U.S. Army Research, Development and Engineering Command

TECHNOLOGY DRIVEN. WARFIGHTER

ARDEC S&T Strategy

59th Fuze Conference

Fuzing Systems for Advanced Weapon Performance

Karen Amabile – ARDEC Fuze Division

AGENDA

- Team Picatinny
- ARDEC Role
- ARDEC's Strategic Partners
- ARDEC Organization
- Fuze Division Commodity Areas & Facilities
- ARDEC S&T Needs and Investment Analysis
- Fuze S&T Traceability to Stakeholder Needs
- Fuzing in a Challenging Environment
- Fuze S&T Efforts
- Fuze S&T Needs
- ARDEC Fuze Conference Briefings

US ARMY RDECOM

Team Picatinny

Other Tenants

Highest Caliber

- PEO Soldier
  PM Soldier Weapons
- PEO Ground Combat Systems
  PM Ground Combat Vehicle
- Defense Contracting Management Agency Springfield
- Civilian Human Resources Agency
- Naval Surface Warfare Center
- Marine Corps G Company 2-25
- Army Contracting Center - NJ
- Army Recruiting Northern NJ HQ (Company)
- 7245th Installation Medical Support Unit

ARDEC

CG/PEO Ammunition

Joint Munition & Lethality LCMC

Garrison Commander

Office of the Executive Director for Conventional Ammunition

- Gov't Population 3,953
- 6,493 Acres
- 909 Structures
- 64 Laboratories

The Joint Center of Excellence for Armaments and Munitions

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

ARDEC's Role

Acquisition Lifecycle


RESEARCH


DEVELOPMENT


PRODUCTION


FIELD SUPPORT


DEMILITARIZATION

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

"Center of Mass" for Armament Systems and Munitions for Joint Services

Strategic Partners

Assigned/Direct Support
Coordination

Headquarters, Department of the Army

Assistant Secretary of the Army
Acquisition, Logistics and Technology
Honorable Katharina G. McFarland, Acting

