

GOVERNMENT OF INDIA
MINISTRY OF DEFENCE
DEFENCE RESEARCH & DEVELOPMENT ORGANISATION
LOK SABHA
UNSTARRED QUESTION NO.2567
TO BE ANSWERED ON 4th August, 2021

VARIOUS R&D PROJECTS TAKEN UP BY DRDO

2567. SHRI VINOD KUMAR SONKAR:

DR. SUKANTA MAJUMDAR:

SHRI RAJA AMARESHWARA NAIK:

DR. JAYANTA KUMAR ROY:

SHRI RAJVEER SINGH (RAJU BHAIYA):

SHRIMATI SANGEETA KUMARI SINGH DEO:

SHRI BHOLA SINGH:

Will the Minister of DEFENCE j{k k ea=h
be pleased to state:

- (a) whether Defence Research Development Organisation (DRDO) undertakes various Research & Development (R&D) projects;
- (b) if so, the details of projects undertaken during the last three years, lab-wise;
- (c) the details of technologies developed by DRDO during the last three years, lab-wise;
- (d) whether the Government has collaborated with FICCI for commercialisation of technologies developed by DRDO; and
- (e) if so, the details of achievements made so far including number and cost of technology commercialized so far;
- (f) whether the Government has reviewed the working of DRDO and if so, the details thereof; and
- (g) the other steps being taken by the Government to improve the functioning of DRDO?

A N S W E R

MINISTER OF STATE
IN THE MINISTRY OF DEFENCE

(SHRI AJAY BHATT)

- (a) Yes, Sir. Defence Research & Development Organisation (DRDO) undertakes various R&D projects.

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(b) The lab-wise details of projects sanctioned during last three years is enclosed as **Annexure 'A'**.

Some of the major projects undertaken are in the areas of:

- Missile Systems
- Airborne Early Warning & Control System
- Fighter Aircrafts
- Armoured Fighting Vehicles
- Bridging and Mining Systems
- Guided Munitions
- Artillery Guns & Rockets
- Small Arms & Ammunitions
- Advanced Torpedoes & Advanced Sonar Suite
- Electronic Warfare
- Long Range Radars
- Artificial Intelligence based Systems
- Sonar & Torpedo
- Autonomous System
- EW System etc.

(c) A list of Technologies developed by DRDO in last three years is attached as **Annexure 'B'**.

(d) & (e): Yes, Sir. DRDO in collaboration with FICCI initiated a DRDO FICCI ATAC (Accelerated Technology Assessment Commercialization) program for Commercialization of DRDO technologies. During this period, 91 ToT agreements were fructified with industries and ToT fee of Rs 11.98 crores was realized.

(f) & (g): Yes, Sir. Following Committee has reviewed DRDO:-

- Kelkar Committee (2004)
- Rama Rao Committee (2007)
- Kota Harinarayana Committee (2013)
- Shekatkar Committee (2016)
- Expert Committee constituted in August, 2019 under the chairmanship of Shri BP Sharma, Chairman RAC and former Secretary, DoP&T to work out roadmap for labs of Life Science (LS) cluster
- Expert Committee constituted in August, 2020 with Director IIT Delhi as Chairman and reps of ISRO and IAF to review charter of labs
- Expert Committee under the chairmanship of Shri BP Sharma, Former Secretary, DoP&T as Chairman and members from DoP&T and DSIR constituted in September 2020 for reviewing Re-organisation of Manpower by Cadre Restructure.

ANNEXURE-A REFERRED TO IN REPLY TO PART (b) OF LOK SABHA UNSTARRED QUESTION NO. 2567 FOR ANSWER ON 04.08.2021 REGARDING 'VARIOUS R&D PROJECTS TAKEN UP BY DRDO'.

Lab-wise details of project sanctioned during last three years (1 Jul 2018 – 30 Jun 2021)

Sl. No.	Lab	No of Project
1	ADA	4
2	ADE	5
3	ADRDE	2
4	ARDE	12
5	ASL	6
6	CABS	5
7	CAIR	10
8	CFEES	6
9	CHESS	2
10	CVRDE	15
11	DEAL	7
12	DEBEL	3
13	DGRE	11
14	DIPAS	2
15	DLJ	7
16	DLRL	7
17	DMRL	9
18	DMSRDE	1
19	DRDE	3
20	DRDL	14
21	DRLT	1
22	DYSL-AI	1
23	DYSL-AT	1
24	DYSL-CT	2
25	DYSL-QT	1
26	DYSL-SM	1
27	GTRE	6
28	HEMRL	7
29	INMAS	1
30	IRDE	8
31	ISSA	3
32	ITR	1
33	JCB	1
34	LRDE	8
35	NMRL	4

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36	NPOL	6
37	NSTL	4
38	R&D(E)	17
39	RCI	22
40	SAG	2
41	SSPL	4
42	TBRL	5
43	VRDE	2
Total		239

The above list does not include projects in strategic and classified domain.

