

NETRA JOINS INDIAN AIR FORCE

WITH INDUCTION OF NETRA, THE INDIGENOUS AIRBORNE
EARLY WARNING & CONTROL SYSTEM, INDIA JOINS THE
EXCLUSIVE CLUB



CONTENTS

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COVER STORY

04

Air Force inducts indigenous Airborne Early Warning & Control system



INNOVATION

Guided Pinaka Test Fired Successfully



TOT

06

DEFENCE CO-OPERATION

08

EVENTS

09

COURSES/ WORKSHOPS

11

HRD ACTIVITIES

14

SPORTS ROUND-UP

16

DRDO SERIES

17

DRDO IN PRESS

20

Website: www.drdo.gov.in

For feedback, please contact: director@desidoc.drdo.in

Tel: 011-23902403; 23902474; Fax: 011-23819151

Pre-press: Mrs Gunjan Bakshi

LOCAL CORRESPONDENTS

Ahmednagar: Lt Col. AK Singh, Vehicles Research & Development Establishment (VRDE); **Ambarnath:** Dr Susan Titus, Naval Materials Research Laboratory (NMRL); **Balalore/Chandipur:** Shri Santosh Munda, Integrated Test Range (ITR); Dr AK Sannigrahi, Proof & Experimental Establishment (PXE); **Bengaluru:** Shri Subbukutti S, Aeronautical Development Establishment (ADE); Smt MR Bhuvanewari, Centre for Airborne Systems (CABS); Smt Faheema AGJ, Centre for Artificial Intelligence & Robotics (CAIR); Ms Tripty Rani Bose, Centre for Military Airworthiness & Certification (CEMILAC); Smt Josephine Nirmala M, Defence Avionics Research Establishment (DARE); Shri Kiran G, Gas Turbine Research Establishment (GTRE); Shri KM Veerabhadra, Electronics & Radar Development Establishment (LRDE); Dr Vishal Kesari, Microwave Tube Research & Development Centre (MTRDC); **Chandigarh:** Dr HS Gusain, Snow & Avalanche Study Establishment (SASE); Shri Ashok Kumar Dahiya, Terminal Ballistics Research Laboratory (TBRL); **Chennai:** Shri PD Jayaram, Combat Vehicles Research & Development Establishment (CVRDE); **Dehradun:** Shri Abhai Mishra, Defence Electronics Applications Laboratory (DEAL); Shri JP Singh, Instruments Research & Development Establishment (IRDE); **Delhi:** Shri Ashutosh Bhatnagar, Centre for Personnel Talent Management (CEPTAM); Dr Rajendra Singh, Centre for Fire, Explosive & Environment Safety (CFEES); Dr KP Mishra, Defence Institute of Physiology & Allied Sciences (DIPAS); Dr Dolly Bansal, Defence Institute of Psychological Research (DIPR); Shri Ram Prakash, Defence Terrain Research Laboratory (DTRL); Shri Navin Soni, Institute of Nuclear Medicine and Allied Sciences (INMAS); Smt Anjana Sharma, Institute for Systems Studies & Analyses (ISSA); Dr Indu Gupta, Laser Science & Technology Centre (LASTEC); Shri Sanjay Pal, Recruitment & Assessment Centre (RAC); Ms Noopur Shrotriya, Scientific Analysis Group (SAG); Dr Rupesh Kumar Chaubey, Solid State Physics Laboratory (SSPL); **Gwalior:** Shri RK Srivastava, Defence R&D Establishment (DRDE); **Haldwani:** Dr Atul Grover, Defence Institute of Bio-Energy Research (DIBER); **Hyderabad:** Shri Hemant Kumar, Advanced Systems Laboratory (ASL); Shri Pramod K Jha, Centre for Advanced Systems (CAS); Dr JK Rai, Advanced Numerical Research & Analysis Group (ANURAG); Shri JP Singh, Centre for High Energy Systems & Sciences (CHESS); Shri ARC Murthy, Defence Electronics Research Laboratory (DLRL); Dr Manoj Kumar Jain, Defence Metallurgical Research Laboratory (DMRL); Dr K Nageswara Rao, Defence Research & Development Laboratory (DRDL); Shri N Venkatesh, Research Centre Imarat (RCI); **Jagdalpur:** Dr Gaurav Agnihotri, SF Complex (SFC); **Jodhpur:** Shri Ravindra Kumar, Defence Laboratory (DL); **Kanpur:** Shri Ashok Kumar Gautam, Defence Materials & Stores Research & Development Establishment (DMSRDE); **Kochi:** Shri S Radhakrishnan, Naval Physical & Oceanographic Laboratory (NPOL); **Leh:** Dr Dorjey Angchok, Defence Institute of High Altitude Research (DIHAR); **Mussoorie:** Dr Gopa B Choudhury, Institute of Technology Management (ITM); **Mysuru:** Dr M Palmurugan and Shri NV Nagraj, Defence Food Research Laboratory (DFRL); **Pune:** Dr (Mrs) JA Kanetkar, Armament Research and Development Establishment (ARDE); Dr Vijay Pattar, Defence Institute of Advanced Technology (DIAT); Shri AM Devale, High Energy Materials Research Laboratory (HEMRL); Shri SS Arole, Research & Development Establishment (Engrs) [R&DE (E)]; **Tezpur:** Dr Jayshree Das, Defence Research Laboratory (DRL); **Visakhapatnam:** Dr (Mrs) V Vijaya Sudha, Naval Science & Technological Laboratory (NSTL)



Defence Research & Development Organisation

FROM THE DESK OF THE CHAIRMAN



Dr S Christopher

CHAIRMAN

Defence Research & Development Organisation

&

SECRETARY

Department of Defence Research & Development

INDUCTION OF AEW&C SYSTEM A MAJOR MILESTONE FOR DRDO

The induction of indigenous Airborne Early Warning and Control (AEW&C) System in the IAF on 14th February during Aero India 2017 was a momentous event for DRDO and the country towards achieving self-reliance and defence preparedness.

Netra, which is an eye in the sky, is a multi-sensor state-of-the-art early warning system for IAF for target acquisition and surveillance. The primary sensor of the Netra are: the Active Electronically Scanned Array (AESA) Radar, Mission Sub-Systems like Identification Friend or Foe, Electronic Support Measures, Communication Support Measures, Line-of-Sight and SATCOM Data Links, etc. These contemporary technologies make AEW&C India a world-class surveillance system. Realization of such a frontline military system was possible only with the well-coordinated efforts of DRDO, IAF, DGAQA, CEMILAC, and a large network of national R&D and industrial establishments. Some of the crucial technologies and design features of AEW&C India could be generated only with intense in-house R&D efforts at various work-centres. Integration of large number of sub-systems and flight-proving the functionality to operational standards have been challenging tasks.

