

# AFRL

THE AIR FORCE RESEARCH LABORATORY  
LEAD | DISCOVER | DEVELOP | DELIVER



## *Air Force Fuze*

# *Science and Technology*

*14 May 2008*

**TIMOTHY TOBIK**

**Chief Fuze Branch**

**Munitions Directorate**





# Agenda



- **AF Posture and Vision**
- **Strategic Planning Process**
- **AFRL S&T Strategic Vision**
- **RW Mission and Objectives**
- **Summary**



# Air Force Vision 2020



## Global

**Vigilance**

**Reach**

**Power**



# AFRL Strategic Vectors



## Strategic Vectors

**Universal Situational  
Awareness**

**Access and Survive  
in the Battlespace**

**Deliver Precision  
Effects**



# Julius Caesar's Vision



## Julius Caesar - 47 BC

**Veni**

I came

**Vidi**

I saw

**Vici**

I conquered





# Restatement of Concepts



## AFRL Strategic Vectors

Universal Situational Awareness

Access and Survive in the Battlespace

Deliver Precision Effects



## Air Force Vision

Global Vigilance

Global Reach

Global Power



## Julius Caesar - 47 BC

Veni  
(I came)

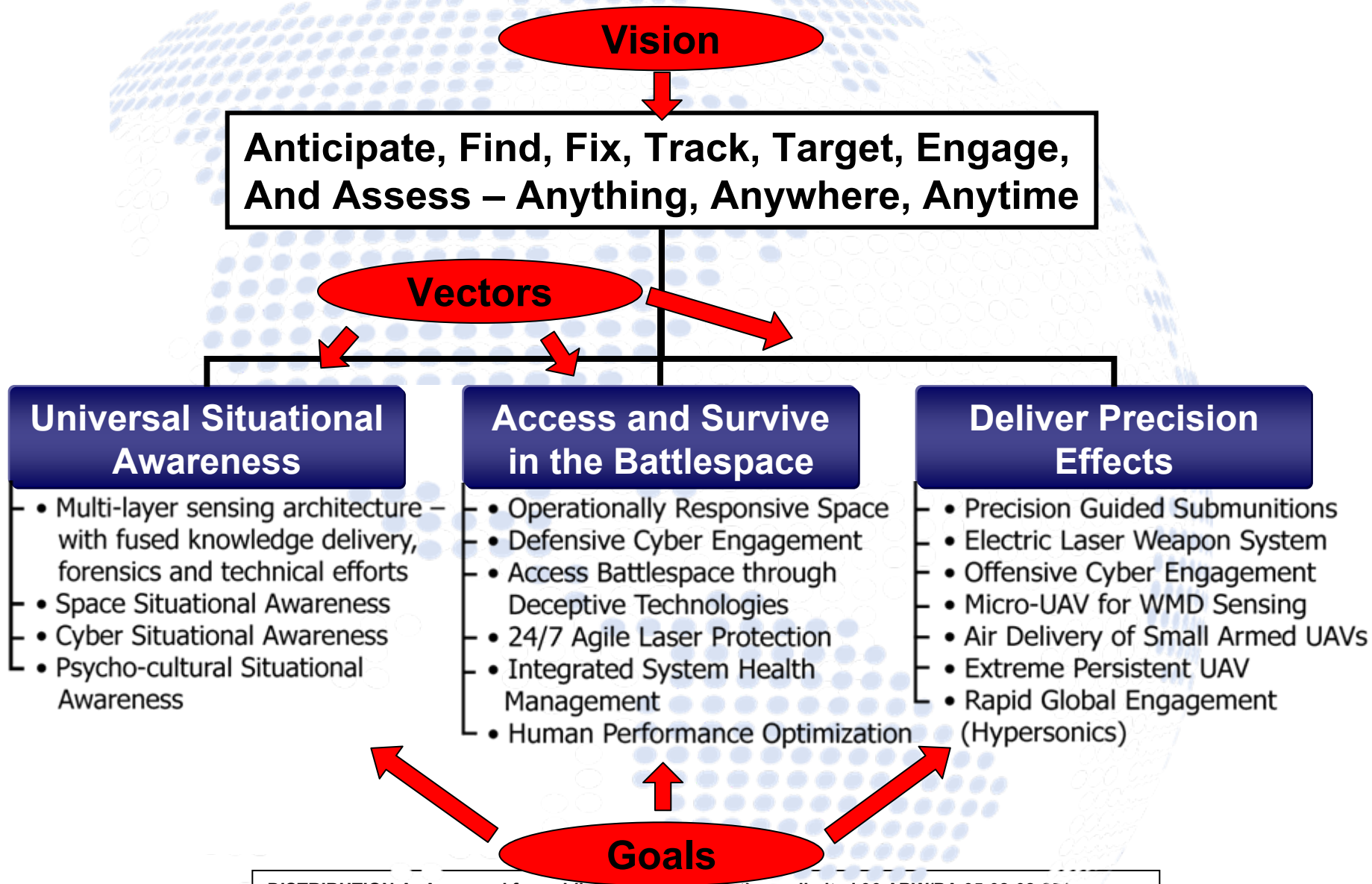
Vidi  
(I saw)

