

DRDO NEWSLETTER

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Tejas commissioned into Indian Air Force

DRDO in Press

THE HINDU

Naval lab to develop optic-guided torpedoes

It will launch major projects during the next three or four years, says outgoing NSTL director 28 July, 2016

Having delivered heavyweight torpedo Varunastra to the Navy and anti-torpedo decoy system Mareech, the Naval Science and Technological Laboratory (NSTL) here will now embark on the development of optic-guided heavyweight torpedoes and lightweight torpedoes with extended range.

"We are moving towards strategic domain taking up products for various advanced platforms, and the user confidence is high," NSTL Director C.D. Malleswar said.

Long strides - The NSTL will see the launch of major projects every year during the next three or four years. The submarine variant of Varunastra would be test-fired in about two months and the optic-guided torpedo trials will begin by the year-end, according to Mr. Malleswar, who held a press conference on Wednesday on the eve of 47th Lab Raising Day. The NSTL worked with BDL and BEL in concurrent engineering mode and once the Navy placed the orders, 73 Varunastra and 33 Mareechs, costing about Rs. 2,000 crore, will be made by them for deployment. Besides, he said, the NSTL has made long strides in fire-control system.

'Agni' award - It has developed Panchendriya for submarines, another system for helicopters. Its integrated anti-submarine warfare complex 'MOD 0' has been inducted on six Rajput Class ships.

ASW complex 'MOD C' has been designed for corvettes of Kolkata, Kamorta and Kochi

Class and these are also ready for inducting Varunastra and Mareech.

International facility - The NSTL has been given 'Agni' award in self-reliance for fire-control systems, Mr. Malleswar said.

Door is also open for defence exports with requests from countries like Vietnam and Myanmar, he said.

He attributed the delay in developing Varunastra to the challenges under water. He recalled that during the trials in 2014, the torpedo recovery vessel sunk and the torpedo under trial was recovered from over 200 metre depth. It was the first time that a torpedo was recovered from such depths, he said. Mr. Malleswar, who is laying down office this month-end, said the NSTL had an excellent international facility in hydrodynamic research with Seakeeping and Manoeuvring Basin inaugurated recently by the Defence Minister at which sea-keeping abilities of vessels are tested with models. The Cavitation tunnel identifies operational regimes for a ship or submarine. The recently installed propulsion system integration centre integrates engines and propellers. It also works on minimising signature of vessels to prevent detection by enemy ships.

"So we have total ship designing indigenously with weapons, propellers, fire control systems, mines and decoys," Mr. Malleswar said.

"There is no looking back and we are confident of doing anything," he said.

The Indian EXPRESS

Parrikar announces DRDO-IIT tie up costing Rs 160 crore

The jet propulsion lab will be jointly set up with IIT Mumbai and IIT Madras. 31 July, 2016

Union Defence Minister Manohar Parrikar on Saturday said the Defence Research and Development

Organisation (DRDO) can have a tie-up with the Indian Institutes of Technology (IITs). "We have signed an agreement with DRDO for jet propulsion lab which is to be jointly set up with IIT Mumbai and Madras, the total cost of which is about Rs 160 crore," Parrikar said after inaugurating the IIT Goa campus in presence of Union HRD Minister Prakash Javadekar.

Some 8,000 scientists of DRDO can be a big resource for the educational institutes, Parrikar said, adding, "We can teach. We can select a few scientists who have done top-end research (for teaching)." On the quality of research at DRDO, the Defence Minister, himself an IIT graduate, said in the next one or two years the country would not

need to import any part of its missile technology, adding, "We will be in the position to manufacture it here. We can have tie-ups with IITs, including Goa IIT, after a couple of years, to develop something, Parrikar said, adding, DRDO laboratories can be used for summer vacation training of IIT students.

"We can tie-up with DRDO to get visiting faculty in various subjects which can give proper adoptable technological edge in education," he added. The defence minister, himself a former chief minister of Goa, at the inauguration said that the state should not be clubbed with other Union Territories for reservation at the technology institutes. He also said that IIT Goa shall be holding a 50 per cent reservation for the local population, a quota which will be shared with Daman and Diu, Dadra and Nagar Haveli.

THE FINANCIAL EXPRESS

DRDO's 155 mm x 52 calibre advanced towed artillery gun test fired successfully

15 July, 2016

DRDO today successfully conducted the proof firing of armament system for 155 mm x 52 calibre Advanced Towed Artillery Gun System (ATAGS).

Giving the 'Make in India' initiative for the defence sector yet another boost, DRDO (Defence Research and Development Organisation) today successfully conducted the proof firing of armament system for 155 mm x 52 calibre Advanced Towed Artillery Gun System (ATAGS).

ATAGS is fully indigenous towed artillery gun system project. The project is part of the artillery modernisation programme of the Indian Army. The first fully integrated gun system is likely to be ready for user (Indian Army) trials by the first half of 2017.

The gun will have a firing range of 40 kms and boasts of advanced features such as high mobility, quick deployability, auxiliary power mode, advanced communication system, automatic command and control system with night firing capability in direct fire mode.

The system comprises of a barrel, breech mechanism, muzzle brake and

recoil mechanism to fire 155 mm calibre ammunition by Indian Army. "This has a longer range, accuracy and precision and provides greater fire power," says a Ministry of Defence release.

The system is configured with an all electric drive aimed at ensuring maintenance free and reliable operation over a longer period of time.

Armament Research & Development Establishment (ARDE), Pune, a nodal laboratory of DRDO is behind the design & development of ATAGS, along with other DRDO laboratories.

DRDO aims to develop the artillery gun system with participation of private industry to meet the requirement of the Indian Army. The idea is to establish indigenous critical defence manufacturing technologies.

DRDO hopes to do this with the participation of Ordnance Factories, DPSUs and private industries including Bharat Forge, Tata Power Strategic Engineering Division and Mahindra Defence Naval System to meet the aspiration of Make in India initiative in defence sector, says the Ministry release.



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Tejas inducted into Indian Air Force

“Induction of indigenously made Tejas fighter jet into the Air Force fills our hearts with unparalleled pride and happiness. I laud HAL and ADA on the induction of Tejas fighter jet. This illustrates our skills and strengths to enhance indigenous defence manufacturing.”

- Narender Modi



The Indian Air Force (IAF) inducted two indigenously developed Light Combat Aircraft Tejas into its '45th Squadron' on 1 July 2016 at a ceremony preceded by inter-faith prayers at the Aircraft System Testing Establishment, Bengaluru. T Suvarna Raju, Chairman, Hindustan Aeronautics Limited (HAL), handed over the certified documents of the indigenous fighter to Air Marshal Jasbir Walia, Air Officer Commanding-in-Chief, Southern Air Command. Tejas is a fourth-generation plus, lightweight, multi-role supersonic single-engine aircraft designed and developed by the Aeronautical Development Agency (ADA) in collaboration with India's largest defence PSU, Hindustan Aeronautics Limited (HAL).

Hon'ble Raksha Mantri Shri Manohar Parrikar congratulated the induction of the Tejas and described the plane a force multiplier. “Moment of national pride. Indigenously developed Tejas fighter jet inducted into Air Force. Tejas will take our air strength to new heights”, said the Raksha Mantri.

Dr S Christopher, Secretary, Department of Defence R&D and DG ADA lauded the 'Team Tejas' and said,

LCA AF MK1



Performance

Speed : 1.8 Mach
Service Ceiling : 50,000 ft
'g' Limits : +8/-3.5

Dimensions

Span : 08.20 m
Length : 13.20 m
Height : 04.40 m

Special Features

- ⊗ Compound Delta Platform
- ⊗ Relaxed Static Stability
- ⊗ Composite Structure
- ⊗ Fly-by-wire Flight Control

Weight

Take-off Clean : 9800 kg
Empty : 6500 kg
External Stores : >3500 kg

Power Plant

F404-GE-IN20

- ⊗ Computer-based monitor & control of Electro Mechanical Systems
- ⊗ Glass Cockpit
- ⊗ Multi-mode Radar

"The team is proud that an idea in late 1980s is today turning into a reality of having our own fighter aircraft. This critical milestone could be achieved only due to the

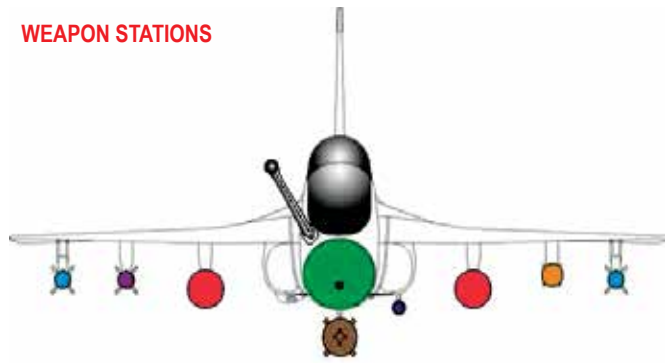
initiative of the Hon'ble Raksha Mantri Shri Manohar Parrikar." The LCA programme has been unique in bringing together stakeholders and partners within and outside the country. HAL has been the principal partner with participation and support of IAF, IN, DRDO, CSIR, CEMILAC, DGAQA, PSUs, academic institutions, private establishments, etc., he further added.

