

# DRDO

NEWSLETTER



A Monthly Bulletin of Defence Research and Development Organisation

ISSN: 0971-4391

[www.drdo.gov.in](http://www.drdo.gov.in)

ANNUAL ISSUE 2018 | VOLUME 38 | ISSUE 13

## ANNUAL ISSUE 2018





# CONTENTS

VOLUME 38  
ANNUAL ISSUE  
ISSN: 0971-4391

1. DRDO Successfully tested Akash Short Range SAM	04
2. Nuclear Capable Agni-5 Ballistic Missile tested Successfully	05
3. ARDE conducts Penetration Trials of 125 mm FSAPDS Mk-II Ammunition	05
4. DRDO transfers Technologies in Defence-Industry Development Meet	06
5. CBRN Defence Technologies Handed Over to the Indian Army	07
6. SEE & Aadhaar Integration Enrolment Application Handed Over to UIDAI	07
7. DRDO Successfully flight Tests Rustom-2 in User Configuration	08
8. NAG ready for Induction	08
9. Ground-Based Mobile ELINT System Handed Over to the Indian Air Force	09
10. Brahmos tested with Indigenous Seeker	09
11. DRDO Robotics & Unmanned System Exposition	10
12. DRDO conducted Validation trials of Service Life Extension & Critical Indigenous Components of Brahmos	10
13. Successful Flight Test of Solid Fuel Ducted Ramjet	11
14. Ballistic Missile Agni 5 ready for Induction	11
15. LCA Tejas Achieves yet another Milestone towards FOC Certification	12
16. DIPR Hands Over Prototype of the Training Management System to ARTRAC	12
17. Dr G Satheesh Reddy, Distinguished Scientist and SA to RM, takes over as Secretary DDR&D and Chairman DRDO	13
18. Ballistic Missile Interceptor AAD Flight Tested Successfully	13
19. Indian Army implements SIZE INDIA Combat Uniform Sets	14
20. DLJ signs LATOT for Multi Spectral Camouflage Paints	14
21. DMSRDE transfers Technology of High Pressure Hydraulic Fluid-PEGCOL 113	15
22. Mobile Food Microbial Analysis Laboratory, Parakh, Launched	15
23. Modular & Customized Ration Storage System Silo inaugurated at 102 Infantry Brigade	16
24. Anti-tank Guided Missile HELINA tested Successfully	17
25. Indian Air Force carries out First Ever Mid Air Refuelling of Tejas Mk 1	18
26. Successful Flight tests of Smart Anti Airfield Weapon	18
27. Rotary Mixer Complex Inaugurated at ACEM	19
28. V-Reality System inaugurated at ITR	19
29. DRDO pays tribute to Dr APJ Abdul Kalam on his Birth Anniversary	20
30. Prahaar tested Successfully	21
31. CAIR Handed Over SDPS Solution to IB	21
32. DRDO conducts Second Flight Test of MPATGM	23
33. IAF conducts Successful Final Development Trials of Astra	24

Editor-in-Chief: Dr Alka Suri  
Managing Editor: B Nityanand  
Editor: Manoj Kumar  
Editorial Assistance: Biak Tangpua  
Multimedia: RK Bhatnagar  
Printing: SK Gupta, Hans Kumar; Distribution: Tapesh Sinha, RP Singh  
For feedback, please contact: director@desidoc.drdo.in  
Tel: 011-23902403; 23902474; Fax: 011-23819151

#### LOCAL CORRESPONDENTS

**Ahmednagar:** Lt Col. AK Singh, Vehicles Research & Development Establishment (VRDE); **Ambarnath:** Dr Susan Titus, Naval Materials Research Laboratory (NMRL); **Balasore/Chandipur:** Shri Santosh Munda, Integrated Test Range (ITR); **Bengaluru:** Shri Subbukutti S, Aeronautical Development Establishment (ADE); Smt MR Bhuvaneshwari, 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); Dr Prince Sharma, 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 Dolly Bansal, Defence Institute of Psychological Research (DIPR); Shri Navin Soni, Institute of Nuclear Medicine and Allied Sciences (INMAS); Shri Anurag Pathak, Institute for Systems Studies & Analyses (ISSA); Dr Indu Gupta, Laser Science & Technology Centre (LASTEC); 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); Ms Bidisha Lahari, 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); **Jagdarpur:** Dr Gaurav Agnihotri, SF Complex (SFC); **Jodhpur:** Shri Ravindra Kumar, Defence Laboratory (DL); **Kanpur:** Shri AK Singh, Defence Materials & Stores Research & Development Establishment (DMSRDE); **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); **Pannagarh:** Shri Anjan Kumar Das; **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 Jaysree Das, Defence Research Laboratory (DRL); **Visakhapatnam:** Dr (Mrs) V Vijaya Sudha, Naval Science & Technological Laboratory (NSTL)



