

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

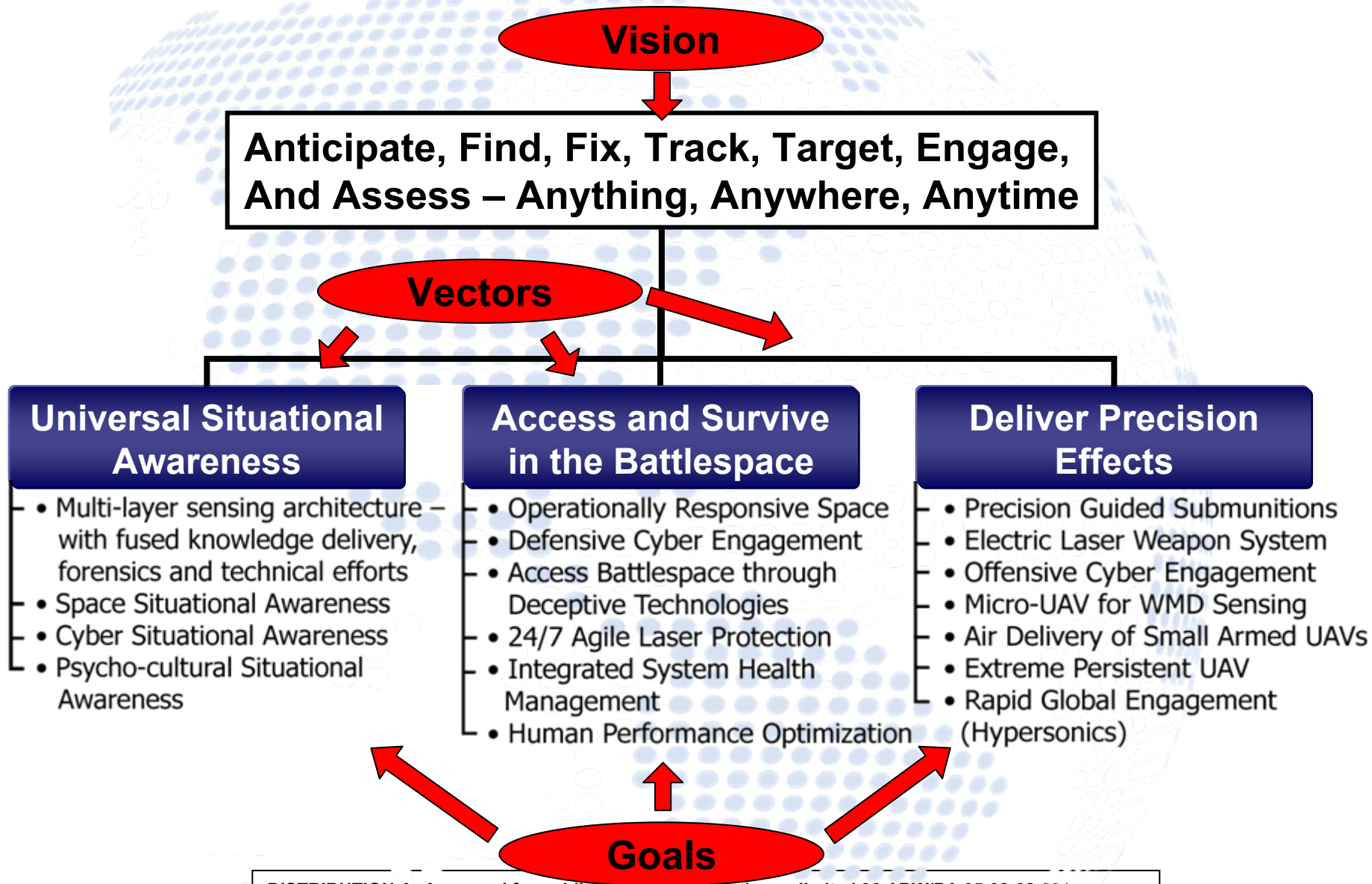
Veni
(I came)

