

DRDO TESTED ATGM NAG SUCCESSFULLY

3RD GENERATION 'FIRE AND FORGET' MISSILE COMPRISES
MANY ADVANCED TECHNOLOGIES INCLUDING THE IMAGING
INFRARED RADAR (IIR) SEEKER



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DRDO TEST FIRES QUICK REACTION SURFACE-TO-AIR MISSILE
DRDO CARRIES OUT SUCCESSFUL FLIGHT TRIALS OF 500 KG GENERAL
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Defence Research & Development Organisation

FROM THE DESK OF THE CHAIRMAN



Dr S Christopher

CHAIRMAN

Defence Research & Development Organisation

&

SECRETARY

Department of Defence Research & Development

DRDO@60

Dear friends,

It's heartening to see the overall performance of labs, their contribution in strengthening the defence of our nation and the appreciation that pours in through mails, letters and in-person. It truly gives me immense sense of pride and satisfaction to head a family, which is dedicated from the core of its heart in whatever job is assigned to each and every individual. The latest glimpse was "Dr APJ Abdul Kalam National Memorial" inaugurated by Hon'ble PM on 27 July 2017 at Rameswaram, wherein each and every member involved, gave their best and the final result is a world-class memorial. My compliments to Team DRDO.

Recently, Hon'ble PM gave a clarion call for transforming our country as "New India" with the motto "Sankalp se Siddhi" – the attainment through resolve – by initiating New India Movement 2017-2022 for an India of our dreams when we celebrate our 75th year of Independence in 2022. Now the issue is what do we expect in New India? What should be our contribution for building New India? How do we do it? Where does DRDO stand in 2022? Well! Ignite your think pads. Give wings to your dreams. Pen down your thoughts and mail them to me. Remember "Sankalp se Siddhi" is not a mere slogan, it reminds us of our commitment towards the nation and the direction we need to pursue it. And the pleasure of self-satisfaction and achievement on accomplishment of our dream of New India would set a new benchmark in the history of DRDO giving inspiration to youth of our nation to contribute to our great organization.

Friends, we are completing 60 years of our journey in 2018. We have travelled a long way and when we look back, we have a saga of achievement behind us. The future holds a bright prospectus for us. We intend to hold a variety of events across the country starting in September 2017 to January 2018 to mark the 60th anniversary of our organisation as "DRDO@60". I have a broad roadmap planned to celebrate our 60th year. To start with, I expect all my team members to initiate a drive to plant 60,000 saplings across the DRDO in various labs and non-technical areas and also to come out with constructive ideas for celebrating DRDO@60, which could enhance the image of DRDO on all fronts. Let's plan a future where we achieve new milestones with each passing moment.

Jai Hind

DRDO TESTED ANTI-TANK GUIDED MISSILE NAG SUCCESSFULLY

The Anti-Tank Guided Missile (ATGM) Nag was successfully flight tested by DRDO in the desert ranges of Rajasthan on 13 June 2017. The capabilities of the top attack 3rd generation 'fire and forget' ATGM Nag are unique and comprises many advanced technologies including Imaging Infrared Radar (IIR) Seeker

with integrated avionics—a capability possessed only by few nations in the world. Senior officials from the Armed Forces participated in the tests. The Ordnance Factory, BEL and L&T have developed the ground systems of Nag.

SA to RM and DG, Missiles and Strategic Systems (MSS), DRDO, Dr G Satheesh Reddy, witnessed

the launch and said, "The successful flight test of 3rd generation ATGM Nag further strengthens the country's defence capabilities."

Chairman, DRDO and Secretary, Department of Defence R&D (DDR&D), Dr S Christopher congratulated the team DRDO and the armed forces who were part of the mission.

The capabilities of the top attack 3rd generation missile are unique and comprises many advanced technologies including IIR Seeker with integrated avionics—a capability possessed only by few nations in the world.





DRDO TEST FIRES QUICK REACTION SURFACE-TO-AIR MISSILE

DRDO developed Quick Reaction Surface-to-Air Missile (QRSAM) was successfully flight tested from ITR, Chandipur, on 3 July 2017. All the technologies and sub-systems of the missile met mission requirements. Shri MSR Prasad, Director, DRDL, Shri BHVS N Murthy, Director, RCI; and Dr BK Das, Director, ITR, monitored the launch operation in the presence of SA to RM and DG (MSS), DRDO, Dr G Satheesh Reddy.

Dr S Christopher, Chairman, DRDO and Secretary, DDR&D congratulated scientists on the successful test fire.

Raksha Mantri Shri Arun Jaitley also congratulated DRDO on the successful trial of QRSAM and said, it is an important milestone in the indigenous SAM development.



ARDE CARRIES OUT SUCCESSFUL FLIGHT TRIALS OF 500 KG GENERAL PURPOSE BOMB

Armament Research and Development Establishment (ARDE), Pune, conducted successful flight trials of the 500 kg General Purpose Bomb during May-June 2017 at Air Force Station, Jodhpur. Testing covered ground adaptation, carriage and handling,

limited separation and release of the bomb from Su 30 MK1 aircraft. The bomb exhibited adequate clearances when adapted on stations 1, 2, 3, 4, 7a, 7b, 8a and 8b.

During the carriage trials, the aircraft touched the carriage limits of 0.85 at 150 m altitude and completed 6.5 'g' and

full roll manoeuvres. Structural integrity of the bomb was found satisfactory after the trials.

The release of the bombs was carried out from station 7 wherein the safe separation has been established and live bomb functioned on impact proving the explosive train.



DFRL SIGNS LAToT FOR PUFF & SERVE CHAPATI

Defence Food Research Laboratory (DFRL), Mysuru, signed Licence Agreement for Transfer of Technology (LAToT) of Puff and Serve Chapati Technology with M/s Ezzy Food, Gujarat. Dr Rakesh Kumar Sharma, Director, DFRL and Smt Madhuriben Pramod Tamboli, Managing Director, M/s Ezzy Food, signed the agreement on 12 June 2017. The inventor, Dr GK Sharma, Sc 'G', Shri Pandit Shrihari and Shri Govindaraj, Technical Officers, Dr Gopalan, Sc 'F' and Dr M Pal Murugan, Sc 'D' from DFRL and Shri Pramod Tamboli, Managing Partner from M/s Ezzy Food, Gujarat, were present during the occasion.

