NANOTECHNOLOGY FOR DEFENCE APPLICATIONS

“Nanotechnology is an emerging field, which can lead to the development of new weapon systems and products that can benefit our nation”, said Shri AK Antony, Hon’ble Defence Minister of India, while inaugurating a one-day workshop on Nanotechnology for Defence Applications at Kothari Auditorium, DRDO Bhawan, on 1 October 2012. He complimented DRDO for taking up nanotechnology mission for defence applications and said, “There is a need to adopt a conglomerate, or consortium approach that involves academic institutions and industries.” Lauding DRDO’s efforts in developing state-of-the-art strategic and tactical weapon systems and technologies to improve the combat efficiency of the soldiers, he said, “The global community has appreciated our technological capability in missiles.”

Shri Antony also lauded the successful launch of Agni 5 by DRDO, which has propelled India into an elite group of nations that possess credible missile technology as a deterrent. He also highlighted other successes of DRDO including the weapon systems like Agni, Akash, BrahMos, and MBT Arjun.

Shri Antony also released a coffee table book, ‘Steely Warrior’, on the development and deployment of MBT Arjun.

Addressing the gathering earlier, Dr VK Saraswat, Scientific Advisor to the Raksha Mantri (SA to RM), Secretary, Department of Defence R&D and DG, DRDO, described nanotechnology as an area with highly promising prospects for turning fundamental research into successful innovations and create new products that will make positive changes in the lives of our citizens. He said, “Nanotechnology is recognized as a very strong innovation driver and is therefore seen as a strategic technology for the world’s future economy impacting virtually all technological sectors including defence and security. Nanotechnology should lead to higher protection, more lethality, longer endurance and better self-supporting capacities of future combat soldiers. Substantial advantages are expected to be gained which include threat detection, novel electronic display and interface systems, as well as a pivotal role for the development of miniaturised unmanned combat
vehicles and robotics. Nanotechnology will also enable small portable sensor systems capable of identifying chemical, biological, nuclear, radiation, or explosive threats”.

Dr Saraswat also informed that more than 30 DRDO laboratories are pursuing R&D in nanotechnology for defence applications and several technologies developed by them are now close to maturity.

Dr W Selvamurthy, DS and Chief Controller R&D (LS&SI), and Chairman of the Workshop, while welcoming the delegates said that the workshop is aimed to prepare a roadmap for DRDO to accelerate the deployment of nanotechnology in various defence systems. A Panel Discussion with participation by DRDO, industry and academia took place with this end in view.

**Defence Minister awards DRDO Scientists**

The Hon’ble Defence Minister Shri AK Antony distributed DRDO Awards in seven categories for the year 2011 to the DRDO scientists for their outstanding contribution in various areas of technology on 1 October 2012 at a function held at Kothari Auditorium, DRDO Bhawan. The awardees are:

**Scientist of the Year**

*Shri Debasish Chakraborti*, Sc G, Naval Science and Technological Laboratory (NSTL), Visakhapatnam, for outstanding contribution in the design and development of a number of mechanical systems for underwater weapons and decoys.

*Shri Prateek Kishore*, Sc F, Terminal Ballistic Research Laboratory (TBRL), Chandigarh, for outstanding contribution in design, development, system integration and product improvement of strategic warheads for multiple launch platforms such as Agni, Prithvi and sub-surface vectors.

*Dr KM Rajan*, Sc G, Armament Research and Development Establishment (ARDE), Pune, for outstanding contribution in the design and development of PINAKA rocket, state-of-the-art case-bonded solid propellant motors for artillery rockets, manufacture of flow forming of high L/D rocket motors, and propellant at parallel sources.

*Shri Vijayakumar NB*, Sc G, Research and Development Establishment (Engineers) [R&D(E)], Pune, for significant contribution in design, development and induction of combat engineering systems such as BLT T-72, Sarvatra, short span bridging system and launch system for UAV Nishant, Lakshya Mk I and autonomous underwater vehicle.

*Ms J Manjula*, Sc G, Defence Electronics Research Laboratory (DLRL), Hyderabad, for significant contributions in the critical core technology area of communication electronic countermeasures.

*Dr Subrata Rakshit*, Sc F, Centre for Artificial Intelligence and Robotics (CAIR), Bengaluru, for outstanding contribution in image processing, pattern recognition, and computer vision.

*Shri Duvvuri Seshagiri*, Sc F, Electronics and Radar Development Establishment (LRDE), Bengaluru, for valuable contributions in design, integration, and testing of the first indigenous active phased array radars, viz., long range solid state array radar and primary radar for airborne early warning and control system (AEW&C).

*Shri K Siva Kumar*, Sc G, Defence Electronics Applications Laboratory (DEAL), Dehradun, for significant contribution in nurturing and sustaining the niche mm wave technology by demonstrating passive mm wave imaging and ensuring conversion of technology into product ideas suitable for exploitation by defence forces.

