



U.S. Army Armament Research, Development, and Engineering Center (ARDEC) Update

Presented to

***NDIA Armaments Technology
Seminar & Exhibition***

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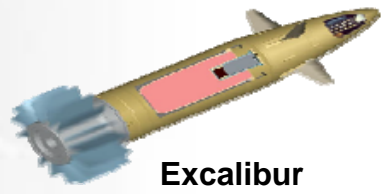


ARDEC Mission

Life Cycle Engineering & Support



Lightweight Dismounted Mortar



Excalibur



Lightweight Handheld Mortar
Ballistic Computer, XM32



Plasma Arc Furnace



Supercritical Water
Oxidation



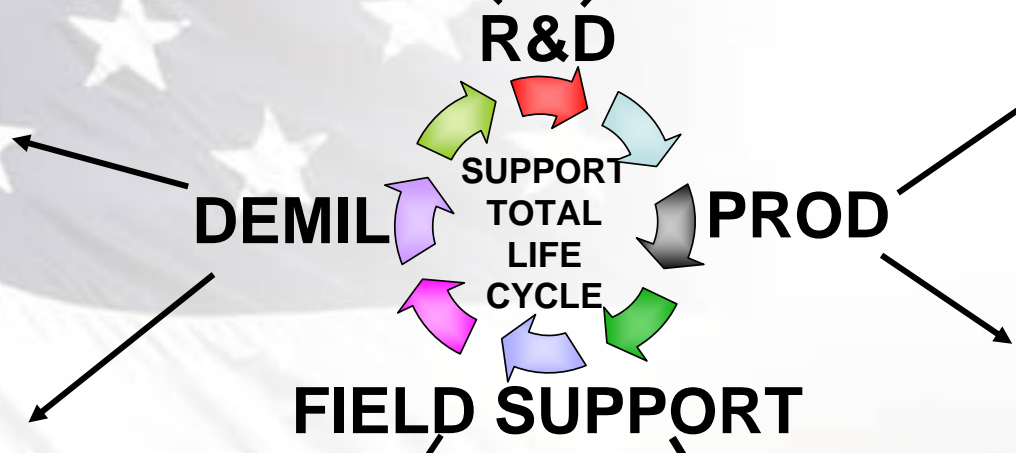
M240B 7.62MM Machine Gun



40mm Multi-Shot Launcher



Lake City Army Ammunition Plant
5.56/7.62



...Providing Over 90% of the Army's Lethality



ARDEC at a Glance

- Established “Center of Mass” for Armament Systems and Munitions for Joint Services
- Proven track-record supporting transition of technologies to the field; since early FY 05.....
 - >28 Material Releases (MR) (>40 since early FY03)
 - >34 Urgent MR (>50 since early FY03)
- ARDEC Personnel ~ 3000; ~900 new hires since FY99
- >\$100M invested in “World Class” experimental R&D facilities since mid-90’s; Additional \$75M planned
- Strong partnerships with Industry, Academia, and other Government agencies.
- In-house rapid prototyping initiatives demonstrating new desired capabilities, supporting production prove-out and initial fielding demands
- >\$125M Tech Base portfolio addressing Joint needs



