



Government of Tamilnadu

Department of Employment and Training

Course : TNPSC Group I Mains Material

Subject : Role and impact of Science and Technology in the development of India

Topic : Defence Research Organizations and other science & technology institution

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Commissioner,

Department of Employment and Training.

DEFENCE RESEARCH ORGANIZATIONS

Defence Research Organizations:

Introduction:

DRDO was formed in 1958 from the amalgamation of the then already functioning Technical Development Establishment (TDEs) of the Indian Army and the Directorate of Technical Development & Production (DTDP) with the Defence Science Organisation (DSO). DRDO was then a small organisation with 10 establishments or laboratories. Over the years, it has grown multi-directionally in terms of the variety of subject disciplines, number of laboratories, achievements and stature.

DRDO works under the administrative control of Ministry of Defence, Government of India. It is working to establish world class science and technology base for India and provides our Defence Services decisive edge by equipping them with internationally competitive systems and solutions.

Today, DRDO is a network of more than 50 laboratories which are deeply engaged in developing defence technologies covering various disciplines, like aeronautics, armaments, electronics, combat vehicles, engineering systems, instrumentation, missiles, advanced computing and simulation, special materials, naval systems, life sciences, training, information systems and agriculture. Presently, the Organisation is backed by over 5000 scientists and about 25,000 other scientific, technical and supporting personnel. Several major projects for the development of missiles, armaments, light combat aircrafts, radars, electronic warfare systems etc are on hand and significant achievements have already been made in several such technologies.

Vision

Make India prosperous by establishing world class science and technology base and provide our Defence Services decisive edge by equipping them with internationally competitive systems and solutions.

Mission

1. Design, develop and lead to production state-of-the-art sensors, weapon systems, platforms and allied equipment for our Defence Services.
2. Provide technological solutions to the Services to optimise combat effectiveness and to promote well-being of the troops.
3. Develop infrastructure and committed quality manpower and build strong indigenous technology base.

Core Competence

1. Dept of Defence Research and Development (R&D) is working for indigenous development of weapons, sensors & platforms required by the three wings of the Armed Forces. To fulfill this mandate, Dept of Defence Research and Development (R&D), is closely working with academic institutions, Research and Development (R&D) Centres and production agencies of Science and Technology (S&T) Ministries/Dept in Public & Civil Sector including Defence Public Sector Undertakings & Ordnance Factories.

Defence Research & Development services (DRDS): Recruitment and selection of right people with desired competencies form the base of building an effective organisation. Defence Research & Development Organisation recruit/select scientists and engineers through an annual competitive examination at national level called Scientist Entry Test (SET) through open advertisement. In addition to this, talent search through campus interviews, scholarship scheme through Aeronautics Research & Development Board (ARDB) and fresh Ph.D scholars under Registration of Students with Scholastic Aptitude (ROSSA) is also launched.

Defence Research Technical Cadre (DRTC): The members of this cadre form strong skilled manpower base to assist scientists and engineers engaged in research and development work.

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Life Sciences Research Board:

The Life Sciences & Research Board (LSRB) supports research proposals in life sciences on broad topics such as biological and biomedical sciences, psychology and physiology, bio-engineering, specialized high altitude agriculture, food science & technology, etc. The Board has instituted a Grants-in-Aid Scheme to nurture the research talent, in IITs, universities, medical and life science institutions, colleges and other research centres including industries, in the country for promoting research and development programmes in life sciences & allied fields. Under this Scheme, grants are offered to approved research institutions, universities or colleges, departments or laboratories both in the Government and non-Government sectors. The scheme is coordinated through a number of specialist panels duly constituted by the Chairman, LSRB to cover different disciplines.

Objectives of the LSRB are as under:-

1. Expanding and deepening the knowledge-base of life sciences in the country through strengthening and use of national resources including know-how and expertise.
2. Catalysing cross-fertilization of ideas and expertise between research scientists for providing support to the soldiers in operations
3. Enhancing core competence in the field of knowledge germane to development, manufacture and use biomedical and biotechnological products
4. Create conditions suitable for attracting talent and expertise from overseas locations through collaborations and other academic exchanges.