Army Materiel Command, AMC
Gen. Dennis L. Via

Joint Munitions & Lethality LCMC
BG Kristin K. French

TACOM LCMC
MG Gwen Bingham

Research, Development and Engineering Command, RDECOM
MG John F. Wharton

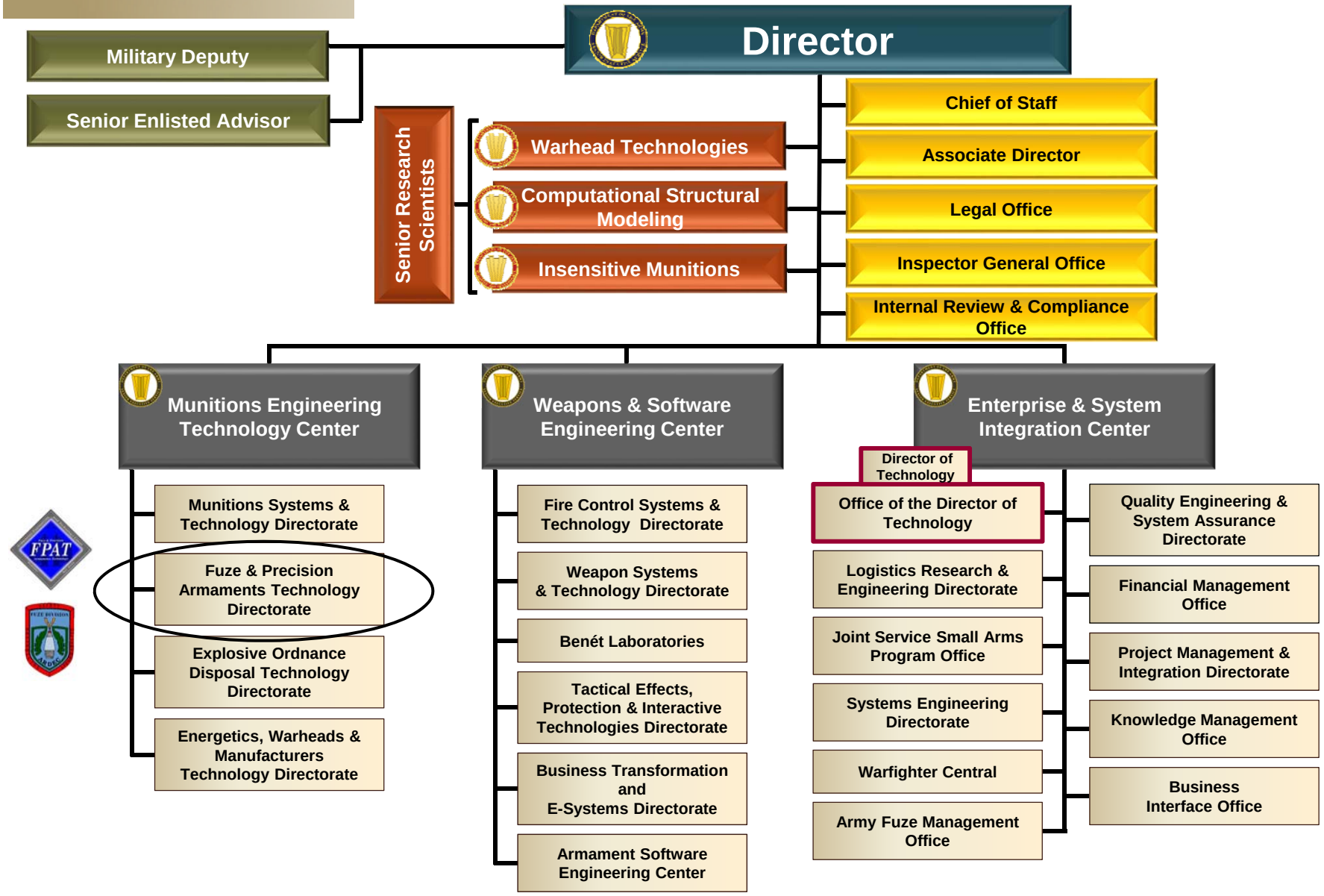
PEO Ammunition
Mr. James Shields

Ammunition Enterprise

Armament Research, Development and Engineering Center, ARDEC
Mr. John Hedderich

Program Executive Office Combat Support and Combat Service Support
Program Executive Office Ground Combat Systems
Program Executive Office Soldier

ARDEC Organizational Chart



US ARMY RDECOM

Fuze Division Commodity Areas

Artillery Fuzes

Mortar Fuzes

Medium Caliber Fuzes

Safe and Arm Devices

Fuze Setters

Hand Grenades

Rockets & Missiles

Tank Ammo

Fuze Division Facilities

Fuze Development Center

R&D Labs, Model Shop Capability

Fuze Sensor Research Facility

Anechoic Chamber

Electromagnetic & Environmental Effects Test Facility

Fuze Development Center

Malcolm Baldrige National Quality Award 2007 Award Recipient

ARDEC S&T
Needs & Investment Equation

Needs/Source Documents

DoD/DA
- OSD Elegant 11
- Army Enduring Challenges
- ASAALT Tech Imperatives (CSA Force 2025)
- ASA(ALT) POM Guidance

PEOs
- PEO AMMO Priorities
- PEO Soldier Priorities
- PEO GCS Priorities
- Endorsements
- LIRA

TRADOC
- Army Operating Concept
- Army Warfighting Challenges
- TRAC Top 60
- JCIDs Documents

- Capability Needs Analysis (CNAs)
- Force 2025 CoE Warfighter Needs
- CoE Gaps and Endorsements (MCoE, FCoE, MSCoE, SCoE, ACoE)
- TCM-ABCT, SBCT, IBCT Needs/Gaps

✓ Identification, coordination, organization of individual "Source Documents" needs/gaps/priorities into one list

✓ Collected from multiple lethality stakeholders

ARDEC S&T Portfolio

✓ Sets priorities for future investments (POM)

