Air Force Research Laboratory

Munitions Directorate

Air Force Fuze Technology Overview

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Historical Perspective
Munition Evolution / Revolution

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WWI	WWII	VIETNAM	GULF WAR	FUTURE CONFLICTS	
1910s-1930s	1940s-1960s	1970s-1990s	2000-2005	2005-2020	> 2020
					
• Single • Unguided	• Carpet Bombing	• Single • Precision • Guided • Man-in-loop • Weather Limited	• Multiple • Autonomous • All Weather • Conventional Warheads	• Global Reach • Directed Energy • Non-lethal • Information Denial • UAV / MAV • Network Centric	• Rev Tech

EVOLUTIONARY → **REVOLUTIONARY** →

MASSIVE DEPLOYMENT

EXPEDITIONARY AEROSPACE FORCE (eAF)

1st Generation R&D | 2nd Gen | 3rd Gen | 4th Gen

Ref: Stephen Korn's Course on "Management Innovation in the 21st Century"

Air Force Research Laboratory's Challenge

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- What is Our Product in The Directorate?
  - Knowledge!
- How do we Transfer Knowledge?
  - Transformed into New Capability
  - Delivered In the Form of Technology

Captured in: Analysis, Experiments, Demos, Breadboards, Brassboards….

- How Do We Transfer Knowledge Into Capability?
  - Show Evidence of Learning in Being Able to Deliver A Capability to Various Specifications of Performance

Ref:

Stephen Korn's Course on "Management Innovation in the 21st Century"

Book: Third Generation R&D, Philip A. Rousell, Kamal N. Saad, Tamara J. Erickson, Harvard Business School Press, 1991 (Arthur D. Little Inc., Copy rights)

Book: Fourth Generation R&D, William L. Miller, Langdon Morris, Copyright 1999, Published by John Wiley & Son, Inc.

Areas for Innovative Management of Fuzing

- Sustainment/Stockpile Management
  - Aging stockpile…reduced/declining reliability
    - Requires Replenishment
- Legacy Systems Will Continue to Require Fuzes as A Commodity
  - P3I or New Fuze
- Future System Trends Toward Integrated Distributed Fuze Systems Within Weapon/Program
  - Integral, Distributed, ESAD-Based, Miniature, Agile, Programmable, More Reliable, “Smart”, Cheap …

Fuze Technology Base Issues

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- Maintain Expertise and Facilities to Support New Technology Research in Fuzing—Balanced Posture
- Require the ability to Resolve Development and Production Problems
- Enhance Enabling Fuze Technologies For Timely Insertion
- Recognition Regarding Sophistication and Complexity---- Often an after/last Thought
- Service Investment--- Specific Near Term Needs
- Industry Relies Heavily on DoD for for Long Term S&T Investment---- Near Term Stakeholders; No Incentive

Lack of S&T Investments and Planning By Industry and Government= Inability to Realize Current requirements and Future Capabilities

Fuze Sub-Core Focus Areas
"Adaptable Fuzing for Focused Lethality"

