



ARDE

Armament Research and Development Establishment

About Lab

Established in 1958, Armament Research & Development Establishment is into the seventh decade of its existence under Defence Research & Development Organisation. The task of Armament R&D was entrusted to ARDE to achieve the cherished goal of self-sufficiency in the vital field of Armaments.

ARDE is one of the important system laboratories of DRDO. The work at ARDE embraces a wide range of disciplines including applied mechanical, electrical and aeronautical engineering, electronics, applied chemistry, physics, mathematics and ballistics, operational research, metallurgy and material sciences. The advice and assistance of higher academic institutions like IITs, IISc, Universities and industries in both Public and Private Sectors is actively and frequently enlisted for completing the multifarious tasks related to the projects undertaken by ARDE.

Using the knowledge base acquired through the development of weapons and ammunitions in the fields of Small Arms, Artillery Guns, Rocket Systems, Air Delivered munitions, Tank Ammunitions, Conventional Munitions, Warheads and Fuze Technology, ARDE is actively pursuing the design and development of weapon systems possessing greater precision, lethality, reliability and automation delivered to longer ranges and functioning in all weather, all terrain conditions.

Another unique capability of ARDE is development of Trajectory Computation Modules (TCM) in the form of Dynamic Link Libraries for artillery weapon system for their integration with SHAKTI environment of ACCCS (Artillery Combat Command and Control System). ARDE has developed and integrated TCM DLL for Pinaka Weapon System with SHAKTI. TCM DLLs for 105 IFG/LFG, 130mm M-46 Gun, 155mmx 45 Cal Dhanush, 155mm FH77B, 122mm D-30 Howitzer, 120mm Mortar and 122mm GRAD MBRL have also been developed and integrated with ACCCS. Development of TCM DLLs for ATAGS, M777 ULH and K9-Vajra is also in progress.

ARDE is also doing exceptional work in the area of Internal and External Ballistics and is the only laboratory in India which is doing work in these two areas. ARDE has generated Range Tables for Dhanush, Bofors and K9-Vajra Artillery Guns.

Core Competence of ARDE

ARDE's core areas of work and the core competence where ARDE has significant strengths are as below:

- Design & Development of Advanced Armament Systems, Advanced Munitions, Advanced Rockets & Bombs and associated Technologies.
- Design & Development of Conventional/ Tactical Warhead Systems & Associated Technologies.
- Design & Development of separation Mechanism for Manned Aerial Platforms and Associated Technologies.
- Computation in Internal and External Ballistics & Aerodynamics.
- Life Assessment & Extension of Above Systems

List of Products

Rockets

- PINAKA weapon system
- Pinaka Enhanced Rocket System
- Pinaka Missile System (Army, Navy, Airforce)
- 122 mm Extended Range Rocket
- Extended Range Anti Submarine Rocket (ERASR) For RBU 6000 / LRL Launcher

Artillery Guns

- Advanced Towed Artillery Gun System (ATAGS)
- Mounted Gun System (MGS) based on ATAGS

PZT

- Specialized Ferroelectric Materials & Pulse Power Generators

Tank Gun & Ammunition

- 120 mm HESH Ammunition
- 120 mm FSAPDS Mk – IA Ammunition for MBT Arjun Tanks
- 120 mm FSAPDS Mk-II Ammunition for MBT Arjun Tanks
- 125 mm FSAPDS PRACTICE Ammunition for T72/T90 Tanks
- 125 mm FSAPDS for T72/T90 Tanks
- 120 mm PCB/TB Ammunition
- ATGM for MBT ARJUN MK II

Small Arms

- Joint Venture Protective Carbine 5.56 x 30mm (JVPC)
- 5.56x45 mm CQB carbine
- 7.62x51 mm Light Machine Gun
- Corner Shot Weapon system for Pistol & UBGL
- 5.56x45 mm INSAS Rifle, LMG & Ammunition
- 40x46 mm Under Barrel Grenade Launcher (UBGL)
- 30mm Grenade for Automatic Grenade Launcher AGS17
- 40mm Air Burst Grenade (ABG) for Under Barrel Grenade Launcher (UBGL)