*Shri P Sidharthan*, Sc E, Microwave Tube Research and Development Centre (MTRDC), Bengaluru, for outstanding contributions in the design, development and productionisation of state-of-the-art electronic power conditioners (EPCs) for microwave power modules (MPMs).

*Shri JP Singh*, Sc F, Research Centre Imarat (RCI), Hyderabad, for significant contributions in design and
development of high bandwidth rate table technology for calibration of Inertial Guidance System of Programme AD, Agni, Prithvi and seeker stabilisation system for missile applications.

Shri R Appavu Raj, Sc G, Integrated Test Range (ITR), Chandipur, for significant contributions in design, development and configuration of real time flight safety expert system. He has also contributed in successful trials of strategic and tactical missiles.

Shri MSR Prasad, Sc G, Defence Research and Development Laboratory (DRDL), Hyderabad, for outstanding contributions in the design, development and testing of submarine launched ballistic missile, specifically airframe design for high temperature application, aerospace mechanism for underwater applications, composite rocket motors casings, and structural dynamics.

Dr PP Krishnapur, Sc G, Defence Bioengineering and Electromedical Laboratory (DEBEL), Bengaluru, for outstanding contribution in the field of aeromedical life-support technology for fighter and transport aircraft resulting in induction of the personal protective equipment for fighter pilot, life-support oxygen system for combat free-fall paratrooper, and helicopter crew into the services.

Dr BS Dwarakanath, Sc G, Institute of Nuclear Medicine and Allied Sciences (INMAS), Delhi, for outstanding contributions in developing mechanism-based approaches for radiation countermeasure and cancer therapy and for fostering multidisciplinary collaborations for futuristic discoveries in radiation countermeasures and cancer therapy.

Shri Manmohan Singh, Sc G, Vehicle Research and Development Establishment (VRDE), Ahmednagar, for outstanding contribution in design and development of road mobile launcher for Agni 4. This has made the Agni Programme fully self-reliant in this area.

Best Techno Managerial Services/Popular Science Communication Award 2011

Two awards were shared by four teams. Dr S Sankaran, Director, ER&IPR, DRDO HQ, and his team for adopting most original and innovative managerial practices which resulted into the current DRDO-IPR portfolio of about 1400 IPRs jointly with Shri RK Jain, Director, Recruitment and Assessment Centre (RAC), Delhi, and his team for establishing effective selection processes and practices in DRDO through introduction of diverse innovative scientific techniques and methods blended with contemporary IT tools which resulted in a coherent and scrupulous selection system.

Late Shri RK Dewakar, Director, Dte of BF&A, DRDO HQ and his team for outstanding contribution in the area of fund management portfolio and statutory audit matters jointly with Dr SM Veerabhadrappa, Director, Dte of P&C, DRDO HQ and his team for outstanding contributions in formulation of XII plan, monitoring of ongoing projects, conduct of parliamentary standing committee meetings, optimisation of human resources management and implementation through dynamic concept of RE of DRDO by introducing flexible sizing of the labs/estts and creation of new units based on functional requirements.

DRDO Award for Path Breaking Research/Outstanding Technology Development 2011

Dr Madangopal Krishnan, Scientific Officer H, Bhabha Atomic Research Centre (BARC), Mumbai, and his team for their pioneering contribution in developing heat shrinkable sleeves made of shape memory alloy for light combat aircraft (LCA) Tejas and thereafter setting up of a unique dedicated production facility for the same at HAL.

Shri K Rambabu, Sc G, Research Centre Imarat (RCI), Hyderabad, and his team for significant contribution in development of state-of-the-art ring laser gyro (RLG) technology and the navigation system with SATNAV, based on RLG and high accuracy quality accelerometer for long-range missile application.

Agni Award for Excellence in Self-Reliance

Shri S Gurudev, Sc G, Aeronautical Development Establishment (ADE), Bengaluru, and his team for developing distributable architecture for the digital fly-by-wire flight control system for LCA.
Smt C Sharada Prabhakar, Sc F, Advanced Systems Laboratory (ASL), Hyderabad, and her team for development of indigenous cost-effective technology for canisterisation of missiles with composite canisters. The technology developed is now being extended to develop composite canisters for BrahMos Missiles and Agni 5 systems.

Shri K Sekar, Sc F, Combat Vehicles Research and Development Establishment (CVRDE), Chennai, and his team for design and development of carrier command post tracked vehicle with the state-of-the-art command and control equipment to support Indian Army in formation of artillery tanks.

Shri RC Agarwal, OS and Director, Defence Electronics Application Laboratory (DEAL), Dehradun, and his team for design and development of Integrated C-band LOS and Ku band Satcom data link.

