US ARMY RDECOM

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

ARDEC Fuze S&T Overview

Joint Armaments Form & Exhibition
Phoenix Convention Center
May 15, 2014

ARMAMENT RESEARCH, DEVELOPMENT AND ENGINEERING CENTER
PICATINNY ARSENAL, NJ

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

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ARDEC Organization
Chain of Command

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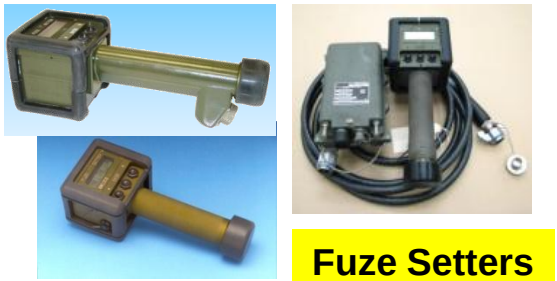
Commodity Areas

Artillery Fuzes

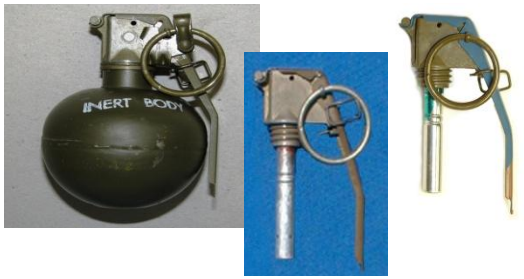
Mortar Fuzes

Medium Caliber Fuzes



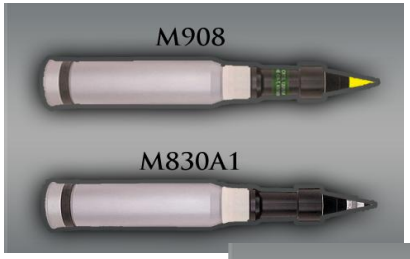
Fuze Setters

Safe and Arm Devices



Hand Grenades

Rockets & Missiles

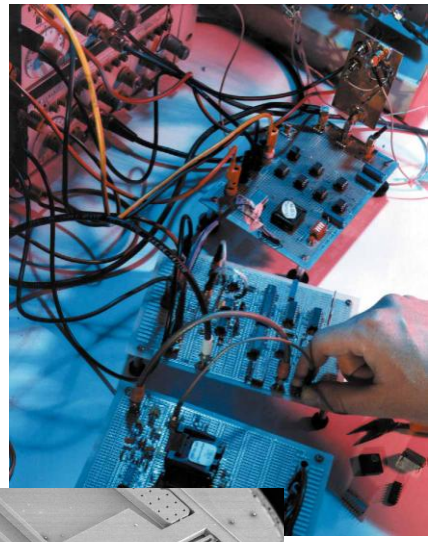


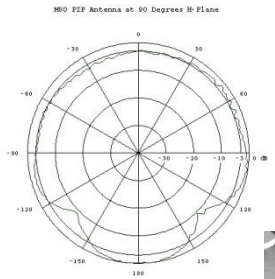
Tank Ammo

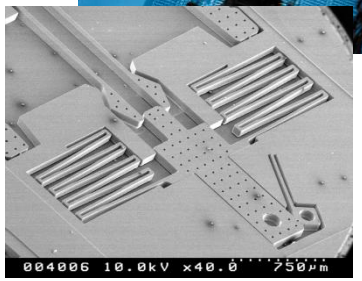
Malcolm Baldrige National Quality Award 2007 Award Recipient

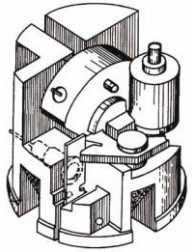
Fuze Division Expertise

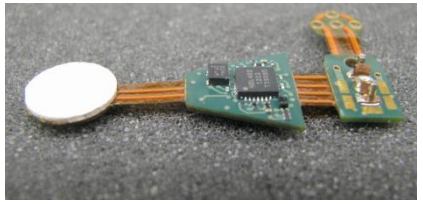
- Low Cost Electronic Fuzing
- Advanced Signal Processing Algorithms
- MMIC Radar Transceivers
- RF Components Design & Testing
- Analog and Digital Circuit Design
- Fuze Testers (RF and IF Simulators)
- ECM Evaluation
- Ultra miniature fuzes
- Antenna design
- MEMS S&As
- Design for High G Launch Loads
- CAD/CAM Design and Layout
- Rapid Prototype Fabrication
- Power sources
- Fuze setters