The technology for Puff and Serve Chapati has been developed by DFRL to



meet short-term requirement of Armed Forces during field operations. The partially baked chapatis are stabilized by incorporating certain anti mycotic, anti-staling and softening agents. Baking over a hot flame or hot plate

puffs them readily to be served as hot phulkaas. The paraphernalia, entailing traditional kitchen drudgery, stands eliminated in the preparation of the chapati.

TECHNOLOGY DEMONSTRATION

DRDO PROMOTES ENTREPRENEURSHIP IN NORTH EAST

Dr Shashi Bala Singh, DS and DG (LS), DRDO, inaugurated the Fruit and Vegetable Processing Plant at Defence Research Laboratory (DRL), Tezpur Detachment, Salari in West Kameng district in Arunachal Pradesh under the DRDO Technology Demonstration Programme "Arunodaya" on 16 June 2017. Dr Rakesh Kumar Sharma, Director, DFRL, Mysuru; Dr PS Raju, Director, DRL; Dr Mala Iyengar, IFA (R&D), DRDO HQ; Shri Devkanta Pahad Singh, Director (PM&SQR), DRDO; local farmers of Salari and members of Ex-Servicemen Association, Bomdila, were present on the occasion.

The plant is equipped with instruments and machineries for processing of locally available fruits

and vegetables for value addition with technical guidance from DFRL and for culturing entrepreneurship in fruit

and vegetable processing amongst the local farmers and ex-servicemen of the region.



ARM UNVEILED COMPILATION OF DRDO'S KEY ACHIEVEMENTS 2014-17

Raksha Mantri Shri Arun Jaitley unveiled a compilation "DRDO Key Achievements 2014-17" comprising contributions of the DRDO to the Indian Armed and Paramilitary Forces on 13 June 2017. Chairman DRDO and Secretary DDR&D Dr S Christopher; Chief of the Army Staff General Bipin Rawat; Vice Chief of the Naval Staff Vice Admiral Karambir Singh; Vice Chief of the Air Staff Air Marshal SB Deo and other senior officials of the Ministry of Defence and the DRDO were present on the occasion.

A number of DRDO developed weapon systems, platforms, dual-use equipment have been accepted and inducted in the Indian Armed Forces and Paramilitary Forces. Some

Production value of DRDO developed products, cleared by the Defence Acquisition Council has grown by 60 per cent in the last three years to approximately ₹ 2,57,000 crore from ₹ 1,61,000 crore.

of the notable successful products inducted are LCA Tejas, Airborne Early Warning and Control System

(AEW&C) System Netra, Akash Weapon System, SONAR systems, Varunastra Torpedo, Bharani Weapon Locating Radar (WLR), Nuclear Biological Chemical (NBC) Recce Vehicle, NBC Drugs, etc.

The production value of DRDO developed products, cleared by the Defence Acquisition Council has grown by 60 per cent in the last three years to approximately ₹ 2,57,000 crore from nearly ₹ 1,61,000 crore. The export potential of DRDO developed systems has also increased manifolds and this year export of torpedoes stands at US\$ 37.9 million. This is a step towards achieving self-reliance in critical defence systems and realisation of the Prime Minister's vision of 'Make in India'.



DRDO LAUNCHES GO GREEN – SAVE GREEN CAMPAIGN

DRDO launched 'Go Green—Save Green' campaign in DRDO Township in Bengaluru on 9 July 2017. Dr S Christopher, Chairman, DRDO and Secretary, Department of Defence R&D along with the first lady of DRDO, Dr Rita Christopher, National President of DRDO Mahila Kalyan Munch, flagged off the event. Dr CP Ramanarayanan, DS and DG (Aero); Ms J Manjula, DS and DG (ECS); Directors of Bengaluru-based DRDO labs, IFA, service personnel, senior scientists, officers and staff of DRDO and their family

members were present on the occasion. Dr Christopher, appreciated efforts made by Estate Management Unit (R&D), Bengaluru, led by Estate Manager Shri MVL Narasimha Rao and his team and volunteers for making the campaign a reality.

The event witnessed plantation of around 1500 saplings of medicinal, fruit bearing and flowering plants. Apart from DRDO, personnel from KV School, CGHS, DSC, and nearly 400 families, 100 children, 80 scouts and guides, and 45 senior citizens totalling to around 2400 participated in the programme.

Dr Christopher planted saplings at Offices of the DG (ECS) and DG (Aero), and at campuses of LRDE, GTRE, ADE, DEBEL, CAIR, DARE, CEMILAC, ADA and CABS.

Around 60 volunteers under the leadership of S/Shri Ramakrishnan Bhat, TV Yogesh and T Raja of DRDO, worked relentlessly for 15 days to make the event a grand success.

The event provided a golden opportunity to the residents to connect with the Mother Nature and to demonstrate their commitment to social responsibility.





DRDO CELEBRATES INTERNATIONAL DAY OF YOGA

June 21 is celebrated every year as the International Day of Yoga (IDY) all over the world after unanimous declaration by United Nations General Assembly (UNGA) on 11 December 2014. The idea of IDY was first mooted by the Hon'ble Prime Minister Narendra Modi during his speech in UNGA on 27 September 2014 wherein he stated: "Yoga is a invaluable gift of India's ancient tradition. The tradition is 5000 years old. It embodies unity of mind and body; thought and action; restraint and fulfilment; harmony between man and nature; a holistic approach to health and well-being. It is not about exercise but discover the sense of oneness with yourself, the world and the nature. By changing our lifestyle and creating consciousness, it can help in well-being. Let us work towards adopting an International Yoga Day."

DRDO celebrated IDY with mass yoga, lectures and workshops. Dr Bhuvnesh Kumar, Director, Defence Institute of Physiology and Allied Sciences (DIPAS), which coordinated the IDY programme for DRDO and Armed Forces including those posted at High Altitude Terrestrial Research Station at Chang La (17664 ft), enunciated the importance of the yoga and encouraged all to adapt yoga in their day-to-day life.

DIPAS conducted Yoga programmes at ISSA, DTRL, SAG, LASTEC, DRL, LRDE, R&DE(E), DEAL, DIPR, DIHAR and Military Station Gwalior. Around 3000 persons participated in the IDY celebration across DRDO labs. Lectures on yoga and its physiological effects were delivered by DIPAS scientists at R&DE(E), Pune, DIPR, Delhi and LRDE, Bengaluru. To create awareness about yoga among Delhi-based DRDO labs and DRDO HQ, Defence Science Forum organised invited talks by Prof. Mohit Gupta, GB Pant Hospital



and Dr Surakshit Goswami, Yoga Guru, Times of India, at Metcalfe House. The following DRDO labs also celebrated IDY at their respective places.