Dr BS Subhash Chandran, OS, Defence Research and Development Laboratory (DRDL), Hyderabad, and his team for successful design, development of static and flight tested solid rocket and solid Ramjet motors for tactical missiles. State-of-the-art technologies such as IRR technology, dual pulse technology, low smoke high energetic propellants and ultrahigh strength materials characterised for rocket motor fabrication were developed indigenously for the first time.

Shri Ramachandra Kuloor, OS, Electronics and Radar Development Establishment (LRDE), Bengaluru, and his team for developing a high performance indigenous low level light-weight radar, Bharani, for detection and tracking of all kinds of aerial targets including low radar cross-section UAVs and have incorporated robust techniques for clutter suppression and survivability in EW.

Shri SV Rangarajan, OS and Director, Naval Science and Technological Laboratory (NSTL), Visakhapatnam, and his team for successfully developing India’s first indigenous heavy weight torpedo with respect to complex propulsion technologies, mechanical construction, control and guidance, acoustic signal processing, sensors, electronics, on-board computer and software, and instrumentation hitherto dependent on foreign agencies.

Shri Alok Mukherjee, Sc F, [R&DE (E)], Pune, and his team for successfully developing state-of-the-art remotely operated vehicle, Daksh, capable of being remotely controlled over a range of 500 m line-of-sight and within buildings, which is an invaluable asset in hands of bomb disposal units in Army, Police and other Paramilitary Forces. The system has been successfully inducted into the Army.

Shri GVS Brahendra Kumar, Sc F, Defence Metallurgical Research Laboratory (DMRL), Hyderabad, and his team for successfully establishing the technology for large scale production of Titanium sponge with indigenous resources paving the way for self-reliance in this strategically important structural material.

Smt Tessy Thomas, Sc G, Advanced Systems Laboratory (ASL), Hyderabad, and her team for successfully realising Agni 4 system, enabling a quantum jump in technology of long-range missiles and a new capability to the Indian defence.

**Special Award for Strategic Contribution 2011**

Shri PN Tengli, Sc G, DRDO and his team for developing the state-of-the-art solid rocket motor processing facilities. In a span of nine years, the team have successfully processed more than 50 solid rocket motors for different versions of Agni systems which have given excellent performance during static/flight tests.

**Best Innovation/Futuristic Development Award 2011**

Dr Arvind Kumar Saxena, Director, Defence Materials and Stores Research and Development Establishment (DMSRDE), Kanpur, and his team for significant contribution in development of novel synthetic method to prepare multifunctional material Polycarbosilane which is required as structural material for rockets, re-entry vehicles, EATERS, Tokomak, etc., and also for high temperature semiconducting devices, armours, stealth technologies and support materials/products.
"The world is watching this programme with bated breath. Its success will put our country into the elite group which can develop and deliver such complex state-of-the-art systems", said Dr VK Saraswat, SA to RM, Secretary Defence R&D and DG DRDO. Dr Saraswat was speaking at a function organised to commemorate the formal receipt of the Airborne Early Warning and Control (AEW&C) aircraft by Centre for Airborne System (CABS), Bengaluru the DRDO laboratory spear heading the AEW&C programme at Begaluru. Dr Saraswat congratulated the AEW&C team from DRDO, Indian Air Force (IAF), Centre for Military Airworthiness and Certification (CEMILAC), DGAQA, and the EMBRAER team for this significant achievement.

"The programme involves installation of the systems on the aircraft, integration of these systems and make the system perform to its optimum capability meeting the user aspirations", said Dr Saraswat. He further added, "The ultimate milestone, the delivery of the fleet of AEW&C systems to the IAF is not only our goal but also a dream for DRDO. The indigenous AEW&C based on projections by the IAF and built on the EMB-145I by DRDO has incorporated more operational capabilities than contemporary systems of its class".

Air Chief Marshal NAK Browne, PVSM, AVSM, VM, ADC, Chief of the Air Staff, was the chief guest in the function. Speaking on the occasion, he said, "He was personally very satisfied with this significant milestone which was not, and still is not, an easy programme." He said the AEW&C programme is the starting point for much larger, more complex projects such as AWACS India programme.

The first aircraft fully modified by Embraer with more than 300 mission system items supplied by CABS, landed in Bangalore HAL airport.

Earlier, while welcoming the gathering Dr S Christopher, DS, Programme Director AEW&C System, and Director, CABS informed that after the operational requirements were firmed up between DRDO and IAF in 2007, the contract for three modified aircraft was finalised in August 2008 with Embraer, Brazil. The present aircraft is scheduled to go for ‘shake down’ trials in the coming week. It will take about a year for completing the integration and development flight trials.

Shri G Elangovan, DS and CC R&D (Avionics & Aeronautics); Air Marshal Rajendra Singh C-in-C HQ Training Command; AVM Nambiar, Commandant, ASTE, Directors of other DRDO laboratories and DRDO HQ, senior officials of Embraer Brazil, DRDO, IAF and former Directors of CABS were present on the occasion.

