The nation owes a deep debt of gratitude to Prof DS Kothari for the foundation he laid for the healthy development and growth of Defence science in the country. Scientific community pays respectful tribute to the memory of this eminent scientist and founding father of Defence research in India with the hope that his ideas will continue to influence succeeding generations of scientists.
India became independent on 15 August 1947. Soon after Independence, there was an intrusion by Pakistan in J&K in 1948, which drew the attention of Prime Minister Pt Jawaharlal Nehru towards the Services. He knew India was way behind both in industrial growth, technical manpower, scientific research and industrial input. On scientific front, Pt Nehru had already laid the foundation of National Physical Laboratory at Pusa, Delhi on 4 January 1947. He was in touch with all well-known scientists, namely Dr SS Bhatnagar, Dr MN Saha, Dr KS Krishnan, Dr Vikram Sarabhai, Dr Homi Bhabha, and Prof DS Kothari. There was a need for a well-informed scientist to advice Pt Nehru on Defence matters and give scientific input, and thus, a post of Scientific Adviser to Minister of Defence was created and Govt of India requested University of Delhi to lend the services of Prof Kothari for three years. Thus, Prof Kothari became the first Scientific Adviser to Rakhsha Mantri in 1948.

**Prof Kothari, prior to SA to RM**

Prof Kothari was born on 6 July 1906 at Udaipur. He passed matriculation in 1922 from Maharaja Shivajirao High School, Indore; Intermediate from the Intermediate College at Udaipur in 1924; BSc in 1926 and MSc in 1928, both from Allahabad University with specialisation in Wireless (now renamed Electronics). Professor MN Saha, Head, Physics Dept at that time was greatly impressed by him because of his depth of understanding and capacity for independent thinking. Their very close association, which started during Prof Kothari’s student days, continued throughout the life. Prof Kothari married Sujan Kunwar (nee Surana) in January 1925.

He was appointed demonstrator in the Dept of Physics, Allahabad University. Soon, he was awarded UP State Govt scholarship to study at Cambridge University, UK.

After obtaining PhD from Cambridge, he returned to India in April 1933 and rejoined Allahabad University as a demonstrator. The University refused to grant him increments for the period he was away for studies in England. Prof Saha felt very unhappy about this. When a post of Reader and Head fell vacant at Delhi University, Professor Saha advised Dr Kothari to apply for it, and he was duly selected in May 1934.

His activities in the Department were strongly supported by physicists and Nobel Laureates during their frequent visits, who included among others, N Bohr, PAM Dirac, P Kapitza, I Prigogine, Professors PMS Blackett, N Bogolubov, S Chandrasekhar, KS Krishnan, HJ Bhabha, CV Raman and MN Saha. As able administrator and organiser, he impressed Sir Maurice Gwyer, the Vice Chancellor of the Delhi University for the expansion of the Physics department to include Astrophysics.

In August 1948, Ministry of Defence asked the University of Delhi to lend the services of Prof Kothari as its Scientific Adviser for three years. He joined back Delhi University in 1952 and was permitted to act as Honorary Scientific Adviser to the Minister of Defence till 1961 and was appointed Chairman, University Grants Commission in the same year. He retired from the University in July 1971, on attaining the age of superannuation. He was then appointed Emeritus Professor and continued to interact with the Department throughout his life. He was made Chancellor, Jawahar Lal Nehru University in 1981 by the then Prime Minister Smt Indira Gandhi, earlier this post was held only by the Prime Minister.

**Initiator of Defence Research in India**

After the appointment of Prof Kothari as SA to RM, a Board of Advisers to the Scientific Adviser was constituted consisting of Dr Homi J Bhabha, Dr KS Krishnan, and Dr SS Bhatnagar. The charter of the Scientific Advisory Board was soon
broadened with an enlarged membership, which included the Defence Secretary, the three Service Chiefs, and the Financial Adviser (Defence). A Defence Science Advisory Committee was also setup with the Scientific Adviser as its Chairman, consisting of a panel of consultants, co-opted Service representatives, and co-opted civilian scientists.

