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**STANDING COMMITTEE ON DEFENCE
(2023-24)**

(SEVENTEENTH LOK SABHA)

MINISTRY OF DEFENCE

**A REVIEW OF THE WORKING OF THE DEFENCE
RESEARCH AND DEVELOPMENT ORGANISATION
(DRDO)**

FORTY-SECOND REPORT



**LOK SABHA SECRETARIAT
NEW DELHI**

December, 2023 / Agrahayana 1945 (Saka)

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RESEARCH AND DEVELOPMENT ORGANISATION
(DRDO)**

Presented to Lok Sabha on 20.12.2023

Laid in Rajya Sabha on 20.12.2023



LOK SABHA SECRETARIAT

NEW DELHI

December, 2023 / Agrahayana 1945 (Saka)

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COMPOSITION OF THE STANDING COMMITTEE ON DEFENCE (2022-23)

SHRI JUAL ORAM

-

CHAIRPERSON

Lok Sabha

2	Shri Nitesh Ganga Deb
3	Shri Rahul Gandhi \$
4	Shri Devaragunda Venkappa Sadananda Gowda
5	Shri Annasaheb Shankar Jolle
6	Choudhary Mehboob Ali Kaiser
7	Shri Suresh Kumar Kashyap
8	Shri Rattan Lal Kataria ^
9	Prof. (Dr.) Ram Shankar Katheria
10	Shri Durai Murugan Kathir Anand @
11	Kunwar Danish Ali
12	Dr. Rajashree Mallick
13	Dr. T.R. Parrivendhar %
14	Shri Reddeppa Nallakonda Gari*
15	Shri Uttam Kumar Reddy Nalamada
16	Shri Anumula Revanth Reddy
17	Shri Jugal Kishore Sharma
18	Dr. Shrikant Eknath Shinde
19	Shri Prathap Simha
20	Dr. Amar Singh #
21	Shri Brijendra Singh
22	Shri Mahabali Singh
23	Shri Kotagiri Sridhar @@
24	Shri Durga Das Uikey

Rajya Sabha

25	Dr. Ashok Bajpai
26	Shri Prem Chand Gupta
27	Shri Sushil Kumar Gupta
28	Shri Venkataramana Rao Mopidevi
29	Shri Kamakhya Prasad Tasa
30	Dr. Sudhanshu Trivedi
31	Smt. P.T. Usha
32	Shri G.K. Vasani
33	Lt. Gen. (Dr.) D. P. Vats (Retd.)
34	Shri K.C. Venugopal

NOTE:- \$Ceased to be a Member of the Committee consequent upon his disqualification from Membership of Lok Sabha vide LSS Notification No. 21/4(3)/2023/TO(B) dated 24/03/2023; and disqualification ceased to be operate vide Lok Sabha Secretariat Notification No. 21/4(9)/2023/TO(B), dated 7th August, 2023 and re-nominated to the Committee on 16.08.2023.

^Sad demise on 18.05.2023.

@ Nominated w.e.f 08.12.2022.

%HS changed the nomination from SCoD to Committee on EWCY&S on 16.11.2022

★ Nominated w.e.f 16.11.2022.

nominated on 16.08.2023.

@@HS changed the nomination from SCoD to Committee on Railway on 16.11.2022

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***Shri Anumula Revanth Reddy ceased to be member of the Standing Committee on Defence w.e.f. 8th December, 2023 vide Lok Sabha Secretariat notification no 21/1(3)/2023/T(B) dated 8th December, 2023.**

@ Shri Uttam Kumar Nalamada Reddy ceased to be member of the Standing Committee on Defence w.e.f. 13th December, 2023 vide Lok Sabha Secretariat notification no 21/1(5)/2023/T(B) dated 13th December, 2023.

SECRETARIAT

1. Dr. Sanjeev Sharma - Joint Secretary
2. Shri Tirthankar Das - Director
3. Shri Rahul Singh - Deputy Secretary
4. Shri Rajesh Kumar - Executive Officer

INTRODUCTION

I, the Chairperson of the Standing Committee on Defence (2023-24), having been authorized by the Committee, present this Forty-second Report (17th Lok Sabha) of Standing Committee on Defence on the subject "A review of the working of the Defence Research and Development Organisation (DRDO)".

2. The subject 'A review of the working of the Defence Research and Development Organisation (DRDO)' was selected for the examination during the year 2022-23. A briefing by the representatives of the Ministry of Defence on the subject was held on 14th November, 2022. The Committee took evidence of the representatives of the Ministry of Defence on 11th April, 2023. The subject was carried forward for examination by the successor Committee during 2023-24. The draft Report was considered and adopted by the Committee at their Sitting held on 18th December, 2023. The Minutes of the Sittings of the Committee are appended to the Report.

3. For facility of reference and convenience, Observations/Recommendations of the Committee have been printed in bold letters in Part II of the Report.

4. The Committee thank their predecessor Committee for taking oral evidence and obtaining information on the subject.

5. The Committee wish to express their thanks to the officers of the Ministry of Defence for appearing before the Committee and furnishing the material and information which the Committee desired in connection with examination of the subject.

6. The Committee also place on record their appreciation of the assistance rendered to them by the Committee Secretariat.

**New Delhi;
18 December, 2023
27 Agrahayana, 1945 (Saka)**

**JUAL ORAM
Chairperson
Standing Committee on Defence**

Report

Chapter I

Introductory

(i) DRDO as an organisation

The Committee have learnt that India's defence requirements in terms of indigenous systems are being taken care of by Defence Research and Development Organisation (DRDO) which works for providing cutting-edge technologies and systems for Armed Forces. DRDO was established in 1958 with an objective to build up science-based capability towards making improvements in existing weapon systems including imported equipment. Later on, during seventies, it got involved in the development of armaments and ammunition. Thrust was given to major programmes, like development of guided missiles, electronic warfare systems, aircraft, communication systems, etc., in 1980s. These programmes gave a new impetus to multiple design and technology centres, which resulted in productionisation of weapon systems during 1990s. The Department of Defence Research and Development Organization (DRDO) came into existence in 1980. DRDO has now emerged as one of the premier scientific and technological organisations in the country.

1.2 The Organization has core competence in systems design and integration of complex sensors, weapon systems and platforms; development of complex high-end software packages; development of functional materials; systems testing and evaluation; and technology transfer for productionisation. Realising the importance of the organization, the Committee took up the subject "A review of the working of DRDO" for detailed examination and report. In pursuance of their examination the Committee undertook briefing as well as oral evidence of the Ministry of Defence/DRDO.

1.3. The Ministry has informed that DRDO primarily takes projects based on the projected requirements in Long Term Integrated Perspective Plan (LTIPP) or their immediate requirements. DRDO also undertakes certain small value projects to enhance science and technology base to support future projects, which DRDO feels, will be required by Armed Forces. It is a known fact that technologically advanced countries do not share their critical technologies with developing countries. As these countries offer only "Buy" category of systems to India, therefore, it became mandatory for DRDO to develop each system, sub-systems and components abinitio including infrastructure and testing facilities at their own volition indigineously.

1.4 The Committee have also learnt that DRDO is spending approx 36 percent of its Annual Budget on development of strategic systems required by the country and many strategic systems developed by DRDO have been inducted into Services. The Organisation is fully dedicated towards progressive enhancement of self reliance in defence systems and state-of-the-art technologies and also to enhance its R&D infrastructural base and capabilities.

(ii) Sphere of Activities/Business of DRDO

1.5 The Committee have been given to understand that the sphere of Activities/Business of DRDO is as follows:

- a) Apprising, assessing and advising Raksha Mantri on the influence on National Security of emerging developments in Science and Technology.
- b) Rendering advice to Raksha Mantri and to the three services and inter-services.
- c) Organisations on all scientific aspects of weapons; weapon-platforms; military operations; surveillance; support and logistics in all likely theatres of conflict.
- d) To function, with the concurrence of the Ministry of External Affairs, as the nodal Coordinating agency of the Ministry of Defence on all matters relating to Instruments of Accord with foreign Governments relating to the acquisition of technologies whose Export to India is the subject of national security related controls of foreign Governments.
- e) Formulation and execution of programmes of scientific research and design, development, test and evaluation, in fields of relevance to national security.
- f) Direction and administration of agencies, laboratories, establishments, ranges, facilities, programmes and projects of the Department.
- g) All matters relating to certification of the design Air Worthiness of Military Aircraft, their equipment and stores.
- h) All matters relating to the protection and transfer of technology generated by the activities of the Department.
- i) Scientific analysis support and participation in the acquisition and evaluation .
- j) Proceedings of all weapon systems and related technologies proposed to be acquired by the Ministry of Defence.
- k) To render advice on the technological and intellectual property aspects of the import of technology by production units and enterprises manufacturing, or proposing to manufacture, equipment and stores for the Armed Services.
- l) To deal with reference made under section 35 of the Patents Act, 1970 (39 of 1970).
- m) Financial and other material assistance to individuals, institutions, universities and bodies corporate, for study and for the training of

- manpower on aspects of Science and Technology that bear on national security.
- n) In consultation with the Ministry of External Affairs, international relations in matters connected with the role of Science and Technology in national security including:
- Matters relating to relations with Research Organisations of other countries and with Inter-governmental agencies, particularly those which concern themselves, Inter-alia, with the scientific and technological aspects of national security.
 - Arrangements with Universities, educational and research-oriented institutions or bodies corporate abroad to provide for foreign scholarships and the training of Indian scientists and technologists under the administrative control of the Department.
- o) Execution of works and purchase of lands debitable to the budget of the Department.
- p) All matters relating to personnel under the control of the Department.
- q) Acquisition of all types of stores, equipment and services debitable to the budget of the Department.
- r) Financial sanctions relating to the Department.
- s) Any other activity assigned to, and accepted by, the Department through Understanding or arrangements with any other Ministry, Department, Agency of the Government of India whose activities have a bearing on the scientific and Technological aspects of national security.

Stakeholders/Clients

1.6 The Ministry has informed that Stakeholders/Clients are primarily, Ministry of Defence (MoD), Ministry of External Affairs (MEA), Ministry of Home Affairs (MHA), Army, Navy, Air Force, R&D centres of other Government Departments, Public and Private Sectors, Academic Institutions, Ordnance Factories, Public Sector Undertakings and Industrial Partners, Citizens of the Country and other Ministries have been identified as stakeholders/clients of the Department of Defence Research and Development in varying degrees.

(iii) Organisational Structure

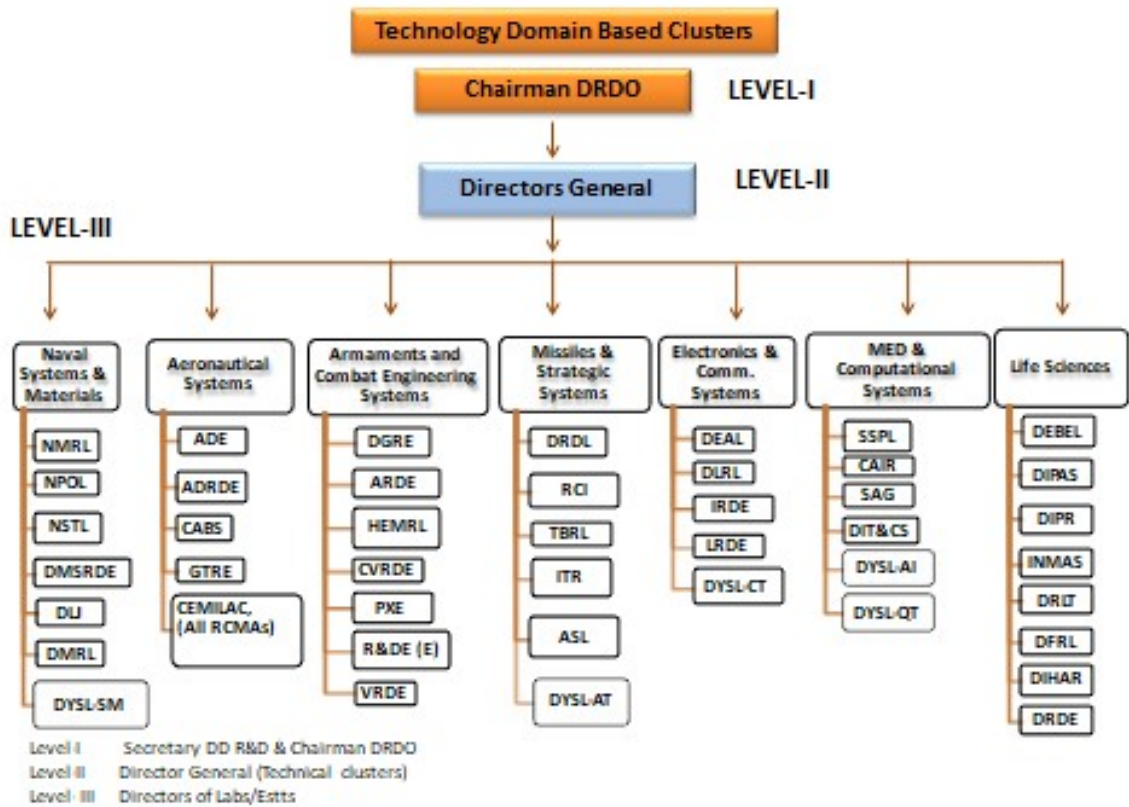
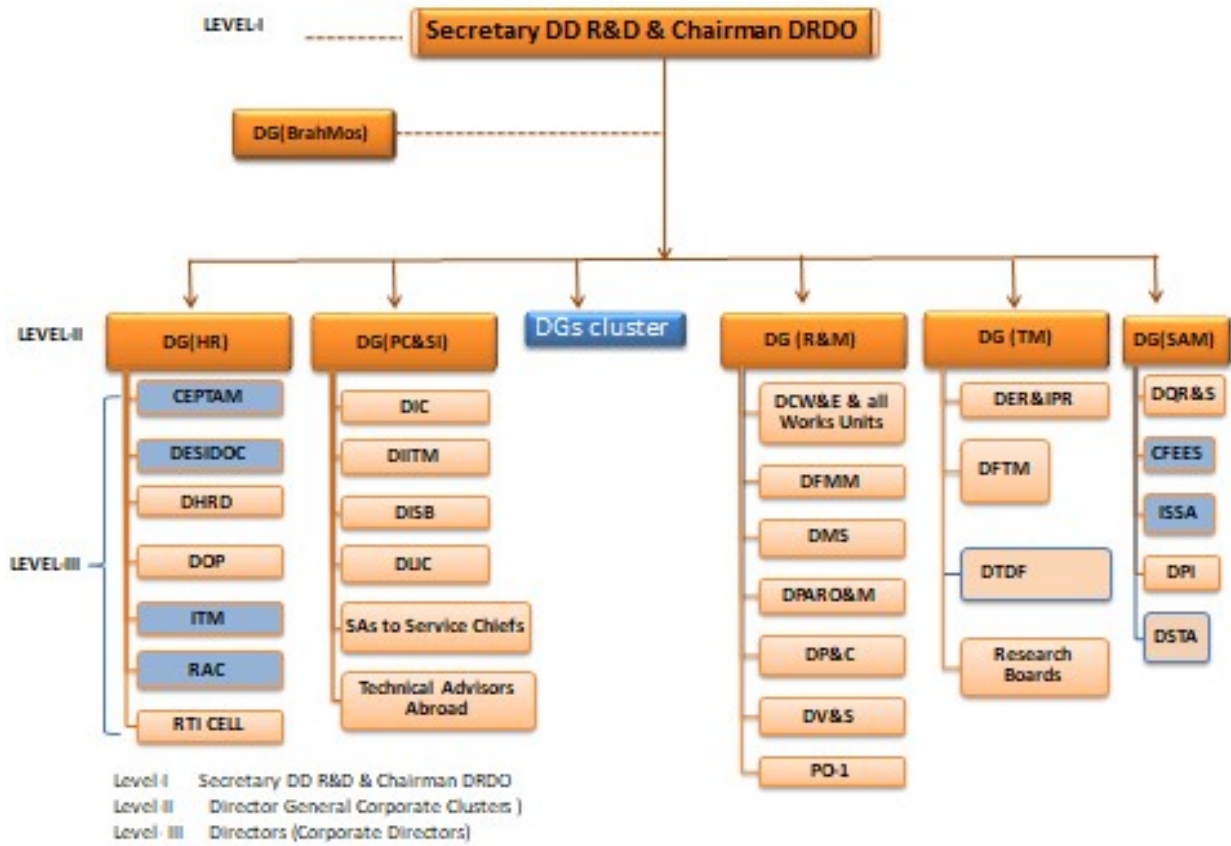
1.7 In a note furnished to the Committee, the Ministry submitted regarding the Organisational Structure of DRDO which is as under :-

“To accomplish the vision and mission, DRDO has a mission mode structure, headed by the Secretary, Department of Defence Research and Development and Chairman, DRDO. The Secretary is assisted by the Director Generals (DGs). The Organisation has Corporate HQrs at New Delhi and laboratories/establishments, regional centers, field stations, etc. spread all over

the country from Jodhpur to Tejpur and Leh to Kochi.

DRDO HQrs has five Director Generals: Human Resources (HR); Resources & Management (R&M); Systems Analysis and Modelling (SAM); Production Coordination & Services Interaction (PC & SI); and Technology Management (TM) at New Delhi. The Corporate Directorates are: Directorate of Personnel; Human Resource Development; Planning & Coordination; Management Services; Civil Works and Estates; Budget, Finance & Materials Management; Vigilance & Security; Parliamentary Affairs and Rajbhasha and Organisation & Methods; Public Interface; International Cooperation; Cyber Security; Industry Interface and Technology Management; Interaction with Services for Business; Low Intensity Conflict; Quality, Reliability and Safety; Futuristic Technology Management Group; Simulation and Modelling and Extramural Research and Intellectual Property Rights. These Directorates formulate policies in their respective areas for enhancing effectiveness of the laboratories and also obtaining Government approvals for taking up projects and for creating new infrastructures, facilities, etc. There are seven Technology Clusters headed by Cluster DGs located all over the country: Naval Systems & Materials at Vishakhapatnam; Armaments & Combat Engineering Systems at Pune; Electronics & Communication Systems and Aeronautical Systems, both at Bengaluru; Missiles and Strategic Systems at Hyderabad; Microelectronic Devices & Computational Systems and Life Sciences, both at New Delhi.

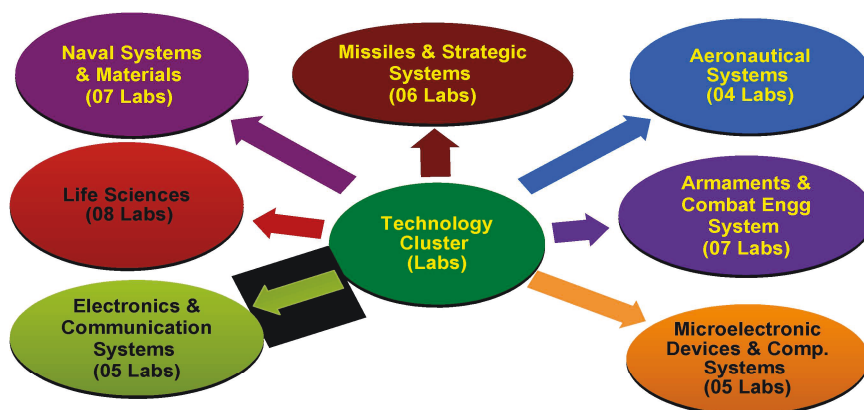
ORGANISATION CHART OF DRDO HQrs



1.8 Programmes/projects of DRDO as intimated are being executed through a network of laboratories/ establishments, Field Stations and Regional Centres of Military Airworthiness (RCMA's) etc. located all over the country. These are engaged in R&D

activities in the field of aeronautics, armaments, missiles, combat vehicles, advanced computing & networking, electronics, opto-electronics, military engineering systems, life sciences, advanced materials & composites, underwater sensors/weapons, warship technology, low intensity conflict technologies, NBC Technology, cyber security etc. These laboratories/ establishments have been grouped into following 7 clusters.

