Air Armament Center

War-Winning Capabilities…On Time, On Cost

U.S. AIR FORCE

Success in Venting Penetrator Warheads

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Background

War-winning Capabilities…On Time, On Cost

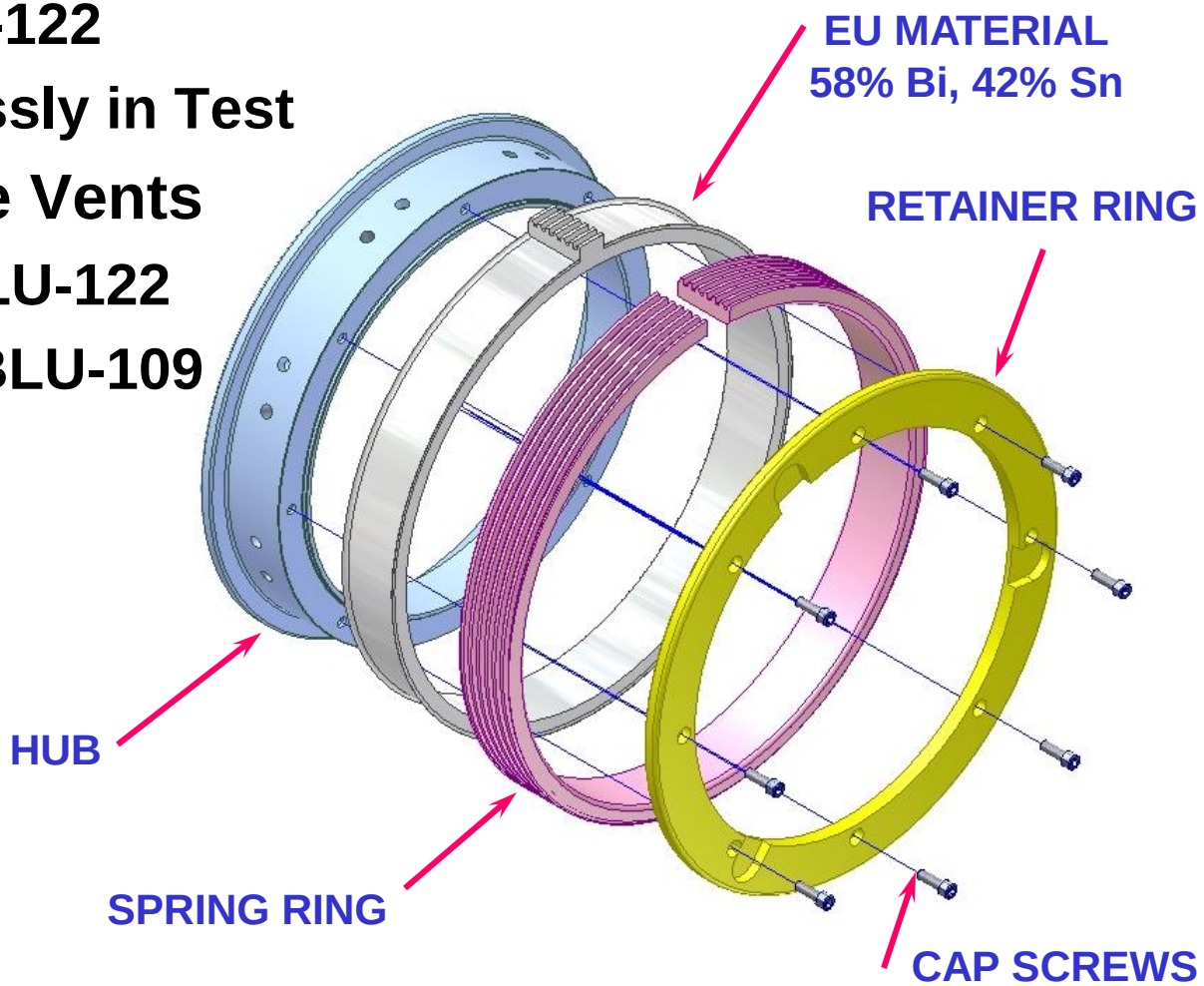
- **General Purpose Bombs IM improved through venting**
  - **500lb, 1000lb, & 2000lb GP warheads**
  - **Primarily aft venting**
  - **Common Air Force & Navy Configurations**
  - **BLU-111, BLU-110, and BLU-117 in production**