ARDE, Pune

Armament Research and Development Establishment (ARDE), organised Yoga training sessions under the guidance of noted yoga expert Ms Seema Deshmuk during 1-20 June 2017. Slogan and essay writing competitions with yoga as the central

theme were organised. On 21 June 2017, employees performed mass yoga. Books on Yoga were given away as prizes to winners of the competitions. Shri PK Mehta, DS and DG (ACE) and Dr KM Rajan, OS and Director, ARDE, spoke about the significance and benefits of yoga. "Nriya Yoga", a programme by artistes from Sanskar Bharati, extolling the virtues of yoga through classical music and dance incorporating Bharatanatyam, Kathak and Odissi, was the highlight.



ASL, Hyderabad

A lecture was organized on the “Importance of Yoga in Modern Life” by Dr Praveen Kapadia, Executive Director of International Health Services, Gandhi Gyan Mandir, Hyderabad. He taught rapid yogic exercises and briefed about the importance of the healthy diet. Dr Tessy Thomas, OS and Director Advanced Systems Laboratory (ASL) and Dr RK Gupta, OS and Associate Director, ASL, elucidated the importance and benefits of yoga. Yoga classes were initiated from 18 May 2017 for two months for the benefit of ASL employees.



CEMILAC, Bengaluru

A workshop on Yoga was organized to celebrate IDY. Instructors from S Vyasa University conducted the workshop.



DEAL, Dehradun

The month-long celebration for IDY commenced on 21 May 2017 with inauguration of Yoga Camp for the employees and their families at Defence Electronic Applications Laboratory (DEAL). Experts from Bhartiya Yoga Sansthan conducted the camp. The camp concluded on 21 June 2017 with grand celebration inaugurated by Dr RS Pundir, Director, DEAL. Around 200 persons from DEAL, IRDE, MES, EMU, and DSC participated in the event.



DEBEL, Bengaluru

Defence Bio-engineering and Electro-medical Laboratory (DEBEL) celebrated IDY organized by a team of dedicated yoga practitioners of the laboratory under the leadership of Dr UK Singh, Director, DEBEL. Dr UK Singh spoke on the basic philosophy of yoga, its relevance and benefits to one's health and how to incorporate simple yogic techniques in our daily life. He added the importance of approaching official assignments in a stress free manner. Demonstration of yogic asanas, which relieve musculoskeletal strain and mental anxiety, was made.



DFRL, Mysuru

Defence Food Research Laboratory (DFRL) organized mass Surya Namaskar. Dr Rakesh Kumar Sharma, Director, DFRL, along with 70 employees of DFRL, 40 employees from No.2, Air Force Selection Board, CPWD



and German Press, Siddarthanagar and nearly 30 students from Raghavendra Yoga Kendra participated in the event. Shri Pashupathi, Yoga Teacher, Raghavendra Yoga Kendra, Mysuru and his expert team demonstrated various yogic asanas.

DLRL, Hyderabad

Defence Electronics Research Laboratory (DLRL) celebrated IDY by organising yoga under the guidance of Yoga Therapist and Trainer. Yoga instructor explained the benefits and importance of yoga in daily life as well as during mental stress.



HEMRL, Pune

Yoga programme was conducted for the benefit of the employees from 19-21 June 2017 at High Energy Materials Research Laboratory (HEMRL). Experts from Shree Ambika Yog Niketan, Mumbai conducted the programme in two sessions on each day. The morning session was as per Common Yoga Protocol in which the participants were trained in exercises, simple asana and meditation. The afternoon session was dedicated to demonstration on Surya namaskar and pranayama.

Shri KPS Murthy, OS and Director, HEMRL, presided over the concluding function and elaborated the importance and benefits of yoga in day-to-day life.





ITM, Mussoorie

IDY begin with asanas and exercises performed by Institute of Technology Management (ITM) employees and participants undergoing Orientation Course. Shri Sanjay Tandon, Director, ITM, highlighted the role of yogic practices in the development of healthy body, mind and soul and urged all to incorporate yoga in their daily life. He also emphasized on the importance of yoga in relieving stress.



ITR, Chandipur

Dr BK Das, OS and Director, Integrated Test Range (ITR), inaugurated the programme and highlighted the importance and need of yoga for harmony and peace in day-to-day life. Shri Manohar Bhaiya and his team from Patanjali, Haridwar, conducted asanas, pranayam and other yogic exercises. More than 100 ITRians attended the programme.



MTRDC, Bengaluru

If the body is healthy than the mind also will be healthy, and it can be achieved by practicing meditation and yoga everyday, said BK Kavitha, Rajayoga Meditation Trainer, Brahma Kumari Samaja, Bangaluru. She was giving a lecture On 'Raja Yoga for Stress Relief and Well-being' on the occasion of IDY celebration at Microwave

Tube Research Development Centre (MTRDC), Bengaluru. Dr Sudhir Kamath, OS and Director, MTRDC, emphasised on the need of yoga for better out come at workplace.



NPOL, Kochi

Naval Physical and Oceanographic Laboratory (NPOL), celebrated IDY with programmes focusing on the significance of yoga for healthy and happy life. Shri KV Rajasekharan Nair, GD (P&A), highlighted the significance of yoga. Shri S Kedarnath Shenoy, OS and Director, NPOL, emphasized the relevance of yoga and its benefits for ensuring healthy and peaceful life. Dr Chethana Ajith kumar, Academic Director, Patanjali Yoga Vidyapeetham, Kochi, conducted a workshop on "Stress Management through Yoga."



RCI, Hyderabad

Dr ALV Kumar, Nuclear Scientist and yoga master delivered lecture on



Yoga: A Holistic Approach for Complete Fitness and conducted interactive sessions on yoga. Shri BHVS Narayana Murthy, OS and Director, Research Centre Imarat (RCI), presided over the function.

R&DE (E), Pune

Teachers from the Art of Living foundation, Pune, conducted yoga and Dr Mantu Saha, Sc 'F', DIPAS, Delhi, delivered a talk on "Yoga: the Ancient Indian Science for maintaining Health and Fitness in Extreme Environments." Yoga chart was given to all participants for performing yoga in their daily life.



