U.S. Army Aviation and Missile Research, Development, and Engineering Center

Fuze Efforts


TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Presented by:

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U.S. Army Aviation and Missile Research, Development, and Engineering Center

15 May 2012
Agenda

- AMRDEC S&T Process Overview
- AMRDEC S&T Capability Areas
- AMRDEC S&T Technology Area - Fuze
- Summary – AMRDEC Issues/Gaps/Needs
• **CAL - Capability Area Lead**
  - Responsible for developing transition and vision systems for Protection, Ground Tactical, Aviation, and Fires capabilities and roadmaps to address the transition and vision system.

• **TAL - Technical Area Lead**
  - Responsible for developing specific technology areas such as Propulsion, Sensor, Warhead, Missile Electronics, etc.

• **PI - Principal Investigator**
  - Responsible for technical execution of funded technology efforts (e.g. Solid Rocket Motor Prognostics, Image Gyro, Selectable Yield Warhead, Guidance Electronics Miniaturization, etc.)

• **Director for Missile Development Focus Areas - Effects Against Fleeting and Moving Targets, Range Extension of Existing Missiles, UAV/Cruise Missile Defense, Deployable Force Protection, Affordability**
**PROTECTION**

Protect the force and selected geopolitical assets from aerial attack, missile attack and surveillance

- Air Defense
- Area Protection
- Platform Protection

**GROUND TACTICAL (CLOSE COMBAT)**

Direct fire weapons, supported by indirect fire, air-delivered fires, and nonlethal engagement means to decide the outcome of battles and engagements

**FIRE SUPPORT**

Destroy, neutralize, or suppress the enemy by cannon, rocket, and missile fire and to help integrate fire support assets into combined arms operations

**AVIATION**

Find, fix, and destroy the enemy through fire and maneuver; and to provide combat, combat service and combat service support in coordinated operations as an integral member of the combined arms team

**TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.**
TECHNOLOGY AREA

FUZE
Technical Area
Time-Phased Schedule

<table>
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<tr>
<th>Year</th>
<th>FY09</th>
<th>FY10</th>
<th>FY11</th>
<th>FY12</th>
<th>FY13</th>
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<th>FY16</th>
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<td></td>
<td>Survivable Modular Fuzing</td>
<td>SWFTICE ATO</td>
<td>Common ESAD/JAGM Risk Reduction Fuze – SLC ATO</td>
<td>Selectable Yield Unitary – STAR ATO/250mm Demo</td>
<td>AMPM</td>
<td>SOPM</td>
<td>Fuze Decision Logic (FDL) – Advanced Munitions Power and Initiation Systems Demonstration</td>
<td>Hardened Selectable Multi-point Fireset - PROPOSED</td>
<td>AMRDEC S&amp;T</td>
<td>Customer Funded Programs</td>
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<td>10-027 – Low Voltage Command Arm System for Distributed Fuze Systems</td>
<td>JAVELIN</td>
<td>HFR+/JAGM</td>
<td>11-G-056 – Sequential Time Fuze for SYU</td>
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**Fuze Decision Logic (FDL)**

**Purpose:**
Investigate methods to use information from various sources to compute an optimal fuzing decision for the given target and situation.

**Results/Products:**
- Models of available information sources.
- Information fusion algorithms.
- Lab prototype hardware and bench-scale HWIL simulation.

**Payoff/Benefits:**
- Understanding of critical enabling technology for warheads and fuzing systems capable of autonomous tailoring of effects.

**Transitions (Area/System(s))**:
- Protection – Swarming missile concept;
- Ground Tactical – IBOPFM, IAM, Javelin Increment III, TOW increment II;
- Aviation – AvM-MRSGM;
- Fire Support – GMLRS Increments 4 & 5.

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**Schedule**

<table>
<thead>
<tr>
<th>MILESTONES</th>
<th>FY12</th>
<th>FY13</th>
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<tr>
<td>Information Source Review</td>
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<td>Classification Algorithm Review</td>
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<tr>
<td>Info Source Model Review</td>
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<td>Info Fusion Simulation Demo</td>
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<td>HWIL Demo</td>
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<td>Integrated System Demo</td>
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**Total Program**

- UFR ($K)
- Other ($K)
- TOTAL Request ($K)
Hardened Selectable Multi-point Fireset

**Purpose:**
Investigate and demonstrate methods to make selectable multipoint firesets survivable for structural penetration applications.

**Results/Products:**
- 2, 4, and 8-point selectable firesets demonstrated functionality using SROAR.

**Payoff/Benefits:**
- Critical enabling technology for tailorable effects warhead & fuze applications.

**Transitions (Area/System(s))**:
- Protection: (Swarming Missile concept)
- Ground Tactical: IBOPFM, Javelin Incr. II, TOW Incr. II, IAM
- Aviation Missiles: MRSGM
- Fire Support: GMLRS Incr. 4 & 5

**Schedule**

Approved for FY12 Start. Re-proposed for FY13 start.
SOPM ESAD

**Purpose:**
- A miniaturized in-line single point Electronic Safe and Arm Device (ESAD) with the capability to accommodate both the size constraints and unique arming environments of small tube launched and hand launched munitions. The ESAD will also provide contact, proximity, and command fuze modes to optimize lethality and safety.