- **Penetrators - IM Improved Designs**
  - **BLU-109**
  - **BLU-122**

Penetrator IM Improvements

War-winning Capabilities…On Time, On Cost

- ***New*** **Eutectic Aft Cover Closure Ring**
  - **Developed for BLU-109 (Common AF & Navy)**
  - **Common in BLU-122**
  - **Releases Flawlessly in Test**
- ***New*** **Eutectic Nose Vents**
  - **Developed for BLU-122**
  - **Transitioned to BLU-109**



Penetrator Aft Closure Plate

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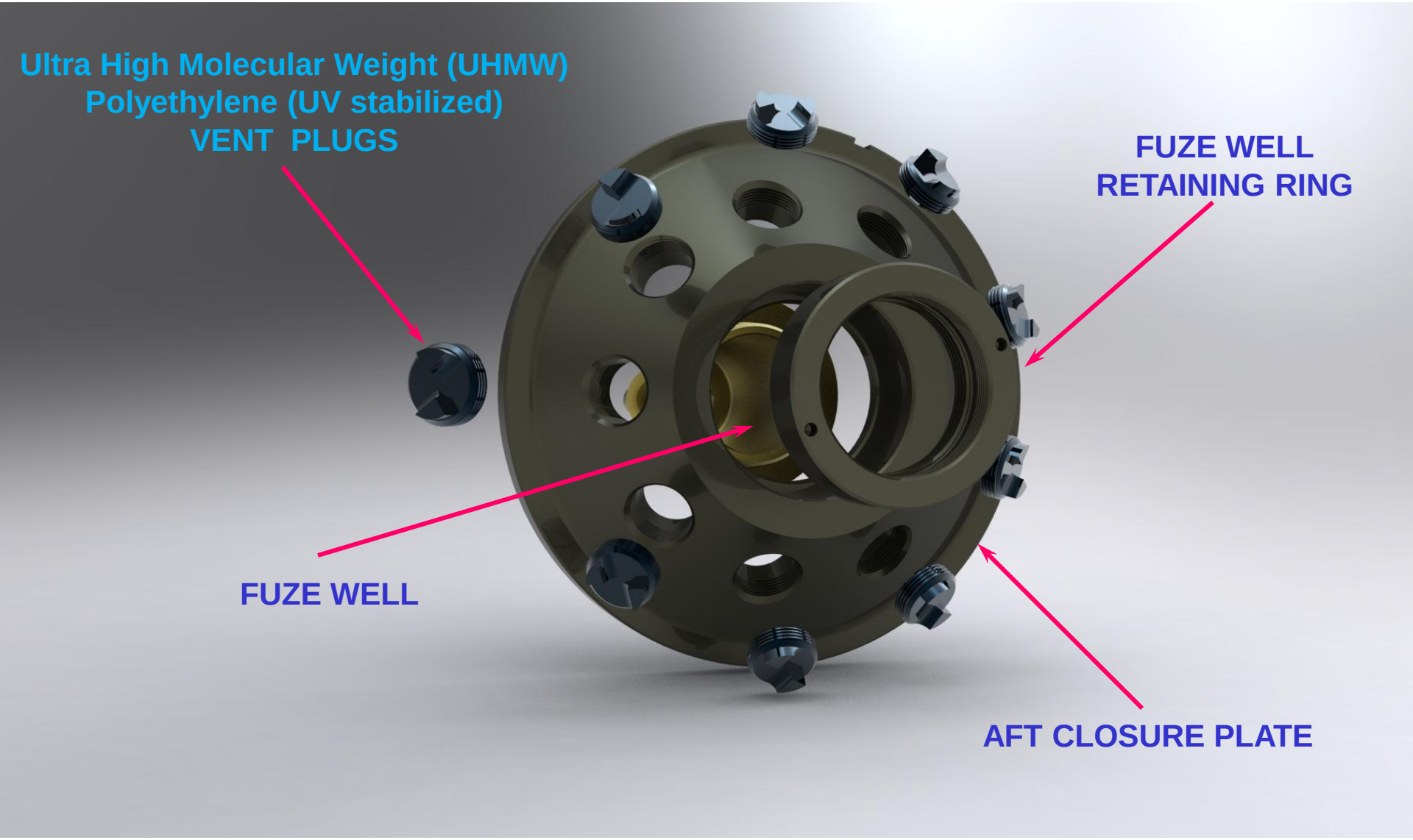