1.9 With regard to various Laboratories/Establishments in DRDO, the Ministry stated as under:



The Technology Cluster Laboratories/Establishments of DRDO are given below:

Missiles & Strategic Systems Laboratories	
1.	Advanced Systems Laboratory (ASL), Hyderabad
2.	Defence Research & Development Laboratory (DRDL), Hyderabad
3.	Integrated Test Range (ITR), Balasore
4.	Research Centre Imarat (RCI), Hyderabad
5.	Terminal Ballistics Research Laboratory (TBRL), Chandigarh
Aeronautical Systems Laboratories	
6.	Aerial Delivery Research & Development Establishment (ADRDE), Agra
7.	Aeronautical Development Establishment (ADE), Bengaluru
8.	Centre for Air Borne System (CABS), Bengaluru
9.	Gas Turbine Research Establishment (GTRE), Bengaluru
10.	Centre for Military Airworthiness & Certification (CEMILAC), Bengaluru
Naval Systems Laboratories	
11.	Naval Materials Research Laboratory (NMRL), Ambernath
12.	Naval Physical & Oceanographic Laboratory (NPOL), Kochi
13.	Naval Science & Technological Laboratory (NSTL), Vishakhapatnam
Materials Science Laboratories	
14.	Defence Laboratory (DL), Jodhpur
15.	Defence Materials & Stores Research & Development Establishment (DMSRDE), Kanpur
16.	Defence Metallurgical Research Laboratory (DMRL), Hyderabad
Electronics & Communication Systems Laboratories	
17.	Defence Electronics Applications Laboratory (DEAL), Dehradun
18.	Defence Avionics Research Establishment (DARE), Bengaluru
19.	Defence Electronics Research Laboratory (DLRL), Hyderabad

20.	Electronics & Radar Development Estt (LRDE), Bengaluru
21.	Instruments Research & Development Estt (IRDE), Dehradun
22.	Laser Science & Technology Centre (LASTEC), Delhi
23.	Centre for High Energy Systems and Sciences (CHESS), Hyderabad
Microelectronic Devices & Computational Systems Laboratories	
24.	Centre for Artificial Intelligence & Robotics (CAIR), Bengaluru
25.	Joint Cypher Bureau (JCB), Delhi
26.	Microwave Tube Research & Development Centre (MTRDC), Bengaluru
27.	Scientific Analysis Group (SAG), Delhi
28.	Solid State Physics Laboratory (SSPL), Delhi
Armament Systems Laboratories	
29.	Armament Research & Development Establishment (ARDE), Pune
30.	High Energy Materials Research Laboratory (HEMRL), Pune
31.	Proof and Experimental Establishment (PXE), Balasore
32.	Defence Geoinformatics Research Establishment (DGRE), Chandigarh
Combat Vehicles and Engineering Laboratories	
33.	Combat Vehicles Research & Development Establishment (CVRDE), Avadi
34.	Research & Development Estt (Engrs) [R&DE(E)], Pune
35.	Vehicle Research & Development Estt (VRDE), Ahmednagar
Life Sciences Laboratories	
36.	Defence Bio-engineering & Electromedical Laboratory (DEBEL), Bengaluru
37.	Defence Food Research Laboratory (DFRL), Mysore
38.	Defence Institute of Bio-Energy Research (DIBER), Haldwani
39.	Defence Institute of High Altitude Research (DIHAR), Leh
40.	Defence Institute of Physiology & Allied Science (DIPAS), Delhi
41.	Defence Institute of Psychological Research (DIPR), Delhi
42.	Defence Research & Development Establishment (DRDE), Gwalior
43.	Defence Research Laboratory (DRL), Tejpur
44.	Institute of Nuclear Medicine & Allied Sciences (INMAS), Delhi
HR Institutions	
45.	Centre for Personnel Talent Management (CEPTAM), Delhi
46.	Institute of Technology Management (ITM), Mussoorie
47.	Recruitment and Assessment Centre (RAC), Delhi
# Others	
48.	Advanced Centre for Energetic Materials (ACEM), Nasik
49.	Centre for Advanced Systems (CAS), Hyderabad
50.	Defence Scientific Information & Documentation Centre (DESIDOC), Delhi
51.	DRDO Integration Centre (DIC), Panagarh
52.	Institute of Systems Studies and Analyses (ISSA), Delhi
53.	Mobile Systems Complex (MSC), Pune
54.	SF Complex (SFC), Jagdalpur
55.	Centre for Fire Explosive & Environment Safety (CFEES), Delhi
Centres of Excellence	
56.	North East Science & Technology Centre (NESTC), Mizoram University
57.	Kalam Centre for Science & Technology (KCST), Central University of Jammu
58.	JC Bose Centre for Advance Technology (JCBCAT) , Jadavpur University (JU) Kolkata
59.	Bi-nodal Centre of Propulsion Technology (CoPT) at IIT-Bombay and IIT Madras
60.	DRDO- IIT Delhi, Joint Advanced Technology Centre (JATC) at IIT Delhi
61.	Advanced Centre for Research in High Energy Materials (ACRHEM) , University of Hyderabad

#62.	DRDU-BU Centre for Life Sciences at Bharathiar university
63.	Research and Innovation Centre (RIC), IIT Chennai
Deemed University	
64.	Defence Institute of Advanced Technology (DIAT), Pune
Autonomous Body	
65.	Aeronautical Development Agency (ADA), Bengaluru
Joint Venture	
66.	BrahMos Aerospace Private Limited, New Delhi
Societies	
67.	Gallium Arsenide Enabling Technology Centre (GAETEC), Hyderabad
78.	Society for Integrated Circuit Technology and Applied Research (SITAR), Bengaluru
69.	Semiconductor Technology and Applied Research (STAR-C)

(iv) Budget and Expenditure

1.10 When asked to furnish the break up of the funds allocated and utilized by DRDO on R&D and fundamental research activities, the Ministry stated as under:

“The Ministry informed that the Department of Defence R&D was allocated Rs 3.14 Cr in 1961-62 out of total budget allocation of Rs 313.00 Cr to Ministry of Defence, which was about one percent of Defence Budget. Over the years, it has gone up and touched Rs 23263.89Cr for the Financial Year 2023-24 with corresponding increase in number of projects/ programmes. The following Table shows Defence R&D Expenditure/Allocation as compared to Defence Expenditure during the period from 2010-11 to 2023-24.

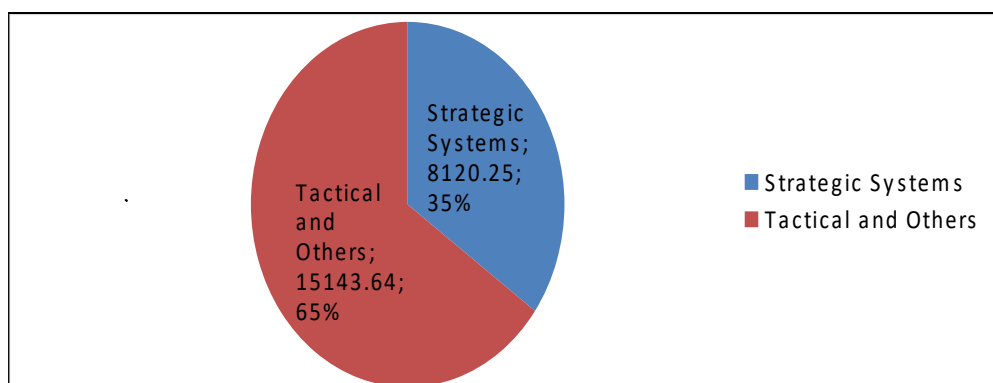
Defence Expenditure vs. Defence R&D Expenditure

Year	DefenceExp (Rsin cr)	DefenceR&D Exp (Rsin cr)	DefenceR&D Exp (as % of DefExp)
2010-11	154117.00	10148.92	6.59
2011-12	170913.00	9893.84	5.79
2012-13	181776.00	9794.80	5.39
2013-14	203499.35	10868.88	5.34
2014-15	218694.00	13257.98	6.06
2015-16	225923.00	13317.12	5.89
2016-17	225900.00	13382.05	5.92
2017-18	272560.00	15203.04	5.58
2018-19	287689.00	17049.01	5.93
2019-20	318664.58	17375.13	6.23
2020-21	340093.51	15706.98	4.62

2021-22	347088.28	20457.44	5.89
2022-23(BE)	385370.15	21330.20	5.53
2023-24(BE)	432604.72	23263.89	5.38

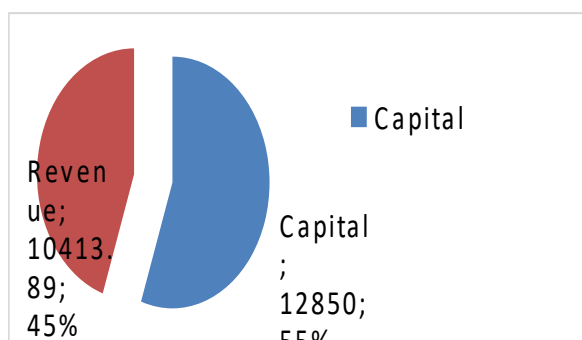
Out of total allocated budget of Rs 23263.89Cr, approximately 34.90% is utilized for Development of strategic systems and 65.10% for the tactical and other systems, including salaries, transportation, training, miscellaneous, etc. The following pie diagram shows the pattern of expenditure to be incurred during current financial year.

BUDGET DISTRIBUTION (2023-24)



Total Budget: Rs 23263.89 Cr

DEFENCE R&D BUDGET (2023-24)



Total (Net) for Defence R&D is Rs 23263.89 Cr, which is 5.38% of Defence Budget (Rs. 432604.72 Cr)

Fund Provision for 2023-24. Total is Rs. 23263.89 Cr

1.11 Of the 65% funds earmarked for R&D activities, the fund requirement for strategic scheme is Rs. 6140 Cr, which is about 52% of funds earmarked for R&D activities:

DEFENCE R&D BUDGET (REVENUE & CAPITAL)

Year	Revenue	Capital	Total
2010-11	5183.83(51.08%)	4965.09(48.92%)	10148.92
2011-12	5277.56(53.34%)	4616.28(46.66%)	9893.84
2012-13	5150.37(52.58%)	4644.43(47.42%)	9794.80
2013-14	5627.36(51.78%)	5241.52(48.22%)	10868.88
2014-15	5775.46(43.56%)	7482.52(56.44%)	13257.98
2015-16	5798.42(43.54%)	7518.70(56.46%)	13317.12
2016-17	6610.54 (49.40%)	6771.51(50.60%)	13382.05
2017-18	7754.54 (51.01%)	7448.50(48.99%)	15203.04

2018-19	7818.38 (45.86%)	9230.29(54.14%)	17048.67
2019-20	8682.03 (49.97%)	8693.10(50.03%)	17375.13
2020-21	7982.67(50.82%)	7724.31(49.18%)	15706.98
2021-22 (BE)	9081.94(44.39%)	11375.50(55.61%)	20457.44
2022-23 (BE)	9348.39(43.83%)	11981.81(56.17%)	21330.20
2023-24	10413.89 (44.76%)	12850.00(55.24%)	23263.89

1.12 During the oral evidence while giving a comparative estimate of the budgetary spending, on R&D in India with that of the developed countries, Secretary, DRDO apprised the Committee as follows:

“Sir, regarding this percentage spent on defence R&D, if we have to compete with the USA and China and want to have aspirations to become a global leader, we have to increase that spend. I guess our economy currently is not in that position because there are lot of other competing needs. So, at this point, if we want to only become *atmanirbhar* and protect ourselves, then with this percentage of funding, we can do a good job of protecting ourselves. But if we have aspirations to become a global leader, this percentage will not be sufficient. We will have to increase the percentage of defence budget that we spend on R&D.”

1.13 Further, on the lower allocation of R&D Budget in India as compared to other countries, he submitted before the Committee by stating:

“We are much lower than what is the norm globally. We have to look at it both as a percentage of GDP and as a percentage of defence budget. As a percentage of GDP, that is the government’s call because government has to allocate resources to various sectors. But as a percentage of defence budget, I think the MOD has to look at how it can increase the R&D budget if we have to achieve Atmanirbharata. Now that the full ecosystem is getting involved, I think there is scope for increasing the percentage of the defence budget for R&D. Currently it is of the order of five per cent. Most countries spend 10 to 15 per cent of their defence budget on R&D. So, there is definitely a scope there”.

1.14 When enquired about the budgetary projections and allocations made for DRDO in the year 2021-22 and 2022-23, the Ministry submitted in its replies as under:

“The Budgetary projection and the allocations to Deptt. of Defence R&D at different budgetary stages is as under -

(Rs in Crore)

Year	BE Proposed	BE Approved	RE Approved	MA Approved
2021-22	23460.00	20457.44	18337.44	18720.44
2022-23	22990.00	21330.20		

1.15 When asked whether the budget provided for the year 2021-22 and 2022-23 is adequate for undertaking the research projects envisaged by DRDO, the Ministry in their written replies submitted as under:

“Yes, Sir. During the Budget announcement 2022, it has been announced by Hon’ble FM that Defence R&D will be opened up for industry, Start-ups and academia with 25 per cent of Defence R&D budget earmarked.

Defence R&D has been opened up with **25% of defence R&D budget** earmarked for the purpose and funding is being done to industry, start-ups and academia. This is being implemented through various existing schemes and new schemes have also been proposed and under approval. This would lead to some amount of deficit in budget of ongoing and future projects of DRDO. Therefore, an additional amount of budget enhancement is required to ensure that research and development activities continue as envisaged by DRDO”.

CHAPTER II

(i) Human Resources

2.1 The Committee have been informed through a written note that DRDO being a premier Defence R&D Organization follows a dynamic system of manpower management which is issued by way of authorized Regular Establishment (RE). The RE is reviewed every two years to meet the contingent requirements on account of workload and new projects undertaken by the laboratories. The Organization optimally utilizes manpower through dynamic manpower management system. In order to keep the Organization young and energetic and also to fill deficiencies created on account of retirement and superannuation, approximately 100 fresh scientists are recruited by Recruitment and Assessment Centre (RAC), DRDO every year as per functional requirements of the laboratories. However, this year under the aegis of Mission Mode Recruitment 2023 (MMR-23) more than 850 Group 'A' posts (Scientists) are under recruitment by RAC and over 2200 vacancies of Group 'B' & Group 'C' posts (Technical Cadre and Admin & Allied Cadres) are under recruitment by Centre For Personnel, Talent Management (CEPTAM), DRDO. The present held strength of DRDO (as on 01 Aug 2023) is as given in the table below :-

Cadre	Strength as on 01 August 2023
Defence Research and Development Service (DRDS)	6713
Defence Research and Technical Cadre (DRTC)	9484
Administration Cadre	1850
Allied Cadre	1898
Works Cadre	33
Service Officers	382
Service Personnel	1371
Total	21731

2.2 DRDO is continuously incorporating new trainings to enhance the organizational effectiveness by enhancing its resources and capabilities through training of personnel in R&D and Engineering skills, exposure to allied technologies and focus on strategic planning and leadership. DRDO ensures training to all cadres of personnel through training institutes like DIAT, Pune (for technical courses); ITM, Mussoorie (for techno-managerial programmes); and Training Institute, Jodhpur (for technical, administrative and allied cadres) so that they are professionally equipped to take further responsibilities. Every year some scientists are deputed to undergo ME/M.Tech & PhD at IITs, IISc Bengaluru and other reputed universities under the sponsorship programme. Targeted Training Centre (TTC) has been set up at Dr. Raja Ramanna Complex, Bengaluru which is used to plan and conduct Targeted Training for DRDO Scientists/Technologists to keep pace with the rapid advancement of technology and

develop competence in state-of-the-art –cutting-edge technologies.

2.3 Further, it is informed that Specialised Technical and Management courses for scientists are being organized at premier S&T and Management Institutes. Continuing Education Programme (CEP) courses are also part of DRDO annual training schedule. To enhance techno-managerial capabilities of Middle and Senior level scientists, various Management Development Programmes (MDPs) are also conducted every year at various IIMs and premier Business Schools.

2.4 On the issue of increasing organizational effectiveness, through training, the Ministry in a written note intimated the Committee as under:

DRDO is continuously devising new methods of training to enhance the Organisational effectiveness by enhancing its resources and capabilities through training of personnel in R&D and Engineering skills, exposure to allied technologies and focus on strategic planning and leadership. DRDO ensures training to all cadres of personnel through training institutes, like DIAT, Pune (for technical courses); ITM, Mussoorie (for techno- managerial programmes); and Training Institute, Jodhpur (for technical, administrative and allied cadre) so that they are professionally equipped to take future responsibilities. Every year few selected scientists are deputed to undergo ME/M Tech & Ph.D at IIT's, IISC, Bangalore and other reputed Indian Universities under the sponsorship programme. Targeted Training Centre (TTC) has been set up at Dr. Raja Ramanna Complex, Bangalore, which is used to plan and conduct Targeted Training for DRDO Scientists/Technologists to keep pace with the rapid advancement of technology and develop competence in state-of-the-art cutting-edge technologies. Specialised Technical and Management Courses for Scientists are being organized at Premier S&T & Management Institutes. Continuing Education Programme (CEP) courses are also part of DRDO annual training schedule.

To keep the technical personnel abreast with latest technologies around the world, they are deputed to undergo technical training at reputed foreign institutes also. They are also encouraged to attend international seminars/conferences/symposiums/workshop etc at various national and international forums.

(ii) Training

2.5 The Committee desired to know the various types of training given to the Scientists and other technical staff. In this regard, the Ministry, through written information informed as under:

DRDO is offering the following types of training to the Scientists and other technical staff :

Technical Training, Targeted Training, Managerial Training, Techno-Managerial Training, Training, Induction Training, Orientation Training, etc.

2.6 Further, the Ministry on the training given to scientists in allied fields other than technical/scientific field, submitted through written replies:

“Yes. The following types of training are also being offered in allied fields other than technical/scientific fields:

Technology Management, Organizational Behaviour, R&D Management, Project Management, Soft Skills for Enhancing Interpersonal effectiveness, Enhancing Public Procurement Skills, etc”.