## FROM THE EDITOR-MANUS



Dear Friends,

Year end is the time to review the performance and to plan for the future. DRDO in its 60th anniversary year achieved a steady progress in its endeavour to provide state-of-the-art indigenous weapon systems to the Indian Armed Forces. The year 2018 witnessed full range testing of long-range surface-to-surface ballistic missile Agni 5, successful flight test of Rustom-2, a medium altitude long-endurance (MALE) unmanned aerial vehicle, in user configuration with higher power engine; developmental flight-test of anti-tank guided missiles (ATGM), Nag, with indigenous IIR seeker and integrated avionics, in desert conditions against two tank targets at different ranges and timings; testing of super-sonic cruise missile BrahMos with indigenous seekers and service life extension and critical indigenous components; firing of Derby air-to-air Beyond Visual Range Missile (BVRM) from LCA Tejas to expand its firing envelope as well as to demonstrate safe operation of the aircraft during missile plume ingestion into the aircraft engine under worst case scenarios; testing of the Advanced Area Defence (AAD) Ballistic Missile Interceptor; testing of indigenously developed Helicopter Launched Anti-Tank Guided Missile HELINA from light combat helicopter of the Army; first ever mid air refuelling of the indigenously build fighter aircraft Tejas Mk 1 by the Indian Air Force; testing of Smart Anti Airfield Weapon (SAAW); successful launch of surface-to-surface tactical missile Prahaar and Man Portable Anti-Tank Guided Missile (MPATGM); and flight trials of Astra Beyond Visual Range Air-to-Air Missile (BVRAAM) by the Indian Air Force reaffirms country's indigenous defence capabilities.

DRDO also helped in promoting entrepreneur participation of private industries especially Micro Small and Medium Enterprises (MSMEs) in Defence manufacturing by transferring a number of technologies and know-how to the industries in the Defence-Industry Development Meet and in DefExpo 2018 in the benign presence of Hon'ble Raksha Mantri Smt Nirmala Sitharaman.

I am happy that *DRDO Newsletter* is bringing out a compilation of all these success stories of the DRDO, covered in its various issues during the year, in its Annual Issue. I sincerely hope that the issue would be a single source institutional repository and referral to the achievements and activities of the Organization in 2018.

I would also like to reiterate my appreciation for the excellent team effort encompassing DRDO labs, editorial team and the readers collectively that have made *DRDO Newsletter* a hugely popular in-house magazine.

I wish you and your family a very healthy, happy and fruitful new year 2019.

Dr Alka Suri  
Director, DESIDOC



# DRDO SUCCESSFULLY TESTED AKASH SHORT RANGE SAM

*The missile is being inducted into Army as Short Range Surface-to-Air Missile (SRSAM).*

The surface-to-air missile Akash, with indigenous radio frequency seeker, was successfully tested against target Banshee, from the Launch Complex-III at Integrated Test Range (ITR), Chandipur. The

radars, telemetry and electro-optical systems along the coast tracked and monitored all parameters of the missile.

This missile is being inducted into Army as Short Range Surface-to-Air

Missile (SRSAM). This is the first surface-to-air missile with indigenous seeker that has been test fired. With this success, India has acquired the capability of making any type of surface-to-air missile.





# NUCLEAR CAPABLE AGNI-5 BALLISTIC MISSILE TESTED SUCCESSFULLY

**L**ong-range surface-to-surface ballistic missile, Agni-5, was successfully flight tested for its full range on 18 January 2018 from Dr Abdul Kalam Island, Odisha. This was the fifth test of the missile and the third consecutive one from a canister on a road-mobile launcher. All the five missions have been successful.

The flight performance of the most advanced missile in the Agni series was tracked and monitored by radars, range stations and tracking systems through out the flight. All objectives of the mission were met successfully. Successful test of Agni-5 reaffirms the country's indigenous missile capabilities and further strengthens our credible deterrence.

Smt Nirmala Sitharaman, Hon'ble Raksha Mantri, congratulated DRDO on this successful feat and also lauded the industries that contributed to the manufacture of indigenous technologies that went into the making of the missile.



## ARDE CONDUCTS PENETRATION TRIALS OF 125 mm FSAPDS Mk-II AMMUNITION

**T**he Armament Research and Development Establishment (ARDE), Pune, conducted successful penetration trials of Fin Stabilized Armour Piercing Discarding Sabot (FSAPDS) ammunition, design and developed for T 72 and T 90 main battle tanks of Indian Army with 1 mil accuracy at 2 km range, at Proof and Experimental Establishment (PXE), Balasore. The trial results established



the penetration capabilities of the indigenously designed FSAPDS ammunition at par with NATO and Russian tank ammunition. With low cost, low wear and moderate chamber pressures, this ammunition is extremely safe and effective up to combat ranges. High Energy Materials Research Laboratory, Pune, provided high performance propulsion system required to launch projectile at hyper velocities.

# DRDO TRANSFERS TECHNOLOGIES IN DEFENCE-INDUSTRY DEVELOPMENT MEET



**H**on'ble Raksha Mantri Smt Nirmala Sitharaman inaugurated a two-day 'Defence Industry Development Meet' organised by the Department of Defence Production, Ministry of Defence, in Chennai to encourage and facilitate participation of private industries especially Micro Small and Medium Enterprises (MSMEs) in Defence manufacturing.

The objective of the meet was to forge new partnerships with private industry with the aim of achieving self-reliance in defence production under the 'Make in India' initiative of the Government. The meet focused on indigenization, import substitution and technology infusion.

The defence-industry interface endorsed 18 technology transfers from the DRDO to private enterprises. Many MSMEs were provided technical know how on manufacturing various defence equipment under the "Make in India" programme.

In all DRDO transferred technology for manufacturing 35-metre mountain footbridge; technology for making propellant for low thrust motor and high thrust motor of BrahMos; and technology for making advance bullet-proof vest. Apart from that there was a Memorandum of Interest (MOI) between Naval Physical and Oceanographic Laboratory (NPOL), a premier naval research laboratory of DRDO, and Cochin Shipyard Ltd for

manufacturing of indigenous ship based on DRDO technologies.

