



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



Distribution A: Approved for Public Release; Distribution is unlimited. Reference AMRDEC, Weapons Development and Integration Directorate, Systems & Warheads Function, (RDMR-WDP-S), 07May2012, Control # FN5850.

TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.

Presented by:

MILTON E. HENDERSON, JR

Systems & Warheads Division

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

15 May 2012

- **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.

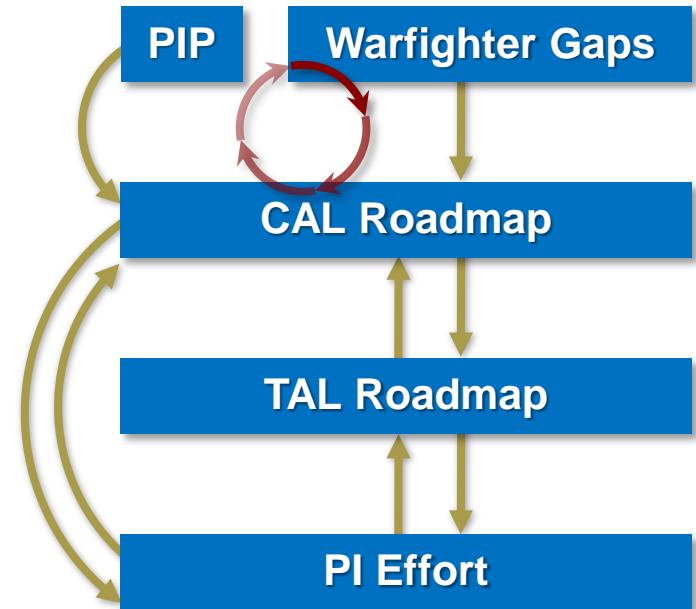
- **TAL - Technical Area Lead**

- 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**



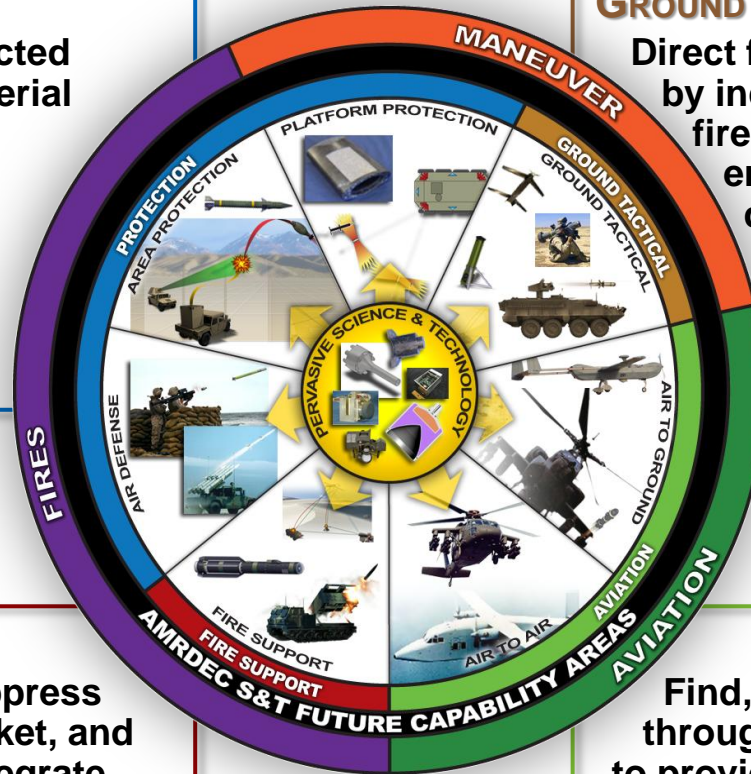
PROTECTION

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

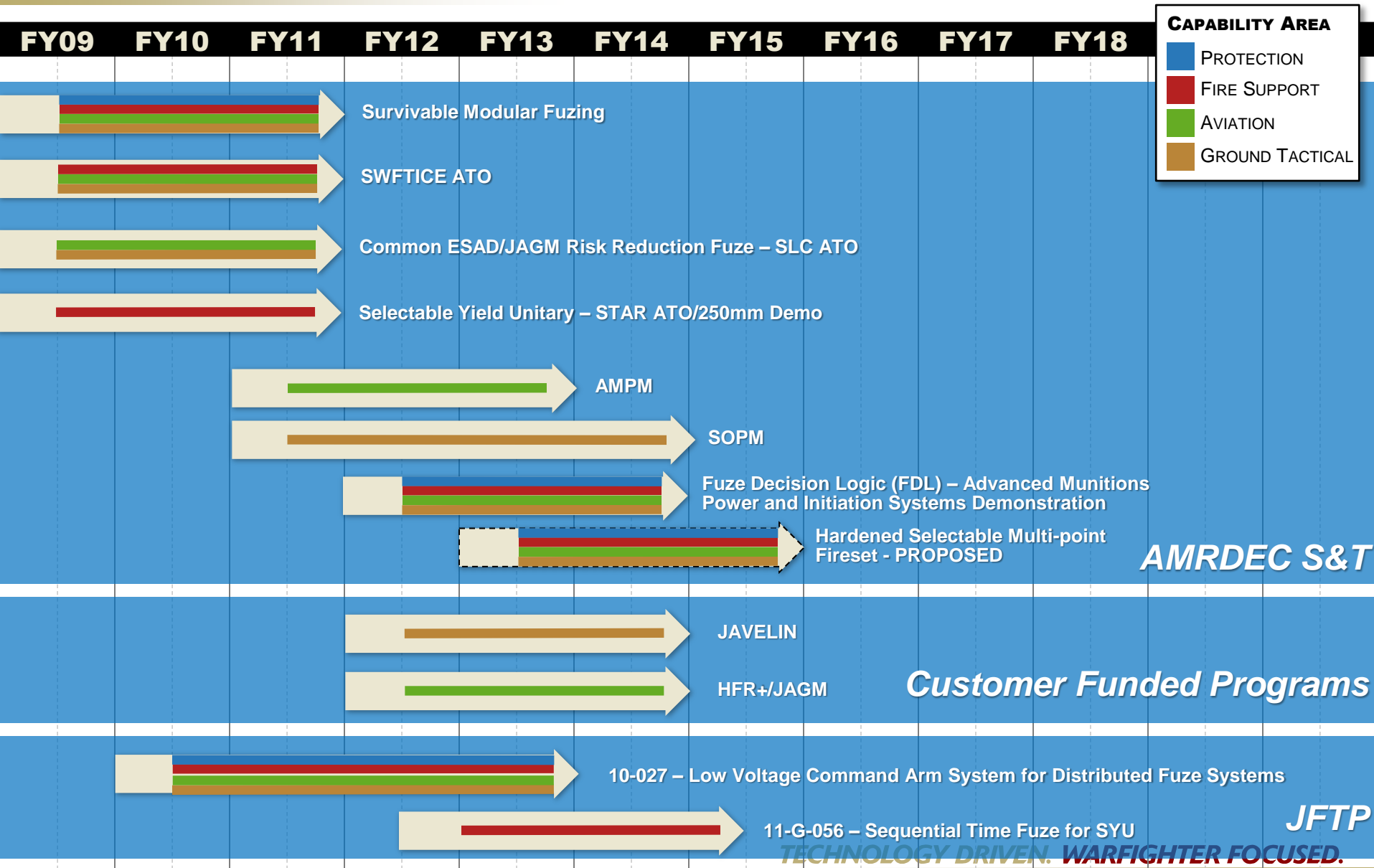
Destroy, neutralize, or suppress the enemy by cannon, rocket, and missile fire and to help integrate fire support assets into combined arms operations