In June 1949, the Govt decided to establish Defence Science Organisation (DSO). It started with 40 senior scientists, 100 junior scientists, and 25 scientific assistants, and was located in H Block, one of the hutments near the Central Secretariat.

**Defence Science Laboratory**

After the building of National Physical Laboratory (NPL) in Delhi was ready and inaugurated by the then Home Minister, Sardar Vallabhbhai Patel on 20 January 1950, Dr Kothari immediately approached Dr KS Krishnan, the first Director of NPL and requested him to lend the second floor (containing around 25 rooms) of NPL building for scientific activities and laboratory work for defence scientists for which he agreed immediately. Some scientist from H Block moved to NPL and the first Defence Laboratory, established in January 1950, was named Defence Science Laboratory (DSL).

Prof Kothari wanted the services of Prof PMS Blackett (an outstanding British scientist and a war-time Scientific Adviser to RAF Command), who could study the prevailing state of the Defence Services. He discussed with Pt Nehru and the three of them helped finalising Defence Science and model of Defence Research in India. The Blackett Report became a white paper for evolving policy guidelines for the Ministry of Defence.

Next on Prof Kothari’s mind was the establishment an institute for training and research in Defence Science. It was a difficult task as there were only five trained military officers (at the Royal Military College of Science at Shrivenham, UK) and only few basic science teachers. Finally, the Institute of Armament Studies was setup at the campus of the College of Military Engineering at Dapodi, Pune, in April 1952, as a part of DSO. Later, the institute was renamed as Institute of Armament Technology. Finally in the birth centenary year of Prof Kothari, this institute has become a deemed university, renamed as Defence Institute of Advanced Technology (DIAT) with Prof P Ramachandra Rao as the Vice Chancellor, making Prof Kothari’s vision and passion towards imparting training to Defence Services along with R&D, a reality.

**Prof Kothari as Defence Scientist**

Prof Kothari’s philosophy is best described in the words of late Shri Nagaratnam who worked with Prof Kothari for a number of years:

“Prof Kothari realised that the main purpose of the Defence Science Organisation was to serve the immediate and long-term needs of the Armed Forces. He, therefore, made efforts to establish rapport with the Chiefs of the three Services. In spite of the different ethos of the university professors, an informal atmosphere, that Prof Kothari was accustomed to and the highly disciplined hierarchical structure of the Armed Forces, he was able to establish extremely cordial relations with the senior service officers at all levels and earned their respect by his vast knowledge and the special efforts to understand their requirements and appreciate their point of view”.

It is a tribute to his clear thinking and visionary foresight that he unerringly identified thrust areas of relevance in the country’s geopolitical context. He carefully chose through personal contact, scientists (mostly from the universities) who had the necessary interest, aptitude, and
competence. He himself spared no effort to get a mastery over all these areas (most of which were new to him). He believed in humble beginnings and natural growth. He, therefore, started all these disciplines in a small way in corresponding “cells” mainly in the Defence Science Laboratory, Delhi. All of these grew over the years, and when these had reached a critical size they took off as independent labs/estts located in different parts of the country.

Because of Dr Kothari’s deep understanding of the fundamentals of physics and astrophysics, he could use his knowledge very profitably in solving problems of defence. An outstanding example is the development of shaped charge for armour penetration. This proved decisive in defending the country against Pakistani invasion using most modern Patton tanks during 1965.

GNAT

Pt Nehru was in a dilemma whether to purchase Gnat fighter planes for the Air Force which had been rejected by NATO. Since Gnat was rejected by NATO, its design was therefore available for sale to other countries. Pt Nehru sought the advice of Prof Kothari before making the final decision. Prof Kothari drew some diagrams and explained the advantages of small target size and great manoeuverability of the Gnat over other bigger aircraft of this class. The analogy with a mosquito brought home the point clearly. Though one can hear it buzz, it is difficult to locate and kill it. The designs of Gnat were then bought by India and everyone knows how useful these proved during the 1965 war with Pakistan.