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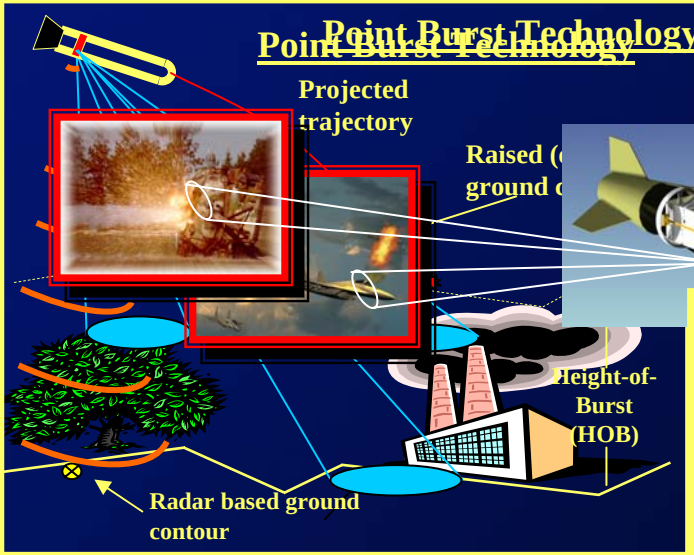
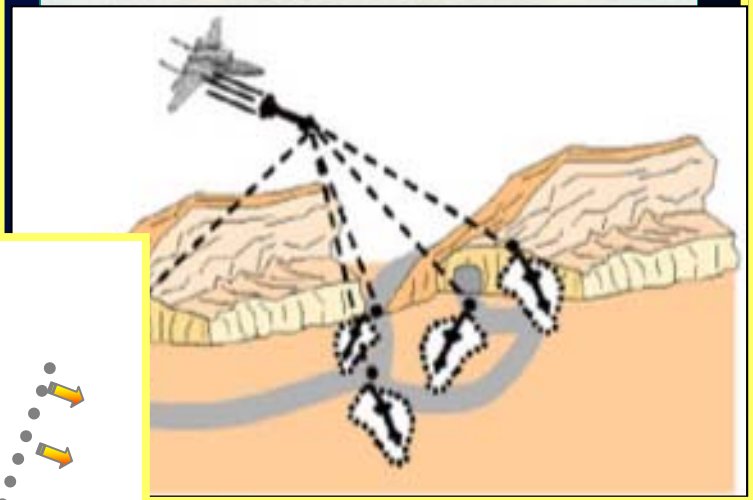
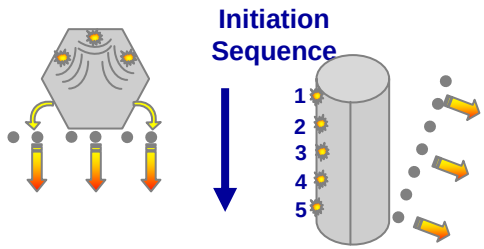
Point Burst Technology



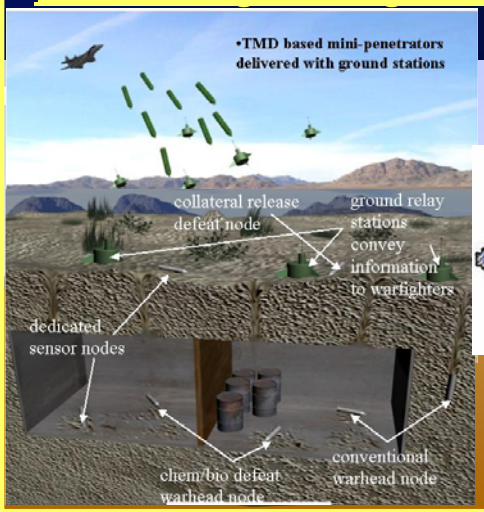
Penetration Fuzing Technology

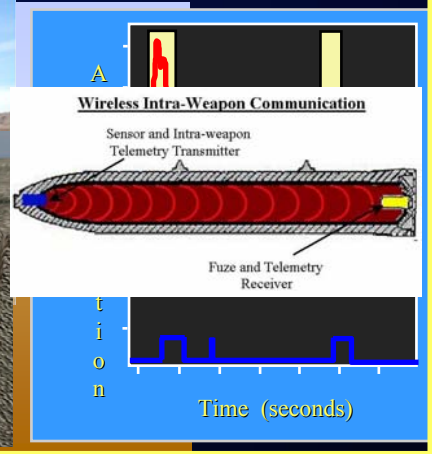


Advanced Initiation



Battle Damage Sensing Technology





Fuze Experimentation

FAST- A Precision HOB, Low Cost Ground Profiling Radar

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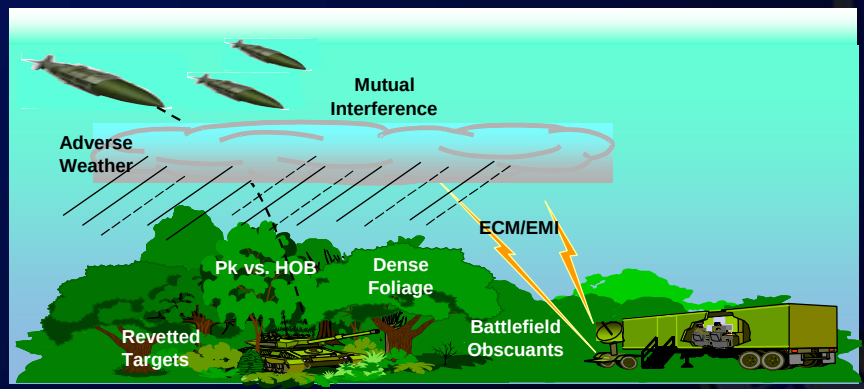
Common Fuze Sensor for a Broad Spectrum of Weapons

