

U.S. Army ARDEC Overview & Special Weapon Observation Reconnaissance Direct-Action System (SWORDS)

Presented to:

***NDIA 40th Annual Armament
Systems: Guns-Ammo-
Rockets-Missiles Conference***

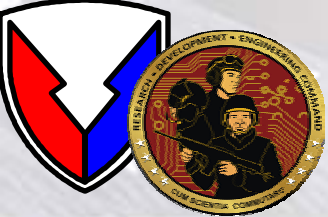
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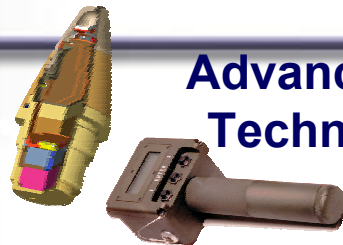
28 April 2005



ARDEC Mission



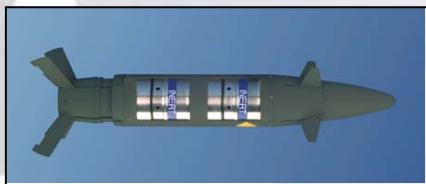
Artillery & Mortar Systems



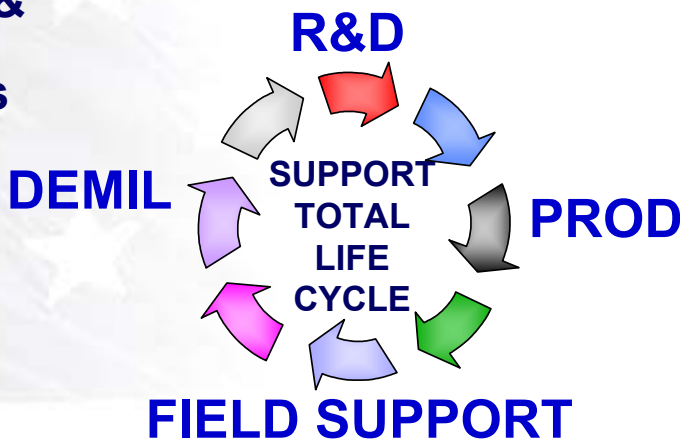
Advanced Fuze Technologies



Special Operations Weapons & Demolitions



Conventional & Smart Munitions



Advanced Energetics & Warhead Development



Combat Vehicle Armaments & Fire Control



Logistics R&D

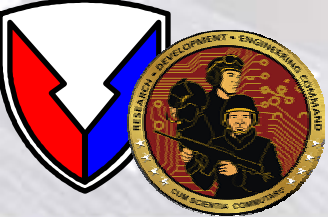


Non-Lethal Technologies



Small Arms

Providing over 90% of the Army's Lethality



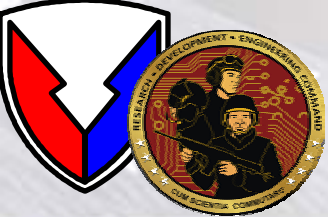
ARDEC at a Glance



- Established “Center of Mass” for Armament Systems and Munitions for Joint Services
- ARDEC Personnel = 2679; 590 new hires since FY99
- \$100M invested in modern experimental R&D facilities since mid-90’s
- Proven track-record supporting transition of technologies to the field; since Nov 03.....
 - 9 Type Classifications
 - 16 Material Releases (MR)
 - 10 Urgent MR (17 since early FY03)
- Strong partnerships with Industry, Academia, and other Government agencies.
- In-house rapid prototyping initiatives overcoming production problems or providing new desired capabilities to field in near term
- >\$125M Tech Base portfolio addressing Joint needs