Vici  
(I conquered)





# AFRL S&T Strategy





# AFRL S&T Strategy



**Anticipate, Find, Fix, Track, Target, Engage,  
And Assess – Anything, Anywhere, Anytime**

## Universal Situational Awareness

- Multi-layer sensing architecture – with fused knowledge delivery, forensics and technical efforts
- Space Situational Awareness
- Cyber Situational Awareness
- Psycho-cultural Situational Awareness

## Access and Survive in the Battlespace

- Operationally Responsive Space
- Defensive Cyber Engagement
- Access Battlespace through Deceptive Technologies
- 24/7 Agile Laser Protection
- Integrated System Health Management
- Human Performance Optimization

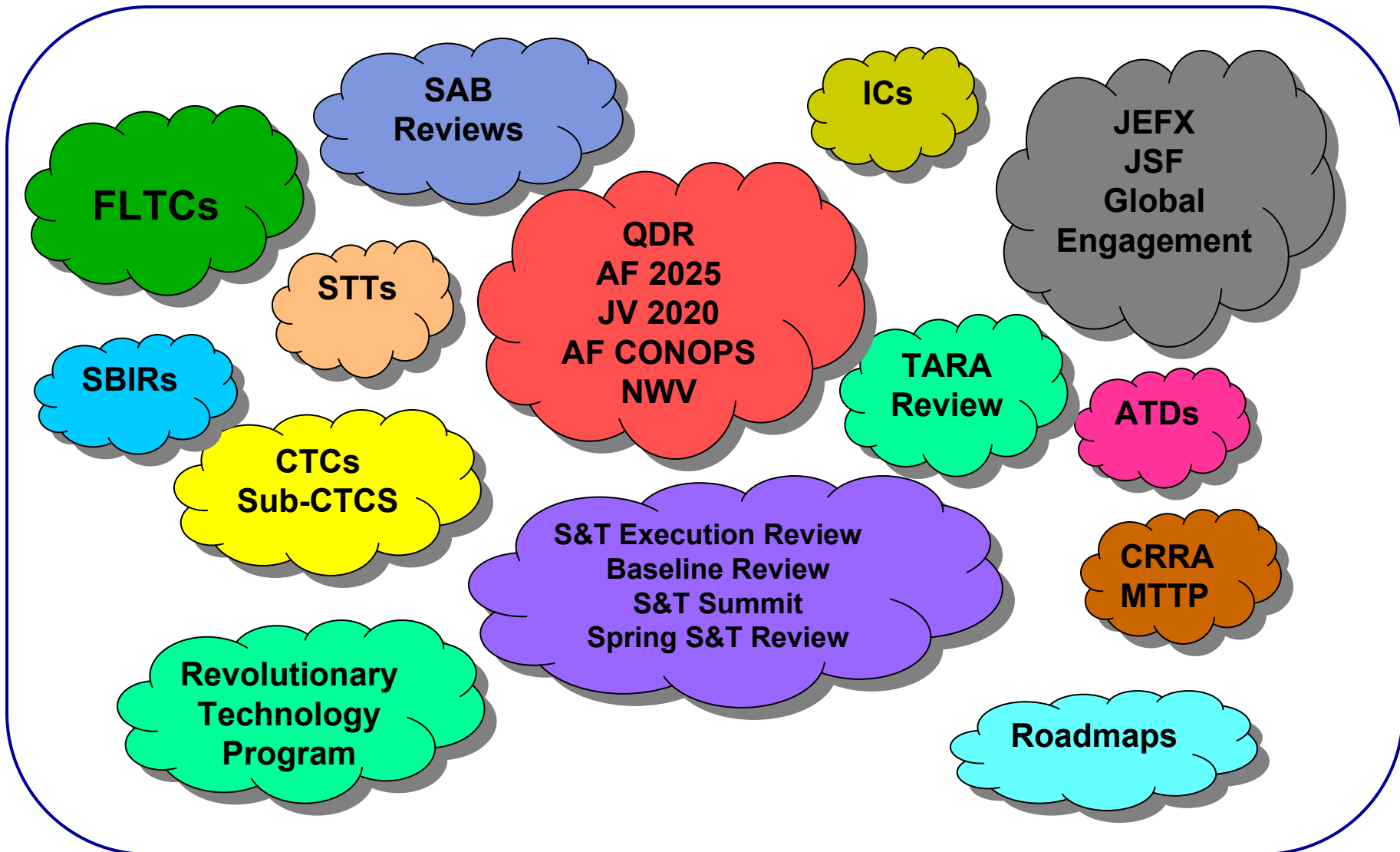
## Deliver Precision Effects

- Precision Guided Submunitions
- Electric Laser Weapon System
- Offensive Cyber Engagement
- Micro-UAV for WMD Sensing
- Air Delivery of Small Armed UAVs
- Extreme Persistent UAV
- Rapid Global Engagement (Hypersonics)





# Strategic Planning





# AFRL/RW Key Technology Areas



## Deliver Precision Effects

- Precision Guided Submunitions
- Electric Laser Weapon System
- Offensive Cyber Engagement
- Micro-UAV for WMD Sensing
- Air Delivery of Small Armed UAVs
- Extreme Persistent UAV
- Rapid Global Engagement  
(Hypersonics)

## Key Technology Areas

Micro-Munitions

Dial-a-yield