CEMILAC celebrated its foundation Day on the 24 August 2012. Air Marshal P Kanakaraj, AVSM, VSM, was the Chief Guest. In his address, the Air Marshal, lauded CEMILAC for the excellent work done and asked scientists to take up further challenges in the field of airworthiness assurance. The Chief Guest presented awards to the outstanding staff.

Air Marshall Kanakaraj at the inaugural function
**Successful Flight Testing of Agni 4**

DRDO developed, 4000 km range ballistic missile Agni, was successfully flight tested from the Wheeler’s Island on 19 September 2012. This long-range missile propelled by composite rocket motor technology, was tested for its full capability. The vehicle, launched from the road mobile launcher, reached the pre-defined target in about 20 min. The missile, equipped with state-of-the-art avionics, 5th generation onboard computer and with distributed architecture, has the latest features to correct and guide for in-flight disturbances. The most accurate ring laser gyro-based inertial navigation system (RINS) and highly reliable redundant micro navigation system (MINGS), ensured the vehicle reach its target within two digit accuracy. The re-entry heat shield withstood temperatures of more than 3000 °C and made sure the avionics function normally with inside temperature less than 50 °C.

All electro-optical tracking systems (EOTS) and radars, located all along the coast, tracked and monitored all the parameters throughout the flight. Two ships located near the target point tracked the vehicle and witnessed the final event.

Dr VK Saraswat, SA to RM, Secretary, Dept of Defence R&D and DG DRDO; Shri Avinash Chander, DS and CC R&D (MSS) and Programme Director Agni, reviewed the launch activities and guided the team. Smt Tessy Thomas, Project Director, Agni 4 led the team of scientists during the operation. Dr VG Sekaran, DS and Director, ASL; Dr SK Chaudhuri, OS and Director, RCI; Shri AK Chakrabarti, Director, DRDL; and Shri MVKV Prasad, Director, ITR witnessed the launch.

Defence Minister Shri AK Antony congratulated all scientists of DRDO for the successful flight test of Agni 4.

**SFC Successfully launches Agni 3 and Dhanush Missiles**

India’s Strategic Force Command (SFC) successfully launched surface-to-air missile Agni 3 and surface-to-surface Dhanush ballistic missile on 20 September 2012 and 5 October 2012, respectively. Agni 3 was launched from the Wheeler island off the coast, Odissa. Dhanush, a navan variant of Prithvi 2, was fired by SFC from a navan ship off the coast Balasore. Both the missiles have been inducted into the Services.

**DRDO bags CSIR Award for S&T Innovations for Rural Development**

Defence Institute of High Altitude Research (DIHAR), Leh, a DRDO laboratory, was awarded CSIR Award for S&T Innovations for Rural Development (CAIRD) for the year 2010 for the Development of cold arid agro-animal technologies for rural development in Ladakh region (J&K). The award was presented by Dr Manmohan Singh, hon’ble Prime Minister of India. Dr RB Srivastava, OS and Director, DIHAR and Dr W Selvamurthy,
Distinguished Scientist and CC R&D (LS&IC), DRDO, received the award at Vigyan Bhawan, New Delhi, on 26 September 2012.

DIHAR, through its multidimensional R&D efforts has brought about qualitative and quantitative changes in agriculture, animal husbandry and cold desert flora of Ladakh. It has identified suitable varieties and developed agro-practices of 78 types of vegetables and 30 types of high altitude medicinal and aromatic plants to boost local production in cold desert region of Ladakh.

DIHAR has developed and successfully commercialized Seabuckthorn products. The Seabuckthorn berries had no commercial value in Ladakh region till the year 2001. However after setting up the first Seabuckthorn processing unit in Leh, Seabuckthorn collection is taken as an important activity and additional source of income for farmers.

It is intently hoped that this award to DIHAR will inspire all those engaged in the profession and business of innovation in the country to find S&T inputs and solution to enable rural development and help in economic development of our rural brethren.

Defence Science Forum organised a DRDO Oration delivered by Shri Sam Pitroda, Adviser to the Prime Minister, Public Information Infrastructure and Innovations, on How Technology and Innovation Drive Global Development at Dr Bhagavantham Auditorium, Metcalfe House, Delhi, on 19 September 2012.

Shri Pitroda served as Chairman of the National Knowledge Commission during 2005-2009. He is presently the Chairman of National Innovation Council, besides being the Chairman and CEO of World-Tel Limited and the founder and CEO of C-SAM, Inc. He is the first person to introduce microprocessor in telephone and is known for his invention of first electronic diary. Shri Pitroda holds around 100 key technology patents. During his distinguished career, he has been conferred with many national and international awards.

Dr RP Tripathi, OS and Director, Institute of Nuclear Medicine and Allied Sciences (INMAS), Delhi welcomed the audience. Dr W Selvamurthy, DS and CC R&D (LS&IC) presided over the function. Dr V Bhujanga Rao, DS and CC R&D (HR) introduced Shri Pitroda to the audience.