Prior to its induction, the fourth generation-plus advanced fly-by-wire fighter has flown about 3,200 sorties testifying its reliability and that LCA Programme is now racing smoothly toward achieving FOC. Equipped with the latest satellite-aided inertial navigation system, the supersonic aircraft has a digital computer-based attack system

and an autopilot.

The fighter is capable of carrying four tonnes of weapons and firing air-to-air missiles and precision-guided munitions like laser-guided bombs. It is also

WEAPON STATIONS



	8	4	2	7	L	1	3	5
BVRM		✦	✦			✦	✦	
CCM	✦							✦
Drop Tanks			●	●		●		
SPL Sensors					●			
Bombs		●	●	●		●	●	
LGB		●	●	●		●	●	

External Stores

- ✦ Air-to-Air Missiles
- ✦ Air-to-Ground Missiles
- ✦ Anti-Ship Missiles
- ✦ Laser Guided Bombs
- Conventional Bombs
- GSh-23 Gun
- Drop Tanks

equipped with a helmet-mounted display and has a distinctive 'glass cockpit' in which information is displayed real-time to the pilot.

IAF has placed order for 20 Tejas in IOC configuration and another 20 aircraft in FOC configuration.

RM Hands Over Varunastra to Indian Navy

Shri Manohar Parrikar, Hon'ble Raksha Mantri, handed over "Varunastra—a ship launched heavy-weight torpedo", also known as underwater missile to the Indian Navy in a befitting ceremony on 29 June 2016.

Speaking on the occasion, Shri Manohar Parrikar congratulated DRDO for the achievement and appreciated the efforts made in this regard. He asked DRDO to ensure its participation in the production process and to keep adequate quality control of their products so that it can meet the international standards. The Minister also stated that in these high technology areas,





DRDO's contribution with 95 per cent of indigenous content is an apt example of Indigenously Designed Developed and Manufactured (IDDM) category.

Varunastra has been developed by Naval Science and Technological Laboratory (NSTL), Visakhapatnam. Bharat Dynamics Ltd has been associated as a production partner in concurrent engineering mode.

The Chief of the Naval Staff, Admiral Sunil Lanba termed the occasion as momentous and described it as yet another feather in the DRDO's cap. He applauded DRDO for rendering yeomen service to the nation in achieving self-reliance in defence and underwater technologies. He said the Navy's partnership with DRDO laboratories has strengthened and matured over the years. "The fact that three of the premier DRDO labs Naval Physical and Oceanographic Laboratory (NPOL), Naval Materials Research Laboratory (NMRL) and NSTL carry the prefix 'Naval' in their names highlights the close relationship between the Indian Navy and the DRDO in our joint efforts", Admiral Lanba stated.

Dr S Christopher, Secretary, Department of Defence R&D and DG DRDO described the induction of Varunastra as a proud moment for the nation as India has joined elite group of countries possessing the technology. Dr Christopher ascertained that Varunastra, has got the goodwill of Navy as a user, which has decided to produce 73 of them immediately. He recalled the induction of Mareech, the Advance Torpedo Defence System, which was handed over to Indian Navy last year. He also conjured DRDO developed LCA Tejas, the first Squadron of which is being raised by IAF, the AEW&C which is also striding towards induction into IAF this year, and successful demonstration of captive trials of BrahMos with

Su 30 aircraft.

Varunastra, a versatile naval weapon, can be fired from the Rajput class destroyers, Delhi class and all future Anti-Submarine Warfare (ASW) ships capable of firing heavy-weight torpedoes. It is capable of targeting quiet and stealthy submarines, both in deep and littoral waters even in intense countermeasure environment.

"In these high technology areas, DRDO's contribution with 95 per cent of indigenous content is an apt example of Indigenously Designed Developed and Manufactured category."

- Manohar Parrikar

The handing over function was attended by Shri G Mohan Kumar, Secretary Defence; Shri AK Gupta, Secretary, Defence Production; Dr G Satheesh Reddy, Scientific Advisor to Raksha Mantri and senior functionaries of Ministry of Defence, Indian Navy, DRDO, and Production and Industry partners.

Varunastra—Salient Features

- ⊗ Weight around 1.25 tonnes
- ⊗ High speed around 40 Nmi/hr
- ⊗ Explosive about 250 kg
- ⊗ Centralised mission control
- ⊗ ACCM features



MRSAM Test Fired Successfully

"I extend hearty congratulations to all those associated with the successful test-firing of the Medium Range Surface-to-Air Missile (MRSAM), developed jointly with Israel. The nation is proud of the achievement made by the DRDO and looks upon DRDO to make even greater efforts to boost India's indigenous defence capabilities in technologically challenging areas."

- Pranab Mukerjee

Medium Range Surface-to-Air Missile (MRSAM) has been successfully tested from the Integrated Test Range off Odisha Coast on 30 June 2016 and 1 July 2016. The missile guided by a radar system and on-board avionics successfully hit the designated targets in all its three missions.

The MRSAM is jointly developed by Research Centre Imarat (RCI), Hyderabad and Israel Aerospace Industries (IAI), Israel, for the Indian Air Force. Many DRDO laboratories,



and public and private industries have significantly contributed to the development of various sub-systems, which were put into use in these flight tests. Both, Indian and Israel teams participated in the

launch campaign. Shri M Ugender Reddy, OS and Project Director led the entire launch operations.

Dr G Satheesh Reddy, Scientific Advisor to Raksha Mantri and Programme Director,

MRSAM who spearheaded the missions, congratulated the team for the spectacular achievement during its maiden missions and said, "It is a quantum jump in air defence capability. All the mission requirements in three different scenarios were successfully met during the trials leading to hat-trick success."

Dr S Christopher, Secretary, Department of Defence R&D and DG DRDO, declared the launch as a major milestone for the IAF towards air defence.

Hon'ble Defence Minister, Shri Manohar Parrikar congratulated the team DRDO, Air Force, IAI, Israel and associated industries for the hat-trick success of MRSAM weapon system.

Hon'ble President of India, Shri Pranab Mukherjee congratulated DRDO on the successful test-firing of the Medium Range Surface-to-Air Missile. In a congratulatory message to the Secretary DDR&D, the President said, "I extend hearty congratulations to all those associated with the successful

test-firing of the Medium Range Surface-to-Air Missile (MRSAM), developed jointly with Israel. The nation is proud of the achievement made by the DRDO and looks upon DRDO to make even greater efforts to boost India's indigenous defence capabilities in technologically challenging areas. Kindly convey my greetings and felicitations to the members of your team of scientists, engineers, and all others involved in this mission. Our nation is grateful for their hard work and proud of their achievement."

DRDO embarked Major Success in Advanced Artillery Gun System

DRDO achieved yet another technological breakthrough by successfully conducting the proof firing of Armament system for 155 mm x 52 calibre Advanced Towed Artillery Gun System (ATAGS) during the technical trials conducted recently at Proof and Experimental Establishment (PXE), Balasore.

ATAGS is fully indigenous towed artillery gun system project undertaken in mission mode by DRDO as a part of artillery modernisation programme of Indian Army. Armament Research and Development Establishment (ARDE), Pune, is the nodal laboratory for design and development of ATAGS along with other DRDO laboratories.