SASE, Chandigarh

An hour of yoga session was organised at HIM Parisar campus for SASE employees under a professional yoga instructor. Participants were also enlightened about benefits of yoga.



SSPL, Delhi

Asana and pranayam were performed by employees for a healthier lifestyle. A lecture on "Importance of Yoga in Human Life" was delivered by Shri Jay Prakash, Sangthan Mantri, Bhartiya Yog Sansthan. A quiz on the benefits of yoga was also organised.

RAISING DAY CELEBRATIONS

CAS, Hyderabad

Centre for Advanced Systems (CAS), Hyderabad, celebrated its 2nd Raising Day on 11 June 2017. Shri Varanasi Uday Bhaskar, Chairman and Managing Director, BDL, was the Chief Guest at the function. Shri RN Agarwal and Shri MH Rahman, DS, DG (HR&TM) were the Guest of Honour on the occasion. Dr MRM Babu, OS and Programme Director, Agni, graced the occasion as the Special Guest. Directors from various DRDO labs and Heads of CDA, IFA (R&D) and DFA also attended the Raising Day celebration.

Dr V Venkateshwara Rao, OS and Director, CAS, welcomed the guests and presented a brief account of the achievements of the Centre during 2016. The Chief Guest congratulated CAS fraternity and emphasized on better co-ordination between BDL, CAS and other DRDO labs to achieve optimum results. The Guests of Honour commended the work done by CAS and stressed the need to intensify the activities.

A statue of Dr APJ Abdul Kalam, former President of India, was unveiled at CAS main gate.

The employees of CAS, RCI, ASL, SSQ AG, BDL, DSC platoons, and children of staff organized a cultural programme. Lab-level DRDO Awards were distributed to the employees. Prizes were given away to the participants of various sports and other events organised to commemorate the Raising Day. Mementos were presented to the employees who completed 20 years of dedicated service. Shri Praveen Tandon, Sc 'F' proposed the vote of thanks.

DEBEL, Bengaluru

Defence Bio-engineering and Electro-medical Laboratory (DEBEL) celebrated its Raising Day on 17 June 2017.



Smt K Manjula, IAS, Addl Chief Secretary, Department of Medical Education, Govt of Karnataka and Dr Maulishree Agarwal, Commissioner, Department of IT and BT, Govt of Karnataka, were the Chief Guest and Guest of Honour at the function. The occasion was graced by Directors of sister DRDO labs in Bengaluru, representatives of the EMU, GE (R&D), former Directors and employees of DEBEL.

Dr UK Singh, Director, DEBEL, welcomed the distinguished guests and gave a brief presentation on the



activities of DEBEL and achievements in the areas related to Biomedical, Aero-medical, Underwater, and NBC defence technologies. He highlighted the induction of DEBEL-developed Tele-medicine System into Indian Navy and final stages of qualification of ILSS for flight trials by the Indian Air Force. He also brought out the Biomedical Products being developed for civilian applications through the Society for Biomedical Technology, which is driven by DEBEL.

The Chief Guest commended the lab for its achievements. She spoke on the possibility of collaborative work in the field of medical devices and potential for induction of DEBEL products for civil use. Dr Maulishree Agarwal gave a talk on Internet of Things and role of IT in broadening reach of medical technology to society. The guests were shown exposition of biomedical products.

The Chief Guest presented laboratory-level DRDO Awards to employees for their meritorious contributions. Dr TM Kotresh, Sc 'G', proposed the vote of thanks.

COURSE ON ADVANCE SUPPLY CHAIN MANAGEMENT & FOOD TECHNOLOGY

Defence Food Research Laboratory (DFRL), Mysuru, conducted a course on “Advance Supply Chain Management and Food Technology (ASMAFT-06)” from 29 May 2017 to 1 June 2017. Dr Rakesh Kumar Sharma, Director, DFRL, inaugurated the course. Course

contents comprised principles of food processing and preservation, quality control, food standards and food supply chain management, ration technology and management, food packaging, The syllabus also included state-of-the-art technologies to render comprehensive knowledge to the participants in

food processing, frozen and chilled meat/chicken, quality control and management. A separate interactive session was also arranged to discuss the issues related to food supply chain management. Twenty-one ASC officers attended the course. Dr R Kumar, Sc ‘F’ was the Course Director.



RESEARCH COUNCIL MEETING

The 5th meeting of Research Council of Advanced Numerical Research and Analysis Group (ANURAG), Hyderabad, was held on 3 June 2017. Prof. UB Desai, Director, IIT, Hyderabad, chaired the meeting. Shri CVS Sastry, OS and Director, ANURAG, briefed the Council about the achievements and progress made by the laboratory since the last meeting. Council members from IISc, BARC, BEL, CDAC and DRDO, attended the meeting. Dr G Athithan, DS and DG (MED & CoS), DRDO, joined the meeting via VTC.



COURSE ON PURCHASE & STORES PROCEDURE

Integrated Test Range (ITR), Chandipur, organized a course on “Purchase and Stores Procedures” during 5-9 June 2017 under the Continuing Education Programme (CEP) of DRDO. Dr BK Das, OS and Director, ITR inaugurated the course and emphasized the importance of the purchase and store procedures in a technology oriented lab.

The course aimed to update the knowledge of the participants on the latest rules and procedures in Procurement Manual 2016. Various topics related to Purchase and Stores Procedures were covered in the course. Thirty-two participants from ITR and other DRDO labs attended the course.



Shri CR Ojha, Sc ‘F’ and the Course Director and the Course
Shri Santosh Munda, Sc ‘D’ were | Coordinator, respectively.

ORIENTATION COURSE FOR TECHNICAL OFFICERS ‘A’

Institute of Technology Management (ITM), Mussoorie, conducted a 10-day Orientation Course for newly promoted Technical Officers ‘A’ of DRDO during 12-23 June 2017. The aim of the course was to enlighten the DRTC officers with the concepts and importance of effective interpersonal and communication skills for better teamwork.

Dr SB Singh, OS and Director, NMRL, and Shri Sanjay Tandon, Director, ITM inaugurated the course. Dr SB Singh, delivered the keynote address on ‘Orientation of Mind’.