Dr Selvamurthy presenting memento to Shri Pitroda

Shri Pitroda, in his oration, highlighted his current initiative, Bharat Broadband. He said “The idea of Bharat Broadband—laying 5,00,000 km of optic fibre to connect over 2,50,000 panchayats will transform the lives of millions and can be used by mobile operators to carry their data.

The Chief Controllers, Directors of DRDO HQ and labs of Delhi, and officers and staff from various Delhi-based labs attended the oration. Dr Rajeev Vij, Secretary, Defence Science Forum proposed the vote of thanks.
Hindi Pakhwara/Divas

Hindi is our national language. It is one the oldest languages and derives much of its academic vocabulary from Sanskrit language. After independence, the Government of India set rules for standardisation of grammar and orthography to bring about uniformity in writing of Hindi. On 14 September 1949, the Constituent Assembly of India adopted Hindi as the official language of India. Since then, 14 September is celebrated as Hindi Divas. With a view to motivate government employees to work in Hindi and to create an environment for implementation of Rajbhasha policy of Government of India in day-to-day official work, organisations celebrate Hindi Pakhwara in September every year. Various laboratories/establishments of DRDO in various parts of country also celebrate Hindi Pakhwara/Divas at their respective place. Various competitions like Hindi poems, noting, tying, translation, shorthand, story recitations, dictations, vocabulary quizzes, essay writing, etc., were organised during the Pakhwara.

The following laboratories/establishments of DRDO celebrated the Pakhwara:

**ASL, Hyderabad**

Advanced Systems Laboratory (ASL), Hyderabad, celebrated Hindi Pakhwara during 1-15 September 2012. Message of Dr VK Saraswat, SA to RM was read. Chief Guest, Dr PK Jain, highlighted the progress and usage of Hindi.

**CAIR, Bengaluru**

Centre for Artificial Intelligence and Robotics (CAIR), Bengaluru, celebrated Hindi Divas on 14 September 2012. Awards were distributed to the winners of Hindi competitions.

**CEMILAC, Bengaluru**

Centre for Military Airworthiness and Certification (CEMILAC), Bengaluru, celebrated Hindi Pakhwara during 3-14 September 2012. Dr K Tamilmani, DS and Chief Executive (Airworthiness), in his address suggested starting of new programmes to popularise the use of Hindi.

**DL, Jodhpur**

Defence Laboratory (DL), Jodhpur, celebrated Pakhwara during 14-28 September 2012. On the concluding day, Chief Guest Dr Rajiv Mishra, Director, AIIMS released in-house Hindi magazine of DL, Marutarang Key Satravay Pushp.

**DESIDOC, Delhi**

Defence Scientific Information and Documentation Centre (DESIDOC), Delhi, celebrated Hindi Pakhwara during 3-18 September 2012. The Pakhwara was inaugurated by Dr Vishram Neelkanth Bapat, Director, Ganga Technical and Management Institute, Jajjar. Shri SK Jindal, Director, DESIDOC, in his welcome address exhorted the employees to work in Hindi.

**DFRL, Mysore**

Defence Food Research Laboratory (DFRL), Mysore, celebrated Hindi Pakhwara during 14-28 September 2012.
HEMRL, Pune

High Energy Materials Research Laboratory (HEMRL), Pune, celebrated Hindi *Pakhwara* during 31 August-14 September 2012. During the occasion, in-house *Patrika, Navchetana’s* 27 issue was released by Chief Guest Dr Haridwar Singh. Prizes were distributed to the contributors of *Patrika*.

NSTL, Visakhapatnam

Naval Science and Technological Laboratory (NSTL), Visakhapatnam, celebrated Hindi *Pakhwara* during 5-20 September 2012. Various competitions were organised during the occasion.

RCI, Hyderabad

Research Centre Imarat (RCI), Hyderabad, celebrated Hindi Day on 27 September 2012. Dr CG Balaji, OS and Associate Director, RCI, was the Chief Guest and inaugurated the new Hindi website of RCI developed in-house by Shri Madanlal Kasotiya and Shri C Chandrasekhar, both Sc C. Message of Dr VK Saraswat, SA to RM was read. A *Hasya Kavi Sammelan* was organised on the occasion.

SAG, Delhi

Hindi *Pakhwara* 2012 was celebrated in Scientific Analysis Group (SAG) during 14-28 September 2012. A function was held on 28 September 2012 to mark the culmination of fortnight long celebration. Dr RP Tripathi, OS and Director, Institute of Nuclear Medicine and Allied Sciences (INMAS), Delhi, the Chief Guest on the occasion, called upon to promote the usage of Hindi by seeking everyone’s participation.

SASE, Chandigarh

Snow and Avalanche Study Establishment (SASE), Chandigarh, celebrated Hindi *Pakhwara* during 1-14 September 2012. Messages of Defence Minister, Home Minister and SA to RM were read during Hindi *Divas*. SASE’s in-house *Patrika, Dhawa’l’s*, authors were also awarded.

