



U.S. ARMY ARMAMENT RESEARCH, DEVELOPMENT, & ENGINEERING CENTER (ARDEC)



TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Barbara Machak
ARDEC Overview
February 4, 2009

- S&T Challenges
 - Current versus future
 - Budget Cycle
 - Government in-house versus contract



Duality Clip

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

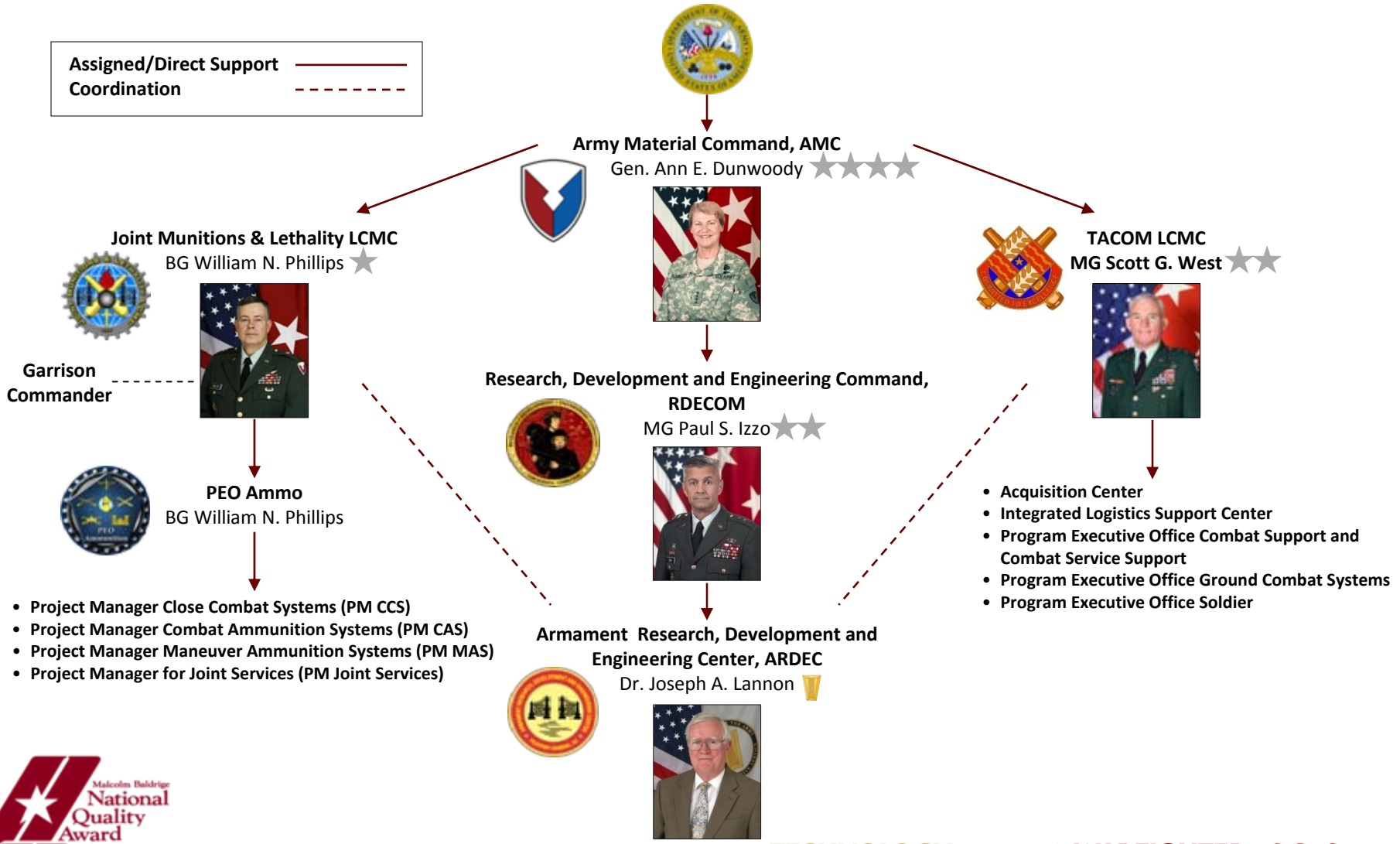
Ammunition – small, medium, large caliber; propellants; explosives; pyrotechnics; warheads; insensitive munitions; logistics; packaging; fuzes; environmental technologies and explosive ordnance disposal