Dr AK Singh, Director, INMAS, delivered the valedictory address, wherein he lauded the role played by DRTC Cadre in accomplishing DRDO projects. Twenty-seven participants from different labs/estts/Dtes attended the course.





COURSE ON KNOWLEDGE MANAGEMENT IN R&D ORGANISATIONS

A CEP course on “Knowledge Management in R&D Organisations” was conducted at Defence Research and Development Laboratory (DRDL), Hyderabad, during 14-16 June 2017. Dr Prahlada, former Director DRDL, CC R&D (Ae&SI) and Vice Chancellor, DIAT, Pune, inaugurated the course and delivered the keynote address on Specific Initiatives required for R&D Organisations.

Twenty-two senior scientists from various DRDO laboratories and two DGMs from BDL participated in the course. Shri AK Chakraborti, former Director DRDL, presented certificates to the participants during valedictory function. Dr Atul Sen, Director, Technology Management, DRDL, was the Course Director.



ADVANCE COURSE IN ORGANISATIONAL BEHAVIOUR

A three-day “Advance Course in Organisational Behaviour for Senior Scientists” was held at ITM, Mussoorie, during 28-30 June 2017. Thirty senior scientists/service officers from different DRDO labs/estts/Dtes attended the course. The aim of the course was to improve participants’ understanding of human behaviour and their ability to lead people more effectively and enhance organizational performance.

Lectures, supported with exercises, questionnaire and video clippings, on Achieving Organizational Excellence, Interpersonal Effectiveness with FIRO-B Analysis, Emotional Intelligence, How to Stay Motivated, Building Collaborative Relationships in Organisation, Creativity and Innovation as Core Competence in R&D, Conflict Management were delivered by expert



faculty during the course.

A session on meditation through heartfulness technique by professional

trainer was also conducted every morning for inner well-being of the body, mind and soul.

LTPP REVIEW MEETING

ANURAG, conducted 2nd meeting to review the Long Term Technology Perspective Plan (LTPP) on 1 July 2017 under the chairmanship of Vice Admiral (Retd) Raman Puri, AVSM, VSM. Shri CVS Sastry, OS and Director, ANURAG, presented the overview of technical activities of the laboratory. LTPP, under three technology verticals of ANURAG, namely High Performance Computing (HPC), Trusted Computing, and Very Large Scale Integration (VLSI), was discussed. Dr Linga Murthy, OS and CEO, STARC, briefed the Committee about work being carried out on MEMS at STARC, Bengaluru.



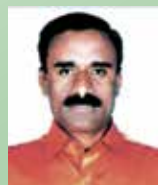
HRD ACTIVITY

HIGHER QUALIFICATIONS ACQUIRED

ARDE, Pune

Shri BB Padhy, Sc 'F', has been awarded PhD by DIAT, Pune for the thesis entitled, "Studies on Advanced Optical Fibre Sensors and their Applications."

CEMILAC, Bengaluru



Shri Nagesh DV, TO 'B', has been awarded PhD in Library and Information Science from Bangalore University for the thesis "Awareness, Use and Effectiveness of Electronic Information Resources and Services in TICs of DRDO Laboratories in India: A Study."

CVRDE, Chennai



Shri S Jothi, Sc 'E', has been awarded PhD by the Syndicate of Anna University, Chennai, for the thesis entitled

"Flexible Multi-body Ride Dynamics of a Military Tracked Vehicle."



Shri G Srinivasan, TO 'C', CVRDE, has been awarded PhD by the Syndicate of Anna University, Chennai, for the thesis entitled "Performance Analysis of Active Suspension System for Armoured Fighting Vehicle."

HEMRL, Pune



Shri Ramesh Kurva, Sc, 'E', has been awarded PhD (Applied Chemistry) by Defence Institute of Advanced Technology (Deemed University) for the thesis entitled "Studies on Development of Bicurative System and its Application in Composite Propellant Formulation to Achieve Optimum Pot life, Mechanical Properties and Performance".



Smt Surekha Sanjay Patwardhan, Sc 'D', has been awarded PhD in Chemistry by Savitribai Phule Pune University, Pune, for the thesis entitled "Studies in Metallized Pressable Plastic Bonded Explosives (PBX's)".

SFC, Jagdalpur



Shri Satish B, Sc 'E', has been awarded PhD in Physics by Cochin University of Science and Technology, Kochi, for the thesis entitled "Growth and Characterization of Pulsed Laser Deposited BaPbO₃ Conductive Oxide Thin Film Electrodes for Ferroelectric and Cr Doped BiFeO₃ for Multiferroic Applications."



PARLIAMENTARY STANDING COMMITTEE ON DEFENCE VISITS ARDE

The Parliamentary Standing Committee on Defence visited Armament Research and Development Establishment (ARDE), Pune, on 4 July 2017. An exhibition of major products of ARDE, HEMRL

and R&DE (Engrs) was organized to appraise the Committee about the technologies developed by these laboratories. Chairman, DRDO, DG (ACE) and Directors of ARDE, HEMRL and R&DE (Engrs) made

presentations to the Committee. The Committee discussed various issues pertaining to Defence R&D. The Committee also witnessed firing demonstration at Pashan Range.



NPOL, Kochi

Shri Bhanu P Srivastava, GM NS (S&CS), Bharat Electronics Ltd (BEL), Bengaluru, visited Naval Physical and Oceanographic Laboratory (NPOL), Kochi on 5 June 2017. He was briefed about the ongoing NPOL Projects.



HEMRL, Pune

Lt Gen PK Srivastava, AVSM, VSM, Director General, Artillery & Colonel Commandant Regiment of Artillery visited HEMRL on 7 June 2017. He was accompanied by Col Amit Khokhran, Director Artillery-14 and Col Ramit Arora, Director, Artillery-13.

Shri KPS Murthy, OS and Director, HEMRL, presented overview and appraised them about the activities of HEMRL. Presentations on the projects related to Solid Rocket Propellants and High Explosives and Gun Propellants/ Ammunitions were given by the senior scientists to the visitors.



DIHAR, Leh

Shri K Ilango, Special Secretary, Aviation Research Centre (ARC), Cabinet Secretariat, visited Defence Institute of High Altitude Research (DIHAR), Leh on 7 July 2017. He was appraised about the activities and ongoing projects of the DIHAR.

Shri Ilango appreciated the research being done by DIHAR scientists and the transformative changes brought by the institute in the local society. He further hoped that in times to come the research work done by DIHAR will make the high altitude desert of Ladakh another “Garden of Eden” and extended his best wishes to all the team members in their future endeavours.





