stations including down range ships.

SMART is a missile assisted release of lightweight Anti-Submarine Torpedo system for Anti-Submarine Warfare (ASW) far beyond torpedo's range. This launch would significantly boost India's ASW capabilities.

SMART system has been jointly developed by DRDO laboratories, viz., Defence Research and Development Laboratory (DRDL) and Research Centre Imarat (RCI), both in Hyderabad, Aerial Delivery Research and Development Establishment (ADRDE), Agra, and Naval Science and Technological Laboratory (NSTL), Visakhapatnam.

Secretary Department of Defence R&D (DDR&D) and Chairman DRDO

Dr G Satheesh Reddy described the test a game changer technology demonstration in the ASW.

Raksha Mantri Shri Rajnath Singh in a tweet congratulated DRDO scientists for the important feat.



Supersonic Missile Assisted Release of Torpedo successfully flight tested from the Wheeler Island





ANTI RADIATION MISSILE RUDRAM FLIGHT TESTED

New generation Anti Radiation Missile (NGRAM), Rudram, developed indigenously by DRDO for the Indian Air Force (IAF) was successfully flight tested on 9 October 2020 onto a radiation target located on the Wheeler Island off the coast of Odisha. The missile hit the target with pin-point accuracy and all mission objectives were successfully met.

The missile is integrated on SU-30 MkI as the launch platform having capability of varying ranges based on launch conditions. The missile has Inertial Navigation System (INS)-Global Positioning System (GPS) navigation with Passive Homing Head (PHH) for the final attack. The PHH can detect, classify and engage targets over a wide band of frequencies as



programmed. Rudram is a potent weapon for suppression of enemy air defence effectively from large stand-off ranges.

The missile is being developed by DRDO's Hyderabad-based Defence Research Development Laboratory

(DRDL) as the nodal agency. Besides, DRDO's many other labs, the IAF, the Hindustan Aeronautics Limited (HAL) and several public and private sector enterprises are also chipping in with their invaluable inputs.

BRAHMOS MISSILE FEATURING INDIGENOUS BOOSTER SUCCESSFULLY TESTED

BrahMos Land-Attack Cruise Missile (LACM) featuring indigenous propeller, airframe, power supply and many other 'Made in India' sub-systems was successfully flight tested for its full range on 30 September 2020 from Integrated Test Range (ITR), Chandipure, by the team of DRDO and BrahMos scientists. The surface-to-surface supersonic cruise missile cruised at a top speed of Mach 2.8.



File Photo

The successful launch has paved the way for the serial production of the indigenous booster and other indigenous components of the powerful BrahMos Weapon System.

Raksha Mantri Shri Rajnath Singh congratulated DRDO and team BrahMos for the successful testing. Dr G Satheesh Reddy, Secretary DDR&D and Chairman DRDO congratulated the DRDO and BrahMos scientific community and industry for the feat.

FLIGHT TESTING OF DRDO'S LASER GUIDED ATGM

DRDO successfully test-fired indigenously developed Laser Guided Anti Tank Guided Missile (ATGM) from MBT Arjun on 1 October 2020 for long range. The test was conducted in continuation of trial done earlier on 22 September 2020 at KK ranges (ACC&S), Ahmednagar.

The ATGM employs a tandem HEAT warhead to defeat Explosive Reactive Armour (ERA) protected

armoured vehicles in ranges from 1.5 km to 5 km. It has been developed with multiple-platform launch capability and is currently undergoing technical evaluation trials from 120 mm rifled gun of MBT Arjun.

Armament R&D Establishment (ARDE), Pune in association with sister DRDO labs High Energy Materials Research Laboratory (HEMRL), Pune, and Instruments Research & Development Establishment

(IRDE), Dehradun, has developed the missile. Raksha Mantri Shri Rajnath Singh congratulated DRDO for this successful feat.

Secretary DDR&D and Chairman DRDO congratulated DRDO personnel for the achievement, which paves the way for Atmanirbhar Bharat pledge of Hon'ble Prime Minister Shri Narendra Modi.

TOT

DIPAS SIGNS LATOT FOR ERGONOMICALLY DESIGNED MULTIPURPOSE LOAD ENSEMBLE

Defence Institute of Physiology and Allied Sciences (DIPAS), Delhi, signed a Licence Agreement for Transfer of Technology (LAToT) of ergonomically designed 'Multipurpose Load Carriage Ensemble (MLCE)' to M/s Miltex Equipment, New Delhi on 21 September 2020. Dr Rajeev Varshney, Director, DIPAS, handed over the LAToT document to the representative of the firm in the presence of inventors Dr Madhusudan Pal, Sc 'F' and his team. The ensemble is based on ergonomic principle (load distributed in front and back of the body) and is modular, lightweight with multiple pockets, horizontal and vertical adjustable features for different height of users, attachment/detachment facility for using as single pack as well as double pack as per user's choice.