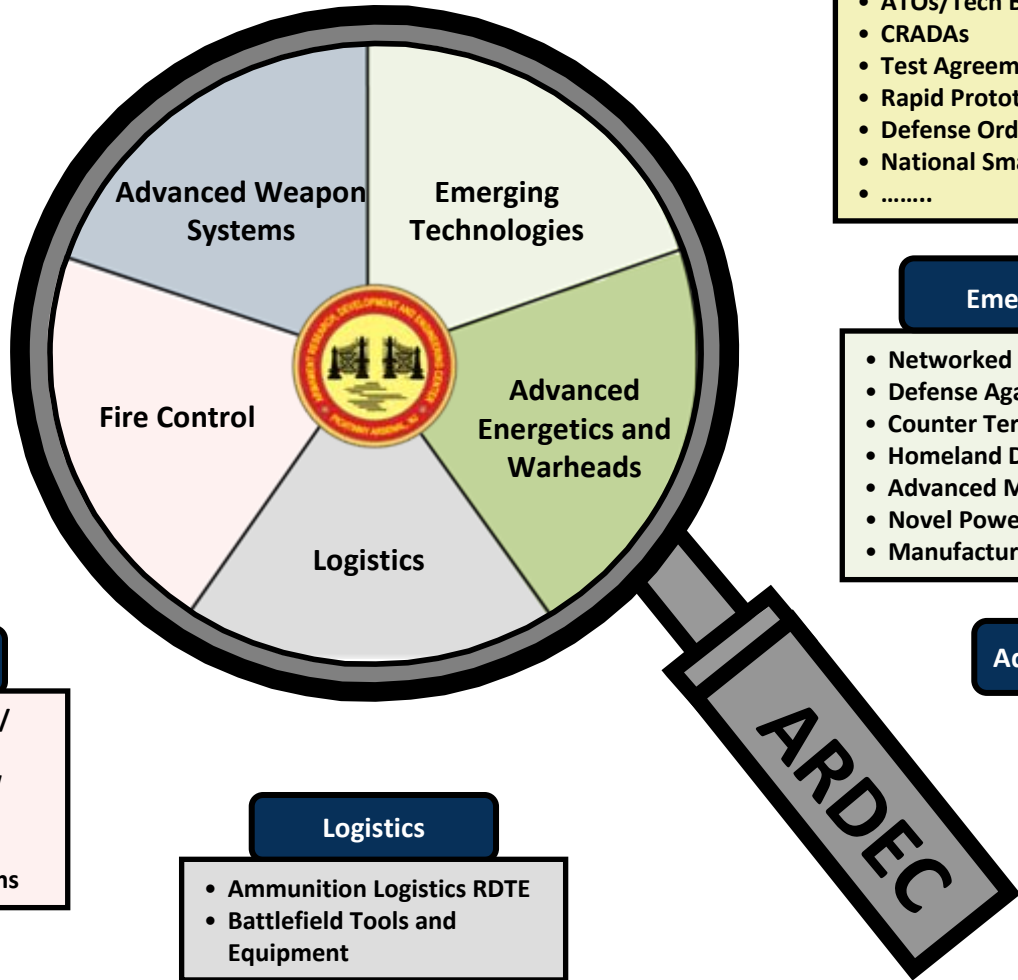
Fire Control – battlefield digitization; embedded system software; aero ballistics and telemetry

**Provides the Technology for Over 90% of the Army's lethality;
Significant support to other services' lethality**



Headquarters, Department of the Army





Advanced Weapon Systems

- Direct Fire
- Indirect Fire
- Scalable Effects
- Non-Lethal Systems
- Small/Medium/Large caliber ammunition
- Directed Energy
- Remote Armaments
- Insensitive Munitions
- Fuzes
- Telemetry
- Precision Armaments
- Grenades
- Maneuver Support Munitions
- Demolitions

Collaboration Mechanisms

- ATOs/Tech Base
- CRADAs
- Test Agreements
- Rapid Prototyping
- Defense Ordnance Technology Consortium
- National Small Arms Consortium
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Emerging Technologies