It is personally enticing and satisfying because my professional life started with the national initiatives for Airborne Early Warning (AEW) studies in 1985 at BEL, Ghaziabad, and continued with demonstrator programme, Airborne Surveillance Platform (ASP), at DRDO in 1988. Luckily, I could continue to be part of the national efforts in that field ever since, as I escaped the crash of ASP; I was flying in the ill-fated aircraft in its previous sortie on January 07, 1999. It is my good fortune that I started the AEW&C programme as Programme Director in 2004 at Centre for Air Borne Systems (CABS), Bengaluru, and could lead the programme till 2015 for the realization of AEW&C India that marks the beautiful culmination of the sustained efforts of two decades. Thanks to all my fellow-workers in the programme, we are now dedicating a world-class system to the nation.

It is heartening to note that DRDO developed systems have attracted the attention of the World and their export potential is increasing. DRDO has taken major strides over the years to contribute significantly and relevantly to the Nation's defence preparedness. And with firm conviction and perseverance, I am very confident of our abilities to continue to serve the nation in securing our borders.

Jai Hind.

AIR FORCE INDUCTS INDIGENOUS AIRBORNE EARLY WARNING & CONTROL SYSTEM

India joins a select group of countries, which have developed AEW&C systems.

The Indian Air Force (IAF) inducted the first indigenously developed all-weather Airborne Early Warning and Control (AEW&C) System, called Netra, in IOC configuration at the Aero India 2017 in Bengaluru, augmenting its air defence capability in the vicinity of Indian borders.

AEW&C System is a system of systems populated with state-of-the-art Active Electronically Scanned Radar (AESA), Secondary Surveillance Radar, Electronic and Communication Counter Measures, Line-of-Sight (LOS) and beyond LOS data link, voice communication system and self protection suite, built on

Brazilian-made Embraer-145 platform, having an air-to-air refuelling capability to enhance surveillance time. The aircraft is also fitted with a comprehensive self-defence suite.

A complex tactical software helps fusion of information from the sensors, to provide the air-situation-picture along with intelligence to handle identification/classification threat assessment. Battle management functions are built in house to work as a network centric system of Integrated Air Command and Control System (IACCS) node.

DRDO's Centre for Airborne Systems (CABS), Bengaluru, is the nodal agency

for design, system integration and testing of the system. Electronics and Radar Development Establishment (LRDE), Bengaluru, and Defence Electronics Application Laboratory (DEAL), Dehradun, the other two DRDO laboratories involved in the development, chipped in with the design of Radar Array and Data Link and Communication Systems, respectively.

The system has been extensively evaluated through collaborative efforts between DRDO and the IAF. Certification clearance and quality assurance have been given by CEMILAC, Bengaluru and DGAQA, respectively.





Hon'ble President Hails DRDO



राष्ट्रपति
भारत गणतंत्र
PRESIDENT
REPUBLIC OF INDIA

MESSAGE

I am happy to learn that the India's first Airborne Early Warning and Control System (AEW&C) developed by Defence Research and Development Organisation in association with the Indian Air Force (in Initial Operational Clearance Configuration) has been successfully inducted and the system handed over to the Air Force on February 14, 2017.

I understand that the AEW&C system will be useful for surveillance, tracking, identification and classification of airborne/sea surface targets. So far, only four countries have this capability. This is a significant milestone in boosting our defence capabilities and will enhance security against incoming ballistic missile threats.

I extend my greetings and felicitations to all members of DRDO and IAF associated with the development and successful induction of India's first AEW&C.


(Pranab Mukherjee)

New Delhi
February 22, 2017

GUIDED PINAKA TEST FIRED SUCCESSFULLY

Equipped with navigation, guidance and control kit, Guided Pinaka has enhanced range and improved accuracy.

DRDO successfully test fired the Guided Pinaka Mark-II from Launch Complex-III, Integrated Test Range (ITR), Chandipur, in two phases on 12 January 2017 and 24 January 2017 for further enhanced range. Pinaka Rocket Mark-II, equipped with navigation, guidance and control kit has enhanced the range and improved the accuracy of Pinaka. The mission met all the objectives. The radar, electro optical and telemetry systems at the range tracked and monitored the rocket all through the flight path. The guided Pinaka is developed by Armament Research and Development Establishment (ARDE), Pune, Research Centre Imarat (RCI) and Defence Research and Development Laboratory (DRDL), both in Hyderabad. ITR provided the range and launch support.

SA to RM and DG (Missiles and Strategic Systems) Dr G Satheesh Reddy; who was present during the launch operations, said that the success of Guided Pinaka has reinforced the technological strength of the country in converting unguided systems into weapons of high precision. Dr KM Rajan, OS and Director, ARDE; Shri BHVS Narayana Murthy, OS and Director, RCI, Dr BK Das, OS and Director ITR, Shri KPS Murthy, OS and Director, High Energy Materials Research Laboratory (HEMRL), Pune; and Shri R Appavuraj, OS and Director, Proof and Experimental Establishment (PXE), Chandipur, were present during the launch operations.

Hon'ble Raksha Mantri Shri Manohar Parrikar congratulated both the Army and the DRDO for developing the Guided Pinaka in a very short span of time.

Chairman DRDO and Secretary, Department of Defence Research



and Development, Dr S Christopher applauded the synergy between the Armed Forces and the DRDO.

Shri Pravin K Mehta, Director General, Armament and Combat Engineering Systems, DRDO, congratulated team Pinaka for their successful endeavour.

The Deputy Chief of Army Staff (P&S) Lt Gen Subrata Saha, DG Artillery Lt Gen PK Srivastava and other senior Army Officers and DRDO Scientists witnessed the successful launch.

DFRL SIGNS MOU FOR TRANSFER OF SHORT-TERM PRESERVED CHAPATIES TECHNOLOGY

The technology would be helpful to meet short-term requirement of Armed Forces during field operations.



Defence Food Research Laboratory (DFRL), Mysuru, signed Memorandum of Understanding (MoU) with M/s Viatla Foods Private Limited, Vijayawada, Andhra Pradesh for transfer of Short-term Preserved Chapatias Technology. Dr Rakesh Kumar Sharma, Director, DFRL and Shri Vijay Krishna Viatla, Director, M/s Viatla Foods Private Limited, signed the MoU on 27 January 2017 at DFRL.

The inventors, Dr GK Sharma, Sc G, Dr AD Semwal, Sc G, and

Shri Ayub Khan, Sc D, Dr M Pal Murugan, Sc D, Technology Transfer Division, and Dr Mallesha, Sc C, PRO, DFRL were present during the occasion.

The Short-term Preserved Chapatias Technology has been developed by DFRL to meet short-term requirement of Armed Forces during field operations. These are fully baked chapatias stabilized by incorporating anti-mycotic, anti-staling and softening agents. The product is in ready-to-eat form. The technology is fairly simple and adaptable by any small

scale entrepreneur. The paraphernalia of operations entailing traditional kitchen drudgery stand eliminated in the preparation of chapatias when making use of the technology.