(iii) Grievances Redressal Mechanism (GRM)

2.7 On Grievances Redressal Mechanism (GRM), the Ministry in their written replies submitted as under:

“Grievances Redressal Mechanism (GRM) in DRDO is as per Department of Administrative Reforms & Public Grievances (DARPG) instructions. Grievances Redress Committees (GRCs) are functioning in every laboratory of DRDO to deal with the administrative grievances of employees working in DRDO for early redressal of grievances. The complaints/grievances received on Centralised Public Grievances Redress and Monitoring System (CPGRAMS) is regularly monitored and put up in the monthly GRC meetings. The report of CPGRAMS is also shared and uploaded on e-samiksha portal of Cabinet Sectt. The status of grievances as on 31st Oct 2022 is as: Received=1220 Disposed=1153. Disposal %age=94.5% in this regard,

The grievances received by the Department are broadly categorized as:-

- (i) Recruitment related;
- (ii) Pension related;
- (iii) Contractual employee issues;
- (iv) Com-passionate appointment related;
- (v) Corruption related;
- (vi) Procurement related;
- (vii) Land & Works issues; and
- (viii) DRDO run schools/Infrastructure issues.”

2.8 When the Ministry was asked on the reasons for not achieving 100% grievance redressal, it was informed as under:

“DRDO maintains a grievance redressal rate of around 95% at any point of time. However, there may be certain pendency in grievance redressal due to the following reasons:-

- (i) Third party grievances: Though interim reply is sent within the stipulated period, the final quality disposal of grievance may take time depending upon receipt of satisfactory reply from the third party i.e. pensions/PCDA (Pensions), etc.
- ii) Quality disposal of grievances: Certain information required for quality disposal of grievances takes time as data is to be collected and collated from multiple agencies. Some of them from outside DRDO.

- (iii) Incomplete data/details in the grievances: Certain complainants fail to provide the cardinal data required for quality redressal of grievances. Much time is lost in deciphering the actual grievance through analytical approach.
- (iv) Wrongly addressed grievances: Grievances with incomplete information when deciphered properly turn out to be not concerned with Department leading in wastage of time and resources.”

(iv) Vacancies

2.9 When asked about the current status in regard to vacancies and plan for filling up the same, the Ministry in its written replies stated as under:

“Recruitment of 859 posts of Scientists is under process in DRDO and this will be completed by June 2023”.

2.10 During oral evidence, a representative of DRDO apprised the Committee on vacant posts of Scientists in DRDO by stating as under:

“सर, हमारे पास साइंटिस्ट्स की करीब 800 वेकेंसीज हैं। हमने अगस्त में ही करीब 700 पोस्ट्स के लिए एडवर्टीजमेंट कर दिया था। The recruitment process is at a very advanced stage. By February end, we will be able to recruit approximately 700 scientists within the organization. So, this will solve the problem. जहां तक दो सालों में आई प्रॉब्लम्स का प्रश्न है, हम लोगों के एकेडमिया के द्वारा जो प्रोग्राम्स चल रहे हैं, जो पीएचडी स्टूडेंट्स हैं, इन सबको यूटिलाइज करते हुए, जो कमी है, उसकी भरपाई करने की कोशिश की है। वह काम ठीक से चल रहा है और जब ये नए लोग जॉइन करेंगे, तब आगे तक जाने में कोई असुविधा नहीं होगी।“

2.11 Further, Secretary, DRDO apprised the Committee on this issue by adding :

“डीआरडीओ ने एडिशनल मैनुपावर के लिए रिक्वेस्ट किया है, लेकिन सरकार का विचार है कि होल-नेशन-एप्रोच यूज करनी चाहिए, आरएंडडी केवल डीआरडीओ में ही नहीं होनी चाहिए। इसीलिए, हम आजकल इंडस्ट्री और एकेडमिया के साथ प्रारंभ से मिलजुलकर काम कर रहे हैं। उससे यह हो रहा है कि भले ही हमारी मैनुपावर नहीं बढ़ रही है लेकिन इफेक्टिव मैनुपावर, जो डिफेंस आरएंडडी पर काम कर रही है, वह काफी बढ़ रही है। अतः जैसा कि आप लोग कह रहे हैं कि कमी न हो, in the number of people working in Defence R&D, इस मेकेनिज्म से उसका हम उपयोग कर रहे हैं।“

2.12 On being asked about issue of delay in promotion of Scientists for two years, Secretary, DRDO during oral evidence stated:-

“सर, यह हमारे अधिकार के बाहर है। डीआरडीओ ने इंटरव्यूज कराए थे। लिस्ट डीओपीटी को भेजी थी। आगे क्यों नहीं हुआ, उसकी जानकारी हम कैसे दे सकते हैं? आप कह रहे हैं, वह सही है, लेकिन यह डीआरडीओ की गलती नहीं थी। हम लोगों ने पूरा इंटरव्यू कनडक्ट करके डीओपीटी को लिस्ट भेजी थी, क्योंकि हमारे प्रमोशन्स, जो सीनियर लेवल पर हैं, वे डीआरडीओ और रक्षा मंत्रालय से नहीं होते, बल्कि वे डीओपीटी और एसीसी के पास जाते हैं। उन्होंने क्यों नहीं किया, यह हम कैसे बता सकते हैं?”

CHAPTER –III

Working of DRDO

The Committee wanted to be apprised of the details of major projects which were being undertaken by DRDO to which the Ministry replied as under :-

(i) Type of Projects undertaken by the DRDO

3.2 Mission Mode (MM) Projects

Major Mission Mode projects include the followings:

- i) Medium Range Surface to Air Missile (MRSAM) system for Indian Air Force
- ii) LCA Mk-II
- iii) LRSAM
- iv) Quantum Communication for Metropolitan Cities (QMAN)
- v) Airborne Early Warning & Control System Mk – II (AEW&C Mk-II) for IAF
- vi) Advanced Light Weight Torpedo (ALWT)

3.3 Technology Demonstration (TD) Projects

Technology demonstration and maturity is the key for self-reliance in defence equipment and systems. Some of the major projects in this category are as follows:

- i) Active Electronically Scanned Array (AESA) Radar
- ii) New Generation Anti-Radiation Missile (NGARM)
- iii) Supersonic Missile Assisted Release of Torpedo (SMART)
- iv) Beam Combined Fiber Laser Source (BCFL)
- v) Digital Fuel Flow Controller

3.4 Science & Technology (S&T) Projects

S&T projects are undertaken for basic or applied research activities Some of the major projects in this category are as follows:

- i) Enhanced Blast Polymer Bonded Explosive Formulations
- ii) Pulsed Fiber Laser Sources
- iii) Double walled single crystal parts from advanced super alloy
- iv) Advanced Warhead Technologies
- v) Enhanced Efficiency of Thermoelectric Generator and Peltier Cooler (EETG)
- vi) Technology development for SiC Fiber (TDSiCF)

3.5 Infrastructure & Facilities (IF) Development Projects

Some of the major projects in this category are as follows:

- i) National Open-Air Range (NOAR)
- ii) Mission System Integration Rig (MSyIR)
- iii) Advanced HILS facility
- iv) Multi Petaflops Computing System
- v) Creation of Automotive and Weapon Systems Testing Center (AWTC)
- vi) Infrastructure for Testing of Expendable Turbo Propulsion System (IT-ET)

3.6 Product Support (PS) Projects

Some of the major projects in this category are as follows:

- i) Post Development Support of AEW&C System (PDSAS)
- ii) Product Support for Arjun MBT
- iii) Upgraded Digital Flight Control Computer (DFCC) for LCA Mk-1A
- iv) Product Support & Product Upgrade for Akash Weapon System
- v) Akash-Prime
- vi) Astra Product Support

3.7 User Trials (UT) Projects

Some of the major projects in this category are as follows:

- i) Development of 5.56 mm Joint Venture Protective Carbine for User Trials
- ii) Modification of Six Aircraft (Su-30 MKI) for Astra User Trials
- iii) Quick Reaction Surface to Air Missile - User Trial (QRSAM-UT)
- iv) User Trials of Air Defence Fire Control Radar
- v) ASTRA Mk – I User Trials
- vi) User Trials of Multi Influence Ground Mines

3.8 Limited Series Production (LSP) Projects

As on date, there is only one project in this category which has been successfully completed and is at closure stage:

- Procurement of 08 X HUMSA UG SONARS, one system for Valsura and one simulator for ASW School

3.9 Status of Ongoing Projects

It was also intimated to the Committee that DRDO currently has 328 ongoing projects (*excluding strategic projects*) amounting to approximately Rs. **99898** Cr (*including User share*). Table 1 below provides a brief outlay of category wise distribution of the projects and their cost.

Category-wise Financial Allocation for Projects

Project Category	No. of Projects	Cost (Rs. in Cr)
Mission Mode (MM)	55	72459
Technology Demonstration (TD)	197	19983
Infrastructure & Facilities (IF)	34	5103
Science & Technology (S&T)	19	428
Product Support (PS)	20	1675
User Trials (UT)	3	250
Total	328	99898

3.10 As on date, there is one project of Limited Series Productionj (LSP) category worth Rs. 19 crore which is under progress.

(ii) Major Systems delivered/ handed over to Users

3.11 Ministry has also informed that the following system have been delivered / handed over to USERS:

1. High Strength Steel for 'INS Vikrant'
2. Main Battle Tank (MBT) 'Arjun' Mk-1A'
3. Shakti : Electronic Warfare System
4. Light Combat Aircraft (LCA) 'Tejas Mk – 1A'
5. Medium Range Surface-to-Air Missile (MRSAM) for IAF
6. Medium Range Surface-to-Air Missile (MRSAM) for Navy
7. Satellite guided Smart Anti Airfield Weapon (SAT-SAAW)
8. Beyond Visual Range Air-to-Air Missile 'Astra'
9. Multi-Mode Hand Grenade (MMHG)
10. Bund Blasting Device (BBD) Mk-II
11. Drone, Detect, Deter and Destroy (D4 System)
12. Chaff Technology for Indian Navy
13. 46m Military Load Class (MLC-70) Modular Bridge
14. Fire Fighting Suit
15. Helmet and pressure breathing Mask
16. Indigenous Filters for P-75 Submarines

3.12 Major Systems Inducted/ being inducted into Services

1. Akash Prime
2. 18Anti-Tank Guided Missile (NAG)
3. Arjun Armoured Repair & Recovery Vehicle (Arjun ARRV)
4. Armoured Engineer Reconnaissance Vehicle (AERV)
5. Short Span Bridging System-10m
6. 120mm Tandem warhead system for anti-tank application
7. 81 mm anti-thermal, anti-laser smoke grenade
8. Joint Venture Protective Carbine (JVPC)
9. Light Machine Gun (7.62X51 mm - LMG)

10. Trawl Assembly for T-72/T-90 Tanks
11. Qualification and Certification of DMR249 and DMR301 Grade Steels, Plates, Bulb Bars and Weld Consumables
12. Digital Radar Warning Receiver (Dhruti)
13. Nayan
14. Software Defined Radio (SDR)
15. High Data Rate HD-VLF-HF Receiver
16. Laser Ordnance Disposal System (LORDS – N)
17. Chaff Technologies for Indian Air Force
18. Magazine Fire Fighting System
19. ARNAV Naval Wargaming
20. NBC Haversack Mk-II

(iii) Major Infrastructure & facilities established

3.13 The Committee have learnt that initially when DRDO undertook a few major programmes as ab-initio designs, no infrastructure was available. Production of certain critical systems, testing and evaluation, facilities and instrumented ranges were the major bottlenecks. Over a period of time, DRDO has invested significantly in establishing high technology infrastructure facilities. Most of these facilities have been established with active participation of Indian Industries. These facilities have become National Assets and have also proved beneficial in accelerating subsequent developments undertaken by DRDO. Some of the major facilities/infrastructure of DRDO are given below.

DRDO Test Facilities Available for Industries

1. Proof and Experimental Establishment (PXE)
2. Ballistic Evaluation test
3. Blast testing
4. Acceleration Test
5. Grenade Testing
6. Arena Testing of Fragmentation warhead
7. Hypervelocity Impact
8. EMI/EMC CS115, CS116 and CS1216 Test
9. Flying and performance evaluation of UAVs
10. Direct Effect Lighting Arc Test
11. Environmental Test Facility
12. Antenna Pattern Measurement
13. Thermal Chamber Test Facility
14. Acceleration Test
15. RBD P. Oil Analysis
16. Nutritional Analysis
17. Black Spots
18. Testing of Night Vision Device, Thermal Imaging Camera system
19. Testing of Image Intensifier tubes
20. Environmental Test Facility (Vibration, Mechanical shock and humidity, Transit Drop)
21. Environmental Test Facility (Acceleration, Test, Dust, Rain Test)
22. Limited Qualification Test
23. EMI EMC Testing
24. HASS Test
25. Altitude Test, CATH Test

26. MIL STD 704D Test
27. ABS Test Track
28. Automotive Bumper Test System
29. Automotive Door Hinges Test System
30. Automotive Noise Test Track
31. Belgian Pave Track
32. AVL Eddy Current Dynamometer (Apha-80) With EDACS, Gravimetric Fuel Flow meter
33. CE 101 Test Set up
34. CE 102 Test Set up
35. Chassis Twister Track
36. Corrugated Track (50mm & 100mm)
37. Cross Country Track
38. CS 101 Test Set up
39. CS 109 Test Set up
40. CS114, CS115,CS116
41. Customized Test Tracks for Mini UGV
42. Deep Wading Trough Track
43. Driving rain chamber
44. Dry heat, Dry Cold & Climatic test chamber
45. Dust Tunnel Track
46. Frontal Impact Test
47. Gradient Track
48. Gradient Track For 'A' Vehicle
49. High Speed Track
50. Integrated Lightening Induced Transients Susceptibility Test System
51. Load Dump Generator, Voltage Dip Simulator, Electric Fast Transient
52. Long Wave Pitching Track
53. Mud Track
54. Pot Hole Track
55. RE 101 Test Set up
56. RE 102 Test Set up (Antenna: Biconilog, Rod, Biconical, DRG Horn & Horn)
57. RS 101 Test Set up
58. RS 103 Test Set up (Antennas: Biconical, VLog, Horn)
59. Sand Track
60. Sealed Housing Evaporative Determination
61. Serpentine Track
62. Shallow Water Trough Track
63. Shielding Effectiveness Test set up
64. Side Slope Track For 'A' Vehicle
65. Step Climbing Facility For 'A' Vehicle
66. Vehicle Dynamics Test Track
67. Integrated Weapon System Design Centre
68. Rocket Integration Building (RIB)
69. Full Mission Simulator for LCA
70. Automated Ultrasonic C-scan facility
71. Air Drop Facility
72. Automatic Weather Station (AWS)
73. Container based Bio-Safety Laboratory (Level – 3) Facility
74. Infrared Technology Enabling Centre (IRTEC)

Foundry for Devices

Gallium Arsenide Enabling Technology Centre (GAETEC)
Semiconductor Technology and Applied Research (STARAC), Bengaluru

(v) Participation with Academia and Industry

3.14 The Ministry in their brief note informed that DRDO, in its pursuit for excellence in developing the cutting edge technologies for Advanced Defence Systems and Platforms, has delivered many state of the art flagship products to the country. In current global scenario, there is a persistent need to accelerate technology innovation and world-class product development, for boosting the “Make in India” policy to its higher level and to achieve self-reliance in defence and security. DRDO strategic academic persuade will foster to enhance the research eco system within academic environment in the country.

3.15 Further, DRDO has been exploring the knowledge and expertise existing within the country at various academic institutes and research organizations by providing research grants for faculty driven projects through Extramural Research & Intellectual property rights (ER&IPR) and various Research Boards namely Aeronautics Research & Development Board (AR&DB), Armament Research Board(ARMREB), Life Science Research Board (LSRB), Naval Research Board (NRB). The objective of these grants has been to foster knowledge-based growth in science and advanced technologies, catalyze cross-fertilization of ideas and experience between DRDO and academic experts. Such grants are awarded mostly for academia originated proposals having probable defence application.

3.16 In last five years, DRDO has given impetus to collaboration with academia for DRDO requirement driven research in the indentified futuristic technology thrust areas. The Directed research is managed by Directorate of Futuristic Technology Management (DFTM) and DRDO has established eight Advanced Technology Centers (ATCs) at the premier institutes for carrying out research in the niche technology areas related to defence& security. The ATCs conducts steers the basic & applied research to offer solutions for technological or engineering challenges to raise the technology readiness level.

3.17 DRDO primarily awards projects to MSME through Technology Development Fund (TDF) for indigenous technology product development. Within this scheme industry can engage academia for better engineering solutions. DRDO has a policy for Protection and disposition of Intellectual Property Rights generated through the award of grants-in-aid projects. Under this policy Intellectual Property, created during the performance of the Project, whether or not legally protected, shall be owned jointly by DRDO and Grantee Institution. DRDO and Grantee Institution shall be deemed to have a royalty-free license to use such joint Foreground Information and Foreground Intellectual Property Rights for their own R&D purposes. The present IPR portofolio is 1852 granted & filed Intellectual Property Rights which includes 623 Indian & Foreign Granted Patents & 967 filed Indian & Foreign Patents.

3.18 DRDO has research collaboration with around 155 institutes. Under the 12th

five year plan 680 research projects costing Rs. 490Cr (Approx) were sponsored to various universities and academic institution and during 13th five year plan 470 research projects have been sponsored so far.

3.19 DRDO has also created infrastructure and management structure to develop, manage and integrate high-cost and high-technology programmes & projects by pooling national resources and expertise available in academic institutions, R&D centres, public and private industries. DRDO has a strong partnership with 50 Public Sector Undertakings (PSUs), 30 Ordnance Factories (OFs) and more than 1800 private sector industries. This has enabled the Organisation to minimize the effect of the Sanctions and technology denials, which were imposed by the technologically advanced countries from time to time and also to enhance self reliance in Defence Products. DRDO's contributions have paid rich dividends to the Nation and have resulted in creating a huge Indian Defense Industry Base with the various partners.

3.20 DRDO works in close association and collaboration with private industries for development of its defence systems and technologies. DRDO has evolved various industry models for engagement and development of Industries. These are Development Partner Model, Consortium Model, Concurrent Engineering Model, Joint Venture (JV) Model, Joint Development Model, Limited Series Production (LSP) Model, Government Owned and Company Operated (GOCO) Model, International Collaboration Model and Transfer of Technology (ToT) Model. These modes of industry engagements, facilitate smooth transfer of DRDO developed technologies, provide necessary hand holding support to industries, provide technical support and support to facilitate exports.

3.21 In a written brief, the Committee have been informed that following steps have been taken by DRDO during the last three years to enhance the involvement of private sector in DRDO projects and programmes:

- i) DRDO has promulgated new ToT policy and procedures with zero ToT fee for its industry partners (Development cum Production Partners (DcPP)/ Development Partner (DP) and zero royalty for supply to Indian Armed Forces and Govt Deptt. Nil ToT fee and royalty will reduce the financial burden on Indian industries and Indian Armed Forces. Only 5% ToT fee will be charged from non DcPP/DP industries. The policy has been made compatible with DPP-2016. This will provide further boost to Indian industries in defence manufacturing sector to achieve more self reliance.
- ii) To facilitate ToT for Cat A (Military Technologies) and Cat B (Spin off/ Commercial use Technologies), a user friendly portal has also been launched for more transparency and clarity for the industry entrepreneurs.
- iii) To unearth the hidden potential of spin off technologies and bring in more transparency, DRDO has entered into MOUs with four leading industry chambers namely Associated Chamber of Commerce and Industry of India (ASSOCHAM), Confederation of Indian Industry (CII), PHD Chamber of Commerce and Industry (PHDCCI) and National Research Development Corporation (NRDC) for technology assessment and

commercialization of dual use, non-security sensitive technologies so that fruits of our technological progress reach the common man.