DRDO

On 1 January 1958 Defence Research and Development Organisation (DRDO) was formed by the amalgamation of the then already functioning Technical Development Establishments (TDEs) of the Indian Army and the Directorate of Technical Development & Production (DTD&P) with the Defence Science Organisation (DSO).

This was the main recommendation of Prof PMS Blackett which was persuaded by Prof Kothari, SA to RM, over the years. Shri VK Krishna Menon, the then Defence Minister played a major role in the formation of DRDO. Major General BD Kapur was appointed as the first Chief Controller Research and Development (CCR&D). DRDO was then a small organisation with only 10 labs/estts.

On 16 October 1958, Prof Kothari with the approval of the then Defence Minister, Shri VK Krishna Menon had setup a guided missile study team under the leadership of Dr BN Singh at the Defence Science Laboratory (DSL), Delhi, named Special Weapon Development Team (SWDT). Later in 1961, the Defence Research and Development Laboratory (DRDL), the first main DRDO laboratory, was formed as an extension of the SWDT. Gp Capt V Ganesan was appointed as its Director in December 1961. Later, it was moved to Hyderabad. This was the beginning of missile development in India.

Metcalf House

The last few years of Prof Kothari were very important for DRDO as he setup many more important task groups in DSL which were later moved to bigger complexes of their own in Metcalf House, earlier occupied by IAS Academy. While moving to Metcalf House, Prof Kothari organised a grand exhibition which was visited by Prime Minister Pt Nehru on 13 April 1960 and by the President Dr Rajendra Prasad on 16 April 1960. Earlier to this, Defence Minister Shri VK Krishna Menon formally opened Defence Science Laboratory in Metcalf House on 9 April 1960.

Defence Science Laboratory was renamed as
Defence Science Centre (DScC) in 1981 and later in 1999, as Laser Science and Technology Centre (LASTEC), Delhi.

**DESIDOC**

His love for books, journals, and magazines was well known. While at Delhi University, he visualised the library of DSL and today, Defence Scientific Information and Documentation Centre (DESIDOC), Delhi, is a dream coming true of the great visionary. On Prof Kothari’s advice, *Defence Science Journal* was started in 1949. The Journal was designed for circulation of information to defence personnel only but later in 1958, the Journal was made open to the general public. A Prof DS Kothari Commemoration issue of *Defence Science Journal* was brought out by DESIDOC in July 1994.

**University Grants Commission (UGC)**

Prime Minister Pt Nehru had a deep feeling for universities. He considered these truly as the temples of learning. It was therefore, appropriate that Prof Kothari, who regarded teaching as noblest profession, was requested to head University Grants Commission (UGC), as Chairman, the highest academic honour.

In early 1961, on receiving the offer of the post of Chairman, UGC, Prof Kothari wrote to Shri VK Krishna Menon, the then Minister of Defence, requesting him to relieve him from the post of Scientific Adviser. The Minister replied, “No one knows better than you how much I value your services and your own indispensability for Defence Science. However, there can be no defence without proper education.”

Prof Kothari excelled in UGC, did a great service to Nation. He will be remembered for his revolutionary input, now famous as Kothari Commission.