ANNEXURE-B REFERRED TO IN REPLY TO PART (c) OF LOK SABHA UNSTARRED QUESTION NO. 2567 FOR ANSWER ON 04.08.2021 REGARDING 'VARIOUS R&D PROJECTS TAKEN UP BY DRDO'.

Lab-wise details of technologies developed by DRDO during last three years

S No.	Lab/Centre	Technology Developed
1	ADE	<ul style="list-style-type: none"> • Unmanned Aerial Vehicles • Cruise missiles • Flight simulator • Flying test bed • Mission Computer for fighter aircraft
2	ADRDE	<ul style="list-style-type: none"> • Parachutes, Brake parachutes and heavy drop systems for various Aero, navy and space
3	ASL	<ul style="list-style-type: none"> • Development of technology for Stealth Structures with Load Bearing Capability. • Design of Composite Shims based Flex Seals. • Developed High temperature Anti-Corrosive low friction Graphene base coating. • Developed Thermal Protection System for High Temperatures (@ 1800⁰C). • 4D C-SiC Hot Gas valve Nozzles proven for 120 seconds duration. • Developed Indigenous Brake Discs for Mirage -2000 & ALH. • Ship based S/Ka dual band telemetry ground receiving stations developed and installed on DRDO Ships.
4	ARDE	<ul style="list-style-type: none"> • Advanced warhead Technology • KE Rod Technology • Multi Point Initiation Technology • Deep Penetration Warhead • Low L/D Shaped Charge Warhead • Ferroelectric Pulse Power Technology For Initiation Of Warheads
5	CAIR	<ul style="list-style-type: none"> • Technologies related to Artificial Intelligence and robotics in Maritime Situational Awareness, Geographical Information System, Multi Agent Robotics, Secure Handset/Mobile, Secure OS, Quantum Communication.
6	CHESS	<ul style="list-style-type: none"> • Multidisciplinary technology consisting of <ol style="list-style-type: none"> 1. Optical Channel for combination of High Power Fibre laser 2. High precision Opto mechanical Technology • Laser based target Neutralization Technique • Spatial Beam Combination technology • Sensible Heat Storage based Thermal Management

7	CASDIC	<ul style="list-style-type: none"> • Mission Computer for Su 30
8	CABS	<ul style="list-style-type: none"> • Airborne Early warning and control systems and associated technologies.
9	CFEES	<ul style="list-style-type: none"> • Environmental & Explosive Safety Technology
10	CVRDE	<ul style="list-style-type: none"> • Technologies for Next Generation Main Battle Tank (Multiple). • Engine Technologies for AFVs (multiple). • Automatic Transmission Technologies for AFVs (Multiple). • Suspension and Running Gear Technologies for AFVs. • Repair and Recovery Technologies for AFVs. • Tele-operated and Autonomous Technologies for AFVs. • Indigenous Landing Gear Technologies for UAVs. • Indigenous Technologies for Aircraft quality Bearings. • Technologies for Brushless DC Generator.
11	DEAL	<ul style="list-style-type: none"> • Bandwidth efficient (low BT modulation/demodulation lossless text compression • High code rate LDPC (Low density Parity check)
12	DLRL	<ul style="list-style-type: none"> • GPS & GLONASS Satellite Navigational Receiver • Jamming and Spoofing in L Band • Detection, Location Fixing and Monitoring & Jamming of Communication Signals in HF & V/UHF Bands • Digital Receivers, Digital Exciters & Wideband High Power Amplifiers
13	DRDL	<ul style="list-style-type: none"> • Two pulse Rocket propulsion system • Solid Fuel Ducted Rocket Ramjet technology • Liquid Propellant based Ramjet System • End game system based on Laser Proximity Fuse • Control guidance algorithms for various class of missiles • Development of on the move Communication system, on the move tracking system, on the move command control system.
14	DRDE	<ul style="list-style-type: none"> • NBC Haversack Mk II • Chemical Agent Monitor (CAM) • Automatic Chemical Agent Detector & Alarm (ACADA) • Three Colour Chemical Detector Paper Mk II • Personal Decontamination Kit Mk II • NBC Canister Mk II • First Aid Kit Type A (Mk II) • First Aid Kit Type B (Mk II)