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ARDEC Fuze S&T

S&T Thrust Areas

Army Challenge: Create Operational Overmatch (enhanced lethality & accuracy)

Reduced logistical burden

Tailorable Effects

Enhanced Lethality

Scalable Effects

High Reliability

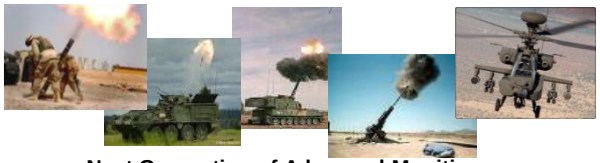
Advanced Fuze Setting


PIAFS

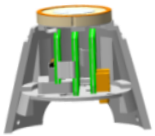
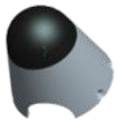

EPIAFS


iPIK

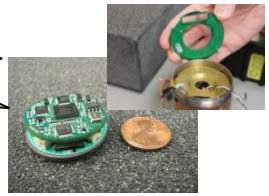
Innovative Packaging Schemes
EM Modeling & Simulation
Complex data processing

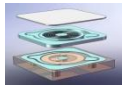

Next Generation of Advanced Munitions

Launch & Target Sensing

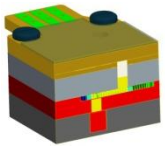
Fuze Decision Logic


Next Generation Prox Sensors



MEMS Acceleration / Impact Switch

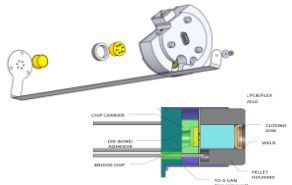

Target Media Sensing

Advanced Warhead Initiation Schemes

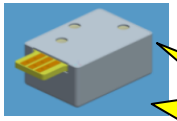

Microscale Firetrain


Miniature Firesets


Electronic Safe & Arm Devices

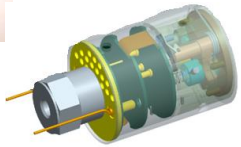

Low Cost Multipoint Initation

Advanced Safe & Arming

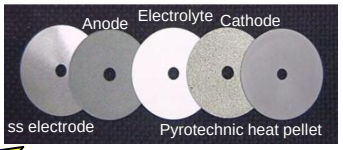


MEMS S&A



Rotor S&A

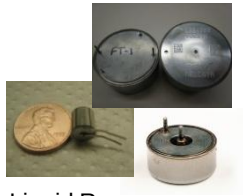

Electromechanical S&A

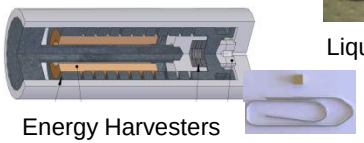
Novel Power & Energy





Thermals


Liquid Reserves


Energy Harvesters

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Fuze S&T and Acquisition Efforts

Emerging & MaturingTechnologies

(6.2 OSD Joint Fuze Technology Program)

- Target Classification Prox for Tailorable Whds
- Nano-Foil Heated Thin Film Thermal Battery

(Current 6.3 OSD Joint Fuze Technology Program)

- PGK IMX-101 Compatibility
- Next Generation Proximity Sensor for Prox Fuzing
- MEMS Retard & Impact Sensor

(RDECOM/ARDEC S&T Projects & Demonstrations)

- Future Initiation, Target Detection, Fuze Setting, Power
- Next Generation Prox Fuzing (*includes OSD sponsored DEF*)
- Distributed Multi-point Initiation
- Thin Film Power Sources
- MEMS Impact Switch Target Sensing
- Fuzing for Cluster Munition Replacement
- 120mm Guided Mortar
- Low Volume and Low Power Prox
- Direct Fire Prox Sensor - (Joint Non Lethal Dir)
- Autonomous Target Sensing for Shoulder Fired
- Airburst/PD and PD delay for Tank Ammo
- Command Arm MEMS S&A w/ Prox for 40mm
- Enhanced Multi-Purpose Grenade
- Low cost air dropped precision guided munition
- MEMS Safe & Arm Reliability & Manufacturing