The armament system of ATAGS mainly comprises barrel, breech mechanism, muzzle brake and



recoil mechanism to fire 155 mm calibre ammunitions with a longer range, accuracy and precision.

ATAGS is configured with all electric drive to ensure maintenance free and reliable operation over a longer period of time. It will have a firing range of 40 km with advanced features in terms of high mobility, quick deployability, auxiliary power mode, advanced communication system, automatic command and control system with night firing capability in direct fire mode.

The development trajectory of ATAGS aims at establishing indigenous defence manufacturing

technologies with the active participation of Ordnance Factories, DPSUs and Private industries including Bharat Forge Limited, Tata Power Strategic Engineering Division and Mahindra Defence Naval System to meet the aspiration of Make in India initiative in defence sector.

DRDO is committed to develop ATAGS in the shortest time frame with active participation by leading industries to meet the requirement of Indian Army. The first fully integrated gun system will be ready for user trials by early 2017.

VRDE Hands Over Rotary Engine to ADE

The indigenous Rotary Engine designed and developed by Vehicles Research and Development Establishment (VRDE), Ahmednagar, a premier establishment of DRDO, was handed over to Aeronautical Development Establishment (ADE), Bengaluru, for their Unmanned Aerial Vehicle (UAV) Nishant and



Wheeled Version 'Panchhi' projects. Shri Manmohan Singh, Director, VRDE formally handed over the engine to Shri Ashok Rangan, Programme Director, UAV, ADE, on 31 May 2016.

Director, VRDE in his address said that the development of Rotary Engine is a big leap towards achieving self-reliance in the field and congratulated the team for their rigorous efforts towards the development of rotary engine. Shri Rangan, expressed that the indigenous rotary engine will replace the imported engine used for the UAV programme of DRDO. DRDO Scientists and senior officials from Directorate General of Aeronautical Quality Assurance (DGAQA), and RCMA were present on the occasion.

RM launches Test-o-Milk Kit

Shri Manohar Parrikar, Hon'ble Raksha Mantri, launched the "Test-o-Milk Kit" developed by Defence Food Research Laboratory (DFRL), Mysuru, to Mumbai-based Pearl Corporation during the 8th Convocation Ceremony of Defence Institute of Advanced Technology (DIAT), Pune, on 31 May 2016. Dr S Christopher, Secretary, Department of Defence R&D and DG DRDO, Dr Surendra Pal, Vice Chancellor, DIAT, Dr Manas K

Mandal, DG (Life Sciences), Dr Rakesh Kumar Sharma, Director, DFRL, Dr MC Pandey, Sc G (inventor of the kit), and Shri Mahesh Rathi, Director of Pearl Corporation, were present during the launching ceremony.

The easy-to-use kit, first of kinds in India, helps in finding out adulteration of urea, starch, boric acid, soap/detergent, neutraliser, hydrogen peroxide, etc, in the milk.



DFRL transfers Retort Processed Ready-to-Eat Food & Instant Idli-Sambhar, Upma and Coconut Chutney Technology

Defence Food Research Laboratory (DFRL), Mysuru, signed Memorandum of Understanding (MoU) for Transfer of Retort Processed Ready-to-Eat Food (RTE) Technology with Indian Railway Catering and Tourism Corporation (IRCTC) for providing safe and nutritious food to passengers of Indian Railway. Dr Rakesh Kumar Sharma, Director, DFRL and Dr AK Manocha, Chairman and Managing Director, IRCTC, signed the agreements on 27 June 2016 at DFRL, Mysuru.

The inventor, Dr R Kumar, Sc F, and his team, Dr AD Semwal, Sc G, Head, Technology Transfer Division and Shri B Ramesh, DGM, IRCTC, Shri Kaverappa, RPRO, DRDO and senior official from IRCTC were present during the occasion. The initiative for providing safe nutritious food to Indian Railway passengers were started during 2012. Trials with ready-to-eat foods, i.e. vegetable pulav, paneer curry, dal curry, roti and chicken curry were conducted in few circuits of Indian Railway network.

Retort processing of foods in rigid containers and flexible packaging systems is the most acceptable form of food preservation with shelf-life of more than 12 months under ambient conditions. The technology is essentially based on three important critical factors namely packaging systems, processing schedule and the requirement of product recipes.

DFRL has designed and developed bulk sterilizers



(retort) with a capacity of 250 to 750 kg per batch. It offers many advantages such as cost-effective (approximate cost Rs 20 lakhs while the cost of similar imported retort is Rs 4-5 crores) provision for rapid cooling, pneumatically operated safety valves, provision to monitor heat transfer/penetration, etc. Product formulation and standardization of the same for various traditional food products for Services as well as civilian market has been developed at DFRL. The process schedule has been optimized for various products, i.e., vegetable pulav, vegetable biriyani, chicken biriyani, mutton biriyani, dal tadka, peas panner curry, peas aloo curry, non veg curries, etc., with respect to compositions as well as volume.

DFRL has transferred this unique technology to 71 enterprises like MTR, ITC, Kohinoor, Tasty Bite, Chokhi Dhani Foods, Haldiram, Taste'L Fine Food, Annamalaiyar

Foods, etc., for production and large scale supplies in India as well as abroad.

Dr AK Manocha, visited different food processing facilities at DFRL and appreciated the laboratory for the development of safe, convenience energy dense and nutritious food products for Armed Forces and civilian population. He also told that IRCTC will exploit the commercial potential of R&D work carried out by DFRL in the field of food product development to meet the varying ethnic food preference of passengers of Indian Railway.

DFRL also transferred the innovative technologies for preparing 'Instant Idli-Sambhar, Upma and Coconut Chutney' to M/s Brahmins Foods India Pvt Ltd, Thodupuzha, Kerala, on 22 June 2016. Dr Rakesh Kumar Sharma, Director, DFRL, exchanged the ToT documents with Shri Sreenath Vishnu, Executive Director M/s Brahmins Foods India Pvt Ltd. The



12 months at ambient conditions. Upma, a semolina-based savoury preparation is relished as an item of snack at any time. The instant upma mix is reconstituted by simmering in water with occasional stirring. The products can be served hot within four minutes of its reconstitution with its characteristic taste and flavour. The shelf-life of the product is 12 months at ambient conditions.

Coconut chutney is a delicious product generally served with dosa, idli, etc. The processing of coconut chutney takes long time at commercial levels. DFRL has developed instant dry mix, which can be reconstituted with water at the time of use. The mix contains coconut grating, tamarind, green chilli, coriander leaves, ginger salt, spices and oil besides curry leaves mustard seeds. The shelf-life of the product is 6 months at ambient conditions.

inventors, Dr GK Sharma, Sc G, Dr AD Semwal, Sc G and Dr OP Chauhan Sc E, with their respective team were present during the event.

Idli, a fermented steam cooked south Indian delicacy with unique textural and sensory attributes, is relished all over the country due to its better digestibility. However,

idlis are highly perishable and get spoiled within 24 hr of preparation. To overcome above problem instant Idlis along with sambhar have been developed by DFRL using combination drying technology. The products are capable of reconstitution in 4-5 minutes by mere addition of hot water. The shelf-life of the products is

RCMA, Chandigarh upgrades Mi-17 V5

Regional Centre for Military Airworthiness (RCMA), Chandigarh, has upgraded Mi-17 V5 helicopters, for VVIP purposes. Under the leadership of Dr PS Kohli, Regional Director, Scientists and Technical Officers made significant contribution for successful upgradation. Airworthiness approval for the upgradation has been accorded by RCMA-Chandigarh.

Shri Ravi Dhingra, Sc D, RCMA, Chandigarh, was awarded AOC-in-C Commendation by Air Marshal P Aneja VSM, AOC-in-C, HQMC, IAF on 7 June 2016 at 3BRD, Airforce, Chandigarh.



Secretary DDR&D lays Foundation of JCB Centre for Advanced Technology

Heralding a new era of DRDO-Academia partnership, DRDO signed a Memorandum of Understanding (MoU) with Jadavpur University (JU), Kolkata, to establish the Jagadish Chandra Bose Centre for Advanced Technology (JCBCAT) on 23 June 2016.