Ergonomical design of the MLCE is efficient in terms of postural and biomechanical load and helps to maintain normal spinal lordosis and kyphosis, reduces the effort (work done and power generation in lower

body joints) during load carriage activities, and minimizes the risk of spinal deformities, back pain, and musculoskeletal disorders. The ensemble will be useful for Armed Forces, CAPF, students and trekkers.

TRANSFER OF AHSP OF PINAKA WEAPON SYSTEM

An important milestone was achieved on 25 September 2020, when Authority Holding Sealed Particulars (AHSP) responsibility of Pinaka Multi Barrel Rocket Launching (MBRL) System was handed over by DRDO to Director General Quality Assurance (DGQA). AHSP transfer marks the successful establishment of production of Pinaka Rockets, Launchers, Battery Command Posts, Loader-cum-Replenishment and Replenishment Vehicle, as well as the successful establishment of quality assurance processes.

Pinaka rockets and ground systems are currently under bulk production at Ordnance Factories, BEML, BEL, Tata Power SED and L&T Defence. Four Pinaka Regiments are already inducted into the service. The Defence

Ministry has placed orders for six more Regiments.

The handing over took place at Armament Research & Development Establishment (ARDE), Pune, wherein the documents required by various production agencies, quality assurance agencies, maintenance agencies and users were formally handed over by ARDE, High Energy Materials Research Laboratory (HEMRL) and Vehicle Research & Development Establishment (VRDE) to Controllerate of Quality Assurance (A).

Dr G Satheesh Reddy, Secretary DDR&D and Chairman, DRDO, described the transfer as a landmark event in the development of Pinaka MBRL System that will go a long way in fulfilling the requirements of Services.

LtGen Sanjay Chauhan, DG, DGQA; Shri CS Vishwakarma, Chairman, OFB; Lt Gen K Ravi Prasad, VSM, DG (Artillery); Shri PK Mehta, DG (ACE), DRDO; Shri AK Srivastava, Director Defence, BEML; Brigadier IM Singh, Controller CQA (W); and Shri Rajeev Puri, Sr GM, OF, Chanda also participated through video conferencing. The acceptance of AHSP from DRDO was formally announced by Lt Gen Sanjay Chauhan from DRDO HQ, New Delhi.

Dr V Venkateswara Rao, OS & Director, ARDE, Shri KPS Murthy, OS & Director HEMRL, Shri Sangam Sinha, OS & Director, VRDE, Shri AV Shinde, Officiating Controller CQA (A) and Smt MGP Dhanraj, DDG, Officiating Controller CQA, (ME) were present at ARDE.



Handing over of AHSP Transfer Certificate

WORKSHOP ON SCIENCE OF CONSCIOUSNESS

Laser Science & Technology Centre (LASTEC), Delhi conducted a workshop on “Science of Consciousness” on 1 October 2020 to commemorate the 150th Birth Anniversary of Mahatma Gandhi. The workshop was chaired by Shri Hari Babu Srivastava, OS & Director, LASTEC. Dr Alka Suri, Director, DESIDOC delivered a talk on Science of Consciousness. Dr Suri uplifted the moral of participants by speaking on the causes, awareness and safety measures to be taken during COVID-19 through Yoga, Meditation, Pranayam so that mental and physical health consequences like anxiety level, loss of appetite, inability to sleep may reduce.



Dr Alka Suri, Director DESIDOC delivering talk on

Dr Suri elaborated that “Pure Consciousness, which is the Heart, includes all, and nothing is outside or apart from it, is the ultimate Truth.” Key to growth is the higher dimension

of consciousness in our awareness, she further added.

The event ended with vote of thanks by Ms Anita Luthra.

ONLINE COURSE ON PROJECT MANAGEMENT COMPETENCIES

Institute of Technology Management (ITM), Mussoorie conducted a four-day online course for Terminal Ballistics Research Laboratory (TBRL), Chandigarh on “Project Management Competencies” during 17-20 August 2020. The objective of the course was to prepare scientists to contribute more effectively in time-bound R&D projects and also acquaint them with fundamentals of Technology Management, Project Management, Organisational Behaviour and Materials Management.

The course was jointly inaugurated by Shri Sanjay Tandon, OS & Director, ITM and Dr Manjit Singh, DS & Director, TBRL. Director TBRL delivered the keynote address.