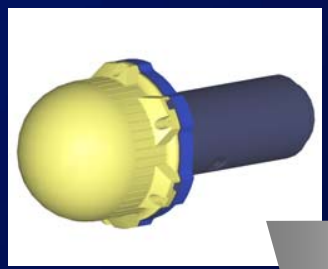
Pulse Doppler Radar Using Low Cost COTS Components

Nose and Tail Mount Configurations Only Differ in the Antenna Structure

Small Volume Common Design Provides Identical Requirements for Any Weapon



- **Advanced Development**
- **Contractor: Mustang**



Nose-Mounted Configuration (DSU-33 Form Factor)

Tail-Mounted Configuration (MK-82 Demo)

100% Common Low Cost Electronics and Operational Software

Flight Tests

Focused Ordnance Controller with Aimpoint Selection (FOCAS) Program Objectives

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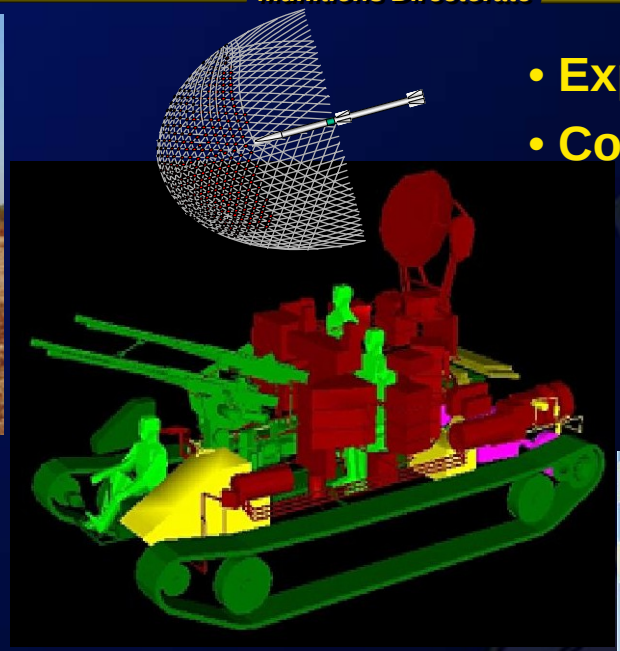
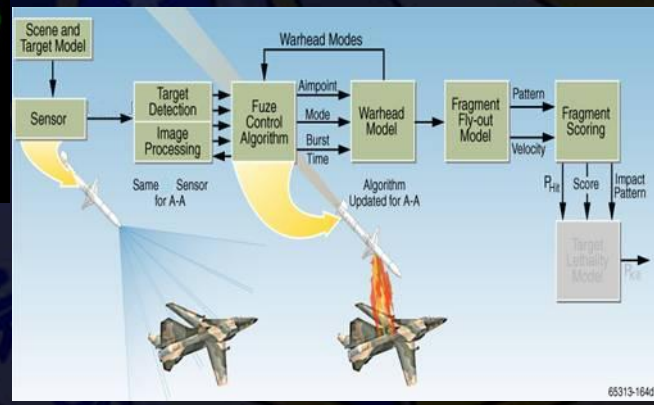


- Exploratory Development
- Contractor: General Dynamics



Objectives:

- Develop the next-generation active imaging fuze sensor to enable aiming of directional mass-focused warheads vs. surface & air targets
- Design, simulate, fabricate, and test an imaging fuze to enable warhead aimpoint selection for air-delivered munitions.