The event provided private firms/companies, especially vendors from Tamil Nadu region, an overview of the existing defence procurement policy, indigenization and outsourcing procedures of DPSUs/OFB and updated them on the Government policy initiatives to promote indigenization and outsourcing and the opportunities thereon.

More than 1,000 MSMEs from Chennai, Trichy, Coimbatore, Maharashtra and other places participated in the meet.



## CBRN DEFENCE TECHNOLOGIES HANDED OVER TO THE INDIAN ARMY

**C**hief of the Army Staff General Bipin Rawat inaugurated a workshop and Exhibition on Chemical Biological Radiological Nuclear (CBRN) Defence Technologies on 12 January 2018 at DRDO Bhawan.

Speaking on the occasion General Rawat complimented DRDO and said, “CBRN threat is becoming a reality, particularly from the non-state actors and I am sure that DRDO in its long-term perspective plan in conjunction with integrated perspective plan of the

services, has encompassed development of mitigation technologies against such threats.”

The occasion also witnessed the handing over of CBRN Suit Mk-V, CBRN First Aid Kit and Remote Radiation Monitoring and Transmission System (RRMTS) by Dr S Christopher, Chairman, DRDO, and Secretary, Department of Defence R&D, to General Rawat. CBRN Training Manual, Military Explosives Handling Guidelines, Hiranyagarbha—a trusted

network router, and Army Air Defence Deployment Simulator System were also released.

Dr Shashi Bala Singh, DG (LS), DRDO, highlighted the contributions of DRDO to the national CBRN Defence Preparedness and Capacity Building and said that more than 68 CBRN products developed by DRDO have already been inducted into the services and 25 more have been realised and ready for induction.



## SEE & AADHAAR INTEGRATION ENROLMENT APPLICATION HANDED OVER TO UIDAI

**S**ecure Execution Environment (SEE) and Aadhaar Enrolment Application developed by Centre for Artificial Intelligence and Robotics

(CAIR), Bengaluru, was handed over to Unique Identification Authority of India (UIDAI) for pan-India roll out. The system was formally handed over

by Dr S Christopher Chairman, DRDO and Secretary, Department of Defence R&D to Dr Ajay B Pandey, CEO, UIDAI, at HQ UIDAI on 12 January 2018.

## DRDO SUCCESSFULLY FLIGHT TESTS RUSTOM-2 IN USER CONFIGURATION

**D**RDO successfully flew Rustom-2, a medium altitude long-endurance (MALE) unmanned aerial vehicle, on 25 February 2018 at its Aeronautical Test Range (ATR) at Chalakere at Chitradurga. This flight assumes significance due to the

fact that this is the first flight in user configuration with higher power engine. All test parameters were normal.

Rustom-2 is being developed to carry out surveillance and reconnaissance roles for the armed forces with an endurance of 24 hours.

The UAV is capable of carrying different combinations of payloads like synthetic aperture radar, electronic intelligence systems and situational awareness payloads.



## NAG READY FOR INDUCTION

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

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







## GROUND-BASED MOBILE ELINT SYSTEM HANDED OVER TO THE INDIAN AIR FORCE

The Ground-based Mobile Electronic Intelligence (ELINT) System (GBMES) was handed over to the Indian Air Force (IAF) at the BEL, Hyderabad Unit on 18 March 2018. DRDO's Defence Electronics Research Laboratory (DLRL), Hyderabad, is responsible for the system design, development of critical sub-systems, and realization of engineered version

of truncated GBMES system as successfully proved in the field. The GBMES comprises one Control Station (CS) and three Receiving Stations (RS) integrated in master/slave concept to search, detect, monitor, record and process the hostile emissions as well as to find out the location of the emitter fulfilling the strategic EW requirements of the IAF. One of the three RS has also

been configured to operate in master/slave configuration (with minimal degradation) in the absence of control station. Each RS contains three ELINT Receiver Segments in the 70 MHz – 40 GHz frequency range. In addition, one Communication Intelligence (COMINT) Receiver Segment, operating in 30-1000 MHz frequency range, intercepts and monitors the COMINT signals.



## BRAHMOS TESTED WITH INDIGENOUS SEEKER

BrahMos, the formidable supersonic cruise missile with indigenous seeker was successfully flight tested at 0842 hrs on 22 March 2018 at the Pokhran Test Range in Rajasthan. DRDO and

BrahMos Aerospace have developed the supersonic cruise missile and the seeker jointly.

The precision strike weapon with indigenous seeker flew in its designated trajectory and hit the pre-set target. The

scientists of DRDO and BrahMos along with the Indian Army conducted the flight test.

# DRDO ROBOTICS & UNMANNED SYSTEM EXPOSITION

**A**s a part of its Diamond Jubilee Celebrations, DRDO organised DRDO Robotics and Unmanned System Exposition (DRUSE) for Indian engineering students. The exposition was an open platform to popularize and synergise the national talent in the areas of robotics and unmanned systems for defence applications.

The competition focused on generating innovative ideas and novel concepts for development of robotics and unmanned systems for some of the challenging operational requirements and needs of the Indian armed forces.