DFRL has already transferred this unique technology to many enterprises, i.e, Joy Products, Mumbai, Hallimane Caterers, Bengaluru, Hunlung Food Pvt Ltd, Shillong, Basics, Greater Kailash Enclave, New Delhi, etc.

INDO-US JTG ORGANISED WORKSHOP ON MEDICAL & CHEM BIO-DEFENCE



The Indo-US defence scientific cooperation is emerging as a major pillar of strategic partnership between both nations to further advance their shared security interests. As part of this exercise, an Indo-US Joint Technical Group (JTG) Workshop on “Medical and Chem Bio-Defence” was partnered by the US Department of Defense and DRDO. The workshop, was organized by the Institute of Nuclear Medicine and Allied Sciences (INMAS), Delhi, from 31 January 2017 to 2 February 2017. Dr Shashi Bala Singh, Distinguished Scientist, Director General (Life Sciences), DRDO, inaugurated the workshop.

The workshop focused on medical, chemical and biological defence strategies. The scope of the workshop was to share current research and seek future cooperation in areas of combat casualty care, neurocognitive assessment, military

The workshop will give a boost to bilateral relationship between USA and India, and will give impetus to future scientific collaboration in the field of medical, chemical and biological defence.

operational environment, detection and diagnostics for chemical and biological defence, medical countermeasures, radiation countermeasures as well as individual and collective protection/decontamination. The workshop sought to identify potentially strategic areas of mutual interest which would culminate

into fruitful scientific collaboration and help in synergizing the strength of both the nations.

The workshop was attended by 27 US delegates headed by Dr Patrick Mason SES, Office of the Assistant Secretary of Defense for Research and Engineering, US DoD.

The Indian delegation, headed by Dr AK Singh, OS and Director, INMAS, constituted 25 members from six DRDO Life Sciences laboratories. Participants shared their knowledge and expertise in order to enhance current and future preparedness for war challenges in these critical and unconventional areas.

This workshop proved a significant milestone in furthering the bilateral relationship of USA with India, and will give impetus to future scientific collaboration in the field of medical, chemical and biological defence.



TEJAS & AEW&C FLY-PAST AT REPUBLIC DAY PARADE-2017

Representing India's stride in indigenous Defence Technologies, the DRDO contingent this year consisted of 155 mm/52 Calibre Advanced Towed Artillery Gun System (ATAGS) and Arudhra, the Medium Power Radar.

The Light Combat Aircraft (LCA) Tejas and Airborne Early Warning and Control System (AEW&C) developed by DRDO fly-past for the first time during Republic Day Parade-2017. Representing India's stride in indigenous Defence Technologies, the DRDO contingent this year consisted of 155 mm/52 Calibre Advanced Towed Artillery Gun System (ATAGS) and Arudhra, the Medium Power Radar.

Tejas is indigenously developed by Aeronautical Development Agency, an autonomous society of DRDO and produced by Hindustan Aeronautics Limited. It is light-weight and multi-role four plus generation tactical fighter aircraft, which can carry laser guided bombs and modern missiles to cause extreme damage to the target. Tejas has been inducted in the 45th Squadron of Indian Air Force. It is more towards self-reliance in 'Air Power' requirement of the nation. Tejas is the pride of the country and a step towards "Make in India" initiative.

The Airborne Early Warning and Control (AEW&C) System is an 'Eye in the Sky'. It is a force multiplier, developed by DRDO for IAF with Centre for Air Borne Systems (CABS) as nodal agency. AEW&C System consists of multiple sensors for Surveillance and Signal Intelligence. It helps in Air Defence operations and is capable of communicating using VHF, UHF, C-Band and SATCOM links for Network Centric Operations. Induction of AEW&C into services will make the country self-reliant and position India in top five countries having this capability.

The Advanced Towed Artillery Gun System (ATAGS) is an indigenous weapon system developed by DRDO under Prime Minister's 'Make in India' initiative. Armament Research and Development Establishment (ARDE), a Pune-based premier R&D establishment of DRDO, is the nodal agency for design and development of ATAGS with industry



ATAGS at Republic Day Parade-2017

partners Bharat Forge Limited and Tata Power SED.

ATAGS has excellent accuracy, consistency, mobility, reliability and automation and is capable of achieving 47 plus km range. The armament system of the ATAGS, which comprises 52 calibre Gun Barrel with Breech Mechanism, Muzzle Brake and Recoil Systems, has been designed and developed to fire the 155mm calibre ammunition held by Army with enhanced range, accuracy and precision as well as greater fire power. The system is configured with all Electric Drive technology for the first time in the world that will ensure maintenance-free and reliable operation over longer periods of time.

Medium Power Radar, Arudhra, has been indigenously developed by Electronics and Radar Development Establishment (LRDE), Bengaluru, an establishment of DRDO. Arudhra is the first indigenous rotating active phased array multi-function radar with digital beam forming technology. The

radar covers 360 degree in azimuth and is capable of performing volumetric surveillance to detect and track aerial targets up to 400 km in range and 30 km altitude. This radar can survive intense ECM environment and electromagnetic interference. Arudhra is integrated with modern Identification of Friend or Foe System to recognise enemy targets and is transportable by road, rail and Air.

DRDO has a mission to empower India with self-reliance in defence technologies. Since its creation in 1958, DRDO's research, design and development efforts have led to the production of hundreds of products that include state-of-the-art weapons, platforms, equipment and life support systems for the Indian armed forces. Today, the production value of systems (excluding the strategic systems) already inducted or approved for induction, exceeds ₹ 2, 60, 000 crore. The strategic systems developed by DRDO have given our country the much needed multi-level strategic deterrence.

RAISING DAY CELEBRATIONS

INMAS, Delhi

Institute of Nuclear Medicine and Allied Sciences (INMAS), Delhi, celebrated its 56th Annual Day on 13 February 2017. Dr Soumya Swaminathan, Director General, ICMR and Secretary, Department of Health, was the Chief Guest and Dr Mala Iyengar, IFA (R&D) and Dr Shashi Bala Singh, DS, Director General (Life Sciences), DRDO, were the Guests of Honour on the occasion.

Dr Ajay Kumar Singh, OS, Director, INMAS, welcomed the guests and highlighted the recent achievements of the laboratory and shared the growth path and future vision of INMAS especially in the areas of combat casualty, CBRN research, radiation biology, and molecular imaging. Dr Soumya Swaminathan in her address appreciated the efforts of life sciences cluster of DRDO and stressed on the need to have concerted efforts by both ICMR-DHR and DRDO to fasten the pace of translational research. The Chief Guest presented laboratory-level DRDO Awards and Cash Awards to meritorious employees for their outstanding contributions.