- iv) DRDO has carried out intense interactions with industries all over the country to boost Defence Manufacturing sector and to achieve self reliance in Defence manufacturing. More than 900 industries were interacted at various cities in India to apprise them on DRDO technologies and to facilitate the industries (including MSMEs) to absorb DRDO technologies to boost defence manufacturing sector and achieve self reliance in the defence technologies.

3.22 The Committee desired to know about the Assessment made by DRDO on Major Research & Development initiatives including by way of Private Participation leading to innovation & import substitution during the last ten years. In this regard, the Committee were informed:-

- i) In line with the aim of 'Atmanirbhar Bharat', DRDO has identified a list of 108 systems and subsystems (hosted on DRDO website) which will be designed, developed and manufactured by industry only and will not be taken up DRDO itself for development. This will boost Research & Development in Private Industry.
- ii) DRDO will provide scientific and technological support to industry on need basis under its policy framework.
- iii) Several world class test facilities have now been opened for industries in DRDO labs to boost design, development and manufacturing by industries.
- iv) DRDO provides transfer of niche defence technologies to industry this in turn enhances the technical capabilities of industry and further R&D for new versions of the product.

3.23 With regard to Parameters with private Industry for confidentiality, the following was submitted before the Committee during the briefing given to them :

“सर, डीआरडीओ में दो तरह के प्रोजेक्ट्स होते हैं। कुछ स्ट्रैटेजिक प्रोजेक्ट्स होते हैं, जहां हम लोग प्राइवेट सेक्टर्स को इनवॉल्व नहीं करते हैं। जो बहुत ही स्ट्रैटेजिक होते हैं, वहां पूरा काम डीआरडीओ ही करता है। जो टैक्टिकल वेपन्स का डेवलपमेंट होता है, उसमें हम प्राइवेट सेक्टर्स के साथ भी काम कर रहे हैं और पब्लिक सेक्टर्स के साथ भी काम कर रहे हैं। इसमें हम लोग नॉन डिस्क्लोजर एग्रीमेंट साइन करते हैं। यह एक कॉन्ट्रैक्ट होता है, जिसके आधार पर हम काम करते हैं।“

3.24 On the process of selecting private industries for the development of product with DRDO, Secretary, DRDO during the briefing tendered before the Committee stated as under:

“At present, we are going only with the registered Indian companies. We are mainly collaborating with well known names such as L&T, Bharat Forge, Tatas, etc. We are going by the reputation. We are also signing the non-disclosure agreement.”

3.25 When the Committee desired to know how integrity is maintained while dealing with private companies, a representative of DRDO submitted:

“Sir, in bigger contracts, we are having the pre-integrity provision, that is, they have to provide additional security. Then, we are also monitoring the suppliers and the industries as to whether any investigation is going on by ED or CBI. We are also seeking that, and whether any banning has happened under that industry or its subsidiaries. We are also seeing these things in addition to NDA. Before disclosing any technical details, we first take the NDA. It is not that we take it after the contract is signed. NDA is prior to disclosing any technical details.”

3.26 The Committee learnt that DRDO's has collaboration with Academia involving many IITs/Universities and other educational institutions. On the involvement of Academia on research with DRDO, the Secretary, DRDO further, submitted as under:

“It is a real time involvement. Our lab scientists also work in the same project with academia in the Centre of Excellence.

In the Extramural Research & Intellectual property rights (ER&IPR) projects which he showed and the Research Boards, the involvement is only in monitoring. There the programmes or projects are also coming from the academic side. They propose that they are interested in doing this and our labs only help in monitoring. In the Centres of Excellence, the programmes and projects are decided jointly because we have a roadmap now. There is an Science and Technology(S&T) roadmap that we have drawn up now. The programmes and projects required to achieve those capabilities are defined sitting together with the academia in those centres of excellence involving industry. There our labs are actively involved not only in monitoring but in actually doing the work.”

3.27 During the oral evidence, when the Committee enquired to know about DRDO transfers their technology to private sector and exports, the Secretary, DRDO, apprised the Committee as under:

“महोदय, मोस्टली हमारी टेक्नोलॉजीज़ डिफेंस के लिए ही हैं। जो डिफेंस की टेक्नोलॉजीज़ हैं, वह तो पता चलता है, क्योंकि बॉयर भी तो इंडियन सर्विसेज़ ही रहते हैं। उनको एक्सपोर्ट करना है, तो बिना परमीशन एक्सपोर्ट नहीं करना है। अगर टेक्नोलॉजी से प्रोडक्ट बना रहे हैं, तो उनको एक्सपोर्ट करना है, तो पहले उनको डीआरडीओ से परमीशन लेनी पड़ती है। वह भी हमको पता चलता है। अभी तक हमारी नजर में ऐसा कोई केस नजर नहीं आया है, जहां इंडस्ट्री ने बिना पूछे उस प्रोडक्ट को बाहर बेच दिया हो।“

3.28 In a reference to query regarding the contribution of DRDO in research conducted in institutions and helping/retention of IIT students in the country, a representative of DRDO apprised the Committee as under:

“महोदय, इस समय लगभग 350 कॉलेजेज़ और यूनिवर्सिटीज़ में हमारे प्रोजेक्ट्स चल रहे हैं। जो प्रोफेसर्स हैं, हमने जिनको ये प्रोजेक्ट्स दिए हुए हैं, वे लगभग 1,400 हैं। मैं आपको लिखित में एग्जैक्ट फिगर दे दूंगा। हर एक पीआई के साथ कम से कम 2 या 3 जेआरएफ या एसआरएफ होते हैं। उस हिसाब से लगभग 4,000 या 5,000 की संख्या होगी। चाहे वह साउथ में हो, नॉर्थ में हो, वेस्ट में हो, ईस्ट में हो, वे चल रहे हैं।

मैं उदाहरण के तौर पर बताना चाहता हूं। जैसा कि आपने कहा कि आईआईटीज़ के स्टूडेंट्स बाहर चले जाते हैं। इसमें कुछ सच्चाई भी है। आजकल थोड़ा सा बदलाव भी शुरू हुआ है। जब से देश में स्टार्ट अप्स में डिफेंस टेक्नोलॉजी या स्पेस टेक्नोलॉजी में काम हो रहा है, तो हमारी आईआईटीज़ के कुछ अच्छे स्टूडेंट्स हैं, वे हमारे यहां पर स्टार्ट अप्स वगैरह खोल रहे हैं। वे अच्छा काम कर रहे हैं। मैं आपसे रिक्वेस्ट करूंगा कि आप कभी आईआईएससी या आईआईटी, बॉम्बे विजिट करें, तो मैं आपको दिखाना चाहूंगा। आपको देखकर खुशी होगी कि हमारे अपने बच्चे ऐसा काम कर रहे हैं।

महोदय, हमने मिनिस्ट्री ऑफ एजुकेशन के साथ एक और प्रोग्राम चलाया है। पीएचडी स्टूडेंट्स को डिफेंस टेक्नोलॉजी में इन्वॉल्व करना है। कुछ समस्याएं आ रही थीं। मिनिस्ट्री ऑफ एजुकेशन और डीआरडीओ ने मिलकर कुछ समाधान निकाल लिया है। ये जो स्टूडेंट्स हैं, वे ऐसी टेक्नोलॉजी में काम कर रहे हैं, जो कि डीआरडीओ के इमीडिएट रिक्वायरमेंट के लिए है। डीआरडीओ लैब में जैसे डीआरडीओ के वैज्ञानिक काम कर सकते हैं, वैसे ही वे भी काम कर रहे हैं। उनको प्रोफेसर्स का भी सपोर्ट प्राप्त है और हमारी लैब का भी सपोर्ट प्राप्त है। ऐसा नहीं है कि सिर्फ आईआईटी या आईआईएससी है। पूरे देश में 350-400 के आसपास संस्थान, कॉलेजेज़, यूनिवर्सिटीज़, प्राइवेट, स्टेट गवर्नमेंट और सेन्ट्रल यूनिवर्सिटीज़ के साथ हम काम कर रहे हैं। हम बाकी की डीटेल्स लिखित रूप से दे देंगे।”

CHAPTER IV

Ongoing Major Programmes/Projects/Systems

(i) Major Systems Undergoing User Evaluation

4.2 In regard to major systems undergoing user evaluation, the Committee, through a written note were intimated as under:

- i) **“Quick Reaction Surface-to-Air Missile (QRSAM):** QRSAM is a land-based on-the-move air defence system developed for Indian army. The system is capable of engaging multi directional targets with search and track on move capability and firing on short halts. The missile is highly agile and can handle maneuverable aerial threats. The missile uses all indigenous sub-systems. Mobile Launcher Vehicle (MLV) for the QRSAM has also been designed and configured to meet the operational requirements and functional needs of the Indian army air defence. Control, Guidance and Warhead trials have been completed. Mobility trials for weapon system were completed in Dec 2021. During Sep 2022, DRDO & Indian Army conducted six flight tests of QRSAM Missile system, which meet the trial objectives.
- ii) **Third Generation Helicopter Launch Anti-Tank Guided Missile (‘HeliNa’/Dhruvastra):** HeliNa is a 3rd generation helicopter-launched anti-tank guided missile (ATGM) with Lock-On-Before-Launch (LOBL) capability with seeker for integration on Advance Light Helicopter (ALH). Joint User trials as per trial directives issued by IA & IAF were completed in Feb 2021 against static and moving targets from hover and forward speed flights. The trial against derelict tank with the final warhead configuration was also demonstrated. This is one of the most advanced anti-tank weapons in the world.
- iii) **Medium Range Surface – to - Air Missile (MRSAM) for IA:** The system has been developed for Indian Army. Verification Flight Trials (VFTs) were conducted. Some Firing Unit (FU) systems have been developed, tested and integrated. Operational training for Army Air Defence Users was completed. Transmission trials were conducted as part of User trials.
- iv) **Advanced Towed Artillery Gun System (ATAGS):** ATAGS is an all-electric drive four wheeled advanced gun system. It meets futuristic requirements such as better accuracy, advanced fire control system, extended range and multiple round simultaneous impact capability with surveillance and sighting systems onboard. The system is capable of firing existing 155mm ammunitions held with Indian Army with higher range, accuracy and consistency. The gun system is compatible with Indian Army’s command and control network. During 2021, the system has completed winter PSQR and most of summer PSQR trials. For the first time, ATAGS was used in the ceremonial 21-gun salute during the Independence Day 2022 celebrations at Red Fort, New Delhi.
- v) **Pinaka Mk-I (Enhanced Range) Rocket System:** Flight stability and range performance of the enhanced range version of the rocket system were proven in flight trials conducted during the year. Rockets were realized through industry partner for assessing accuracy & consistency of rocket. Series of instrumented flight trials were conducted on two

- consecutive days in Jun 2021, wherein 25 rockets were launched in quick succession at various ranges. During the mission flight, data required for generation of range table was captured. All rockets demonstrated satisfactory range performance.
- vi) **125mm Fin Stabilized Armour Piercing Discarding Sabot (FSAPDS):** 125mm FSAPDS Ammunition is the primary ammunition for T72 and T 90 tanks. DRDO has undertaken the project for design and development of 125mm FSAPDS 530mm Depth of Penetration (DOP) Ammunition for T 72/T90 tanks against the Indian army requirements. During the month, lethality trials were conducted at KK Ranges, Ahmednagar in the presence of Users in June 2022. Ammunition penetrated through the target and achieved a high depth of penetration
- vii) **Multi Influence Ground Mine (MIGM):** MIGM is an underwater naval mine equipped with precision sensors for triggering the mine based on multiple influences such as magnetic, electrical, acoustic, pressure and Extra Low Frequency Emissions (ELFE). MIGM is deployable from ships and submarines. Acoustic Counter Countermeasure (ACCM) features are inbuilt in the logic to discriminate between ship and hammer/sweep. Advanced target classifier store signature of friendly ships has been incorporated in the mine to prevent firing against the set of friendly ships as and when detected.
- viii) **Advanced Light Weight Torpedo (ALWT):** Advanced Lightweight Torpedo (ALWT) is an anti-submarine torpedo capable of being launched from helicopter and ship. ALWT has dual speed capability and endurance. For air launched version of ALWT, flight clearance has been obtained from CEMILAC. For ship launched version of ALWT all technical trials and User Associated Trials (UATs) have been completed and it is undergoing User Evaluation Trials (UETs).
- ix) **Portable Diver Detection Sonar (PDDS):** PDDS is high frequency sonar for detection and classification of underwater threats like divers and swimmer delivery vehicles; especially near water-side assets and ships at anchor or in harbour. The system will be deployable and retrievable as and when required. The system was trial evaluated by Indian Navy. ToT to production agency has been completed.
- x) **Air Independent Propulsion (AIP) System for Submarines:** DRDO has developed a full-scale Land Based Prototype (LBP) for demonstration of hydrogen fuel cell-based AIP system, which when proved and inducted by the Indian Navy would enhance underwater endurance of diesel-electric submarines. The AIP system is being developed in collaboration with the submarine designer. The system has completed endurance trials in Jan 2021 followed by completion of Max mode operation in Mar 2021. A programme has been undertaken for retrofitment of the AIP system onboard Scorpene submarines.
- xi) **Air Defence Fire Control Radar (ADFCR) – Atulya:** ADFCR, in conjunction with Anti-Aircraft Guns, forms a Ground Based Air Defence (GBAD) system whose main purpose is effective point defence against all air threats (fighter aircraft, helicopters, and UAVs) at short and very short ranges during day and night, under all weather conditions and also in the presence of enemy jamming. During 2021, the radar has completed summer trials and rail transportability trials. Electronic Warfare (EW) trials as part of PSQR validation trials were completed during Jan 2022.
- xii) **GaN Technology Development:** DRDO has developed 1 kilo watt CW GaN UHF high power amplified and GaN MMIC X-Band power amplifiers with power output of 20W and 30W. MMIC designers can now develop and produce indigenous GaN MMICs for various applications and

frequencies upto X-band. India is now self-reliant in GaN MMIC technology. This is a big step towards Make in India and Aatmanirbhar Bharat in semiconductor technology. The next step will be towards development of GaN MMIC for applications upto Ku band.

- xiii) **Tele-operated Dozer:** The unmanned dozer can meet all types of demanding earth moving operations like land slide and snow clearance operations at high altitude and other hazardous locations. It ensures safety of personnel during dozer operations at unfriendly terrains. It has secured communication links with encryption and anti-jamming features. The dozer can be operated in three modes i.e tele operation, remote control and manual mode of operation. Technical demonstration and real-time utilization of the equipment by Border Road Organisation (BRO) for unmanned snow clearance operations of the dozer were completed in 2021.
 - xiv) **Oxygenated Shelter:** A solar heated, solar powered oxygen enriched shelter has been installed in the Tawang sector of Arunachal Pradesh at an Army site. It is under user evaluation. This shelter will be useful for rapid induction of troops during emergency situation, short duration visit of unacclimatised persons and for the treatment of Acute Mountain Sickness (AMS) patients.
 - xv) **Extreme Cold Weather Clothing System (ECWCS):** The ECWCS developed by DRDO is a modular, three layered clothing system which has been designed and evaluated to meet the insulation, waterproofing, strength, light weight and ergonomically evaluated wearer comfort requirements during combat operations in extreme altitude regions. The product has been field evaluated and ToT has been done to industries.
- ii) 4.3 **MAJOR SYSTEMS UNDERGOING DEVELOPMENTAL TRIALS**
- i) **BrahMos:** BrahMos is a two stage precision strike supersonic cruise missile operating on fire and forget principle. It can be launched from multiple platforms (like air, sea and ground) against land and sea targets. First launch of Extended Range version of BrahMos missile was conducted from Su-30 Mk1 aircraft on 12th May 2022. With this, capability has been achieved to carry out precision strikes from all three vectors (Land, Air & Sea). MoD signed a contract with M/s Brahmos Aerospace Pvt Ltd for acquisition of additional dual role capable Surface-to-Surface Brahmos Missile at an approximate cost of Rs 1700 Cr.
 - ii) **Stealth Wing Flying Testbed (SWiFT):** DRDO is developing a flying wing test bed to demonstrate the capabilities & technologies by flying a scaled down UCAV of similar configuration, with comparable key parameters like thrust to weight, wing loading etc and maximum re-use of systems from other UAVs. Stealth Wing Flying Testbed (SWiFT), had undergone successful maiden flight on 01st Jul 2022. Operating in a fully autonomous mode, the aircraft exhibited a perfect flight, including take-off, way point navigations and a smooth touchdown.
 - iii) **Very Short Range Air Defence System (VSHORADS):** VSHORADS is a 4th generation system compared to contemporary Man Portable Air Defence System (MANPADS) 3 rd generation systems. The indigenously developed VSHORADS weapon is technically superior to exiting MANPADS as it employs state of art uncooled imaging infrared seeker in MANPADS systems. DRDO conducted maiden developmental flight tests (02 nos.) of indigenous VSHORADS Missile from ITR Chandipur off the Coast of Odisha on 27th Sept 2022.

- iv) **Vertical Launch Short Range Surface to Air Missile (VL-SRSAM):** VL-SRSAM is a vertical launch short range surface to air missile having a strike range upto 80 km for Fighters aircrafts, helicopter, UAVs etc. The missile has been developed for the Indian Navy for neutralizing various aerial threats at close ranges including seaskimming targets. The missile was flight tested on 23rd Aug 2022 from Integrated Test Range, Chandipur, off the coast of Odisha. The launch of the system was conducted against a high speed unmanned aerial target for demonstration of Vertical Launch capability.
- v) **Solid Fuel Ducted Ramjet (SFDR) Technology for Air Launched Tactical Missiles:** The state-of-the-art air-to-air missile powered with 'SFDR' propulsion enables the missile to intercept aerial threats at very long range at supersonic speeds. The missile is designed with an advanced propulsion system and is configured with nozzle-less booster, thrust modulation system and sustainer to deliver specific impulse in ramjet mode. The missile was flight tested on 8th Apr 2022.
- vi) **Akash New Generation (Akash-NG):** Akash - NG is a new generation surface- to-air missile meant for use by IAF with an aim of intercepting high maneuvering low RCS aerial threats. Maiden launch of Akash – NG missile was conducted by a joint team of DRDO, BDL and BEL from ITR, Chandipur, Odisha on 25 Jan 2021. The missile intercepted the target with precision, meeting all objectives by performing high maneuvers during the trajectory. The missile was also successfully fired from Pokhran range in Rajasthan in Mar 202. Subsequently the missile was fired from the coast of Odisha on 08th Jun 2022 and Electro Optical Targeting System (EOTS) tracked the Banshee Target successfully. With this trial EOTS integration with Akash-NG has been completed.
- vii) **Man-Portable Anti-Tank Guided Missile (MPATGM):** MPATGM is a 3rd generation ATGM with 'Fire & Forget' and 'Top Attack' capabilities and the missile can be used by day and night. It is intended to be a replacement for 2nd generation MILAN and Konkurs ATGM in service with Indian Army. Max Range trials were already completed. Min Range requirement is critical and demanding as the flight ime available to act and guide the missile to the target is less than 2 sec. Performance at min range with consistency and accuracy was demonstrated during the guidance flight trials carried out in Jul 2021. The missile was again flight tested in final deliverable configuration from a Tripod Launcher integrated with Thermal Sight in Jan 2022, proving repeatable performance at min range.”