- Networked Lethality
- Defense Against Unmanned Systems
- Counter Terrorism Technologies
- Homeland Defense Technologies
- Advanced Materials / Nanotechnologies
- Novel Power & Energy Systems
- Manufacturing Science Technologies

Fire Control

- Battlefield Digitization / SW Applications
- Embedded Systems SW
- Firing Tables
- Ballistics
- Automated Test Systems

Logistics

- Ammunition Logistics RDTE
- Battlefield Tools and Equipment

Advanced Energetics and Warheads

- Propellants
- Explosives
- Pyrotechnics
- Warheads
 - Kinetic Energy
 - Chemical Energy
 - Shaped Charges
 - EFPs
 - Fragmentation



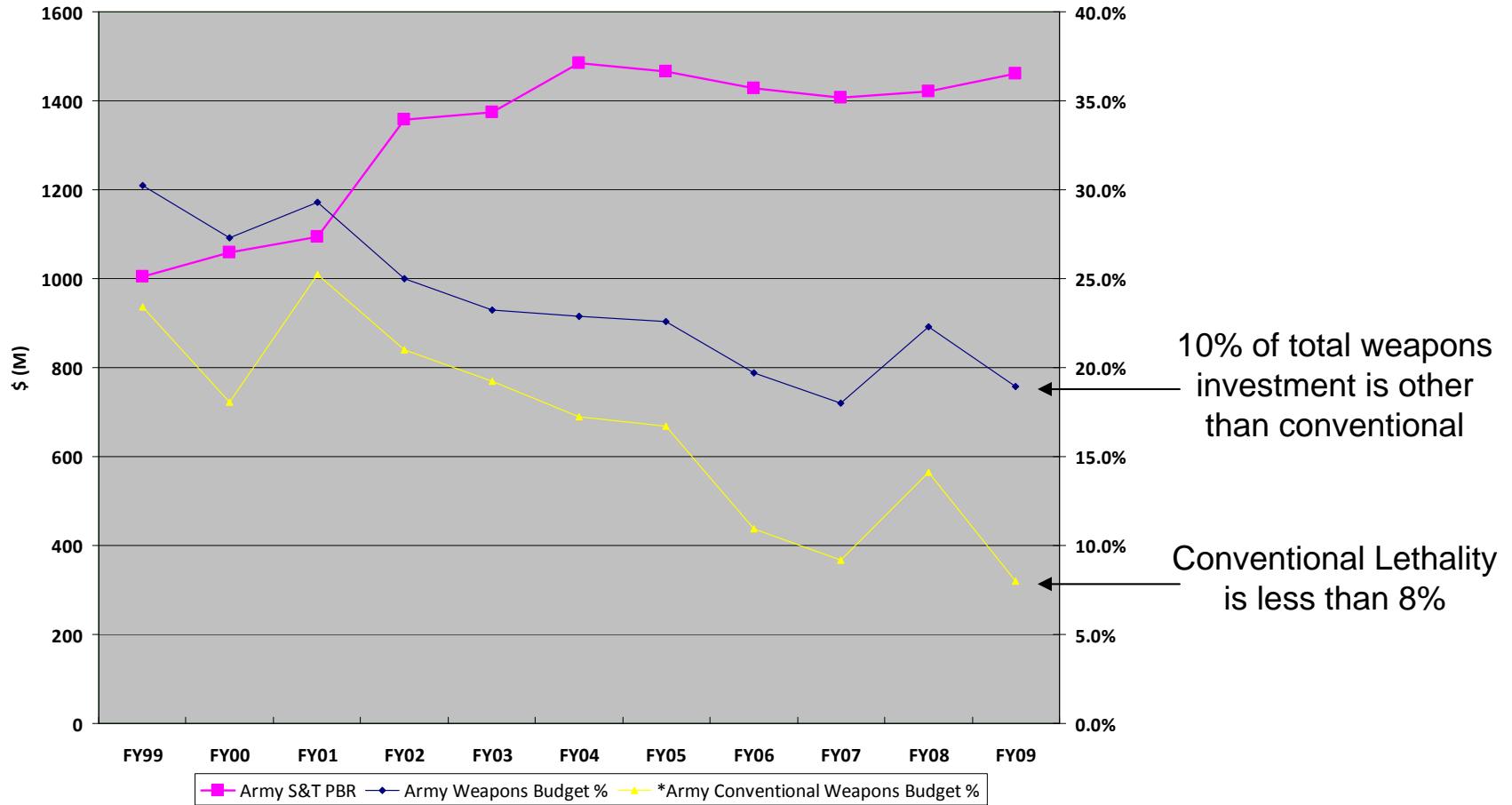


- Courtesy of:
Keith Luhmann
Staff Specialist for Conventional Weapons