2004 & 2006 Army Large R&D Lab of the Year



R&D and Experimentation Facilities

Major Examples



Davidson Advanced Warhead Development Facility

Opened 1996

\$11.7M



- Maximum 50 TNT equivalent capability
- 100m indoor warhead test range

Precision Armaments Lab

Opened 2000

\$8.8M

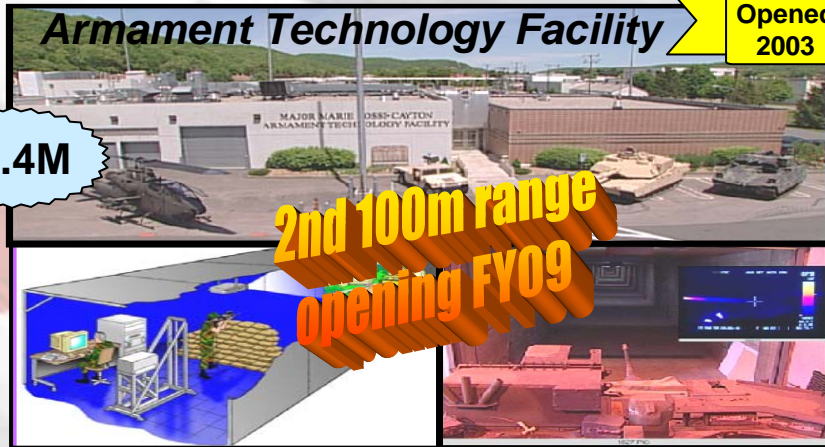


- 2 Lab grade elevators for sensor dev
- 3 Target locations; 150m, 400m, & 1500m

Armament Technology Facility

Opened 2003

\$8.4M



2nd 100m range opening FY09

- 100 & 300m indoor ranges
- Environmental chambers

Armament Software Engineering Cntr

Opened 2005

\$15.5M



Level 5 CMMI Certified

- Integrated S/W & H/W development/integration
- Multi-platform SOSI highbay capability



New Facilities Under Construction Breaking "Old" Grounds



Soft Recovery System (SRS)

Opening
Summer
FY07

\$9.0M



- High-g test Munition/Components to 20K g's
- 155mm capability (current); Only one in existence
- Navy 5", 120mm mortar, and EM Gun planned

High Energy Propellant Formulation Facility

Opening
FY08

\$17.7M

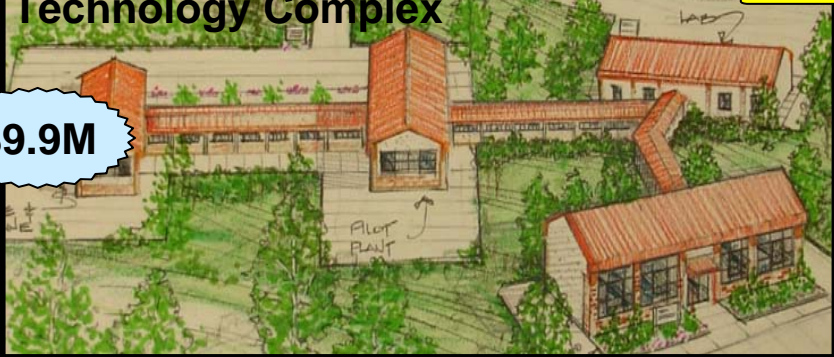


- 45,000 ft2 Propellant Pilot Plant
- Characterization Laboratories
- Magazine Storage / Offices

Pyrotechnic Research & Technology Complex

Opening
FY08

\$9.9M



- 33,000 ft2 Engineering Offices & Laboratories
- Pilot manufacturing facility
- Energetic stowage

Explosives R&D Loading Facility

Opening
FY09

\$8.0M



- 28,000 ft2 Melt Pour Operations & Engineering
- Climate Controlling Machining
- Explosive Pressing, Cast Cure, & X-Ray



Urgent Fieldings Some Recent Examples



M1028 120mm Canister Cartridge



- New Anti-Personnel capabilities for Abrams Tank out to 500m+
- >15,000 rounds fielded to Army/Marines.

M113A2 Rapid Entry Vehicle (REV)



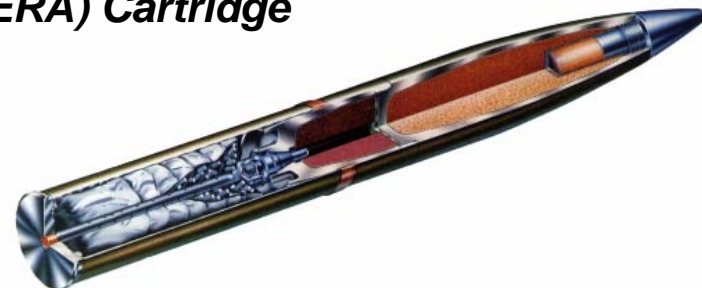
- Non-lethal response under armor with
 - 4 modified M870 shotguns
 - 6 Modular Crowd Control Munitions
- 4 vehicles fielded

M100 Rifle Launched Grenade Muniton



- Door Breaching Muniton fired from M16A2 and M4 with standard 5.56mm M855 rounds.
- 300 tactical/1250 training rounds fielded