On-going 6.6 Fuze Technology Integration

EMD/Production support for PM MAS, PM CAS, PM CCS, PD JP

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Advanced Proximity Sensor Technologies

Next Generation Proximity Sensors

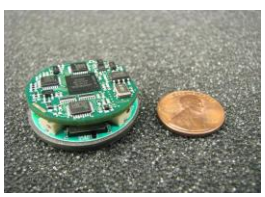
A Joint Fuze Technology Program
ARDEC led with technical participation by AFRL, NAWC-WD

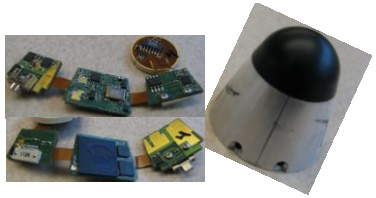
Advanced next-generation low cost sensor technologies to provide

- Enhanced battlefield performance
- Small form fit precision burst point control

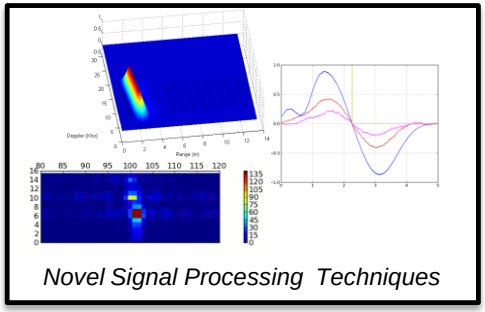
Research in the area of:

- FMCW, Spread Spectrum, Stepped Frequency RADAR Systems
- Novel Digital Signal Processing Range Extraction Techniques
- Improved performance RF front ends for miniature sensors





Miniature Software Defined Sensors



Novel Signal Processing Techniques

Target Classification Sensors for Fuzing Applications

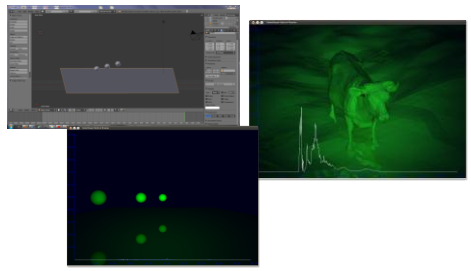
A Joint Fuze Technology Program

Advanced Simulation toolsets for prediction of FMCW data for complex targeting scenes

- Mesh based object / scene creation
- Shooting-Bouncing-Ray Solver
- Generation of IF return data for use in algorithm development and performance estimation

Classification Technique Research

- Range profile, feature extraction
- Range vector envelope correlation techniques



Advanced targeting scene modeling

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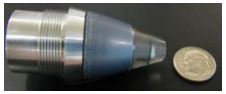
Proximity Sensor Development and Production Support

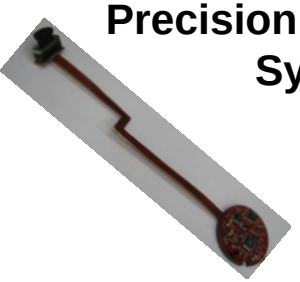
M789 / XM799 Prox Sensor



Development of autonomous airburst capability for the LW30 apache weapon system

- Custom Power Source
- Custom MMIC transceiver
- Custom signal processor
- Custom antenna designs
- Integration, Design, Fabrication, and Test in-house

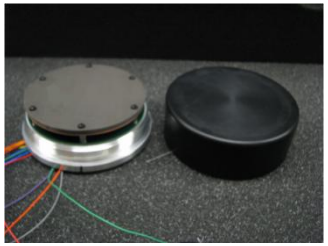
Precision Acquisition Weapon System (PAWS)



Proximity sensor for a lethal UAS

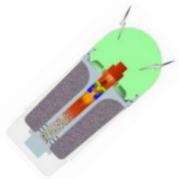
- Design and Fabrication
- Evaluation and Qualification
- Field Test Support
- Completed in-house at ARDEC

ORIOLE Medium Altitude Prox Sensor



- Detection of tree canopy at 150m
- Custom high power transceiver section
- Custom antenna sub-system design
- FPGA based software defined sensor
- Directional Doppler Ratio Ranging Firmware developed in-house
- All design, fabrication, and qualification completed in-house

XM1112 Airburst Non-Lethal Munition (ANLM)