2004 Army Large R&D Lab of the Year



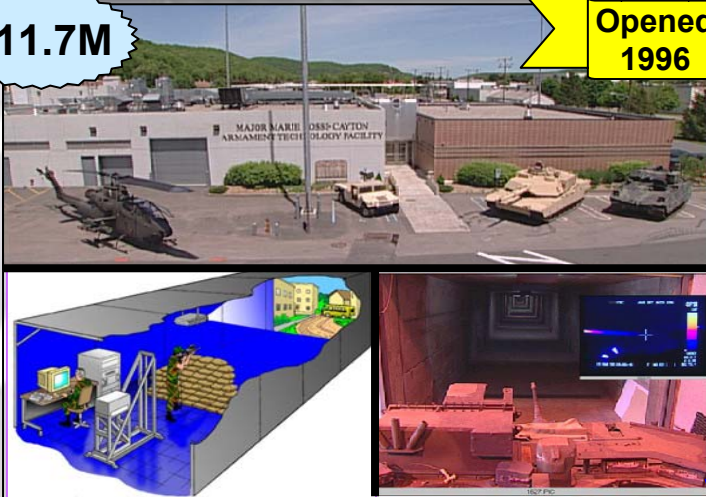
World Class Facilities

Most Recent in Operation



\$11.7M

Opened
1996



Armament Technology Facility

\$8.8M

Opened
2000



Davidson Advanced Warhead Development Facility

~\$45M in Facility Modernization invested over last 10yrs

\$8.4M

Opened
2003



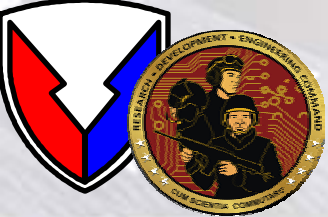
Precision Armaments Laboratory

\$15.5M

Opened
2005



Armament Software Engineering Center



World Class Facilities

Breaking "old" grounds



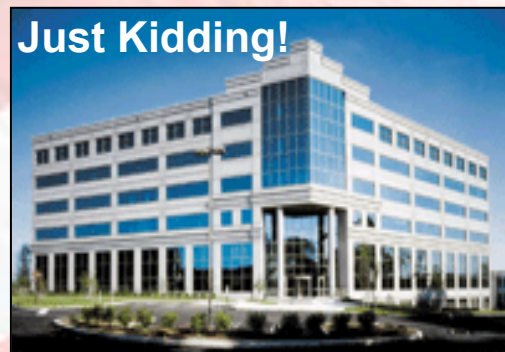
High Energy Propellant Formulation Facility

- MCA Funded - \$17.7M
- Planned Completion – FY07
- 45,000 ft² -
 - Propellant Pilot Plant /
 - Characterization Laboratories /
 - Magazine Storage / Offices



Pyrotechnic Research & Technology Complex

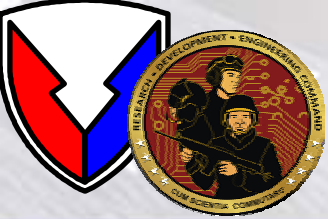
- MCA Funded - \$9.9M
- Planned Completion – FY07
- 33,000 ft² –
 - Engineering Offices & Laboratories
 - Pilot manufacturing facility
 - Energetic stowage



**Actual
Building
Concept
Available
May 05**

Explosives R&D Loading Facility

- MCA Funded - \$8.0M
- Groundbreaking Dec 05; Completion – FY07
- 28,000 ft² –
 - Melt Pour Operations & Engineering
 - Climate Controlling Machining
 - Explosive Pressing, Cast Cure, & X-Ray



Type Classification & Material Releases

Some Examples - FY04 to Present



Type Classification Items

- M85 Remote Activation Munitions System Trainer
- M111 Improved Position, Azimuth Determining System
- M192 Lightweight Ground Mount
- M240H- 7.62mm Aviation Machine Gun (Aviation Version)
- M255A1 Flechette Warhead, 2.75 Inch Rocket
- MK281 Cartridge, 40mm TP-T
- M393A3/M467A1 Cartridges, Tank 105mm
- HE441D RS 84mm Munition
- HEAT551C RS 84mm Munition

