

Armament Research, Development and Engineering Center



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by

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Armament Research, Development and Engineering Center (ARDEC)



Vision:

Innovative Armaments Solutions for Today and Tomorrow

Mission:

Provides fully integrated life cycle engineering (from R&D to demil) for armaments and munitions in support of the Army, Program Executive Offices, the Single Manager for Conventional Ammunition, Air Force, Navy, Marines, Coast Guard and Special Operations Forces

Advanced Weapons – line of sight/beyond line of sight fire; non line of sight fire; scalable effects; non-lethal; directed energy; autonomous weapons

Ammunition – small, medium, large caliber; propellants; explosives; pyrotechnics; warheads; insensitive munitions; logistics; packaging; fuzes; environmental technologies and explosive ordnance disposal

Fire Control – battlefield digitization; embedded system software; aero ballistics and telemetry

Provides the Technology for Over 90% of the Army's Lethality; Significant support to other Services Lethality

FCS Key Initiatives



- **S&T Successfully Transitioned Key Armament Technologies to FCS**
 - LOS/BLOS Armament
 - NLOS-M
 - MRM
- **Successful Partnership with LSI for SDD Armaments**
- **ARDEC Meeting and Exceeding LSI Expectations**

120mm LOS/BLOS S&T ATD



PROBLEM:

105mm weapon systems could not provide lethality necessary to defeat the next generation Main battle tank; existing 120mm systems worldwide too heavy and not integratable onto a preferred 20 ton class vehicle

SOLUTION:



- Produced Lightweight 120mm Gun Assembly
 - Initial Proof-of-Principle Gun designed, built, fired in 13 months, compared to 24 month average
 - Gun Assembly Wt. ~ 4200 lbs. as compared to M256 Abrams 120mm main armament – 6800 lbs.
 - Reduced gun firing impulse for integration in 20 Ton class vehicles, 5300 lb-sec vs. 7000 for M256
 - Ability to fire both current & developmental 120mm rounds – 5 current rounds + 3 new rounds
- Developed enabling fabrication techniques
 - New steel w/ 20% higher yield strength
 - Integrated muzzle brake, saves ~200 lbs in gun weight
 - Lighter Composite over wrapped gun tube (lower weight without loss of pressure containment, over 35% lighter than the M256)

120mm LOS/BLOS Transition to Mounted Combat System (MCS)



Primary Weapon

for Mounted Combat System

- Provides direct fire in support of forces in the Unit of Action (UA).
- Beyond Line-of-Sight (BLOS) capability to 12 km with Medium Range Munitions (MRM).
- All the Performance of Current 120mm Cannon in a Light Weight, Compact Design
- Over 2,000 lbs lighter than 120mm Gun used on Abrams Tank
- Muzzle Brake & Recoil System Design Enables a 120mm Gun to fire from a 20 Ton Vehicle.

Lightweight Gun Mount

- Compact Cradle Design
- Titanium Recoil Rails
- Lt Wt - Modular Recuperators
- Composite Replenisher *
- Titanium Recoil Brakes *
- Titanium Yoke/Adapter *

Lightweight 120mm Gun Tube

- High Strength Gun Steel / Composite Wrap
- Dual Autofrettage
- High Efficiency Muzzle Brake
- Reduces Firing Shock to Vehicle & Crew
- Enables 120mm Gun to fire from 20 Ton Vehicle

Multi-Lug Breech Mechanism

- Long Life, Compact, Light Weight
- 600VDC Electrically Actuated
- Ammo Data-Link Enables Communication to Smart Rounds
- Electro-Thermal Ignition *

* Technologies not transitioned



GENERAL DYNAMICS
Land Systems



Gun Technology Demonstrated on Over 730 Rounds of Live Fire Testing on various iterations

ARDEC Science & Technology Objective LOS/BLOS Technology Video



ATD for 120mm LOS/BLOS Armament:

- Successfully completed in FY05 and transitioned to LSI
- ARDEC is providing SDD engineering, design and hardware for the primary weapon assembly to LSI under CRADA
- Timeframe Oct 2005 – Jan 2013; \$71.1M

**MCS 120 LW
Cannon**

ARDEC's Objective NLOS-M Technology Development



PROBLEM:

No existing mortar system, US or foreign, could meet the FCS NLOS-M threshold requirements for lethality, range, and rate fire using existing family of ammunition at target weights

SOLUTION:



- Produced Breech Loading 120mm Mortar and demonstrated FCS required technologies
 - Ability to fire both current & developmental 120mm mortar rounds with no ammunition modification or expendable devices at threshold rates of fire. No competitive system could do this
 - Thick walled mortar tube provides passive tube cooling
 - Fast acting screw block breech, based on artillery designs
 - Three ammunition position & retention technologies to ensure proper loading and firing
 - Innovative out of line firing pin to permit safe loading
 - Mortar Assembly (including mount) Wt. ~ 1200 lbs. compared to competitive systems 1900 to 2900 lbs. Weight was not optimized in this program.
 - Turret, mount, & ammunition handling systems developed to support demonstration
 - Demonstrated 12 RPM firing

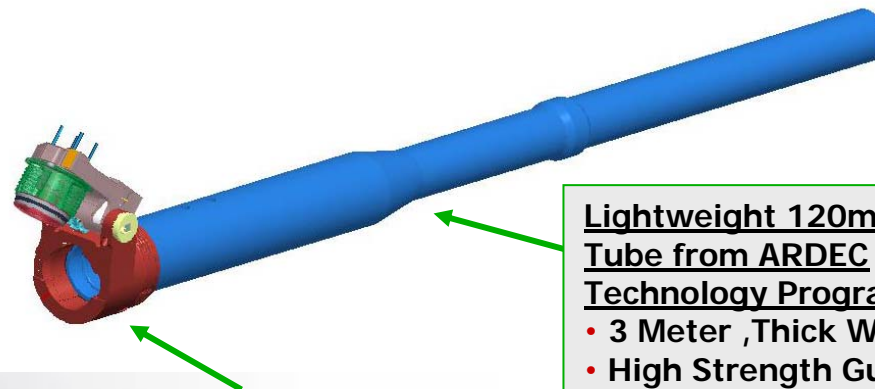
ARDEC's Technology Transitioning to 120mm XM325 Non Line of Sight Mortar



Primary Weapon

for Future Combat System NLOS-M

- Mortar developed under ARDEC Science & Technology Objective program.
- Provides breech loaded 120mm mortar capability. DEMONSTRATED
- Non Line-of-Sight (NLOS) capability to 8 km with unmodified M900 series mortar ammunition. DEMONSTRATED
- Can fire 16 rounds per minute, 8 rounds per minute sustained. 12 rounds per minute DEMONSTRATED



Lightweight 120mm Gun Tube from ARDEC Technology Program

- 3 Meter ,Thick Wall Tube
- High Strength Gun Steel

Screw-Block Breech Mechanism from ARDEC Technology Program

- Modified for NLOS-M System Integration.
- Incorporates one ARDEC Ammunition Retention Technology
- Integrates with BAE Mount, Ammunition Loading, Round Retention, Firing Mechanism, & Actuation Devices *

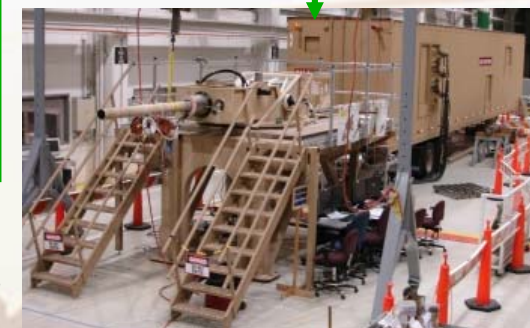
NLOS-M Firing Platform (BAE)

- ARDEC's XM325 EP1 has successfully integrated on the NLOS-M Firing
- Firing Tests by BAE are underway



BAE SYSTEMS

* Technologies not transitioned



ARDEC Science & Technology Objective NLOS Mortar Technology Video



XM325, Cannon, 120mm Mortar, Breech Loading:

- Successfully completed in FY06 and transitioned to LSI
- ARDEC is providing SDD engineering support, design and hardware for the 120mm cannon assembly to LSI under CRADA
- Timeframe Oct 2006 – Mar 2011; \$4.1M



Mid Range Munition (MRM) for the FCS Mounted Combat System



PROBLEM:

The FCS MCS required an extended range, heavy armor target engagement capability to increase the lethality and survivability of the system.