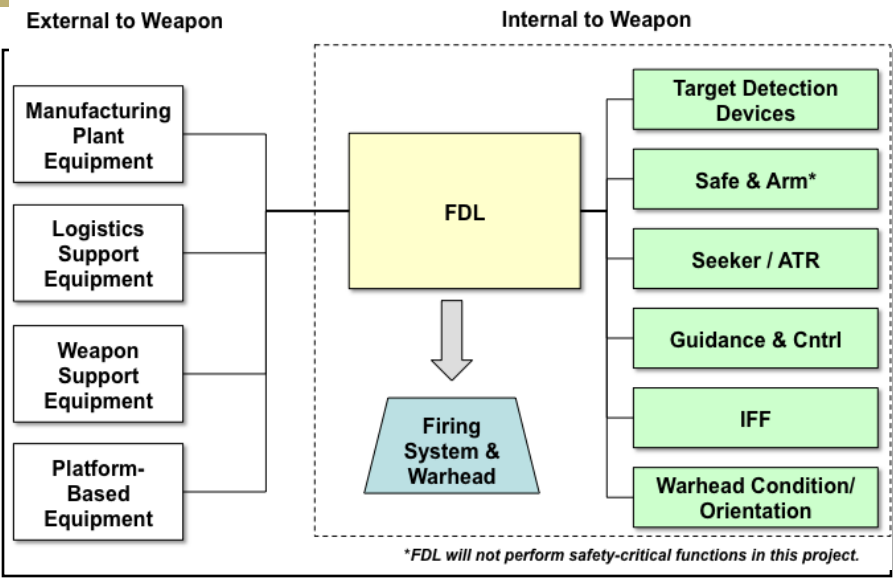
AVIATION

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 AREA FUZE

Technical Area Time-Phased Schedule





Schedule

MILESTONES	FY12	FY13	FY14
Information Source Review	2		
Classification Algorithm Review		3	
Info Source Model Review			
Info Fusion Simulation Demo			
HWIL Demo			4
Integrated System Demo			
Total Program	UFR (\$K)		
	Other (\$K)		
	TOTAL Request (\$K)		

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.

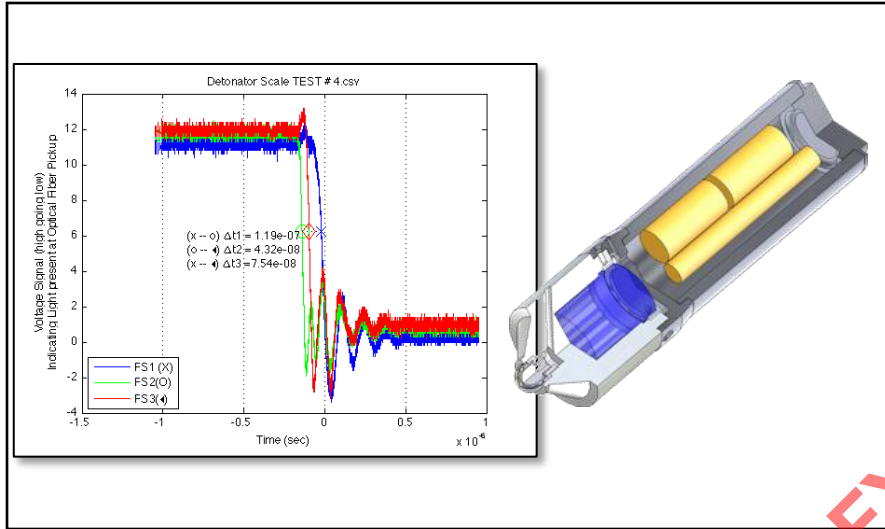
Payoff/Benefits:

- 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.

Hardened Selectable Multi-point Fireset



Schedule

WBS	Description	Milestone	FY12	FY13	FY14
1.0	Level of Effort				
2.0	Two-Point Fireset	4		5	
3.0	Four-Point Fireset		4	5	
4.0	Eight-Point Fireset			5	5
5.0	Analysis				
6.0	Testing				
6.1	Test Planning				
6.2	Step Stress Protocol Definition	1			
6.3	Stress Screening Procedure Definition	2			
6.4	Static Testing				
6.5	Low-level Shock Testing				
6.6	Medium-level Shock Testing				
6.7	High-level Shock Testing				
6.7.1	Developmental ROAR tests				
6.7.2	Two-Point ROAR test	3			
6.7.3	Four-Point ROAR test	4			
6.7.4	Eight-Point ROAR test	5			
6.8	Vibration Testing				
6.9	Support Equipment Tests				
6.10	Material Tests				

Purpose:

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

Results/Products:

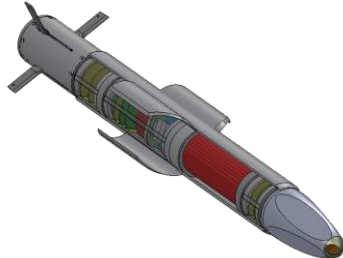
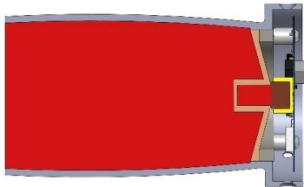
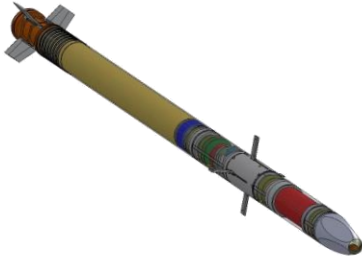
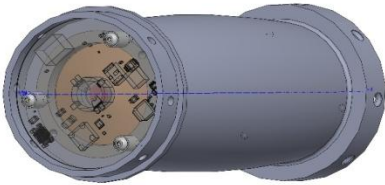
- 2, 4, and 8-point selectable firesets demonstrated functionality using SROAR.

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



Purpose:

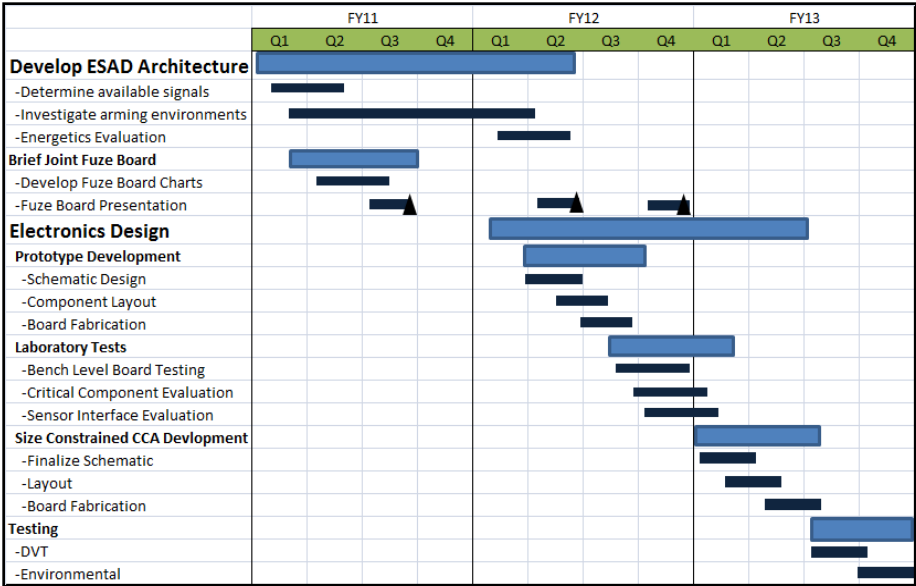
Develop and demonstrate an electronic safe, arm, and fire device (ESAD) and Ignition Safety Device (ISD) for the AMPM modular Drop-Glide and Forward Fire munition

Product:

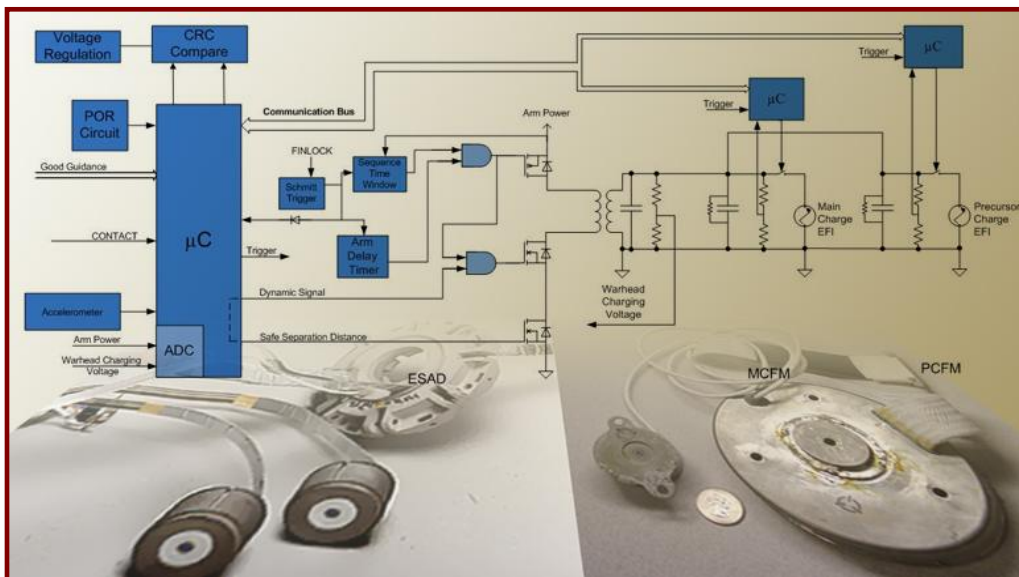
- MIL-STD-1316 Compliant ESAD
- Selectable Initiation Mode (Dual, Fore, Aft)
- Selectable Trigger Mode (HOB, Contact, Delay)
- MIL-STD-1901 compliant ISD
- Multi-application versatile ESAD

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.