Weapon Systems Directorate
USD(AT&L) / DDRE / DUSD(S&T)
- Numbers are yearly President's Budget Requests (PBR) from the USD (Comptroller) R-1/R-2 Forms. Weapons Taxonomy is categorized by the Defense Technical Information Center.
- The category "Conventional Weapons" is defined as the total Weapons S&T (BA2+BA3) less Directed Energy Weapons, Countermine/ Mines, EM Gun, and Electronic Warfare.

Note: BA2 = 6.2 (applied research)
BA3 = 6.3 (demonstration)

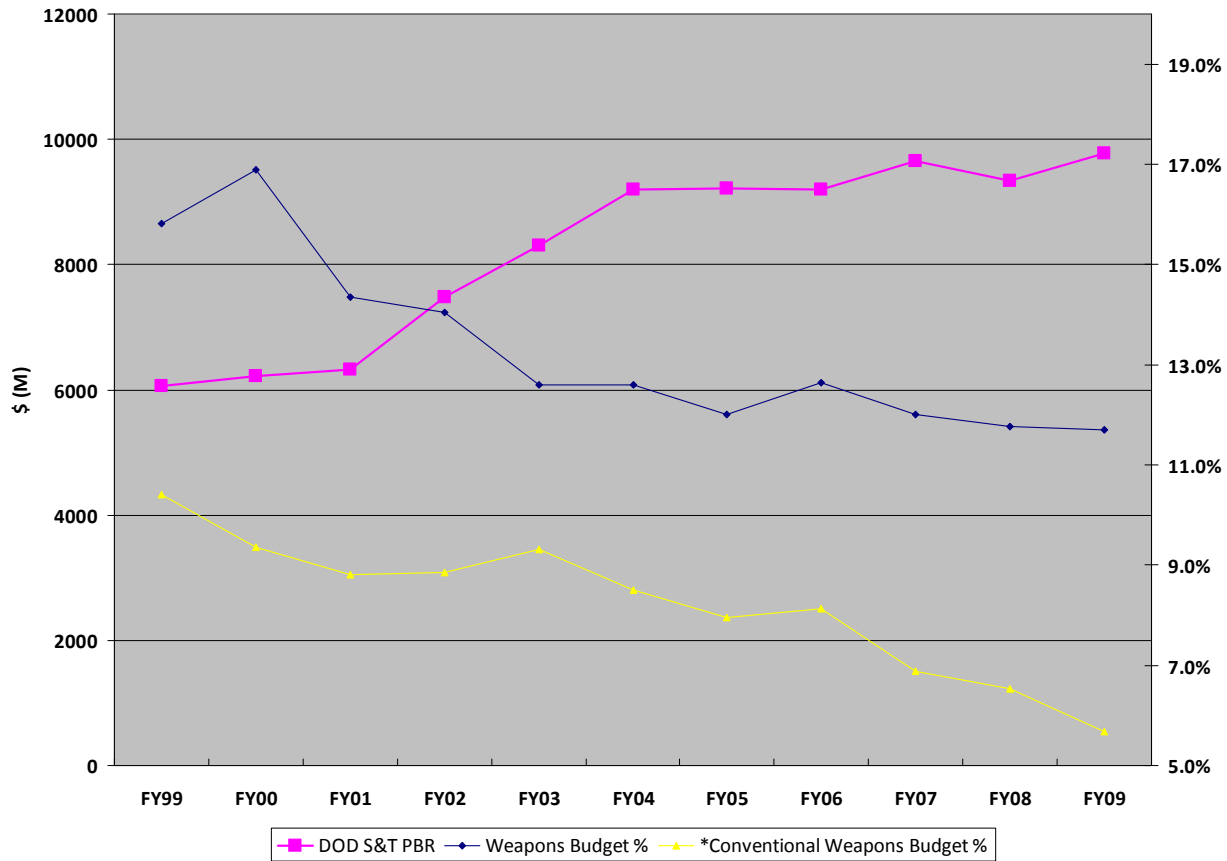


Army Conventional Weapons S&T (BA2+BA3) Percent of Total



*Conventional Weapons = Total Weapons S&T Budget – Directed Energy – Countermine/Mines – EM Gun – Electronic Warfare (FY99-00)