15	DMRL	<ul style="list-style-type: none"> • Sm₂Co₁₇ magnets in large sizes (1-2 kg brick) with energy product of 28-30 MGOe and iHc of 12 – 20 kOe • Developed temperature compensated Sm₂Co₁₇ magnets with near zero (10-25 ppm) temperature coefficient of remanence and energy product of 14-18 MGOe. • Sm₂Co₁₇ magnets capable of working at 550oC with energy product of 6-10 MGOe and iHc of 5-8 kOe at 550oC (BLDC in extreme environments). • Nd-Fe-B magnets with energy product of 40-45 MGOe and IHc of 10 – 15 kOe in operating temperature range of ~150oC. • Microwave lossy materials (absorbers, buttons, terminations and severers ets.) for S & G band frequencies were developed. • High conductivity AlN substrate materials bonded with copper single/both sides for electronic devices developed. • Ferroelectric materials for electron emission cathode developed. • Developed materials, coatings and related processes for applications involving extreme thermal, mechanical and oxidising environments as experienced in hypersonic cruise vehicles. • C-SiC composite, ZrB₂-SiC composite, high purity Nb and Nb alloy Cb752, metallic thermal protection system incorporating metallic honeycomb sandwiches and ceramic insulations, Ni base superalloy foam, and functionally graded material based on Ni base superalloy and yttria stabilised zirconia (YSZ) were developed. • Developed oxidation resistant silicide coatings for Nb alloy, thermal barrier coatings for Ni base superalloy, oxidation resistant ZrB₂-SiC coatings for C-SiC and high emissive coatings for Ni base superalloys. • Revised Total Technical Life (TTL) of transport aircraft engine from the present 7000 to 8000 hours based on Damage Tolerance concepts • Developed tungsten heavy alloy penetrator rods of size 26 mm D., 600 mm L with mechanical properties as follows: <ul style="list-style-type: none"> • Ultimate tensile strength :1600 MPa (min.) • % plastic elongation to failure: 8-10% (min.) • Charpy impact energy on : 100 J/cm² (average) unnotched specimen • Demonstrated the ability to fabricate segmented/jacketed penetrators with tungsten heavy alloy as the core and steel as the jacket
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16	DEBEL	<ul style="list-style-type: none"> • Medical Oxygen Plant • Individual Underwater Breathing (IUWBA) • Physical Efficiency Test Monitor • Air Sterilization Unit
17	DIPAS	<ul style="list-style-type: none"> • Space Heating Device (Bukahari) • Oxygenated Solar Shelter • Ergonomically Designed Backpack (90 Ltrs) • Cognobar and Quercetin Bar
18	DFRL	<ul style="list-style-type: none"> • Terrain and Weapon Platform specific MREs for Army and Navy • Frozen/Chilled Mutton/Chicken Test Kit
19	DIPR	<ul style="list-style-type: none"> • Night Vision Human Performance Attributes (NVHPAs) • Manuals and ComBAT Active App on Stress Management • Crowd Behaviour Analysis Software (CBAS) for crowd management
20	DRL	<ul style="list-style-type: none"> • Snake Repellent
21	DGRE	<ul style="list-style-type: none"> • Development of Landslide forecasting model for a particular site. • Terrain Contour mapping • Weak Zone Susceptibility Mapping • Trafficability evaluation by developing a suitable DSS • Development of Operational Avalanche Forecast Models • Design of Avalanche Control Structures • Development of Snow Cover Model for different Snow Climatic Zones
22	DMSRDE	<ul style="list-style-type: none"> • Bullet Proof Jacket as per GSQR 1438 • Boot Antimine Infantry (BAMI) • Anti-Personal Mine Blast Protective Suit (APMBPS) • DMS HOTS Oil – I • DMS HIDE Fuel • PEGCOL-113 • ECW Protective Goggles • NBC Gloves • NBC Overboot • Gloves ECW • Mounting and Support Equipment for Multi Spectral Camouflage Net • Filtration Cartridge and Prefilters using nano-enabled technologies • Thermally Conducting Light Weight nano-composite based structures for damping applications (BLDC Motor) • Development of Anti COVID-19 Personal Protective Equipment (PPE) Coverall • Sanitizing Fluid “DefSen-2020”