SOLUTION:

MRM SYSTEM CHARACTERISTICS:

- Precision Munition for FCS MCS Vehicle
- Designed to Defeat High Pay-Off, Fleeting Targets (MBTs with ERA, APCs, Artillery, etc.)
- Incorporates Autonomous and Designated Mode Seekers
- Operates in Line-of-Sight or Beyond Line-of-Sight from 2km out to 12Km



The MRM provides the FCS Mounted Combat System (MCS) with a precision munition capable of defeating LOS/BLOS threats out to 12km.

Mid-Range Munition

ARDEC S&T is developing two competing concepts with industry partners Raytheon and ATK



MRM-KE



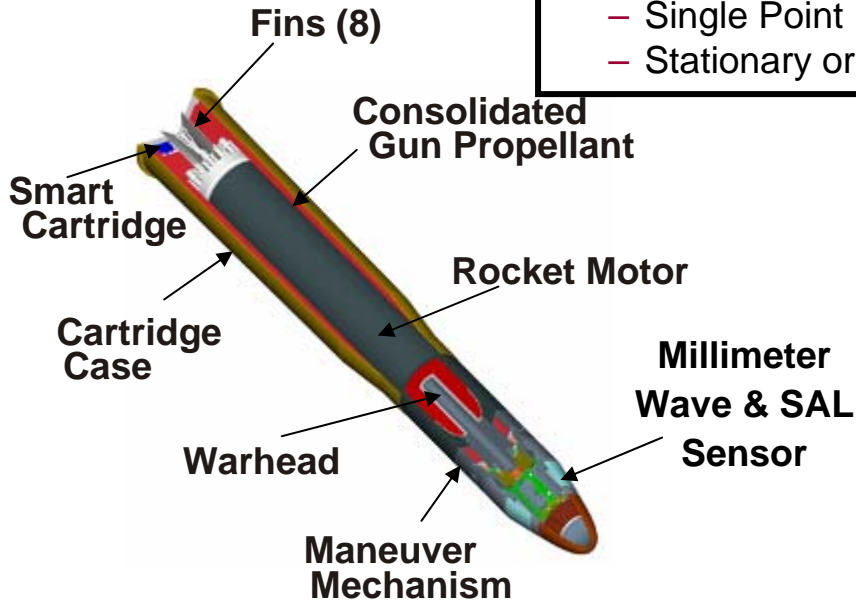
•Target Types

- Main Battle Tanks (MBT) w/ ERA
- Light Armor (BMP)
- Self Propelled Artillery (SPH)/(MRL)
- Air Defense Artillery (ZSU)
- Bunkers (Earth & Timber)

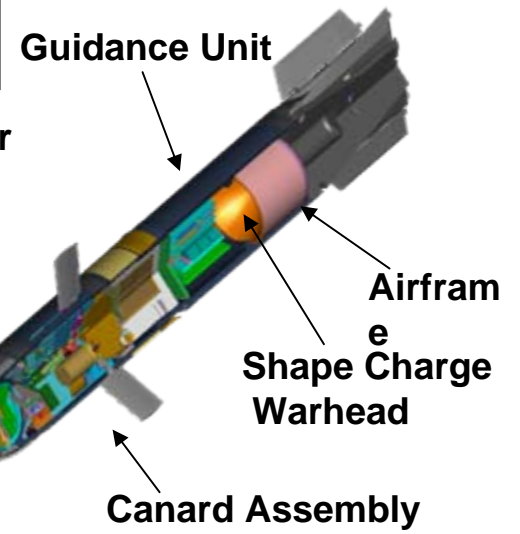
•Attributes

- Fleeting High Payoff Targets
- Single Point Defeat
- Stationary or Moving (Fleeting)

MRM-CE



Dual Mode Seeker
Uncooled IIR
SAL

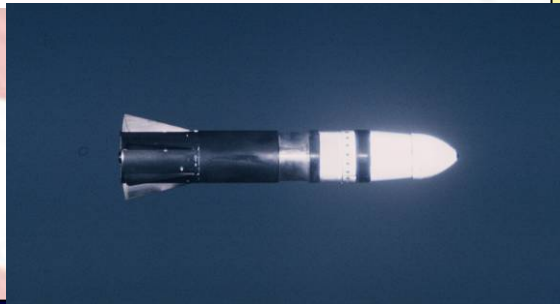


Program has Achieved Autonomous, SAL, and Dual Mode TRL 6!