Naval Research Board:

The NRB was set up in August 1996 to encourage basic research in the field of marine technologies and to strengthen & deepen the knowledge-base related to the naval environment. The Board has instituted a Grants-in-Aid Scheme to nurture research talent and to create research facilities in IITs, universities, higher technological institutions, engineering colleges and other research centers including industries in the country for promoting basic research, design & development.

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Objectives of the NRB are as under:-

1. To encourage and provide funds for basic research in pertinent scientific disciplines of broad relevance to our future Navy by enabling and supporting emerging talent, most particularly in academic institutions.
2. To create and evolve a knowledge-base potentially applicable to the Navy.

The Board supports basic research that will generate new knowledge potentially useful to the Navy and to train young minds to generate and apply that knowledge for Naval purposes. The Board approves research programs for funding based on evaluation and recommendations of specialist panels in various disciplines i.e. composite materials sealth materials, hydrodynamics (including propulsion), sonar & signal behaviour, ocean environment, and scientific computing.

Significant achievements of DRDO:

Some of the major products/systems developed by DRDO and accepted/inducted by Armed Forces are:

Platforms:

1. Light Combat Aircraft 'Tejas'
2. Remotely Piloted Vehicle 'Nishant'
3. Pilotless Target Aircraft 'Lakshya-I'
4. Main Battle Tank 'Arjun Mk-I'
5. Armoured Amphibious Dozer Mk-I
6. Armoured Engineer Recce Vehicle
7. NBC Recce Vehicle
8. Bridging Systems 'Sarvatra'

Sensors:

1. Airborne Early Warning & Control (AEW&C)
2. Integrated Sonar System for EKM Submarine.
3. Hull Mounted Sonar.

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4. Short Range Battle Field Surveillance Radar
 5. Weapon Locating Radar 'Swathi'
 6. 3D Low Level Light Weight Radar 'Aslesha' Mk-I
 7. 3D Surveillance Radar 'Revathi'
 8. Electronic Warfare System for Navy 'Sangraha'
 9. Electronic Warfare System for Army 'Samyukta'
 10. Electronic Warfare System 'Divya Drishti'
 11. Electronic Support Measure 'Varuna'
 12. Commander's Thermal Imager Mk-II for T-72, T-90 and BMP tanks
 13. Holographic Sights for Small Weapons

Weapon Systems:

1. Akash Weapon System
2. Prithvi Missile for Army and Air Force
3. Supersonic Cruise Missile 'BrahMos'
4. Multi Barrel Rocket Launcher System 'Pinaka' Mk-I
5. Torpedo Advanced Light
6. Heavy Weight Ship Launched Torpedo 'Varunastra'

Soldier Support Systems:

1. Computerised Pilot Selection System for Indian Air Force
2. Telemedicine System for Navy
3. Submarine Escape Suit
4. Flame Retardant Gloves
5. NBC products

SCIENCE & TECHNOLOGY INSTITUTIONS

DEPARTMENTS AND INSTITUTIONS

Department of Science & Technology (DST): DST was established in May 1971, with the objective of promoting new areas of Science & Technology and to play the role of a nodal department for organizing, coordinating and promoting S&T activities in the country.

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Some of the important domains in which the Department devotes its attention are:

1. Strengthening the pool of scientists and technologists for carrying out globally competitive R&D in cutting-edge areas of science;
2. Nurturing R&D institutions and building infrastructural facilities for enhancing global ranking of India in scientific research;
3. Support for the establishment of multi-stakeholder mechanisms for partnerships for promoting science;
4. Deploying technology through national missions;
5. Developing capacity of institutions and industry for technology commercialization for solving national challenges;
6. Providing S&T inputs to society for its socioeconomic benefits; and
7. Policy formulation for S&T sector.

Department of Scientific & Industrial Research (DSIR):

The Department of Scientific and Industrial Research (DSIR) is a part of the Ministry of Science and Technology, which was announced through a Presidential Notification, dated January 4, 1985 (74/2/1/8 Cab) contained in the 164th Amendment of the Government of India (Allocation of Business) Rules, 1961.