Dr S Christopher, Secretary, Department of the Defence R&D and DG DRDO laid the foundation of the JBCAT at the university campus. Dr Christopher in his address called for focused research and development at the centre and urged for continued cooperation to achieve success in long term. "Novelty in production needs to be designed keeping in mind constraints of time, cost and space", he said.

The Vice Chancellor of JU, Prof. Suranjan Das welcomed the DG, DRDO and said it is a matter of great honour for the university to be associated with DRDO. He assured the DG that JCBCAT would be a centre of excellence and assist in nation-building.



Shri MH Rahman, OS and Chief Controller R&D (Technology Management), DRDO, in his address said that JCBCAT would equip itself with advanced and unique research facilities and multi-university collaboration for quality research outcome which would involve the best researchers.

Research contributions made to DRDO by the JU and existing research potential in the university led to establishing this centre of excellence. The MoU will facilitate DRDO and the JU to pursue collaborative advanced research. The JCBCAT will primarily undertake research in areas of secure systems and cognitive technologies, directed energy, unmanned and robotics technologies and other futuristic technologies.

The Centre will strengthen DRDO's relationship with the JU and with other academic research institutions in the region. The scientists and engineers working in DRDO will get the opportunity to work with the faculty and scholars of the university towards addressing scientific problems and finding innovative solutions.

DRDO will support and facilitate advanced research and utilize the outcome in developing futuristic defence systems. The researchers will also have the opportunity to work on real problems in the advanced areas of Defence technologies. The concerted research efforts at this centre will lead to realization of indigenous technologies in critical areas and enhance self-reliance.

CHES develops Two Axis Gimbal Tracker for Laser Beam Orientation

Centre for High Energy Systems and Sciences (CHES), Hyderabad, has developed two axis gimbal tracker for mounting of laser beam directing channel for coarse tracking of target. The system is direct drive

with very high resolution optical encoder feedback system and achieved accuracy of 5 arc second with 40 kg payload. The operators console enables user control through manual toggle or computer

screen display. It has RS 232 serial link interface for analog and digital data input and output. CHES has evolved capabilities to develop high precision gimbal system in-house.

DRDO establishes Centre of Propulsion Technology

DRDO signed a Memorandum of Agreement (MoA) with Indian Institute of Technology (IIT) Bombay and IIT Madras to establish a bi-nodal 'Centre of Propulsion Technology' (CoPT) at the two institutions on 9 July 2016. Dr S Christopher, Secretary, Department of Defence R&D and DG DRDO, signed the MoA with Prof. Devang Khakhar, Director, IIT Bombay and Prof. B Ramamurthi, Director, IIT Madras.

CoPT, as the main Centre of Propulsion Technology, has been conceptualized to engage with the IIT Bombay and IIT Madras and other research institutions/centres to undertake advanced collaborative research in the critical defence technology areas. It will facilitate and undertake multidisciplinary directed basic and applied research in the focused areas of: Futuristic aero-engines, hypersonic propulsion for



long duration flight, solid propellant combustion modelling, morphing aircraft including its propulsion and associated technologies addressing the emerging defence and security needs.

For the First Phase of CoPT activities, an amount of Rs 160 Crores has been sanctioned for

technical programmes pertaining to gas turbine propulsion for small engine, solid propellant combustion modelling, and morphing aircraft technologies, Infrastructure development, and running expenses of CoPT. The cost is to be met entirely out of Grants-in-Aid funds of DRDO.

DMRL signs MoU with CMET

A Memorandum of Understanding (MoU) was signed between Defence Metallurgical Research Laboratory (DMRL), Hyderabad, and Centre of Materials for Electronics Technology (C-MET), Hyderabad, by Dr Samir V Kamat, OS and Director, DMRL and Dr NR Munirathnam, DG, C-MET on 21 June 2016. The purpose of the MoU is to lay down the general framework of collaboration between C-MET and DMRL to work on process development for SiC single crystal bulk growth using DRDO funded physical vapour transport reactor facility at C-MET, growth and supply of single crystal boules with desired target properties, and any other related work mutually agreed upon.



DRDO celebrates International Day of Yoga



June 21 is celebrated every year as the International Day of Yoga (IDY) all over the world after unanimous declaration by United Nations General Assembly (UNGA) on 11 December 2014.

The idea of IDY was first mooted by the Hon'ble Prime Minister Narendra Modi during his speech in UNGA on 27 September 2014. He stated: "Yoga is a invaluable gift of India's ancient tradition. The tradition is 5000 years old. It embodies unity of mind and body; thought and action; restraint and fulfilment; harmony between man and nature; a holistic approach to health and well-being. It is not about exercise but discover the sense of oneness with yourself, the world and the nature. By changing our lifestyle and creating consciousness, it can help in well being. Let us work towards adopting an International Yoga Day".

DRDO celebrated IDY in true spirit and practise. Dr S Christopher, Secretary, Department of Defence R&D and DG DRDO, DGs of various clusters, Corporate Directors, scientists and staff of DRDO participated in the function held in DRDO Bhavan.

Dr Shashi Bala Singh, OS and Director, Defence Institute of Physiology and Allied Sciences (DIPAS), Delhi, welcomed the august gathering. In her welcome address, she spoke about the



Dr Christopher presenting plant to Dr Surakshit Goswami (right)



Senior scientists and staff of DRDO participated enthusiastically in Yogic kriyas

science and physiology behind the yoga and described it as the oldest Made in India product, which is now being understood in term of men to molecule because of advancement in technology.

Dr Surakshit Goswami, Yoga Guru from Yoga Mandir Trust, and

the Chief Guest, described yoga a tool to bring synergy between mind and body and its benefits by demonstrating various kriyas and asanas.

The following DRDO laboratories also celebrated the ancient Indian tradition in their respective places:

Armament Research & Development Establishment

A lecture by yoga expert Shri Maruti Padekar was arranged at Armament Auditorium. Apart from giving simple tips on incorporating yoga in daily life, Shri Padekar also held a practice session for the employees, who participated with great enthusiasm.



Centre for Fire, Explosive & Environment Safety

Centre for Fire, Explosive and Environment Safety (CFEES), Delhi, celebrated IDY on 21 June 2016. Shri Karan Nijhawan, a yoga instructor from Art of Living Foundation, provided important tips and guided the assembly of officers and staff to perform simple yoga postures. He shared his experience and highlighted the benefits of doing the yoga on regular basis.



Defence Scientific Information & Documentation Centre & Institute for Systems Studies and Analyses

Defence Scientific Information and Documentation Centre (DESIDOC) and Institute for Systems Studies and Analyses (ISSA) jointly celebrated IDY at Bhagavantham Auditorium, Metcalfe House, Delhi. Braham Kumari

Kamla was the Chief Guest of the function and delivered a lecture on the topic, Yoga: Sharirik, Mansik, Samajik evam Adhyatmikta ka Upaay. In her informative talk, she confabulated yoga as a connection between the mind and the body. We are progressing scientifically, financially, and materialistically but we are still not satisfied and unintentionally falling victim to so many ailments. Yoga helps us in maintaining physical, mental and spiritual well-being, she added further.



Defence Food Research Laboratory

The month long celebration comprised lectures/talks by experts on yoga and its benefits, meditation, stress management, pranayama, dhyana and acupressure. Daily yoga classes were conducted by trained instructors from Raghvendra Yoga Kendra for the employees of DFRL. A mass 'Surya Namaskar' was performed on 21 June 2016 in which around 200 employees of nine Central Government Organisations situated in and around Mysuru participated enthusiastically under the guidance of Shri Pashupathi Yoga instructor.



Defence Metallurgical Research Laboratory & Advanced Numerical Research & Analysis Group

Defence Metallurgical Research Laboratory (DMRL), Hyderabad in association with Advanced

Numerical Research and Analysis Group (ANURAG), Hyderabad celebrated the IDY on 21 June 2016. The Works Committee organized a popular talk on current issues faced by the people and how yoga can provide solution on these problems followed by demonstrations. Shri Rama Krishna Kompella, Doctoral Researcher from University of Rhode Island (URI), USA, the invited speaker, explained the importance of Yoga in reducing the diseases. He also demonstrated different Yoga exercises for managing Diabetes. Dr Samir V Kamat, OS and Director, DMRL, and other dignitaries graced the occasion.



