Air Armament Center

War-Winning Capabilities…On Time, On Cost

U.S. AIR FORCE

Venting Techniques for Penetrator Warheads

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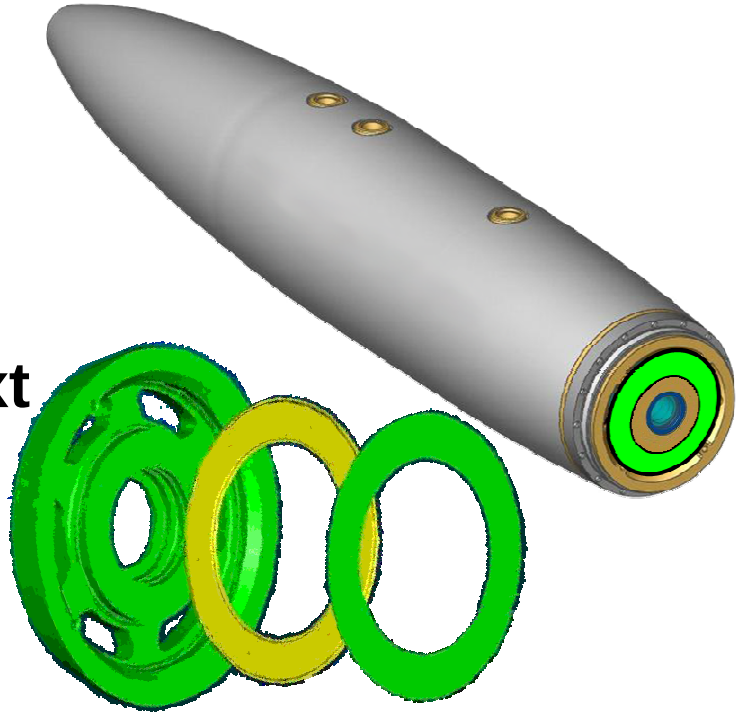
Background

War-winning Capabilities…On Time, On Cost

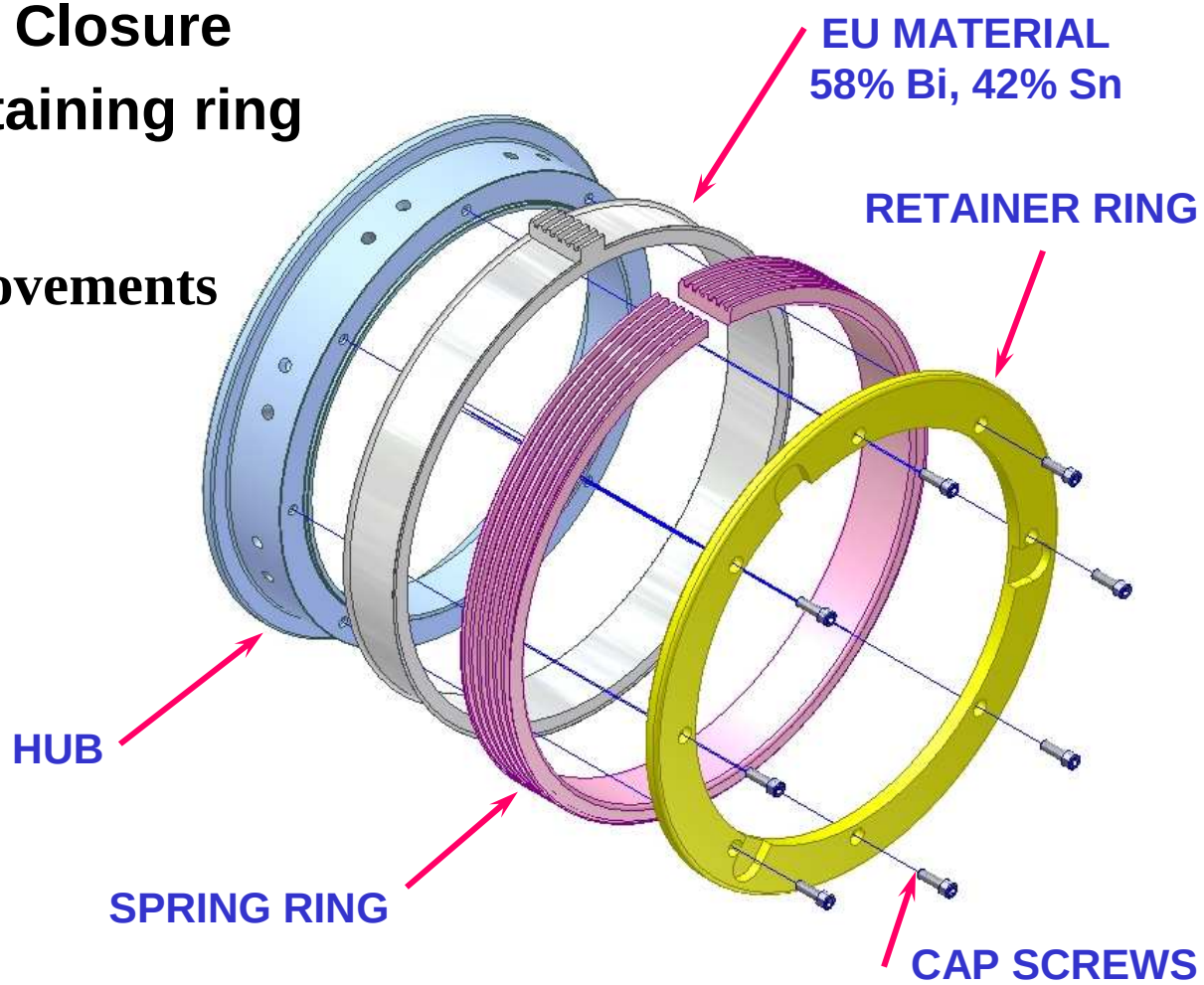
- General Purpose Bombs IM improved through venting
  - 500lb, 1000lb, & 2000lb GP warheads
  - Primarily aft venting
  - Common Air Force & Navy Configurations
- On contract
  - BLU-111
  - BLU-110
  - BLU-117
- Penetrators Next
  - BLU-109
  - BLU-122