Bio-mimicry

Hard & Deeply Buried  
Targets (HDBT)

Hypersonics

Joint Dual Role Air Dominance  
Missile (JDRADM)

Chemical, Biological, Radiological, Nuclear & Explosive (CBRNE) Defeat



# AFRL/RWMF Technology Thrusts



**Micro-Munitions**

**Miniature & Micro-Safe & Arm**

**Dial-a-yield**

**Software Defined Safe & Arm**

**Joint Dual Role Air Dominance  
Missile (JDRADM)**

**Novel Initiation**

**Bio-mimicry**

**Multiple point/function Initiation**

**Hard & Deeply Buried  
Targets (HDBT)**

**Active Imaging Target Detection Device**

**Hypersonics**

**Guidance Integrated Fuzing**

**Chemical, Biological,  
Radiological, Nuclear &  
Explosive (CBRNE) Defeat**

**Bio-Inspired Target Detection Device**

**Shock Hardened electronics**

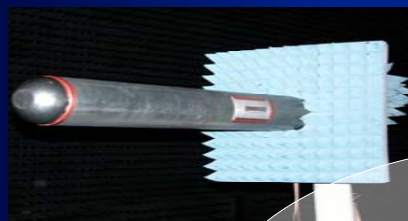
**Non-inertial void detectors**

**Shock mitigating Technologies**



# Fuzes Vision

*Discover, Develop, Integrate, and Transition Science and Technology  
For Fuzing of Air-Delivered Munitions that Maximize Weapon Effectiveness*



Point Burst



Advanced Initiation



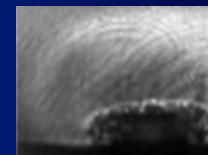
Experimentation



Fuze Computational Model



Penetration



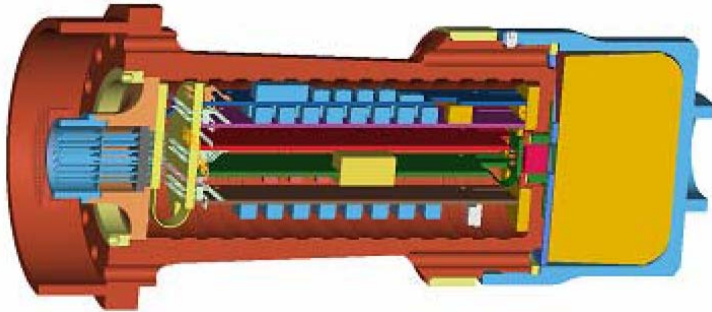


# Robust Intelligent Void And Layer (RIVAL) Fuze



AFRL/RW

Technology Development Tasks



Req'mts Def./Survivability Eval.