Various topics, viz., Role and Scope of Technology Management in DRDO and Understanding of Technology Life Cycle, An Overview of Project Management and Life Cycle Management, Project Planning through Network, Technology Gap Analysis and Technology Planning

and Key success factors in Technology Transfer, etc., were covered during the course.

The course concluded with valedictory address by Shri Sanjay Tandon and vote of thanks by Shri Tarun Mohindra, Sc ‘G’ & Course Director.



53RD ENGINEERS' DAY CELEBRATIONS

ARDE, PUNE

Armament Research and Development Establishment (ARDE) celebrated 53rd Engineers' Day on 16 September 2020 to mark the birth anniversary of Bharat Ratna M Visvesvaraya—an Indian Civil Engineer and Statesman who implemented an intricate system of irrigation in the Deccan Plateau, and designed and patented a system of automatic weir water floodgates that were first installed in 1903 at Khadakvasla Reservoir near Pune. A webinar was organized on 'Design Thinking for Self-reliant India'.

Dr Sanjay G Dhande (Padma Shri Awardee), former Director, IIT Kanpur delivered a talk on design thinking process. He explained the design thinking process and exhorted ARDE fraternity to innovate and become self-reliant in the area of armament and related technology. Dr V Venkateswara Rao, OS & Director, ARDE, expressed his gratitude to the speaker for his informative and impressive talk.



Dr Sanjay G Dhande addressing the ARDE fraternity through virtual platform

ITR, CHANDIPUR

53rd Engineers' Day was celebrated at Integrated Test Range (ITR) on 15 September 2020. Shri HK Ratha, Sc 'G', Associate Director, ITR inaugurated the programme. In his inaugural address, he highlighted the contributions of the engineers towards the development of the nation and the world. A talk

on 'Engineers for Self-Reliant India' by Prof. AR Mohanty, IIT Kharagpur through video conference was organised during the occasion.

The programme was organised by Shri MK Pal, Sc 'F' and Shri PN Panda, Sc 'F' and team.

ARDE CELEBRATES LIBRARY WEEK

Library Week was celebrated at Information Centre for Armament Technology (ICAT), ARDE, Pune during the first week of September 2020. ICAT Logo competition on the theme 'Total User Satisfaction', Armament Crossword, Armament Quiz, ICAT Poll and an exhibition on Artillery Ammunition were organized in an online environment. Books were awarded to the winners by Dr V Venkateswara Rao, OS & Director, ARDE.



Award distribution on the occasion of ARDE Library Week

INAUGURATION OF IEEE COMMUNICATION AND COMPUTER SOCIETY JOINT CHAPTER

IEEE Communication and Computer Society Joint Chapter, ITR Chandipur (Chapter Code: CH10943) was e-inaugurated at Integrated Test Range (ITR), Chandipur on 16 September 2020 through video conferencing. Shri DK Joshi, Director, ITR, Shri HK Ratha, Associate Director, ITR, all executive members of IEEE from ITR Chandipur were present during the programme.

Prof. AK Tripathy, Chair IEEE Bhubaneswar Sub-section, in his inaugural address said that the computer and communication joint society chapter provides the world's largest forum for sharing the latest in technological developments in the field of communication and computer in developing standards that guide the development and construction of equipment and systems and for educating members of the industry and the general public. Prof. Ganapati Panda immediate Chair of Bhubaneswar, IEEE chair who is regarded as bridge between ITR, Chandipur and IEEE Sub-



Inaugural session of Communication and Computer Joint Society Chapter

section, Bhubaneswar addressed the gathering. He congratulated Shri HK Ratha, Associate Director and his team for their tireless efforts and successful attempt to establish a joint society chapter at Chandipur and expressed his happiness on the occasion.

Dr BK Das, Director, IRDE, Dehradun, who envisioned the idea of starting IEEE society at ITR also

addressed the august gathering with his motivating thoughts. He suggested the team to conduct virtual conferences in the future.

A technical talk on 'IOX-Communication Framework for the Internet of Everything' by Prof. Subrat Kar, Head, Sense IIT Delhi, was organised on the occasion.

HINDI PAKHWADA CELEBRATIONS

Hindi Fortnight is celebrated every year from 14 September to 24 September or 1 September to 14 September in all the offices, enterprises, institutions of the Government of India. Fourteen September is celebrated as Hindi Day to commemorate the adoption of Hindi in Devanagari script as one

of the official language in different Hindi speaking states of India. Hindi was adopted as one of the two official languages of the Republic of India by Constituent Assembly of India.

Hindi Pakhwada is organized before or after Hindi Day as per the convenience of the offices. Various DRDO labs/estts also celebrated

Hindi Pakhwada at their respective places.

