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Technology Demands on the Future Industrial Base

Achieving Efficiencies in an Uncertain Budget Environment

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Ammunition Executive Summit

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Director, US Army RDECOM-ARDEC

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Unclassified **TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.**



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Armament Research, Development and Engineering Center



Research



Development



Production



Field Support



Demilitarization



Vision

Innovative Armaments Solutions for Today and Tomorrow

Mission

To Develop and Maintain a World-Class Workforce to Execute and Manage Integrated Life-Cycle Engineering Processes Required for the Research, Development, Production, Field Support and Demilitarization of Munitions, Weapons, Fire Control and Associated Items

Advanced Weapons - Line of Sight Fire; Beyond Line of Sight Fire; Non Line of Sight Fire; Scalable Effects; Non-Lethal; Directed Energy; Autonomous Weapons

Ammunition - Small, Medium and Large Caliber; Propellants; Explosives; Pyrotechnics; Warheads; Insensitive Munitions; Logistics; Packaging; Fuzes; Environmental Technologies; Explosive Ordnance Disposal

Fire Control - Battlefield Digitization; Embedded System Software; Aeroballistics; Telemetry

ARDEC Provides the Technology for over 90% of the Army's Lethality and Significant Support to other Services Lethality



Core Competencies



Advanced Weapon Systems

- Direct Fire weapons
- Indirect Fire weapons
- Scalable lethal Effects
- Non-Lethal Systems
- Small/Medium/Large Caliber Ammunition
- Directed Energy
- Remote Armaments
- Insensitive Munitions
- Fuzes
- Telemetry
- Precision Armaments
- Grenades
- Maneuver Support Munitions
- Demolitions
- Weapons & Munitions Manufacturing technology
- Detonators
- Explosive ordnance devices

Fire Control

- Battlefield Digitization - Software Applications
- Embedded Systems Software
- Firing Tables - Aeroballistics - Automated Test Systems
- Optics for Fire Control
- Smart Sight
- Projectile Tracking and Control
- Vehicle Health Management System
- Software Acquisition Support
- Software Engineering Processes
- Fire Control Technologies



Emerging Technologies

- System Engineering
- Modeling & Simulation of Armament systems
- Advanced Materials / Nanotechnologies
- Networked Lethality
- Defense Against Unmanned Systems
- Counter Terrorism Technologies
- Homeland Defense Technologies
- Novel Power & Energy Systems for weapons and munitions
- Armaments Manufacturing Science Technologies
- Reliability & Predictability Technology

Advanced Energetics and Warheads

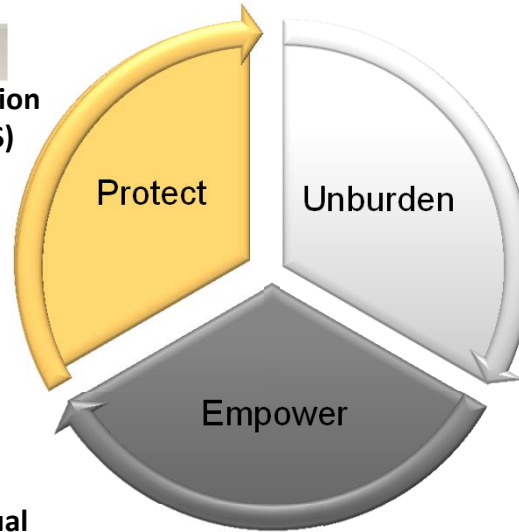
- Propellants
- Explosives
- Pyrotechnics
- Warheads
 - Kinetic Energy
 - Chemical Energy
 - Shaped Charges
 - EFPs
 - Fragmentation
 - Thermo baric
 - Multi purpose & Scalable
 - Non lethal
- Environmental Technologies
- Demil Technologies

Logistics

- Ammunition Logistics RDTE
- Battlefield Tools and Equipment
- Packaging



Technology Investments



CROWS XM153



Solid State Active Denial Technology

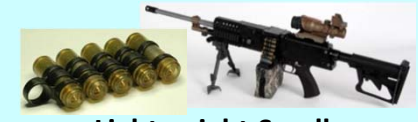


HPM Non-Lethal

Laser Ignition for Artillery



Lightweight Small Arms Technology



Networked Munitions



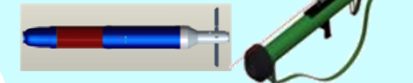
Extended Area Protection & Survivability (EAPS)