# DRDO CONDUCTS VALIDATION TRIALS OF SERVICE LIFE EXTENSION & CRITICAL INDIGENOUS COMPONENTS OF BRAHMOS

**B**rahMos, supersonic cruise missile was successfully test fired from Integrated Test Range (ITR), Balasore, Odisha, as part of service life extension programme. The life extension test firing, witnessed by the scientists from DRDO and BrahMos, was conducted from a Static Inclined Launcher proving the efficacy and longevity of the system. BrahMos was tested again at 1145 hours on 22 May 2018 from ITR from a Mobile Autonomous Launcher (MAL) and successfully flew in the pre-set trajectory fulfilling its mission objectives. The major sub-



systems manufactured indigenously under “Make in India” campaign were tested during the launch. Through this launch the critical indigenous

components including fuel management system and other non-metallic airframe components have qualified to form part of the missile.

## SUCCESSFUL FLIGHT TEST OF SOLID FUEL DUCTED RAMJET

The technology demonstrator flight test of 'Solid Fuel Ducted Ramjet (SFDR)' propulsion-based missile was carried

out successfully from the Launch Centre-III of ITR, Balasore, Odisha, on 30 May 2018. The flight test met all the mission objectives. The technology of

nozzle less booster was successfully demonstrated during the test for the first time in the country.

## BALLISTIC MISSILE AGNI 5 READY FOR INDUCTION

The long range ballistic missile Agni 5 was successfully flight tested at 0945 hrs on 3 June 2018 from Dr APJ Abdul Kalam Island (Wheeler Island), Odisha. Radars, Electro Optical Tracking Stations and Telemetry Stations tracked the vehicle all through the course of the trajectory. All the mission objectives were successfully achieved. Raksha Mantri Smt Nirmala Sitharaman congratulated DRDO scientists and staff, the Armed Forces and industries for the success of the mission.

Agni 5 is the most advanced missile in the Agni series with new technologies incorporated in it in terms of navigation and guidance, warhead and engine. The missile has a high speed on-board computer and fault tolerant software along with a robust and reliable bus. Its path is precisely directed by the advanced on-board computer and inertial navigation system.

The three-stage Agni 5 has higher reliability and enhanced mobility. This was the sixth trial of the state-of-the-art ballistic missile.





# LCA TEJAS ACHIEVES YET ANOTHER MILESTONE TOWARDS FOC CERTIFICATION

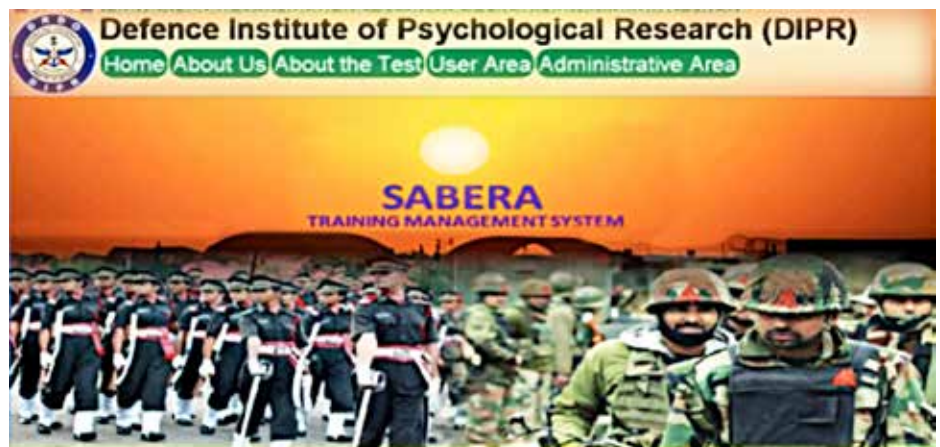
**T**ejas, the Light Combat Aircraft (LCA), successfully fired Derby air-to-air Beyond Visual Range Missile (BVRM) to expand its firing envelope as well as to demonstrate safe operation of the aircraft during missile plume ingestion into the aircraft engine under worst case scenarios, on 27 April 2018 from the firing range off the Goa coast after exhaustive study of the missile separation characteristics and plume envelope. Integration of Derby is one of the major objectives of Final Operational Clearance (FOC) of Tejas. Tejas has been designed and developed by DRDO's autonomous society Aeronautical Development Agency (ADA).



## AUGUST

# DIPR HANDS OVER PROTOTYPE OF THE TRAINING MANAGEMENT SYSTEM TO ARTRAC

**D**efence Institute of Psychological Research (DIPR), Delhi, DRDO's centre of excellence in military psychology, handed over prototype of Organizational Effectiveness and Competence Building Training Management System, SABERA®, to the Army Training Command (ARTRAC) Shimla. SABERA is a web-based real-time training management system comprising user interface and administrator interface and is useful both at individual as well as administrator/organizational level. Individual level can be used for assessing individuals in leadership style and behavioural competencies of their strength and the areas they may like to include in their personal development programme. Organizational level is useful for



the organization as human resource inventory, a decision-aid in designing customized training programme and as a personalized automated training aid. The system can also be used as HR

management system. The application has gone through rigorous trials at the Cat 'A' training establishments of Indian Army including HQ ARTRAC and was found useful.



# Dr G Satheesh Reddy, Distinguished Scientist and SA to RM, takes over as Secretary DDR&D and Chairman DRDO

**D**r G Satheesh Reddy graduated in Electronics and Communication Engineering from JNTU, Anantapur and received his MS and PhD from JNTU Hyderabad. He joined Defence Research and Development Laboratory (DRDL), Hyderabad, in the year 1986. He later joined Research Centre Imarat (RCI), the brain child of Dr Kalam and a premier DRDO laboratory responsible for R&D of missile systems, guided weapons and advanced avionics for the Indian Armed Forces.