ADE, BENGALURU

Hindi Diwas/Hindi Fortnight Inauguration program at Aeronautical Development Establishment (ADE) was organized from 14 September 2020 to 29 September 2020.



Dr S Venugopal, OS & Director, ADE inaugurated the programme. Various competitions were conducted on-line during the event, viz., Hindi handwriting, drawing/sketching/painting, essay, translation, look at the picture and write a story in Hindi/Kannada, Hindi noting and quiz competitions. Hindi poetry and technical writing in Hindi on any ADE's project were the two new competitions included in the programme.

Hindi Fortnight valedictory ceremony was conducted on 29 September 2020. Smt. Anjali Ellis Shanker, IDAS, IFA (Research & Development) Aero, Bengaluru graced as Chief Guest of the function and delivered a motivational speech.

'Manthan' a special programme was presented by Senior Scientist & Officers wherein they expressed their views on various subjects in Hindi. Mementos were presented to 'Manthan' participants by Chief Guest & Prizes for the winners of Hindi Fortnight Competitions were awarded by Director. The programme concluded with a cultural programme presented by ADE Cultural Society.

DIHAR, LEH

Hindi Pakhwada 2020 was celebrated with a plethora of Official Language-based competitions from 1 September to 14 September 2020 at Defence Institute of High Altitude Research (DIHAR HQ), Leh and its detachments at Siachen Sector and Base Lab, Chandigarh to spread awareness of Rajbhasha among employees. Inauguration Ceremony was chaired by Dr OP Chaurasia, Director, DIHAR. The Pakhwada was coordinated by Dr Anand Kumar Katiyar, under the guidance of Vice President, Official Language



Pakhwada valedictory function at ADE

Implementation Committee, DIHAR Dr Narendra Singh, Sc 'F'. Six competitions were organized.

Closing and Prize Distribution Ceremony was organized on 14 September 2020. Dr Chaurasia distributed the prizes among the winners. The Pakhwada was organized as per the Covid 19 guidelines.

DMRL, HYDERABAD

Defence Metallurgical Research Laboratory (DMRL) celebrated Hindi Fortnight from 14 September 2020 to 25 September 2020 with great zeal. On this occasion eight events—Noting & Drafting, Quiz, Antakshari, Typing, Reading, Essay Writing, Elocution and



Pakhwada celebration at DIHAR



Dr Homnidhi Sharma DGM-HR (OL), Bharat Dynamics Limited delivering talk at DMRL

Dictation were organised. The topic of Essay Writing was “Necessity of Self Dependence in Defence Sector.” The DMRL fraternity participated in all the events with gusto.

The valedictory function of the Hindi Fortnight and Hindi Diwas was celebrated on 25 September 2020 at Tamhankar Auditorium. Dr Homnidhi Sharma, DGM-HR (OL), Bharat Dynamics Limited was invited as the Chief Guest. Dr Sharma in his address appreciated the efforts of DMRL. All necessary precautions were taken up during the Pakhwada due to the pandemic.

ITR, CHANDIPUR

Hindi Day was celebrated in Integrated Test Range (ITR), Chandipur with enthusiasm on 14 September 2020. The programme was inaugurated by Shri DK Joshi, Director, ITR. Shri Joshi in his inaugural speech encouraged all to promote Hindi in every field including in day-to-day official works. He read out the message of the Secretary, DD R&D and Chairman DRDO. During the fortnight various competitions were organised.

The prize distribution and closing day ceremony was organised on 30 September 2020. In his address, Director ITR congratulated the employees for participating in the competitions. He further encouraged and urged the employees to impart more and more work in Hindi in their routine office work. The programme was organised maintaining social distancing and with face masking and was limited in numbers.

The programme was organised by Shri PN Panda, Sc ‘F’, Associate Group Director (HR), HRD Group and Hindi Cell and his team.



Closing ceremony of Hindi Pakhwada at ITR

NPOL, KOCHI

Naval Physical and Oceanographic Laboratory (NPOL) celebrated the Hindi Pakhwada during 14-25 September 2020. Shri S Vijayan Pillai, OS & Director, NPOL inaugurated the celebration on 14 September 2020. Hindi Diwas messages from Hon'ble Home Minister Shri Amit Shah and Secretary, DDR&D and Chairman DRDO, Dr G Satheesh Reddy, were read. Fourteen competitions were organised for NPOL employees. For employees of Underwater Acoustic Research Facility (UARF), Idukki, online Hindi competition was

conducted. The competitions were aimed to promote Rajbhasha in the laboratory. An Official Language Exhibition was also organized to commemorate the occasion.