Land Based Munitions

- NIPUN (Soft Target Munition)
- PRACHAND (Influence Anti Tank Munition)
- VIBHAV (Anti-Tank Point Attack Munition)
- VISHAL (Anti-Tank Bar Munition)
- ADRUSHY MK-II (Anti Tank Influence Mine)
- PARTH (Directional Fragmentation Munition)
- ULKA (Jumping Fragmentation Munition)

Air Armaments

- 3 kg Practice Bomb
- Tail Unit (BTU) 1111 for 1000 lb Bomb
- Tail Unit (RTU) 1121 for 1000 lb Bomb
- 450 kg HSLD Bomb with BTU (2211) and RTU (2231)
- 250 kg HSLD Bomb with TB 250 (BTU) and TR 250 (RTU)
- Pre-Frag OFAB 100-120 Bomb
- 250 kg Prefragmented Bomb
- 500 kg General Purpose Bomb
- 500 kg Preformed Fragmentation Bomb

Precision Guided Munitions

- Precision Guidance Kit For 450 Kg HSLD Bomb

Warheads

- DPICM (Dual Purpose Improved Conventional Munition) (ADM-1) Warhead
- Warheads for PRITHVI Missile System
- Warheads for AKASH Missile System
- Warheads for SUB-SONIC CRUISE Missile (SSCM) System
- Warheads for NAG Missile System
- Warheads for TRISHUL Missile System
- Warheads for AAD Missile System
- Warheads for PAD Missile System
- Warheads for LIGHT WEIGHT TORPEDO

Electromagnetic Rail Guns

- 10MJ/100MJ Electromagnetic Railgun

Technology Achievements

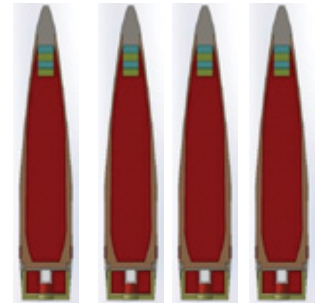
155 mm x 52 Cal Advanced Towed Artillery Gun System (ATAGS)

ARDE has designed and developed 155mm x 52 Cal Advanced Towed Artillery Gun Systems (ATAGS) which can use existing ammunition of ERBT and ERBB and can fire up to 40km and 48km respectively with this ammunition. ATAGS is an all electric drive gun system and have advanced features that would ensure reliable and maintenance free operations for longer period of time.



Family of 155mm Bourlette Ammunition

ARDE has undertaken project for design and development of family of Bourlette ammunition to enhance the firing capabilities of ATAGS. Three variants are been pursued namely: HE-BT, HE-BB and Illuminating



Joint Venture Protective Carbine (JVPC)

Unique Calibre Protective Carbine being developed to replace 9 mm Carbines. It is very sophisticated weapon having Light weight and low recoil provides single hand firing capability



Corner Shot Weapon System

The weapon system enables firing around the corner without exposing the fire. Thus it is useful in low intensity conflict operation. The main features of the weapon are Common platform for firing in service Pistol and UBGL, Ergonomic design for easy maneuverability, Trigger system with safety mechanism, Foldable Butt stock, Universal Picatinny rail, Day and Night firing capability, Adjustable LCD monitor, High power re-chargeable battery, and Image own loading & transmission ability.



MultiCaliber Individual Weapon System (MCIWS)

A Multi caliber weapon has been developed through which ammunition of various calibers like 5.56x45mm (INSAS), 7.62x39 mm (AK-47) and newly developed 6.8x43 mm can be fired by changing the Barrel Assembly to meet various tactical requirements of ranges from 100 to 700m



Light Machine Gun

7.62 X 51mm Light Machine Gun has been designed and developed by ARDE in association with OFB. It is light weight sophisticated weapon which can be mounted on Tripod. Its rate of fire is 700-800 RPM with an effective range of 800m



Close Quarter Battle Carbine (CQB)

5.56 X 45mm CQB carbine is capable of firing both 5.56mm NATO and INSAS Ammunition. It is light weight weapon with low recoil. This is being developed by ARDE in association with OFB. It is an ambidextrous weapon with an effective range of 200m.