Fuze Design

Fuze Build and Lab Test

Government Sled Testing

Tech Availability at TRL=6

Description	Benefits to the WarFighter
<p>Advance/demonstrate fuze technology for hard target defeat by repackaging current hardened state-of-the art intelligent fuze electronics into a three-inch form factor</p>	<ul style="list-style-type: none"> <li>• Compatible with legacy penetrators.</li> <li>• Compatible with existing guidance kits for precision delivery</li> <li>• Ability to reach hardened and deeply buried targets which cannot currently be reached.</li> <li>• Fuze capable of void, layer and depth of burial (DoB) modes of operation.</li> </ul>
Technology	
<ul style="list-style-type: none"> <li>• Shock Hardened Electronics</li> <li>• Intelligent Post-Impact Algorithm</li> </ul>	



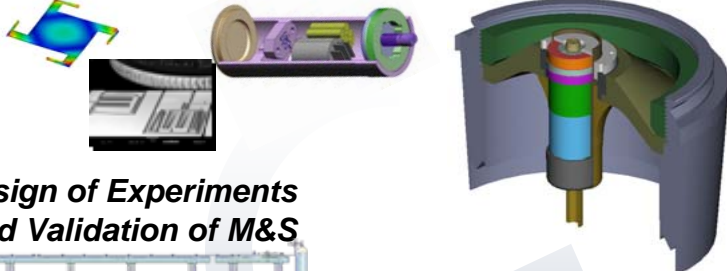


# Harsh Environment Fuze Technology (HEFTY)



## AFRL/RW

Component/Interface/  
Assembly Modeling



Design of Experiments  
and Validation of M&S

Lab Reproduction of  
Harsh Environments

Improved  
Design  
Tools

## Technology Development Tasks

Impact Test with 1.5" Hopkinson Bar

Create Opposing loads with Vacuum Gun

Quantify Test Articles and Full-Scale Weapons  
(Reverse Ballistics)

Modeling

### Description

Develop the capability to model, characterize, design, and test fuzes and fuze components in harsh environments based on requirements for current and future munitions.

### Technology

Survivable fuze technology  
Validated M&S of fuze well environment  
Model-based design of experiments  
Scaling of models for harsh environment prediction  
Dynamic test apparatus and methodology

### Benefits to the War Fighter

- Enhanced fuze reliability and performance in harsh environments of Global Strike weapons
- Supports Global Attack capability (Time Critical Targets)- Planning hi-velocity follow-on FY12+
  - High speed boost-glide penetrating weapons
  - Hold high value, time-critical targets at risk
- Provide M&S and Test methodologies to Industry



# Modular Fuze Architecture



## MAFIA : Modular Advanced Fuze Interface Architecture

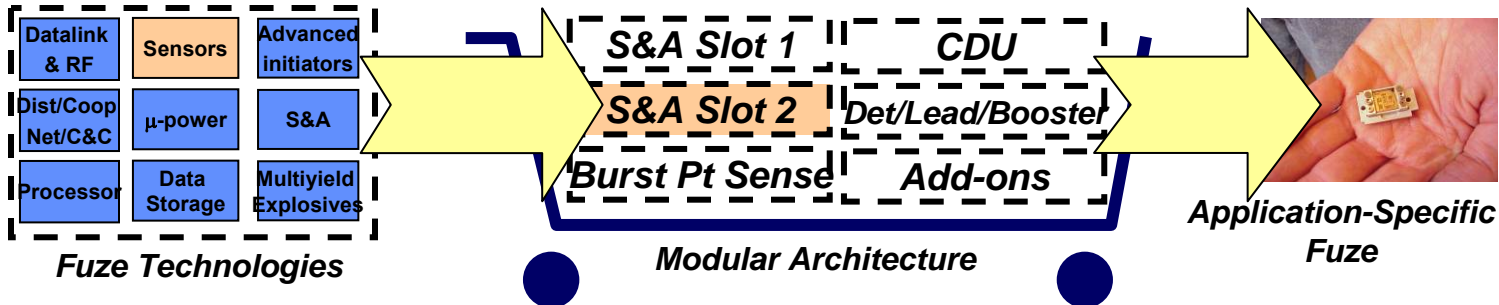
### Benefits

- Modular Open Systems Approach (MOSA)
- Faster, lower cost weapons systems integration
  - “Plug and play” compliant warheads
  - Service and CTR mix-n-match
    - Multiple subs for multiple modules
    - Army vs. Navy vs. AF core competency
  - Predicted improvement in “-ilities”
    - Affordability, Reliability, etc.
- Piecewise capability development
  - Incremental acquisition strategy
  - Modular capability becomes “COTS” for integration