Winners of the competitions were awarded by Director NPOL. Shri Ram Lochan Awasthi, Sc ‘D’ & Hindi officer presented an overview of fortnight celebrations conducted in the year 2019. ‘Hindi Fortnight Rolling Trophy’ was presented to the house, which scored maximum points.

Dr A Raghunatha Rao, Sc ‘F’ was the Chairman, Hindi Fortnight Celebrations Committee.



Inaugural ceremony of Hindi Pakhwada at NPOL

COMMEMORATION OF 150TH BIRTH ANNIVERSARY OF MAHATMA GANDHI

DEAL, DEHRADUN

Defence Electronics Application Laboratory (DEAL), Dehradun earnestly celebrated the Gandhi Jayanti towards the conclusion of two-year long commemoration of 150th birth anniversary of Mahatma Gandhi. Banners and cut outs showcasing the life of Mahatma were displayed, which were appreciated by the visitors. Shri PK Sharma, Director, DEAL, paid floral tributes to Gandhiji along with other officials and spearheaded the cleanliness and sanitization drive in the campus. During his address, he emphasized on the non-violence and inclusiveness propagated by Gandhiji. Online quiz competition and philatelic exhibition on the life of Mahatma Gandhi was also organized. The celebrations concluded with an online lecture on 'Gandhiji and his Satyagrah' by Shri Abhai Mishra.

VRDE, AHMEDNAGAR

Vehicle Resarch and Development Establishment (VRDE) celebrated the occasion by organising Cleaning Drive from 25 September 2020 to 2 October 2020 with active participation of the employees.

All technical accommodations, office buildings, meeting halls were cleansed by the respective employees of the divisions. Common areas were thoroughly cleansed. Director, VRDE, along with employees paid a floral tribute to Mahatma Gandhi. A documentary showcasing Life of Mahatma Gandhi was also screened. Director, VRDE, addressed the



Shri PK Sharma, Director DEAL paying floral tributes to Mahatma Gandhi

gathering and emphasized on the principles of Mahatma Gandhi and urged everyone to follow the same.

A quiz competition based on 'Life & work of Mahatma Gandhi' was organized. Total 10 teams comprising of three participants each

participated in the event with full zeal and enthusiasm. Computer-based quiz programme made in-house was utilized for the event. Winner team was awarded certificate.

Covid-19 norms were adhered to during the event.



Floral tributes being paid to Mahatma Gandhi

NPOL, KOCHI

Naval Physical and Oceanographic Laboratory (NPOL) organized the “Cleanliness Drive” during 25 September 2020 to 2 October 2020 in accordance with the nation wide sanitation campaign towards ‘Clean India’ on the occasion of the 150th birth anniversary of Mahatma Gandhi. Cleanliness drive on 2 October 2020 was led by Shri S Vijayan Pillai, OS & Director NPOL. In the inaugural address, he highlighted the relevance of cleanliness drive and stressed that the cleanness should be followed throughout instead of a one time event. A quiz on the Life of Mahatma Gandhi was conducted by Shri Kiran Govind, Sc ‘E’. Shri K Ajithkumar, Sc ‘E’ & GD (WES) also spoke on the occasion.

Cleaning of work places headed by respective Group Directors/Project Directors was carried out on 1 October 2020 in addition to the common area cleaning started from 25 September. One hundred and sixty employees participated with great enthusiasm



Cleanliness drive at NPOL campus

and team spirit in the event and cleaned the corridors and immediate premises of groups, integration rooms, etc. of main building and various technical complexes. Cleaning activities were also carried out both inside and outside of the building at Underwater Acoustic Research Facility of NPOL at Kulamavu, Idukki. NPOL Works Committee and Works,

Estates & Services Group conducted the cleanliness drive.

Large congregation was avoided in view of the Covid-19 pandemic. All Officers and Staff who participated in the drive followed social distancing norms, sanitization, wearing of mask, as preventive measures to contain the spread of Covid-19.

LABNET – β RELEASE

Dr Tessy Thomas, DS & DG (Aero), DRDO launched the β -version of the new portal ‘LABNET’ on 17 August 2020 at Aeronautical Development Establishment (ADE), Bengaluru. Dr S Venugopal, OS & Director, ADE was also present on the occasion. Dr Thomas congratulated ADE completing Beta version in a short time. She also emphasized the need for digital platform especially to manage and monitor large number of projects being executed by ADE.

Dr S Venugopal expressed gratitude for the support extended



Dr Tessy Thomas, DG (Aero) releasing the Beta Version of LABNET Platform



by Director and DNet team of DRDL, Hyderabad. The platform is being developed with the support of CDAC, which is developing it in a planned and systematic manner by preparing SRS for various modules, their design and development, followed by rigorous

testing, in line with the software life cycle development.