9 X 19mm Machine Pistol

An very effective weapon for close range of 100m, this weapons has been designed and developed by ARDE. It can fire in-service and NATO ammunition



120 mm Armaments for ARJUN MBT

The most effective ammunition to fight and defeat heavily armoured MBTs is the high-velocity kinetic energy ammunition fired from tank guns. This is accomplished in the current generation tank guns by firing Fin Stabilized Armour Piercing Discarding Sabot (FSAPDS) ammunition. In principle, it depends upon the high kinetic energy, super-dense, arrow-shaped, penetrator launched at hypersonic velocities to defeat the multilayer armour with which the modern MBTs are protected. The deceptively simple looking design, however, involves some of the most demanding design and production technologies.

ARDE has designed and developed a super velocity 120mm Main Armament as well as secondary ammunition as High Explosive Squash Head



40mm Grenade

To enhance the Soldier firepower with over match capabilities in the future digitized battlefield, ARDE has developed 40mm Low Velocity Air Bursting Grenades, which can be fired from existing UBGL. No special weapon required.

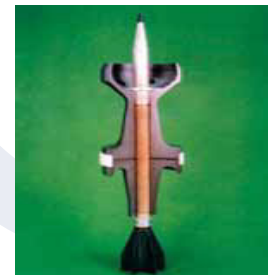
Similarly, 40mm air burst grenades with impact and self destruction mode of four other types are been designed and developed. These four types are HEAP, HEDP, RP and TM.



Variants with practice Ammn

125mm FSAPDS Ammunition

125mm FSAPDS ammunition has resulted in quantum jump in firepower performance of T-72/T-90 tank. ARDE has successfully designed and developed 125mm FSAPDS as well as Practice ammunition.



120 mm Penetration Cum Blast (PCB) AND Thermobaric (TB) Ammunition For MBT Arjun

ARDE has developed Penetration-Cum-Blast (PCB) and Thermobaric (TB) ammunition in order to increase the capacity of Arjun Main Battle Tank to neutralize a wide range of targets. Design commonality with existing ammunition has been achieved and hence the PCB/TB ammunition can be accommodated in the existing configuration of Arjun MBT. PCB ammunition is capable of defeating hard concrete targets and TB ammunition is effective against soft skinned targets. PCB/TB ammunition provides possibility of application in urban warfare scenario.



Anti Tank Guided Missile (ATGM)

The Anti Tank Guided Missile (ATGM) being developed under Cannon Launched Missile Development Programme is designed to be launched from the MBT ARJUN tank gun. It is intended to destroy modern and future Main Battle Tanks protected with explosive reactive armor, hardened point targets and low flying helicopters. The key feature of the ATGM is a semi-active laser homing guidance.



New Family of Munitions (NFM)

With a view to enhance the performance of the munitions and equip the Users with munitions having advanced features, the design and development of the New Family of Munitions with state of the art technology, improved safety features and kill mechanisms has been taken up. ARDE has designed and developed six types of munitions. The munitions have the capability of being laid both mechanically and manually.



NIPUN



PARTH



PRACHAND



VIRHAV



VISHAL

Influence Munition Mk-I and Mk-II

Adrushi Influence Munition is an intelligent Anti Tank Munition. With the introduction of this munition with shaped charge and magnetic or seismic cum magnetic influence fuze a new dimension has been given to the munition warfare. Sophistication, simplicity in handling and indomitable kill capacity makes the munition invincible and user friendly. Mk-II version of this munition with higher reliability has been developed and is currently under production.



250 kg Prefragmented Bomb

250 kg pre-fragmented bomb has the external features, inertial properties and ballistic performance similar to that of the Russian OFAB 250-270 bomb. The 250kg Prefragmented Bomb is modular in design.