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

The function saw the culmination of a fortnight long scientific, societal, sporting and cultural activities held at the institute. Dr Rashi Mathur, Sc E,



Chairperson, Annual Day Celebrations Committee, proposed the vote of thanks.

R&DE(E), Pune

Research and Development Establishment (Engineers) [R&DE(E)], Pune, celebrated its 55th Annual Day on 9 February 2017. As a part of Annual Day celebrations, Aga Memorial Lecture was organised in honour of Brig. Aga, the founder Director of R&DE(E). The lecture was delivered by Air Marshal BN Gokhale, PVSM, AVSM, VM, on 'National Security and the Role of Technology'. A few ex-employees of the establishment were felicitated in recognition of their valuable contribution

to the Establishment. On this occasion the latest issue of 'RDE Insight' was released by Shri PK Mehta, OS and DG (ACE). Smt Asha Joshi inaugurated the 'MR Joshi Technology Exposition Arena' where prototypes of systems developed in the establishment are exhibited.

To mark the Annual Day various event like walk for Swachh Bharat, Art Exhibition, Photograph Exhibition, sports activities and open day for families of employees were organised. As a part of the event, a one-day seminar on 'Production Management of Military Systems' was also organised. Shri Anil M Datar, Dr BD Nagchaudhuri, DRDO Chair delivered the keynote address.





COURSE ON FOOD SAFETY AND QUALITY STANDARDS

Defence Food Research Laboratory (DFRL), Mysuru, conducted a Targeted Training course on 'Food Safety and Quality standards: Role of Advanced Analytical Techniques' for Armed Forces and DRDO personnel during 3-13 January 2017. The course was aimed to give detailed up-to-date expertise/skills in food quality and standards and the techniques used.

The various topics covered in concurrence with the course theme were quality assessment of cereals, pulses and their milled products, advanced techniques in quality analysis of wheat and wheat milled products; modern food traceability systems for assessing quality and safety standards of meat and milk products; quality standards of spices and products; role of advanced analytical techniques, chromatographic

techniques, Application of continuous flow analyzer in food analysis & quality control, Applications of NIR and MID infra-red spectroscopy in food analysis, Mineral analysis. Microbial quick test kits, etc.

The course covered practical/demonstrative exposure to participants. The service officers from Army made technical presentation about the Defence Food Specification (DFS) and the recent scenario of FSSAI regulations.



COURSE FOR RETIRING EMPLOYEES

Naval Physical and Oceanographic Laboratory (NPOL), Kochi, organized a two-day orientation course during 19-20 January 2017 for superannuating employees. The objective of this customized course was to prepare the target participants to make a smooth transition from an active service life to an equally fulfilling retired life. Shri SK Shenoy, OS and Director, NPOL, inaugurated the course and highlighted the relevance and significance of the course. The course had a special training module covering the psycho-sociological aspects of retired life, in addition to special health segments in geriatrics and ayurveda for healthy living. Exposure was also given on Pension Pay Order and pensionary benefits, medical reimbursement under CGHS and post-retirement fund management.



COURSE ON PROTECTIVE EQUIPMENT AND FLYING CLOTHING



A course on Protective Equipment and Flying Clothing was organized by Defence Bioengineering and Electromedical Laboratory (DEBEL), Bengaluru, during 19-20 January 2017 on the request of IAF for logistic officers. The course participants included 12 IAF officers and three officers from friendly

foreign countries.

Dr UK Singh, Director, DEBEL, inaugurated the course and delivered the inaugural address on Importance of Life Support System, Protective Equipment and Flying Clothing. The lectures included development and testing of PE&FC products such as FR

overalls, helmet, mask, anti G suit and cold weather clothing. The highlights of the lectures were a talk on certification of indigenous PE&FC by Shri Mahuli Pradeep, Regional Director, RCMA(A/C) and on High Performance fibres/textiles by Dr TM Kotresh, Associate Director, DEBEL.

SML FREE SERVICE CAMP/TRAINING FOR MECHANICS & DRIVERS

A one-day SML Free Service Camp/Training Programme for Mechanics and Vehicle Operators was organised in Integrated Test Range (ITR), Chandipur, in collaboration with Sri Balaji Automobiles, Balasore, and M/s SML ISUZU Ltd, Kolkata on 6 February 2017. Dr BK Das, OS and Director, ITR, inaugurated the programme.

The objective of the programme was to educate the vehicle operators, technicians regarding safe and economical driving skills and to familiarise with the modern maintenance practices for the state-of-the-art SML vehicles operated at ITR and other units of the stations.



WORKSHOP ON POTENTIAL COLLABORATION IN THE AREA OF FOOD S&T

A one-day workshop on Potential Collaboration in the Area of Food Science and Technology was conducted by Specialist Panel of Food Science, Hill Agriculture, Biofuels and Bioresources (FSH-ABB), Life Science Research Board (LSRB), DRDO, on 27 January 2017 at Defence Food Research Laboratory (DFRL), Mysuru.

The project proposals presented by participants in the workshop were evaluated by a committee of panel members comprising Dr BS Mahapatra, Professor, Govind Ballabh Pant Nagar Agriculture University, Uttarakhand; Prof. Gurumukh Singh, Dr Alok Shah, Member Secretary, LSRB; Dr P Chattopadhyay, Director's Rep, Defence

Research Laboratory (DRL), Tezpur and senior scientists from DFRL. Forty-eight Project Proposals were discussed.

Sixty-one participants from ICAR, NDRI, CFTRI, IIHR, CIPHET, NIN, GKVK, JNCASR and Coffee Board and 14 universities attended the workshop.



HINDI WORKSHOP

Research Centre Imarat (RCI), Hyderabad, organised 3rd Hindi Workshop on 27 January 2017. Shri T Narasimha Rao, Sc G, Vice Chairman, OLIC, inaugurated the course. Shri N Venkatesh, Sc F, and Shri Kazim Ahmed, Senior Hindi Translator, delivered lectures on Current Trends in e-Governance and Hindi Grammar and its Role in Hindi Implementation, respectively.

SCIENCE COUNCIL

RCI organised Ist Science Council on 27 January 2017. Shri A Rama Rao, Associate Director, Reactor Design Group, BARC, and Prof. Rudra Pratap from IISc, Bengaluru, delivered lectures on Nuclear Power Generation and Bio-inspired Micro and Nano Engineering, respectively. Shri BHVS Narayana Murthy, OS and Director, RCI, presided over the function.

APPOINTMENT

Director, ITM



Shri Sanjay Tandon, Sc G, has assumed the charge of Director, Institute of Technology Management (ITM), Mussoorie. He was earlier Director in

the Directorate of Material Management (DMM), at DRDO HQ. He also hold the additional charge of DBFA from 16 July 2012 to 23 December 2016. He started his career with DRDO in 1986

as Sc B in Scientific Analysis Group (SAG), Delhi, after completing his Post-graduate degree in Mathematics from Indian Institute of Technology (IIT), Kanpur. During his tenure in SAG, he was associated in the Pattern Recognition Division. Later he was Head of Technical Coordination and Information Division.