Shri R Chandrasekaran, Sc 'G' made a presentation on 'Overview, challenges and roadmap of the platform. He presented the Genesis of LABNET, which is aimed at

office/workflow automation at corporate level encompassing all major segments like administration, pay, finance, budget, personnel, material management and project management for online processing, faster delivery and decision making.

DRDO PARTICIPATES AT ARMY-2020

The International Military-Technical Forum 'ARMY-2020' was held from 23 August 2020 to 29 August 2020 at the Patriot Convention and Exhibition Centre, Kubinka Air Base, Moscow, Russia. DRDO showcased 11 world class export ready products at the event as part of India Pavilion along with the state-owned Defence industries consisting of Bharat Dynamics Limited, Goa Shipyard Limited, Ordnance Factory Board and BEML Ltd. Shri Raj Kumar, Secretary, Defence Production led

the high-level MoD delegation to the exhibition. Shri Ajit Chaudhary, OS, DRDL, Hyderabad was part of team. The DRDO team interacted with various stakeholders and had focused interactions with the Russian defence services, military delegations from various countries, industries and the media.

DRDO products included Beyond-visual-Range air-to-air Missile 'Astra', Anti-Tank Guided Missiles 'Nag' and its air-launched version 'HELINA', Ground-based High Performance

Mobile Electronic Intelligence (ELINT) Systems, Weapon Locating Radar 'Swathi', Air Defence Fire Control Radar 'Atulya', Advanced Towed Artillery Gun Systems, Main Battle Tank 'Arjun MK1A', Submarine Sonar Suite 'SMS-X', Low Frequency Dunking Sonar, and Torpedo Advanced Light.

Substantial interest was expressed by visitors in the DRDO products. ARMY-2020 will reinforce the strength and marketability of the products showcased by DRDO.





DRDO HARNESSING SCIENCE FOR PEACE & SECURITY

CHAPTER 4: MARCHING FORWARD

The article is 56th 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). This is the last part of the series History of DRDO.

VEHICLES

Combat Vehicles Research & Development Establishment

Thus, DRDO with the Government in concurrence, chalked out a development strategy which reduced uncertainty, while at the same time kept its options open with respect to the technological advances in the weapons area. This was the first multi-institutional project for DRDO in systems development.

By the end of the 1970s, the design of major subsystems was completed and the hardware was being fabricated for the prototypes so that the first prototype with 115 mm gun would be ready by the end of 1981. The status of the four major sub-systems, namely the engine, the gun and its ammunition, fire control and vision instruments, and armour would be a fair indicator of the pace of development.

The import of an engine of adequate power from abroad did not succeed mainly due to political reasons and the fall-back option of indigenous development turned out to be the only option available. It was commendable that CVRDE with no prior experience succeeded in designing and developing an air-

cooled engine with an output of about 1500 HP and had assembled the first prototype. This would be subjected to tests and evaluation and were tested for full output with the turbocharger, the development of which was entrusted to GTRE.

As far as the gun was concerned, the firing performance of the first 115 mm prototype gun firing soft core APDS ammunition gave results far superior to the Vijayanta which was encouraging. If the guns were autofrettaged at higher pressures, then still higher performance would be possible. The accuracy of firing was as good as that of Vijayanta even though the range was double. One gun barrel was tested and proved for pressures that might develop during firing. A second barrel intended to be used in the first prototype of the tank would be modified in length to meet the requirement of CVRDE for fitment. The recoil system was also improved to prevent leakage. Low pressure ammunition, such as HESH and smoke would be supplied with brass cartridge cases whereas APDS ammunition would be with semi-combustible cartridge cases. Several batches of high energy propellant for the ammunition were produced so that adequate quantities would

be made available by HEMRL by December 1980. The technology for semi-combustible cartridge case was already established by HEMRL and the Laboratory was ready to transfer the technology to ordnance factory. As far as the fire control and vision systems were concerned, all the necessary hardware and sub-systems were already developed except for the thermal imager. The software development for the ballistic computer was awaiting ballistic data about the new gun. As far as armour was concerned, the monolithic armour namely 5 per cent nickel steel armour, was being progressed by DMRL at three manufacturers and proof plates for trials would be made available by December 1981.

As the hardware was getting ready for assembling and integration of the first mild steel prototype, winds of change had already begun to blow. DRDO and CVRDE initiated the development effort when the armed forces of the world were between two generations of tanks. The obsolescence of the current generation was clearly understood but the configuration of the next generation was yet to emerge out of the clouds of uncertainty. For DRDO it was Hobson's choice and so it accepted the prevailing uncertainty



and started the development. Six years later, it accepted the changes and promised to move ahead.