23	DLJ	<ul style="list-style-type: none"> • Indigenization of Microwave Chaff Cartridge 118/I for IAF • Radiation Contamination Monitoring Systems for Indian Navy • Thermal Targets for Strategic Weapon Systems • Network of Radiation Monitoring Sensors for Strategic Locations • CBRN Water Purification System • Indigenization of Microwave Chaff Payload for Indian Navy • Artificial Engineered Materials (AEM) and Radar Absorbing Structures (RAS) • Radiation Detection Measurement & Control Unit (RADMAC-A) • High Altitude Water Purification System (HAWPS) • Flexi Life Saver Water Bottle • SIGMA 3.0 Software
24	GTRE	<ul style="list-style-type: none"> • Development of gas turbines for aero engines, cruise missiles and associated technologies
25	HEMRL	<ul style="list-style-type: none"> • High Performance Solid Rocket Propellant (Specific Impulse ~250s) to increase payload and range of Rockets & Missiles. • High performance Gun Propellant for improved armour penetration capabilities. • Thermobaric composition for warhead to enhance lethality and performance • Less Sensitive Explosive compositions for IM compliant munition. • Tank protection technologies: Anti Thermal Anti Laser Smoke Grenades and Next Generation ERA(NGERA) • Aircraft protection technologies: IR Flars (MTV Based) and Chaff cartridges • Explosive Detection technologies: OPX Revilator for trace/micro detection.
26	IRDE	<ul style="list-style-type: none"> • Raman spectroscopy based Explosive identification technique • Digitised Libraries of Explosive Agents for quick identification • Laser based Dazzling technique for non-invasive countermeasures • Low power Laser based invisible deterrence technology

		<ul style="list-style-type: none"> • Video based Remote controlled Day /Night Capability with Alarm • laser based advanced surveillance device capable detection and location of Optical targets viz., NVD, CCD, LRF, Sniper Sight, Binoculars, etc. • Retro reflector based optical assembly based on CATS Eye effect • Sighting technology based on holography • Sighting technology with Day/Night capability and Laser based target Designation for Tanks • Visual Tracking based Laser Target neutralization Technology • Sighting System for small rifles, Shoulder Fired Missiles • Test jig for guided weapon performance evaluation before the firing of the missile. • optical surveillance technologies for detection of Targets • Target engagement technology for the terminal phase of missile.
27	INMAS	<ul style="list-style-type: none"> • Bike Ambulance
28	ISSA	<ul style="list-style-type: none"> • Systems Analysis Software Tool • Mission Planning Software for HEAVU • Air Direction Training Simulation System
29	LRDE	<ul style="list-style-type: none"> • Rotating 4D phased Array Radar with Solid State T/r Modules • Digital beamforming Technique • Advanced Electronic counter counter measure features (ECCM) • Modern generation coherent solid state Radar designed for 24 x 7 operation • First Ground based radar with Dual Frequency of operation for operation in inclement weather conditions • Detection algorithms for small RCS targets (boats & dingies) in presence heavy sea clutters • Ultra wide Band antenna technology • Step Frequency Continuous wave form technology • Low power signal and data processing Techniques • Clutter and data processing techniques for identification of buried objects • Ultra wide Band antenna technology • Step Frequency Continuous wave form technology • Micro Doppler based processing for identifying object behind wall