Dr Satheesh was elevated as Distinguished Scientist in September 2014 and was later appointed as Scientific Adviser to Raksha Mantri (SA to RM) and Director General, Missiles and Strategic Systems (MSS). He is well known for his significant contributions towards indigenous design, development, deployment of diversified Missiles and Strategic Systems, Guided Weapons, Avionics Technologies and for sustained efforts in advancement of Aerospace technologies and Industries in India.

As SA to RM, he significantly contributed towards the formulation of many national policies and was pivotal in evolving roadmap for self-sufficiency in missiles. As Director General (MSS),



he spearheaded Dr APJ Abdul Kalam Missile Complex, cluster laboratories and technical facilities. He led the design and development of a wide range of tactical and strategic missile systems to attain complete self-sufficiency in missiles and initiated many new projects to equip Armed Forces with state-of-the-art weapons and technologies. He invigorated the Ballistic Missile Defence (BMD) programme and developed the mission critical technologies for Long Range Agni-5 missile. As Director, RCI, he led many Programmes, Projects and steered the development of advanced Avionics Technologies.

He is a renowned navigation and avionics expert and has been elected as the Fellow of Royal Institute of Navigation (FRIN), London, Royal Aeronautical Society, UK (FRAeS) and the Foreign Member of the Academy of Navigation and Motion Control, Russia. He is an Honorary Fellow of CSI and Project Management Association of India, Fellow of Indian National Academy of Engineering, IET (UK), Associate Fellow of American Institute of Aeronautics and Astronautics, USA and many other academies/scientific bodies in the country and abroad.

Dr Satheesh is the recipient of several prestigious international and national awards, which include the Indian Science Congress Association Homi J. Bhabha Memorial Gold Medal, National Aeronautical Prize, National Design Award, National Systems Gold Medal, the first IEI-IEEE (USA) joint award for Engineering Excellence and was conferred with the Silver Medal of Royal Aeronautical Society, London. He is also the recipient of Dr Biren Roy Space Science Design Award, Astronautical Society of the India Rocketry and Related Technologies Award and has been conferred with Honorary Degrees of Doctor of Science by many leading universities in the country.

## BALLISTIC MISSILE INTERCEPTOR AAD FLIGHT TESTED SUCCESSFULLY

**D**RDO conducted successful test of the Advanced Area Defence (AAD) Ballistic Missile Interceptor on 2 August 2018 from Abdul Kalam Island, Odisha. The endo-atmospheric missile, capable of

intercepting incoming targets at an altitude of 15 to 25 km, was launched against multiple simulated targets of 1500 km class ballistic missile.

One target among simultaneously incoming multiple targets was selected

on real time, the weapon system radars tracked the target and the missile locked on to it and intercepted the target with a high degree of accuracy. CAS Air Chief Marshal BS Dhanoa, witnessed the flight test.

# INDIAN ARMY IMPLEMENTS SIZE INDIA COMBAT UNIFORM SETS

**S**ize Roll as sets of shirt and trouser for uniform of Indian Army, developed and proposed by Defence Institute of Physiology and Allied Sciences (DIPAS), Delhi, has been accepted for implementation by the Master-General of the Ordnance (MGO). This is the first of its kind Size Roll in India with 12 sizes recommendation of combat uniform for male soldiers. The Size Roll has been extracted from the anthropometric database of around 8,000 soldiers of the Indian Army generated using India's first 3D whole body scanner.

An extensive anthropometric study of the Army was undertaken by DIPAS



for scientific study of best combination of sizes for the Indian Army. Earlier,

the shirt and the trouser of the combat uniform were provided from two different sources leading to mismatch and fitments disturbing uniformity of the uniform, which affected troops' combat preparedness.

DIPAS recommended a combination of four sizes in shirts and five in trousers with 12 combinations to attain maximum coverage of the users in minimum number of sizes. After successful human trials of the uniform sets in different units along with UN Mission troops from the Armed Forces, extensive provisioning has been undertaken by MGO, as per revised Size Roll, for its induction in the Indian Army during 2019-20.

# DLJ SIGNS LATOT FOR MULTI SPECTRAL CAMOUFLAGE PAINTS

**D**efence Laboratory, Jodhpur, (DLJ) signed License Agreement for Transfer of Technology

(LATOT) of Multi Spectral Camouflage Paints (MSCP) with Marudhar Paints and Polymers, Jodhpur, and Prolite

Paints and Chemicals, Kolkata, on 13 June 2018 in the presence of Dr SV Kamat, DS and DG (NS&M),







DRDO. Shri Vijay Kumar Sharma, Proprietor, Prolite Paints and Chemicals, and Shri Ashish Mathur, Partner, Marudhar Paints and Polymers, signed LATOT with Dr SR Vadera, OS and Director, DLJ. Dr SV Kamat handed over the ToT documents to the representatives of

the two firms and received the Demand Drafts of ToT fees.

The MSCP coatings have been developed by DLJ to provide cover to combat vehicles/installations in visual, near-IR, and thermal infrared spectral regions. The MSCP coatings are specially designed for low gloss, and colour

matching with the natural surroundings such as sand and vegetation. In addition, the near-IR reflectivity of the various shades are matched to corresponding terrain features like vegetation, sand, etc. They also have low emissivity for moderation of thermal infrared signatures.