RETURNS & REWARDS

The question, whether R&D can generate its own resources has been posed to many of us, both by lay persons and by the cognoscenti. It would mean that the input/output ratio has to be less than one. By that criterion, if the input is represented by the annual budget of DRDO and the output by the orders placed by the Services on production agencies for the products developed by DRDO, then in our case, the ratio is about 1.86 as the input is ₹ 520 crores and the output ₹ 280 crore. However, worldwide, R&D for defence is subsidised by the State in one form or the other. Therefore, the input/output ratio has always been greater than one. The main reason is that in defence, the customer seeks systemic change which translates into a distinct change for the better in performance parameters, like radius of action, accuracy, lethality, mobility and so on. The complexity of the system rises and makes it difficult for us to break it down to sub-systems of manageable complexity (modularity) so that most, if not all of these, can be simultaneously designed and developed. With increasing complexity, modularity can no longer be taken for granted and the probability of rework increases, leading to time and cost over runs.

For the scientists and technologists, the returns for their effort is in terms of the peer recognition. Awards at the national level by a group of

peers is generally considered as recognition by the peers. Many DRDO institutions and scientists have been awarded national awards like Salwan Award, Import Substitution Award, and Invention Promotion Award. In addition, the nation has recognised the contributions made by our senior scientists by the Padma Awards. In 25 years of its existence, the President of India was pleased to confer Padmashri to the following for their contributions to defence.

Lt Col Santosh Kumar Mazumdar – INMAS (1964)

Dr Nautum Bhagwanlal Bhatt – SSPL (1969)

Mr Hari Prasad Jaiswal – LRDE (1972)

Dr Waman Dattatraya Patwardhan – ERDL (now HEMRL)/ARDE (1974)

Mr Nagapattinam Sambasiva Venkatesan – ARDE/TBRL (1975)

Dr Brojendra Kishore Banerjee – DSL (now LASTEC) (1976)

Mr Debi Prasad Mukherjee – CVRDE (1976)

Mr Vakkaleri Narayan Rao – DLRL (1982)

We salute all of them.

EPILOGUE

More than 20 years have passed since the last event described in the book took place. DRDO has passed many significant milestones in its march towards progress, and therefore, a short account of these would be in order.

Firstly, from 1982 onwards, the Scientific Advisers have been from within the Organisation, a clear sign that the organisation has provided adequate opportunities and challenges for the scientists to excel and be

recognised. Dr VS Arunachalam followed Dr Raja Ramanna in Office and had a tenure of about ten years, a period during which the Organisation expanded and excelled. Dr APJ Abdul Kalam was the Scientific Adviser from 1992-1999 during which period the tempo of activities was maintained. Dr Kalam today is the President of India and it is a matter of pride to the defence scientists of the country that one amongst us became the first citizen of India. Dr VK Aatre took over from Dr Kalam as Scientific Adviser and has maintained the tradition of excellence and accountability.

In this volume, a mention of the seeds of two major programmes being sown has been made. These were, the Integrated Guided Missile Development Programme (IGMDP) and the Light Combat Aircraft (LCA) programme. The Integrated Missile Development Programme was a major effort and involved development of five missiles, Prithvi and Agni, which are surface-to-surface missiles, Akash and Trishul, which are surface-to-air missiles and Nag, which is an antitank missile. It is indeed a matter of great pride to all of us that Prithvi and Agni have entered into Service for the Army and for the Indian Air Force. It is the goal of the DRDO scientists that the other three missiles, which are in the advanced stages of development, will find their way in the armoury of our fighting forces. The light combat aircraft development programme, which was considered too ambitious a programme to embark upon, especially as the country had no real R&D programme in aircraft for more than fifteen years and had relied on



imports from the West and from Russia for meeting the needs of the military and the civil aviation, has put us in the ranks of the select few in the comity of nations. The aircraft was designed and developed with advanced features, such as composites for the fuselage and fly-by-wire, has been successfully flown and has completed more than 200 flight trials.

It is a reliable fighting machine and will join the Indian Air Force with a modern indigenously designed and developed radar which is under evaluation.

Another major system development programme mentioned in the volume is the development of the tank. Subsequent to 1982, a clear QR emerged in 1985. Prototypes were built for integration, testing and changes/modifications were progressively incorporated. The tank was named ARJUN and was inducted into the Army in 1993 with pre-production models, which were subjected to gruelling tests by field formations. After evaluation and assessment of the performance by the Army, order for its production was placed in 2000 on the Heavy Vehicles Factory, Avadi.