In July 1996, he joined Defence Materials and Stores Research and Development Establishment (DMSRDE) at Kanpur. In DMSRDE, he was engaged in various techno-managerial activities, which included Project Reviews, Decision Aid for Technology Evaluation (DATE), Budget, Contracts for the Acquisition

of Research Service (CARS), Intellectual Property Right (IPR) and responsibilities of HR Coordinator. In 2008, he was appointed Director, DMM at DRDO HQ in Delhi.

As Director DMM, he was responsible for timely support and guidance to the Labs/Estts on issues pertaining to Material Management. Under his guidance, numerous updates and guidelines on policy matters were issued. He was Chairman of the drafting committee of updated version of Procurement Manual of DRDO. As Director DBFA his responsibilities were to look after the issues related to Budget Management and statutory Audit of DRDO.

AWARDS

Gaurav Samman

Dr Sudhir Kumar Mishra, DS and Chief Controller R&D (BrahMos) and CEO and MD BrahMos Aerospace has been honoured with the “Gaurav Samman” of Government of Madhya Pradesh. The Prestigious Award is conferred to individual, hailing from Madhya Pradesh, who has performed exceptionally well in brightening the name of the State at global level. Dr Mishra received the award from Shri Shivraj Singh Chouhan, Hon'ble Chief Minister of Madhya Pradesh.



Dr Sudhir Kumar Mishra receiving the award from Hon'ble Chief Minister of Madhya Pradesh.

Distinguished Professionals Achievement Award

Dr P Sivakumar, DS and Director, Combat Vehicles Research and Development Establishment (CVRDE), Chennai, has been honoured with “Distinguished Professionals Achievement Award” by ASM (American Society for Metals) International Chennai Chapter. ASM International is world's largest and most established materials information society.





Vigyan Ratna Award

Dr Tessy Thomas, OS and Director, Advanced Systems Laboratory (ASL), Hyderabad, was conferred Vigyan Ratna-2016 Award. Dr Thomas received the award for her outstanding contributions in the design of Agni missiles by Vigyan Parishad Prayag, Jodhpur Centre.



Rajbhasha Award

Naval Physical and Oceanographic Laboratory (NPOL), Kochi, bagged the Rajbhasha Rolling Trophy (2015-16) for the 15th consecutive year from Town Official Language Implementation Committee (TOLIC), Kochi. The award was in recognition of securing the first place for the best performance in official language implementation. Shri KV Rajasekharan Nair, Group Head (Personnel and Administration) and Smt KK Oormila, Assistant Director (OL), NPOL, received the Trophy from Dr P Radhika, Professor and Head, Post Graduate Research Centre, Dakshin Bharath Hindi Prachar Sabha, Kochi on 18 January 2017.



NPOL team also received several prizes in the various Rajbhasha competitions conducted in connection with 'Joint Hindi Week Celebrations-2016' organized under the auspices of TOLIC.

Best Presentation Award

Shri ML Meena, Sc D, Defence Laboratory, Jodhpur (DLJ), was awarded Best Presentation Award at DRDO Young Scientist Meet for presenting his work on Microwave Stealth and Radar Signature Studies. Dr G Satheesh Reddy, DS, SA to RM and DG (MSS), DRDO, presented the award to Shri Meena.



HIGHER QUALIFICATION ACQUIRED

ACEM, Nasik



Shri SC Bhattacharyya, Sc G, Advanced Centre for Energetic Materials (ACEM), Nasik, has been awarded PhD by the Indian Institute of Technology Bombay for the thesis entitled

'Studies on the Heterogeneous Reaction Kinetics in the Synthesis of Triaminotrinitrobenzene by a Gas-Liquid Reaction.'

DRDO HQ



Shri Vivek Raghav, Sc D, Directorate of Industry Interface and Technology Management (DI2TM), DRDO HQ, has been conferred PhD by Sambalpur University for the thesis titled "Some Studies on Pulsed Nd: YAG Laser Drilling by Thermal Modelling and Artificial Neural Network".

ITR WINS BADMINTON TOURNAMENT

Integrated Test Range (ITR), Balasore, won the Central Zone Badminton Championship 2016-17 organised by Research Centre Imarat (RCI), Hyderabad, during 4-7 January 2017. A felicitation programme was organised to felicitate members of the team ITR. Dr BK Das, OS and Director, ITR, praised the efforts of players who played extremely well to clinch the trophy and encouraged the employees to maintain physical fitness and carry on good work in official as well as co-curricular activities.



DRDO SOUTH ZONE CRICKET TOURNAMENT

Centre for Artificial Intelligence and Robotics (CAIR), Bengaluru, organized the 11th DRDO South Zone Cricket Tournament during 23-27 January 2017. Nine teams from South Zone participated in the championship. Smt Manimozhi Theodore, Sc G and Officiating Director, CAIR, distributed trophies, medals and certificates to the winners and runners-up. The team GTRE, Bengaluru, won the championship. CVRDE, Chennai, was the runner-up.



DRDO NORTH ZONE CARROM TOURNAMENT

Defence Scientific Information and Documentation Centre (DESIDOC), Delhi, conducted DRDO North Zone Carrom Tournament during 15-17 February 2017. Dr Rajeev Vij, Sc F, Chairman, Organizing Committee, inaugurated the tournament. Teams from DMSRDE, LASTEC, SAG, TBRL, JCB, RAC, SSPL, INMAS, ISSA, DLJ, DRDE, CEPTAM and DESIDOC participated in the tournament. SSPL won the team championship. JCB was the runner's-up. Dr Rajeev Vij, Sc F, and Smt Sumati Sharma, Sc F, gave away the trophies and medals to the winners and the runners-up.





DRDO HARNESSING SCIENCE FOR PEACE AND SECURITY-XIII

CHAPTER 2: TRANSFORMATION-DEFENCE RESEARCH & DEVELOPMENT (1958-1969)

The article is Thirteenth 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).

PROF S BHAGAVANTAM BECOMES SCIENTIFIC ADVISER

The choice of successor to Dr Kothari fell on Prof. Suri Bhagavantam who had earlier worked in London at the High Commission of India with Shri VK Krishna Menon. He was at that time, the Director of the most prestigious academic institution in the country namely, the Indian Institute of Science, Bangalore. Prof. Bhagavantam was at first reluctant to accept the invitation of the Minister, but under pressure from the Minister he later agreed to be the Scientific Adviser on a part-time basis in the first instance. Within a year, Prof. Bhagavantam realized that he could not do justice to either of the two jobs and opted for being the full time Scientific Adviser to the Defence Minister.