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

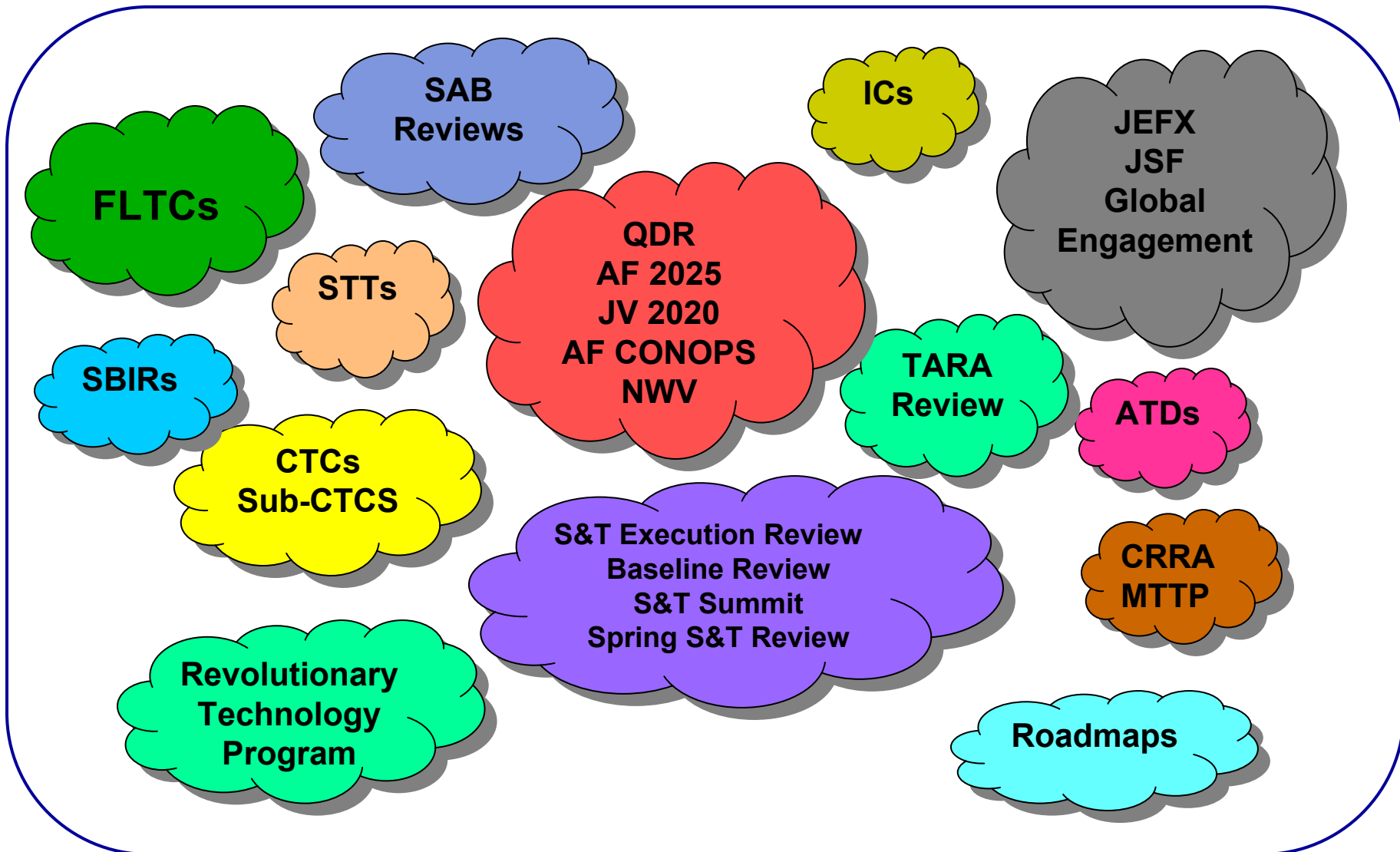
- Operationally Responsive Space
- Defensive Cyber Engagement
- Access Battlespace through Deceptive Technologies
- 24/7 Agile Laser Protection
- Integrated System Health Management
- Human Performance Optimization

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

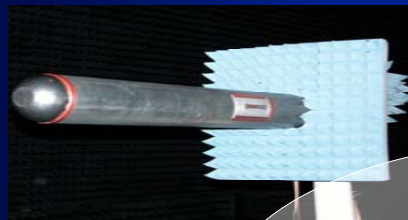
Shock mitigating Technologies



Fuzes Vision



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



Point Burst



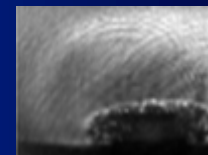
Advanced
Initiation



Experimentation



Fuze
Computational
Model



Penetration



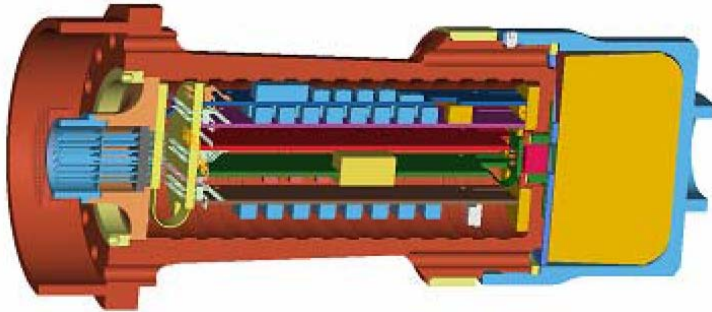


Robust Intelligent Void And Layer (RIVAL) Fuze



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"> • Compatible with legacy penetrators. • Compatible with existing guidance kits for precision delivery • Ability to reach hardened and deeply buried targets which cannot currently be reached. • Fuze capable of void, layer and depth of burial (DoB) modes of operation.
<p>Technology</p>	
<ul style="list-style-type: none"> • Shock Hardened Electronics • Intelligent Post-Impact Algorithm 	