Eutectic Retaining Nut

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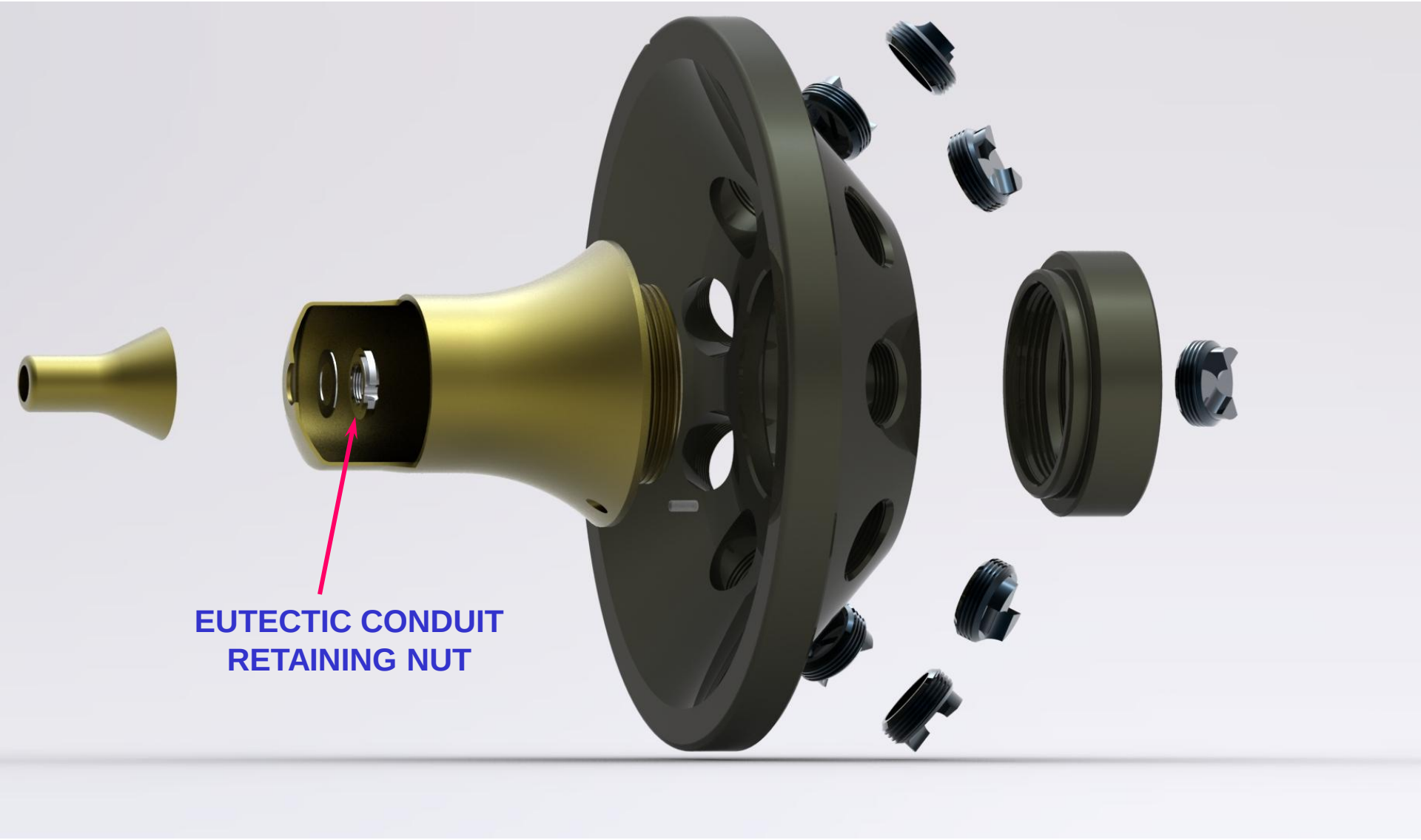