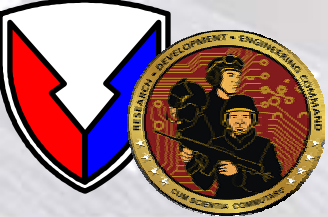
Materiel Release (MR) Items

- XM101 Common remotely Operated Weapon Stations (CROWS)
- M930E1 120mm Illuminating Mortar Cartridge
- M19/M20 Modernized Demolition Initiator
- CHARGE, PROPELLING, 155MM: M232 (MACS)
- Cartridge, 60mm: Smoke, WP, M722A1 w/ Fuze PD/DLY M783
- M769, 60mm, Full Range Practice Cartridge (FRPC)
- M829A3, Cartridge, 120mm, Armor Piercing, Fin Stabilized, Discarding Sabot with Tracer (APFSDS-T)
- M879, 81mm, Full Range Practice Cartridge (FRPC)
- M1155 Portable Inductive Artillery Fuze Setter (PIAFS)
- M303 Special Operations Forces Demo Kit
- M95/M96 Mortar Fire Control System
- Cartridge, 9mm, Jacketed Hollow-Point,
- M255A1 Flechette Warhead, 2.75" Rocket
- MK399 Mod 1 Point Detonating/Delay Fuze

Urgent MR Items

- XM32 Lightweight Handheld Mortar Ballistic Computer
- M107 Cal .50 Long Range Sniper Rifle (LRSR)
- M211 and M212 Flare: Countermeasure
- Non-Lethal Capabilities Sets
- AT4 Confined Space High Performance Weapon
- MP5-A5 9mm Submachinegun
- Lightweight Shotgun System
- M203 Grenade Launcher (GL) Day/Night Sight (DNS)
- Vehicle Lightweight Arresting Device (VLAD)
- X26E Advanced Taser Weapon and Associated Equipment

Supporting Transition of Technologies to Production/Field During War Time

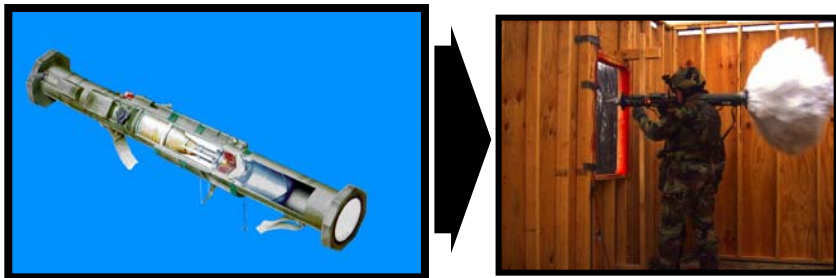


Urgent Fieldings

Some examples



AT-4 Confined Space (CS)



- Enables safe firing in MOUT environments
- Same performance as AT-4
- ~800 systems to Army and SOCOM FY03/04

M26/X26E TASER



M26 Advanced Taser

X26E Taser/
M4 Adaptor



- M26 is modified COTS
- X26E provides readily available non-lethal capability to XM-4 carbine
- 42 M26 & 350 X26E Tasers fielded since Jun 03

Gunfire Detection System (GDS)

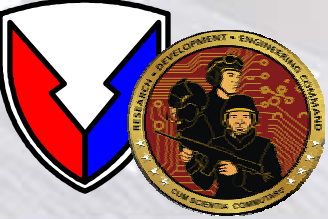


- Acoustically locate small arm fire origins
 - Provides azimuth, elevation & range
 - 360 degree coverage
- >100 systems fielded to Army and SOCOM since Aug 03

M211/212 Countermeasure Flares



- Broadens countermeasure signature to defeat all fielded Surface-to-Air Missile (SAM) Threats
- > 65,000 Flares fielded to Army & Air Force since Jan 03



Rapid Prototyping Initiatives

Examples Supporting Production Requirements



Stryker Ballistic Shield



- Lightweight (145lb) Cupola mounted ballistic titanium protection w/armor windows
- Leverages ARDEC success from Titanium Welding Manufacturing Technology Program
- Ensures weapons maneuverability
- Production/fielding of 136 kits for Army's Stryker Brigade underway; 70 kits produced and shipped

M54A1 Burster Tube Loading

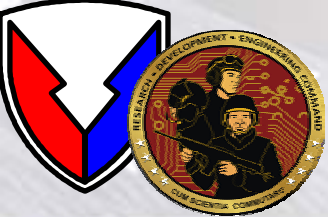


ARDEC
Load
Process



155mm M110A2
WP Smoke
Projectile

- Problem: M54A1 production problems impacted fielding of M110A2 to USMC
- ARDEC developed new melt pour & controlled cooling process
- 7000 Burster Tubes loaded/delivered by ARDEC to Pine Bluff by May 05
- ARDEC executing new requirement for additional 7000 burster tubes
- Technology transfer of ARDEC process to industry underway