✓ Enables adjustments to on-going efforts

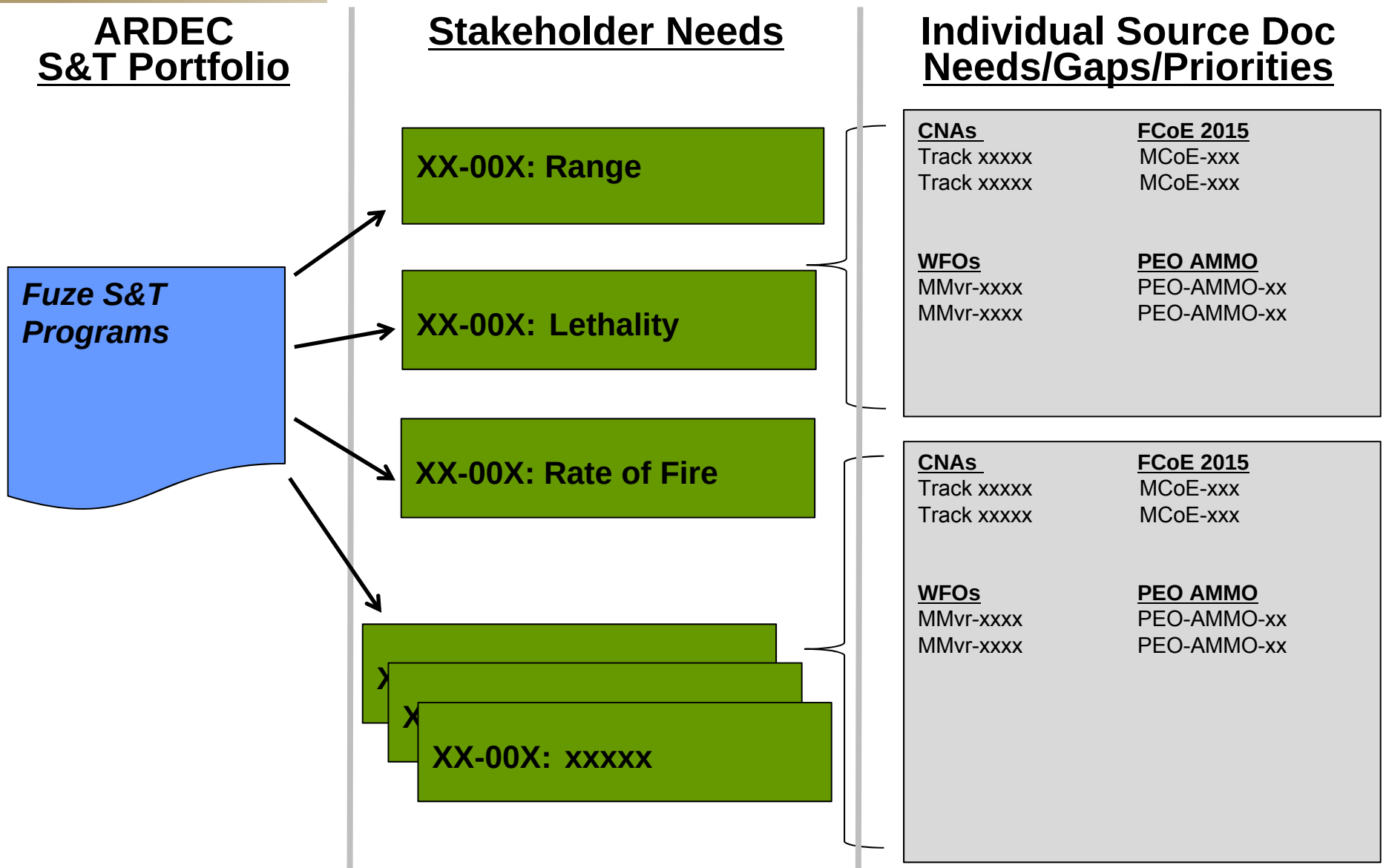
✓ Details/communicates opportunities to Service labs, industry, academia, international

Lethality S&T Opportunities

✓ Utilized by ARDEC Scientists and Engineers to marry innovation to needs

✓ Available to industry partners
- …to facilitate cooperative long term planning to include IR&D investment
- …realized in the DOTC Annual Technology Plan

Fuze S&T Traceability To Stakeholder Needs



Fuzing in a Challenging Environment

Emerging Threats

- A once predictable operating environment has become increasingly complex, unstable, & dynamic
- Adversaries gain access to advanced military capabilities through exploitation of commercially available technologies
- Spread of advanced cyberspace and counter-space capabilities

Tomorrow's Challenges with Yesterday's Budget

- The past decade of warfare has impacted Army S&T, shifting the S&T portfolio into a near-term focus
- Future needs can drive cost-prohibitive solutions
- S&T budgets continue to diminish
- Availability of budgeted funds for timely execution of programs
- Most projects leverage other funding to deliver required capabilities

Building on BBP 3.0 tenets:

Next Generation of Precision Fuzing

Incentivizing Innovation in Industry and Government; Promote effective competition.