**Results/Product:**
- ESAD with initial safety certification that meets the form factor and system requirements for integration and flight tests.
- Prototype flight hardware, schematic designs, CCA board layouts, and test data.

**Payoffs/Benefits:**
- Identification and evaluation of small ESAD related components.
- Potential for development of miniaturized packaging techniques in ESADs.
- ESAD usable in the evaluation of AMRDEC developed payload in both tube launch and hand miniature aerial vehicles.

**Transition (Systems):**
- PM CCWS for Army LMAMS POR.

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**MILESTONES**

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<tr>
<th>MILESTONE</th>
<th>FY11</th>
<th>FY12</th>
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<td>ICD / Test Bed Integration</td>
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Aviation Multi-Platform Munition (AMPM) Payload ESAD/ISD

**Purpose:**
*Develop and demonstrate an electronic safe, arm, and fire device (ESAD) and Ignition Safety Device (ISD) for the AMPM modular Drop-Glide and Forward Fire munition*

**Product:**
- MIL-STD-1316 Compliant ESAD
- Selectable Initiation Mode (Dual, Fore, Aft)
- Selectable Trigger Mode (HOB, Contact, Delay)
- MIL-STD-1901 compliant ISD
- Multi-application versatile ESAD

**Payoff:**
- Effects against fleeting and moving targets
- Reduced kill chain timeline
- Improved effectiveness against soft target set
- Improved control of collateral damage (for urban engagements)
- Reduced payload weight to improve load-out and/or endurance of integrated aviation platforms
- Ability to address unique engagement parameters compatible with aviation mission profiles.
- Weapon modularity for tailoring weapon solutions and reduced upgrade costs
**Javelin Fuze & Ignition Safety Device**

**Purpose:**
- Design and develop a low cost fuze ignition safety device made up of both an electronic safe, arm, and fire device (ESAD) and ignition safety device (ISD) for use in Javelin BLK 1 and future variants.

**Products:**
- MIL-STD-1901 compliant ISD
- Hardened Firing Modules
- Mini Qualification Test Data
- Tech Data Package
- Fault Tree Analysis

**MILESTONES**

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**Payoff**
- Low cost ESAD and Ignition Safety Device
- Designed for Multi-Service Safety Acceptability
- Industry transitionable for vendor manufacture
- Will accommodate Arming Delay differences due to Warhead Modes

**TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.**
**Objective**

To develop a low voltage command/arm system that sends a unique, non-reproducible signal(s) to remote firing modules that will allow the module to charge to the necessary firing voltage once the required arming conditions have been met while maintaining system safety.

**Technical Challenges**

- No standards, design guidelines, or safety requirements to guide future development work. Actual acceptability of a design remains a mystery.
- DoD Safety Standard Compliance.

**Technical Approach**

- Total of three different design approaches to reduce risk.
- Implement designs in breadboard hardware.
- Conduct performance/safety tests.
- Solicit feedback of design & test results from FESWG.
- Revise designs & conduct further testing based on feedback.

**Progress**

- Completed Trade Studies & Initial Design Work
- Completed FESWG Tech-Assist
- Hardware has been manufactured

**Leveraging and Transition Opportunity**

- Leveraging
  - Sandia National Lab: PALs, CAN Bus
  - Navy – NAVAIR: MEMS Out-of-Line Distributed Fuze
- Transition
  - STAR ATO, SWFTICE ATO
  - Javelin, Hellfire, JAGM, TOW, GMLRS

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**Technology Investment Schedule (FY) As of 26April 2011**

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**OBJECTIVE**

- Define components for multi-mode, multipoint sequential timing fuze designs that will increase shock survivability & improve reliability

**CURRENT YEAR MILESTONES**

- G switch replacement w/ accelerometers
- Void counting algorithm development

**TECHNICAL APPROACH**

- Accelerometer feasibility study
- Void counting algorithm development
- Hardened detonator technology

**LEVERAGING & TRANSITION OPPORTUNITY**

- Leveraging AMRDEC S&T work; DSR & AFRL shock survivability knowledge
- Future GMLRS, TOW, JAGM

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<th>Tasks</th>
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<td>void counting algorithm refinement</td>
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<td>hardened detonator</td>
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<td><strong>Total (in $K)</strong></td>
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AMRDEC Fuze Gaps/Needs/Issues

- Fuzing for Tailorable Effects on multiple (some smaller) munitions
  - (Continued) miniaturization of fuze components.
  - “Non-conventional” TE approaches.

- Fuzing for Multi-role munitions
  - Survivability – hardening of fuze components
    - Detonator
    - Capacitors
    - Energetics (HNS4, RSI-007/CL-20 based secondaries)
    - Switches

- Affordability

- Reliability
  - Initiation of IM energetic components

- Availability
  - “Obsolescence”/unavailability of acceptable fuze CPU components (e.g., anti-fuse).
  - Proliferation of flash devices other currently unacceptable technologies.
Questions