**The Post-Kothari Period of DRDO**

In 1961, Prof Kothari passed on the charge as Scientific Adviser to Dr S Bhagavantam (a distinguished spectroscopist who had made important contributions in the studies leading to the discovery of the Raman Effect). The third SA to RM was Prof BD Nag Chaudhuri (a distinguished nuclear physicist who had worked with Prof EO Lawrence of cyclotron fame), who in turn was succeeded by Prof MGK Menon, FRS (with outstanding contributions in the field of cosmic ray and particle physics). All the four Scientific Advisers were the distinguished scientists from various academic institutions. DRDO has been fortunate to have a succession of outstanding scientists as...
Scientific Advisers. Dr Raja Ramanna, an associate of Dr Homi Bhabha right from the early days of the country’s atomic energy programme, succeeded Prof Menon. All the above five SAs to RM were Physicists. Dr VS Arunachalam, Director, Defence Metallurgical Research Laboratory, Hyderabad, was appointed the SA after Dr Ramanna’s return to Bhabha Atomic Research Centre. Dr Arunachalam was a metallurgist (although he was MSc in physics); he was also the first scientist from within the DRDO community to be selected as the SA. Next was Dr APJ Abdul Kalam, an Aeronautical Engineer, who was serving as the Director and the Distinguished Scientist of the Defence Research and Development Laboratory, Hyderabad, before he became the SA. Dr VK Aatre was the next SA to RM after Dr APJ Abdul Kalam followed by the present SAs to RM, Shri M Natarajan. Both Dr Aatre and Shri Natarajan were CCs R&D before they were appointed SA to RM.

Dr APJ Abdul Kalam’s Ignited Minds

Dr APJ Abdul Kalam (now the President of India) in his recent book, Ignited Minds: Unleashing the Power Within India wrote “Dr DS Kothari, a a professor at Delhi University, was an outstanding physicist and astrophysicist. He is well-known for ionisation of matter by pressure in cold compact object like planets. This theory is complementary to the epoch making theory of thermal initiations of his guru, Dr Maghnad Saha, Dr Kothari set a scientific tradition in Indian defence tasks when he became Scientific Adviser to Defence Minister in 1948. The first thing he did was to establish the Defence Science Laboratory to do research in electronic materials, nuclear medicine, and ballistic science. He is considered the architect of defence science in India. His race continued and followed up with a momentum working and contributing in the areas of strategic systems, electronic warfare systems, armaments, and life sciences”.

Authors’ interaction with Prof Kothari

My personal interaction with Prof Kothari started in early seventies when I was doing my PhD and Postdoctorate in the Department of Physics and Astrophysics with Prof GP Srivastava. I had a colleague Dr Prafulla Kothari (now Senior Scientist at NPL) who was nephew of Prof Kothari and had come for PhD from Udaipur. Even though I met Prof Kothari for short time in the evenings, he made me feel as if he knew me for ages and never let me feel different.

During that period, there was a session of Indian Science Congress at Chandigarh and he was invited there as the Chief Guest. He took us (me and Prafulla) to Chandigarh where he asked us to share his room. I was deeply touched and I learned human values from him. He made it a point to introduce us to all top scientific personalities with pride and made us feel important.

In the last few years, Prof Kothari spent his time in reading and spiritual learning. He was a great Jainist. He died on 4 February 1993 in Jaipur while staying with his second son Shri Lalit Kothari.

Prof Kothari was media-shy, he never talked about his achievements to any one, including his sons.

Compiled and Written by Dr Anil Kumar
Director, LASTEC, Delhi

Note: The information given in the article is collected from various sources including personal communication with his family members.
DRDO Hqrs and Delhi-based labs/estts celebrated the National Technology Day on 11 May 2006 in a function organised by the Defence Science Forum at Metcalfe House, Delhi, under the chairmanship of Shri M Natarajan, SA to RM. Other DRDO labs/estts in the country also celebrated the National Technology Day. Presentations were made and speakers were felicitated with commendation certificates and medals.

Shri SS Prasad, Director, DTRL and ISSA, Delhi, and Convener, Defence Science Forum delivered the welcome address. Shri Natarajan delivered the Technology Day Address and gave away certificates and medals to the speakers. He also released the *DRDO Science Spectrum 2006*, compiled and edited by DESIDOC, Delhi.