The primary endeavor of DSIR is to promote R&D by the industries, support a larger cross section of small and medium industrial units to develop state-of-the-art globally competitive technologies of high commercial potential, catalyze faster commercialization of lab-scale R&D, enhance the share of technology-intensive exports in overall exports, strengthen industrial consultancy & technology management capabilities and establish user friendly information network to facilitate scientific and industrial research in the country. It also provides a link between scientific laboratories and industrial establishments for transfer of technologies through National Research Development Corporation (NRDC) and facilitates investment in R&D through Central Electronics Limited (CEL).

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The above objectives are sought to be achieved through the following during the Tenth Plan.

1. Technology Promotion, Development and Utilization (TPDU) Programmes
2. Council of Scientific and Industrial Research (CSIR)
3. Consultancy Development Centre (CDC)
4. National Research Development Corporation (NRDC)
5. Central Electronics Limited (CEL)

Department of Atomic Energy (DAE):

DAE came into being on August 3, 1954, under the direct charge the Prime Minister through a Presidential Order. According to the Resolution constituting the AEC The Secretary to the Government of India in the Department of Atomic Energy is ex-office Chairman the Atomic Energy Commission.

It is committed to peaceful uses of atomic energy, is mainly engaged in establishing production of safe economical nuclear power, using the country's resources of uranium and thorium. It also extends non-electricity applications of nuclear energy in agriculture, healthcare and industry to improve the quality life. It builds research reactors and develops technologies related to accelerators and lasers, and supports basic research in areas related to nuclear energy and other frontier areas of science, though it well equipped multi-disciplinary R&D Centres.

Department of Space (DoS):

DoS operates through a major. Set-up, the Indian Space Research Organisation (ISRO), which is responsible for planning and executing a viable space programs develop satellites and launch systems and provide space-based services in the areas communication, meteorology, resources survey, management and sustainable development.

The Department of Space manages the following agencies and institutes:

1. Indian Space Research Organisation (ISRO) – The primary research and development arm of the DoS.

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2. Vikram Sarabhai Space Centre (VSSC), Thiruvananthapuram
 3. Liquid Propulsion Systems Centres (LPSC), Thiruvananthapuram.
 4. Satish Dhawan Space Centre (SDSC-SHAR), Sriharikota
 5. ISRO Satellite Centre (ISAC), Bangalore
 6. Space Applications Centre (SAC), Ahmedabad
 7. National Remote Sensing Centre (NRSC), Hyderabad
 8. ISRO Inertial Systems Unit (IISU), Thiruvananthapuram
 9. Development and Educational Communication Unit (DECU), Ahmedabad
 10. Master Control Facility (MCF), Hassan
 11. ISRO Telemetry, Tracking and Command Network (ISTRAC), Bangalore
 12. Laboratory for Electro-Optics Systems (LEOS), Bangalore
 13. Indian Institute of Remote Sensing (IIRS), Dehradun
 14. Antrix Corporation – The marketing arm of ISRO
 15. Physical Research Laboratory (PRL), Ahmedabad
 16. National Atmospheric Research Laboratory (NARL), Gadanki
 17. North-Eastern Space Applications Centre (4) (NE-SAC), Umiam
 18. Semi-conductor Laboratory (SCL) Mohali. Indian Institute of Space Science and Technology (IIST), Thiruvananthapuram - India's space University

Department of Biotechnology:

Realising the tremendous potential of biotechnology in improving human and animal health and productivity, enhancing agricultural activity and providing a safe and clean environment, the government set up a multi-agency board namely National Biotechnology Board (NBTB) way back in 1982 with the participation of DST, UGC, ICMR and CSIR to promote activities in biotechnology. Subsequently, the National Board was upgraded to a fully fledged Department of Biotechnology under the Ministry of Science and Technology in 1986. This provided the much-needed impetus to biotechnology, and the Department conceived programmes and formulated integrated programmes in line with its allocation of business rules.

The Department of Biotechnology aims at achieving vision by facilitating emergence of a system that promotes excellence and sustains innovation through implementation of novel schemes/programmes and institutional mechanisms to: ensure availability of

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required numbers of world-class scientists and professionals relevant to R&D and technology development along with a well trained and skilled technical workforce for industry; establish adequate infrastructure, biotechnology incubators and clusters; engage public-private partnerships for development of products of social relevance for applications in agriculture, healthcare, environment and industry, and provide a fiscal, regulatory and legal framework that encourages risk-taking by investors. From the setting up of a National Biotechnology Board in 1982 to a full-fledged Department in 1986, the DBT had attained several milestones in its 30-year journey. There have been significant achievements in the growth and application of biotechnology in the areas of agriculture, healthcare, animal sciences, environment and industry.