Prof. Bhagavantam hailed from a family of Vedic and Sanskrit scholars of Andhra Pradesh. From the very beginning, he displayed his brilliance in his studies by standing first in High School examination and subsequently in the BSc degree in Physics of the University of Madras. On the basis of his academic record and a prize-winning essay on Physics, he was accepted by Prof. CV Raman to join him at his laboratory at the Indian Association for the Cultivation of Science at Calcutta. At that time, he was not even 19 years but he worked hard and his research work was of such high

caliber that Prof. Raman was impressed by his experimental as well as theoretical skills. He obtained his MSc degree under the direction of Prof. Raman and when Andhra University was on the search for a faculty member in Physics to organize the department, Prof. Raman had no hesitation in recommending his prized student for the post. Within a span of five years at the age of twenty eight, Bhagavantam rose to become one of the youngest professors anywhere in India and a little later he was called upon to shoulder the responsibility as Principal of the University Colleges of Science, Technology, Law, Arts, Commerce, etc. In spite of all the administrative duties where he showed his skills in the management of these institutions in rapidly changing political climate, he continued to carry out scientific research. The combination of proven administrative ability and a reputation in research attracted the attention of India's political leaders who were on the look out for a Scientific Liaison Officer in London at the Office of the Indian High Commissioner. He accepted the post and carried out the job with rare distinction. During the short period of stay, he earned the respect of Shri VK Krishna Menon who was the High Commissioner, with whom he formed an abiding friendship. On his return to India, Dr Bhagavantam became Professor and Head of the Department of Physics at Osmania University where he built up a school of physics, which became known

for its research nationally as well as internationally. His reputation as an able academic and administrator propelled him into the Vice Chancellorship of the University, which he fulfilled with distinction. In 1957, the position as Director of the most prestigious academic institution, the Indian Institute of Science was offered to him. According to Dr BV Subbarayappa, the official historian of the Indian Institute of Science, Bangalore, "Bhagavantam's period was particularly noted for obtaining a new status for the Institute. Bhagavantam succeeded in securing the status of a 'Deemed University' for the Institute. In addition, he also ensured that political and other pressures, which have usually been the bane of Indian Universities, did not encroach upon the autonomy of the Institute. In any case, the 'Deemed University' status for the Institute added a new dimension; for, it allayed the apprehension that the Institute was not gaining due recognition for its intensive training programmes and conferments"⁶. When Shri Krishna Menon became the Defence Minister and began the reorganization of defence research, he turned to Professor Bhagavantam to become the Scientific Adviser after Dr Kothari relinquished the office.

Professor C Mahadevanone of the earlier associates of Professor CV Raman at the Indian Association for the Cultivation of Science at Calcutta, and who was working next door to Professor

Bhagavantam stated in 1953 that, “one of the most remarkable scholars to come to Professor CV Raman for research was Professor Bhagavantam. He was in his teens at that time, a number of people used to come to work and not having much initiative, and Professor Raman not having much time, either stagnated or left after sometime. He [Professor Bhagavantam] was within a very short time one of the closest associates of Professor Raman in his work, and if I may say so, was one of the very few who could rise to levels to hold discussions with him. His work was characterised by highest standard and something out of the ordinary. He was remarkably clear headed and unassailable, whether in scientific work or in controversial conversation.

Prof. Bhagavantam was not a mere first class first; he was exceptionally brilliant with intellectual gifts of the rarest type and a vision. Dr M Krishnamurthy who was one of his closest associates from the Osmania University days and who later retired as CCR&D of the DRDO, states that “Bhagavantam was a talented teacher, cast in the mold of Gurus of ancient India. He was a scholar in Telugu and Sanskrit. He was a man of wit and humour and ready repartee. The way he used to defuse tense situations in various meetings by a ready and apt joke was worthy of emulation. He was warm-hearted but sometimes had as severe exterior, which frightened people away. Once they came close, they could not but feel attracted by his many qualities of head and heart. He was one of the very few persons who kept very friendly and close contacts with Prof. Raman throughout his life.”

Dr V Ranganathan who worked as Deputy Chief Scientist with Dr Bhagavantam, states that Prof. Bhagavantam was a brilliant man who could have received top honours in physics if only he had devoted his time fully to science and scientific research.

Dr VS Arunachalam who was the Scientific Adviser in the 1980s stated that Prof. Bhagavantam “took over the stewardship [of the DRDO] during the turbulent times of the sixties when there

were concerns about the strength of our defence forces. The Defence Research and Development Organisation he was leading then, was a fledgling one with modest facilities and infrastructure. He soon realised that to provide, tactical advantage it was necessary to be technologically up-to-date and went about setting up laboratories. It is this foresight that is paying us rich dividends today...” To those of us who were at the middle level in the DRDO, Dr Bhagavantam appeared as a man of few words, of serious mien, a person to whom one gave respect and listened to with attention when he spoke.

THE EARLY YEARS OF DRDO

In 1958, when the DRDO was formed, it appeared as though a Defence Minister had forced it on the Services by his sheer strength of conviction of the necessity for scientists and technologists to be involved with defence weapons, and by his influence with the Prime Minister. The Defence Minister with the concurrence of Dr DS Kothari entrusted the Chief Controller R&D with actual task of separating the personnel in the Technical Development Establishments under the Army who were predominantly involved in “development” activities, and finding the equipment and space for them to function. The Defence R&D Organisation had an able CCR&D in Major General BD Kapur who lightened the administrative burden of the Scientific Adviser in carrying out promptly, the wishes of the Defence Minister without ruffling too many feathers in the bureaucratic and Service circles. He was joined by Dr V Ranganathan who as Deputy Chief Scientist formed with him a cohesive team which had its task cut out for separating the personnel carrying out research and development tasks in the TDEs, in finding them laboratory space and getting them to function. In spite of the backing of the Minister, the going was hard and General Kapur has provided some glimpse of the difficulties he faced in the early days. He has stated that, “it became a real headache for me

to segregate the ‘developing component’ of the Controller General of Defence Production [CGDP] Organisation and bring these components into the new fold of the ‘Defence Research and Development Organisation’, and find space for them in little nooks and corners of the Ordnance factories with the indulgence of the Director General of Ordnance Factories (DGOF). The opposition came from not only within the Ministry but also from the Army. With lack of support of the Chief of Army Staff, I [Kapur] could get little sympathy from his Principal Staff Officers. Our effort for the Navy and the Air Force was so small that they were not bothered...”