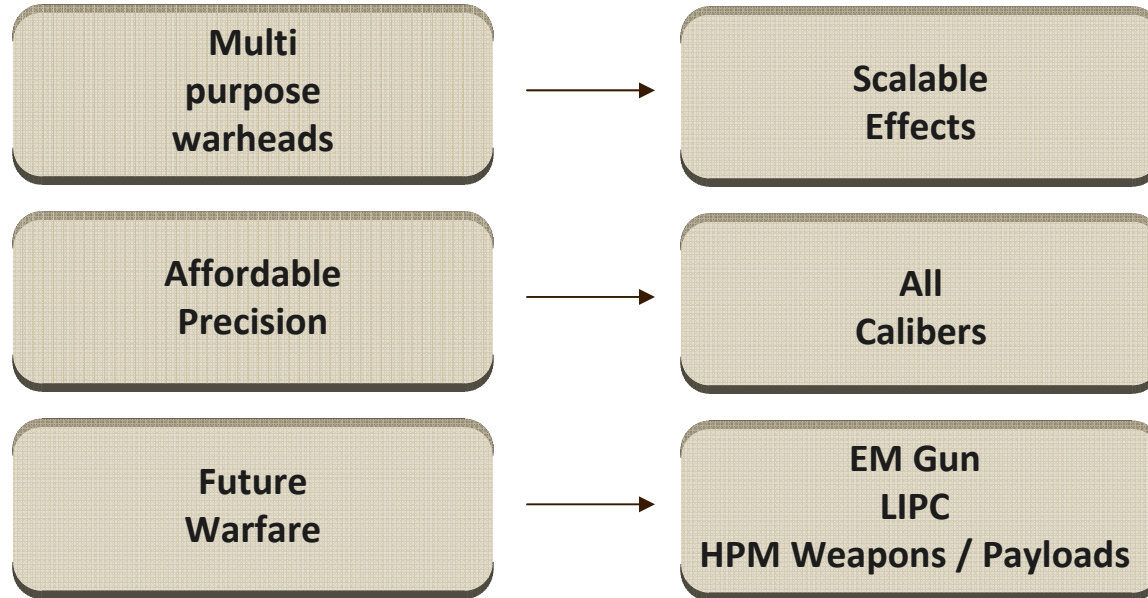




*Conventional Weapons = Total Weapons S&T Budget – Directed Energy – Countermine/Mines – EM Gun – Electronic Warfare (FY99-00)

Across services, lethality investments are low





Target Engagement <ul style="list-style-type: none"> • Smart sights • Acoustics • Technical Fire Control 	Weapon/Launcher System Control <ul style="list-style-type: none"> • Remote weapons • EM Gun • Laser Induced Plasma Channel (LIPC) • High Power Microwave (HPM) 	Project Energy <ul style="list-style-type: none"> • Multi-mode warheads • Fuze and power • Nano technologies • MEMS IMU/S&A 	Effects on Target <ul style="list-style-type: none"> • MOUT Structures • Affordable Precision • Non-Lethal • Scalable Warheads 	Effects Assessment <ul style="list-style-type: none"> • Area denial • Survivability • Lethality
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**Underpinning Enabling Technologies
Energetics, Fuze, Power, GNC, IM, etc.**



Mid Range Munition

- Transitioned in FY07 to PM MAS
- 1st BLOS smart munition
- Autonomous and SAL designated
- Raytheon (Technology Base Provider) selected for SDD



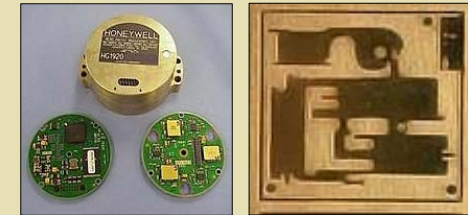
120 mm Mortar / Mount

- Transitioned in FY06 to PM FCS /LSI
- 1st breech loaded mortar firing existing ammo without modification
- CRADA with FCS to provide engineering and mortar tubes in SDD