Distributed Miniature Initiation Technology

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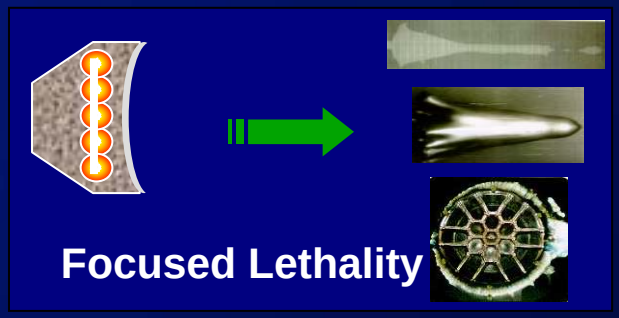
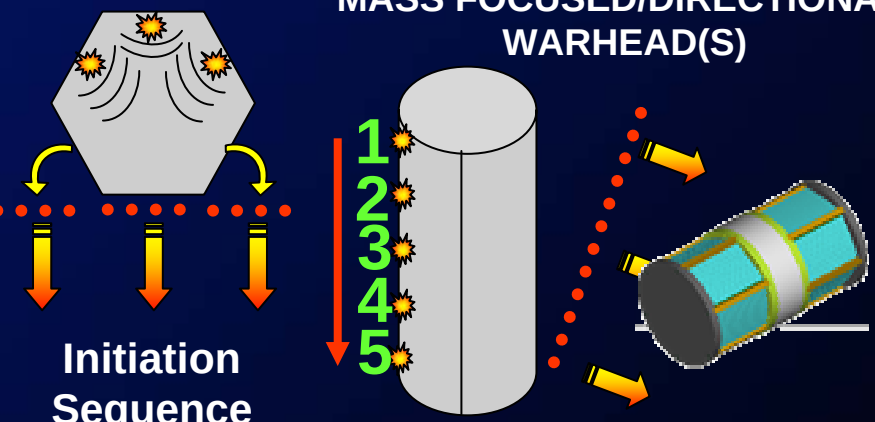
- Enable focused warheads in smaller, adaptable ordnance packages to effectively counter targets with reduced collateral damage



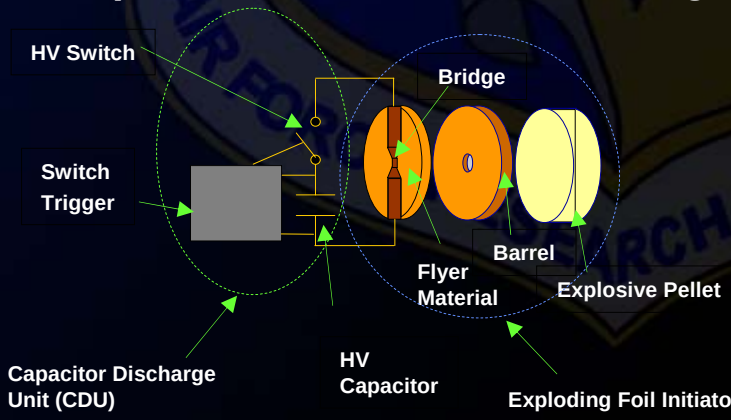


Initiation Needed For Aimable Warheads:

- Individual control of initiation points
- Low firing energy detonators
- Miniature firing systems
- Initiation of various high explosives

Aimable Warheads Attributes:

- Smaller
- Higher P_k
- Lower potential for collateral damage



Critical EFI Component Development, Miniaturization and Integratio

Adaptable Miniature Initiation System Technology (AF & DOE Kansas City Plant)