Direct Fire proximity sensor technology

- Custom signal processor, MMIC transceiver, and power source
- Initial demonstrations and tactical electronics design completed in-house
- Currently in Developmental Test

Small Arms Grenade Munition (SAGM)

Development of a miniaturized defilade detection prox sensor system

- Developed using government owned technology
- Defilade detection to support PM MAS's Increased Range Anti-Personnel (IRAP) program
- Integration with custom battery and MEMS based fuze

M782 Multi-Option Fuze for Artillery (MOFA)

Integrated Sensor and Fuze electronics

- Custom signal processor, MMIC transceiver, and power source
- Initial demonstrations and designs completed in-house
- Production Item

M734A1 Multi-Option Fuze for Mortars (MOFM)

Integrated Sensor and Fuze electronics

- Custom signal processor, MMIC transceiver, and power source
- Initial demonstrations and designs completed in-house
- Production Item

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Novel Power Sources for Advanced Munitions

Medium Caliber Power Sources

Medium Caliber applications present unique and challenging power requirements

- Fast Rise Time
- Energy Density
- High-G Survivability
- Long Shelf Life
- Operational Temperatures
- Form Factor

Current investments addressing technical challenges for the development of a small form factor liquid reserve battery to meet operational and performance requirements.

Target applications

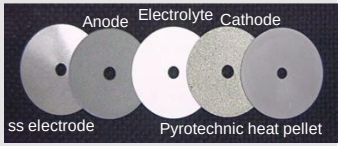
- M789 LW30mm Proximity Sensor for Apache
- XM1158 Airburst Non-Lethal Munition
- Small Arms Grenade Munition

Thin Film Thermal Battery Electrode Fabrication

Traditional pressed pellet fabrication methods press powders into pellets.

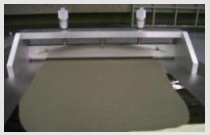
Large presses with high force produce flat discs

- Components are fragile
- Geometry limitations – excess material
- Batch process



Transition to thin film manufacturing process

- Reduced limitations on electrode thickness, aspect ratio, and shape
- "Roll to Roll" manufacturing process – low cost
- Electrodes stamped out from continuous sheet
- More robust – flexible, less waste in manufacturing



Target applications

- Pushing long runtime applications for artillery (150s)
- Ideal for those applications that require excess material for pellet manufacture/handling
  - Short runtime applications (EAPS)
  - High Voltage
- Continuous production and scalability should reduce cost

ARDEC continues to seek industry and academia partnerships to explore next generation power sources to meet the increasing power demands for munitions and fuzing applications

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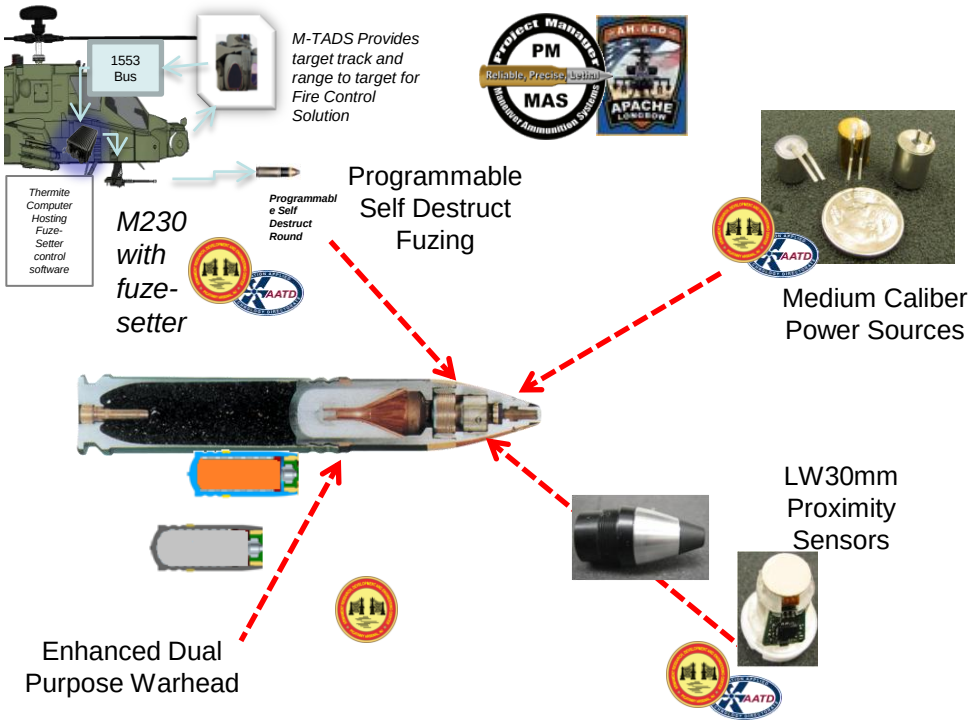
Medium caliber Fuzing technologies