## DMSRDE TRANSFERS TECHNOLOGY OF HIGH PRESSURE HYDRAULIC FLUID-PEGCOL 113

Defence Materials and Stores Research and Development Establishment (DMSRDE), Kanpur, transferred the technology of High Pressure Hydraulic Fluid,

PEGCOL 113 to M/S Protochem Industries Pvt Ltd, Navi Mumbai, on 2 July 2018.

PEGCOL 113 is a new product developed by DMSRDE on the urgent

demand of Programme ATPV. The hydraulic fluid would be used in steering gear system of underwater platforms.

## MOBILE FOOD MICROBIAL ANALYSIS LABORATORY, PARAKH, LAUNCHED

Mobile Food Microbial Analysis Laboratory, Parakh, developed by Defence Food Research Laboratory (DFRL), Mysuru, for detection and identification of food and water borne pathogens was launched by Dr RK Sharma, Director, DFRL, in the presence of Dr Upendra Kumar Singh, OS and Director, Defence Bio-engineering and Electromedical Laboratory (DEBEL), Bengaluru, on 31 July 2018. Dr MM Parida, Sc 'G', and his team, who contributed in the development of the facility, were present during the launch.

This readily deployable laboratory can be used for rapid detection and characterization of pathogen and toxins in food and water. The laboratory is an autonomous 20 feet container mounted on Ashok Leyland 1618-2C-4700 cabin chassis. It adheres to class ISO 7 and operates with negative pressure to handle clinical, food and environmental samples during biological emergency without any risk to personal and



environment. It is equipped with a dynamic pass box for transferring the samples directly inside the class III bio-safety cabinet for safe handling of samples.

Parakh is capable of identifying select food borne pathogen and toxins

(Anthrax, Brucellosis, Salmonella, Shigella, E. Coli, Listeria, Yersinia, Botulinum, Staphylococcal Enterotoxin, Afla toxin, Ochra toxin, etc.) using both immunological and molecular test. Its users include ASC-CFL's, RVC, AFMC, NDMA, FSSAI, etc.

# MODULAR & CUSTOMIZED RATION STORAGE SYSTEM SILO INAUGURATED AT 102 INFANTRY BRIGADE

A modular and customized ration storage system, Silo, developed at Defence Food Research Laboratory (DFRL), Mysuru, under Young Scientist Project Soldier Assist System for Difficult Areas, installed at 5102 Coy ASC Comp, Khalsar, Nubra Valley, J&K, was inaugurated by Brigadier Bhupesh Hada, SC, Commander 102 Infantry Brigade, on 3 July 2018. Dr Rakesh Kumar Sharma, Director, DFRL, and Dr OP Chaurasia, Director, Defence Institute of High Altitude Research (DIHAR), Leh, were present on the occasion.

The issue of freezing of fresh fruits, vegetables, special ration items such as juices, chocolates amongst others is a dampener to morale of troops deployed at high altitude. The options of resuscitation of freshness by means of boiling the vegetables, exposure to limited sunlight available in the area and use of additives for tenderizing and thawing have not delivered satisfactory results.

To address the problem, DFRL developed this customized Silo System. The aspect of camouflage, concealment, ruggedness, transportability, need for

modular structure and easy operability and its functioning on solar power was kept in mind at the design stage.

The system caters to two segments, namely, commodities like rice, pulses, sugar and salt, and commodities like spices, condiments, oil hydro, tea rations, perishable fresh items, etc. The present modular and expandable structure was envisaged for minimum 3 tons of rations during land locked periods at Siachen. The Silo will be under trial for another one year for its on ground efficiency particularly during peak winters.







# ANTI TANK GUIDED MISSILE HELINA TESTED SUCCESSFULLY

*The upgraded air version of 'fire-and-forget' anti-tank guided missile (ATGM) Nag was tested for its full range.*

**I**ndigenously developed Helicopter Launched Anti-Tank Guided Missile 'HELINA' was successfully flight tested from light combat helicopter of the Army at 1400 hr in the ranges of Pokhran, on 19 August 2018. The weapon system has been tested for its full range. The 'HELINA' weapon system released smoothly from the launch platform and tracked the target all through its course before hitting it with high precision. All the mission parameters were monitored by the telemetry stations, tracking systems and the helicopters.

The missile is guided by an Infrared Imaging Seeker (IIR) operating in the 'Lock on Before Launch' mode. It is one of the most advanced anti-tank weapons in the world. Senior officials



from DRDO and Indian Army were present during the mission.

Raksha Mantri Smt Nirmala Sitharaman congratulated DRDO

and the Indian Army on the successful flight test and for further strengthening the defence capabilities of the country.





# INDIAN AIR FORCE CARRIES OUT FIRST EVER MID AIR REFUELLING OF THE TEJAS MK 1

**I**ndian Air Force successfully carried out the first ever mid air refuelling of the indigenously build fighter aircraft Tejas Mk 1 from IL-78 Mk 1 tanker of the 78 Squadron on 4 September 2018. The tanker flew from its base in Agra while the Tejas took off from Gwalior. The specially modified Tejas aircraft carried out a series of test profiles including a 'Dry Contact' with the tanker. A second Tejas aircraft flying in formation was used to observe the exercise closely.

