Success in Venting Penetrator Warheads
2012 Insensitive Munitions & Energetic Materials Technology Symposium
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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

**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

War-winning Capabilities...On Time, On Cost

Ultra High Molecular Weight (UHMW) Polyethylene (UV stabilized)
VENT PLUGS

FUZE WELL RETAINING RING

FUZE WELL

AFT CLOSURE PLATE
Eutectic Retaining Nut

War-winning Capabilities...On Time, On Cost
Aft Closure Test Results

*War-winning Capabilities…On Time, On Cost*

![Image of warhead components: Warhead Case, Aft Closure Plate, Eutectic Retaining Ring]
Nose Venting Concepts

War-winning Capabilities…On Time, On Cost

• 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

*War-winning Capabilities...On Time, On Cost*

- **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

War-winning Capabilities...On Time, On Cost

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

War-winning Capabilities…On Time, On Cost

• 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

War-winning Capabilities...On Time, On Cost

• Modeling Supports Blast Mitigation
  – Pumice Panels Designed
  – Shroud over Protruding Tail of Warhead
  – Use Existing Pallet
# IM Test Results

**War-winning Capabilities…On Time, On Cost**

<table>
<thead>
<tr>
<th></th>
<th>BLU-109C/B (Eutectic Aft)</th>
<th>BLU-109 with nose vents</th>
<th>BLU-122/B</th>
<th>BLU-122X/B with nose &amp; tail vents</th>
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<tbody>
<tr>
<td>Fast Cook-off</td>
<td>IV</td>
<td>(V)</td>
<td>III</td>
<td>IV</td>
</tr>
<tr>
<td>Slow Cook-off</td>
<td>IV</td>
<td>(V)</td>
<td>II</td>
<td>V</td>
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<td>Bullet Impact</td>
<td>VI</td>
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<tr>
<td>Fragment Impact</td>
<td>IV</td>
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<td>Sympathetic Reaction</td>
<td>F</td>
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<td>Shaped Charge Jet</td>
<td>P</td>
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**Legend**

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

**No Reaction Example:** Bullet Impact
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

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IM Test Facilities
846th Test Squadron, Holloman AFB
High Speed Test Track