(iii) Drone / Anti Drone Capabilities

4.4 On the issue of on the current advancements in the drone / anti-drone and intercepting capabilities undertaken in DRDO keeping in view the threat perception specially the intrusion of drones by the unfriendly neighbours on our land borders, Ministry in its written replies submitted as under:

“DRDO is making drone based systems and anti-drone systems based on the requirements of User Agencies. DRDO has developed a comprehensive integrated Anti-Drone System which comprises of detection, identification and neutralization of a drone as under:-

- i) **Detection**
RF Detection and direction finding
Radar detection
- ii) **Identification:** EO/IR confirmation of target upon are from Radar
- iii) **Neutralization:**
RF/ GNSS Jamming (Soft+Kill)
Laser weapon (Hard Kill)
- iv) **Laptop based Command Post:** The command post controls all operation from a single point.

The Transfer of Technology(ToT) for above technologies has been handed over to Pvt industries including M/s BEL, M/s Adani, M/s L&T and M/s Icom. Three services (IA, IAF & IN) have already placed 23 orders on M/s BEL for DRDO developed technology.

The above technology is suitable for detection, identification and neutralization of an intruding drone on our land borders also. The solutions can be customized for different challenges.

- v) Drones: R&DE / DRDO has designed, developed and tested following multi-copters (drones) for various applications.
- vi) Untethered Multi-copters with payload capability of 5kg to 15kg and endurance 30 min.
- vii) Tethered Multi-copters with payload capability of 30kg to 50kg and endurance 4 hours.
- viii) Other Technologies developed are as follows:
 1. Beacon Based Landing accuracy 60mm.
 2. Auto Charging on Landing.
 3. Ground Vehicle Follow mode.
 4. Auto Payload Release at waypoints.
 5. Foldable Carbon Composite frame.
- ix) Indigenous Counter Drone Technology which is capable of counter attacks including detection, Soft Kill and Hard Kill of all types of Drones including Micro Drones are being developed in DRDO.
- x) The Counter DRONE System is ready for production and already demonstrated to Armed Services and other internal security agencies.
- xi) The Technology is transferred to M/S BEL, Bengaluru who are the Production Agency for the System. In addition, Transfer of Technology (ToT) is given to four more firms from Indian Industry for the production of Anti-Drone Systems.
- xii) MALE UAV (TAPAS) developed for ISTAR application is in advance stage of developmental trials.
- xiii) Short Range Armed UAV (Archer) is being developed for Reconnaissance, Surveillance and low intensity conflict. Developmental flight trials under progress”.

4.5 During the briefing, it was submitted before the Committee that drone batteries are unavailable in the Country. Later, the Ministry in its written replies submitted as under:

“The older generation of drones were using Ni Cad and Silver Zinc batteries as secondary source of power. The basic cells for Ni Cad, Silver Zinc chemistry are being made in India and there is no issue with the availability of these batteries for use on the drone.

However, due to weight concerns and advancement in the battery technologies, Lithium Ion chemistry is now the being used.

Lithium Ion based battery with indigenous Battery Management System has been developed at ADE, DRDO Lab in association with a private vendor and is being used on TAPAS UAV. The cells are however, imported.

DRDO and ISRO are working on Lithium Ion cell development, but the activity is still in infant stage.

ADE, DRDO has proposed to work with FFC on the development of Lithium Phosphate cells with its Battery Management System. With these efforts it is felt that DRDO will be self-reliant in the drone batteries in the future.”

4.6 During oral evidence, Secretary DRDO in this regard apprised the Committee by stating:

“सर, मैं ड्रोन टेक्नोलॉजी के बारे में पहले जवाब दूंगा। ड्रोन टेक्नोलॉजी को लेकर इंडस्ट्री में अभी काफी मैच्योरिटी है। काफी स्टार्टअप्स हैं, इंडस्ट्रीज हैं, जो तरह-तरह के ड्रॉन्स बना रही हैं, ये छोटे ड्रॉन्स होते हैं। डीआरडीओ में हमारा फोकस बड़े ड्रॉन्स हैं, जो आठ-दस घंटे ऊपर रह सकते हैं। इसको **MALE** कहते हैं, जिसका अर्थ **Medium Altitude Long Endurance** होता है। इस पर कार्य हो रहा है, लेकिन जिन ड्रॉन्स के बारे में आप कह रहे हैं, उनको लेकर इंडस्ट्री में काफी मैच्योरिटी है। काफी स्टार्टअप्स हैं, इंडस्ट्रीज हैं जो विभिन्न प्रकार के ड्रॉन्स बना रही हैं और सर्विसिज भी उनसे डायरेक्टली खरीद रही हैं।

अतः ड्रोन टेक्नोलॉजी में अभी इंडिया की सिचुएशन बहुत अच्छी है और आत्मनिर्भरता है। ड्रॉन्स में एक प्रॉब्लम है कि हम लोगों की बैटरी टेक्नोलॉजी और मोटर टेक्नोलॉजी पर आरएंडडी होनी है, क्योंकि वह आजकल बाहर से आनी है। अतः ड्रोन तो देश में बन रहे हैं, लेकिन उनके जो ब्रशलैस डीसी मोटर्स हैं और जो बैटरीज हैं, वे बाहर से आ रही हैं। उस पर देश में आरएंडडी अभी चल रही है, लेकिन ड्रॉन्स को एक सिस्टम के रूप में बनाने में कोई दिक्कत नहीं है। आजकल इंडस्ट्री उसमें काफी मैच्योर है।“

4.7 On this issue, during the oral evidence, a representative of DRDO supplemented as under:

“As I said, drones are increasingly becoming very important in warfare, as this war has shown.

In the country, the capability to make a variety of drones is fairly good. The industry is fairly mature. So, DRDO is not actively involved because the Services’ needs are being met by the industry. Our focus is to make more the longer-range drones, the higher endurance drones and unmanned combat aircraft. That is our focus. DRDO is focussing more on the more advanced drones which nobody talks about in the current scenario. The US and China have these kinds of drones. They are not called drones; they are called UAVs or unmanned aerial vehicles. The drones, which are mostly being talked about in this Ukraine War, are smaller drones which can loiter, which can attack. That capability exists in our country with the industry. That is not a focus area for DRDO.

Anti-drone technology is where the focus should be and in that, DRDO is working very closely with the industry. We are also doing a lot of R&D for doing anti-drone, protection against these types of drones.”

He also stated:

“सर, मैं वही कह रहा हूँ कि यह ड्रोन टेक्नोलॉजी अभी सरप्राइज आ गई है। देखिये, अगले पाँच साल में enough anti-drone technology will come and the drones will not be effective. Then, the tanks will not be vulnerable to drones. Since it was a surprise thing, it has caught everyone by surprise. Therefore, the effect has been much more than what it should be with the kind of drones being used.”

(iv) Delay in the Projects / closed projects

4.8 On being asked to furnish the list of projects having been abandoned or delayed due to the reduced budgetary support, the Ministry replied as under:

“No Sir, projects have not been abandoned or delayed due to the reduced budgetary support.”

4.9 During oral evidence on the reasons for the delays of projects particularly keeping in view the fact that out of 55 projects, 23 were not completed within the stipulated time, Secretary, DRDO apprised before the Committee:

“सर, आप ठीक कह रहे हैं। डिल नहीं होनी चाहिए। अभी हम लोग एक कन्सल्टेंट को हायर कर रहे हैं, जो हमें बताएगा कि किन कारणों से अधिकतर प्रोजेक्ट्स डिले हो रहे हैं। उसमें हम लोग

सुधार करने की कोशिश करेंगे। हम लोगों ने बहुत कोशिश की है। एक मुख्य प्रॉब्लम यह है कि हम लोग एस्टिमेशन सही नहीं करते हैं। हम लोग जब प्रोजेक्ट्स लेते हैं, तो बहुत ऑप्टिमिस्टिक रहते हैं कि इन्हें हम 3 या 4 सालों में कर पाएंगे। जब हम प्रोजेक्ट्स लेते हैं, तो इंडस्ट्री में जो कैपेबिलिटी है, जो सप्लाइ चेन्स के इश्यूज हैं, उन पर हम ध्यान नहीं देते। इसके अलावा और भी कई कारण हैं। मॉनीटरिंग के कारण हो सकते हैं, पर्याप्त मैन पावर रिसोर्सज हम एलोकेट नहीं करते। ऐसी कई समस्याएं हैं। जो प्रोजेक्ट्स डिले हुए हैं, वे क्यों डिले हुए, इस हेतु हम आपको लिखित में दे देंगे। हम अभी कोशिश कर रहे हैं कि भविष्य में ऐसा न हो। हम आपसे कह सकते हैं कि अगले दो-तीन सालों में ऐसे प्रोजेक्ट्स के डिले हमारी तरफ से नहीं होंगे। हम इसकी पूरी कोशिश करेंगे। जो हुआ, हम मानते हैं कि वह हमारी गलती थी। आगे से ऐसा न हो, ऐसी हमारी पूरी कोशिश रहेगी।“

4.10 When the Ministry was asked to furnish the details of closed projects during the last ten years and the money spent on these closed projects, specific reasons thereon and the system in place to establish accountability in case of such closed projects, the Ministry replied as under :—

“571 projects worth Rs 34161.58 Cr have been successfully completed and closed during the last 10 years (01 Jan 2012 – Till date). With respect to projects which were partially successful or unsuccessful, 8 such projects worth Rs 770.31 Cr were stage closed during this period.”

It was further informed as under:

“Reasons for closure of projects which were partially successful or unsuccessful are, unanticipated technical complexities, technological denials and price inflations in capital equipment to be sourced from foreign OEMs and related feasibility issues etc., change in user requirements etc., The project proposals are extensively reviewed by Peer Review Committees and Design Review Committees to identify possible risks and to draw risk mitigation plans accordingly. However, certain projects have been stage closed due to the above mentioned risk factors. These are rare occurrences, in spite of the projects being reviewed by peer review and design review committees at various stages.”

CHAPTER - V

Self Reliance and Indigenisation

(i) DPSUs and erstwhile OFBs

5.1 On the role the DRDO in helping DPSUs and Ordnance Factories in achieving the goal of self-reliance, Ministry in its written reply submitted to the Committee as under:

“DPSUs are one of the major Industry partners involved in the production of DRDO designed and developed systems/platforms/equipments. Contracts for D&D projects are entered with DPSUs for the development of systems/platforms/equipments. Under the Development cum Production Partner (DcPP) policy for DRDO developed systems, industries including both public sector entities (DPSUs, erstwhile OFBs etc.) and/or private sector entities, as the case maybe, are involved from the beginning of development cycle, thus facilitating hand-holding throughout the development phase which in turn helps them in achieving the goal of self-reliance.

DRDO has taken following measures for helping DPSUs and Ordnance Factories in achieving the goal of self-reliance:

- i. **Transfer of Technology (TOT) to Industries:** Indigenous technology is the key for strengthening R&D base within the country. DRDO has laid down procedure by which DRDO developed technologies are transferred to industries by entering into Licensing Agreement for Transfer of Technology (LATOT). These technologies are hosted on DRDO website and Indian industry can take these high end defence technologies as per the provisions on DRDO policy and procedure for transfer of technology.
- ii. **Test Facility support to Industries:** Several world class test facilities have now been opened for industries in DRDO labs and necessary SOP has been formulated.
- iii. **Technology Development Fund (TDF):** DRDO has launched Technology Development Fund (TDF) which provides financial and technical support to the Indian industries for the design & development of new technologies & innovative defence products.
- iv. **DRDO Patents:** The details of the DRDO patents are available on DRDO website for use by industries. These patents are available free of cost to industries to enable Atmanirbhar Bharat.
- iv. **Support for issue of Industrial Licences:** DRDO supports industries by providing on-time positive feedback to MoD for issue of Industrial Licences for manufacturing defence products.
- v. **Scientific and Technological Support:** Scientific and Technological support is provided to industry by DRDO on need basis.

- vi. **Export Support:** DRDO supports export of defence products. DRDO has also evolved a compendium on “DRDO products for exports”. The same is hosted on DRDO website. Industries utilize the information provided in this compendium to initiate export dialogue with friendly foreign countries. DRDO has also evolved “DRDO SOP for Export” to support Indian industries for executing exports of DRDO designed and developed products”.

5.2 When enquired whether any coordination mechanism exists, especially in regard to meeting the sectoral needs of the three organizations/Forces with the aim of achieving an overall self-reliance in the defence sector, Ministry submitted as under:

“DRDO takes up activities and projects for development of new technologies and systems based on the evolving threat perception and other inputs from the environment. DRDO actively involve the Users right from the conceptualization of the project through peer reviews, design reviews, and a 3-tier project monitoring mechanism as per DRDO procedure. In addition, Users participate in review meetings like QIMs with IA; QPRs with IAF, Synergy meeting with IN and Apex level reviews by Chiefs, Vice Chiefs and Deputy Chiefs of the Services during the execution of the projects. In addition, for all AoN accorded cases, an Apex Board/Bi-annual Review and Monitoring Team (BRMC) review the projects bi-annually and a Joint Project Monitoring Team (JPMT) facilitates synergy amongst the various stakeholders including Users, designers, certification agencies etc.”

5.3 DRDO is contributing immensely in taking the country towards self reliance and indigenization. Some of the major projects developed by DRDO is attached as Appendix ‘A’.

5.4 The Committee was desirous to know as to what extent the Main Battle Tank (MBT) Arjun stands at par with its counterpart in other developed countries in terms of state of the art technology and striking capabilities with precision. In this regard, the Ministry supplied the following information:

- (i) Arjun MBTs are very much capable of meeting the present and future requirements of the Armed Forces and comparable with its counterparts all over the world. Performance of 120mm MBT Arjun Weapon System is at par with its counterpart. Added to this, at present, Indian Army is fully satisfied with the performance of Arjun MBT Mk-I, which had been proven in many User trials including comparative trials.
- ii) Arjun MBT Mk-IA has been designed and developed by CVRDE / DRDO based on the upgrades suggested by Indian Army. The Arjun MBT Mk-IA manifests the latest battle tank technologies that make it a distinct front-runner amongst the array of contemporary Main Battle Tanks (MBTs) of modern armies in world over. Arjun MBT Mk-IA offers the troops a state-of-the-art tank with superior firepower, high mobility, excellent protection and accommodates four men Crew. The Arjun MBT Mk-IA is capable of firing variety of ammunitions.”

5.5 On the issue of percentage of the indigenously developed and imported parts in the tank, Ministry submitted through written reply:

- “(i) Indigenous content for Arjun MBT Mk-I is about 38-40% percent by cost. Army had placed indent for 124 Arjun MBT Mk-I tanks, which have already been produced and inducted into Service by IA. The Indigenous content of Arjun MBT Mk-IA is over 50% by cost. After successful validation of Arjun MBT Mk-IA, Army has signed a deemed contract on AVNL, Avadi for the production of 118 Nos.
- (ii) 120mm MBT Arjun Weapon System is completely indigenously developed (100%), manufactured at Ordnance factories”.

5.6 The Committee desired to know the details of the indigenous production of Defence equipment designed and developed by the DRDO along with their value vis-à-vis the products imported during the last five years to which the Ministry submitted:

“List of Systems developed by DRDO where AoN has been accorded for induction in the Services during the last five years is enclosed herewith as **Appendix ‘A’**”

5.7 The Committee wanted to know about the latest items of the Negative List of the imported items and number of items planned to be indigenously developed through technology by the DRDO. The Ministry, through written replies apprised the Committee as under:

“List of Weapons/ Platforms/Systems /Ammunition as per the 4th Positive Indigenisation List planned to be developed through technology by DRDO is enclosed herewith as **Appendix ‘B’**.”

5.8 During deliberations, the Ministry was asked to brief the Committee on the concept of Make in India. In this regard, the Secretary, DRDO informed as under:

“Sir, currently, the definition of Make in India is more than 51 per cent should be made within the country. But in most DRDO products, our indigenous content is more than 70-80 per cent”.

5.9 Further on the subject, Secretary, DRDO apprised the Committee:

“.....हमारे इंडिजिनस डेवलपमेंट प्रोजेक्ट्स में जो इम्पोर्टेड कॉम्पोनेंट्स लगते हैं, उनके बारे में था। हम लोगों की कोशिश रहती है कि ऐसा मिनिमम हो, लेकिन कभी-कभी प्रोजेक्ट की टाइमलाइन को मीट करने के लिए हम लोगों को इम्पोर्टेड कॉम्पोनेंट्स यूज करने पड़ते हैं। हमारी कोशिश है कि पैरलली उसका भी इंडिजिनस डेवलपमेंट शुरू किया जाए, ताकि जब तक प्रोडक्शन शुरू हो, तब तक उसमें वह इंडिजिनस कॉम्पोनेंट या सब-सिस्टम लग जाए।

अतः यह हमारी पूरी कोशिश होती है कि प्रोजेक्ट टाइमलाइन को मीट करने के लिए हम लोग जो

भी इम्पोर्टेड कॉम्पोनेंट या सब-सिस्टम ले रहे हैं, उसका डेवलपमेंट पैरलली हम इंडस्ट्री द्वारा या हमारे लैब द्वारा उस पर आरएंडडी शुरू कर दें। यह हमारी कोशिश रहती है।“

5.10 During oral evidence, the Committee desired to know, how DRDO is helping the country in reducing dependency on foreign Military platforms. The Secretary, DRDO apprised the Committee:

“.....you mentioned about 60-75 per cent of dependence still, of military platforms, on Russian as well as other foreign origins. There is a definite need to reduce this.

In DRDO also, we have proposed that we will now make the advanced medium combat aircraft. The main costs are coming in import of aircraft. Ships are now mostly being made in the country. So, the ships are not an issue. The major cost is coming in aircraft. It is coming in tanks also. DRDO has been recommending that NGMBT or new generation or, as the Army calls it, the FRCA has to be made in the country. Then only, this dependence will come down.”

“And we are more hopeful than you, Sir, that in the next 10 years, our indigenisation will be much higher than what it is today. I do not think that it is possible for any country to reach 100 per cent, but we are hopeful. Currently also, it is now 60 per cent to 70 per cent. We are hopeful that we will reach 80 per cent to 90 per cent in the next 10 years”.

(ii) Technology Development Fund (TDF) Scheme

5.11 The Committee have learnt that Government of India has set up the ‘*Technology Development Fund (TDF)*’ scheme under **Make in India** initiative to create an ecosystem for enhancing cutting edge technology capability by inculcating R&D culture in Industry for building indigenous state-of-the-art systems for defence applications. Technology Development Fund (TDF) Scheme aims for the development of defence and dual use technologies that are currently not available with the Indian defence industry, or have not been developed so far. The cost of development spread across all the required technology development phases will not exceed INR 10 Crore and typically projects will not exceed a development period of two years.

5.12 Through a written note, the Ministry informed that the funding is provided through provision of grants to public and private sector industry especially MSMEs&Startups that may work in collaboration with the academia or research institutions to carry out innovation, research and development with a limit of Rs 10 Crore per project. The focus will be on funding for the development of technologies that will form the kernel of components/Assemblies, which will in turn be used to develop defence equipment/systems/sub-systems/platforms.