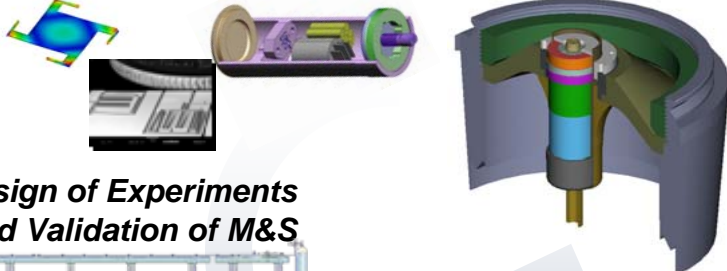


Harsh Environment Fuze Technology (HEFTY)



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

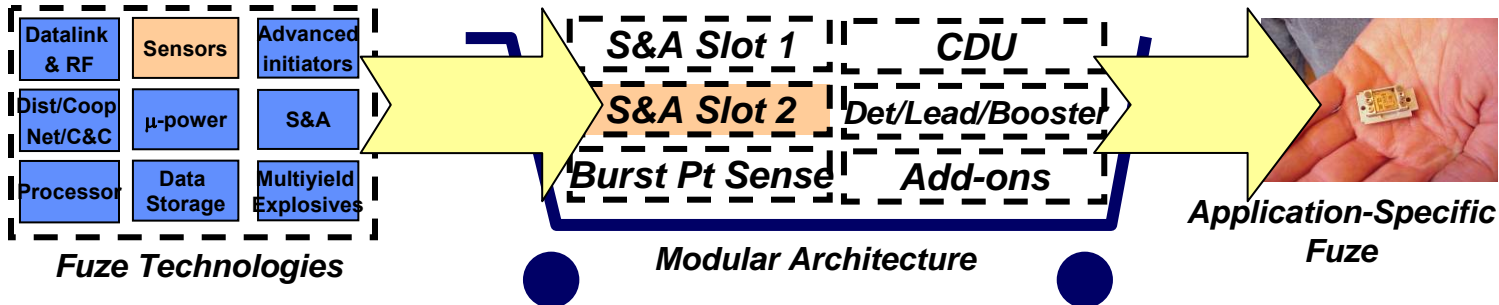
Benefits

- 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)

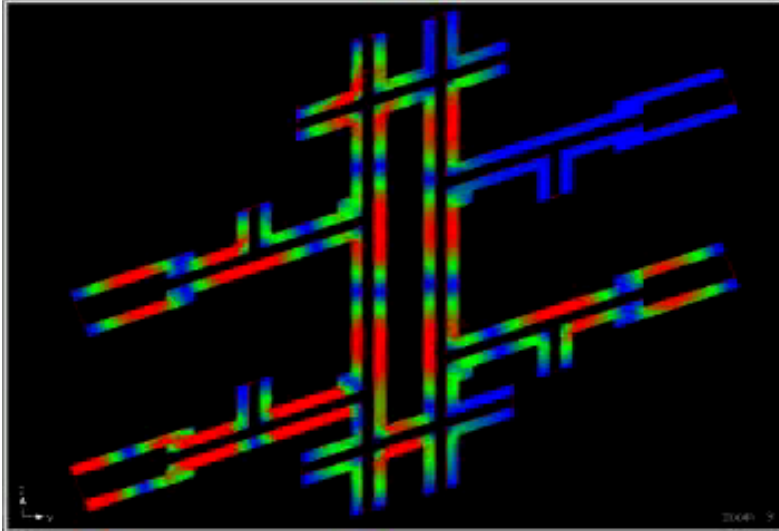




Sub-millimeter Wave Imaging Fuze Technology (SWIFT)



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"> • Reduction in Fuze Radar Aperture <ul style="list-style-type: none"> • Ideal For Miniature Munitions • More Easily Integrated with Guidance • Enables Mass Focused Warhead Concepts with Increase in Fragments on Target • Easier Detection of Targets • Low Probability of Intercept • Common Fuze Sensor Hardware for Dual-Role Munitions – Air-Surface and Air-Air Applications
<p>Technology</p> <ul style="list-style-type: none"> • Radar Components for >200 GHz Operation • Miniature Conformal Antennas • Coherent Software Defined Fuze Radar • Validated Target & Background Measurements 	



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**