Defence Research & Development Establishment

Defence Research and Development Establishment (DRDE), Gwalior organized a special lecture on the topic Yoga, Stress and Lifestyle on 21 June 2016 to celebrate IDY. Shri Anil Sarode, a prominent thinker and yoga guru of Vivekanand Needam, Gwalior, delivered the lecture to lead a stress free life. Dr Lokendra Singh, OS and Director, officers/scientist/staff of DRDE attended the lecture.



High Energy Materials Research Laboratory

An activity-based yoga programme was arranged, which included pranayama, simple asanas and meditation. The program was conducted by Member of Art of Living Foundation and Scientist of ARDE, Shri RS Kalaskar. Director, HEMRL, inaugurated the session followed by a short lecture by the speaker in which he brought about the importance of yoga for health and well-being. The speaker then introduced the audience to pranayam and few basic asanas for daily routine and also conducted panchakosha meditation in Hindi.



Integrated Test Range

The programme was formally inaugurated by Dr BK Das, OS and Director, Integrated Test Range (ITR), Chandipur. Dr Das in his inaugural address highlighted the importance and need of yoga for harmony and peace in every day life. Shri Chittaranjan Sahu, Yoga Therapist of M/s Yogic Science in Naturopathy, Balasore, conducted various ashanas, pranayam and laughing therapy. More than 70 officers and staff attended the programme. Shri CR Ojha, Sc F and Shri Subhasis Kar, TO A, organized the programme.



Laser Science & Technology Centre

Laser Science and Technology Centre (LASTEC), organised a talk on Yoga For Health at Bhagwantham Auditorium, Metcalfe House. Shri Deshraj Gupta,

General Secretary, Bhartiya Yog Sansthan, was the invited speaker. Asanas and pranayam were performed by the employees of LASTEC.



Research Centre Imarat

Research Centre Imarat (RCI), Hyderabad, celebrated IDY on 21st and 24th June 2016. Shri Jitender, Sc F, Advanced Systems Laboratory (ASL), Hyderabad, conducted yoga session for RCI employees. Shri D Shriram, Head, HR, BSE Ltd, Mumbai, delivered a lecture on Holistic Work: Life Balance.

Naval Physical & Oceanographic Laboratory

Naval Physical and Oceanographic Laboratory (NPOL), Kochi, celebrated IDY on 21 June 2016 with enlightening programmes. Dr VT Ravi, Senior Neurologist, Maulana Hospital, Perithalmanna, Kerala, delivered a talk on Natural Way to Health and Happiness, which focused on the science and role of yoga for healthy living. Shri Mohan P Mathew Officiating Director, NPOL, addressed the gathering and emphasized the significance of yoga and its role in performance excellence in a research organization. The programme included practical sessions for the NPOL fraternity who participated enthusiastically in the event.



Research & Development Establishment (Engineers)

International Day of Yoga was celebrated at Research and Development Establishment (Engineers) [R&DE(E)], Pune, with enthusiasm. Smt Meenakshi and Shri Amarnath Lal, teachers from the Art of Living Foundation, Pune, conducted the event in accordance with the guidelines issued by AYUSH Ministry of Health. Opening the event by a prayer from the Rigveda, they explained the significance of the yoga and how to make it part of daily lifestyle. Asana, pranayam and meditation were conducted to mark the occasion. Shri Sangam Sinha, Officiating Director, felicitated the teachers.



Solid State Physics Laboratory

International Day of Yoga was celebrated in Solid State Physics Laboratory (SSPL), Delhi, with mass yoga performed by employees for a healthier lifestyle. Various asans like Surya Namaskar, Bhujangasan, Vajrasan, Shalbhasan, Marktasan and Pranayams such as Kapalbhati, Anulom-Vilom and Bhramari were performed. It was followed by a lecture on benefits of Yoga and Meditation by Heartfulness Foundation.



Raising Day Celebrations

Centre for Advanced Systems

Centre for Advanced Systems (CAS), Hyderabad, celebrated its 1st Raising Day on 11 June 2016. Dr Satish Kumar, DS and Director General (Missiles & Strategic Systems), DRDO, was the Chief Guest and Dr G Satheesh Reddy, SA to RM was the Guest of Honour. Dr V Venkateswara Rao, OS and Director, CAS, presided over the function and delivered the welcome address. He also presented the future goals of CAS along with plan for green initiative; installation of 1 MW solar power plant at the Centre, in collaboration with CIL.

Bhoomi Pujan for upcoming Integration and Storage Facility was also performed. Inauguration of System Integration Complex was also done. Dr Tessy Thomas, OS and Director, Advanced Systems Laboratory (ASL) and Dr MRM Babu, OS and PD (A) along with senior scientists of missile complex

attended the function.

A cultural programme by SSQAG, BDL and children of CAS employees was the highlight of the Raising Day. DRDO Laboratory-level Awards were given to meritorious employees. Awards for BDL and SSQAG were also presented. Prizes were distributed to the winners of sports and cultural activities as well as to the participants of cultural programme. Shri Praveen Tandon, Sc F, proposed the vote of thanks.

Defence Bio-Engineering & Electromedical Laboratory

Defence Bio-engineering and Electromedical Laboratory (DEBEL), Bengaluru, celebrated its Raising Day with grandeur on 17 June 2016. Dr Satish Kumar, DS and Director General (Missiles & Strategic Systems), DRDO and Air Cmde Rajeev Punj, CRPO, Aircraft and Systems Testing Establishment (ASTE), Bengaluru were the Chief Guest and Guest of Honour of the function, respectively. Air Cmde

Ravi Taneja, Commandant, IAM, Bengaluru; Dr UK Singh, Director DEBEL; Directors of sister DRDO labs in Bengaluru; representatives of the Estate Management Unit, GE (R&D), former Directors of DEBEL, former scientists, officers and staff of DEBEL also graced the occasion.

Dr UK Singh, Director, DEBEL, presented the activities and achievements of DEBEL in the areas related to Biomedical, Aeromedical, Underwater, NBC and Materials. He highlighted the induction of DEBEL-developed Telemedicine System into Indian Navy and clearance of On-Board Oxygen Generation Systems (OBOGS) for flight trials by the Indian Air Force. He also emphasized about the Biomedical Products being developed for civilian applications through DEBEL-driven Society for Biomedical Technology.

Dr Satish Kumar commended the laboratory for its achievements and spoke on the need to involve academia and industry in our R&D due to changing scenario





for technology development. He talked about different models of R&D and exhorted DEBEL to make outstanding contributions for the benefit of the Armed Forces.

Air Cmde Rajeev Punj praised DEBEL for its work in the area of life support systems and offered all cooperation in its efforts. The Chief Guest presented Laboratory-level DRDO Awards to scientists and staff for their meritorious contributions on the occasion. Dr TM Kotresh, Sc G and Associate Director, DEBEL, proposed the vote of thanks.

Manpower Development Activities Conferences/Seminars/Symposia/Training Courses/Meetings

Course on Energy Harvesting Wireless Sensor Networks and Internet of Things

Advanced Numerical Research and Analysis Group (ANURAG), Hyderabad, organised a course on Energy Harvesting Wireless Sensor Networks and Internet of Things under DRDO's Continuous Education Programme (CEP) during 22-24 June 2016. Shri RN Bagdalkar, General Manager, Bharat Electronics Limited (BEL) Hyderabad, was the Chief Guest during inaugural session of the course. Eminent speakers and domain experts from academia, DRDO and industry delivered lectures on diverse areas pertaining to the course topic. Opportunities and challenges in Energy Harvesting Wireless Sensor Networks (EHWSN) and emerging IoT Systems was discussed in the lectures. Case studies were presented for exploring full potential

of EHWSN and IoT in Defence applications. Forty-one scientists from various DRDO laboratories including ANURAG attended the course.

Workshop on DESIDOC Services

The regional Workshop on DESIDOC Services was arranged by Armament Research and Development Establishment (ARDE), Pune, on 15 July 2016 in coordination with Defence Scientific Information and Documentation Centre (DESIDOC), Delhi. Eighty-five scientists/officers from ARDE and DRDO West Zone laboratories participated in the workshop, which aimed at increasing user awareness of the publications and information services provided by the DESIDOC. An exhibition of DESIDOC services was arranged in Information Centre for Armament Technology (ICAT)



premises, which was inaugurated by Dr KM Rajan, OS and Director ARDE.