5.13 Also it was informed that TDF scheme will cover the following nature of products/technologies

- i) The scheme will be limited to development of technologies or prototype of product having potential use for the Services.
- ii) Technology readiness level (TRL) up-gradation from TRL-3 onwards to

- realization of products as per Services requirements.
- iii) Import substitution of components whose technologies doesn't exist with the Indian industry.
- iv) Significant improvements/ up-gradation/ further developments in existing products / process/application/ upgrades in terms of reduced material consumption, improved functioning, improved quality etc. resulting in overall cost reduction.
- v) Development of futuristic technologies/ innovative products having defence application in future.

UNDER TECHNOLOGY DEVELOPMENT FUND (TDF) SCHEME MAJOR ACHIEVEMENTS AS ON DATE SINCE ITS LAUNCH ON SEP 2016

- Separate Budget Code Head has been created for TDF under Grants-in Aid of DRDO – **Major Head-2080, Minor Head -004, 852/08**
- An interactive online TDF Web-portal (www.tdf.drdo.gov.in) has been made operationalized.
- **Eighteen (18)** projects have been Sanctioned/awarded till date under TDF Scheme at total cost of INR **10831.78 Lakh** to various industries (MSME/ Startups) and progressing well and regular Monitoring is being done by **Project Monitoring and Mentoring Group (PMMG)** of each of the project.

On TDF Web-portal registration of Indian Industries /Academia and Experts done till date, the status is as follows:

- Indian Industries Registered with their profile: **3164**
- Indian Academia Registered : **623**
- Experts from Academia /Institutes/Industries registered: **1120**

(iii) The Kalam Vision: Dare to Dream Scheme

5.14 The Ministry, throwing light to the above, apprised on the salient features of scheme through written information which is as under:

1. The Kalam Vision: The Dare to Dream Scheme aimed at creation of an ecosystem to foster innovation and technology development in Defence and Aerospace by engaging Start-ups and individual innovators and engage them to carry out R&D development which has good potential for future adoption for Indian defence and aerospace needs.
2. The objective “The Kalam Vision: Dare to Dream” Scheme is to unearth unexplored ideas and concepts in technologies identified by DRDO for enhancing defence capabilities.
3. The **core objectives** of setting up the TheKalam Vision: Dare to Dream Scheme are to:
 - Facilitate rapid development of new, indigenized, and innovative technologies from ideation to production for the Indian defence and aerospace sector, to meet needs for these sectors in shorter timelines
 - Create a culture of engagement with individual innovators, innovative startups, to encourage co-creation for defence and

- aerospace sectors
- Empower a culture of technology co-creation and co-innovation within the defence and aerospace sectors.
- To achieve the above objective, “The Kalam Vision: Dare to Dream” Scheme will undertake the following activities: -
- Communicate with innovators/startups regarding defence and aerospace needs.
- Organizing various challenges/hackathons to shortlist potential technologies for defence and aerospace use.
- Evaluate Ideas, Proof of Concepts, Prototypes coming from innovators/start-ups in terms of their utility and impact on the Indian defence and aerospace setup. Reward the best of these.
- Tie-ups with existing Incubation Centres and establishment of new incubation centres as required.
- Interface with the Tri-Services (Army/Navy/Airforce) about key innovative technologies and encourage their adoption into the defence establishment with suitable assistance.
- Enable the pilots, Facilitate participation in prevailing schemes available in DRDO for the purpose.
- Facilitate scale-up, indigenization and integration in manufacturing facilities for successfully piloted technologies.
- Second phase of Dare to Dream(D2D) scheme has been launched and a total of 1738 (375 Startups + 1363 individuals - Innovators) applications have been received against twelve (12) technical areas and are under evaluation through various Technical Expert Committee.

(iv) Technology Demonstration (TD) projects

5.15 When enquired about the TD projects developed by DRDO during the last 3 years, Ministry in its written replies submitted:

“During the last 03 years (01 Jan 2020 – Till date), **122** TD Projects worth Rs **8946.39** Cr were sanctioned. During this period, 84 TD Projects worth Rs 2743.36 Cr, which were sanctioned in earlier years were successfully completed.”

5.16 When asked about the Technology Demonstration (TD) projects developed by DRDO transferred to DPSUs for mass production, Ministry in its written replies stated:

“Post successful development, DRDO transfers the technology to industries by signing the Licensing Agreement for Transfer of Technology (LATOT). Till date, DRDO has entered into 1532 Licensing Agreement for Transfer of Technology (LATOT) with industries for mass production. Out of which, 106 LATOTs have been signed with DPSUs.”

5.17 On the cost of development of TD projects, Ministry in its written replies stated as under:

“Total 122 TD Projects worth Rs 8946. 39 Cr were sanctioned during 01st Jan 2020 to till date.”

Related Issue

The Committee have found that a 9 Member High Powered Committee headed by former Principal Scientific Advisor to Government Prof. K Vijaya Raghvan has been set up by the Government tasked to review the functioning/overhauling of DRDO. It is learnt that the Committee is mandated to submit its report within three months.

PART - II

Observation / Recommendations of the Committee

Introduction

The examination of the subject 'A review of the working of the DRDO' assumes significance as DRDO is the foremost research and development organization of the country whose inception took place as early as in the year 1958. It consistently undertakes research and development consistently for our defence organisations. The beneficiary of the research undertaken by DRDO are not only the Defence Forces in all conceivable areas but also the citizens of this country. After gleaning through all the information and material available before the Committee and sifting the same the Committee have given their considered observations and recommendations which are contained in the subsequent paragraphs of this part of the Report.

The Committee find that Defence Research & Development Organisation (DRDO) caters to the need of India's defence requirements by providing cutting-edge technologies and advanced systems for Armed Forces. It was established with an objective to build up science-based capability towards making improvements in existing weapon systems including imported equipments. The DRDO subsequently got involved in the development of armaments and ammunition since 1970s. In 1980s, thrust was given to major programmes, like the development of guided missiles, electronic warfare systems, aircraft communication systems, etc. These programmes gave a new impetus to multiple design and technology centres, which resulted in the productionisation of weapon systems during the 1990s. Following the right trajectory DRDO consequently emerged as one of the premier scientific and technological organisations in the country with core competence in systems design and integration of complex sensors, weapon systems and platforms; development of

complex high-end software packages; development of functional materials; systems testing and evaluation; and technology transfer for productionisation. The Committee undertook oral evidence of the representatives of Ministry of Defence and DRDO where a wide gamut of issues pertaining to the working of DRDO were deliberated. After arriving at the inferences, the specific observations and recommendations of the Committee are detailed below:

1. **DRDO : An Accomplished Research & Development Organisation**

The Committee note that the DRDO as the premier agency under the Department of Defence Research and Development in the Ministry of Defence in the Govt. of India is charged with the Military's research and development. Though DRDO primarily takes projects based on the specific requirements in Long Term Integrated Projects (LTIP) or their immediate requirements, it also undertakes certain small value projects to enhance science and technology base to support future projects, which will be required by Armed Forces. The Committee have been informed that since the technologically advanced countries do not share their critical technologies to developing countries and offer only 'Buy' category of systems to India, therefore, it became imperative for DRDO to develop not only each system, sub-systems and components, but also infrastructures and testing facilities at their respective laboratories. The Committee, while appreciating DRDO's endeavor in this direction also hope that through their ongoing research and development drive, they will enable India to acquire the cutting edge technology and expand their research-base to be not only parallel but ahead with the emerging trends in the field of science and technology development. Here, it goes without saying that Government should provide all facilities required for our scientists in their research and development initiatives.

2. Sphere of Activities

Sphere of activities of DRDO is yet another milestone, which came to the notice of the Committee during examination. The Committee find that while on the one hand, the DRDO render advice to Raksha Mantri and the three Services and inter-services organizations on all scientific aspects of weaponry, weapon-platform, military operations, surveillance, support and logistics, on the other hand, they apprise, assess and advise him on the influence on National Security of the emerging developments in science and technology. They also note that DRDO inter-alia functions as the nodal coordinating agency of the Ministry of Defence on all matters relating to Instruments of Accord with foreign Governments relating to the acquisition of technologies where Export to India is the subject of their national security related controls of foreign Governments. They also deal with matters relating to relations with Research Organisations of other countries and with inter-governmental agencies particularly those relating to scientific and technological aspects of national security. Committee's examination also revealed that the DRDO also overseas arrangements with Universities, educational and research-oriented institutions to provide for foreign scholarships and the training of Indian scientists and technocrats under the administrative control of the Department. The Committee have been given to understand that because of the wide gamut of activities, the clients-base of the organization is also very wide. Ministry of Defence (MoD), Ministry of External Affairs (MEA), Ministry of Home (MHA), Army, Navy, Air Force, R&D Centres of other Govt. Departments, Public and Private Sectors, Academic Institutions, Ordnance Factories, Public Sector Undertakings and Industrial Partners, Citizens of the country and other Ministries which have been identified as stakeholders/clients of the DRDO in varying degrees. The Committee also understand that a wider organizational set up of DRDO provides the

administrative, infrastructure and academic back-up in pursuance with its multifarious activities.

The Committee reiterate in expressing their deep sense of appreciation for the wide gamut of activities that are being undertaken by the DRDO, being the premier R&D Wing of the Ministry of Defence with a vision to empower India. The Committee while specifically appreciating DRDO's arrangements with foreign Universities & Research Institutions recommend that DRDO should also enter into MoUs with these Universities/Research institutions on a long-term basis so that more number of Indian scientists will get the opportunity to get acquainted with latest development in science and technologies on a regular basis, which will ultimately benefit the country. The Committee would like to be informed of the actions taken in this regard.

In addition to the existing sphere of activities of the organization, the Committee are of the view that in view of the problems created by Climate Change and Green House effect and their impact on environment, DRDO may also branch out its research wing to focus on environment pollution so that the health hazards created by such eventualities can be curbed.

3. The Technology Cluster Laboratories

The Committee note with satisfaction that DRDO's laboratories/establishments, regional centres, field stations etc. spread all over the country from Jodhpur to Tejpur and from Leh to Kochi. The Committee understand that there are seven Technology Clusters headed by Cluster DGs located all over the country : Naval Systems and Minerals at Vishakhapatnam; Armaments and Aeronautical Systems, both at Bengaluru; Minerals and Strategic Systems at Hyderabad; Micro electric Devices & Computational Systems and Life Sciences; both at New Delhi.

The Committee also understand that DRDO has touched every aspect of Defence Research and development of technology concerning the country's critical defence needs through their technology cluster laboratories. However, they would like to urge the DRDO to focus more on new and emerging areas of technology applications such as Artificial Intelligence (AI) and Robotics for furthering their research-base and also exploring the possibility of AI's application in various systems & sub-systems developed by them. They are also of the opinion that DRDO should establish their research laboratories in premier institutes of technologies such as the IITs and IIC, Bengaluru so that students having interest in defence & military technology can be motivated to undertake further research in the area. This, the Committee feel, will enable DRDO to tap young scientists at an early stage.

4. Budget and Expenditure

The Committee note that the Department of Defence R&D was allocated Rs 3.14 Crore in 1961-62 out of the total budget allocation of Rs 313.00 Crore to Ministry of Defence, which was about one per cent of Defence Budget. Over the years, this allocation has enhanced and touched Rs 23263.89 Crore for the Financial Year 2023-24, which is 5.38 percent of the total Defence Budget with a corresponding increase in the number of projects/ programmes. Presently, DRDO is spending approximately 36 per cent of its Annual Budget on the development of strategic systems required by the country and many strategic systems developed by DRDO have been inducted into Services.

The Committee while looking at the budgetary provision made to the Department of Defence, R&D during the last two years, note that there has been a decrease in the Budget estimation and the Budget approved or allocated. In the year 2021-22, the projected amount was Rs. 23,460 and the allocated amount was Rs. 20,457.44 crore which was Rs 3002.56 less than the projection. Later, at the

stage of Revised Estimate, the allocation was reduced to Rs 18,337.44 crore. Likewise, in the year 2022-23, the projected amount was Rs. 22,990 crore and the allocated amount stood at Rs. 21,330.20 crore which was Rs 1659.80 crore less than the projection. Since providing a budget to an organization is a conscientious exercise envisaging R&D activities in a year, making a cut at the last stage will have an adverse impact on the performance of the organization. The Committee, therefore, recommend that the Ministry should undertake all out efforts and impress upon the Ministry of Finance to provide sufficient budgetary support as near as possible to the projections of DRDO. They also recommend that in future it should be ensured that no cuts are made in the Defence Budget pertaining to DRDO while allocating the finances.

In respect of the Defence Expenditure of the Country comparing with Defence R&D Expenditure, the Committee learn that a trend is emerging which is registering a continuous decline in DRDO expenditure percentage-wise. To be precise, they would like to point out that the Defence R&D Expenditure as a percentage of Defence Expenditure was 6.59 per cent in the year 2010-11, which was reduced to 5.79 per cent in the year 2011-12. It was again reduced to 5.39 in the year 2012-13 and this percentage further declined to 5.34 percent in 2013-14. The share had slightly improved to 6.6% in 2014 -15 but was again reduced to 5.89% during 2015-16. In the year 2019-20, the percentage share enhanced and stood to 6.23 per cent of the Defence Expenditure but after that, it had an incessant decline and in the last three financial years 2021-22, 2022-23 and 2023-24, the share merely 5.89, 5.53 and 5.38 per cent respectively. The Committee also learned from the data supplied to them that the exclusive Research and Development budget is Rs. 5,000 crore only, out of which 25% i.e. around Rs. 1300 crore is earmarked for the private sector. Hence, it is inferred without any doubt that the amount actually left for DRDO is under constraints. The Committee

observe that R&D is a prerequisite for a robust modern Defence mechanism and the Government has to take care of funds for in-house projects of DRDO along with outsourcing defence R&D. The Committee, therefore recommend that adequate funds for R&D activities should be provided to DRDO for its ongoing and future projects.

Drawing a comparative analysis of the budgetary spending on R&D in India with that of developed countries, the Committee take note that with the current percentage of funding, our country can only aspire to become *atmanirbhar* and protect ourselves. However, to have aspirations to become a global leader, this percentage will not be sufficient. Keeping this objective in the mind the Committee desire that R&D expenditure with respect to the percentage of defence budget should be increased in subsequent years so that DRDO can achieve and accomplish their well defined objectives and render technical deliverance through their ongoing projects.

The Committee find that 8 to 10 per cent of the total DRDO budget is being spent on fundamental research. The Committee have reservations about the existing state of affairs regarding the utilization of fund for existing R&D activities in DRDO. The Committee, while noting that DPSUs and erstwhile Ordnance Factories approach DRDO for requisite upgrades, have in their Ninth Report (14th Lok Sabha), emphasized that Defence Public Sector Undertakings and ordnance factories should have their in-house R&D centers for such purposes. At the same time, the Committee expect from DRDO to extend all possible assistance to 16 DPSUs including newly formed DPSUs in setting up necessary infrastructure and technical know-how to strengthen their R&D Centres in advisory capacity.

The Committee understand that the mandate of DRDO is to develop cutting-edge technologies and to equip Services with internationally competitive systems and platforms through the transfer of such technologies. They also find that DRDO has proven its competence to produce state-of-the-art strategic and tactical military hardware and related technologies in diverse disciplines such as Aeronautics, Armaments, Combat Vehicles, Combat Engineering, Electronics, Missiles, Life Sciences, Materials and Naval Systems. Reckoning the fact that when the budgetary allocations are consistently going down, it would be difficult for DRDO to attain developmental goals, and to attain an edge over adversaries. The Committee, in this regard feel it onerous duty to recommend that budgetary grants of DRDO should be suitably enhanced so that India could become a global leader in the field of armament and new tech weapon systems and DRDO also be able to make first-of-its-kind products. Keeping this in mind the Committee can state with certitude that the time would not be far when India would become a major exporter of arms and ammunitions and would also indulge in technology export to our friendly nations/countries.

5. Human Resource Management

The Committee note that DRDO being a premier Defence R&D Organization follows a dynamic system of manpower management which is issued by way of authorized Regular Establishment (RE). The RE is reviewed every two years to meet the contingent requirements on account of workload and new projects undertaken by the laboratories. The Organization optimally utilizes manpower through dynamic manpower management system. In order to keep the Organization young and energetic and also to fill deficiencies created on account of retirement and superannuation, approximately 100 fresh scientists are recruited by Recruitment and Assessment Centre (RAC), DRDO every year as per functional requirements of the laboratories. The Committee are happy to

learn that this year under the aegis of Mission Mode Recruitment 2023 (MMR-23) more than 850 Group 'A' posts (Scientists) are under recruitment by RAC and over 2200 vacancies of Group 'B' & Group 'C' posts (Technical Cadre and Admin & Allied Cadres) are under recruitment by Centre For Personnel, Talent Management (CEPTAM), DRDO. The Committee recommend that the above recruitment process should be completed at the earliest but essentially within the prescribed time lines under intimation to the Committee. As technical manpower availability is backbone of any research institution specifically for an establishment like DRDO, top level management should continuously monitor the vacancies which needs to be filled, in near future.

6. Training of Personnel

The Committee also note that DRDO is continuously incorporating new training modules to enhance the organizational effectiveness by augmenting its resources and capabilities through training of personnel in R&D and Engineering skills, exposure to allied technologies and focus on strategic planning and leadership. DRDO ensures training to all cadres of personnel through training institutes like Defence Institute of Advance Technology (DIAT), Pune (for technical courses); Information Technology and Management (ITM), Mussoorie (for techno-managerial programmes); and Training Institute, Jodhpur (for technical, administrative and allied cadres) so that they are professionally equipped to take further responsibilities. They have also been informed that every year some scientists are deputed to undergo ME/M.Tech & PhD at IITs, IISc Bengaluru and other reputed universities under the sponsorship programme. Targeted Training Centre (TTC) has been set up at Dr. Raja Ramanna Complex, Bengaluru which is used to plan and conduct Targeted Training for DRDO Scientists/Technologists to keep pace with the rapid advancement of technology and develop competence in state-of-the-art –cutting-edge technologies.

The Committee are of the considered view that since training helps in expanding the knowledge-base and acquaints oneself with the emerging trends in research and technology, DRDO should look into all available possibilities to tie up with various Universities, Institutions and Workplaces for its officers to undergo training and experience at regular intervals for expanding the knowledge-base and acquainting themselves with emerging and new technological knowhow. The Committee would like to be apprised of the tangible developments in this regard.

7. Working of DRDO

The Committee's examination has revealed that DRDO undertakes various types of major projects. One of the types of such project is Mission Mode (MM) Project which include Medium Range Surface to Air Missile (MRSAM) system for Indian Air Force, LCA Mk-II, LRSAM, Quantum Communication for Metropolitan Cities (QMAN), Airborne Early Warning & Control System Mk – II (AEW&C Mk-II) for IAF and Advanced Light Weight Torpedo (ALWT). Besides MM Projects, there are Technology Demonstration (TD) Projects, encompass Active Electronically Scanned Array (AESA) Radar, New Generation Anti-Radiation Missile (NGARM), Supersonic Missile Assisted Release of Torpedo (SMART), Beam Combined Fiber Laser Source (BCFL) and Digital Fuel Flow Controller amongst the others.