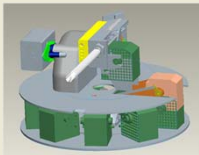
Lightweight Dismounted Mortar



MOUT/Urban Lethal Technologies



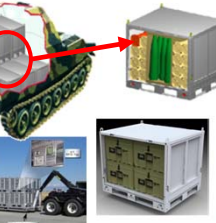
Advanced Remote Armament System (ARAS)



Tunable Pyrotechnics



Unburden



Ammunition Logistics



Soldier & Small Unit Lethality Integration

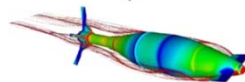
120mm XM360 LOS/BLOS Cannon



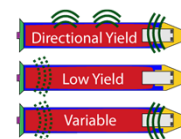
25 mm Individual Weapon System (IAWS)



Empower



Very Affordable Precision Projectile



Scalable Effects Warhead Technology



M32 LHMBC

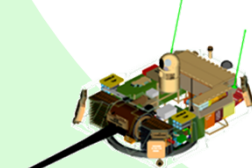


NLOS-C

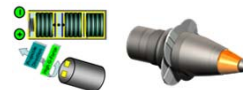
NLOS-M



Advanced Lethality & Accuracy System Medium Caliber (ALAS-MC)



Affordable Precision Component Technology



Next Generation KE



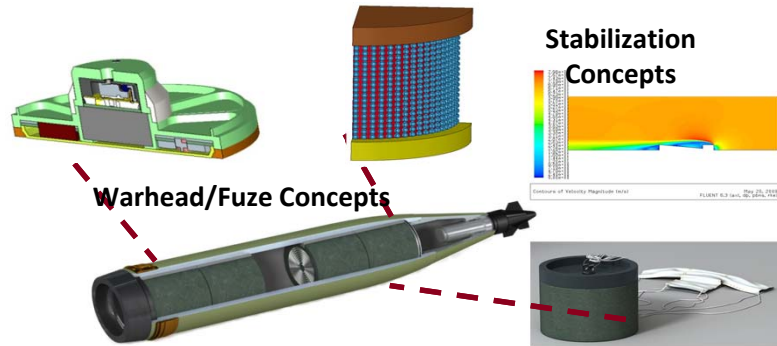
Cluster Munitions Replacement



2007 Award Recipient



Cluster Munitions Replacement



Schedule & Cost

Milestone	FY11	FY12	FY13	FY14
Fuze/Power Candidates Selection				
Fuze Component Lab Tests	3	4	5	
Warhead Trade Study/Down Select				
Lethality Testing (Arena)	3	4	5	6
Submunition Dispense & Flight Stability Verification	3	4	5	
Prototype Integration	3	4	5	6
Ballistic Engineering Tests				
Integrated System Demo				
Optimize Design/ Reliability Tests				

Metrics
Unexploded Ordnance (UXO)
Payload Lethal Area (Normalized)
Number of Submunitions in 155mm Carrier
Total Payload Weight
System Reliability

Purpose:

- Demonstrate an ultra reliable, lethal NLOS Cluster Munition (CM) Alternative which is compliant with signed DoD CM Policy and achieve <1 % UXO

Products:

- 155mm cannon ballistic demonstration of integrated “full bore” sub-munition prototype
 - Flight demonstration of ultra reliable multifunctional sub-munition fuzes
 - Demonstrate optimized dispense/stabilization systems and Warhead Structural Integrity/Safety
- Arena test demonstrating enhanced lethality blast fragmenting submunition & effective lethal area
- Application scalability analysis across multiple calibers and delivery systems

Payoff:

- Warfighter operational benefits
 - Enables continued use of critical lethality capability
- Specific Transitions Concepts
 - FY14 EMD start with PM CAS to meet 2018 IOC deadline
- Benefits (ATO-D)
 - DoD CM Policy dated 19 June 2009 compliance (<1% UXO)
 - Lower costs via reuse of demilled 155mm metal parts

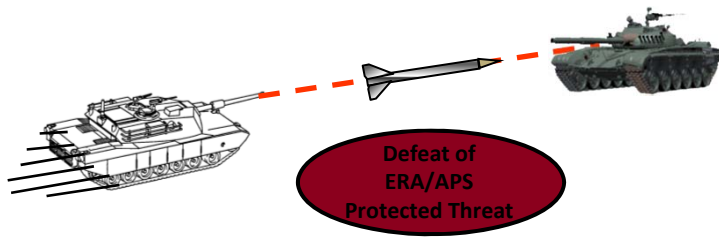




Next Generation Kinetic Energy (NGKE) Cartridge



120mm Next Generation Anti-Tank Cartridge



Purpose:

Demonstrate 120mm cartridge technology enabling defeat of current and future heavy armor threat without Depleted Uranium (DU).