Today, India is among the top 12 biotech destinations in the world and ranks third in the Asia-Pacific region, India has the second-highest number of US Food and Drug Administration (USFDA) approved plants, after the USA and is the largest producer of recombinant Hepatitis B vaccine.

Ministry of Earth Sciences (MoES):

The Department of Ocean Development (DOD) was created in July 1981 as a part of the Cabinet Secretariat directly under the charge of the Prime Minister and came into existence as a separate Department in March 1982. The Erstwhile DoD functioned as a nodal Ministry for organizing coordinating and promoting ocean development activities in the country. In February 2006, The Government notified the Department as the Ministry of Ocean Development.

The Government of India further recognized the Ministry of Ocean Development and the new Ministry of Earth Sciences (MoES) came into being vide Presidential Notification dated the 12th July 2006 bringing under its administrative control India Meteorological Department (IMD), Indian Institute of Tropical Meteorology (IITM) and National Centre for Medium Range Weather Forecasting (NCMRWF). The Government also approved the setting up of Earth Commission on the pattern of Space Commission and Atomic Energy Commission.

The Ministry of Earth Sciences (MoES) is mandated to provide the nation with best possible services forecasting the monsoons and other weather/climate parameters,

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ocean state, earthquakes, tsunami and other phenomena related to Earth systems through well-integrated programmes. The Ministry also deals with science and technology for exploration and exploitation of ocean resources (living and non-living), and play a nodal role for Antarctic/Arctic and Southern Ocean Research.

The Defence Research and Development Organisation (DRDO):

DRDO under Ministry of Defence, former in 1958 by the merger of the Technical Development Establishment and the Directorate of Technical Development and Production with the Defence Science Organisation, is charged with the military's research and development.

With a network of 52 laboratories, which are engaged in developing defence technologies covering various fields, like aeronautics, armaments, electronics, land combat-engineering, life sciences materials, missiles, and naval systems, DRDO is India's largest and most diverse research organization. The organization includes around 5,000 scientists belonging to the Defence Research & Development Service (DRDS) and about 25,000 other scientific, technical and supporting personnel.

The Indian Council of Agricultural Research (ICAR):

ICAR is an autonomous organization under the Department of Agricultural Research and Education (DARE), Ministry of Agriculture and Farmer Welfare, Government of India. Formerly known as Imperial Council of Agricultural Research, it was established on 16 July 1929 as a registered society under the Societies Registration Act, 1860 in pursuance of the report of the Royal Commission on Agriculture.

The Council is the apex body for coordinating, guiding and managing research and education in agriculture including horticulture, fisheries and animal sciences in the entire country. With 101 ICAR Institutes and 71 agricultural universities spread across the country, this is one of the largest national agricultural systems in the world.

The ICAR has played a pioneering role in ushering Green Revolution and subsequent developments in agriculture in India through its research and technology development that has enabled the country to increase the production of food grains by 5.4 times,

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horticultural crops by 10.1 times, fish by 15.2 times, milk 9.7 times and eggs 48.1 times since 1951 to 2017.

The Indian Council of Medical Research (ICMR):

ICMR the apex body in India for the formulation coordination and promotion of biomedical research, is one of the oldest and largest medical research bodies in the world. The ICMR is funded by the Government of India through the Department of Health Research, Ministry of Health and Family Welfare.

ICMR's 26 national institute address themselves to research on specific health topics like tuberculosis, leprosy, cholera and diarrheal diseases, viral diseases including AIDS, malaria, kalaazar, vector control, nutrition, food & drug toxicology, reproduction, immuno-hematology, enology medical statistics, etc. its six regional medical research centres address themselves to regional health problems and also aim to strengthen or generate research capabilities in different geographic areas of the country.

In addition to R&D establishments, the other major body pursuing S&T activities in India is the country's vast university system.

Questions:

1. Give a brief history of DRDO and also explain its significant achievements.
2. Mention some of the Science and Technology Institutions in India. Explain it.