Supporting the Industrial Base

- Government unique requirements drives the need for unique or custom components
- Diminishing IR&D in fuzing focus areas
- Need for Government – Industry partnerships for best use of core competencies
- Engaging academia & new industry partners
- Exploitation of commercially available technologies

Requirements Definition

- Emerging technologies can help inform Stakeholder requirements
- Emerging requirements can create a need that is not fully defined or fully understood
- Competing requirements with limited resources
- Requirements creep throughout program lifecycle
- Joint or common requirements for problem sets that may more Service-specific

ARDEC Fuze S&T Efforts

Emerging & MaturingTechnologies

6.2 OSD Joint Fuze Technology Program

- Target Classification Prox for Tailorable Whds
- Micro Scale Materials and Energetic Effects Characterization

6.3 OSD Joint Fuze Technology Program

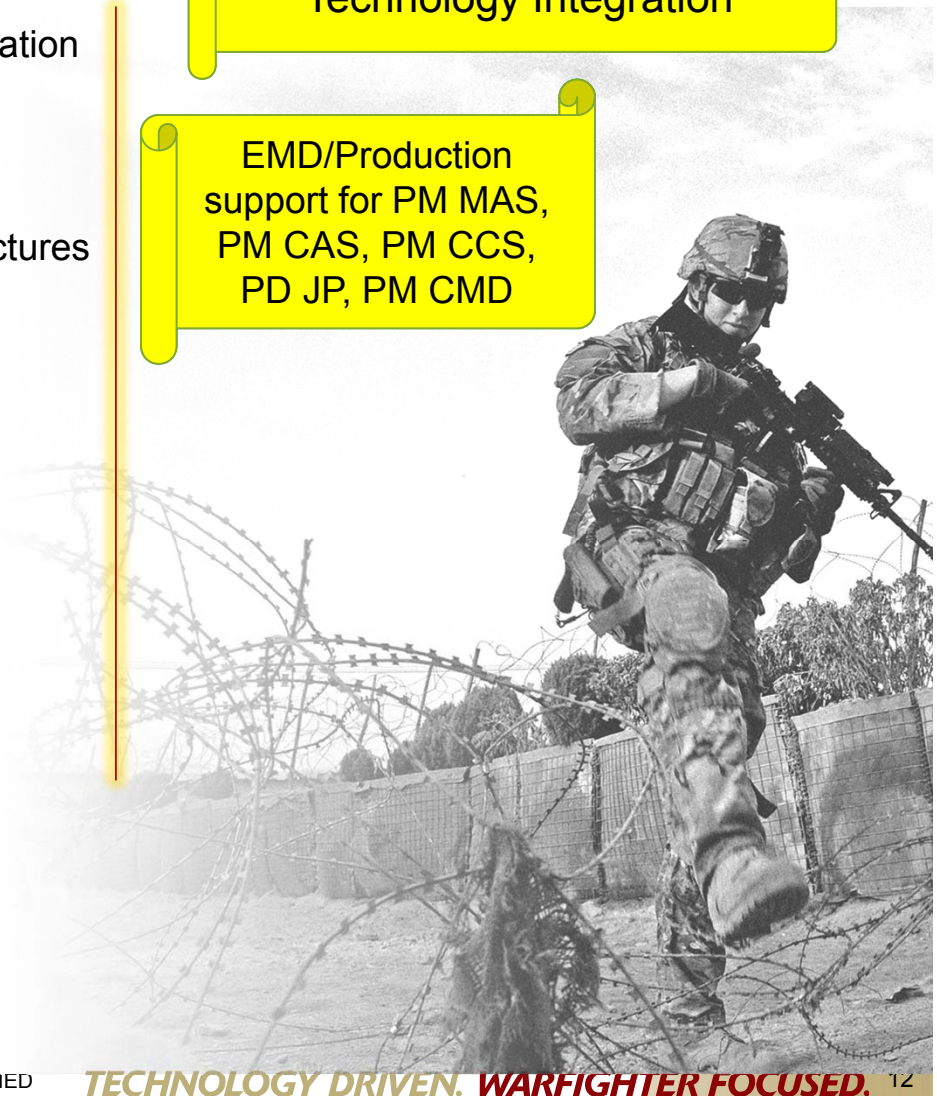
- PGK IMX-101 Compatibility
- Next Generation Proximity Sensor for Prox Fuzing
- Command Arm Actuation for Non-Spinning S&A Architectures
- Prox Sensor Modeling and Validation Transition