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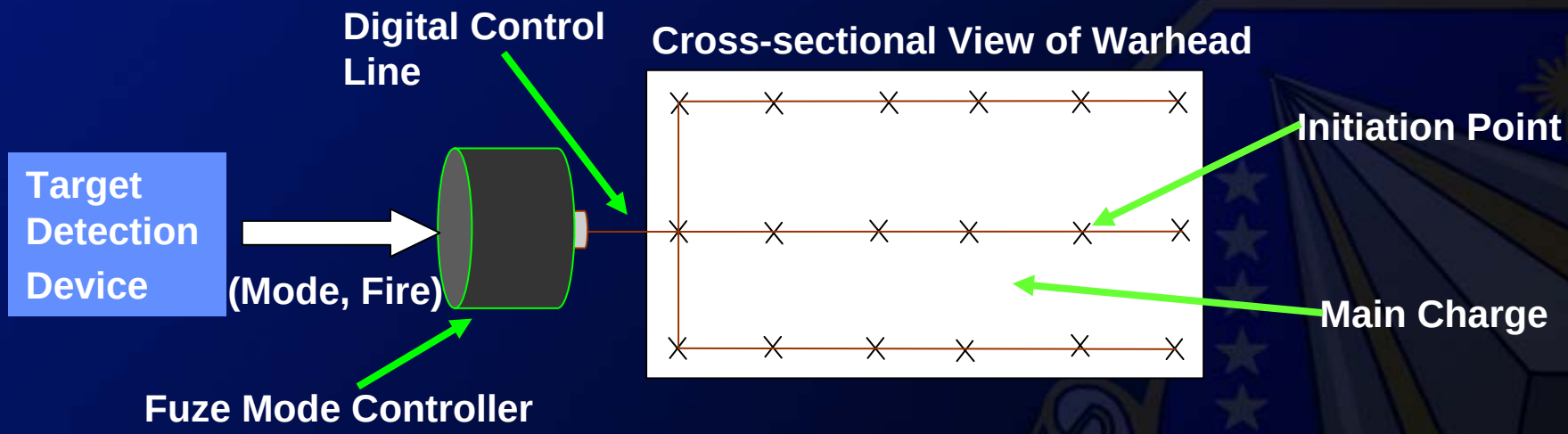
AMIST Architecture II: Autonomous Initiation Points



Initiation Point Components

EFI Detonator
CDU
Trigger Circuit
Voltage Step up
Power Supply
Memory
Logic
Clock

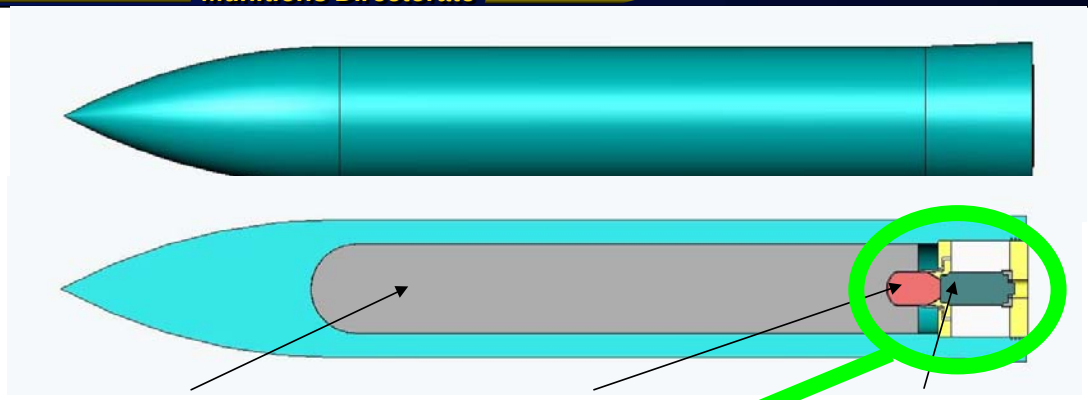
Advantages

Low voltage routed in main charge
Wire routing doesn't limit mode selection
Submunition application
Minimal amount of wiring

Disadvantages

Maximum quantity of components in fill
Maximum complexity

Fuzing For High Speed Penetrator



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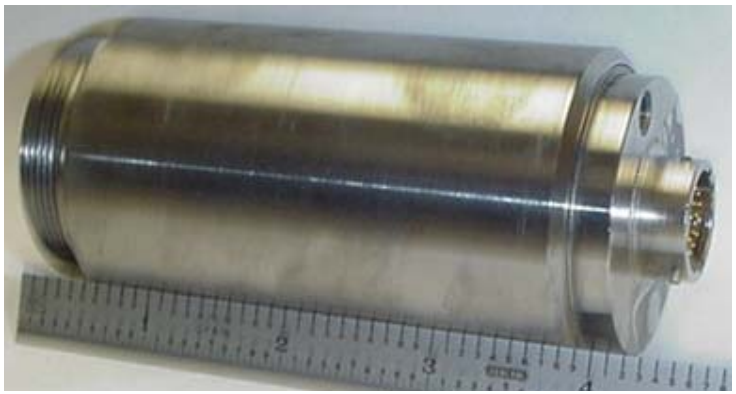
High Speed Penetrator Ordnance Package