MEM IMU

- Transitioned in FY07 to PM CAS
- Co-developed with AMRDEC
- Common munitions / missile IMU
- Used in Excalibur



Lightweight Dismounted Mortar

- Transitioned in FY06 to PM Mortars
- 30% weight saving and 50% reduction in manufacturing cost
- Qualified for Army and Marine Corps use
- Applied to 60mm and 120mm



LW 120 Gun w/ Advance Muzzle Brake

- Transitioned in FY05 to PM FCS/LSI
- Reduced armament weight by 2 tons
- CRADA with FCS to provide engineering and components in SDD



Joint Modular Intermodal Distribution System (JMIDS)

- JMIC+JMIP transition in FY09 to PM-FSS
- Critical supplies delivered faster - 45% fewer C17 missions
- Reduces exposure to IEDs - 40% fewer vehicle trips



ATO-M: Pax-41 and Pax-3

- Scale up of IM explosives
- Transitioned to PM CCS for Spider and Bunker Defeat Munitions



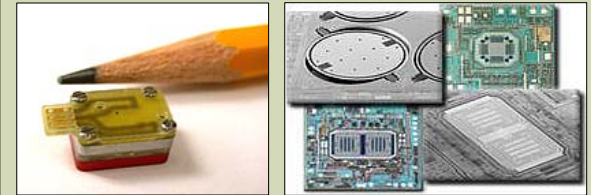
MOUT

- Behind wall effects
- Single step operations
- Less weight



MEM S&A

- S&T and MTO
- Proven at TRL 6 and MRL 7 for 20mm and 155mm
- Saves space for more lethality



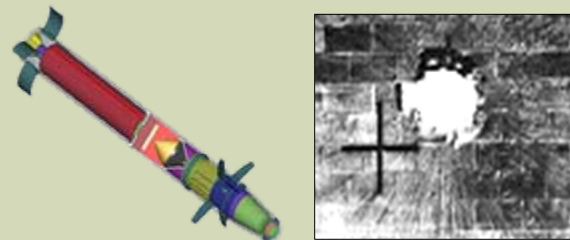
Common Smart Submunition

- Discriminating, fuzed sensor submunition
- Defeat both Hard and Soft Targets



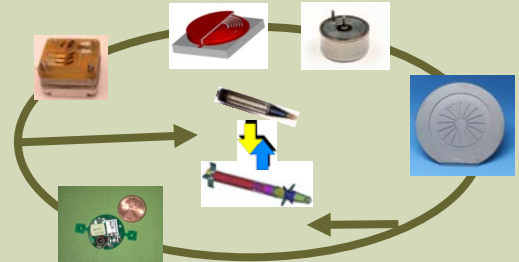
Hardened Combined Effects

- Bash through structures
- Transitioned already to NLOS-LS PGMM and MRM



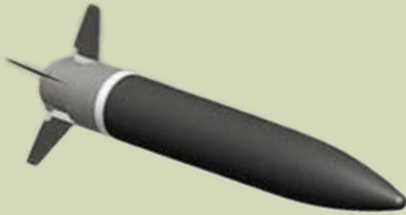
Fuze and Power

- High Voltage Fireset
- MEMS Impact Sensor
- Thermal/Reserve Batteries
- Shaped Charge Array for MP ESAD



Very affordable Precision Projectile

- Precision at \$10,000 / RD
- Government design
- Forthcoming CDD for 105mm



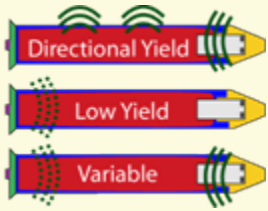
Small Arms Deployable Sensors Network (SmADSNet)

- Gun fired fused sensors for building ID
- Meets objective requirements
- Utilize cots with ARDEC G-harden capability



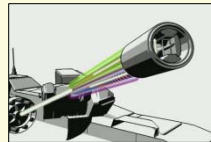
Scalable Technology for Adaptive Response (STAR)

- Scalable, selectable & adaptive lethal effects
- Demonstrators: 250mm (GMLRS), 155mm (Excalibur), 30mm (M789/Mk238)