M927 105mm High Explosive Rocket Assist (HERA) Cartridge



- Extended range capability to 16km+ to meet critical mission need
- Combination new production and M913 conversion yielded ~3600 cartridges
- ~700 cartridges fielded



Rapid Prototyping Initiatives

Examples of "Tech Push" for Early User Demo's AND Support to Production Requirements

Gunner's Protection Kits (GPKs)



M1114 Objective GPK (O-GPK)

- Concept Demo in 6 Months
- ARDEC Level III TDP
- Depot Production for >15K GPKs



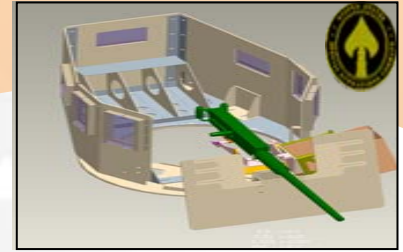
Stryker Cupula Shield

- PM Request
- Concept Demo in 90 days
- ARDEC LRIP to OIF (7 Brigades)



RG31 GPK

- Modified O-GPK
- ARDEC LRIP underway



SOCOM GPK

- Expanded Requirements
- ARDEC LRIP underway



Sculpted Transparent Armor

- Curved Transparent Armor
- Enhanced Situational Awareness
- Concept demo planned May 07



Engineering Boat (MK1) Survivability Enhancements

- Baseline Design Complete
- Prototype Demo Planned May 07
- LRIP Quantity Planned 3rdQ FY07

MAJOR DESIGN GOALS

- Maximize protection level & area
- Minimize weight
- Maintain situational awareness
- Use existing attachment points
- Utilize proven ballistic materials
- Minimize number of components
- Interface with standard weapon mounts
- Modularity

Initial Production Prove-Out and Fielding Support

Close Coordination with Customers Key to an Integrated Solution for Survivability, Lethality, and Situational Awareness

Concept Design



Rapid Prototyping Initiatives

Examples of "Tech Push" for Early User Demo's AND Support to Production/Fielding Requirements

Remote Armaments for Unmanned Platforms



Tactical Amphibious Ground System (TAGS)

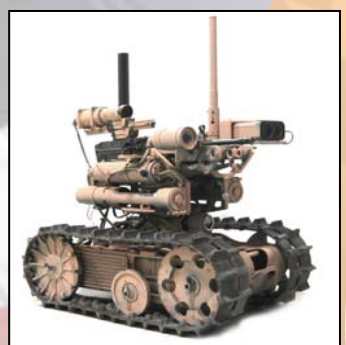
Picatinny LtWt Mount on TAGS

- ARDEC in-house developed mount
- <200lb weight class with M240/M249
- 3 mounts supporting customer demos



Obj NLOS Mortar Technology

- Elevating automated turret concept
- Demo on surrogate platforms FY07-09



"I'm ready to deploy with this unit and SWORDS"

- SGT, 1-3 Cavalry, 3BDE/3ID

Key Design Challenges:

- Weight/Cube/Power
- Weapon Re-arm/Automation
- Integration on COTS platforms
- Communications
- Roof and internal structures
- No fire zones / motion inhibits
- Vehicle dynamics
- EMI



Remote Armament Sys Tech

- Weapon designs specifically for unmanned platforms
- Ease of integration/functionality
- Concept demos FY08/09

Special Weapon Observation-Reconnaissance Direct Action System (SWORDS)

- Safety Confirmation Jun 06
- 3 Deployed to 3rd ID
- Urgent Material Release Underway

Initial Production Prove-Out and Fielding Support

Valuable Lessons Learned on Design and Safety Considerations to Apply to Remote Armament Programs

Concept Design



Engineering Analysis/Evaluation

Example of evaluation of system technology performance



Evaluation of Acoustic Sniper Detection Systems

- **PURPOSE:** Validate accuracy of vehicle mounted gunfire detection systems, both statically and on the move against vendor stated performance specifications

- Verify performance of system's ability to detect/locate sniper fire under various conditions
- Verify system robustness to false alarms