Aft Closure Test Results

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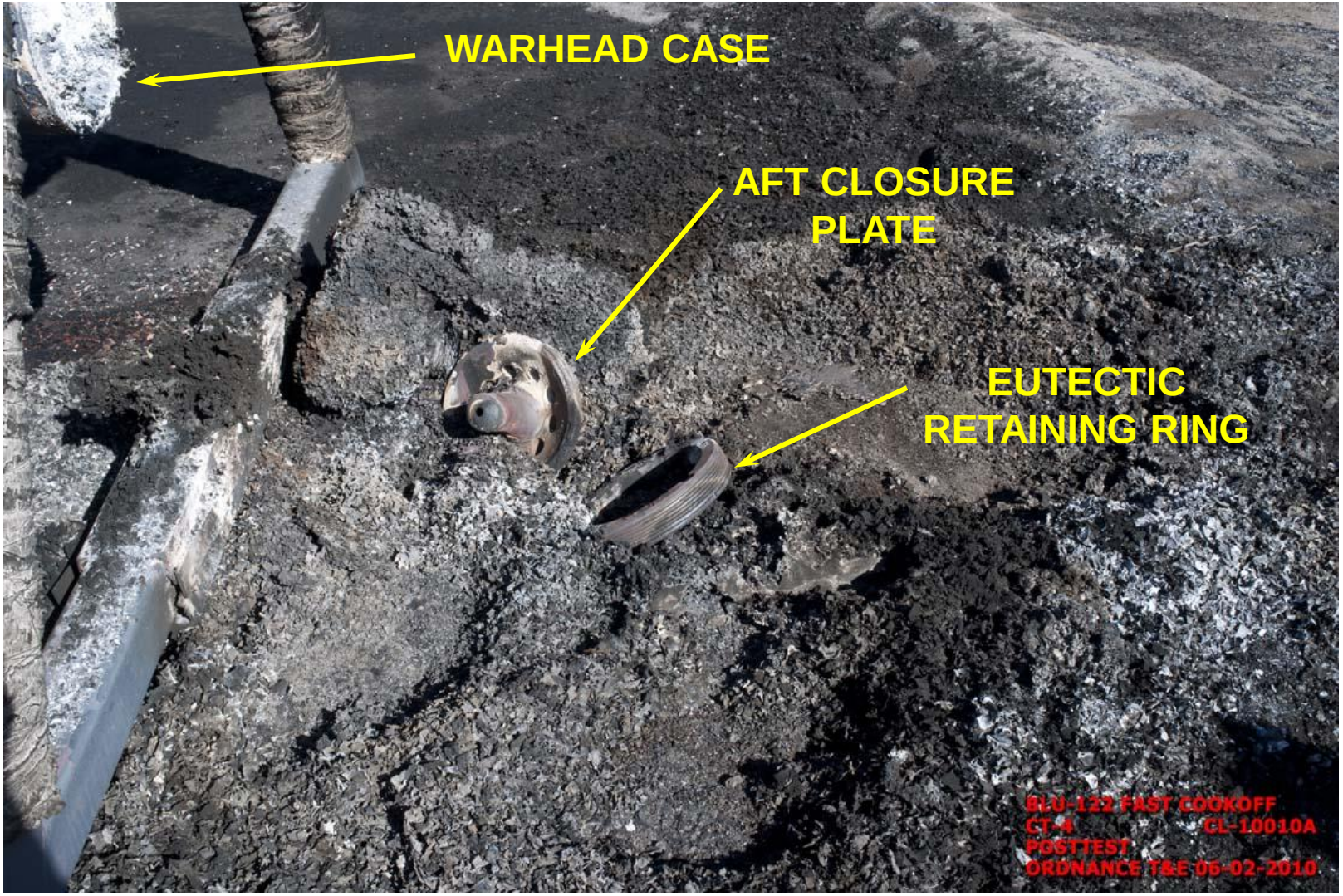