The separation of the personnel of the TDE into those who are suitable for R&D activities and those who would carry on inspection activities was not an easy task. It not only involved examining in detail their qualifications and work experience but also in overcoming the reluctance of the Army to release them. In addition, these personnel had to be provided with covered space and additional test equipment and laboratory facilities suitable for R&D activities. It took nearly ten years to set up these laboratories as detachments or as autonomous units under the DRDO umbrella. The major institutions/laboratories that constituted the Defence R&D Organisation at the time of its formation were:

- ✦ Armament Research and Development Establishment, Pune
- ✦ Defence Metallurgical Research Laboratory, Ishapore (presently located at Hyderabad)
- ✦ Defence Research Laboratory (Stores); now called Defence Materials and Stores Research and Development Establishment (DMSR&DE), Kanpur
- ✦ Defence Science Laboratory; named as Defence Science Centre and now called Laser Science & Technology Centre, Delhi
- ✦ Electronics Research and Development Establishment; now called Electronics and Radar Development Establishment, Bangalore
- ✦ Explosives Research and



Development Laboratory; now called High Energy Materials Research Laboratory (HEMRL), Pune

- ✦ Defence Institute of Fire Research; now called as Centre for Fire, Environment and Explosive Safety (CFEES), Delhi
- ✦ Indian Naval Physical Laboratory; now called Naval Physical and Oceanographic Laboratory (NPOL), Kochi
- ✦ Institute of Armament Studies; now called Institute of Armament Technology (IAT), Pune
- ✦ Instruments Research and Development Establishment, Dehradun

The Psychological Research Wing, which was part of the Defence Science Organisation, automatically became a part of the DRDO. Out of these ten, two laboratories, namely the Armament Research & Development Establishment (ARDE), and the Explosives Research & Development Laboratory (ERDL) were directed to armaments. ARDE and ERDL were formed out of the TDE (Armaments) and TDE (Weapons) with a group of scientists who were carrying out import substitution and limited development of armament stores at the Ammunition factory, Khadkee, in the vicinity of Pune. These two institutions would from now on be concerned with tasks of design and development of small arms, guns and rockets for ARDE and of research and development of explosives for ERDL. The scope of activities of the Defence Science Laboratory was enlarged to include new activities namely, Weapons Evaluation and Guided Weapons Study. In addition, a Scientific Information Bureau was also set up mainly to collect and disseminate information on scientific and technical areas of relevance to the projects undertaken by the scientists. The Electronics Research and Development Establishment (LRDE) and the Instruments Research and Development Establishment (IRDE) were part of the TDE (Instruments and Electronics) which was at Dehradun. LRDE was nucleated from the scientists and technologists concerned with inspection and indigenisation of signals equipment

related to the army and who had been shifted from Dehradun to Bangalore to be closer to the proposed defence factory Bharat Electronics Ltd. (BEL) which was being set up for manufacture of communications equipment in Bangalore. The personnel involved in indigenisation and limited development were separated from those carrying out inspection to form LRDE which then moved into hutments that had been used as barracks by the British troops during World War II. The charter of LRDE was to design and develop mobile and portable electrical generators, signal communication and radar equipment for the three Services. The IRDE remained at Dehradun to be nearer to the Ordnance factory at Dehradun for purposes of design and development of optical instruments such as telescopes and gunsights used by the Armed Forces. The Defence Metallurgical Research Laboratory (DMRL) was carved out of the TDE (Metals) which was earlier called the Inspectorate of Metals and Steel situated at Ishapore. The DMRL remained as a composite unit along with the inspectorate at Ishapore. The main purpose of DMRL was to carry out research and development with respect to metallic and ceramic materials of interest to defence. The Indian Naval Physical Laboratory (INPL) was taken over from the Indian Navy which had established it in 1952 for purposes of solving day-to-day problems and also for undertaking investigations in underwater acoustics, magnetism and physical oceanography. The Defence Research Laboratory (Stores) was created out of the TDEs at Kanpur which had earlier been part of the Inspectorate of General Stores. The main purpose of the TDE(L) had been inspection, routine testing and quality control of various nonmetallic materials in the general stores category used by the Army. That part of the TDE(L) which was responsible for indigenisation and substitution of nonmetallic materials was separated out and merged into the DRDO to be called the Defence Research laboratory (Stores). Thus, out of these ten main institutions/laboratories, three were part of the Defence Science

Organisation, one was under the Navy, and the rest were under the Army.

The formation of the DRDO changed the main role of the scientists and technologists from that of being mere advisers to one of design and development of weapon, sensors, sighting, communication systems, and so on.

After more than a year, that is in August 1959, activities related to production were added to the earlier charter of responsibilities of the DRDO. These were:

- ✦ Modifications to existing equipment relating to design of improvement which is not of a minor nature
- ✦ Investigations and experiment at all stages of development with a view to determining the causes of failures, if any, and suggesting remedial measures for production
- ✦ Preparation of specifications of new weapons and equipment based on qualitative requirements given by the Services. Preparation of such drawings as may be asked for by production authorities in cases of establishment of indigenous manufacture under license.
- ✦ Technical guidance to civil trade for the manufacture of prototypes of equipment designs of which not to date have been sealed for Services use.

These activities linked the development conducted either by DRDO or by any other agency with the concurrence or under the guidance of DRDO to the production agency in such a way as to facilitate the manufacture of the product that has been designed and developed.

Thus, right from the beginning, the emphasis was on applied research, design and development leading to production and thus aim for self-sufficiency in arms, weapons, and materials for Defence.

To be continued...



THE HINDU SUNDAY, 12, 2017

INDIAN DEFENCE PRODUCTS RIPE FOR EXPORT: DRDO CHIEF

After years of developing defence goods, the focus of the country's military R&D establishment is now on pursuing export of a host of Indian products and technologies, said S. Christopher, chairman of the Defence Research and Development Organisation (DRDO), on Saturday. Efforts are on to find overseas buyers for homegrown products and technologies such as the light combat fighter (LCA), pilotless aircraft Rustom-1 and Rustom-2 Tapas, the small AEW&CS plane for surveillance, and the Astra and Pinaka missiles, he said at a customary news briefing ahead of the three-day Aero India Seminar, which begins here on Sunday. As part of this strategy, DRDO will encourage potential overseas customers to fly in the LCA's trainer version during the Aero India, which begins on February 14. For the first time, the DRDO outdoor display will showcase a real Tejas LCA aircraft. Export of its products is the DRDO's key agenda this year, Dr. Christopher said, adding, "We are geared up to do it. We have come to the extent of showcasing our fighter aircraft to the world and [to] demonstrate the LCA to customers. It will be a good return on the investments if we produce them at a reasonable cost and export them. It will also do the nation good."

hindustantimes

New Airborne Surveillance Plane to give IAF Eyes in Sky

The Indian Air Force (IAF) on Tuesday inducted its first indigenously developed airborne early warning and control (AEW&C) system, mounted on a Brazilian Embraer-145 jet, ramping up its capability to detect enemy aircraft and missiles. The Netra AEW&C system has been developed by the Defence Research and Development Organisation (DRDO) and has a range of around 200 km. The aircraft was handed over to the IAF on the opening day of Asia's largest airshow Aero India-2017, more than six years behind schedule. Over 550 defence and aerospace firms, including 279 foreign companies, are taking part in the event being held at the air force base. An IAF officer said, "The induction of the AEW&C system is the highlight of the airshow for the air force. We need to scale up our airborne surveillance capabilities." India inked a \$208-million contract for three Brazilian Embraer-145 planes in 2009 as part of a DRDO programme to set up the IAF's AEW&C capability. The deal was in the news last year due to kickback allegations. IAF currently operates three Phalcon airborne warning and control system (AWACS) from Russian IL-76 heavy-lift aircraft and there are plans to buy two more.

indiatoday NEWS

INDIA TO FIRE SELF-MADE TORPEDO VARUNASTRA, SAYS DRDO

The ship-launched anti-submarine torpedo called Varunastra, from Sindbhughosh submarines, has been accepted and will be going into production phase, the Defence Research and Development Organisation said. DRDO Director General Dr S Christopher, Commodore CID Balaji (Retd), Director, Aeronautical Development Agency (ADA) and top scientific brass of the country were present on the occasion.



