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

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ARDEC Mission
Life Cycle Engineering & Support

Lightweight Dismounted Mortar
Plasma Arc Furnace
Supercritical Water Oxidation
M240B 7.62MM Machine Gun
40mm Multi-Shot Launcher
Lake City Army Ammunition Plant

Excalibur
Lightweight Handheld Mortar
Ballistic Computer, XM32

…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
- 100 & 300m indoor ranges
- Environmental chambers

Armament Software Engineering Cntr
-Opened 2005
-$15.5M
- Integrated S/W & H/W development/integration
- Multi-platform SOSI highbay capability
New Facilities Under Construction
Breaking “Old” Grounds

Soft Recovery System (SRS)
- High-g test Munition/Components to 20K g’s
- 155mm capability (current); Only one in existence
- Navy 5”, 120mm mortar, and EM Gun planned
- Opening FY07
- $9.0M

Explosives R&D Loading Facility
- 28,000 ft² Melt Pour Operations & Engineering
- Climate Controlling Machining
- Explosive Pressing, Cast Cure, & X-Ray
- Opening FY09
- $8.0M

High Energy Propellant Formulation Facility
- 45,000 ft² Propellant Pilot Plant
- Characterization Laboratories
- Magazine Storage / Offices
- Opening FY08
- $17.7M

Pyrotechnic Research & Technology Complex
- 33,000 ft² Engineering Offices & Laboratories
- Pilot manufacturing facility
- Energetic stowage
- Opening FY08
- $9.9M
Urgent Fieldings
Some Recent Examples

**M100 Rifle Launched Grenade Munition**
- Door Breaching Munition fired from M16A2 and M4 with standard 5.56mm M855 rounds.
- 300 tactical/1250 training rounds fielded

**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

**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)

**M114 Objective GPK (O-GPK)**
- Concept Demo in 6 Months
- ARDEC Level III TDP
- Depot Production for >15K GPKs

**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

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

**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

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

Rapid Prototyping Initiatives
Examples of “Tech Push” for Early User Demo’s AND Support to Production/Fielding Requirements

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

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

Special Weapon Observation-Reconnaissance Direct Action System (SWORDS)
- Safety Confirmation Jun 06
- 3 Deployed to 3rd ID
- Urgent Material Release Underway

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

“I’m ready to deploy with this unit and SWORDS”
- SGT, 1-3 Cavalry, 3BDE/3ID

Tactical Amphibious Ground System (TAGS)

Obj NLOS Mortar Technology
- Elevating automated turret concept
- Demo on surrogate platforms FY07-09

Picatinny LtWt Mount on TAGS

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

New Integrated Weapon/Platform Interface Design

Initial Production Prove-Out and Fielding Support
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

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

- 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

Selected Cannon by FCS Program
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**
- M908
- M830A1
- M830
- M1028

**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

- Simulated ATGM defeat 1000m
- 30 Man Platoon Defeated > 1000m
- 1-Shot T-55 Defeat
- 2 Shots - Defeat DRC
- 1 Shot Bunker Defeat
Los-Mp Design Process

- 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

No iteration of design during testing!

Flight Performance
Fragmentation
Verify Models

Lethality Models CASRED/MPR3D/AJEM/MUVES
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)
• 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!

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