30	NSTL	<ul style="list-style-type: none"> • Advanced Light Weight Torpedoes • Ship Launched • Air Launched • - Advanced Heavy Weight Torpedo (with Fibre Optic Communication) • MIGM (Multi Influence Ground Mine) • Subsurface Platforms - WFCS • Air platforms – AFCS • Submarine -Submarine Fired Decoy –SFD (MOHINI) • TORPBUSTER (MOHANASTRA) • Autonomous Underwater Vehicles • High Power Li-ion Battery Technology • SMART: Supersonic Missile Assisted Release of Torpedo
31	NPOL	<ul style="list-style-type: none"> • DIFAR Sonobuoy • Portable diver detection system • Near field acoustic calibration system • Expendable bathy thermograph • Fiber optic intrusion detection system • Underwater acoustic nodes • Underwater acoustic targets • Flank Array, Conformal Array & Towed Array Sonars for Submarines • High Frequency imaging Sonar
32	NMRL	<ul style="list-style-type: none"> • NMR-Indium free Aluminium Sacrificial Anode (NMR-IFASA) • NMR -Aluminium Anode for ship propeller (NMR-AASP) • NMR - Zinc sacrificial anode for fast moving Crafts and Jet propulsion system (NMR - ZSA) • NMR-IPR 1074 and NMR-IPR 1075 Rubber Roll • Porous Carbon Paper (NMR-PCP) • NMR-Mastic (Damping of Structural Vibrations) • NMR- Anticorrosive and Antifouling Under Water Paint for application under Immersed Condition (NMR-AAUWP) • NMR- Corrosion resistant fuel cell catalyst for acid Fuel cells (NMR-CrCAT-FC) • Self Cleaning Coating (NMR-SCC) • Rubber lining system for submarine battery pit compartments and its application technology (NMR-RLSBP) • Hydrophobic Potting material (NMR-HPM)

		<ul style="list-style-type: none"> • Besafe' Technology for accelerated bioremediation of marine oil spill (NMR-Besafe) • NMR-Radar Absorbing Paint (NMR-RAP) • Fuel Cell based Air Independent Propulsion Technology for Naval Submarines (NMR-FCAIP)
33	RCI	<ul style="list-style-type: none"> • Imaging Infrared (IIR) seeker • Ku-band RF Seeker • Ship Inertial Navigation Systems (INS-SA) • Land INS (LNAV) • Miniature High Dynamics Global Navigation Satellite System (GNSS) • On Board Computers (OBC) • Integrated Avionics Modules • Electro Mechanical Actuators • Electro Pneumatic Actuators • Electro Hydraulic Actuators • On board batteries (PSS) • Launcher Interface units • Missile Interface Units • Seeker Processing Modules • Data link systems (Tx & Rx) • Telemetry, Transponders and Tele Command Systems • MEMS Pressure Sensors • High Accuracy Quartz Accelerometers • Ring Laser Gyros (RLG) • Fiber Optic Gyros (FOG) • Radio Proximity Fuze (RPF) • Radio Altimeters • Ceramic /Composite Radomes • Antennas for Seekers / GPS / Altimeters/ Telemetry etc. • Environmental Test Facilities (ENTEST) • Hardware in Loop Simulation (HILS) • EMI /EMC test facility • Open Range RCS measurement Facility • Antenna Test Facility • Seeker test Facilities • System Integration (Mech. & Electrical)
34	R&DE(E)	<ul style="list-style-type: none"> • CompositeSonarDome • LargeSpanInflatableHangar • MobileShelter-NBC • UnexplodedOrdnanceHandlingRobot • SurveillanceRemotelyOperatedVehicle(SROV) • ConfinedSpaceRemotelyOperatedVehicle(CSROV)

		<ul style="list-style-type: none"> • 46mMLC-70ModularBridge • BarMineLayer • MountainFootBridge • MineFieldMarkingEquipmentMk-II • TrawlAssemblyforT-72fr-90Tanks • QRSAMMobileLauncherVehicleandCanister • MRSAM MobileLauncherSystem
35	SAG	<ul style="list-style-type: none"> • Technologies for ensuring Communication Security and assuring trust in security products
36	SSPL, Delhi	<ul style="list-style-type: none"> • Technologies related to GaAs/GaN MMIC, IR Detectors, Semiconductor Laser Diodes, MEMS Devices, Acoustic Emission Sensor, SiC Crystal Growth etc
37	TBRL	<ul style="list-style-type: none"> • Ultra-fine β-HMX and Fine RDX < 6 μm (surface mean) • Electronic Fuze for 81mm Mortar Bomb • Post Impact Delay Fuze for Air Delivered Bomb • Multi-Mode hand grenade • Bund Blasting Device (BBD) Mk-II
38	VRDE	<ul style="list-style-type: none"> • 65HP Rotary Engine for conventional Take- off and Lading UAV • Development of Technologies for Autonomous Unmanned Ground Vehicle: DeTA-UGV • 70Ton Tank Transporter for MBT Arjun MK-II
39	DYSL-QT	<ul style="list-style-type: none"> • Quantum Technology
40	DYSL-AI	<ul style="list-style-type: none"> • Artificial Engineering