Presentations were made on: *Futuristic UAVs: Enabling Technologies and Concept of Operations* by Shri G Sivasankaran, Sci G, ADE; *Cognitive Radio—the Future of Software Radio Technology* by Shri Shankar Mahto, Sci F, DEAL; and *Comprehensive Battery of Cognitive Assessment (CBCA)* by Dr (Mrs) Soumi Awasthy, Sci E, DIPR, Delhi. Highlights of the activities of some of the labs/estts are reported here:

**ADE, Bangalore**

Dr Sivathanu Pillai, DS and CCR&D (NS & ACE) was the chief guest. Shri G Sivasankaran, Sci G was awarded for his oration.

**ARDE, Pune**

Shri PN Chine, Sci D delivered the oration on Fuze Technology.

**ASL, Hyderabad**

Shri PVG Brahmanandam, Sci F gave the oration on Design and Development of Large Solid Rocket Motors–Issues.

**CAIR, Bangalore**

Shri T Balakrishnan, Sci E, delivered the oration on IFF Technology–Global Scenario.

**DEBEL, Bangalore**

Dr KS Manja, Director, DOP, DRDO Hqrs, New Delhi, was the Chief Guest and delivered the lecture on Bench Marking in R&D. Shri GSN Murthy, Sci E gave oration on Underwater Escape Systems.

**DLRL, Hyderabad**

Shri BR Gandhe, Sci G delivered the oration on Unconventional Weapons and Warfare.
Shri RC Malhotra, Sci F delivered the oration on Integrated Pest Management using Attracticide.

Dr RK Hemachandra, Sci F, was awarded for his oration on Contributions Towards KMG Engines Testing at National Dockyard, Vizag.

Shri RS Rautela, Sci B gave the oration on Auto-Tuned Bilateral Breast Coil for MRI and MRS.

Shri Rahul Bhatt, Sci C was awarded for his contributions in photonics leading to the development of a Holographic Sight for Rifles and Carbines.

Shri M Goswami, Sci C and Shri MK Shrivastava, Sci C were awarded on the occasion.

Prof VK Tripathi from IIT, Delhi delivered a talk on Laser Driven Ion Coulomb Explosion.

Shri M Vijayakumar, Sci F gave the oration on Rajendra Multifunction Integration with Akash SAM System.

Shri S Subramaniam, Sci E gave the oration on Thermal Management of Microwave Tubes.

Shri Dhirendra Kumar, Sci G gave the oration on Smart Coatings.


To mark the occasion, Shri R Srihari, Sci E was awarded.

Dr S Vathsal, Director, ER & IPR, DRDO HQrs, Delhi, delivered the lecture on, Role of Extramural Research and IPR Awareness for Technology Growth.

Dr Alok Jain, Sci E delivered the oration on Development of High Power Diodes and Arrays.

Shri Prerak Vyas, Sci D gave the oration on A Case Study on Development of Line-of-Sight Stabilisation System.
New Developments

High Power Laser Diodes and Arrays

Solid State Physics Laboratory (SSPL), Delhi, has undertaken the Development of High Power Laser Diodes and Arrays under the DRDO photonics programme. These laser diodes are used for pumping of solid state lasers and proximity fuses. SSPL has made significant progress in this area since 1998 when the work was started under Phase I of the project. SSPL has now delivered single-stripe pulsed and CW laser diodes to IRDE, Dehra Dun and LASTEC, Delhi. Light current (L-I) characteristic of pulsed laser diode emitting peak power of 14W and CW laser diode emitting power of 1.5 W has been worked out. CW laser diode developed at SSPL was used for pumping solid state Nd:YVO₄-KTP microcavity in collaboration with LASTEC, Delhi. The green laser emission from microcavity was observed which indicates the suitability of SSPL laser diodes for solid state pumping.