Products:

- *Specific novel penetrator designs providing lethal overmatch vs. most difficult threat targets.*
- *Fully integrated 120mm Cartridge System without DU flight test demonstration at Ordnance velocity.*
- *Flight demonstration of improved precision and overall system effectiveness of 120mm KE penetrator with surrogate fire control at long range*
- *Penetration and lethality data and models proving novel penetrator performance vs. advanced full-scale armor threat targets from Ordnance through Hypervelocity impact.*

MILESTONES	FY11	FY12	FY13	FY14
System Perform. Evaluation	4			
Novel Penetrator Lethal Effects	5	Ordnance Velocity	4	Hyper-Velocity
Tactical Deploy Mechanism		5		
DU Replacement Materials			4	
Integrated System Tests			Lethal Mech. Select	
Lethality Demonstration				6
System Accuracy Demo (LC ³)	4			5

Payoff

- *War fighting operational benefits*
Maintain the Warfighters over match of current and future armor threats even if DU is no longer available.
- *Specific Transitions Concepts*
Transitions to PM MAS follow-on developments (multiple calibers) end of FY14
- *Benefits (ATO-D)*
Removes current dependence on single supplier for penetrator material

Metrics
Normalized Penetration @ range
Hit Probability improve @ range





Advanced Munition Warhead Manufacturing Improvements



Schedule & Cost

MILESTONES	FY11	FY12	FY13	FY14
IM/ frag sleeve molding in-warhead, single inc. no post machine	4	6		6
Field Assisted Sintering (FAST) manufactured M-EFP		4	6	
Embedded fragment		4	6	
Transitions			7	

MRL 7

Metrics
System Weight - MOUT
EFP - EAPS
Warhead Cost – Advanced Multi-Purpose
Embedded Fragmentation Sleeve – Cluster Munition Replacement

Purpose:

- Reduce unit production cost, system weight and enable design optimization for manufacturing advanced munitions including:
 - MOUT ATO Shoulder Launched munition
 - Extended Area Protection & Survivability ATO (EAPS)
 - 120mm Advanced Multi-Purpose (AMP)
 - Next Gen Artillery Improved Conventional Munition (ICM)/ Cluster Munition Replacement (CMR) ATO

Product:

- Reduced warhead production costs, manufacture times and improved integration of advanced system technologies in warheads, reduced system weight and design time
 - Example: 120mm AMP; 3 lbs lighter, \$2523.00 lower cost/ round, a 30% per round cost reduction
 - Example: MOUT; Reduced design constraints enabling optimized system weight

Payoff:

- Lower cost, more reliable munitions with reduced number of manufacturing processes
- Improved safety by decreasing touch labor during munition manufacture





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IMX-104 Manufacturing Process Optimization



81 MM HE Mortar (IMX-104)



SPIDER



120 MM HE
Mortar



60 MM HE
Mortar



105 MM HE
Artillery



M67
Grenade

=TRL/MRL

Schedule & Cost

Milestones	FY10	FY11	FY12	FY13	FY14
Initial Plan/Prep					
Identify & Optimize Process Parameters					
Production Run					
Loading 81MM Mortar Cartridges					
Final Report / Transition					

Metrics
IMX-104 Unit Cost
IMX-104 Efflux Viscosity (second)

Purpose:

Establish a capability to manufacture IMX-104 with optimum parameters to reduce unit price and maintain its IM properties. IMX-104 will support the production of the 81MM HE mortar and is the leading candidate to replace Comp B and its equivalence, PAX-21 and PAX-41 as the HE fill in various munitions items.

Products:

- Optimized production process
- Improved manufacturing efficiency
- Product with consistent IM properties
- ROI -24.7:1

Payoff:

- IM compliant product for warfighters
- Reduce unit cost by 20%
- Ability to manufacture IMX-104 on a large scale
- Better understanding of operating condition on the quality of final product