STRIFE Fuzing



- **Advanced Development**
- **Contractor: ATK/Thales**

Changes Implemented To MEHTF for Tactical Baseline Point Design Fuze

Fuze Integrated Bomb Damage Information Demonstration Demonstration vs CONOPS

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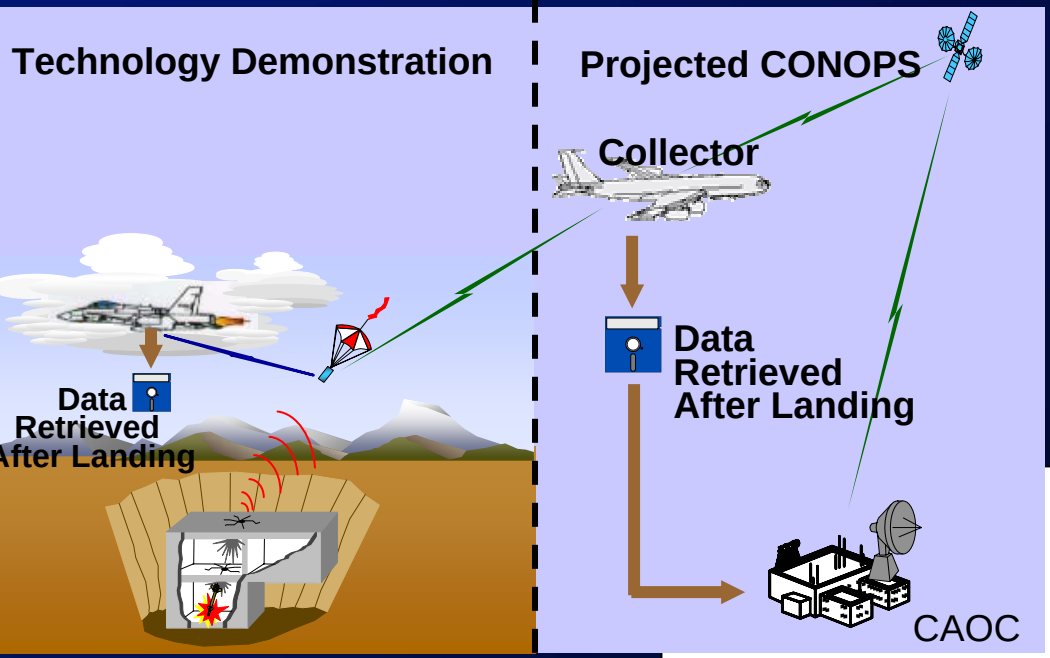
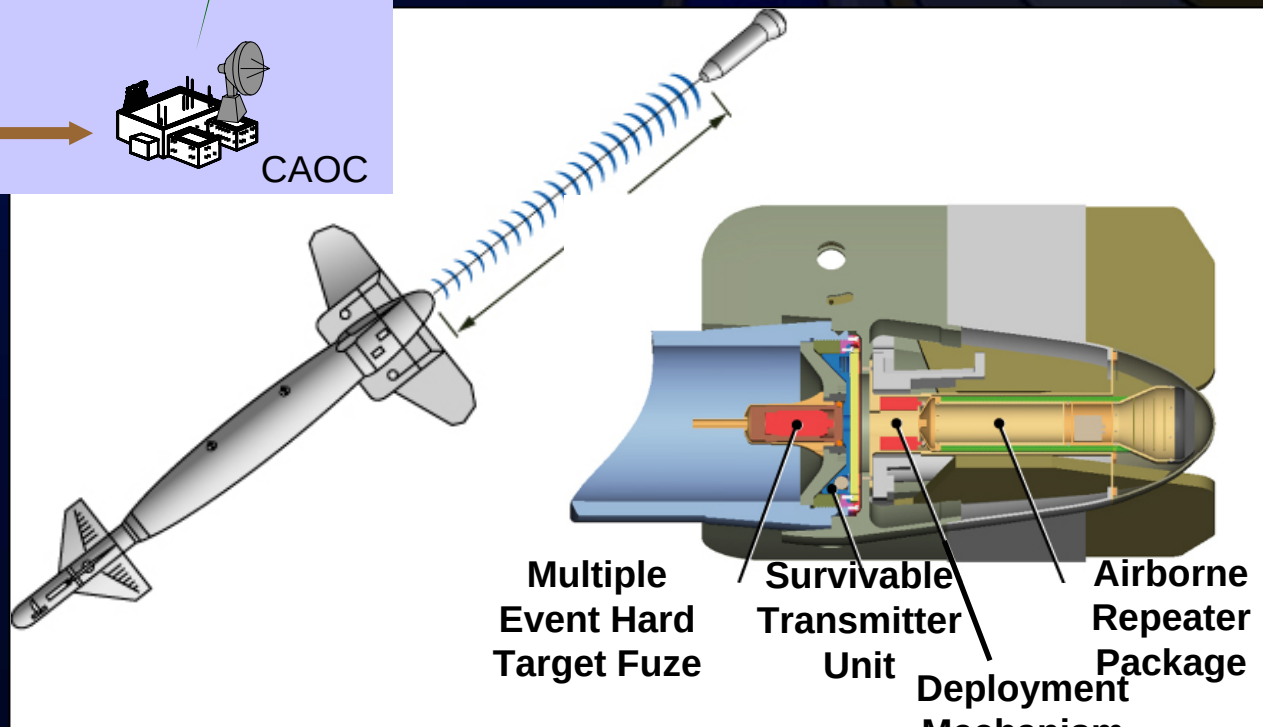


