Developments in Medium-Caliber Bursting Munitions

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• ATK Bursting Munition Activities

• Contract: OICW 20mm Subsonic

• IR&D Thrust: 30mm AAAV Applications

• Future Development:
  - 25mm (Bradley), 40mm, 120 and 105mm Tank Ammo

Leverage Common Components & Technology for Cost, Producibility and Reliability
30mm HE-AB Projectile and Cartridge

- Modified GAU-8 Body
- Fuze
- Cartridge
Electronics Functions through 70 Kg Setback

Gun Hardened Electronics Assembly

Folded to Fit Projectile Nose
Air Bursting Fuze

- Safe and Arm
- Explosive Lead
- Battery
- Radome
- Setback / Impact switch
- Body
- Fuze electronics
- Lead Retainer
Safe & Arm

- Common applications to smoothbore and rifled munitions
- Command arm (outside safe separation) for MOUT
- Less than .1 cubic inch of volume
- Mil Std 1316 E Compliant
- 20 Round Varicomp testing—"Safe to 99.9999%"
- Additional Out-of-line and environmental testing completed
Setter will inductively transfer data to the fuze

Programmable multi-modes

• Fuze power off
• Point Detonate Delay
• Point Detonate
• Airburst @ Time
• Airburst @ Turns
• Hybrid Airburst (Times & Turns)
30mm Design Update

• Low power design: Reduce Current Drain to 20% of Present

• Power Source
  – Integrate Reserve Battery
  – Set-Back Generators

• Packaging Improvements
  – Smaller fuze
Ballistic Softcatch Technology

• Round loaded and fired

• Capability to record 8 seconds of data

• Titanium nose protects electronics as it slows from Impact velocities of 1000 to 460 m/s
OBR Data Reduction

- Simple, Rugged OBR clock synchronized at setting
- Radar Track ties time, turns and distance together
  - OBR clock accuracy: 0.5%
- 500 meter tests in both Gau – 8 and AAAV Barrels, 2000 meter AAAV ongoing
HE Air Burst Testing

• Five Full up HE Rounds Tested in December, 2002
• Set for Air Burst at 471 meters utilizing Turns count Mode.
• First HE Air Burst test for Lethal Supersonic Rounds
• Burst Range determined from Raw Radar Doppler Signal and confirmed by Video Tape
• Precision Air Bursting Achieved—Comparable to subsonic 20mm OICW results at same range

Ballistic Results

<table>
<thead>
<tr>
<th>Round</th>
<th>Muzzle Velocity m/s</th>
<th>TOF-air burst sec</th>
<th>Range m</th>
<th>Decay m/s/m</th>
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<tbody>
<tr>
<td>305-66</td>
<td>1087.8</td>
<td>0.4685</td>
<td>470.19</td>
<td>0.365</td>
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<td>3.9</td>
<td>0.0014</td>
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Mean 1σ
Warhead Fragment Distribution – Ground Plane
Warhead Fragment Trajectories – Top View
Air Bursting Algorithms

- Fundamental Challenge of Air Burst: Target no longer “events” Round

- First Order Methods: Timer or Turns Counter estimates when desired range to burst is reached. Assuming accurate Range and MET Data, Random (round-to-round) Errors will define accuracy.

- Second Order: Reduce round-to-round Muzzle Velocity error
  - External Measurement
  - “Hybrid” Utilize on-board timer and turns counter - No need for Gun Muzzle modifications

- Third Order: Direct Range estimate (1-D IMU)
  - Integrate Axial accelerometer twice on the fly
  - Requires higher CPU capabilities, accelerometer must survive Set-back g’s with no zero shift and be accurate to the 0.1 g level
OBR, HE Tests confirm simple Turns Counter effective close-in (<1000 m), Hybrid improves accuracy at greater ranges
### Accuracy Estimates from OBR Flight Data

#### AAAV Barrel @ 500 Meters

<table>
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<tr>
<th>SN</th>
<th>time counter</th>
<th>turns counter</th>
<th>hybrid</th>
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<tbody>
<tr>
<td>29</td>
<td>1.30</td>
<td>0.64</td>
<td>0.95</td>
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<tr>
<td>25</td>
<td>5.29</td>
<td>-0.64</td>
<td>-1.32</td>
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<tr>
<td>60</td>
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<tr>
<td>65</td>
<td>-3.30</td>
<td>-1.30</td>
<td>-1.20</td>
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<tr>
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<td>-3.30</td>
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<td>71</td>
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<tr>
<td><strong>Grouped</strong></td>
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<td><strong>1.14</strong></td>
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#### Gau 8 Barrel @ 500 Meters

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<td>10(2)</td>
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<tr>
<td>9</td>
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<td>0.20</td>
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<td>14</td>
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<td><strong>Grouped</strong></td>
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<td><strong>0.75</strong></td>
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#### AAAV Barrel @ 2000 Meters

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<tbody>
<tr>
<td>73</td>
<td>30.20</td>
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Video of Full-up HE Air Burst Rounds 12/07/2001
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