Penetrator IM Improvements

War-winning Capabilities…On Time, On Cost

- **BLU-109 2000lb Penetrator (Common AF & Navy)**
  - **Selected AFX-757 fill**
  - **Vent Plugs in Aft Closure**
  - **New Eutectic Retaining ring**
- **BLU-122 (AF Only)**
  - **All BLU-109 improvements**
  - **New Nose venting**



Penetrator Aft Closure Plate

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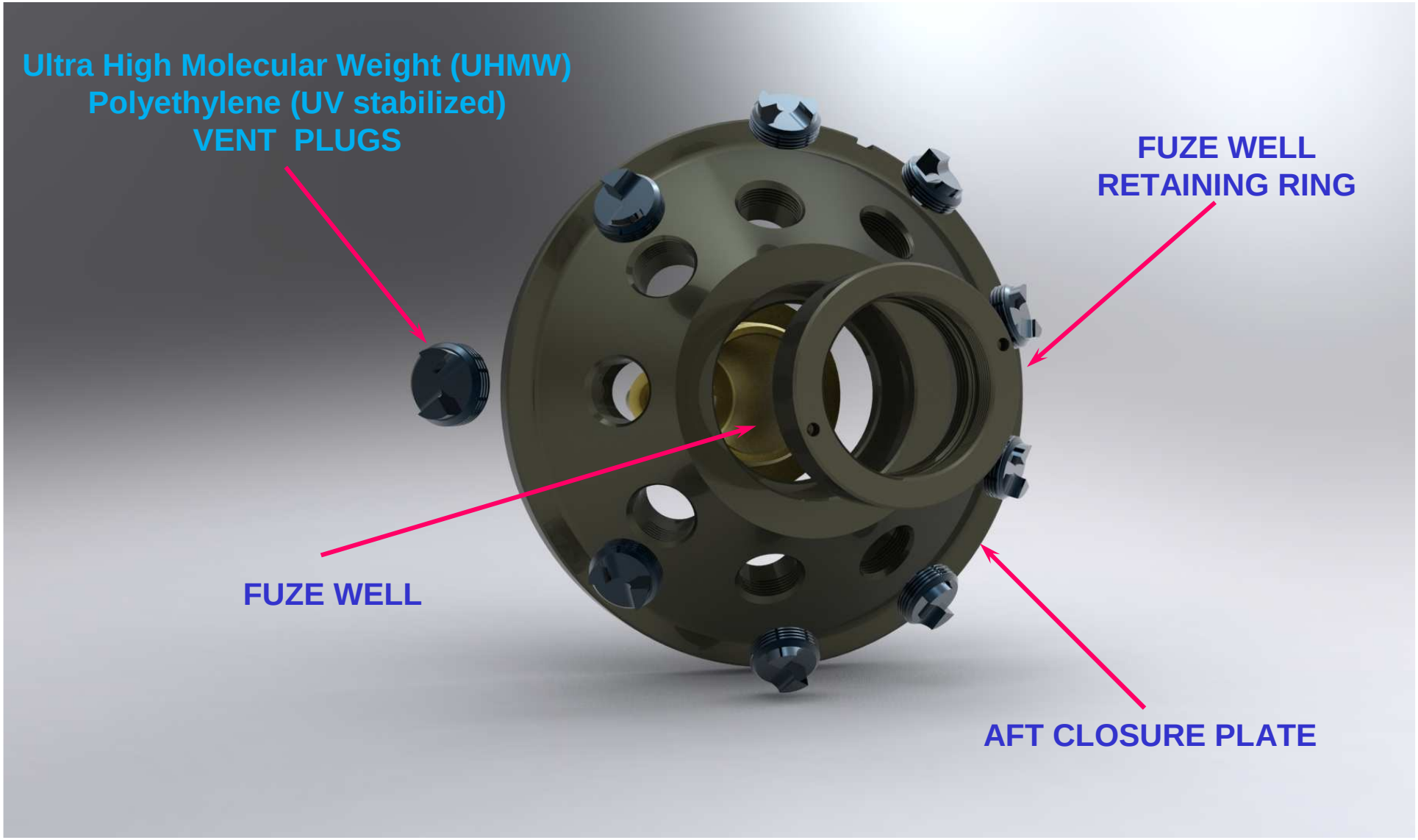