The development activities of the Armament group of laboratories in weapons and ammunition have resulted in production orders worth about Rs 2000 crores. Similarly, the electronic group of laboratories carrying out development activities

in radar, electronic warfare and communication equipment and systems have contributed more than Rs 2000 crores to the output of DRDO. The INDRA radar, which was mentioned in Chapter 3, was successful and both the Army and the Indian Air Force have introduced it in Service. INDRA radar was followed by INDRA Mark II, for which repeat orders have been received from the Indian Air Force recently. In addition, DRDO developed in fairly quick time, a short-range battlefield surveillance radar for the Army which successfully withstood competition from abroad. The Army was happy to place an order for a large number of these, and currently, it is under production.

The Central Acquisition Radar has found favour with both the Indian Navy and the Indian Air Force. They have placed orders for supply of multiple number of these. The development effort of DRDO on radar has generated a total order of about Rs 1000 crore. In electronic warfare, considerable expertise exists at the component, subsystem, and system levels within DRDO; equipment and systems have been developed, evaluated, and accepted for introduction by the three Services. Systems with ELINT and COMINT functionalities, self-protection jammers, radar warning receivers are typical of the hardware that has been designed and with software added, supplied to the Armed Forces. Suffice

it to state that the production agencies associated with these programmes have orders worth more than Rs 1000 crore for these products developed by DRDO. In the last few years, both the Army and the Navy have further demonstrated their confidence in the capabilities of DRDO by joint funding of their respective EW programmes of truly massive proportions.

The communication group of DRDO which was the first in the country to develop an entire range of mobile electronic switching systems has kept pace with their colleagues by ensuring that the Services place an order to the tune of over Rs 400 crores on production agencies for manufacture of equipments developed by them for Plan AREN and subsequent updated network. In addition, production orders over Rs 100 crores have been generated by the speech secrecy systems developed by them.

All of these are high-tech military systems where the value added is very high compared to the raw materials and component costs. The agency responsible for value addition is R&D and it is precisely the reason why these systems have been effectively used as instruments of foreign policy by advanced nations by selective denial or access to their high-tech military systems. Defence R&D, thus will continue to play an important role for the three Services in the years to come.

DRDO NEWSLETTER



Readers' Views

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

1. Name of the Establishment: _____
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Excellent Very Good Good Fair Satisfactory
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Please send your suggestions to:

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AWARDS

Engineer of the Year Award



Dr N Kishore Nath, Sc 'G' and Project Director, VEDA, Advanced Systems Laboratory (ASL), Hyderabad has been conferred the prestigious "Engineer of The Year Award" (R&D)-2020 for his contribution in the field of Engineering for Design Development, Flight Testing Production and deployment of Long Range Agni IV Missile System. The award was given by the Govt. of Telangana and the Institution of Engineers (India), Telangana State Centre, Hyderabad. It was awarded on the occasion of 53rd Engineers' Day Celebrations (in commemoration of 160th Birthday Celebrations of Bharat Ratna Sir Mokshagundam

Visvesvaraya) on 15 September 2020. The Award was presented by Dr Tamilisai Soundararajan, Hon'ble Governor of Telangana on the Engineering Day Function held at IEI Centre Khairatabad, Hyderabad.

Lion's Award

Lions Club, Dehradun felicitated Shri PK Sharma, Director, DEAL for the contributions made by Defence Electronics Application Laboratory (DEAL) in the field of Defence R&D. In a plain and simple ceremony held at DEAL on 26 August 2020, Lion



Anil Gupta, President, Lions Club, Dehradun West, presented a memento and a Corona Kit to Shri Sharma as a token of gratitude and appreciation on behalf of the Lions Club.

HIGHER QUALIFICATION ACQUIRED



Ms Sudharani SV, Sc 'G', ADE, Bengaluru has been awarded PhD in Computer Science by Bharatiar University, Coimbatore, for the thesis entitled "Mutation Testing, Mutant Operators and Metrics Introduced in the Avionics Systems Integration Domain."

VISITORS TO DRDO LABS/ESTTS

Shri G Kishan Reddy, Hon'ble MoS (Home), GoI, visited Defence Institute of High Altitude Research (DIHAR) on 29 September 2020. He was briefed about the activities of the lab by Director DIHAR, Dr OP Chaurasia. He took special interest in the agro-animal technologies developed by DIHAR. The double humped camels of DIHAR were a show stopper during his visit wherein he was especially interested to know about the importance and utility of these camels at high altitude. Hon'ble Minister emphasized that DIHAR Agro-animal Technologies should be disseminated effectively among the whole tribal communities of Ladakh for the benefit of soldier and society.



Shri G Kishan Reddy, Hon'ble MoS (Home), GoI, being briefed by Director DIHAR