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 Monographs

Defence Scientific Information and Documentation Centre (DESIDOC) on behalf of Defence Research and Development Organisation (DRDO) brings out a large number of publications covering current developments in Indian Defence R&D.

DESIDOC publishes scholarly books and treatises authored by eminent scientists of DRDO as Monographs/Special Publications Series. These Series aim at capturing the tacit knowledge of senior scientists gained through their life-long research in their area of expertise and disseminating the specialized information covering different aspects of Defence R&D to interested readers. Each title of this Series provides in-depth information on a specific subject area, indicating the current and future trends.

Copies of the monographs can be obtained by sending the appropriate amount in the form of a crossed bank draft drawn in favor of 'The Director, DESIDOC' payable at Delhi.

Discount: Libraries/individuals: 15 % Publisher: 40 %

Distributors/booksellers: Please contact DESIDOC for attractive discount.



For further information, please contact:

**The Director
Defence Scientific Information &
Documentation Centre (DESIDOC)
Metcalfe House, Delhi – 110 054, India**

Tel: +(011) 23902403, 23902612

Fax: +(011) 23813465

E-mail: director@desidoc.drdo.in



AAYUDH BAL BHAVAN AT ARDE

Under the initiative taken by Women’s Cell of Armament Research and Development Establishment (ARDE), a Day Care Centre for children of ARDE employees has been established as a welfare measure. The centre, named ‘Aayudh Bal Bhavan’ was inaugurated by Dr KM Rajan, DS and Director, ARDE on 26 April 2017. Dr (Ms) SD Naik, Chairperson, ARDE Women’s Cell and ARDE Day Care Centre Committee, senior officers, committee members, children availing the facility and their parents were present on the occasion.

The Centre is housed in a spacious, secure accommodation with well furnished halls earmarked for various

purposes, such as, dining area, activity area, relaxation area, etc. A kitchen with modern amenities is available for providing hot meals to the children.



ITR ORGANIZES INTEGRATED BLOOD DONATION CAMP

Integrated Test Range (ITR), Chandipur, organised Integrated Blood Donation Camp on 28 June 2017. Dr BK Das, OS and Director, ITR, inaugurated the camp. Dr B Das, CDMO District HQ Hospital, Balasore, Dr S Pradhan, Blood Bank Officer, Balasore, Dr MK Mohapatra, Sc ‘D’, Head, Health Care Centre, Shri Niladri Roy, Sc ‘F’, GD (DOMS), ITR, were present during the occasion.

Dr BK Das, in his inaugural speech said that there is no substitution for blood donation as it gives someone another chance to live. The camp collected 237 units of blood. The donors were awarded a certificate.



DRDO HARNESSING SCIENCE FOR PEACE AND SECURITY- XVIII

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

The article is Eighteenth 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).

CONSOLIDATION

Defining the Role of DRDO

Dr Bhagavantam recognised the need for the two groups, one favouring equipment orientation and the other, which favoured the technique oriented approach, to work together to meet the needs of the Services. The Indian Army being the largest Service of the three and the first to be modernized after independence was the major customer for the DRDO. In many technology fields such as armaments, electronics, engineering and vehicles, the Indian Army had brought out their long term needs in the General Staff Policy Statements and their immediate needs in the form of Qualitative Requirements. The expansion of the Indian Air Force as an after math of the Chinese aggression of 1962 also contributed to the workload though not to the same extent. The requirements of the Indian Navy with the exception of armaments were being met mostly by the two DRDO laboratories namely, NPOL and NMRL, which were situated in the Naval premises in Kochi and Mumbai and were working in close liaison with the Navy. Under these circumstances, the equipment-oriented approach would enable the DRDO to meet the immediate needs of the Indian Army in particular and could contribute to the building up of confidence in and credibility of the Organisation. It would thus ease the pressure on the technique-

oriented group so that they can be more effective in development of new requirements and of the next generation equipment. Thus, together they would provide continuity in the response of the DRDO. During his tenure as Director of the Indian Institute of Science, Dr Bhagavantam had been aware of the changes in engineering education in the developed countries towards greater reliance and sophistication in analytical techniques, and the advances that were taking place in the technology fields of electronics, aeronautics, and mechanical engineering. As a member of the Electronics Committee of the Government of India (more commonly known as Bhabha Committee), he was fully cognizant of the latest advances in electronics such as lasers, integrated circuits, which would influence the next generation weapon system designs.

Dr Bhagavantam went about in closing the divide by emphasizing the need for diversity in the personnel of the DRDO by virtue of the charter of duties entrusted to it. In this he was ably assisted by Major General JR Samson who established harmonious relationship with the Service Officers and the Scientists alike by his sincerity of approach and desire to solve problems. The cordial relationship between him and the Deputy Chief Scientist (DCS) also helped. Dr Bhagavantam made it a point to acknowledge their contribution by telling the Directors that, "The Chief Controller and the Deputy Chief Scientist

are the two focal points with whom I have to deal as far as the organization is concerned. They have a difficult task to perform and they are doing their best." Dr Ranganathan who was the DCS at that time, recalled that the Scientific Adviser delegated his powers to the CCR&D and to him and asked them to consult him only if they felt necessary.

Dr Bhagavantam in his meetings with the Directors stressed that the activities of DRDO has to go beyond the range normally associated at that time with research and development and that to meet these obligations, DRDO has to contain personnel with diverse educational backgrounds and professional experience and expertise. He pointed out that, ".....The R&D Organisation is essentially a supporting organisation for the Armed Forces..... We have to render scientific advice to the Services Headquarters; we have to carry out applied research to solve manifold scientific problems that confront the Services; we have to design and develop weapons and equipment for the Services as they tell us from time to time, to meet their operational requirements; we have to evaluate and carry out technical trials of any new weapons and equipment that may be designed, developed and produced in the country or acquired by the Services from abroad; and lastly we have to educate and render technical guidance to civil trade in the country to help build-up its competence for development and production of items of defence weapons



and equipment....". He described the gamut of products and services provided by DRDO in the following manner. "... In rendering service to the Armed Forces in accordance with the above charter, most important of all, we are called upon to provide the design and know-how for producing hardware that the Services need. This hardware is of a very wide variety; it may be a gun; a rifle; a bridge; a blanket; a shoe; or even sometimes a small chocolate ration cake. Also, it may run to more sophisticated equipment like a radar of a communication set; and so on. There are many problems confronting us in this wide variety of activity flowing from the charter. Many of the problems not concerned with the hardware are also dealt with by the scientists and technologists in the Defence R&D. We deal with the physiological efficiency of the soldier when he works at heights and under low pressure and extreme cold temperature. We deal with recruitment results and constantly improve these recruitment procedures and we follow-up appropriate rations for use at high altitudes. We prepare ballistics range tables; we introduce corrections and make statistical studies. We press into use, for the benefit of our services, such new scientific technique as operations research, work study and so on. We prepare other type of services such as training, advice and application of psychology and other scientific disciplines to various problems which the Services meet and where they need assistance from R&D Organisation...."