Eutectic Retaining Nut

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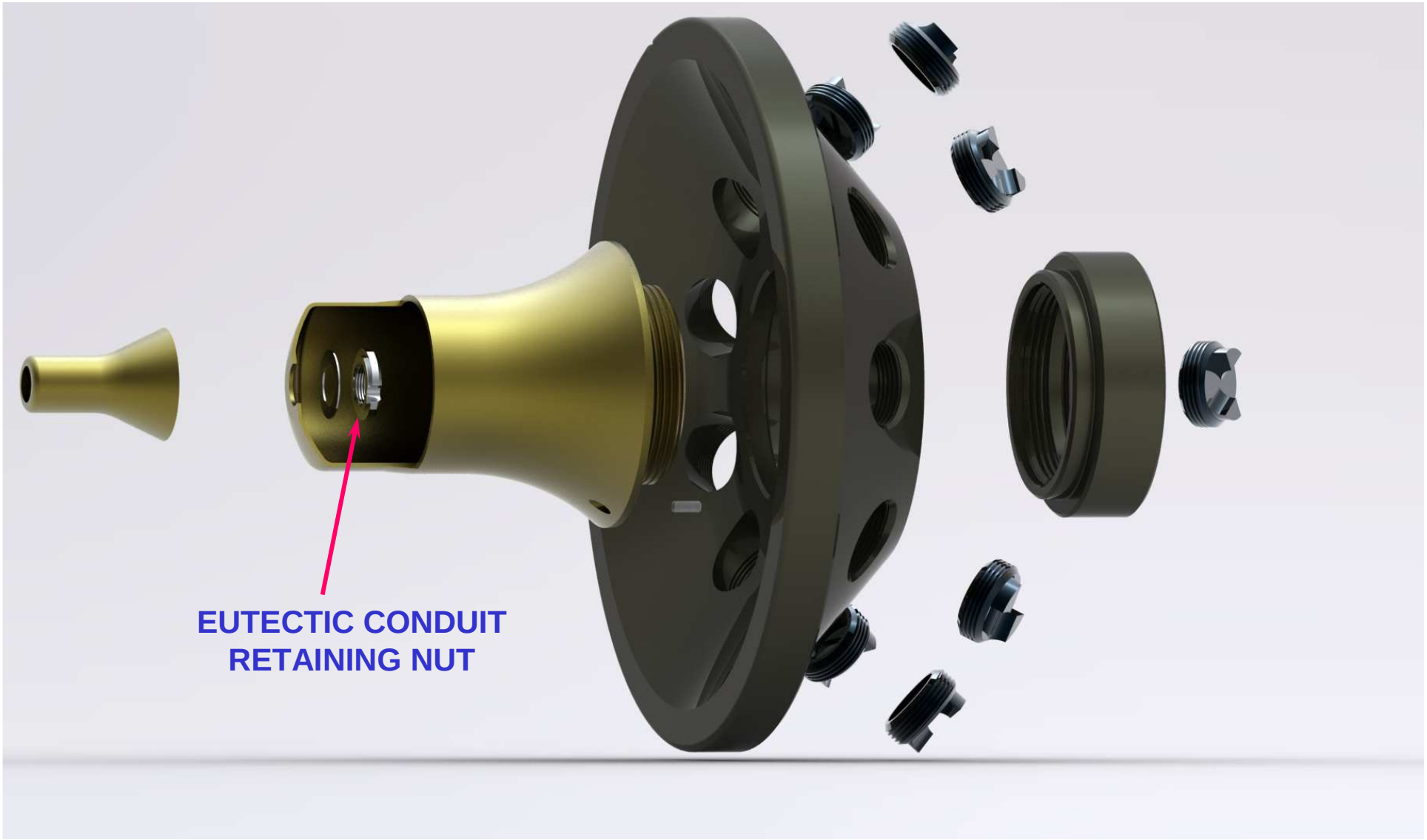
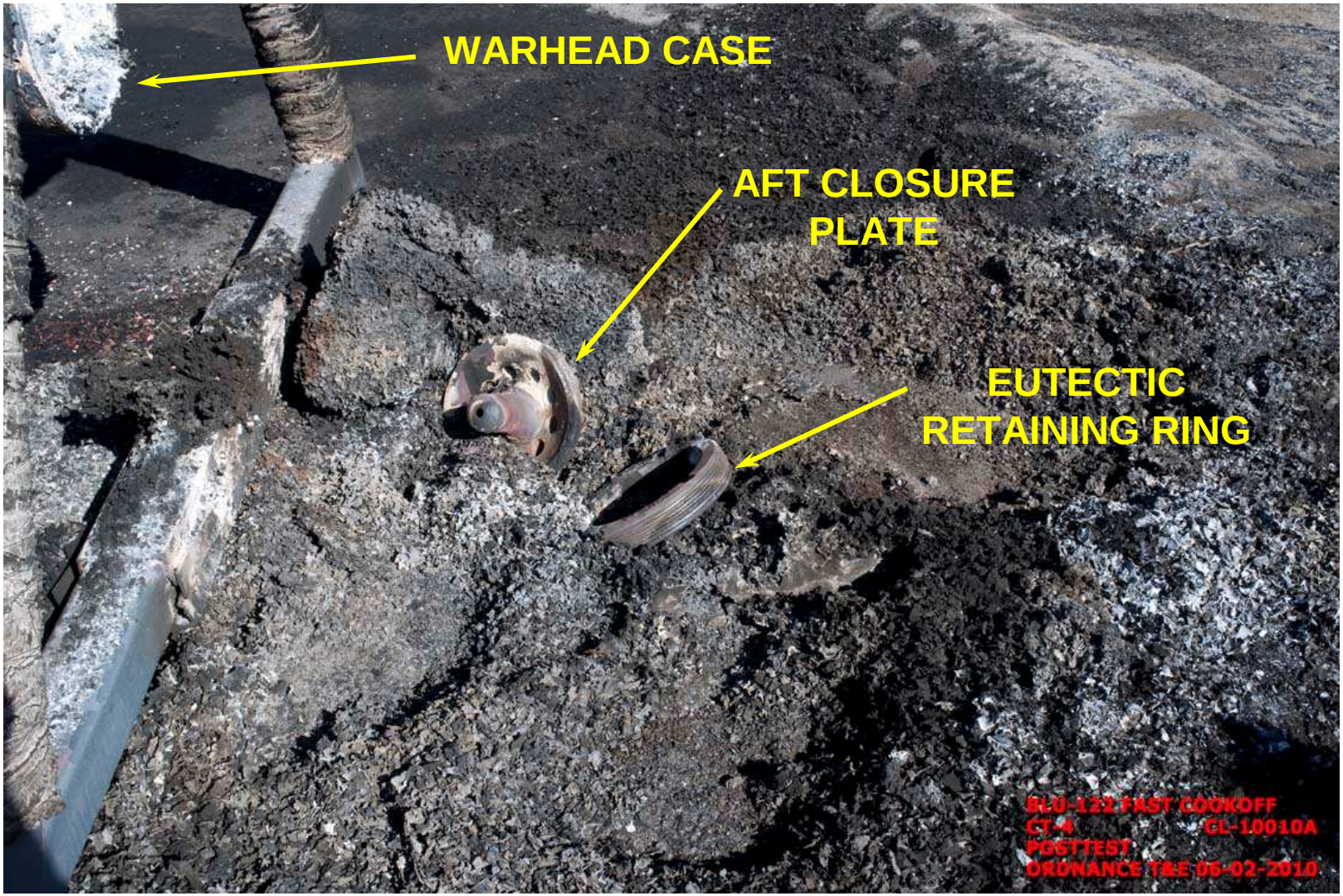


