GENERAL DYNAMICS
Ordnance and Tactical Systems

NDIA 43rd Annual Armament Systems: Gun and Missile Systems Conference & Exhibition Event #8590
April 21-24, 2008
New Orleans, Louisiana

30x173mm High Explosive Incendiary Product Improvement

Approved For Public Release
GAU-8 Avenger
• 7 Barrel Rotary Cannon
• 30x173mm ammunition mix
• PGU-14/B Armor Piercing Incendiary (API)
• PGU-13/B High Explosive Incendiary (HEI)
• Light and Heavy Armored Ground Targets
PGU-13/B High Explosive Incendiary (HEI) Cartridge

Propulsion System
- Aluminum Cartridge Case
- Percussion Primer
- Flashtube
- Extruded Propellant

Projectile
- Steel Body
- Dual Plastic Driving Bands
- High Explosive Fill
- M505 Point Detonating Fuze

290mm (11.4in)
OPPORTUNITY:
Increase System Effectiveness
By Extending HEI Ballistic Match Range

1300m Altitude, 300 knots Aircraft Speed, 6° Dive Angle, Standard Atmosphere
Fire Control Solution Puts PGU-14/B On Target, PGU-13/B Falls Short
30x173mm PGU-13/B HEI Improvement

Incendiary Pellet

High Explosive

One-Piece Plastic Driving
Common Within Ammunition Family

Steel Front Body

Alternate Explosive Fill
Incorporates Incendiary Function
Volume Equal To PGU-13/B

Aft Body Is Cobalt Free Tungsten Alloy With High Iron Concentration
Boattail Added For Reduced Drag, Same As PGU-14/B API

NDIA Presentation, April 2008  Approved For Public Release
### Projectile Mass and Muzzle Velocity

<table>
<thead>
<tr>
<th>Projectile</th>
<th>Mass</th>
<th>Muzzle Velocity</th>
</tr>
</thead>
<tbody>
<tr>
<td>PGU-14/B API</td>
<td>426 g</td>
<td>990 m/s</td>
</tr>
<tr>
<td>Improved HEI</td>
<td>419 g</td>
<td>1013 m/s</td>
</tr>
<tr>
<td>PGU-13/B HEI</td>
<td>367 g</td>
<td>1021 m/s</td>
</tr>
</tbody>
</table>

Improved HEI is predicted to meet pressure and action time requirements using the same propulsion system as PGU-14/B.
Radial Miss Distance From PGU-14/B Mean Point Of Impact
As Fraction Of Range

Improved HEI Extends 1.2mil Threshold From 1430m to 3220m
A 125% Increase vs PGU-13/B
Improved HEI Extends 2 meter Threshold From 1420m to 2970m
A 110% Increase vs PGU-13/B
IMPROVED HEI STATUS:

• **Key innovation is the use of non-standard tungsten alloy aft body material** that adds a degree-of-freedom for projectile design. This eliminates sleeved designs that are susceptible to setback induced motion with associated potential for in-bore detonation.

• **Ammunition ICD requirements are met** and the ammunition family **common propulsion system can be utilized.**

• Bourrelet length is reduced 6% versus PGU-13/B (tends to increase dispersion) but aerodynamic jump factor is also reduced 19% (tends to decrease dispersion). Net effect is predicted 14% reduction in dispersion due to balloting. **No net increase in dispersion versus PGU-13/B is expected.**

• **The projectile is gyroscopically and dynamically stable,** predicted maximum yaw limit cycle is 1 degree.

• **Ballistic match is greatly improved (smaller miss distance)** past 1400m with only a small penalty below 1400m. Bi-conic ogive is believed to provide lower drag than modeled in this example. Margin could be used to reduce pressure (through reduced muzzle velocity) or to further extend ballistic match range.
IMPROVED HEI STATUS:

- Concept shown preserves blast and fire start lethality while eliminating separate incendiary pellet.

POTENTIAL CONCERNS:

- Predicted aft body stresses are higher than the expected strength of the cobalt free tungsten alloys being considered. Future optimization studies will likely reduce explosive volume to allow sidewall thickness increase for reduced stress. Ballistic match will be preserved.

- Net effect on lethality for reduced explosive payload will need to be evaluated; increased density of the aft body fragments should improve penetration.

- Direct contact of tungsten alloy with the bore is not now done for any product known to GD-OTS. Potential for increased barrel wear exists. The high iron concentration of the aft body should mitigate this risk and coatings are available to further reduce it.
NEXT STEPS:

- Verify capability to fabricate aft bodies over the potential range of densities.
- Characterize aft body material strength and finalize sidewall thickness.
- Evaluate methods for joining aft and front bodies.
- Evaluate metal parts security and total drag by ballistic test.

General Dynamics 30x173mm Improved HEI Provides A High Degree Of Compliance With Technical Requirements And Is Ready For Prototyping