Rapid Prototyping Initiatives

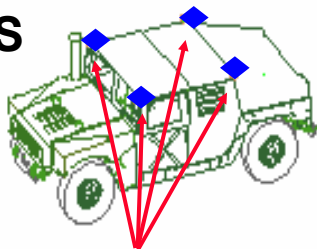
Examples of “Tech Push” for Early User Demo’s



Remote Weapon Counter Sniper System



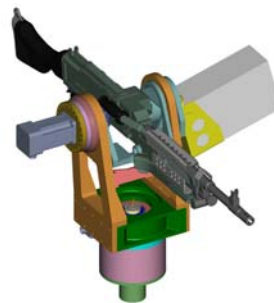
CROWS



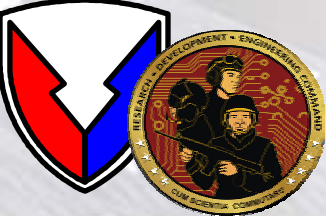
Acoustic Sensor Array x 4

- Joint ARDEC, AMC-FAST, PM-Soldier Weapons (PM-SW), & Industry Program
- Integrates 360° acoustic detection & location with remote weapon station
- Automatic or manual weapon position
- On-the-move weapon position updates
- USARPAC evaluation in CONUS and Limited Safety Release May/June 05
- ARDEC & PM working path ahead for evaluations in Iraq

Picatinny Lightweight Remote Weapon Station (PLRWS)



- Joint ARDEC, PM-SW, and REF Program
- Provide lightweight remote mount for M249, M240, & ACSW applications
- Target Wt: <150lbs with weapon/ammo
- Compliments CROWS-type system
- Elevation Range: +45° to -15°
- 2-Axis Stab; 360° continuous rotation
- Live-Fire testing underway
- ARDEC & PM working path ahead for evaluations in Iraq



ARDEC Tech Base Investments

Some examples w/ Joint Service linkage



LtWt 81mm Dismounted Mortar (FY04-06)

\$7M

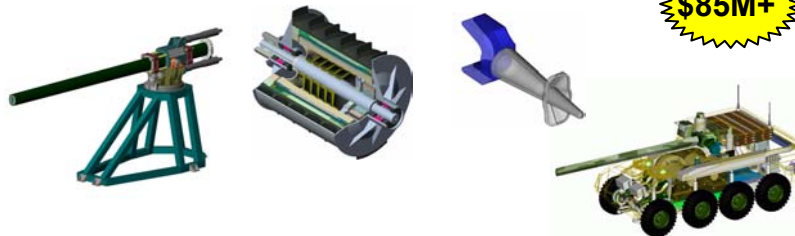


- 40-50% weight reduction
- Joint Army/USMC (ONR) funded
 - \$10M (N)
- Transition to SDD FY06



Electromagnetic Gun (FY04-06+)

\$85M+



- Subsystem Technology Maturation
- Broad weapon mission applications across Services
- Army/Navy collaboration



Micro Electro Mechanical Systems (MEMS)

Inertial Measurement Unit

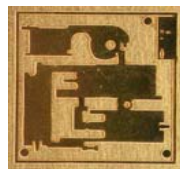


\$110M

- Common Guidance across munition/missile
- Includes Mantech \$'s
- Army Lead; Joint with Navy & Air Force



Safe & Arm Fuzing

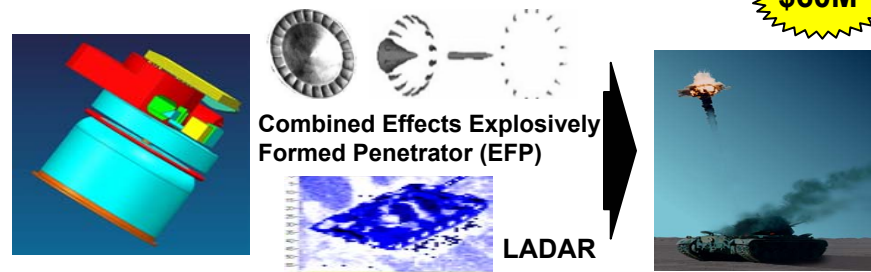


\$22M

- Gov't high-G design
- Applications to small - large caliber applications
- Includes Mantech \$'s