ASA(ALT) & RDECOM Priorities



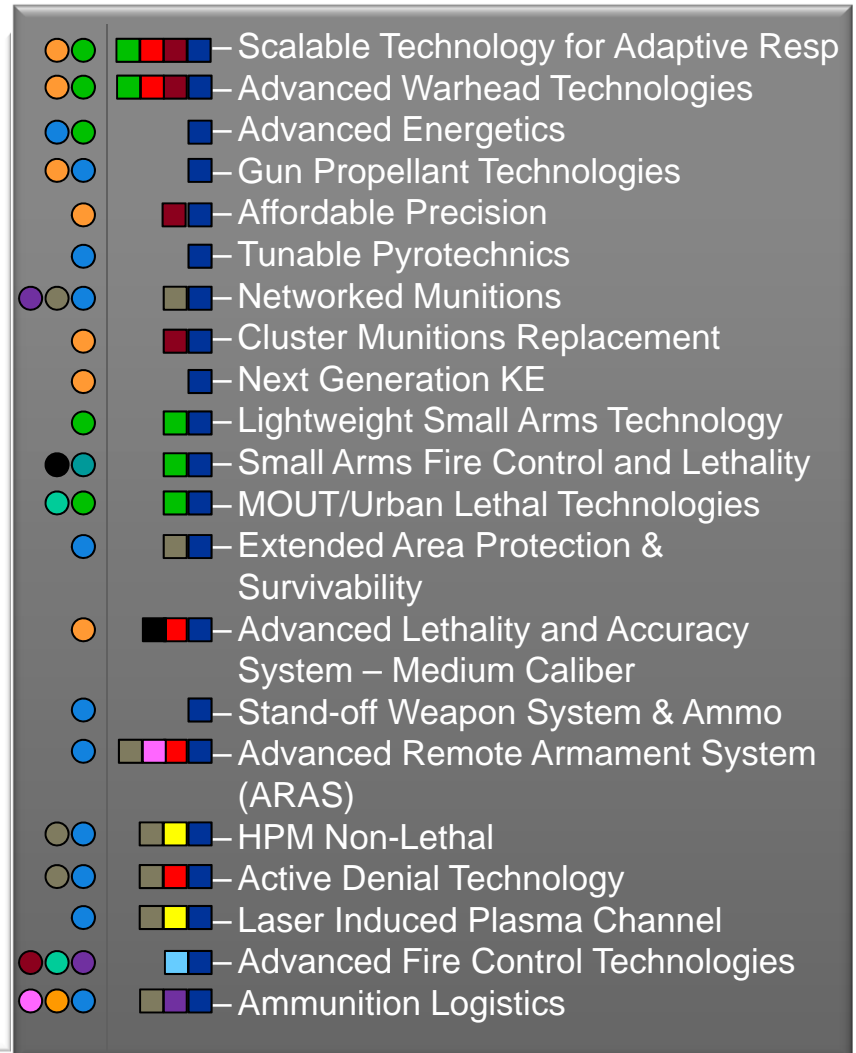
ASA(ALT) S&T Vectors



RDECOM CG Priorities

- **Logistics (O&S Cost Reduction)**
- **VCSA Portfolio Reviews**
- **Robotics**
- OPORD 10-010 FRAGOs
 - **ACT VI (FRAGO 1/7)**
 - **BCT Mod (FRAGO 2)**
 - **CIED (FRAGO 3)**
 - **JMR (FRAGO 8)**
- **SID -TFT Gap Analysis**
- OSD
 - **Future Vertical Lift**
 - **Mobile Base Camps**
- Technology -enabled Capability Demonstrators (TCD)**
 - **JMR**
 - **Lightening the Load**
 - **ACT VI (GCV)**
 - **IBD and EBC**
 - **Data to Decision**

Current/Planned ARDEC S&T Projects





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Industrial Base Challenges/Opportunities



- **Funding concerns**
- **Improve Tech Base to IB transitions**
- Looking for help from the Industrial Base to get the job done
 - Over past year, closer coordination with IR&D reviews have been helpful. Needs to continue.
 - We have strategies for future investments. Need your support and assistance.
 - CRADAs, experimentation agreements, early partnerships
 - Focus on cost of technology solution.
 - Joint planning to overcome future obstacles (laws, safety, interoperability, etc.)
 - Assistance to overcome the Valley of Death – what prevents us from getting projects transitioned?
 - Leverage partnerships, capability sharing
 - Identifying efficiencies to take us closer to transitioning technology
 - DOTC as a vehicle to execute S&T programs

... S&T will have impact on Industrial Base - let's work it together





Teaming with ARDEC



ATOs/Tech Base	Allan Aprea	973.724.5015
Rapid Prototyping	Bernie Rice	973.724.8501
DOTC	Don Geiss	973.724.3386
Small Arms Consortium	Frank Puszycki	973.724.6081
Test Agreements/IR&D/CRADA	Tim Ryan	973.724.7953
International Office	Lu Ting	973.724.6979

Industry/Government Tech Base investment must be **focused on warfighter requirements**
 – both from Combat Developer (TRADOC) and Materiel Developer (PEO/PM)

“Best of Breed” low-cost, multipurpose munition components are needed
 – **IP concerns must be not impede this and must be negotiated up front**

Industry proposals must be timed to support Army budget process - **Out-of-cycle proposals by exception only**



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“Without lethality, it’s just another parade”