- Advanced Development
- Contractor: General Dynamics
- EGBU-27 & GBU-33 (BLU-109) Demos



Air Force BLU-97 Fuze Effort

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UXO:

- Danger to Friendly Forces and Civilian Population
- Danger to Potential IED's - Improvised Explosive Devises

Deliverables:

- Detailed Drawings of fully integrated Self-Destruct design
- Demonstration Prototype
- Final Report detailing tests results and summary of effort
- Business Implementation Plan for Retrofitting CBU-87

Activity:,

Release AFRL/MN BAA, March 05

Proposals due, April 22

Award Contract, Mid May

Hardened Miniature Fuze Technology

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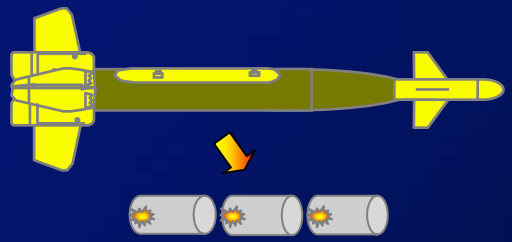


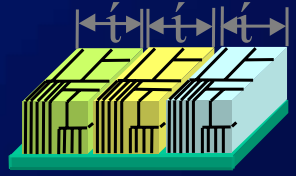
Objective:

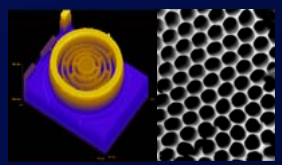
- Develop Hardened Miniaturized Fuzing Technology that Can Perform Active Target Detection and Initiation Functions for Novel Weapon Concepts

Deliverables:

- Detailed Drawings of Miniature Fuze design
- Demonstration Prototype
- Final Report detailing tests results and summary of effort

Packaging





MEMS/NEMS Sensors

Activity:,

- Release AFRL/MN BAA, Jun 05
- Proposals due, Aug
- Award Contract, Sep

Long Term Fuze Vision

- Watch makers Paradigm
  - Mechanical – Electro Mechanical - Electronic
- Fuzing Technology
  - IM compatibility
  - UAV Weaponization
  - Urban Terrain
  - High Degree of Weapon Integration
  - Network Centric Data Infusion

Conclusion

- Understanding AFRL's Role in Fuzing
- Continue to Investing in Science and Technology
  - Explore innovative funding options
- Dialog strategies with User and Industry
  - "Early and Often"
- Visualize Long Term Fuze Requirements