Aft Closure Test Results

War-winning Capabilities…On Time, On Cost



BLU-109 IM Test Results

War-winning Capabilities…On Time, On Cost

Fast Cook-off	Deflagration	Explosive beyond 50 feet
Slow Cook-off	Deflagration	Explosive beyond 50 feet
Bullet Impact	No Reaction	
Fragment Impact	Deflagration	One of two tests propulsive
Sympathetic Reaction	(Partial Det)	
Shaped Charge Jet	Pass	Case ruptured (2 times)

Bullet Impact **No Reaction**

Environmental Tests Pass No Issues

Nose Venting Techniques

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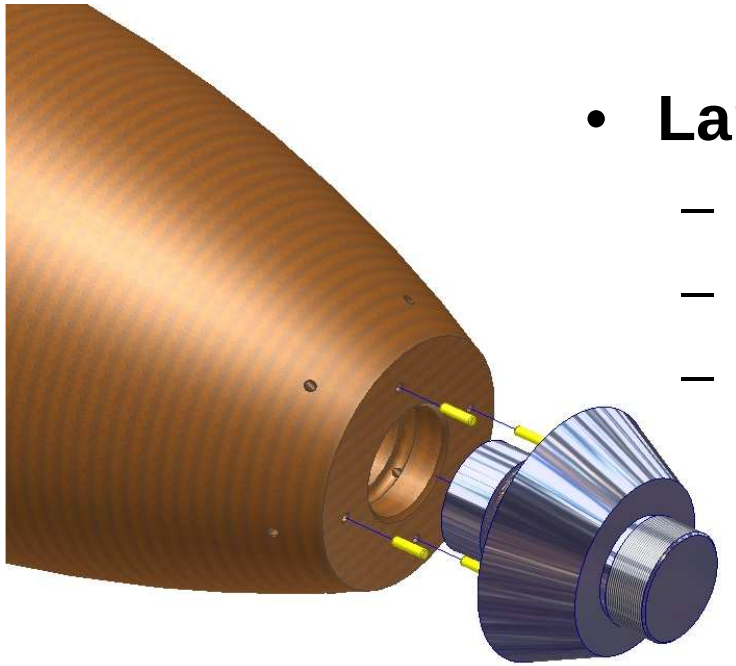
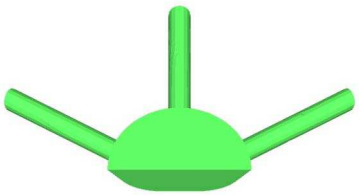
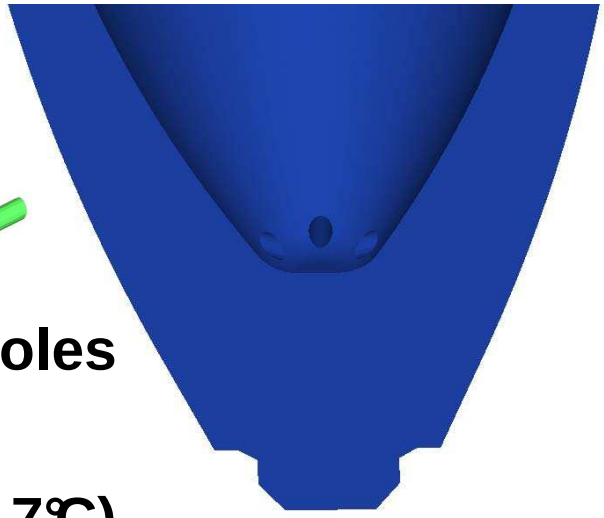