Nose Venting Concepts

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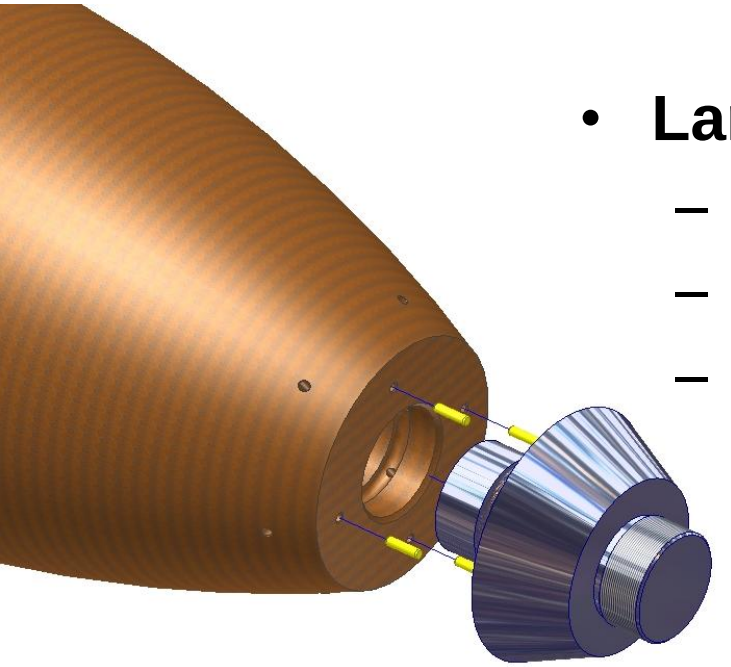
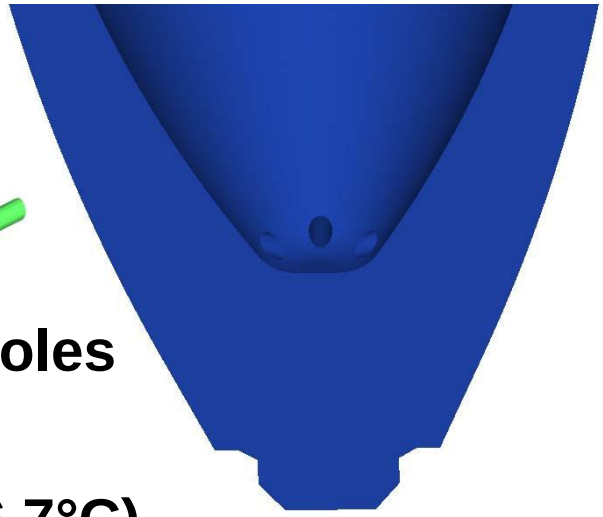


- **Large Frontal Plug**
  - **Eutectic O-ring to release**
  - **Pins to prevent rotation**
  - **Weep holes for eutectic**



- **Six Vent Holes**
  - **Eutectic reservoir to flow into vent holes**
  - **Eutectic melts at 281°F (138°C)**
  - **Asphaltic Liner applied at 350°F (176.7°C)**