THE TIMES OF INDIA Tue, 14 Feb, 2017

DRDO Young Scientists Meet at Aero India Seminar

DRDO Young Scientists Meet (YSM) 2017 was inaugurated by Secretary DDR&D and Chairman DRDO Dr S Christopher, at Yelahanka, Bengaluru on the sidelines of Aero India Seminar. For the first time the event has been planned during Aero India to provide an opportunity for the young scientists to witness the biennial mega event. YSM is a two-day technical event with participation of young scientists coming from DRDO

to motivate the young minds. The meet offered young scientists from DRDO an opportunity to share and exchange scientific experience, present their work before the head of the organisation and unleash their creative and innovative potential. Dr Christopher in his inaugural address highlighted the importance of innovations in the lives of young scientists. He reiterated that innovations can be achieved even in day-to-day activities and one has

MAIL TODAY Read by those who matter

DRDO'S V-DAY GIFT TO IAF: AN ALL-WEATHER ALLY

This arena couldn't have come at a better time than this. On February 14, the day Aero India 2017 begins, the IAF will be the proud owner of its very own indigenously all-weather airborne early warning and control system popularly known as the AEW&C. This aerial platform is meant to be a force multiplier that will guide the IAF's fighter aircraft during combat. It will have the capability to detect incoming fighters, cruise missiles and even drones from both Pakistan and China. For DRDO Chairman Dr Christopher, it will be a fine day indeed.



Business Standard English | Hindi

AERO INDIA SEMINAR TO SHOWCASE AEROSPACE TECHNOLOGIES, MILITARY PRODUCTS

India will showcase its aerospace technologies and products for military applications on Sunday ahead of the Aero India 2017 air show starting in Bengaluru from Tuesday, said an official on Saturday. "A three-day international seminar on 'Aerospace: Technology Collaboration and Self-reliance' is being held as a prelude to the 11th edition of the biennial air show where we will showcase technologies and products developed by our defence labs and the aerospace industry," Defence Research and Development Organisation (DRDO) Chairman S Christopher told reporters. The state-run DRDO and its various aerospace arms like Aeronautical Development Establishment (ADE), Aeronautical Development Agency (ADA) and Gas Turbine Research Establishment (GTRE) have developed technologies and applications for aircraft systems, unmanned platforms, C4ISR (Command, Control, Communications, Computers Intelligence, Surveillance and Reconnaissance), avionics, space and missile systems, propulsion, materials and manufacturing.

DefenceNews.Org

Hopeful of flying Kaveri engine in next Aero India: DRDO

Reliability and safety are foremost concerns. Now, someone has to audit this engine and say it is safe for flying, said CP Narayanan. (PTI) With French company Safran agreeing to help India revive its Kaveri combat jet engine project, a senior DRDO official said on Thursday they hope to fly the engine in the next Aero India. The issue of safety is involved since the engine is supposed to be used in Light Combat Aircraft, Defence Research and Development Organisation's Aeronautical Systems Director General C.P. Narayanan told IANS on the sidelines of the Aero India 2017. "Safety is a concern if you are flying a single-engine aircraft; if it is a twin engine, there

DEFENSE WORLD.NET

DRDO Plans to Increase Focus on Unmanned Platforms

India's Defence Research Development Organization (DRDO) will increase its focus on developing unmanned platforms for land, sea and air operations in keeping with global trends. "DRDO has developed two rotors 'Daksh Mini' and 'Daksh Scout' that are capable of detecting and defusing improvised explosive devices (IED) on aircraft and trains. With focus of military operations in urban areas the demand for unmanned systems is high," S. Christopher, DRDO Director said during Aero India 2017 air show Wednesday. The DRDO will have a contest in May this year to encourage School and College kids to come up with ideas for Unmanned systems, Christopher added. Unmanned systems for DRDO will be used for... (text continues)

The Indian EXPRESS

QuEST keen to double its headcount in India

Singapore-headquartered QuEST Global Engineering is in talks with Defence Research and Development Organization (DRDO) to explore possibilities to work on India's aero engine project. With many opportunities in the Indian defence sector opening up, the company, which is mainly into design and development of high technology products for defence and aerospace sector, plans to double its headcount in India in the next 3-4 years. Of its 8,200 employees working from 11 countries, 4,500 work from three centres in India — Bengaluru, Belagavi and Thiruvananthapuram. According to Raman Subramanian, Senior Vice President—Strategic Initiatives and Marketing, QuEST Global always encourages local talent. "In next three to four years, we will be focusing more on India," said Raman, an alumnus of Indian Institute of Technology (IIT) Madras and Indian Institute of Management (IIM) Bangalore. Bengaluru-based Gas Turbine Research Establishment (GTRE), a DRDO laboratory, had worked on developing the aero engine Kaveri which was meant to power the indigenously designed and developed Light Combat Aircraft (LCA) Tejas. However, it failed to meet the requirements and DRDO had to opt for an US-made aero engine.

DECCAN Chronicle Friday, Feb 17, 2017

Aeronautical Development Establishment developing solar powered UAVs

Bengaluru: Scientists at the Aeronautical Development Establishment (ADE) are working on developing a solar-powered unmanned aerial vehicle (UAV) which can fly on all-weather conditions for at least a month. Mr M. Hari Prasad, a scientist at ADE, said, "UAVs will be the future of all combat vehicles. They are used for varied purposes right from carrying out recon missions along the border to collecting crucial information from neighboring countries. They are needed for real-time information and data through a secure data link."

Brahmand.com

DRDO looking at optimizing defence products

Giving thrust on exports, Defence Research and Development Organisation has said it is looking at optimizing defence products for which the advanced versions have been developed, by exporting them to other countries. DRDO Chairman S Christopher on Saturday said besides bringing in economical advantage, it will also help India build its might in the region. Apart from importing the foreign defence goods, if we can make a small change in terms of delivering or exporting some of our defence goods, that will be the happiest movement for the nation, and DRDO should strive to do that," Christopher said.