Smt SS Avachat, Sc G and Head, ICAT, briefed the participants about ICAT collection and services. Dr Rajeev Vij, Sc F; Smt Sumati Sharma, Sc F; Shri V Senthil, Sc E; and Shri Sudhanshu Bhushan, Sc E from DESIDOC briefed the participants about the various information services being provided by the DESIDOC.

Hindi Workshop

Dr Rakesh Kumar Sharma, Director, Defence Food Research Laboratory (DFRL), Mysuru, inaugurated first Hindi Workshop for the financial year 2016-17 on 30 June 2016. In his inaugural address, Director, DFRL, emphasized the importance of Hindi in promoting national harmony. He also motivated the participants to use Hindi in their day-to-day activities. Smt Bhargavi R Gopal, Assistant Director (Official Language), presented a talk on 'Why Hindi only took the Status of Official Language. Miss Anitha, Hindi Officer, CFTRI, Mysuru, delivered lecture on "Noting and Drafting" and Shri Rohit Kumar Soni, Technical Officer A, briefed about 'Unicode and its Usage" and provided hand on experience to the participants.



CBRN Training Course for National Security Guards

CBRN Training Course for National Security Guards (NSG) was conducted on 21 June 2016 by Institute of Nuclear Medicine and Allied Sciences (INMAS), Delhi. One Hundred and Six participants from NSG attended the training course. The course was specifically designed to complement the lecture-based training with review exercises to accommodate functional integrity of each participant. They were trained in management of dirty scenarios while undertaking complete precautions towards self-protection measures with the help of

facilities available like Human Patient Simulator, Mobile Whole Body Counter, Radio-Chemical Analytical Facility, etc. Participants were also sensitized about the role of facilities during the CBRN Emergency.



Programme on Radiation Medicine & Medical Management of Radiation Injuries

A two-week Special Training Programme on 'Radiation Medicine and Medical Management of Radiation Injuries' was conducted by INMAS during 13-24 June 2016. This course was specifically designed to meet the requirements of the medical officers and nursing officers of Indian Navy working or supposed to work at nuclear platforms. The first phase of the course was conducted at INMAS during 13-21 June 2016 and the second phase was conducted from 22-24 June 2016 at SAUW, INS Satavahana, Vishakhapatnam.

The course comprised 85 per cent experimental demonstrations and hands-on exercises on radiation safety and medical management of radiation emergencies. The trainee officers were made familiar with the practical aspects of radiation safety and handling of radioactive subjects in case of any nuclear emergency.



Workshop on Medical Management of CBRN

Third workshop on Medical Management of CBRN Casualties for Medical Officers of Army, Navy, Air Force and Paramilitary Forces was conducted by INMAS during 29-30 June 2016. Total 80 officers participated in the course. The course was specifically designed to complement the lecture based training with review exercise to accommodate functional integrity of each participant. The scenario specific discussion was one of the special feature of the course. Various interactive sessions were held to enhance decision making ability of medical officers. This advance training-cum-sensitization course was highly appreciated by the participants.



Security Sensitization Programme

Security Sensitization Programme for DRDO labs/ estts was organized by Integrated Test Range (ITR), Chandipur, on 21 June 2016. Dr Anand Kumar, Special Director (IB) inaugurated the programme. Dr BK Das, OS and Director, ITR, welcomed the guests and the participants. Shri R Appavuraj, OS and Director, Proof and Experimental Establishment (PXE), Chandipur, also graced the occasion.



Dr Anand Kumar and his team delivered lectures on various topics related to Security Sensitization Programme such as strategies on security measures and how to handle the upcoming challenges and various issues of security threat throughout the country and its monitoring and control. The programme was highly informative and created a new dimension on security sensitization to an organization where security is of paramount importance. More than 130 scientists and officers participated in the programme. Shri Niladri Roy, Sc F and Shri CR Ojha, Sc F coordinated the programme. Senior Scientists, Service Officers and Technical Officers of ITR, PXE and AD (RADARS) were present during the programme.

Course on Six Hat Theory for Problem Solving

A CEP on Six Hat Theory for Problem Solving in Research was organised by Proof and Experimental Establishment (PXE), Chandipur, during 20-24 June 2016. Sixteen participants from various DRDO labs attended the course. Shri R Appavuraj, OS and Director PXE, inaugurated the CEP. Dr AK Sannigrahi, Course Director, briefed about the necessity and importance of the course for team leaders. Topics like Human Mind and Thought Process, Basics of Six Thinking Hats, Decision Making: Individual vs Team, Stress Management through Yoga, Role of Emotional Intelligence in Problem Solving, Application of Six Thinking Hats Theory in Decision Making, etc., were dealt by expert faculties from FM University, Balasore, IIT Kharagpur and PXE, Chandipur. An industrial visit to Emami Paper Mills Ltd., Balasore, was organized for the participants for creating awareness of working system in industry. Director PXE distributed the certificates to the participants.



Seminar on New Generation Smart Weapons

Society for Failure Analysis (SFA), Hyderabad, in association with Hyderabad-based Regional Centres

for Military Airworthiness (Missiles, Materials) jointly organised a one-day Seminar on New Generation Smart Weapons: Development and Certification Challenges.

Dr K Tamilmani, DS and DG (Aero) was the Chief Guest and Shri Sudhir Mishra, OS and Chief Controller (R&D) and CEO & MD, BrahMos Aerospace was the Guest of Honour for the event. Shri P Jayapal, President, Society for Failure Analysis and Chief Executive (Airworthiness), CEMILAC graced the occasion along with the Directors of various labs of Missile Complex. Shri Rajiv Gupta, Regional Director, RCMA (Msl) welcomed the august gathering. The seminar featured keynote address by Guest of Honour, two plenary sessions included six invited talks by eminent speakers. The sessions focused on various challenges faced during ab initio, design, development and certification of state-of-the-art smart weapons of Indian origin. Two hundred and twenty delegates participated in the seminar. The event was supported by many public and private industries, viz, M/s BrahMos (Aerospace), M/s Bharat Dynamics Limited, M/s Midhani, etc. Shri B Saha, Regional Director, ECMA (Mat) and Co-Convener of the event proposed the vote of thanks.

Dissemination Meeting on Avalanche Feedback

The 18th Dissemination Meeting on Avalanche Feedback was organized by Snow and Avalanche Study Establishment (SASE), Manali, at RDC SASE on 24 June 2016. This annual meeting is convened primarily to bring the users and the scientists on a common platform to discuss the difficulties faced by troops due



to avalanches during winter 2015-16 and steps taken by SASE to further develop technologies and improve the techniques that would ensure safe mobility of troops in mountains. The meeting was attended by officers from 14 Corps, 15 Corps, 16 Corps, 2 Corps, 9 Corps, ITBP, High Altitude Warfare School (HAWS), HQ UB Area, 33 Corps and BRO. Shri Ashwagosh Ganju, Director, SASE, presided the meeting.

Discussions on the analyses drawn by the SASE scientists and valuable inputs on the actual situations, provided by the users deployed in field areas during winter 2015-16 brought forth the grey areas, which need to be addressed during the next winter by SASE as well as the users to ensure safe mobility of troops in avalanche prone areas.

Shri Ashwagosh Ganju emphasized that SASE and users have a role to play to ensure no camp is located in the direct fall line of avalanche and protective measures to be taken to safeguard the camps if re-siting is not possible.

Patent Granted

A patent on "A method and apparatus for producing aeronautical grade titanium sponge from titanium tetrachloride" (Patent No. 270009) has been granted by the Patent Office, Government of India, to Shri

CS Ramachandran, Sc G (Retd), Dr TS Sitaraman, Sc G (Retd), Dr Ch RVS Nagesh, Sc G and Shri GVS Brahmendra Kumar, Sc F of DMRL.

READERS' VIEWS

Your feedback is important for us as it gives us scope for improvement and serve you in a better way. *DRDO Newsletter* requests its esteemed readers to send their views about the quality of contents and coverage in the Newsletter. Please send your suggestions to:

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

Personnel News

Appointments

Director, Centre for Advanced Systems



Dr Vemana Venkateswara Rao, OS and Project Director, Agni 3, has assumed the charge of Director, Centre for Advanced Systems (CAS), Hyderabad. Dr Rao obtained his BE in Mechanical Engineering from AU College of Engineering, Vishakhapatnam, MTech (Thermal) from NIT, Warangal, and PhD (Mechanical Engineering), from JNTU, Hyderabad, for which he received the best PhD thesis award in 2011. He has also obtained MBA from IGNOU, New Delhi.