RDECOM/ARDEC S&T Projects & Demonstrations

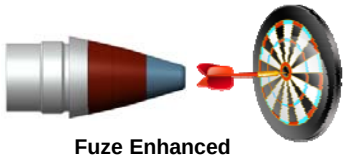
- Airburst Precision for Medium Caliber Fuzing
- Next Generation Large Cal Setters
- Low-Cost ESADs
- Thermal Battery R&D for Extended Range
- Next-Gen Prox Sensor
- Embedded Firesets
- Fuzing for Cluster Munition Replacement
- 120mm Guided Mortar
- Direct Fire Prox Sensor - (Joint Non Lethal Dir)
- Autonomous target discriminating; shoulder fired
- Airburst/PD and PD delay for Tank Ammo
- Command Arm MEMS S&A w/ Prox for 40mm
- Low cost air dropped precision guided munition
- MEMS Safe & Arm Reliability & Manufacturing
- Missile Counter UAS

On-going 6.7 RDTE Fuze Technology Integration

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

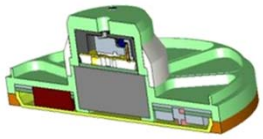


Fuze and Power Technologies for Munitions



Fuze Enhanced Airburst Response

Advanced Munitions Power



Next Generation Sensors and Safety

Next Generation Large Caliber Setting

Schedule

MILESTONES	FY15	FY16	FY17	FY18	FY19
Fuze Enhanced Airburst Response		4	5		6
Next Generation Large Caliber Setting		4	5		6
Next Generation Sensors and Safety		4	5		6
Advanced Munitions Pow er		4		5	6

Milestone Indicators: TRL or SRL: ◆ Milestone Timeline: ▬

Purpose:

- Develop and advance Fuze and Power Technologies to achieve leap ahead capabilities such as high accuracy air burst, advanced setting methodologies, innovative sensing (launch and target detection), as well as next generation safety and power systems .
- Demonstrate applications of these technologies in multiple munitions across commodities in order to handoff mature concepts to Program of Record EMD efforts.

Results/Products:

- Research advanced launch and high accuracy target sensing/classification components & methodologies, advanced fuze communication schemes, integration of printed materials for conformal antennas, power sources and energy harvesters. Develop advanced safe and arm devices to support advanced warhead and munition requirements.
- Demonstrate advanced technologies for high accuracy air bursting, target classification and high rate fuze setting in a relevant environment.
- Surrogate sub-system integration of technologies and components, for a TRL 6 demonstration.
- Develop and validate Fuze-centric analysis techniques across multiple technology efforts. Validated modeling will decrease development cycle of future fuze systems .

Payoff(s):

- Enables increased and scalable lethality in broader applications across multiple munitions.
- Maximizes lethality while minimizing collateral damage and reducing logistical burden.
- Spiral technology solutions into numerous Program of Records and other S&T efforts.

Affordable Fuzing and Power Systems for enhanced effects and operational overmatch

Emerging Fuze S&T Needs

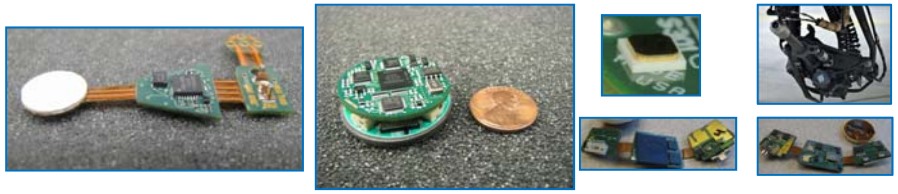
High Reliability Fuzing (<1% UXO)

- **Compliance with DoD Cluster Munition Policy**
- **Fuze component technologies & functional architecture(s) for a system function reliability of >99%**
- **Non-networked, self-contained, & independent submunition fuzing solutions**

Airburst Fuzing Technologies

- **Higher-accuracy medium caliber air-bursting solutions**
- **Advanced communication & programming methodologies**
- **Autonomous airburst for 30mm munition**

Next Generation Target Detection & Sensing



- **Advanced Next Generation low cost sensor technologies to provide enhanced battlefield performance & small form fit precision burst point control**
- **Accurate stand-off detections for emerging threats and more complex indirect, direct, and air target sets**
- **Target media classification MEMS-based G-switch capable of coarsely detecting target media types & voids upon impact**
- **FMCW target classification proximity sensor**