All flight parameters of Tejas aircraft were transmitted live to a ground control unit set-up at Gwalior airbase, wherein scientists from Aeronautical Development Agency (ADA)—an autonomous society of DRDO—constantly monitored the technical parameters of the mission. Prior to the test flight, extensive ground trials were conducted in all possible conditions under the supervision of ADA scientists.



The aircraft is being manufactured by Hindustan Aeronautics Limited.

The success of these trials is a major leap for the indigenous fighter and has enhanced its mission capability by increasing its range and payload. The

ability to carry out air-to-air refuelling is one of the critical requirements for the LCA to achieve 'Final Operational Clearance'.

## SUCCESSFUL FLIGHT TESTS OF SMART ANTI AIRFIELD WEAPON

**I**ndigenously designed and developed Smart Anti Airfield Weapon (SAAW) was successfully flight tested from IAF aircraft at Chandan range. The weapon system, integrated with live warhead, destroyed the targets with high precision. The telemetry and tracking systems captured all the mission moments. The weapon is

capable of destroying variety of ground targets using precision navigation. A total of three tests with different release conditions were conducted during 16-18 August 2018 meeting all the mission objectives.

The weapon has undergone eight developmental trials till date and its performance for different ranges under multiple launch conditions has been

demonstrated. Senior officials from DRDO, HAL and Indian Air Force participated and witnessed the flight tests.

Raksha Mantri Smt Nirmala Sitharaman congratulated DRDO, IAF and HAL on the successful flight tests and for further enhancing the defence capabilities of the country.



## ROTARY MIXER COMPLEX INAUGURATED AT ACEM

The Rotary Mixer Complex was inaugurated at Advanced Centre for Energetic Materials (ACEM), Nasik, by Shri Pravin Kumar Mehta, DS and DG (ACE), DRDO, making ACEM a unique facility with capability of processing HD 1.1 class of solid rocket propellant in the country. The mixer complex houses two rotary mixers of 1000 litre working volume with utilities like hot and cold water system, vacuum system, hydraulic power pack and compressed air system. The system would be used for mixing highly energetic propellant compositions. Shri Srinivasan Seshadri, General Manager, ACEM, explained the requirement and advantages of the rotary mixer over conventional vertical planetary mixers.

Various unique features of the rotary mixer like rotor and mixer wheels with variable speed drive unit,



vacuuming unit for rotor chamber, liquid charging system, solid charging system, discharge system, cleaning system, safety interlocks, operational mechanism, PLC/SCADA-based automation were explained to DG (ACE) by Dr SC Bhattacharya, Sc 'G', ACEM, and his team.

As a part of the 'Green India initiative', the function concluded with tree plantation by the Chief Guest, and cluster Directors, Integrated Financial Advisor, Chief Construction Engineers (R&D) West, and representatives of ACE cluster.

## V-REALITY SYSTEM INAUGURATED AT ITR

Dr BK Das, OS and Director, Integrated Test Range (ITR), Chandipur, inaugurated V-Reality System developed by the range. The range elements including flight vehicle tracking sensors and allied instrumentation along with the environment have been simulated in the V-Reality platform, using a distributed simulation framework to accurately assess the performance of the range elements during mission before conducting the same. The system will help ITR in deciding the optimal resource deployment required for a given mission geometry. This will be equally helpful in training range personnel by providing a real-time environment for training under different mission scenarios. This is the first of its kind system in the country.





# DRDO PAYS TRIBUTE TO DR APJ ABDUL KALAM ON HIS BIRTH ANNIVERSARY

**D**RDO celebrated 87th Birth Anniversary of Dr APJ Abdul Kalam, the former President of India and DRDO Chief at a function in DRDO Bhawan on 15 October 2018. Raksha Mantri Smt Nirmala Sitharaman graced the occasion as the Chief Guest, which also had the presence of Raksha Rajya Mantri Dr Subhash Ramrao Bhamre, and Prof. K Vijay Raghavan Principal Scientific Advisor (PSA) to the Government of India, along with other dignitaries.

Speaking on the occasion Smt Sitharaman shared her experience of meeting with Dr Kalam and said, “He was not only a good scientist but also an excellent administrator who could spot and nurture talent among his team members. That among others

made this ‘missile man’ a great team leader.” Addressing the gathering, Raksha Rajya Mantri said, Dr Kalam believed in a strong nation—one that is scientifically superior and always used to inspire people for putting their total commitment towards the mission in hand. This can be gauged in his words, “If you want to shine like sun, first burn like sun.”

Raksha Mantri also launched a DRDO website dedicated to the theme ‘The Kalam Vision: Dare to Dream’ for engaging young minds in emerging technologies like Artificial intelligence, Cyber security, Robotics, Autonomous Systems, etc. The website (<https://drdo.gov.in/drdo/kalam/kalam.html>) will facilitate open competition for students and start ups.

Hindi version of the book “Incredible Kalam”, brought out by Defence Scientific Information and Documentation Centre (DESIDOC), was released by Dr Bhamre. The book is a compilation of experiences of some distinguished scientists about their association with Kalam. A short film on Dr Kalam and his association with DRDO was also screened on the occasion.

Students of three Delhi-based schools attended the function. These schools have set up Atal Tinkering Lab in their schools under Atal Innovation Mission of Government of India. Students from IIT Delhi also attended the function. The aim of inviting young minds was to motivate them with diverse and great qualities of Dr Kalam.