Modeling To Validate Design

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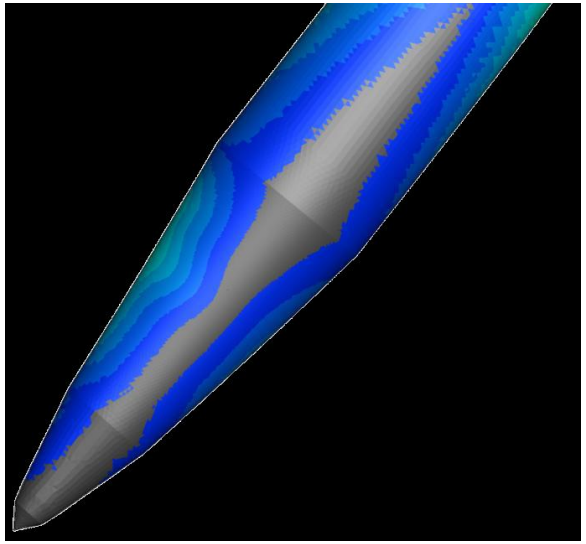
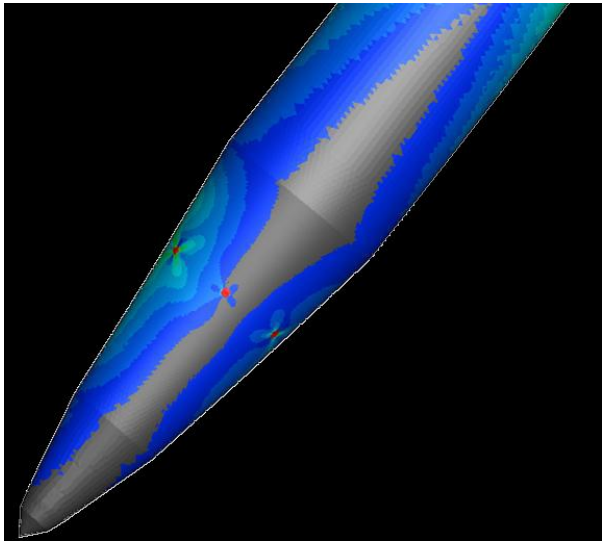


No Nose Venting



¾ inch Nose Vent Holes

- **Stress in the BLU-122 Nose Area**
  - **Oblique impact – worst case**
  - **Different hole sizes considered**
  - **Not significantly higher stress than without holes**
  - **¾ inch diameter holes selected**