INMAS, Delhi

A specialised training course on CBRN Emergency Management for QRT/QMRT and NDRF was conducted by Institute of Nuclear Medicine and Allied Sciences (INMAS) during 17-21 September 2012. The Course Director was Dr RK Sharma and Shri Vinod Kaushik was the Course Co-ordinator. Ninety-five candidates participated in the course. Lt Gen KR Salgotra, VSM, DCIDS (Med), HQ, IDS, Delhi, was the Chief Guest of the function. Dr RP Tripathi, OS and Director, INMAS, welcomed the Chief Guest and course participants.

The course covered the different issues on the management of the CBRN emergencies. Faculties were drawn from different DRDO laboratories viz., INMAS, Delhi, Defence Research and Development Establishment (DRDE), Gwalior, Centre for Fire, Explosive and Environment Safety (CFEES), Delhi, Defence Laboratory (DL), Jodhpur and AIIMS, Delhi. Lectures on basic life support and on prevention and management of biological emergencies were also delivered.

There was a demonstration-cum-exercise on protection, detection and decontamination of chemical warfare agents by the expert team from DRDE, Gwalior.
There was a demo of remotely operated vehicles, Daksha and Natra. Daksha can be used to defuse the bomb at the time of emergency. All the participants get knowledge on CBRN and how to deal with all the affairs related to the CBRN emergencies.

Mock drill like donning/undonning of the personal protective clothing was also organised.

NMRL, Ambernath

Naval Materials Research Laboratory, Ambernath, organised a Continuous Education Programme (CEP) course on Advanced Ceramics: Processing and Applications during 10-14 September 2012. The objective of the CEP was to update and upgrade the knowledge domain of researchers with concurrent technologies used world-wide for the development of advanced ceramic materials and their potential uses in various defence and civilian applications.

Dr RS Hastak, OS and Director, NMRL inaugurated the course. In his inaugural address he talked about the objective and need of the course. He also mentioned that course will be beneficial for finding out better technical solutions of the research problems. Dr BC Chakraborty, OS and Associate Director, NMRL, distributed the certificates to the participants in the valedictory function.

Twenty participants participated in the course. Faculty for the course comprised experts from DRDO, IIT, DIAT, BARC and from various industries working on advanced ceramics. The course material was designed to cover the basic scientific aspects of almost all processing techniques of advanced ceramics and their applications as functional and structural ceramics in the field of missiles, acoustics sensors, solar energy, and biotechnology.

NSTL, Visakhapatnam

Naval Science and Technological Laboratory (NSTL), Visakhapatnam, organised a CEP course on CNC Manufacturing Practices during 24-28 September 2012 to acclimatise the participant to operate the CNC machine by giving required approach training.

Twenty participants including scientists, technical officers, senior technical assistants, technical assistant and technicians attended the course. The syllabus of course covered introduction to CNC machine tools and programming; basics of control systems; non-conventional CNC machines; CNC–CMM measuring techniques (T); advanced manufacturing practices. It also comprised practical session on CNC milling and CNC turning and demo on manufacturing of propellers. The faculty for the course was drawn from Andhra University, local Engineering Colleges, Govt Polytechnic and M/s SIEMENS Ltd. Machining of CNC components was demonstrated on CNC Lathe.

The course was inaugurated by Dr K Sudhakar, OS and Principal Associate Director, NSTL. Shri RVS Subrahmanyam was the Course Director. Shri NV Raghava Rao, Sc G, was the Chief Guest for valedictory function.

PXE, Chandipur

Proof and Experimental Establishment (PXE), Chandipur, organised a CEP course Developing Effective Interpersonal Relationship during 3-7 September 2012 in collaboration with Centre for Personnel Talent Management (CEPTAM), Delhi. Twenty-eight participants attended the course. The course was designed to develop the interpersonal relationship. Major thrust was given on team building concepts,
leadership development, interpersonal relationship, decision making, transactional analysis, fundamental inter personnel relation orientation behaviour (FIRO-B), attitude matter and analysis, motivation, written communication skill, stress management, presentation skill, application of soft skill, time management, conflict management, emotional intelligence management and interpersonal communication. These were dealt in details by expert faculties from PXE and ITR, Chandipur; IIT, Kharagpur; and FM University, Balasore.

Maj Gen P Mathur, Director, PXE, distributed certificates to participants in the valedictory function. Dr AK Sannigrahi, Sc F, was the Course Director as well as the Course Coordinator.

RCI, Hyderabad

Research Centre Imarat (RCI), Hyderabad, conducted a CEP Course on Basics of Battery Technology and its Application for Defence during 10-14 September 2012. Dr SK Chaudhuri, OS and Director, RCI inaugurated the course. Participants from various DRDO labs, RCMA (Msl) and INS Shivaji. Shri DS Reddy, former Program Director (Retd), AD, Dr S Laxaminarayanan and Shri SK Chopra, delivered special lectures on requirement of batteries for missiles, flow battery, lithium-ion battery and thermal battery technologies.