- **Three-Phase Test at APG:**

- Stationary – Open Field (Completed)
- On the Move – Open Field (Completed)
- Stationary – Urban Environment (May - Jun)



- **Emerging Results:**

- System tested provide varying degrees of detect and locate capabilities
- In general, discrepancies exist between vendor claimed performance specifications and test results

- **Specific platform testing requested by customers underway**



SYSTEMS	MANUFACTURER
PD-Cue® 4 Corner	AAI
PD-Cue® Tetrahedral	AAI
Ferret	MacDonald Detwiler & Associates
VM-GDS	01dB, Metravib
Boomerang v2.5	BBN Technologies
SNIPOS	Axcess Technologies
VAAPS/LWAS	Land Warrior Acoustic Systems
Red Owl	iRobot

Testing Critical for Requirements Generation and Establishing TTPs

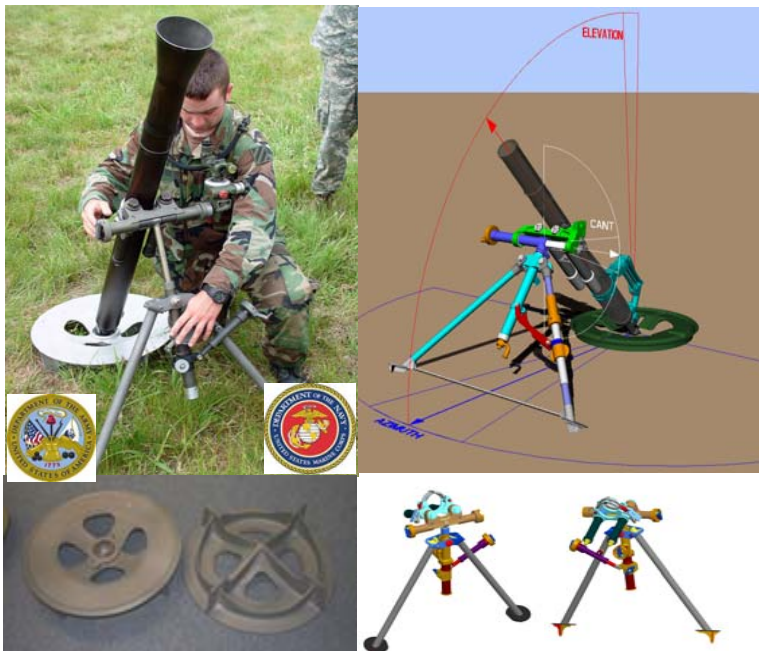


Recent Tech Base Transitions

Major Examples-Weapons

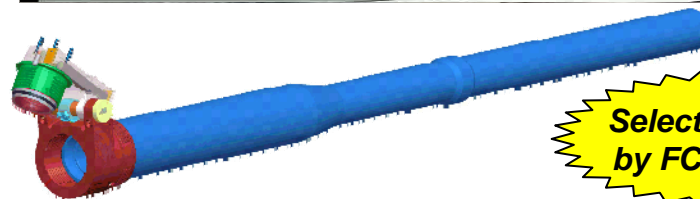


LtWt 81mm Dismounted Mortar



- Joint Army/Navy Funded
- ~30% weight reduction (to <70lbs)
- New Inconel Tube Mat'l & Process
- Simpler, More Ergonomic Bi-Pod
- ~50% UPC reduction
- Transitioning to Prod ECP FY07