Common Smart Submunition (FY04-09)

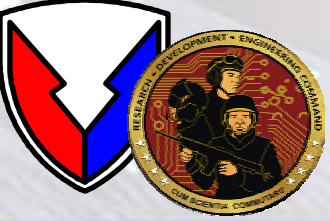
\$60M



- Next generation smart submunition
- High kill probability against threat spectrum incl APS
- Application across munitions/missiles (≥105mm) & UAVs
- Supports Air Force "Area Dominance" via MOA

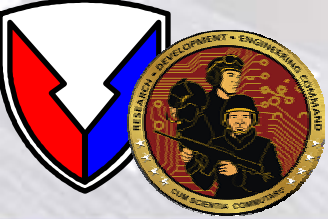


\$xM = Army Funding



Special Weapon Observation Reconnaissance Direct- Action System (SWORDS)





SWORDS

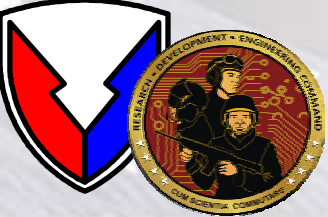
Program Description



- **Objective:** Demonstrate integration of available firepower options on small, low-cost, remotely operated weapon system at extended ranges
- **Warfighter Payoffs:**
 - Remotely Operated Recon & Security Asset
 - Remote sniper capability
 - Increased weapons accuracy/control
- **Design Approach:**
 - Maximize use of proven components
 - Enable easy integration of existing fielded small arms
 - Early User feedback on design
 - Early Safety Confirmation testing
- Joint ARDEC/OSD funding (~\$2M)
- Transitions to Joint Project Office for Robotic Systems

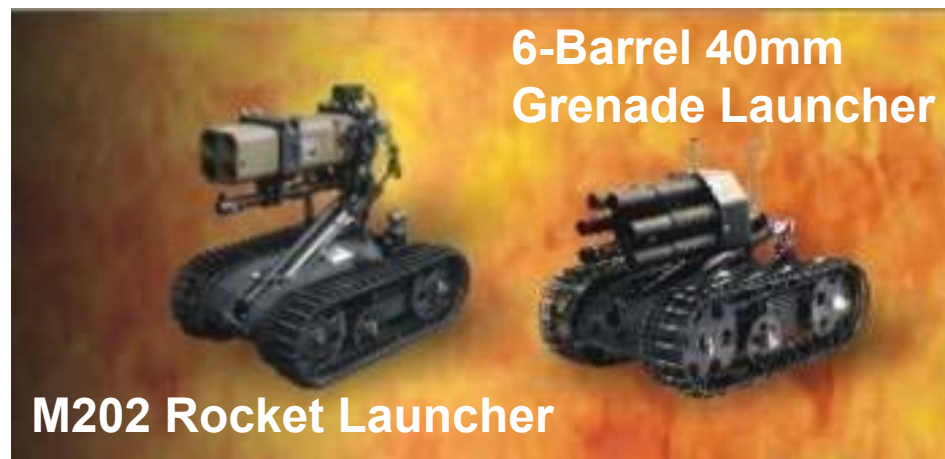


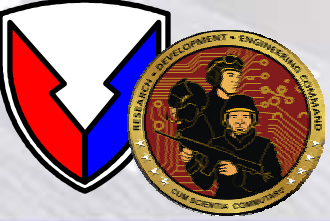
Helps keep soldiers out of harms way



Background

- Project initiated from a deployed EOD Unit's desire to clear cave entrances of potential threats (i.e. IEDs, enemy combatants)
- Two (2) concept demonstrators completed in ~1 month+
 - ARDEC EOD NCO "boot strap project"
 - Capitalized on existing EOD TALON Robot
 - Reinforced EOD robotic arm
 - Maximized use of existing armaments and/or ammo