Hon'ble Raksha Mantri releasing memoirs Incredible Kalam





## PRAHAAR TESTED SUCCESSFULLY

**D**RDO successfully flight tested the indigenously developed surface-to-surface tactical missile Prahhaar from Launch Complex-III, Integrated Test Range (ITR), Balasore on 20 September 2018. Range stations and electrooptical systems tracked the missile throughout its flight.

Prahhaar is a contemporary weapon system capable of carrying multiple types of warheads and neutralizing a wide variety of targets.

Hon'ble Raksha Mantri Smt. Nirjala Sitharaman congratulated DRDO, Army, industries and other team members for the successful mission and said, "Indigenously developed Prahhaar will further strengthen our defence capabilities."

Chief of the Army Staff General Bipin Rawat and Dr G Satheesh Reddy, Secretary, Department of Defence R&D and Chairman, DRDO, witnessed the launch and complimented all the team members.



## CAIR HANDS OVER SDPS SOLUTION TO IB

**D**RDO handed over Secure Desktop Processing System (SDPS) Solution to Intelligence Bureau (IB) for their internal usage. The solutions were architected and developed by the Centre for Artificial Intelligence and Robotics (CAIR), Bengaluru, while the product definition and refinement was done with the users in multiple iterations.

SDPS solution provides immutable and integrity preserving secure editing platform for creating, reading, editing and sharing of sensitive data. These SDPS are for standalone document processing and for network access (including Internet). The ceremony was attended by Shri AK Gupta from IB, and Director, CAIR, and her team.



# READERS' VIEWS

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

1. Name of the Establishment: \_\_\_\_\_

2. How would you rate the *DRDO Newsletter* as a medium to adequately present DRDO developments?

Excellent  Very Good  Good  Fair  Satisfactory

3. How would you rate the technical contents of the *Newsletter*?

Excellent  Very Good  Good  Fair  Satisfactory

4. How would you rate the quality of photographs in the *Newsletter*?

Excellent  Very Good  Good  Fair  Satisfactory

5. Ideal number of pages you would like for the *Newsletter*?

8 Pages  12 Pages  16 Pages  20 Pages

6. In which format do you prefers the *Newsletter*?

Print  E-pub  Video magazine

7. When are you receiving the *Newsletter*:

In the previous month of publishing  In the same month of publishing   
In the next month of publishing

8. Suggestions, if any, to further improve the technical content of the *Newsletter*?

-----  
-----  
-----

Name: .....

Address: .....  
.....  
.....

**Please mail your suggestions to:**

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



# DRDO CONDUCTS SECOND FLIGHT TEST OF MPATGM

**D**RDO successfully flight tested indigenously developed Man Portable Anti-Tank Guided Missile (MPATGM) second time from the Ahmednagar range in Maharashtra on

16 September 2018 fulfilling all the mission objectives. The flight missions were conducted on 15 and 16 September 2018 for different ranges and validated its maximum range capability.

Raksha Mantri Smt Nirmala Sitharaman congratulated the team DRDO, Indian Army and associated industries for the twin success of MPATGM weapon system.

## Salient Features

- \* Fire and forget third-generation anti-tank guided missile
- \* Capable of being fired from shoulder
- \* Strike range of around 2.5 km
- \* Effective against both stationary and moving targets



## IAF TEST FIRES ASTRA BVRAAM

**A**stra, Beyond Visual Range Air-to-Air Missile (BVRAAM), developed indigenously by DRDO was successfully test fired by the Indian Air Force (IAF) from Su-30 aircraft on 26 September 2018 from Air Force Station, Kalaikunda. The missile successfully engaged a manoeuvring target with

high precision meeting the mission objectives.

In the series of trials held to date, Astra has been launched in the complete Su-30 flight envelope. The latest flight test assumes significance as it was part of the series of final pre-induction trials. Astra is the best in class weapon system and has undergone more than

20 developmental trials.

Raksha Mantri Smt Nirmala Sitharaman lauded the efforts of Indian Air Force, DRDO and associated team members involved in the mission and said, India has attained a high level of capability in the indigenous design and development of advanced weapon systems.



# IAF CONDUCTS SUCCESSFUL FINAL DEVELOPMENT TRIALS OF ASTRA

*Indigenously developed missile is expected to be inducted into IAF in 2019.*

Indian Air Force conducted a series of flight trials of Astra Beyond Visual Range Air-to-Air Missile (BVRAAM) from 26 September 2018 to 3 October 2018 at Integrated Test Range (ITR), Balasore, as part of final development trials of the missile.

The trials were a combination of complex tests for engagement of pilotless target in different modes of manoeuvring, off-bore sight, medium and long ranges. The missiles were telemetered for evaluation of online

performance of all sub-systems especially the data link, RF seeker and proximity fuse for end-game performance. Astra has been tested six times under different launch conditions and ranges as part of the final development trial. The missile has engaged targets and all the mission objectives have been met.

With IAF's active participation, DRDO has developed the missile and integrated the weapon on Su-30 and other air platforms. Hindustan Aeronautics Limited (HAL), Nasik, has

been instrumental in the modification of a number of Su-30 aircraft for Astra weapon integration and support during trials. More than 50 private and public sector industries are involved in the development and production of different sub-systems of the missile. The missile is expected to be inducted into IAF in 2019.

Raksha Mantri Smt Nirmala Sitharaman congratulated DRDO, IAF, HAL and associated industries for the successful trials.