The Committee further note that another category of project, i.e. Science & Technology (S&T) Project, which is undertaken for basic or applied research activities i.e. Enhanced Blast Polymer Bonded Explosive Formulations, Pulsed Fiber Laser Sources, Double walled single crystal parts from advanced super alloy, Advanced Warhead Technologies, Enhanced Efficiency of Thermoelectric Generator and Peltier Cooler (EETG) and Technology development for SiC Fiber (TDSiCF). Few more categories in regard to Infrastructure & Facilities (IF)

Development Projects are National Open-Air Range (NOAR), Mission System Integration Rig (MSyIR), Advanced HILS facility, Multi Petaflops Computing System, Creation of Automotive and Weapon Systems Testing Center (AWTC) and Infrastructure for Testing of Expendable Turbo Propulsion System (IT-ET).

User trials (UT) Projects are yet another category that has come to the notice of the Committee. Major projects in this category are development of 5.56 mm Joint Venture Protective Carbine, Modification of Six Aircraft (Su-30 MKI) for Astra, Quick Reaction Surface to Air Missile - (QRSAM-UT), Air Defence Fire Control Radar, ASTRA Mk – I and Multi Influence Ground Mines.

The Committee also note that DRDO not only develop systems but also provides product support for its major systems and to efficiently support the same, it has Product Support (PS) Projects and the major projects in this category are Post Development Support of AEW&C System (PDSAS), Product Support for Arjun MBT, Upgraded Digital Flight Control Computer (DFCC) for LCA Mk-1A, Product Support & Product Upgrade for Akash Weapon System, Akash-Prime and Astra Product Support.

The Committee earnestly feel that diversified projects that are undertaken by the DRDO have enabled India to achieve competitive technological and military edge vis-à-vis our immediate neighbours. The Committee appreciate the mammoth work undertaken in the field of development of critical and strategic systems by DRDO. While commending the role played by the Organisation in the last 65 years in the areas of scientific, technological and armament development, they desire that DRDO should be encouraged to further expand the existing research-base and venture into new areas of development keeping in view the country's future military needs. They hope that Govt. will extend all out support to enable DRDO to withstand any kind of eventualities in future.

8. Status of Ongoing Projects

The Committee also note that DRDO currently has 328 ongoing projects (*excluding strategic projects*) amounting to approximately Rs.99,898 Cr (*including User share*) out of which 55 projects are Mission Mode, 197 Technology Demonstration (TD), 34 are Infrastructure & Facilities (IP), 19 are Science & Technology (S&T), 20 Product Support (PS) and 3 User Trial (UT) projects. The Committee has every reason to believe that the category-wise details of the ongoing projects eloquently speak of the success story of the Organisation.

The Committee further note that DRDO has already handed over to the users various systems such as High Strength Steel for 'INS Vikrant', Main Battle Tank (MBT) 'Arjun' Mk-1A', Shakti : Electronic Warfare System, Light Combat Aircraft (LCA) 'Tejas Mk – 1A', Medium Range Surface-to-Air Missile (MRSAM) for IAF, Medium Range Surface-to-Air Missile (MRSAM) for Navy, Satellite guided Smart Anti Airfield Weapon (SAT-SAAW), Beyond Visual Range Air-to-Air Missile 'Astra', Multi-Mode Hand Grenade (MMHG), Bund Blasting Device (BBD) Mk-II, Drone, Detect, Deter and Destroy (D4 System), Chaff Technology for Indian Navy, 46m Military Load Class (MLC-70) Modular Bridge, Fire Fighting Suit, Helmet and pressure breathing Mask and Indigenous Filters for P-75 Submarines.

The Committee's attention was also drawn towards major systems which were inducted/being inducted into Services. They include Akash Prime, 18Anti-Tank Guided Missile (NAG), Arjun Armoured Repair & Recovery Vehicle (Arjun ARRV), Armoured Engineer Reconnaissance Vehicle (AERV), Short Span Bridging System-10m, 120mm Tandem warhead system for anti-tank application, 81 mm anti-thermal, anti-laser smoke grenade, Joint Venture Protective Carbine (JVPC), Light Machine Gun (7.62X51 mm - LMG), Trawl Assembly for T-72/T-90 Tanks, Qualification and Certification of DMR249 and

DMR301 Grade Steels, Plates, Bulb Bars and Weld Consumables, Digital Radar Warning Receiver (Dhruti), Nayan, Software Defined Radio (SDR), High Data Rate HD-VLF-HF Receiver, Laser Ordnance Disposal System (LORDS – N), Chaff Technologies for Indian Air Force, Magazine Fire Fighting System, ARNAV Naval Wargaming and NBC Haversack Mk-II.

The Committee are happy to note about the efforts undertaken by DRDO in establishing high technology infrastructure facilities. Most of these facilities have been established with the active participation of Indian Industries. These facilities have become National Assets and have also proved beneficial in accelerating subsequent developments undertaken by DRDO. The Committee appreciate that DRDO has made these Test Facilities available to the Industries, which would definitely result in future development of weaponry at a faster pace.

The Committee appreciate the hard work put forth by DRDO in the development of armaments, critical and strategic systems, Extreme Weather clothing and equipment, food items for High Altitude Terrain and other innovations during its journey which started in the year 1958 with an objective to build up science-based capability towards making improvements in existing weapon systems including imported equipment. DRDO has come a long way since then and has developed many import substitution products besides innovating superior weapon systems for the forces. The Committee at this juncture can only recommend that DRDO should put in place the arrangements to tie up with a consortium of Industries for creating widespread infrastructure so that the systems created by the organization can become future-ready. The initiatives taken in this regard and the road map/timeline drawn to accomplish the same must be intimated to the

Committee at the earliest but definitely at the time of furnishing the Action Taken Notes.

9. Participation with Academia and Industry

The Committee are happy to note that DRDO has been exploring the knowledge and expertise that exist within the country in various academic institutions and research organizations by providing research grants for faculty driven projects through External Research & Intellectual Property Right (ER&IPR) and various Research Boards, namely, Aeronautic Research & Development Board (AR&DB), Armament Research Board (ARMREB), Life Science Research Board (LSRB), Naval Research Board (NRB) etc. The Committee have also come to learn that the objective of these grants has been to foster knowledge-based growth in science and advanced technologies, catalyze cross-fertilization of ideas and experience between DRDO and academic experts.

The Committee note that during the last five years, DRDO has given impetus to collaboration with academia for DRDO requirement-driven research in the identified futuristic technology thrust areas. The Directed research is managed by the Directorate of Futuristic Technology Management (DFTM) and DRDO has established eight Advanced Technology Centers (ATCs) at the premier institutes for carrying out research in the niche technology areas related to defence & security. The ATCs conduct steers the basic & applied research to offer solutions for technological or engineering challenges to raise the technology readiness level.

The Committee feel that DRDO's research collaboration with 155 institutes and the present IPR portfolio speak eloquently of its own success stories. The Committee hope that this will surely help in making India self-reliant in real sense of the term. Here, the Committee would like to recommend the DRDO to further encourage and support Research and Development in private industry by

identifying systems and sub-systems to be developed by the private industries. They would also recommend to expand their outreach to include and associate with more and new upcoming industries by way of adopting inclusive approach. This, the Committee feel, will help achieve the goal of 'Atmanirbhar Bharat'.

10. Ongoing Major Programmes/Projects/Systems

The Committee note that the major Systems Undergoing User Evaluation include Quick Reaction Surface-to-Air Missile (QRSAM), Third Generation Helicopter Launch Anti-Tank Guided Missile ('HeliNa'/Dhruvastra), Medium Range Surface – to - Air Missile (MRSAM) for IA, Advanced Towed Artillery Gun System (ATAGS), Pinaka Mk-I (Enhanced Range) Rocket System, 125mm Fin Stabilized Armour Piercing Discarding Sabot (FSAPDS), Multi Influence Ground Mine (MIGM), Advanced Light Weight Torpedo (ALWT), Portable Diver Detection Sonar (PDDS), Air Independent Propulsion (AIP) System for Submarines, Air Defence Fire Control Radar (ADFCR), Air Defence Fire Control Radar (ADFCR) – Atulya, GaN Technology Development, Tele-operated Dozer, Oxygenated Shelter and Extreme Cold Weather Clothing System (ECWCS).

DRDO has also provided information on Major Systems Undergoing Developmental Trials, which include BrahMos, Stealth Wing Flying Testbed (SWiFT), Very Short Range Air Defence System (VSHORADS), Vertical Launch Short Range Surface to Air Missile (VL-SRSAM), Solid Fuel Ducted Ramjet (SFDR) Technology for Air Launched Tactical Missiles, Akash New Generation (Akash-NG) and Man-Portable Anti-Tank Guided Missile (MPATGM).

The Committee are of the opinion that DRDO being a premier development agency for conduct of all types of research, has the onus of responsibility for creating credible deterrence capabilities for the Indian Armed Forces by developing technologically superior weapon systems. The Committee in this

regard recommend that DRDO should leave no stone unturned and concentrate by focusing on augmenting the level of research and technological output to superior strata in order to be at par with the other developed countries. The Committee also desire that DRDO may explore the idea of having joint venture/collaboration with foreign partners to attain the capability to design and develop state-of-the-art future-centric weapon systems which can later be passed on to Indian Industry for manufacturing.

11. Drone / Anti Drone Capabilities

The Committee understand that drones are increasingly becoming very important in warfare, as is evidenced in the recent ongoing wars. The Committee have been given to understand that DRDO is developing drone based systems and anti-drone systems based on the requirements of User Agencies. DRDO has developed a comprehensive integrated Anti-Drone System which comprises of detection, identification and neutralization of a drone. After developing the technologies, the Committee can see that in the fitness of things and as a natural course of event that these are handed over to established Private industries as well as the budding ventures coming up under the new start ups umbrella under the Transfer of Technology (ToT) vertical. Three services (IA, IAF & IN) have already placed 23 orders on M/s BEL for DRDO developed technology. While developing the drone/anti drone capabilities the Committee would also recommend that DRDO must look into all the pragmatic angles of developing “Interceptive Drone” and Sea Drone capability.

The Committee have been informed that the older generation of drones were using Ni Cad and Silver Zinc batteries which were available in India. Notwithstanding the fact, the Committee find that owing to advancement in battery technology, Lithium Ion chemistry is now being used, which is not hitherto available in India. Although ISRO and DRDO are working on Lithium Ion

Cell, yet the activity is still in nascent stage of development. The Committee have further been informed that ADE, DRDO has proposed to work with FFC on the development of Lithium Phosphate cells with its Battery Management System. They, therefore, recommend that DRDO should take up this as a mission mode project to develop the required battery cells so that the new generation of Drones and Anti-drones be developed in a time bound manner to cater to the needs of our military capabilities.

12. Delay in the Projects / closed projects

The Committee note with concern that out of 55 projects, 23 were not completed within the stipulated time. Although, 571 projects worth Rs 34161.58 Cr have been successfully completed and closed during the last 10 years (01 Jan 2012 - Till date), with respect to projects which were partially successful or unsuccessful, 8 such projects worth Rs 770.31 Cr were stage closed during this period. On an earlier occasion also, the Committee observed that scores of projects with DRDO were plagued by time and cost overruns and several projects were short closed due to change in the General Staff Qualitative Requirements (GSQRs)] by the user or due to technological obsolescence. In the instant case, the reasons put forth by DRDO for closure of projects are, unanticipated technical complexities, technological denials and price inflations in capital equipment to be sourced from foreign Original Equipment Manufacturers (OEMs) and related feasibility issues etc. The Committee also note that project proposals are extensively reviewed by Peer Review Committees and Design Review Committees to identify possible risks and to draw risk mitigation plans accordingly. The Committee are surprised to find that despite the projects being reviewed by peer review and design review committees at various stages, certain projects have been stage closed due to the above mentioned risk factors.

Keeping in view the above facts the Committee are of the firm opinion and therefore in consonance recommend that all review mechanisms must be revisited by DRDO as they themselves may be the cause of delays in some cases. The Committee are also of the opinion that review mechanism should be inclusive of technical personnel (if not in place already) which can effectively guide the research projects towards their timely accomplishment. This can be staffed by senior scientists from different research/educational organisations who have experience and expertise in the relevant fields. Even the retired scientists from ISRO and Atomic Energy Commission etc. can also be associated with the review committees. The Committee also recommend that the reviews should have standard yardsticks so that when there is a deviation from it, corrective measures can be taken at the earliest and unnecessary delay/cost-overrun can be avoided.

13. Self Reliance and Indigenisation

The Committee are happy to note that DRDO is contributing immensely in taking the country towards self-reliance and indigenization. The Committee have also been informed that DPSUs are one of the major Industry partners involved in the production of DRDO-designed and developed systems/platforms/equipment. Contracts for D&D projects are entered with DPSUs for the development of systems/platforms/equipment. Under the Development cum Production Partner (DcPP) policy for DRDO developed systems, industries including both public sector entities (DPSUs, erstwhile OFBs etc.) and private sector entities, as the case may be, are involved from the beginning of the development cycle, thus facilitating hand-holding throughout the development phase which in turn helps them in achieving the goal of self-reliance.

The Committee appreciate the measures taken by DRDO for helping DPSUs and Ordnance Factories in achieving the goal of self-reliance i.e. Licensing

Agreement for Transfer of Technology (LATOT), Test Facility support to Industries, Technology Development Fund (TDF), Export Support etc. The Committee are happy to note that DRDO takes up activities and projects for development of new technologies and systems based on the evolving threat perception and other inputs from the environment. However, the Committee are concerned to note that the country is still dependent on foreign countries with respect to military platforms. The Committee have been informed that with the current rate of indigenization, DRDO is hopeful that the country may achieve 80 to 90 percent indigenization in the next 10 years.

The Committee are of the considered view that long and continued dependence on imported weapon systems may act as a discouraging phenomenon to our renewed saga of 'Make in India' initiative. Therefore, the Committee recommend that there should be greater professionalism in integrated defence capability planning, management of Research and Development and priority should be given to self-reliance, thereby nurturing the nation's industrial capability in defence sector.

14. Technology Development Fund (TDF) Scheme

The Committee learn that Government of India has set up the '*Technology Development Fund (TDF)*' scheme under Make in India initiative to create an ecosystem for enhancing cutting edge technology capability by inculcating R&D culture in Industry for building indigenous state-of-the-art systems for defence applications. Technology Development Fund (TDF) Scheme aims for the development of defence and dual use technologies that are currently not available with the Indian defence industry, or have not been developed so far.

The Committee have been informed that the funding is provided through provision of grants to public and private sector industry especially MSMEs &

Startups that may work in collaboration with the academia or research institutions to carry out innovation, research and development with a limit of Rs 10 Crore per project. While appreciating the spectacular achievements of awarding 18 projects under the TDF scheme, the Committee desire that DRDO should ensure that the funding so provided must focus on development of technologies that will form the components which, in turn, will be used to develop defence equipment/systems/sub-systems/platforms.

15. The Kalam Vision: Dare to Dream Scheme

The Committee note with appreciation the Kalam Vision: The Dare to Dream Scheme, which aim at creation of an ecosystem to foster innovation and technology development in Defence and Aerospace by engaging Start-ups and individual innovators and engage them to carry out R&D development which has good potential for future adoption for Indian defence and aerospace needs.

The Committee have been informed that the core objectives of setting up the The Kalam Vision: Dare to Dream Scheme are to facilitate rapid development of new, indigenized, and innovative technologies from ideation to production for the Indian defence and aerospace sector, to meet needs for these sectors in shorter timelines and create a culture of engagement with individual innovators, innovative startups, to encourage co-creation for defence and aerospace sectors. The Committee feel that this also empowers a culture of technology co-creation and co-innovation within the defence and aerospace sectors.

The Committee are of the view that this is certainly a step forward in achieving the prime objective of 'Make in India' initiative and furthering the goal of 'Atmanirbhar 'Bharat'. The Committee, therefore, desire that the Govt. should encourage and promote potential start-ups and prototypes coming for innovators where, they are sure that such ventures have utility and impact on the Indian defence and aerospace set up.

16. Technology Demonstration (TD) projects

The Committee note that during the last 03 years (since January, 2020), 122 TD Projects worth Rs.8946.39 Cr were sanctioned. During this period, 84 TD Projects worth Rs.2743.36 Cr, which were sanctioned in earlier years, were successfully completed. It is understood that post successful development, DRDO transfers the technology to industries by signing the Licensing Agreement for Transfer of Technology (LATOT). DRDO has entered into 1532 Licensing Agreement for Transfer of Technology (LATOT) with industries for mass production. Out of which, 106 LATOTs have been signed with DPSUs.

The Committee appreciate the efforts made by DRDO in executing the Licensing Agreement for Transfer of Technology for mass production. They also appreciate DRDO for 106 LATOTs that have been signed only with DPSUs, which, they feel, will certainly empower the industries, albeit the DPSUs in enhancing production and galvanizing their efforts towards achieving greater self-reliance. The Committee would like to be informed of the updated status in this regard.

Related issue:

The Committee learn that a high Powered Committee has been set up by the Government assigned with a task of overhaul of DRDO. While not keen to be apprised of the functioning of this Committee as it is not the mandate of Standing Committee on Defence, yet they would like to have some rudimentary feed back from DRDO at least their suggestions on the proposed revamp covering inter alia very broad areas.

Conclusion :

In summation, Committee's examination of the subject 'A Review of the working of DRDO' reveals that DRDO is the R&D Wing of Ministry of Defence,

Govt. of India, with a vision to empower India with cutting edge defence technologies and a mission to achieve self-reliance in critical defence technologies and systems while equipping our armed forces with state-of-the-art weapon systems and equipment in accordance with requirements laid down by the three services. DRDO's pursuit of self-reliance and successful indigenous development and production of strategic systems and platforms have given quantum jump to India's military might, generating effective deterrence and providing crucial leverage. Started as a small organization in 1958 with 10 establishments/ laboratories, DRDO has grown multi-directionally in terms of the variety of subject disciplines, number of laboratories, achievements and status.

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 simulations, special materials, naval systems, life sciences, training, information systems and agriculture. Several major projects for development of missiles, light combat aircrafts, radars, electronic warfare systems etc. are on hand and significant achievements have already been made in numerous technologies. Moreover, as part of 'Make In India' and 'Atmanirbhar Bharat' initiative, DRDO, under development come production partner programme, allowed hand holding of private industries to improve their development and production cycle of complex defence systems. Thus, DRDO has fulfilled its vision of empowering the nation with state-of-the-art indigenous Defence technologies and systems. The relentless effort made by DRDO in various fields as discussed in the various chapters above is in the right direction to fulfill the mission of the organization, viz. i) Design, develop and lead to production of state-of-the-art sensors, weapon systems, platforms and allied equipment for our Defence Services, ii) Provide

technological solutions to the Services to optimize combat effectiveness and to promote well-being of the troops, and iii) Develop infrastructure and committed quality manpower and build strong indigenous technology base.

The Scientific/technical service delivery of DRDO is on the right trajectory and with the impetus and fillip given by the Government, the day would not be far when it would be an institution to be reckoned at par with other international organizations in the field.

**New Delhi;
18 December, 2023
27 Agrahayana, 1945 (Saka)**

**JUAL ORAM
Chairperson
Standing Committee on Defence**

STANDING COMMITTEE ON DEFENCE (2022-23)

**MINUTES OF THE SECOND SITTING OF THE STANDING COMMITTEE ON
DEFENCE (2022-23)**

The Committee sat on Monday, the 14 November, 2022 from 1100 hrs. to 1245 hrs. in Committee Room No. 'C', Parliament House Annexe, New Delhi.