XM325 120mm Mortar Cannon

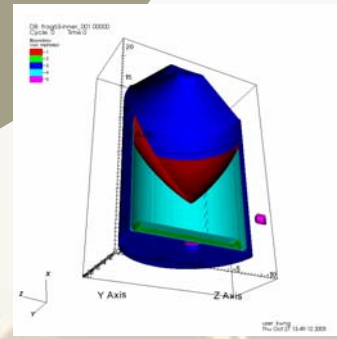
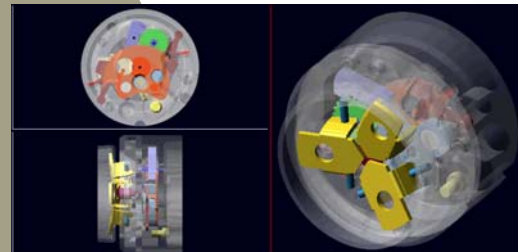
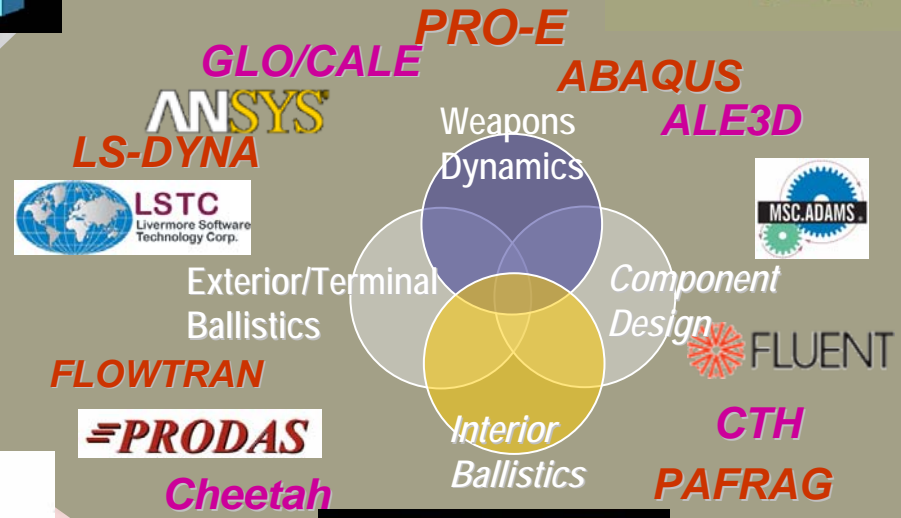
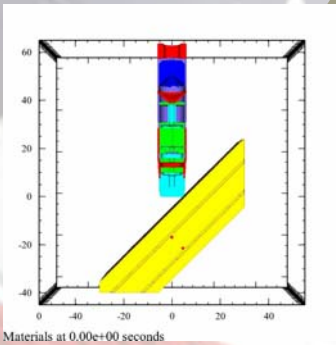
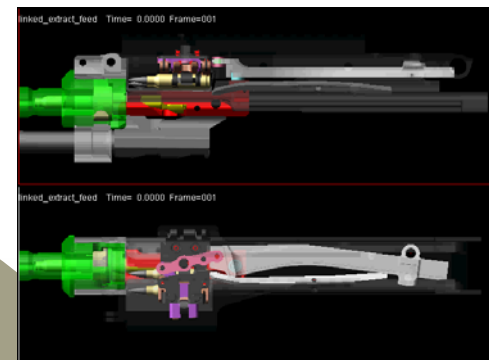
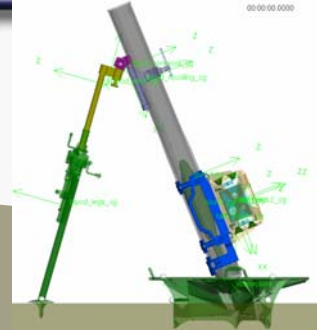
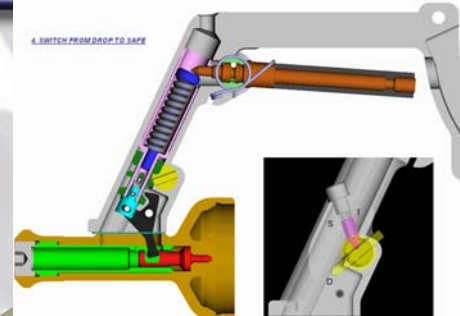


**Selected Cannon
by FCS Program**

- 3 meter tube with screw block breech
- 8 km range with M900 series ammo
- Demonstrated 12 rpm firing rate (FCS Threshold Requirement)
- Transitioned to FCS Program at TRL 6



Engineering Design and Analysis



Application of World-Class M&S Tools is Dramatically Enhancing the Way We Design and Assess Products/Processes



Recent Tech Base Transitions

Major Example-Ammunition

Line-of-Sight-Multi-Purpose (LOS-MP)