Scientists from Naval Materials Research Laboratory, Ambermath and Naval Science and Technological Laboratory, Visakhapatnam, delivered lectures on various power source technologies, namely, zinc-air, supercapacitor, fuel cell, sea water activated battery, lead acid battery, batteries of heavy-weight torpedo, and mines. Lectures on fundamentals of electrochemical principles, evolution of power sources, dry cell manufacturing, missiles batteries, primary lithium battery, hybrid power pack, PEMFC technology, power generating shoes for soldiers, non-conventional, and future generation energy concepts were delivered by scientists from RCI. Lectures were also delivered by various industry representatives on various technologies like thermal battery, nickel-cadmium battery, silveroxide-zinc battery, and battery test equipment.

Dr VG Borkar, Technology Director, DEM, chaired the valedictory function. Shri VV Rama Sarma Sc G gave certificates to participants.

RCI also conducted an induction programme for STA B at Hyderabad-based DRDO laboratories who joined on or after 1 January 2010, during 17-21 September 2012. Dr SB Gadgil, Sc G and Officiating Director, RCI inaugurated the course and released the course material. Thirty-six participants including 25 from other Hyderabad-based DRDO laboratories/establishments attended the course. The faculty comprised experts from Osmania University, Defence Electronics Research Laboratory (DLRL) and RCI, Hyderabad. The topics covered during the course included overview of DRDO vision, mission and organization structure; conduct rules, dos and don’t for government officials; implementation of Rajbhasha policy; ethics and values in government service; allowances/advances/incentives/bonus and welfare measures in DRDO, leave rules, LTC rules, communication skills and interpersonal relation, etc.

Shri M Sankar Kishore, Sc G, and Course Director distributed certificates to the participants.

SAG, Delhi

Scientific Analysis Group (SAG), Delhi, organised an Advanced Course on Cryptology and Information Security (ACCIS-12) during 3-14 September 2012 at Nalanda Auditorium, Metcalfe House. Dr PK Saxena, OS and Director, SAG, inaugurated the course. In his keynote address, Dr Saxena discussed various security issues and cryptographic solutions. Shri Ram Ratan, Sc F, and the Course Director, presented the overview of the course. The course focused on various information security issues for protection of network infrastructure and sensitive information. In addition to internal speakers, distinguished speakers like Dr Gulshan Rai, Director General, CERT-IN; Dr BJ Srinath, Senior Director, CERT-IN; Prof. Subhomay Maitra, ISI, Kolkata; Prof. NV Narendra Kumar, CRRIMSCS, Hyderabad and Dr Ashitosh Saxena, Infosys, Hyderabad delivered informative lectures.
SAG also organised a one-day workshop for Service Officers on 18 September 2012. The aim of the workshop was to showcase the strength of SAG in the field of cryptography, cryptanalysis, steganography and network security. Dr KD Nayak, DS and CC R&D (Med, MIST and CS) presided over the inaugural function. AVM Sanjay Sharma, ACAS (Sigs and IT) was the Chief Guest for the occasion. The workshop attracted wide participation from senior officers from the Indian Army, Air Force and the Navy.

Dr KD Nayak, in his presidential address, pressed the need for R&D in the area of network security, cyber systems and cryptanalysis. He advised the participants not to fall prey to tall claims by private vendors on security services. He also advised scientists to mark this workshop as a milestone for knowing their capabilities.

AVM Sharma in his address emphasised that there is a serious deficit of trained manpower in the area of Cryptology and Cryptanalysis and it needs to be strengthened. He appreciated the steps taken by SAG in organising this workshop and also initiating other training programmes for the Services and users. Participants were given live demos of the tools developed by SAG in the area of high performance computing, speech processing, network security, cyber security and regional language ciphers. The concluding remarks were delivered by Dr AK Singh, Director, DHRD, DRDO HQ, wherein he emphasised that Service Officers today are seen as Developer Partners for DRDO rather than as customers.

SAG also organised a CEP course on Design and Analysis of Block Cipher during 24-28 September 2012. The course covered design, implementation, security analysis and application of block ciphers. Twenty-two participants from IB, CABSEC, ADGSI, WESEE, sister labs and SAG attended the Course. The faculty comprised speakers from ISI, Chennai; IISc, Bengaluru and SAG. Dr Sucheta Chakrabarti, Sc E, and Dr Dhananjay Dey, Sc D, were the Course Director and Deputy Course Director, respectively.

**SASE, Chandigarh**

The Society of Crypspheric Science (SCS) is aimed towards bringing all scientific professionals working in Cryospheric Sciences on a common platform. This is a unique effort as no other professional society in India with a focus group having the potential to cover all components of Cryosphere, exists on date. Dr VK Saraswat, SA to RM, is the patron of the Society, which has its registered office at Research and Development Centre, Snow and Avalanche Study Establishment (SASE), Chandigarh.

