GENERAL DYNAMICS
Ordnance and Tactical Systems

42nd Annual Armament Systems: Gun and Missile Systems
Conference & Exhibition
Event #7590
April 23 - 26, 2007
Charlotte, North Carolina

“Meeting Warfighter Needs for the Asymmetric Threat”

GD-OTS 20mmx102mm Mechanically Fuzed Projectile Program
Introduction:
GD-OTS 20mm Fuzed Cartridge Alternative

- For the last several years, GD-OTS has invested funds into the development of a mechanically fuzed variant to the 20mm PGU-28A/B.

- GD-OTS has made a conscious effort to make safety a number one priority during the development process.
- Fuze has been designed to operate with delay or point detonating mode.
- Fuze has capabilities in calibers other than 20mm.
Cartridge Safety and Performance Requirements

**Configuration Requirements**

- Fully compliant with current PGU-28A/B Cartridge envelope.
- Ballistic match with current 20mm PGU family of ammunition.
Performance Requirements

- **Design Requirements (Delay Fuze) per AS6120**
  - Function after impact with .063 inch aluminum plate at 200 yards
  - Function delay of 400-800 microseconds after impact with .080 inch aluminum plate at 200 yards
  - Function after impact with .080 inch aluminum plate @ 75° NATO at 200 yards
  - Produce a low order reaction of the body explosive after initiation
  - Defeat 3/8 inch RHA @ 45°obliquity with a probable ballistic limit velocity of 2786 ft/sec

- **Design Requirements (Point Detonating)**
  - Function after impact with .063 inch aluminum plate at 200 yards
  - Function after impact with .080 inch aluminum plate @ 75° NATO at 200 yards
  - Produce a high order reaction of the body explosive after initiation
  - Defeat 3/8 inch RHA @ 45°obliquity with a probable ballistic limit velocity of 2786 ft/sec
Identify Fuze Requirements

- Must fit within PGU 28A/B Nose envelope.
- Must be within reasonable range of current PGU 28A/B pyrotechnic nose mass.
- Must be able to function across all temperature extremes.
- Must be able to defeat light skin targets at both low and high graze angles.

Safety

- Survive acceleration at high temperature and pressure launch
- Fully compliant with Mil-Std-1316
- Fully compliant with Mil-Std-331 and Mil-Std-810 cartridge safety and environmental requirements
- Fully compliant with Mil-Std-1751
Approach

- Identify Fuze Requirements
- Conduct Market Survey
  - Conduct Risk Assessment.
  - **Key parameters:**
    - Method of initiation
    - S&A type
    - Firing train
    - Fuze interface with projectile body
    - Maximum commonality to existing 20mm
- **Other Factors**
  - Performance history
  - Minimize fuze design changes to interface with existing 20mm projectile configuration
  - Ease of qualification
- Acquire Test Hardware
- Conduct Design Demonstration Testing
Cartridge Description

The General Dynamics-OTS solution utilizes the following:

- A ball rotor approach fuze similar to the M505 that employs dual independent safeties and can function in either the delay or point-detonating mode.
- Ballistic match to the 20mm PGU family of ammunition.
- Meets the 20mmx102mm Cartridge envelope.
- Utilizes components common to the 20mm PGU family of ammunition.

GD-OTS developed a cartridge to meet the requirements of the USAF and leverage commonality with existing technology and manufacturing processes.
Cartridge Description

- Cartridges utilize same propellant and LAP facility.
Trajectory Conditions:

- Aircraft Altitude: 6,000 ft ASL
- Aircraft Airspeed: 450 knots
- Muzzle Velocity: 3440 ft/sec
- Standard Atmospheric Conditions

PGU-28A/B, 20mm Mechanically Fuzed Variant
Trajectory Comparisons

Projectile Velocity At Slant Range

- 20mm SAPHEI PGU-28A/B
- 20mm LD w/MECHANICAL FUZE
PGU-28A/B, 20mm Mechanically Fuzed Variant Trajectory Comparisons

Trajectory Conditions:
- Aircraft Altitude: 6,000 ft ASL
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- Muzzle Velocity: 3440 ft/sec
- Standard Atmospheric Conditions

Projectile Time of Flight at Slant Range
PGU-28A/B, 20mm Mechanically Fuzed Variant Trajectory Comparisons

Projectile Drop at Slant Range

Trajectory Conditions:
- Aircraft Altitude: 6,000 ft ASL
- Aircraft Airspeed: 450 knots
- Muzzle Velocity: 3440 ft/sec
- Standard Atmospheric Conditions
Hand Safety Testing

Primary Component
Safety Test Set Up from
Mil-Std-331
Hand Safety Testing

Design passes the D1 “Out of Line” safety test per Mil-STD-331
Detonation Delay/Point Detonating Test Set-Up Description

- Target Array
- Gun and Mount
- Aluminum Trigger Plate
- Witness Panels 4’ and 6’ Behind Trigger Plate

630 ft
Pictures from Demonstration Testing

Impact with .080” Aluminum at 200 yards

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Pictures from Demonstration Testing

Ø of hole is approximately 60mm

.080” Aluminum trigger plate
for point detonating test

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Pictures from Demonstration Testing

.080” Aluminum Trigger plate (75 degrees) for Graze Sensitivity Test, 100% Function

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Pictures from Demonstration Testing

Witness Panel 4' behind trigger plate for Graze Sensitivity Test

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Summary of Results

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<th>Verification Tests</th>
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<td>Static Booster Testing</td>
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<td>Complete</td>
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<td>Complete</td>
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<tr>
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<tr>
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<td>Met Requirement</td>
<td>Expected to meet requirement per AS6120</td>
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<tr>
<td>Projectile Sensitivity</td>
<td>Demonstrated</td>
<td>Demonstrated</td>
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<tr>
<td>Point Detonating Function</td>
<td>N/A</td>
<td>Demonstrated</td>
</tr>
<tr>
<td>Fragmentation</td>
<td>Test Not Performed, witness panel comparison to PGU 28-A/B yields better fragmentation</td>
<td>Test Not Performed</td>
</tr>
<tr>
<td>Graze Sensitivity (75 Degrees)</td>
<td>Demonstrated</td>
<td>Demonstrated</td>
</tr>
<tr>
<td>Function and Casualty</td>
<td>Test Not Performed</td>
<td>Test Not Performed</td>
</tr>
<tr>
<td>Safety Tests</td>
<td>Passed Mil-Std-331 D1 Out-of-Line Safety Test @ Ambient, Tests at Hot Yet to be Conducted</td>
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</tr>
<tr>
<td>No-Arm (3 meters against .040&quot; Al)</td>
<td>Passed</td>
<td>Passed</td>
</tr>
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**GD-OTS has performed testing against all of the key baseline performance requirements to ensure future success**
Summary

• GD-OTS has developed and successfully demonstrated a Mil-STD-1316 compliant, mechanically fuzed variant, both point detonating and delay, to the 20mm PGU 28 A/B Cartridge.

• Fuze has been proven to function across temperature extremes.

GD-OTS has completed significant testing and investment on a 20mm fuzed cartridge and is prepared to move forward.
Questions?