500 kg General Purpose Bomb

ARDE has designed and developed 500 kg GP Bomb which has the physical parameters and mass properties of the bomb similar to that of Mk-83 bomb so that the bomb can be directly fitted with LGB kits available with Air Force to utilize the limited concrete penetration capabilities of the bomb.



Precision Guidance Kit For 450 KG HSLD BOMB

The product is a laser guided Precision Guidance Kit to convert 450 kg HSLD bomb to precision guidance bomb which can be launched from SU-30 MKI aircraft.



CSS for LCA

The sequential seat ejection system is available in all the fighter aircraft for escape of pilots in emergency both in flight and ground. This process takes about 1400 ms before pilot can come out of the cockpit of the endangered craft. ARDE with state of art technologies and improved safety features has designed and developed Canopy Severance System which is the fastest solution for pilot egress during emergencies both in flight and on ground.



Turbogenerator based ET fuze

During flight of a rocket, ram air enters through an intake venturi & drives the generator/alternator to produce the electrical power required for electronic fuze application. Such type of turbogenerator based ET fuze has been successfully developed.



Power Cartridges

Power Cartridges are Propellant Actuated Devices (PADs) which are utilized to ensure specified performance in the actual system or subsystem.

Features that are included in the design of Power Cartridges are simplicity, high power to weight ratio, light weight, compactness, reliability close to hundred percent, safety in handling and transportation and long shelf life. ARDE has developed many cartridges which are being used by various Aircraft/ Helicopters of Indian Air Force & Navy, such as Su-30, Mig-29, Mirage-2000, Jaguar, Kiran, Sea Harrier & Hawk



DPICM Warheads

Aerial Denial Munition (ADM) Type – 1 warhead which is also known as Dual Purpose Improved Conventional Munition (DPICM) Warhead. This warhead houses 234 Nos of Sub-munitions & same are dispensed over the target area to cover a min area of 120 x 90 sq. m.

This warhead is one of the sub-munition class of warheads developed for Pinaka Rocket System.



PIEZOCERAMICS

Modified Lead Zirconate Titanate (PZT) Piezoelectric Ceramics, a class of poly-crystallines, exhibit excellent piezoelectric properties and find wide ranging applications in electro-mechanical / mechano-electrical energy conversion transducers. ARDE has done pioneering R&D and prototype manufacturing work on these materials & offers various grades of high quality PZT based ceramics for strategic applications. Various grades of hard and soft ferroelectric materials designated as PZT Type-4 (Navy-I), Type-5A (Navy-II), Type-8 (Navy-III), Type-5J (Navy-V), and Type-5H (Navy-VI) with extremely good electromechanical properties have been developed, standardized and produced



Prefragmented Warheads

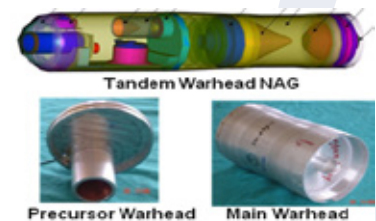
ARDE has designed and developed prefragmented warheads for many missiles including Prithvi, Akash, Trishul, Nirbhaya and Pinaka Rocket System



1000 kg Prithvi WH

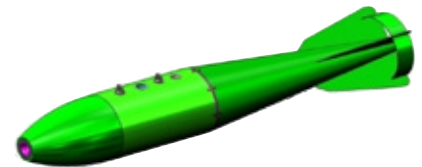
Shaped Charge Warheads

ARDE has designed and developed Shaped Charge warheads for ATGM-NAG, ATGM-HELINA, Tandem WH for SANT and MLPGM



500 kg Preformed Fragmentation Bomb

The 500 kg PF Bomb has external profile, physical properties and ballistics matching with that of FAB-500 M-62 Bomb. The Bomb is designed to have provision for carrying on aircrafts of Russian origin as well as western origins. The bomb meets the lethality criteria of Perforation in 10 mm thick RHA plate at 50 m radius from the point of burst



Submunition Warheads

ARDE has designed and developed Submunitions warhead for various systems such as Prithvi Incendiary submunition, Prithvi RDPS etc



500 kg RDPS Prithvi

Incendiary Warheads

ARDE has designed and developed Incendiary Warheads for Pinaka as well as Prithvi missile



Incendiary Warhead Effect

PINAKA Multi Barrel Rocket Launcher System

Development of the surface-to-surface Pinaka MBRLS was undertaken in view to meet Indian Army's need for a weapon system which could neutralize targets at ranges exceeding 30 km.