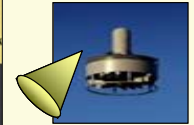
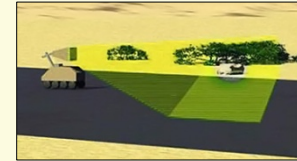
EM Gun

- Eliminate use of energetics with increased lethality
- Enhanced Survivability with reduced launch signature
- 20MJ Railgun Launcher, Integrated Launch Package, & 20MJ Pulsed Power supply



High Power Microwave/LIPC

- Weapon and a payload technologies
- Multi-effects across multiple targets



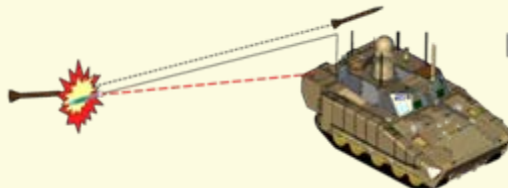
Lightweight Small Arms Technologies

- Advanced lethality with increased munition effectiveness to target
- Advanced firing control systems for more accurate precision engagements
- 50% weight reduction in gun and bullet due to novel materials



KEAPS

- For FCS to meet objective threat
- ARDEC providing the warhead
- FY10 demo planned



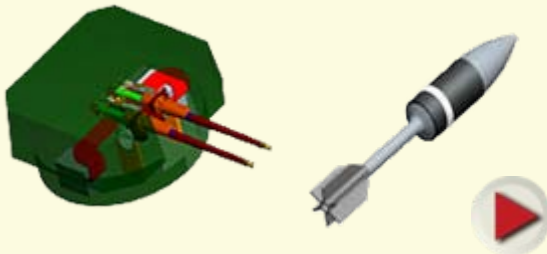
Insensitive Munitions (IM)

- HPC institute, ARL and ARDEC teamed to develop the next generation of M&S for Insensitive Munitions application
- New M&S capability: Faster design and implementation
- Improved tactical and combat survivability
- IM efforts for HE Munition and new IM Fills



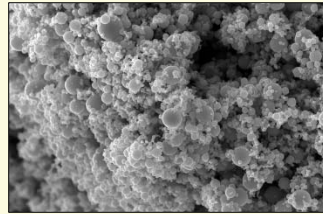
Extended Area Protection System (EAPS)

- 50mm gun and guided bullet
- Counter rocket artillery and mortar



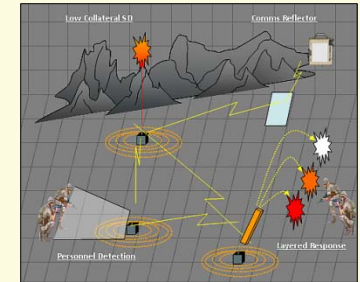
Novel/Nano Structured Energetics

- High performance extremely insensitive fills
- Structural Energetics



Networked Munitions Technologies

- Graduated response
- Improved detection of personnel
- Reduced collateral damage when self destructed



Multi-Mode Warheads

- Target Selectable (e.g. armor or bunkers)
- Scalable (Full or mitigated effect)
- Tunable (non-lethal to highly lethal)



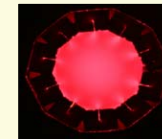
Replacement for DPICM

- Cluster Munitions Replacement Technologies



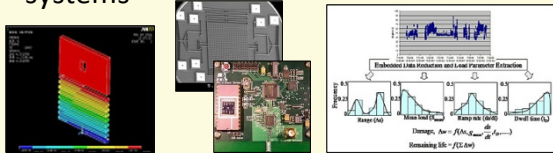
Breach Mounted Laser Ignition

- Being developed for 155mm artillery
- Replacement for primer based ignition
- Provides logistics and operational benefits
- Improves mission readiness
- Supports continuous high rates of fire



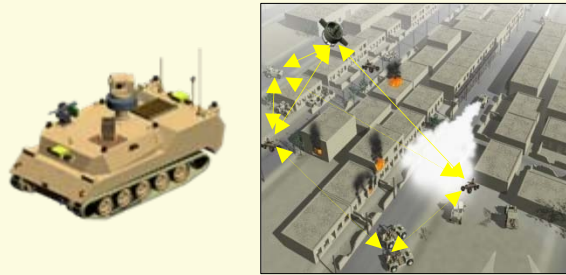
Prognostics and Diagnostics for Operational Readiness