- **Large Frontal Plug**
  - **Eutectic O-ring to release**
  - **Pins to prevent rotation**
  - **Weep holes for eutectic**

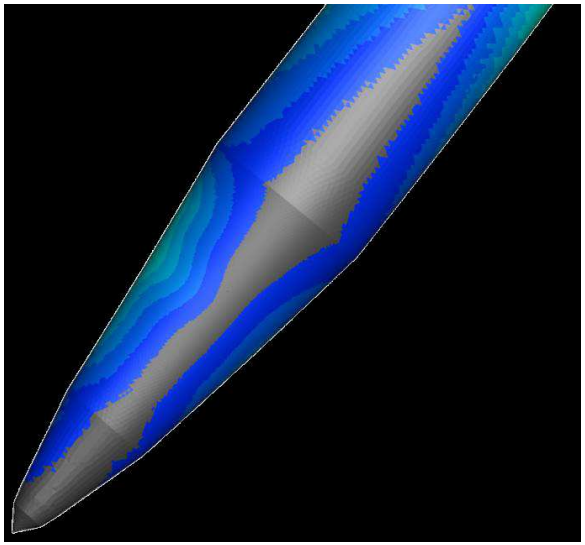




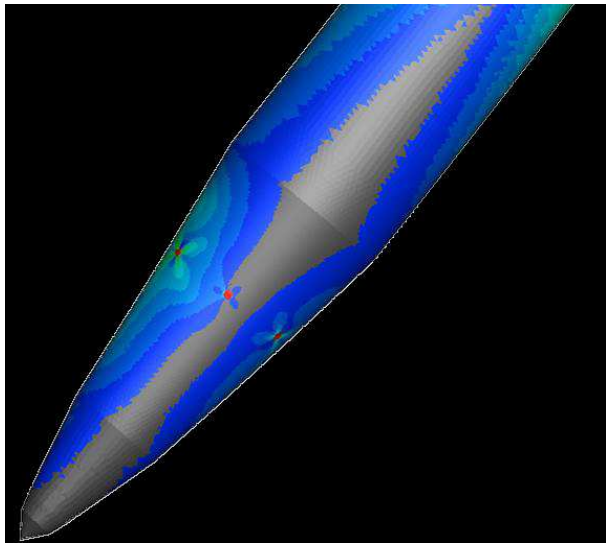
- **Six Vent Holes**
  - **Eutectic reservoir to flow into vent holes**
  - **Eutectic melts at 281℉ (138℃)**
  - **Asphaltic Liner applied at 350℉ (176.7℃)**

Modeling To Validate Design

War-winning Capabilities…On Time, On Cost



No Nose Venting



¾ inch Nose Vent Holes

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

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**

Fast Cook-off – Vents

Sled Test – Survives

Path Forward

War-winning Capabilities…On Time, On Cost

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

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Modeling and Simulation – Dr. Brian Plunkett

Project Engineer – Mr. Terry Byrd

Test Engineers – Lt. Jason Moran, 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