MBRL provides a unique capability to 'accurately deliver a devastating' lethal and responsive fire against a variety of area targets such as exposed enemy troops, armored and soft skin vehicles, communication centers, air terminal complexes, fuel and ammunition dumps.

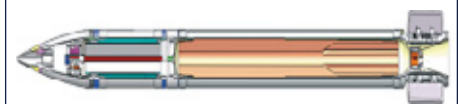
The system comprises of free-flight artillery rockets with monolithic fragmentation and RHE types of warhead & fuzes, a multi-tubelauncher vehicle, a replenishment-cum-loader vehicle, a replenishment vehicle and a command post vehicle. There are two pods containing 6 rockets each, capable of firing in salvo mode within 48 sec neutralizing the area of 700 x 500 m. The use of sub-munitions warhead technology will increase capability of attacking different type of target with higher hit probability and greater target coverage. This is a major multi-discipline program involving several DRDO Labs, Public and Private Sector Firms. ARDE is the system integrator and is also responsible for the flight vehicle, warheads, fuzes and launcher systems. The system has been introduced into service.

Pinaka has a range of 37.5 Km. It can be brought into action within 3 minutes and can fire a salvo of 12 rockets in 44 seconds. Pinaka can neutralize a target area of 1000m X 800m.



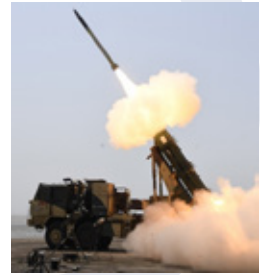
Pinaka Mk-II (60 km Range Rocket)

In light of the requirement of the Army for a free flight rocket with range enhanced to 60 km, ARDE has developed Pinaka Mk II rocket increasing the rocket motor length, use of high energy propellant, case bonded motor with fin-o-cylgrain design for increased volumetric loading of propellant, changing the rocket calibre, etc



Pinaka Mk-I enhanced rocket

Propulsion system of Pinaka Mk-II rocket reconfigured to restrict range to 45 km and bring the length and weight of rocket within the envelope of Mk-I rocket. This can go up to 45km



Guided Pinaka

Development of Guided Pinaka rocket has been initiated by ARDE in association with RCI, DRDL, HEMRL and PXE. This rocket system is capable of precisely engaging small size enemy targets located up to range of 80 km with an accuracy of < 60 m. Guided Pinaka rocket is propelled by the propulsion system developed for Pinaka Mk-II rocket. The Guidance Navigation and Control (GNC) kit has been placed in the empty ogive section of warhead. Various GNC kit components like actuators, thermal battery, GPS, INS, onboard processor and telemetry developed for other missile systems of missile cluster laboratories have been adopted to cut down the development time cycle.



122mm Extended Range Rocket (ERR)

Various sub-systems of rocket such as propulsion system, ignition system, stabilisation etc. have been designed and flight tested.

Range of 38 + km achieved during trials

Anti Submarine Rocket for RBU 6000 Launcher

ARDE has successfully developed the Extended Range Anti-Submarine Rocket (ER-ASR) to enhance the range of existing RGB-60 Anti Submarine Rocket from 5.3 km to 8.0+ km. ER-ASR consists of two motor propulsion systems which can fire the rocket in Short Range mode and Long Range mode to achieve different range capabilities from 500 m to 8900m.



Electromagnetic Railgun (EMRG)

ARDE has successfully designed and developed EM Gun powered by 10MJ capacitor bank and now working on ambitious project of Design, Development and Installation of EM Railgun powered by 100MJ Capacitor Bank on Fixed Firing Stand for EM Launch Technology.





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