PRESENT

SHRI JUAL ORAM

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CHAIRPERSON

MEMBERS

LOK SABHA

2. Shri Devaragunda Venkappa Sadananda Gowda
3. Shri Annasaheb Shankar Jolle
4. Shri Suresh Kumar Kashyap
5. Shri Rattan Lal Kataria
6. Dr. Rajashree Mallick
7. Shri Anumula Revanth Reddy
8. Shri Jugal Kishore Sharma
9. Shri Brijendra Singh
10. Shri Mahabali Singh

RAJYA SABHA

11. Dr. Ashok Bajpai
12. Shri Prem Chand Gupta
13. Smt. P.T. Usha
14. Shri G.K. Vasani
15. Lt. Gen. (Dr.) D. P. Vats (Retd.)
16. Shri K.C. Venugopal

SECRETARIAT

1. Smt. Suman Arora - Joint Secretary
2. Dr. Sanjeev Sharma - Director
3. Shri Rahul Singh - Deputy Secretary

**LIST OF WITNESSES
MINISTRY OF DEFENCE**

S.No. Name & Designation

1. Dr. Samir Venkatpati Kamat, Secretary, DDR&D & Chairman, DRDO
2. Shri K.S. Varaprasad, DS & DG(HR)
3. Shri Hari Babu Srivastava, OS & DG
4. Dr. UK Singh, OS & DG(R&M)
5. Dr. Chandrika Kaushik, OS, BDG(PC&SI)
6. Shri Purusottam Bej, OS & Director

7. Shri Vedveer Arya, Addl FA & JS
8. Dr. Ravindra Singh, Scientist 'G' & Director, DPARO&M
9. Dr. Sumit Goswami, Scientist 'F' & Director, DP&C

2. At the outset, the Chairperson welcomed the Members and informed them about the agenda of the Sitting i.e. to consider and adopt the Draft Report on the subject 'Assessment of Welfare Measures available to War Widows/Families in Armed Forces' and briefing by the representatives of the Ministry of Defence on the subject 'A review of the working of the Defence Research and Development Organisation (DRDO)'.

3. The Committee first took up the draft Report for consideration. After some deliberations, the Committee adopted the Report without any changes/modifications. The Committee authorized the Chairperson to finalise the above draft Report and present the same to the House on a date convenient to him.

3. The Chairperson, then invited representatives of the Ministry of Defence representing Defence Research and Development Organization (DRDO) to the Sitting of the Committee and requested them to brief the Committee on the subject. He further drew their attention to the Direction 55(1) of Directions by the Speaker, Lok Sabha regarding maintenance of confidentiality of proceedings.

4. Thereafter, a Power Point Presentation on the subject 'A review of the working of the Defence Research and Development Organisation (DRDO)' was made before the Committee by the representatives of DRDO. This was followed by extensive discussion inter-alia on the following points:

- 1) Drone and Anti Drone System technologies / capabilities
- 2) Development of engine for LCA/UAVs
- 3) Development and supply of different versions of LCA Tejas
- 4) Spying activities /checking of antecedents of contractual staff
- 5) Non-discloser agreement regarding maintenance of confidentiality of the systems/products developed by DRDO in collaboration with private players/industries;
- 6) Products and Systems developed by DRDO under "Make in India" Initiative;
- 7) Budgetary allocation for research and development of Light Weight Tanks and the status of their availability to the Indian Army;
- 8) Details of research and development by DRDO on Aircraft Communication Systems;
- 9) Indigenisation of components of Sukhoi Aircraft in collaboration with Russia;
- 10) Shortage and Recruitment of scientists in DRDO

5. The representatives of DRDO responded to various queries raised by the Members. The Chairperson directed the representatives of the Ministry to furnish written replies/information on the points raised by the Members, which were not readily available, at an early date, which the representatives assured.

6. The Chairperson thanked the representatives of DRDO for the extensive discussion on the subject.

The witnesses then withdrew.

7. Then, the Committee have decided that one more subject 'A review of Sainik Schools', may be included in the list of subjects selected for the year 2022-23. Further, the Committee also decided to undertake a study visit in the month of January 2023.

The Committee then adjourned.

8. A copy of verbatim record of the proceedings has been kept on record.

STANDING COMMITTEE ON DEFENCE (2022-23)

**MINUTES OF THE EIGHTH SITTING OF THE STANDING COMMITTEE ON
DEFENCE (2022-23)**

The Committee sat on Tuesday, the 11th April, 2023 from 1500 hrs. to 1600 hrs. in Committee Room No. 'D', Parliament House Annexe, New Delhi.

PRESENT

SHRI JUAL ORAM

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CHAIRPERSON

MEMBERS

LOK SABHA

2. Shri Devaragunda Venkappa Sadananda Gowda
3. Shri Annasaheb Shankar Jolle
4. Shri Durai Murugan Kathir Anand
5. Kunwar Danish Ali
6. Dr. Rajashree Mallick
7. Shri Reddeppa Nallakonda Gari
8. Shri Brijendra Singh
9. Shri Mahabali Singh

RAJYA SABHA

10. Shri Sushil Kumar Gupta
11. Shri Venkataramana Rao Mopidevi
12. Dr. Sudhanshu Trivedi
13. Smt. P.T. Usha
14. Shri G.K. Vasani
15. Lt. Gen. (Dr.) D. P. Vats (Retd.)

SECRETARIAT

1. Smt. Suman Arora - Joint Secretary
2. Dr. Sanjeev Sharma - Director
3. Shri Rahul Singh - Deputy Secretary

LIST OF WITNESSES

DEFENCE RESEARCH AND DEVELOPMENT ORGANISATION (DRDO)

S. No.

Name & Designation

1. Dr. Samir Venkatpati Kamat, Secretary, DDR&D & Chairman, DRDO
2. Shri K.S. Varaprasad, DS & DG(HR)
3. Shri Hari Babu Srivastava, OS & DG (FM)

4. Ms. Suma Varughese, OS & DG (MED & CoS)
5. Dr. UK Singh, OS & DG (LS)
6. Shri Purusottam Bej, OS & DG (R&M)
7. Shri AD Rane, OS & DG (Brahmos)
8. Dr. Chandrika Kaushik, OS & DG (PC&SI)
9. Shri Vedveer Arya, Addl. FA & JS
10. Shri D.K. Rai, Joint Secretary

2. At the outset, the Chairperson welcomed the Members and informed them about the agenda of the Sitting i.e. to take oral evidence of the representatives of the Ministry of Defence on the subject 'A review of the working of the Defence Research and Development Organisation (DRDO)'.

3. The Chairperson, then invited representatives of the Ministry of Defence representing Defence Research and Development Organization (DRDO) to the Sitting of the Committee and requested them to brief the Committee on the subject. He further drew their attention to the Direction 55(1) of Directions by the Speaker, Lok Sabha regarding maintenance of confidentiality of proceedings.

4. Thereafter, a Power Point Presentation on the subject 'A review of the working of the Defence Research and Development Organisation (DRDO)' was made before the Committee by the representatives of DRDO. This was followed by extensive discussion *inter-alia* on the following points:

- 1) Achievements of DRDO and its contribution in empowering armed forces;
- 2) Development of 155 mm Artillery Gun;
- 3) Drone and Anti Drone System technologies / capabilities;
- 4) Development of engine for LCA/UAVs;
- 5) Development and supply of different versions of LCA Tejas;
- 6) Recent incidents spying activities in DRDO and steps taken to curb such incidents and need to have deterrence to curtail leak of sensitive information;
- 7) Mechanism formulated by DRDO to take in account technological advancement in order to ensure that developing technology does not become obsolete;
- 8) Details of technology export to friendly countries;
- 9) Budgetary allocation for research and development to DRDO vis-a-vis other developed countries;
- 10) Prolonged delay in completion of various research programmes under DRDO and steps taken by the Ministry to ensure completion of these programmes in a time bound manner;
- 11) Details regarding promotions to scientist and experts employed by DRDO;
- 12) Current status of defence corridor in Tamil Nadu;
- 13) Modus operandi of various ongoing research project of DRDO in various academic institutes like IITs and others;
- 14) Details of internship/apprenticeship schemes being implemented by DRDO;
- 15) Mechanism developed by DRDO/Ministry to analyse usability of technology after Transfer of Technology to defence PSUs; and
- 16) Details of research and development of Kaveri engine by DRDO and its current status.

5. The representatives of DRDO responded to various queries raised by the Members. The Chairperson directed the representatives of the Ministry to furnish written replies/information on the points raised by the Members, which were not readily available, at an early date, which the representatives assured.

6. The Chairperson thanked the representatives of Ministry and DRDO for the extensive discussion on the subject.

The witnesses then withdrew.

The Committee then adjourned.

A copy of verbatim record of the proceedings has been kept on record.

STANDING COMMITTEE ON DEFENCE (2023-24)

**MINUTES OF THE SECOND SITTING OF THE STANDING COMMITTEE ON
DEFENCE (2023-24)**

The Committee sat on Monday, the 18th December, 2023 from 1500 hrs. to 1615 hrs. in Committee Room 'D', Parliament House Annexe , New Delhi.

PRESENT

Shri Jual Oram - **Chairperson**

MEMBERS

Lok Sabha

- | | |
|----|----------------------------------|
| 2 | Shri Durai Murugan Kathir Anand |
| 3 | Kunwar Danish Ali |
| 4 | Shri Rahul Gandhi |
| 5 | Shri Annasaheb Shankar Jolle |
| 6 | Shri Suresh Kumar Kashyap |
| 7 | Prof. (Dr.) Ram Shankar Katheria |
| 8 | Dr. Rajashree Mallick |
| 9 | Shri Jugal Kishore Sharma |
| 10 | Dr. Shrikant Eknath Shinde |
| 11 | Shri Prathap Simha |
| 12 | Shri Brijendra Singh |

Rajya Sabha

- | | |
|----|-----------------------------------|
| 13 | Dr. Ashok Bajpai |
| 14 | Shri Kamakhya Prasad Tasa |
| 15 | Dr. Sudhanshu Trivedi |
| 16 | Smt. P.T. Usha |
| 17 | Shri G.K. Vasani |
| 18 | Lt. Gen. (Dr.) D. P. Vats (Retd.) |

SECRETARIAT

- | | | | |
|----|---------------------|---|-----------------|
| 1. | Dr. Sanjeev Sharma | - | Joint Secretary |
| 2. | Shri Tirthankar Das | - | Director |

2. At the outset, the Chairperson welcomed the Members of the Committee and informed them about the agenda for the Sitting. The Committee then took up for consideration the following draft Reports:-

- i) **Draft Report on the subject 'A review of working of Defence Research and Development Organisation(DRDO)';**
- ii) **Draft Report on Action Taken by the Government on the Observations/ Recommendations contained in the Thirty-fifth Report (17th Lok Sabha) on 'Demands for Grants of the Ministry of Defence for the year 2023-24 on General Defence Budget, Border Roads Organisation, Indian Coast Guard, Defence Estates Organisation, Defence Public Sector Undertakings, Welfare of Ex-Servicemen and Defence Pension (Demand Nos. 19 and 22)';**
- iii) **Draft Report on Action Taken by the Government on the Observations/ Recommendations contained in the Thirty-sixth Report (17th Lok Sabha) on 'Demands for Grants of the Ministry of Defence for the year 2023-24 on Army, Navy, Air Force, Joint Staff, Ex-Servicemen Contributory Health Scheme and Sainik Schools (Demand Nos. 20 and 21)';**
- iv) **Draft Report on Action Taken by the Government on the Observations/Recommendations contained in the Thirty-seventh Report on 'Demands for Grants of the Ministry of Defence for the year 2023-24 on Capital Outlay on Defence Services, Procurement Policy and Defence Planning (Demand No. 21)'; and**
- v) **Draft Report on Action Taken by the Government on the Observations/Recommendations contained in the Thirty-eighth Report on 'Demands for Grants of the Ministry of Defence for the year 2023-24 on Directorate of Ordnance (Coordination and Services)–New DPSUs, Defence Research and Development Organisation and National Cadet Corps (Demand Nos. 20 and 21)'.**

3. After some deliberations, the Committee adopted the above reports without any modifications. The Committee, then, authorized the Chairperson to finalise the above draft Reports and present the same to the House on a date convenient to him.

4. *****Does not pertain to the Report*****

The Committee then adjourned.

AoN approvals for Systems Developed by DRDO: 2018 onwards

Major systems developed by DRDO where AoN has been accorded for induction in the Services during the last five years include:

Sno.	System/Equipment	Cost (in Cr)
1.	Mountain Foot Bridge	26.77 Cr
2.	Advanced Torpedo Decoy System (ATDS) Mareech	850.00
3.	Ground Based Systems for AWACS	116.00
4.	P-16 Heavy Drop Platform & Parachute System (HDS-16-T) for Airborne Forces	86.24
5.	Mine Anti Tank Point Attack Vibhav (NFM)	233.85
6.	Mine Anti Tank Bar Mine Vishal (NFM)	158.70
7.	Digital Instant Fire Detection and Suppression System (IFDSS) for Tank T-72	288.21
8.	NAG Missile System (Tracked)/ NAMIS (Tr)	524.021
9.	Joint Service Application (JSA) for Generating Fused Conventional Operational Picture of War	5.5
10.	Vertically Launched SRSAM	1981.60
11.	Advanced Towed Artillery Gun System (ATAGS)	3364.78
12.	Test Eqpt for Guided Wpn sys of T-90	53.19
13.	Armoured Recovery Vehicle (ARV) and Armoured Vehicle Tracked (AVT) Light Repair/Field Repair (LR/FR) for MBT Arjun	689.54
14.	Tri-Services Indigenous Geographical Information System	9
15.	Brahmos Systems	218.53
16.	EON 51 Electro optical fire control system	238.16
17.	Multi Mode Hand Grenade	531
18.	Mechanical Minefield Equipment Mark II	143.36
19.	SDR (Tactical) for Ships and Shore establishments	1100.8
20.	Next Generation Maritime Mobile Coastal Batteries	1196.97
21.	Mechanical Mine Layer (SP)	288.86
22.	HIMSHARAVAN (EW System)	480
23.	Shatrughat (EW System)	1650.00

Appendix 'A'

24.	Samaghat (EW System)	3500.00
25.	Sonar USHUS Version 2	8.32
26.	Integrated ASW Complex (IAC) Mod 'C'	286.70
27.	Indigenous Ships Comint system –Nayan	438.88
28.	Ashlesha Mk-1Radar	298.35
29.	Long Range Land Attack Cruise Missile (LR-LACM)	10702
30.	Man Pack V/UHF Software Defined Radio (SDR)	90
31.	Astra Mk I beyond Visual Range Air to Air Missile	3129
32.	Weapon Locating Radar (Mountains)	396.48
33.	125 mm APFSDS (Armour Piercing Fin Stablised Discarding Sabot) ammunition for Tank T-72/T-90	306.8
34.	Unit Repair Vehicle (URV) for MBT Arjun	8.26
35.	Smart Anti Airfield Weapon (SAAW)	967
36.	125mm APFSDS (Armour Piercing Fin Stabilised Discarding Sabot) Practice ammunition for tank T-72/ T-90	269.93
37.	Modular Bridge system	2526.74
38.	BrahMos missile	1782.97
39.	AEW&C Mk-II	10994.44
40.	MBT Arjun Mk-1A	8379.616
41.	Medium Power Radar (Arudhra)	2863.73
42.	BrahMos Missile regiments	138.42
43.	Trawl assembly for T-72/T-90 tanks	340.94
44.	Border Surveillance Systems (BOSS)	76.3

Appendix 'A'

45.	Medium Range Surface to Air Missile (MRSAM) (Classified)	(Classified)
46.	DR-118 RWR System and associated equipment for Su-30 MkI Aircraft (Classified)	(Classified)
47.	Missile Akash Weapon System	6376.1 Cr
48.	High Explosive Pre Fragmented (HEPF) Mk-I (Enhanced) and Practice Reduced High Explosive (RHE) Mk-1 (Enhanced) rocket ammunition for 214mm Multi Launch Rocket System	3722.78
49.	Indigenous Software Defined Radio (Portables) for Ships and Shore Establishment	265.5
50.	Laser Ordnance Disposal System (LORDS-N)	28.78
51.	Laser Ordnance Disposal system Mk-I (LORDS Mk-I)	40.64
52.	High Data Rate VLF-HF receiver for ships and shore establishments	257.05
53.	Individual under water Breathing Apparatus (IUWBA) for T-90 tanks Crews	27.04
54.	Automatic Chemical Agent Detector and Alarm (ACADA)	54.21
55.	Ulka (NFM)	163.92
56.	Anti-Thermal Anti Laser Smoke Grenade for Armoured Fighting Vehicles (AFVs)	75.04
57.	Bridge Laying Tank (BLT) T-72	561.93
58.	Weapon Locating Radar (WLR) SWATHI (Plains)	981.76
59.	Unit Maintenance Vehicle (UMV) for MBT Arjun	109.33
60.	Self Propelled Mine Burier (SPMB)	344.9
61.	SARANG ESM System	351.39
62.	Guided Extended Range (GER) Rocket Ammunition for 214 mm Pinaka Multiple Launch Rocket System (MLRS)	1815.05
63.	Infantry Combat Vehicle-Command" (ICV-Command)	3783

Appendix 'A'

64.	Area Denial Munition (ADM) Type-1 Dual Purpose Improved Conventional Munitions (DPICM) Rocket Ammunition for 214 mm Pinaka Multiple Launcher Rocket System (MLRS)	3000.81
65.	NAMIS(Tr) for one Recce & Support (Tracked) company of Mechanised Infantry	711.095
66.	Unit Repair Vehicles (URVs) for MBT Arjun	29.82
67.	5M Short Span Bridge Mounted on HMVs	85.25
68.	100m Infantry Floating Foot Bridge	84.11

4th POSITIVE INDIGENISATION LIST

List of Weapons/Platforms/Systems/Ammunition as per the 4th Positive Indigenisation List being developed/planned to be developed through technology by DRDO include:

SNo.	Description
1.	Full Motion Simulator (FMS) for Light Combat Aircraft (LCA)
2.	Ship Based Expendable Aerial Target
3.	High Explosive Pre-Fragmented (HEPF) Mk-1 (Enhanced & Practice RHE (Reduced High Explosive) Mk-1 Rocket Ammunition for 214 mm Multiple Launch Rocket System (MLRS)
4.	Area Denial Munition (ADM) (Anti Tank Minelets) for Pinaka Multiple Launch Rocket System (MLRS)
5.	Area Denial Munition (ADM) (Anti Tank Personnel) for Pinaka Multiple Launch Rocket System (MLRS)
6.	100m Infantry Foot Bridge (Ft Br) Floating
7.	Expendable Underwater Target for Naval Applications
8.	Effectors for Anti-Torpedo Counter Measure System
9.	Surface to Surface Missile (Pralay) and Associated System for Air Force
10.	Image Intensifier (II) Based Uncooled Hand Held Thermal Imager (HHTI)
11.	Automatic Missile Detection Radar for Ships
12.	Integrated EW System for High Altitude Area (HAA) for Army
13.	EW System for Plains for Army
14.	EW System for Deserts for Army
15.	Next Generation War Gaming Simulator (NAURAN) for Naval Applications
16.	Lox Tank for Air Independent Propulsion for Submarines
17.	Long Range Anti-Ship Missile (LRashM)
18.	Long Range UAV (HALE)
19.	Medium Range Maritime Reconnaissance (MR) Aircraft