As an inaugural event, the Society organised one-day Colloquium on Water Availability in Himalayan Cryosphere—Emerging Issues on 22 September 2012. In his inaugural speech, Shri A Ganju, Director, SASE, and President, SCS, set the roadmap to address the emerging challenges related with availability of water in Himalayan cryosphere; various trends, futuristic scenarios and likely socio-economic and political impacts. He further called upon greater interaction and cooperation among the various scientific stake holders.

On this occasion, Prof. GB Pant, former Director, IITM, Pune, and Visiting Professor, School of Environment and Natural Resource, Doon University, Dehradun, delivered an invited talk on Himalaya: Meteorology, Climatology and Environment. Dr MR Bhutiyani, Associate Director, SASE, also delivered a talk on various issues related to water scarcity, receding glaciers and changing hydrological regimes and likely trends in the Himalayan region.
**VRDE, Ahmednagar**

Shri Manmohan Singh, Sc G, has taken over as Director, Vehicles Research and Development Establishment (VRDE), Ahmednagar, wef 8 August 2012.

Shri Manmohan Singh did his graduation in Mechanical Engineering from Government Engineering College, Jabalpur, in 1983. Subsequently, he did his Master in Engineering (ME) from Pune University in the Year 1990 and MMS/MBA from Pune University in 1999. He joined VRDE on 30 July 1986 as Sc B. He has served in various capacities including Project Director for Agni 5 Ground Support Vehicles. He was involved in design and development of road mobile launchers, specialist vehicles, weapon platforms (rockets and missiles) and ground support systems for various programmes like Agni, IGMDP, and projects, e.g., Pinaka and NBC related systems. Most of these vehicles are under large scale production stage.

In reorganisation to his significant contribution and various achievements, he has been awarded the following DRDO Awards: DRDO Scientist of the Year Award 2011; DRDO Laboratory Technology Group Award 2010 for design and development of IMS vehicle; DRDO Award for Path Braking Research/Outstanding Technology Development 2007 for Development of Agni System; DRDO Award for Performance Excellence 2002 for successful design and development of Pinaka multi barrel rocket system; DRDO Agni Award for Excellence in Self-Reliance 2002 for design and development of mobile decontamination system; DRDO Agni Award for Excellence in Self-Reliance 2002 for contribution in design and development of Agni 1 road mobile missile system; and Commendation Certificate for significant contribution in IGMDP in 1989.

**RIC, Chennai**

Dr V Ramanujachari, Sc G, has assumed the appointment of Director, Research and Innovation Centre (RIC), IIT Madras Research Park, wef 1 October 2012. Dr Ramanujachari obtained his BE degree in Mechanical Engineering from Annamalai University and MTech and PhD from IIT Madras. He joined DRDL, Hyderabad, as Sc B in 1982 and contributed to the preliminary design of rocket ramjet propulsion system for Akash missile.

Dr Ramanujachari served in the Faculty of Guided Missiles, Institute of Armament Technology, Pune, during 1986 to 2004 and was responsible for the development of infrastructure and test facilities to carry out research in the field of missile propulsion. Later, he joined Defence Research and Development Laboratory, Hyderabad, as Deputy Project Director, Hypersonic Technology Demonstrator Vehicle (HSTDV), and was responsible for the design and development of scramjet engine. He became Project Director in the year 2009 and was instrumental in overall development of the HSTDV. As a Leader of the Scramjet Engine Development Team, he has been awarded the DRDO Best Innovation/Futuristic Development Award of the DRDO for the year 2010.

Dr Ramanujachari has guided 65 ME dissertations and a few PhD theses recognised by the University of Pune. He has published over 65 papers in various international/national journals and conferences on the subjects related to combustion and propulsion. He was the Chairman of the Combustion Institute Indian Section, in 1999.
Visits to DRDO Labs/Estts

DARE, Bengaluru

Dr V Bhujanga Rao, DS & CC R&D (HR) on 21 September 2012.

DEBEL, Bengaluru

Surgeon Vice Admiral AC Anand, VSM, Director General Medical Services (Navy) on 3 September 2012. He evaluated the Telemedicine System developed by DEBEL and also reviewed the on-going Navy-related projects.

SAG, Delhi

Prof (Dr) DN Reddy, Chairman, RAC, on 27 September 2012. He was briefed about the work being carried out in SAG by Dr PK Saxena, OS and Director, SAG. Prof. Reddy was also given practical demonstrations of tools developed by high performance computing, speech processing and network security.

TBRL, Chandigarh

Vice Adm B Kannan, AVSM, VSM, on 27 September 2012.

Air Mshl Jagjeet Singh, VSM, DG (Aircraft) on 28 September 2012.