PM MAS, PM Apache, ARDEC, and AMRDEC-AATD have teamed to develop enabling technologies for improved lethality multi-mode fuzed medium caliber munitions to support future requirements

- Munition technologies being developed as government owned technical data
- Final System integration and munition demonstration programs are currently in proposal phase and unfunded

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XM1112 Air Burst Non-Lethal Munition (ANLM)

Description

- ANLM is a Non-lethal, low velocity, 40mm flash/bang cartridge which is fired from the M320 or M203 Grenade Launcher
- Proximity fuze technology provides leap-ahead NL capability – same NL effect at any operational range
- User selectable proximity and delay modes
- In proximity mode, initiates approximately 5 meters from target at any range from 35-300m, projectile decelerates after initiation
- In delay mode, initiates 1.75 meters beyond target

Status/Issues

•Capability Production Document at HQDA pending 1 star Staffing.

•Cartridge integration test ongoing

•Qualification build to follow 4QFY14

•Tactical Non-Lethal Munition approved by the Munitions Council of Colonels in the FY15 TAMR.

Way Ahead /Roadmap

- Complete Integration Test
- Successful CDR
- DT Build/Test
- Achieve MS C
- Transition to from PM Soldier Weapons to PM-Close Combat Systems for production

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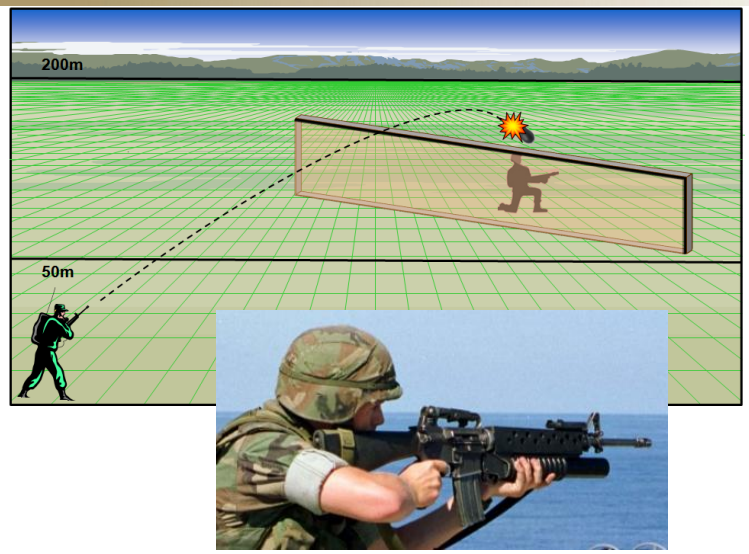
Small Arms Grenade Munition (SAGM)



Purpose

- Engage threat personnel in defilade at ranges between 50-200m with Smart 40mm HEDP low velocity grenade.
- Provide an improvement in effectiveness for the 40mm Low Velocity Grenade while maintaining compatibility with current and future grenade launchers.

Product

- 40mm Autonomous Air Bursting grenade (TRL 6) capable of air bursting over/behind defilade at ranges from 50 to 200m in addition to point detonating and deliver enhanced anti-personnel effectiveness.

Milestones & Deliverables

FY14:

Baseline Tests / M&S

FY15:

Design, build, test optimized cartridge
Integration and Test

Warfighter Benefit

- Expands the squad's 40mm grenade toolbox. Grenadier can defeat or suppress threats in defilade.
- Increase effective probability of incapacitation for the Soldier, Squad and Platoon against combatants in defilade.
- Adds capability without adding to the soldier's weapon load out.
- Works with existing M203/320 weapons.
- Does not require additional power or weapon accessories.

Points of Contact

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Steven Gilbert, SAGM Project Officer
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