He followed it up by stating that for DRDO to meet its obligation, "... we have to have in the Defence R&D Organisation, a wide and rather odd assortment of 'Scientists'. Under the heading 'Scientists; we have physicists, chemists, mathematicians, economists, statisticians and so on. And then the scientists are mixed with the technologists. We have Army, Naval and Air force Officers and..... we have Administrative officers as well in the Organisation of Defence Research and Development. Such a motley crowd, if I may use that expression, today constitutes what the Government

brought into existence some years ago...".

To those scientists who had earlier joined the Defence Science Organisation and were hesitant to switch away from basic research he was explicit in stating that purely basic research, which has no bearing on defence is not to be pursued in DRDO. He made it clear that since the resources invested in DRDO are from the total defence budget, the work of the DRDO laboratories should have a bearing on either the immediate or long range needs of the defence. A year later here iterated by stating "so far as Defence R&D is concerned, our main task is to carry out applied research. However, we should not neglect basic research. It should be a subsidiary activity, to the extent necessary, to keep the scientists alive, to keep their professional status at a high level and to provide the necessary backing for the objective oriented task which we have to perform..." [10th Annual R&D Conference, Hyderabad, 1967]. Thus, he set firm guidelines for the Organisation to pursue namely, applied research and development directed towards defence applications.

It is worthwhile to note that by 1969, the equipment oriented laboratories started to veer around the need for taking up applied research before the formulation of the General Staff Policy Statement or the QR. The tremendous technological advances that were taking place in the USA in electronics and aerospace with the US Department of Defence as the technology driver, led to many new concepts mainly to improve lethality, range, and accuracy of weapons, range, resolution and accuracy of sensors and improved communications for strategic and tactical scenarios. For the electronics laboratories of DRDO the opportunity to take up contemporary equipment development came about as an after math of the Chinese invasion of 1962 when the Services went for modernisation of their communication systems and sensors. The technological advances in this area had made it possible for them to conceive of solutions which were not linear extrapolations of their present holdings. The Army proposed Plan, AREN (Army Radio Engineering

Network) for tactical communications and the Air Force decided on the ADGES (Air Defence Ground Environment System) plan for radar coverage of the country with troposcatter and microwave terrestrial systems for communication. The scientific and technical community participated in their deliberations for the Plan AREN (communication) for the Indian army and for the Plan ADGES (radars) for the Indian Air Force. Both of these concepts were state-of-the art at that point of time and would provide the Services with a quantum jump in their capabilities. These were not mere extrapolations of existing equipment and to a large extent required assistance from the scientific community to link the technological advances that were taking place, their potential as well as constraints and to explore the possibilities of new architecture at the system and at the equipment levels. The projects arising out of these, which were undertaken by DRDO, were high value for the services, innovative in development and would result in the state-of-the art equipment/system. LRDE which was one of the foremost equipment oriented laboratories in DRDO and which was involved in the formulation of concepts and experimentation that was being carried out for the Plan AREN for the Army, recorded the following in 1969. "In electronics, the undertaking of equipment-oriented development projects can not entirely depend on the availability of Qualitative Requirement from the Services.... the Services cannot realistically visualize and formulate in time their futuristic requirements in detail, unless they are made aware of the potentialities and the impact of the changing state-of-the-art. This is done by demonstrating to them experimental models of equipment, systems designed by R&D as a result of their continuing system studies and simulation in the laboratory. In fact, the QRs get evolved and finalised as a result of continued dialogue between the designer and the User...".

To be continued...

The Arunachal Times

Sat, 22 July, 2017
(Online)

Indian Army to get MRSAM missiles capable of shooting down ballistic missiles, aircraft

New Delhi: The Defence Research and Development Organisation (DRDO) has signed a pact with the Army for developing a medium-range surface to air missile (MRSAM) which will be capable of shooting down ballistic missiles and aircraft. "The MoU heralds the commencement of development of MRSAM system in the configuration as required by the Army," a senior Army official said.

He said the missile will be produced by the DRDO in collaboration with the Israel Aerospace Industries (IAI). The missile will be capable of engaging multiple aerial targets at a range of more than 50 kms. In April, Israel's state-run IAI had said it signed a contract with India worth over \$1.6 billion for providing the missile to the Army.

The MRSAM system will be capable of shooting down enemy ballistic missiles, aircraft, helicopters, drones, surveillance aircraft and AWACS (Airborne Warning and Control Systems) aircraft," the official said on condition of anonymity as he is not authorised to speak to the media.

He said procurement of the MRSAM will mark a paradigm shift in the Army's strike capability. The Army has been pressing the government for the MRSAM to enhance its strike capability. MRSAM's current version is operational with the Indian Air Force and Navy.

The Indian EXPRESS

Tue, 04 July, 2017

Defence Minister Arun Jaitley congratulates DRDO on successful missile test

Defence Minister Arun Jaitley complimented the DRDO and said the successful test firing of indigenously built Quick Reaction Surface-to-Air (QRSAM) missile, which has a capability of engaging multiple targets, was test-fired from a test range along the Odisha coast.

Defence Minister Arun Jaitley on Monday said the successful test firing of a quick reaction missile paved the way for complete indigenisation of surface-to-air missiles. He complimented said the successful test firing will add to India's defence capabilities. "The indigenously built Surface-to-Air (QRSAM) missile, which has a capability of engaging multiple targets, was test range along the Odisha coast on Monday.