Nose Venting Solution

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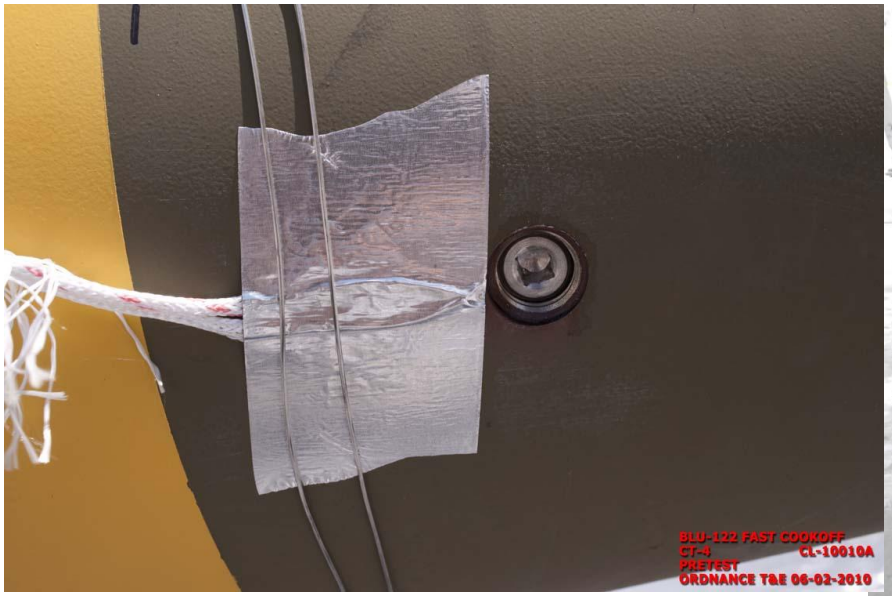
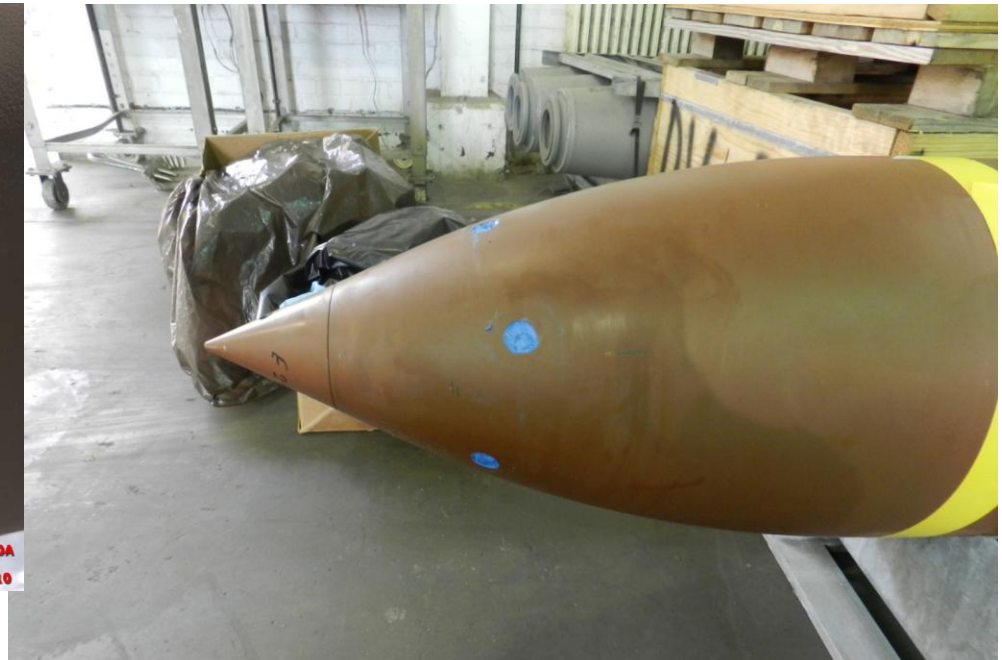
- **Eutectic Pin**
  - **Vents Pressure Build-up**
  - **Installed after Tar Lining**
  - **Environmental Sealed**
    - **with RTV** (room temperature vulcanization) **Blue Gasket Maker**





Testing the Nose Vent

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- **Plug design for nose vents**
  - **Tested FCO & SCO – pass**
  - **Sled tested inert and live fills**
  - **Warhead structurally sound**