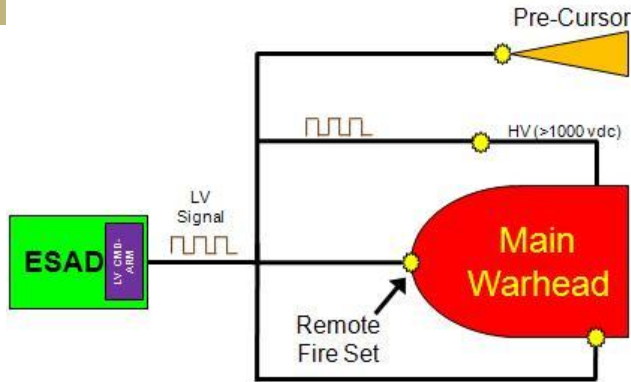
Products:

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

MILESTONES	FY12				FY13				FY14			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Stakeholder Requirements Definition & Requirements Definition												
AFSRB/ISSRB/FISTRP												
Architecture Design												
CCA Fabrication												
Energetics Testing/Analysis												
Design Verification Testing												
Mini Qualification												
Fuze Fabrication												
Testing												
Specification Documentation Generation												

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



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.

Technology Investment Schedule (FY) As of 26 April 2011

Tasks	10	11	12	13
Tech/Safety Analyses				
Safety Board Presentations				
Trade Studies				
Breadboard Design				
Breadboard Fab & Test				
1st Design Revision				
Final Design Revision				
Funding JFTP (\$K)				

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.

Progress

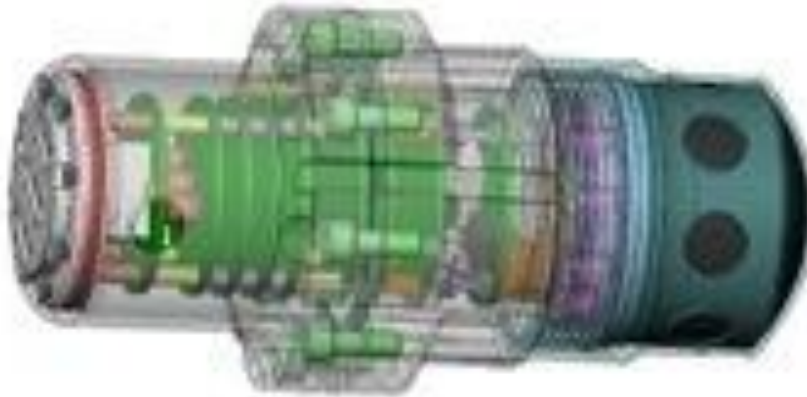
- Completed Trade Studies & Initial Design Work
- Completed FESWG Tech-Assist
- Hardware has been manufactured

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.

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



Tasks	FY12	FY13
accel study		
void counting algorithm refinement		
hardened detonator		
Total (in \$K)		

OBJECTIVE	CURRENT YEAR MILESTONES
<ul style="list-style-type: none"> • Define components for multi-mode, multipoint sequential timing fuze designs that will increase shock survivability & improve reliability 	<ul style="list-style-type: none"> • G switch replacement w/ accelerometers • Void counting algorithm development
TECHNICAL APPROACH	LEVERAGING & TRANSITION OPPORTUNITY
<ul style="list-style-type: none"> • Accelerometer feasibility study • Void counting algorithm development • Hardened detonator technology 	<ul style="list-style-type: none"> • Leveraging AMRDEC S&T work; DSR & AFRL shock survivability knowledge • Future GMLRS, TOW, JAGM

- **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.

The U.S. Army Aviation & Missile Research, Development & Engineering Center



Questions