MRM Technology Status



Smear from Round #109



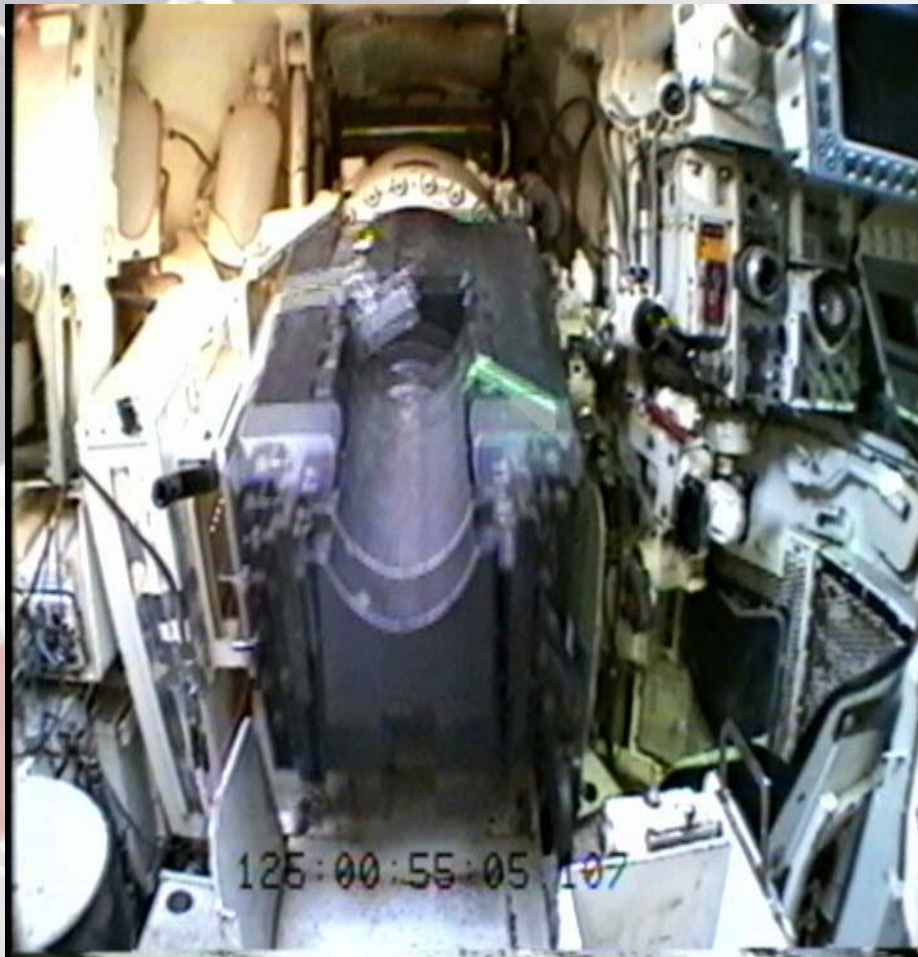
MRM has demonstrated TRL6 for:

- ✓ **All major Subsystems**
 - Warhead
 - Airframe
 - Propulsion
 - G&C
 - Seeker
- ✓ **Integrated Autonomous Seeker Guide to Hit - 2004**
- ✓ **Integrated SAL Seeker (Designate) Guide to Hit - 2006**
- ✓ **Integrated Dual Mode Seeker (Autonomous & SAL) Guide to Hit - 2007**

ARDEC Science & Technology Mid-Range-Munition (MRM) Video



MRM CE – Semi Active Laser Designated



MRM CE - Autonomous Mode



Complete rounds fired except for warhead. Space was used for telemetry. Lethality demonstration was done separately. Full up round firing will occur during SDD

In Summary...



- ▲ ARDEC successfully developed Armament Technologies for FCS
- ▲ Successfully transitioned from S&T
 - ▲ LOS/BLOS 120mm Armament
 - ▲ NLOS-M cannon assembly
 - ▲ Expect to transition MRM 1QFY08
- ▲ ARDEC has successful partnership with LSI contractors to continue development in SDD

.....Continued Dialog to Maximize Collaboration Opportunities