### Approach

Design & Promote Modular Fuze Architecture By:

- Providing an enabling environment
  - Joint advocacy through FESWG, etc.
  - Minimum Qualifications For Tri-Service Requirements
- Parsing Fuzing System Functional Allocations
  - Communication, Safety, TDD
- Determining/Defining Interfaces
  - Interface Control Document (ICD) Style
  - Establish Rules/Conditions That Can Allow “Plug & Play” Functionality
- Determine Certification, Conformant, Metrics
- Support Legacy Weapon Systems (If Reasonable)

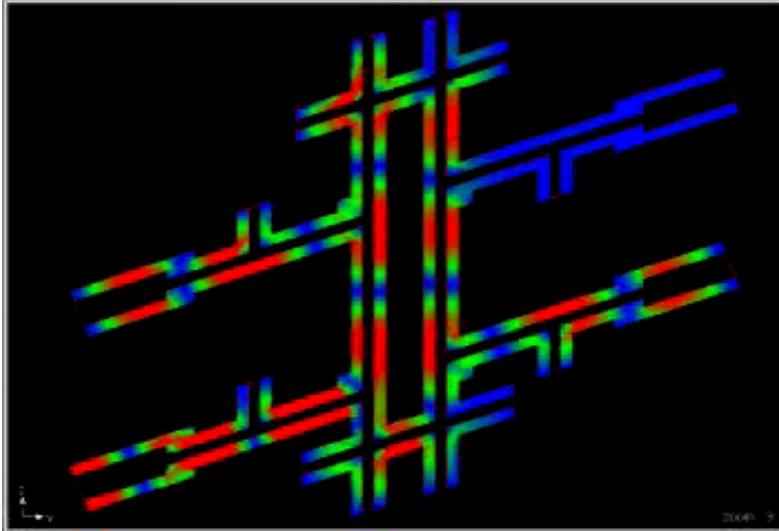




# Sub-millimeter Wave Imaging Fuze Technology (SWIFT)



**AFRL/RW**



## Technology Development Tasks

Contract Award 2QFY09

Breadboard Design Complete

Breadboard Fabrication

Refine Hardware Model

Field Testing Completed

Description	Benefits to the War Fighter
<p>Develop a Miniature, High-Speed, Imaging Fuze Sensor that Performs Target Detection, Classification, and Aimpoint Selection for Mass-Focused Ordnance Concepts Used with Smaller Munitions</p>	<ul style="list-style-type: none"> <li>• Reduction in Fuze Radar Aperture               <ul style="list-style-type: none"> <li>• Ideal For Miniature Munitions</li> <li>• More Easily Integrated with Guidance</li> </ul> </li> <li>• Enables Mass Focused Warhead Concepts with Increase in Fragments on Target</li> <li>• Easier Detection of Targets</li> <li>• Low Probability of Intercept</li> <li>• Common Fuze Sensor Hardware for Dual-Role Munitions – Air-Surface and Air-Air Applications</li> </ul>
<p><b>Technology</b></p> <ul style="list-style-type: none"> <li>• Radar Components for &gt;200 GHz Operation</li> <li>• Miniature Conformal Antennas</li> <li>• Coherent Software Defined Fuze Radar</li> <li>• Validated Target &amp; Background Measurements</li> </ul>	



# Summary



- **Munitions Directorate mission objectives align our thrusts with the Air Force's S & T strategy**
- **Fuze Branch's technology focus addresses seven major areas:**
  - **Micro-munitions**
  - **Dial-a-yield**
  - **Bio-mimicry**
  - **CBRNE defeat**
  - **Hypersonics**
  - **JDRADM**
  - **HDBT**
- **Your role is critical in achieving our organization's success**