Sled Test – Survives

Fast Cook-off – Vents

Sympathetic Reaction Mitigation

Concept

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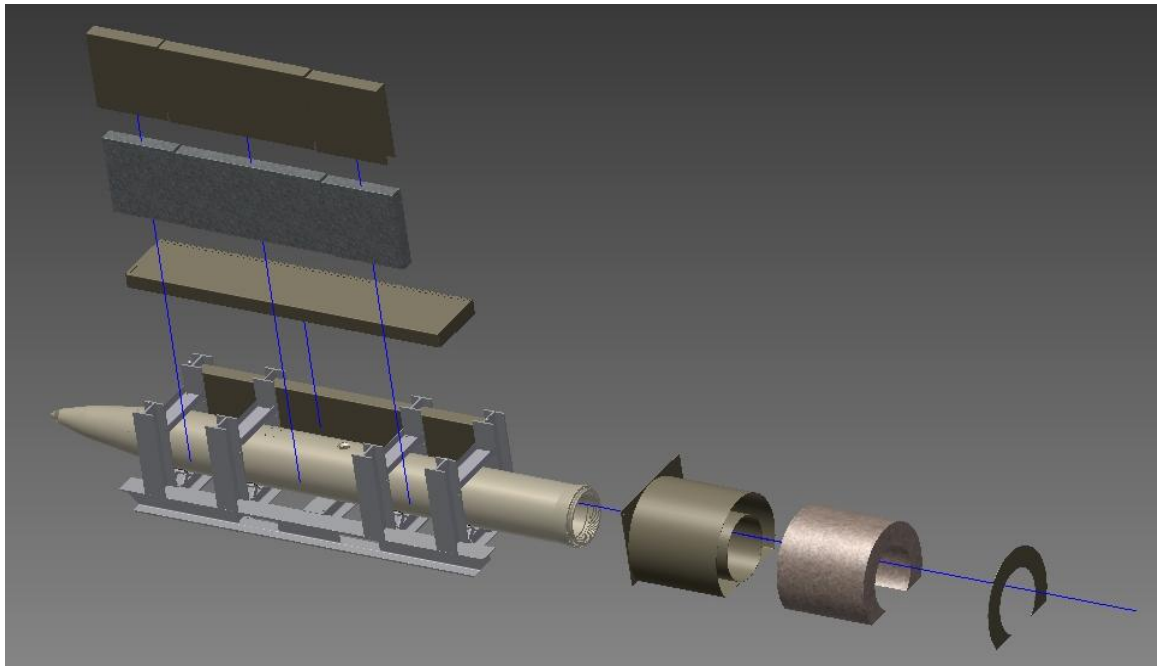
- **Modeling Supports Blast Mitigation**
  - **Pumice Panels Designed**
  - **Shroud over Protruding Tail of Warhead**
  - **Use Existing Pallet**



IM Test Results

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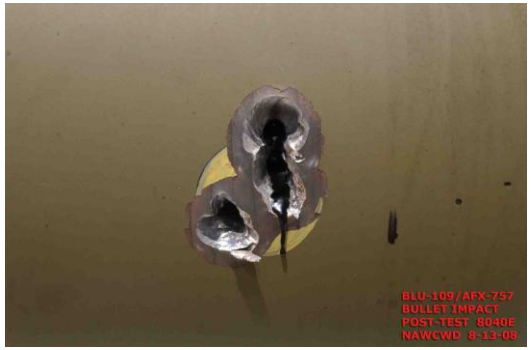
	BLU-109C/B (Eutectic Aft)	BLU-109 with nose vents	BLU-122/B	BLU-122X/B with nose & tail vents
Fast Cook-off	IV	(V)	III	IV
Slow Cook-off	IV	(V)	II	V
Bullet Impact	VI		VI	
Fragment Impact	IV		VI	
Sympathetic Reaction	F		F	
Shaped Charge Jet	P		P	



No Reaction Example: **Bullet Impact**

Legend

Detonation	I
Partial Detonation	II
Explosion	III
Deflagration	IV
Burn	V
No Reaction	VI

Path Forward

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Refine the IM Design

- Incorporate in Production
- Safer Weapons
- Maintain or improve lethality

ACKNOWLEDGMENTS

War-winning Capabilities…On Time, On Cost

Project Lead – Mr. Randy Black

Design and Drafting – Mr. Barry Cantrell & Mr. Frank Zaborowski

Modeling and Simulation – Dr. Brian Plunkett & Mike Gunger

Project Engineer – Mr. Norm Babbitt

Test Engineers – Capt. Jason Moran, Capt. Oscar Palomino, Mr. Chuck Schneider, & Mr. Brad Pattullo

Naval Air Warfare Center – Weapons Division, China Lake

IM Test Facilities

846th Test Squadron, Holloman AFB

High Speed Test Track