2014 Joint Armaments Forum, Exhibition & Technology Demonstration for Small Arms, Guns, Ammunition, Rockets & Missile Systems

Event #4610
May 12-15, 2014
Phoenix, AZ
“Balancing Armament Innovation and Readiness Improvements within Budget Constraints”
LW30mm SMP®855 Propellant Development

Government and industry working together to balance armament innovation and readiness improvements within budget constraints.

Government  

Industry

GENERAL DYNAMICS
Ordnance and Tactical Systems

PIE-T  M788  M789  TP-Spotter
LW30mm Ammunition: Background

The US Army’s Apache helicopter has experienced M789 HEDP ammunition issues in the field that require Government and industry attention:

**Issue:**
1. Long term ammunition exposure to high temperature storage can result in a propellant chemical breakdown resulting in higher pressures that damage the Apache’s LW30mm M230 weapon
2. Projectile muzzle velocities at temperature extremes do not match the weapon fire control which result in missed targets
LW30mm Propellant Solution

PMMAS, ARDEC, GD-OTS, and St. Marks Powder® have worked together to develop, test, load M788 and M789 qualification lots, and conduct qualification testing to resolve the performance issues.

Solution:
SMP®855 Ball Powder® Propellant from St. Marks Powder® was developed using stabilizing chemicals to endure robust high temperature storage and
• Produce normal operating pressures after exposure to long term high temperature storage
• Yield muzzle velocities that match the weapon fire control across temperature extremes
LW30mm Apache Ammunition Description

- **SMP®855 BALL POWDER® PROPELLANT**
Issue 1: Severe High Pressure Results after Long Term High Temperature Storage

Damaged Apache LW30mm M230 Weapon

Damaged LW30mm M789 HEDP Cartridges
Issue 1:
Long Term High Temperature Stability Solution

**M788 Pressure when aged at 71°C fired at 21°C**

- **Maximum Hot/Cold Temperature Pressure Limit**
- **Maximum Ambient Temperature Pressure Limit**

**Propellant**

- **Standard Production Propellant**
- **Improved Propellant Performance**

High pressures resulting in weapon failures

M789 HEDP

Propellant
Problem 2: Apache Fire Control Muzzle Velocity Profile

- Projectile velocity differences from the Apache fire control result in missed targets when fired at temperature extremes.
- SMP®855 brings extreme temperature muzzle velocities back to fire control velocities.

![Graph showing velocity vs. temperature for Apache Fire Control and 80's, 95's production models, with a comparison to current production values.](image-url)
## LW30mm Propellant Improvement Schedule

<table>
<thead>
<tr>
<th>Task Description</th>
<th>Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMP®855 Qualification lot built</td>
<td>Complete</td>
</tr>
<tr>
<td>Build M788 TP and M789 HEDP qualification lots</td>
<td>Complete</td>
</tr>
<tr>
<td>US Army qualification tests</td>
<td>Q2 2014</td>
</tr>
<tr>
<td>M788 and M789 ECP approved</td>
<td>Q4 2014</td>
</tr>
<tr>
<td>Revised M788 and M789 performance specification</td>
<td>2015</td>
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</table>

Government and industry working together to incorporate SMP®855 into the LW30mm ammunition TDPs
# LW30mm Propellant Qualification Matrix

<table>
<thead>
<tr>
<th>Test Description</th>
<th>Test Rounds</th>
<th>Status</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>M788</td>
<td>M789</td>
</tr>
<tr>
<td>40-Foot Drop Test</td>
<td>440</td>
<td>440</td>
</tr>
<tr>
<td>Sympathetic Reaction Test 1</td>
<td>440</td>
<td>440</td>
</tr>
<tr>
<td>Sympathetic Reaction Test 2</td>
<td>440</td>
<td>440</td>
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<tr>
<td>Liquid Fuel External Fire</td>
<td>440</td>
<td>440</td>
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<tr>
<td>Transportation Vibration at Temperature</td>
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<tr>
<td>Temperature- Humidity</td>
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<tr>
<td>Extreme Temperature Storage</td>
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<tr>
<td>Temperature Shock</td>
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<tr>
<td>Pressure, Velocity, and Action Time*</td>
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<tr>
<td>Temperature, Humidity, and Altitude</td>
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<tr>
<td>Aircraft Vibration</td>
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<tr>
<td>Toxic Fumes</td>
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<tr>
<td>Test Spares</td>
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<tr>
<td>Thermal Characterization</td>
<td>Components</td>
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<tr>
<td>High Temperature Stability</td>
<td>Propellant</td>
<td>-</td>
</tr>
<tr>
<td>* All testing except PVAT conducted by the USG</td>
<td>2605</td>
<td>1760</td>
</tr>
</tbody>
</table>
Summary

• PMMAS, ARDEC, GD-OTS, and St. Marks Powder® have successfully worked together to bring SMP®855 propellant through qualification

• Solution addresses ammunition issues reported from the field:
  • Ammunition propellant capable of handling long term high temperature storage
  • Ammunition propellant that complies with the Apache fire control extreme temperature muzzle velocities

“Innovation and Readiness Improvement within Budget Constraints”
Points of Contact

Medium Caliber Ammunition and Weapons Systems
Marion, IL Operations
6658 Route 148 South
Marion, IL  62959
www.gd-ots.com

Matt Solverson
Director of Marketing and Business Development
618-993-9306
Matthew.Solverson@gd-ots.com

Paul Reynolds
R&D Sr. Associate Engineer
618-993-9331
Paul.Reynolds@gd-ots.com