Dr Rao started his career as Sc/Eng-Sc in 1987 at SDSC SHAR Centre, ISRO, Sriharikota, where he worked on integration and testing of solid rocket motors for PSLV and GSLV developments. During 1995-1997, he was in-charge of launch vehicle integration of PSLV and involved in liquid stage integration and testing.

In 1997, he joined Defence Research Development Laboratory (DRDL), Hyderabad, as System Manager, SF&D and carried out design, realization, integration and testing of large size solid rocket motors for Agni 3 (A 3).

Since 2011 as Project Director, A 3, he has delivered missiles at site and static training missile after providing training to the regiment. As a Technology Director, SPRITE (2007-2014), he was involved in managing a group of scientists and officers for the design, development, integration and static testing of various solid rocket motors of all programmes of missile complex (SF&D, ANSP, ASTRA, HELINA, PJ-10, AD, NAG, LRSAM, etc.)

Dr V Venkateswara Rao has received Best Scientist Award from Chairman, ISRO in 1996 and Agni Technology Pathbreaking Award from SA to RM, DRDO, in 2007.

He has published 25 papers in various international and national journals and presented in national and international conferences. He has submitted one patent which is under process of approval. He is also guiding five PhD projects.

He is life member of several professional societies like, Indian Welding Society, Indian Institute of Welding,

Aeronautical Society of India, Indian Society of Non-destructive Testing, High Energy Materials Society of India, and Astronautical Society of India.

Director, Instruments Research & Development Establishment



Shri Benjamin Lionel, Sc G, has taken over as Director, Instruments Research and Development Establishment (IRDE), Dehradun, with effect from 1 July 2016. He obtained MSc in Physics from Madurai Kamraj University in 1983 and MTech in Applied Optics and Optical Instrumentation from IIT Delhi, with specialization in Design and Development of Opto-Electronic Systems in 1985. He received training at Centre for International Trade and Security, University of Georgia, USA, in 2004.

Shri Benjamin joined IRDE in 1985 as Sc B and worked for four years in optical design area. In 1989, he joined Combat Vehicles Research and Development Establishment (CVRDE), Chennai, and worked in Fire Control Systems (FCS) for Tanks and AFVs for 14 years at various designations. In year 2006, he was appointed Counsellor at TAD, London and performed various duties for three years. In year 2009, he joined CVRDE as Additional Director (IFCS & TEPS) and worked for two years. In year 2012, he was appointed Director of Combat Vehicles and Engineering (DCV&E) in DRDO HQ. In year 2014, he took over as Director (Vehicles) in DRDO HQ and later was appointed Head Programme Office (HPO II) in year 2015.

His main contributions have been integration and evaluation of FCS of MBT Arjun and proving the weapon system performance of Arjun. He has in-depth practical exposure and knowledge of FCS of T-55, T-72, T-90 and MBT Arjun tanks. He has evolved various techniques for proving the performance of AFVs. As a team leader, he got developed Gunnery Simulators for MBT Arjun, created container-based infrastructure at PFFR, Pokhran for supporting DRDO teams during trials and resolved several issues with users in the course of trials.

Shri Benjamin has to his credit several technical papers and reports in journals and international conferences. He has been awarded DRDO Technology

Award in the year 1995 for successful integration and interfacing of FCS of MBT Arjun and Technology Group Award in the year 2004 for Development of Muzzle Reference System of MBT Arjun. He is life member of Optical Society of India (OSI) and Instrument Society of India.

Awards

Scientific Excellence Award

Dr P Sivakumar, DS and Director, Combat Vehicles Research and Development Establishment (CVRDE), Chennai, has been conferred 'Scientific Excellence Award' in recognition to his significant contributions in the field of scientific developments related to defence. Dr K Rosaiah, Hon'ble Governor of Tamil Nadu, presented the award to Dr Sivakumar on 22 June 2016.



Fellow of EMSI

Dr Partha Ghosal, Sc F, Defence Metallurgical Research Laboratory (DMRL), Hyderabad, has been elected Fellow of Electron Microscope Society of India (EMSI) during International Conference on Electron Microscopy (EMSI 2016) held at Varanasi from 31 May 2016 to 4 June 2016.

The Fellowship has been conferred on Dr Partha Ghosal for his significant contributions in the area of advanced characterization techniques. Dr Ghosal has carried out extensive microscopic work on titanium and tungsten based alloys, nanomaterials and nanocomposites that have led to the development of components with enhanced properties for Indian Defence Programmes.



Best Presentation Award

Dr Rajeev Vij, Sc F, Additional Director, Defence Scientific Information and Documentation Centre (DESIDOC), Delhi, was awarded Best Presentation Award during 5th Library and Information Professional Summit (LIPS) 2016 organised jointly by the Society for Library Professional and Special Library Association, Asian Chapter, during 19-20 May 2016 at Ambedkar University, Delhi.



Best Innovation Award

Dr AK Mukhopadhyay, OS and Associate Director, Defence Metallurgical Research Laboratory (DMRL), Hyderabad, and his team comprising five engineers from BrahMos Aerospace Private Limited, Hyderabad, have been awarded Best Innovation Award 2016 by BrahMos Aerospace on 17 June 2016 at New Delhi. The team led by Dr Mukhopadhyay has made outstanding contributions in achieving self-reliance in processing, productionization and quality control of five Russian grade wrought aluminium alloys in nine semi-product forms and eight different heat treatment tempers using the existing infrastructure in nine Indian industries for

missile applications. This work has been accomplished indigenously with significant monetary savings. Dr S Christopher, Secretary, Department of Defence R&D and DG DRDO presented the award.



Fellow of Telangana Academy of Sciences

Dr Prakash Chand Jain, Sc G, Defence Research and Development Laboratory (DRDL), Hyderabad, has been inducted as Fellow of Telangana Academy of Sciences in the field of Engineering Sciences for his contributions in the area of Rocket Structures. Dr Jain, has significantly contributed towards the success of various national projects. In a recently held function Dr Ch Mohan Rao President Telangana Academy of Sciences conferred the Fellowship to Dr Jain in the august presence of Dr Ashutosh Sharma, Secretary, DST, Gol, New Delhi.



Rajbhasha Pustak Puraskar



Shri AK Varshney, Sc D, Laser Science and Technology Centre (LASTEC), Delhi, has been awarded first prize under DRDO's Rajbhasha Pustak Puraskar Yojana 2014-15 for his book entitled Laser: Manav Anuprayogo me Bhumika.

Higher Qualification Acquired

High Energy Materials Research Laboratory

Shri Mukesh Kumar Jain, Sc E, has been awarded PhD (Applied Chemistry) by Defence Institute of Advanced Technology (DIAT), Pune, for the thesis entitled "Studies on Rheological Behaviour of HTPB/AP/Al-based composite Propellant Slurry."

Dr Christopher inaugurates state-of-the-art Visualisation Centre

Integrated Test Range, Chandipur has set up a state-of-the-art curved Display Wall in the Block House of Dr APJ Abdul Kalam Island, Dhamra, Orissa, for missile launch operations and range command and control. This replaces the legacy cube-based display system, which has been in use for monitoring and decision making by the Mission Managers during the flight trials of Agni and Air Defence Missiles launched from the island complex. The newly introduced system comprises a display wall made of 28 state-of-the-art LED cubes placed across a 90° arc segment. The display system is extremely flexible in its capability to capture and render video sources linked over the network with minimum latency and provides content management software to configure mission-specific layouts. The consoles of the set up have been redesigned for optimal utilization of space housing maximum numbers of stakeholders and VIPs during the flight trials. The project was completed in record time.



Dr S Christopher, Secretary, Department of Defence R&D and DG DRDO inaugurated the facility on 12 July 2016. DG (MSS) and CE (CWE) were also present in this occasion. Dr BK Das, OS and Director, Integrated Test Range, Chandipur explained the nobility of the technology to Dr Christopher. The functionality of the system was demonstrated with a mock count down and lift-off of a recently concluded Agni 4 flight trial.