- Holistic open architecture
- Core sensor/processor tag & prognostic engine
- Provide ability to communicate the health and predict readiness of multiple systems



Near Autonomous Unmanned Systems

- Unmanned armaments with autoloading Capability (7.62mm)



Acoustic/Seismic Sensors

- Enhanced acoustic, UV, IR, narrow-band, and/or optical augmentation sensors to detect/locate/ID shooters
- Provide combat forces with actionable understanding of hostile shooters & gunfire in real-time & enhance TTPs to defeat threats



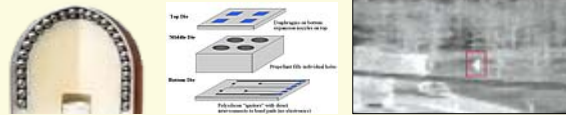
Soldier and Small Unit Lethality Integration

- Innovative message processing & Decision Aid for collaborative target engagement
- Integrated networked weapon sensors (Smart Sight) w/laser rangefinder & digital compass
- Soldier Integrated gun fire detection sensors (acoustic)



Joint Service Small Arms Project (JSSAP)

- Improved munition effectiveness to targets
- Correct range to moving targets and further power sharing within weapon



Tunable Pyro-technics

- Specific IR Counter Measure Output
- Insensitive igniters
- Enhanced primers, tracers & illumination
- Increased War fighter and aircraft survivability



- Over past year, closer coordination with IR&D reviews have been helpful. Need to continue.
- Re-enforce message on need to invest in lethality
- Focus on cost of technology solution
- Emerging technologies are not readily transferable to IB - need to dialogue on how to best handle
- DOTC is still preferred vehicle to execute S&T programs

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

- DPICM Replacement
 - Integration of advanced component technologies, including fuzing, power sources, multi-mode sensor-fused submunitions, and UXO location to mitigate issues with current DPICM with respect to US and international pressure to eliminate unexploded ordnance resulting from use of “cluster munitions”, and enable focused research into components for a future novel DPICM capability
- Affordable Precision Technologies
 - Development of low cost common components, including seekers, guidance control and navigation concepts, fuzing, and power sources that can be integrated into current precision projectiles and enable focused research for future precision munitions across a broad spectrum of calibers and mission areas
- Insensitive Munitions
 - IM requirements are integrated into all ongoing and future Tech Base projects which utilize energetic materials
- Individual Assault Weapon
 - Provide a single shoulder launched system meets or exceeds current capabilities of multiple systems against bunkers and light armor targets, adds lethal effects behind the wall, and can be fired from enclosure

- Munitions Fuze and Power Sources Technologies
 - Integration of advanced fuze and power source technologies into current systems to provide multifunction capability, greatly improve reliability, and reduce acquisition and life cycle costs
- Payload for Active Protection against all threats
 - Warhead technologies enabling a single APS effector to defeat the full spectrum of battlefield threats
- IED/Mine Neutralization with conventional ammunition
 - Integration of weapon, munition, and fire control technologies which allow defeat or neutralization of roadside or buried threats
- Probabilistic Reliability
 - Provide the capability to predict and mitigate failures before they occur. Initial focus will be MEMS ammunition components and remote weapon systems.
- Remote Armaments and integrated sensors
 - Provide remote weapon systems that utilize components optimized for unmanned firing capability to improve reliability and provide escalation of force and multiple lethality options with improved accuracy

- Digitization of weapons (105mm Art. And Small Arms)
 - Allow greater first and subsequent round hit probabilities by scaling digital fire control down to the smallest possible calibers
- Scalable Lethality
 - Fully scalable effects, from non-lethal to highly lethal, from one weapon/ammunition item
- EM Gun System Technologies
 - Power supply launcher, and launch package maturation and integration into a weapon system for a full scale demonstration
- LIPC/HPM weapons and payloads
 - Integration of DE capabilities into weapon systems and warheads for gun and missile launched effectors
- Counter RAM gun and guided bullets
 - Full up demonstration of an optimized weapon system to improve shortcomings of Phalanx
- Next generation seekers and Guidance Navigation & Control (GNC)

- Balance between current and future technology is ongoing
- We have strategies for future investments. Need your support and assistance.
- Funding decline in S&T is disturbing. We are open to ideas on how to reverse this trend.

.....Continued Dialog to Leverage Collaboration Opportunities