International recognition for DRDE

Defence Research & Development Establishment (DRDE), Gwalior, has been designated by the Organization for Prohibition of Chemical Weapons (OPCW) for off-site analysis of Chemical Warfare Agents (CWAs) and their environmental markers. The Establishment has achieved this status after continuous successful performance in the international official proficiency tests conducted by OPCW. The off-site analysis of CWAs and their markers is critical for the verification process of chemical weapon convention as it proves the compliance or non-compliance of the chemical weapon convention. DRDE is the only Establishment in the country to achieve this status.

DRDO Newsletter extends heartiest congratulations to DRDE for this recognition.
Transfer of Technology

CFEES signs three Memorandums of Understanding

Centre for Fire, Explosive and Environment Safety (CFEES), Delhi, has signed the following three Memorandum of Understanding for Transfer of Technology on 6 June 2006.

Intelligent Fire Sensors under the guidance of Shri JC Kapoor, Sci G and Smt Meenakshi Gupta, Sci E to Southern Electronics Pvt Ltd, Bangalore.

Advanced Oxidation Process for Treatment of Hazardous Organics in Effluents under the guidance of Shri JC Kapoor, Sci G; Dr M Pandit, Sci D; and Dr Mary Gelin, Sci C to Quality Water Management Systems Pvt Ltd, Chennai.

VISITORS TO DRDO LABs/ESTTs

**LRDE, Bangalore**

Lt Gen KS Dogra, AVSM, VSM, DG and Sr Col Comdt Army AD with Brig VK Saxena, VSM DDG (B), visited Akash Weapon System at K-site, on 26 June 2006.

![Lt Gen KS Dogra keenly observing the activities of LRDE](image)

**RCI, Hyderabad**


![Shri M Natarajan showing keen interest in the activities of RCI](image)

**DEBEL, Bangalore**

Dr KV Raghavan, Chairman, Recruitment & Assessment Centre (RAC), Delhi on 3 July 2006.

Lt Gen Devraj Singh, PVSM, AVSM, Director General (Infantry) Army HQrs, New Delhi on 4 July 2006.

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**Patents Granted**

A patent on, A Process for the Preparation of Dually Microstructure Shaped Nickel-Based Super Alloy Components having one Structure by Casting and the other by Powder Metallurgy by Dr MC Somani and Dr NC Birala, of Defence Metallurgical Research Laboratory (DMRL), Hyderabad, has been granted by the Indian Patent Office, New Delhi.
Obituary

Dr BD Nag Chaudhuri
(6 September 1917-25 June 2006)

DRDO family condoles the sudden demise of its third Scientific Adviser to Raksha Mantri, Dr Basanti Dulal Nag Chaudhuri on 25 June 2006, due to cerebral stroke at, Kolkata.

Born on 6 September 1917 at Barodi, Dhaka District, Bangladesh, he obtained MSc from Calcutta University and PhD (Nuclear Physics) from the California University, USA.

The various posts/positions held by him include: Lecturer, Calcutta University (1942-46); Reader (1946-53); Professor (1953-60); Deputed to Saha Institute of Nuclear Physics, 1951; Visiting Prof Illinois (1962-1969); Member, Planning Commission (1967-70); Scientific Adviser to Minister of Defence (1970-74); Vice Chancellor, Jawaharlal Nehru University, (1974-78); Chairman, Cabinet Commission on Science and Technology (1968-70); Chairman, National Committee of Environmental Planning and Co-ordination (1975-77); Chairman, Science and Technical Manpower Commission, Govt of India (1980); President, Indian Association for the Cultivation of Science (1975-78).

At DRDO, in a short period, Dr Nag Chaudhuri set the strategic direction to the Organisation as contemporary system development for new direction and vision. He was responsible for decentralising the decision process, which has ended in healthy growth of the Organisation.

DRDO family places on record his valuable services rendered to the nation and pays gratitude to him for his able leadership and guidance to DRDO.

We pray to the Almighty to grant eternal peace to the departed soul, and strength and fortitude to the bereaved family to bear this irreparable loss.

(DRDO Family)