DRDO: Harnessing Science for Peace and Security-VI

Chapter 1: The Beginning — Defence Science

The article is Sixth in the Series of extracts of the monograph, "Defence Research and Development Organisation: 1958-1982", by Shri RP Shenoy, former Director of Electronics and Radar Development Establishment (LRDE).

Post-Independence Scenario

Report of Professor PMS Blackett

The upper ceiling for the availability of resources as well as the foreign exchange for the Defence Services, weapons and equipment having been estimated, Professor Blackett turned his attention to the type of armaments a modern army would have to possess. He categorised these mainly into two types, the first type namely, weapons which are newer and more sophisticated, such as the jet fighters and bombers, airborne radars, high altitude anti-aircraft guns with radar and predictors, heavy tanks, large and fast aircraft carriers, and so on; and the second type such as the light anti-aircraft guns, 25-pounder field guns, light tanks, motor transport, naval escort aircraft, aircraft for training, transport, and general military purposes, etc., which were technologically simpler. He opined that the latter could be productionised in India in a short period of time and this step "would give an extremely valuable stimulus to the... (the national) economy and present a very considerable step forward in industrialization."

He further stated, "at present India would have to buy from abroad very sophisticated weapon systems and consider only the simpler ones for manufacture in the country in the immediate future. Therefore, a decision would have to be taken about the percentage of the resources and foreign exchange that would be spent on importing sophisticated weapons from abroad and for purchase of machine tools for production in India of the second type of weapons."

He turned his attention next on the choice of weapons. Since very high performance weapons have to be imported, and that too for a considerable period in the future, he considered the option of replacing some of these by more number of lower performance weapons. Professor Blackett's operations research experience led him to state, "a large part of military equipment and weapons are noncompetitive in the sense that the precise military performance is not decisively important and that a small inferiority in performance can be usually compensated for by increase in numbers". Examples of such noncompetitive weapons and equipment according to him, are rifles, machine guns, field guns, Ack Ack (anti-aircraft) guns, naval escort vessels, submarines, motor transport light tanks, aircraft for coastal defence and antisubmarine operations, night bomber except against very heavy opposition." He mentioned that even though there was no clear cut distinction between

competitive and noncompetitive weapons, the reason for categorising these into two classes was because the engineering complexity of noncompetitive weapons being lower, these could be manufactured in India in a shorter period of time.

His plan of action for attainment of self-sufficiency in defence armament envisaged,

- (a) Early indigenous manufacture of the simpler weapons,
- (b) Working out a strategy and evolving military tactics in detail, to reduce for the immediate future, the need for complicated weapons which the country could not manufacture, and
- (c) Preparation of long-term plans for the manufacture of high performance and complicated weapons as soon as the technological level and the degree of industrialisation would make this possible.

Professor Blackett stated that at the time of writing the report, India was dependent on UK and the USA for most of the weapons and heavy equipment used by its Armed Forces. If the country were to attempt to free itself of its dependence on import of weapons by the use of less up-to-date equipment and weapons, this would be against India's security interests. On the other hand, a long and continued dependence on imported weapons might not be acceptable militarily and politically. Firstly, difficulties could be experienced in getting the latest weapons from abroad without

accepting military and political obligations, which might give rise to the risk of the country being drawn into conflicts against its will and not directly concerning it. Secondly, even if no strings were attached at the time of import of these weapons from another country political pressure could be exercised on the country by withholding deliveries of these weapons or spares. The difficulty would be all the more great, as these equipment have relatively long operational life, between ten and twenty-five years, in which case the country's foreign policy would have to be aligned with that of another country for such a long period. This might be unacceptable in view of the fluid situation prevailing at that time, where the policies of the major powers kept changing rapidly. Professor Blackett pointed out that in spite of these constraints, there would be no escape from the fact, "the duration of dependence on a foreign power inherent in the continued use of imported major weapons is likely to be longer than is tolerable". He was of the opinion that these arguments made it necessary for the country to plan its defence strategy with these factors in mind, and at the same time, aim at a rapid achievement of technological independence in the field of defence.

The apportionment of the financial resources among the three Services could only be decided based upon a strategic plan which should have the objectives of defending the country against enemy attack and of maintaining the internal unity. After considering different conflict scenarios, Professor Blackett was of the

opinion that the most relevant one was a relatively small war against an evenly matched neighbour. In such a case the chief threats to India, against which defence would have to be planned are likely to be:

- (a) Attack by land forces across a land frontier,
- (b) Combined land and sea attack along the coast,
- (c) Small-scale landing operations on the Indian coast to seize a port or other important objectives, and
- (d) Attack on coastal shipping by aircraft, submarines or surface vessels.

Professor Blackett then analyzed in detail the roles, the tasks, and composition of the Army, the Navy and the Air Force and drew conclusions about the type of equipment and systems that would be required to counter the threats outlined earlier. He analyzed these requirements of the three Services from the point of view of technology and manufacturability in India and stated, "the problem of attaining technical self-sufficiency is likely to be achieved much earlier by the Indian Army than by the Navy or the Air Force. Already a considerable number of the major weapons are made in India by the ordnance factories and plans are under way to add to these. Probably, the major deficiency at present is in motor transport, tanks and high-velocity guns but stocks of the latter are adequate for some time. As regards general army equipment (apart from weapons and vehicles) India is already producing a considerable fraction of what she needs and

has the technical organisation to produce more. The radio industry appears to be rather backward and needs to be expanded so as to produce the main communication sets required by the Services."

On the basis of the foregoing analysis, Professor Blackett picked out the following roles for the proposed Defence Science Organisation. It was mainly advisory and similar to the role played by the Director of Scientific Research and his scientists during the war in the British Admiralty. To be effective in such a role, he suggested that the scientists selected for the proposed Defence Science Organisation should be of the highest scientific calibre and they should be encouraged to retain their academic links while serving the Organisation. According to him, "These men will form groups studying various subjects, such as, radar, gun design, bomb, and gun sights, etc., both from official service manuals and from published literature. They should spend some time on loan to the relevant.... [Technology Development Establishments attached to the Directorate of Technical Development] where they should do actual bench work, and should be attached to relevant service units or training establishments to learn the actual use of weapons in service. Apart from the study of weapons and military technology, a considerable part of the effort of the scientific staff should be directed to the study of the broader aspects of military

To be continued...

Visitors to DRDO Labs/Estts

High Energy Materials Research Laboratory

Maj Gen SK Shrivastava, DG Comb. Engrs. and Brig. SS Kahlon, DDG, CE (B) visited High Energy Materials Research Laboratory (HEMRL), Pune, on 3 June 2016.



Centre for Fire, Explosive & Environment Safety

Shri PK Mehta, DG (ACE), DRDO, visited Centre for Fire, Explosive and Environment Safety (CFEES), Delhi, on 15 June 2016. He was briefed about the ongoing R&D activities of the lab and presented live demonstration of the products developed by the laboratory.



Institute of Nuclear Medicine & Allied Sciences

Lt Gen BK Chopra, PVSM, AVSM, PHS, DGAFMS and Col Commandant and Dr Manas K Mandal, DG R&D (LS), DRDO, visited Institute of Nuclear Medicine and Allied Sciences (INMAS) on 14 June 2016. Dr AK Singh, OS and Director INMAS, briefed the visitors about the R&D activities being conducted at INMAS.



Instruments Research & Development Establishment

Parliamentary Standing Committee on Defence led by Maj Gen BC Khanduri (Retd), visited Instruments Research and Development Establishment (IRDE), Dehradun, on 2 June 2016 for on the spot study of DRDO establishments at Dehradun. The committee was apprised about the activities of IRDE and Defence Electronics Application Laboratory (DEAL). An exhibition showcasing the products of IRDE, DEAL, R&DE(E), DIBER and DRDL was also visited by the committee.

Solid State Physics Laboratory

Dr G Athithan, DS and DG (MED, CoS & CS), visited Solid State Physics Laboratory (SSPL), Delhi on 27 June 2016. Dr RK Sharma, OS and Director, SSPL briefed him about the technical activities and achievements of the laboratory. Dr Athithan visited various technical facilities of the laboratory and interacted with the scientists.