Current

Future- 1 Round



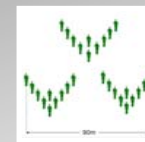
• Enhanced Lethality with One-Round against:

- Concrete Wall
- Earth and Timber Bunker
- Lt Armor
- Personnel

• LOS-MP TRL6 Exit Criteria met:

- Defeated Double reinforced concrete wall with Hole size 30"x50" in <3 shots
- Demonstrated greater than threshold range (700m) with potential to meet objective capabilities (40-2000m)

• Transitioned to PM-MAS



30 Man
Platoon
Defeated >
1000m



1-Shot T-55 Defeat



2 Shots- Defeat DRC



1 Shot Bunker Defeat

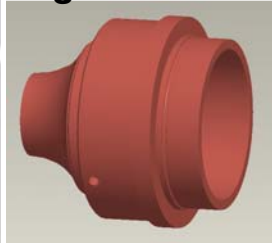


LOS-MP Design Process

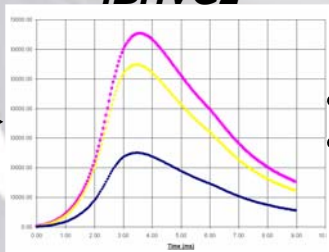
Enabled TRL 6 Demo in 2 Years

- Initial conceptualization to meet requirements
- Definition of high risk process and long lead items
- Define shortfalls of M&S: Fill gaps with test, experience

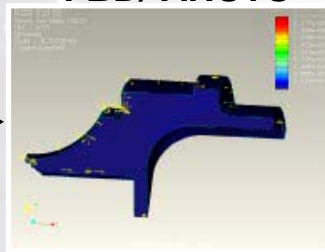
**Modeling/
Configuration Pro
Engineer/ Intralink**



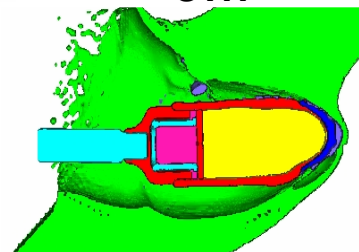
**IB Simulation
IBHVG2**



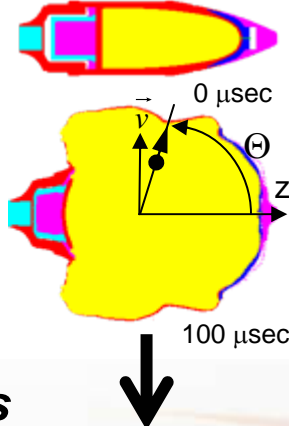
**Structural analysis
FBD/ ANSYS**



**Target penetration
CTH**

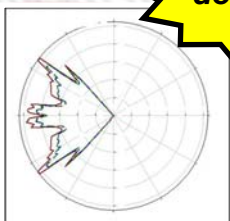


**Fragmentation
CALE/PAFRAG**



Failure in any model reiterates design process

No iteration of design during testing!



**Lethality Models
CASRED/MPR3D/
AJEM/MUVES**

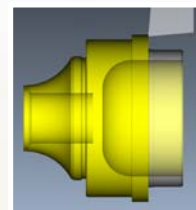
Flight Performance



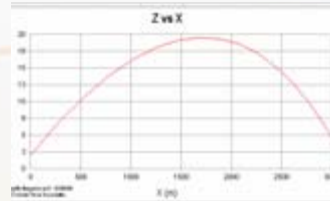
Fragmentation



Verify Models



**3D numerical control
Pro Manufacture**



**Flight performance
PRODAS**



DR concrete wall

Modeling and Simulation Saved \$6.8M and 27 Months



MCS and Abrams Ammunition System Technologies (MAAST)





In Summary....ARDEC/Picatinny...



- **Established “Center of Mass” for Armament Systems and Munitions for Joint Services**
- **Proven track record of rapid transition of technology to the field**
- **Modernizing R&D facilities maintaining world-class capabilities**
- **Developing new concepts/technologies to enhance warfighter capabilities**
- **Demonstrating future warfighting capabilities today!**

ARDEC/Picatinny.....

Products, people, and processes enabling our ultimate customer, the soldier, to “take care of business” throughout the spectrum of conflict!