Live Fire - Early Concepts

40mm Grenade Launcher



Mobile 40mm Grenade Launcher Prototype Tests

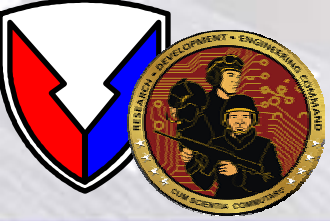


sponsored by TACOM

Range supported by ARDEC - Picatinny

testing performed by  Foster-Miller

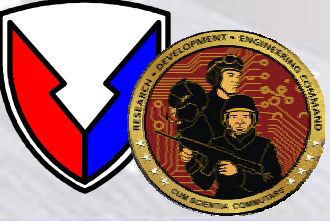




Live Fire - Early Concepts

M202 66mm Rocket Launcher





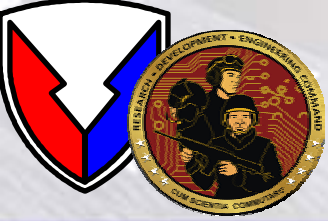
Early User Demonstrations



- **Army's Stryker Brigade**
 - FY03 at Ft. Lewis; Proof of Concept
 - FY04 in Kuwait; User evaluation
 - Yielded evolution of SWORDS configuration integrating small arms
- **SOCOM in FY03/04**
- **VERY POSITIVE** feedback on utility of concept



Early User Feedback Key to Validate Design Principles



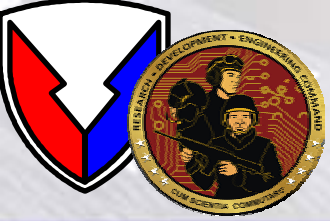
System Description

Latest Configuration



- Integrates TRAP Mount on TALON
 - Accurate weapon pointing independent of chassis
 - $\pm 35^\circ$ Az and $\pm 22.5^\circ$ EI
 - Integrates M249, M240B, M16, & 0.50 Cal Sniper Rifle w/o weapon modifications
- Unmanned RF control to 1KM (line-of-sight) via Operators Control Unit (OCU) for:
 - Mobility
 - Camera display options (view up to four images)
 - Weapon arm/safe/firing
- Five cameras/sights
 - Day/ Night drive cameras
 - Pan & tilt camera (situational awareness)
 - M145 w/Unitary Night Sight (Gen 3) for targeting
- Combat weight 180-190 lbs (w/o OCU)
- 3-6hr Lithium Ion Battery Life

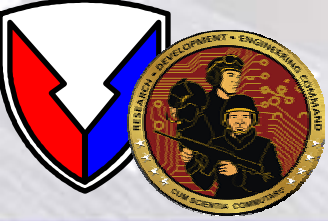




Live Fire & Mobility Demo

(segment from History Channel's "Mail Call")





Safety Confirmation Test Program



- Initiated early in development to support Urgent Material Release and flush out any anomalies
 - Two test iterations: Jun 04 & Jan 05
 - Included 100hrs reliability testing
- Testing currently halted; Program addressing test findings
- What's been demonstrated:
 - Stable firing platform for accurate single shot & burst performance
 - Better line-of-sight range command control performance than expected
 - Excellent video performance from cameras/sight upwards to 1km
- Remaining areas to be validated:
 - Weapon safety during communications loss/interruption & operator notification
 - Fire on the move disable feature
 - Lithium battery performance parameter refinement (controls) for safe operation, charging, and discharging
 - Sunlight readable LEDs on OCU

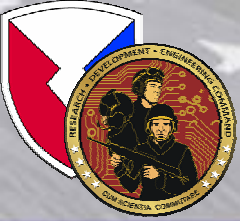
Design modifications required for operation in theater of war



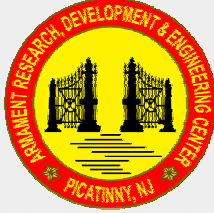
Path Ahead



- **Return to Safety Confirmation Testing (~Jun 05)**
- **Continue demonstration of capabilities to Users**
- **Continue preparation activities for Urgent Material Release**
- **Plan and seek resources for follow-on spiral improvements**



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!