"Congratulations to DRDO for successfully test firing Quick Reaction Surface to Air Missile. India's defence capabilities," Jaitley tweeted. The missile has a strike range of 25 km to 30 km. a quick reaction missile, it involves an all-weather weapon system capable of tracking and firing

The INDIAN PANORAMA

Sat, 22 July, 2017
(Online)

Israel to Partner Drdo for Developing Missile Defence System for India

New Delhi (TIP): In a major upgrade to its defences, the Indian Army has signed a MoU with the Defence Research and Development Organisation (DRDO) to raise one regiment of the advanced Medium Range Surface to Air Missiles (MRSAM). The army plans to have a total of five regiments of this air defence system, which will be deployed opposite to China and Pakistan.

पंजाब केसरी

Tue, 04 July, 2017

एक और मिसाइल का परीक्षण

वाले झर (ओडिशा), (भाषा): स्वतंत्र प्रतिक्रिया के साथ सह से हवा में मार करने वाली स्वदेशी निर्मित (क्यूआरएसएम) कम दूरी की मिसाइल का आज ओडिशा के समुद्र तट के पास एक परीक्षण रेंज से सफलतापूर्वक परीक्षण किया गया जिसमें एक साथ कई लक्ष्यों पर निशाना साधने की क्षमता है। मिसाइल में 25 से 30 किलोमीटर की दूरी तक प्रहार करने की क्षमता है और इस स्वतंत्र प्रतिक्रिया वाली मिसाइल के रूप में तैयार किया गया है। इसमें हर मीटिंग में काम करने वाली शक्ति प्रणाली है जिसमें लक्ष्य को पहचानने और उस पर निशाना साधने की क्षमता होती है। रक्षा अनुसंधान और विकास संगठन (डीआरडीओ) के मुजों ने बताया कि चांदीपुर में एंजाइन्ड परीक्षण रेंज (आईटीआर) में स्थित प्रक्षेपण पारिसर-3 से एक टुकड़े पर लगे कैनिसटर के लॉचर से मुबह करीब 11:30 बजे मिसाइल का परीक्षण-प्रक्षेपण किया गया। उन्होंने कहा कि इस अत्याधुनिक मिसाइल



नई उपलब्धि

● 25 से 30 किलोमीटर दूरी तक प्रहार करने वाली स्वदेशी मिसाइल

किया। मुजों के अनुसार सभी गहराओं, इलेक्ट्रो ऑप्टिकल प्रणाली, टेलीमेट्री प्रणालियों और अन्य स्टेशनों ने मिसाइल पर निगरानी रखी और सभी मानदंडों पर नजर रखी।

पर डीआरडीओ को बधाई दी और कहा कि यह सतह से हवा में प्रहार करने वाली स्वदेशी मिसाइलों (एमएसएम) के विकास में एक महत्वपूर्ण मील का पत्थर है। रक्षा अनुसंधान और विकास (आरएंडडी) के सचिव डॉ. एम. क्रिस्टोफर ने सफल परीक्षण पर सभी वैज्ञानिकों को बधाई दी। रक्षा अनुसंधान और विकास प्रयोगशाला के निदेशक एमएसआर प्रमुख, अनुसंधान कैड इत्यादि जीवीएचएम के निदेशक पर

दैनिक जागरण

Fri, 14 July, 2017

पाकिस्तान छूट पीछे, अब निशाने पर चीन



चीन को खान में रख भारत अब कर रहा सैन्य तैयारी

कुछ साल पहले तक भारत की रक्षा नीति, परमाणु हथियार और अन्य सैन्य तैयारी परियोजनाओं को खान में रखकर की जाती थी, लेकिन अब उस पर इमन हो गई है। भारत अब निशाने पर चीन को खान में रखकर अपनी सैन्य तैयारी में जुटा है। भारत की रक्षा नीति में भी बदलाव हो रहा है। अखिल भारतीय आन्दोलन मिशन के अध्यक्ष-अमर संकलन में एक लेख प्रकाशित हुआ है। अमेरिकी विशेषज्ञों द्वारा लिखे गए 'इंडियन न्यूजियर' पत्रिका में 2017 लेख के मुताबिक भारत एक ही परमाणु मिसाइल बना रहा है जिससे वह दक्षिण भारत से भी दूर चीन को खड़ा कर सकता है।

परमाणु परीक्षणों के बाद भारत के युवाओं के मुताबिक भारत के पास कुल सात परमाणु सक्षम प्रणाली है। इनमें विमान से संचालित होने वाली, जमीन से संचालित होने वाली बैलिस्टिक मिसाइल और समुद्र से मार करने वाली बैलिस्टिक मिसाइल शामिल है। कक्ष और प्रणालियों पर काम कर रहा है।

गजबूत तैयारी: अग्नि-4 से भारत पूर्वोत्तर से अभी भी दूर चीन को निशाना बना सकता है। कक्ष हजार किलोमी से अधिक रेंज वाली अग्नि-5 इंटर्मीडियेट रेंज बैलिस्टिक मिसाइल विकसित कर रहा है। साथ ही 8,000 से 10,000 किलो रेंज वाली अग्नि-6 आन्तरीक्षीय की तैयारी भी शुरू कर दी है। इसे जमीन और समुद्र दोनों से दमन जा सकता है।

परमाणु हमला करने में सक्षम विमान

नाम	देनाही का साल	रेंज
मिराज 2000एच व्ज	1985	1,850
जगुआर आइएस-अइवी शम्लेर	1981	1,600

भारत की मिसाइलों की गति

समुद्र से मार करने वाली	जमीन से मार करने वाली
वर्ष	वर्ष
के-15	अग्नि-2
के-4	अग्नि-3
	अग्नि-4
	अग्नि-5

परमाणु सिरपट्टों का विनाश

दूर दूरस्थित प्रयोगशाला रिक्टर के अक्षय भारत दी और रिक्टर का निर्माण कर रहा है। कक्षाकक्षय में बने वाले कार्टर और रिक्टर से भारत की दूरस्थित अयस्क क्षमता बढ़ेगी। परीक्षण दूरस्थित के इस्तेमाल से वह परमाणु हथियार बना सकता है।

MAIL TODAY

Tue, 04 July, 2017

DRDO is sharper and quicker now

After working for long years on development of missile systems such as Agni-series and Akash missile systems, DRDO's learning process has been shortened by several years now while developing new weapons. DRDO proved this on Sunday when it successfully test-fired the indigenous Quick Reaction Surface-to-Air Missile system taking only a short time to develop the system. This is definitely making the armed forces very happy.