Emerging Fuze S&T Needs

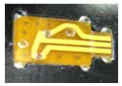
Networked Munitions

- **MIL-STD-1911 compliant fuzing concepts**
- **Fireset hardware and firmware for main munition**

Advanced Fuze Setting

- **Smaller and lighter large caliber fuze setter for use in auto-loading cannon systems and guided mortar applications**
- **High rate medium caliber fuze programming & communication for enhanced airburst response**
- **Advanced setting for increased data and power transfer for next generation of guided mortar applications**
- **Advanced wireless setting technique for rocket & missile applications**

Miniaturized Fuzing



- **High volume, cost-effective manufacturing processes for MEMS scale components**
- **Mature the manufacturing readiness level with the elimination of touch labor and rework, establishing second sources of supply, optimizing tolerances and reducing process variation**

Fuze Data Hold

- **Higher energy storage**
- **Cold temperature performance**
- **Unlimited number of sets & resets**

Emerging Fuze S&T Needs

Munitions Power Sources



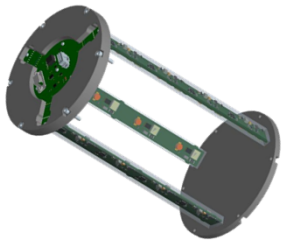
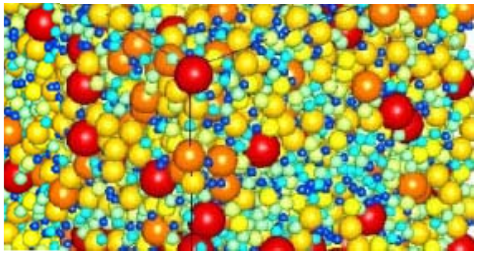

Thermal Reserves

- **New power source technologies with a very high energy density and power density for use in extended range applications and the next generation of artillery fuzes**
- **Smaller in size and affordable**

Liquid Reserves

- **Very small, reliable, & affordable power sources for use in medium caliber & hand emplaced applications**
- **Reliable performance throughout MIL-STD operational temperatures**
- **Higher energy densities**

Initiation of Insensitive **Munition High** Explosives

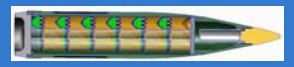



- **Small, low cost, high voltage components for advanced initiation techniques for sustainment of detonation velocity in highly insensitive energetic materials**
- **Highly simultaneous multi-point solutions for initiation of IM fills**
- **Novel integration techniques to reduce cost and size of existing component technologies**
- **Next generation of high voltage detonators that will reduce total energy requirements**

ARDEC Briefings

Command Arm Actuation for Non-Spinning Safe & Arm Architectures – Mr. John Geaney

High Reliability Fuzing Architecture for DPICM XL (Dual Purpose Improved Conventional Munition) – Mr. Stewart Genberg

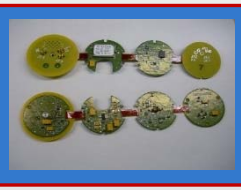


Hard Target Detection Algorithm Using Multi-Threshold G-Switches – Ms. Sandy Risha

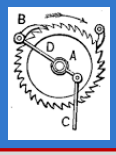
Airburst Nonlethal Munition Program Update – Mr. Tim Mohan

ARDEC Briefings

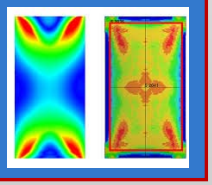
Lightweight 30mm Proximity Sensor- Mr. Daniel Kelly



Feasibility of Reversing Rotary Motion for Miniature Delay Device- Mr. Tom Ziegler



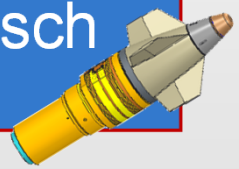
Micro Scale Materials & Energetics Effects Characterization – Mr. John Geaney



Manufacturing MEMS Safe and Arm – Ms. Lynne Rider

ARDEC Briefings

Booster Design for IMX-101– Mr. Jason Sweterlitsch



Integration of Energetics and Electronics Using Additive Manufacturing Processes for Fuze Applications – Mr. Jeffrey Kraft

Grand Challenge Test Article 2 Modeling During Impact on Very High G Machine – Mr. Miroslav Tesla


"Without lethality
it's just another parade"

Thank you!