Unique Partnership to Provide Precision and Lethality to Tomorrows Warfighter

US Army, Alliant Techsystems and Rheinmetall Nitrochemie

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Guns and Missile Systems - 17-20 May 2010
Presenter: Kelly Brown Moran  kelly.moran@atk.com
Combining Nitrochemie’s Advanced Technology with ATK’s High Volume Manufacturing to Provide our DOD Customers with Key Requirements

Combining Nitrochemie’s modern world class propellant production capabilities with the US Army’s largest propellant production facility
Manufacturing License provides the exclusive ability to transition production of the following advanced propelling solutions: EI, ECL, SCDB, R-Type and Combustible Cartridge Cases
120mm Mortar Extended Range + Igniter Improvements

Lead by Howard Shimm, ARDEC, Picatinny Arsenal
Demonstrated range to 8.2 km; currently demonstrating non-NG igniter

XM350 – Combining the M67 and M200 charges into single charge round

Lead by Nguyen Tran, ARDEC, Picatinny Arsenal
Combining the M67 & M200 systems into single cartridge

LW30 Qualification Program

Lead by Andy Lewis, PM MAS, Picatinny Arsenal
Demonstration and Qualification of Improved LW30 propellant

Next Generation 120mm Tactical Tank

Lead by ATK – Advanced Weapons
Demonstration of flat temperature response in the 120mm tactical tank
# Advantages of ECL Across All Systems

<table>
<thead>
<tr>
<th>Improved Characteristic's of ECL®</th>
<th>Translates to…</th>
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<tbody>
<tr>
<td>High energy density formulations</td>
<td>Improved ballistic performance and efficiency</td>
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<td>High thermal conversion</td>
<td>Flat, tuneable ballistic profile across temperatures</td>
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<tr>
<td>Tuneable performance and force</td>
<td>Improved dispersion, repeatability</td>
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<td>No mobile plasticizers, non-nitroglycerin</td>
<td>No migration of NG into cases</td>
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<td>Improved system compatibility</td>
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<td>Improved safety during manufacture</td>
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<td>Enhananced IM properties</td>
<td>Higher cook off temps - improved crew survival</td>
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<td>Less sensitive/no reaction to impact</td>
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<td>Non-toxic, &quot;green&quot; formulation</td>
<td>Better for the environment</td>
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<td>Better for the user/manufacturer</td>
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<tr>
<td>Chemical stability</td>
<td>Ammunition can be deployed to extreme climates</td>
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<tr>
<td>Ballistic stability</td>
<td>with no degradation in performance</td>
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<td>Longer service life for ammunition</td>
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Requirements for Future Fight Scenarios:

*Mortars are becoming the weapon of choice due to mobility*

- Ability to compensate for heavier projectiles
  - ECL® provides energy density necessary for precision guided rounds

- Potential for extension of battle space ranges
  - ECL® has the potential to extend range out to 12 km

- Reduction in number of rounds fired to eliminate target
  - ECL® demonstrates consistent ballistics & improved dispersion

- Safe use / storage in hot climatic zones + no NG, no toxic ingred
  - ECL® provides reduced life cycle costs, reduced demil costs
  - Ideal candidate for improved celluloid cases
ECL® Propellant Demonstrates Stability and Range

**ECL® Excellent Ballistic Stability and Performance**

Results from Tests Yuma, June 2008

Extended Range Propellant Candidate Comparison

- **ECL® Conditioned at 71 C for 20 days**

- **ECL®** exhibits **NO CHANGE** in velocity compared to competitors
- **Provides CONSISTENT BALLISTICS** after hot temperature storage

- **8.2 km range achieved with 80% bulk fill of case**
- **Perfect candidate for future extended range mortar solutions**

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<tr>
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<th>+70 F</th>
<th>+145 F</th>
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<tbody>
<tr>
<td>Velocity</td>
<td>8190 m</td>
<td>8460 m</td>
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<tr>
<td>ToF</td>
<td>43.9 s</td>
<td>44.8 s</td>
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<tr>
<td>Pressure</td>
<td>14.4 kpsi</td>
<td>17.1 kpsi</td>
</tr>
<tr>
<td>Range</td>
<td>8.2 km</td>
<td>8.5 km</td>
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XM350 – Concept 2009

A premier aerospace and defense company

Gun
- M119A2

Propellant
- M1 (DNT, DBP, DPA)

Range
- 11.5 km

Gun
- M119A2

Propellant
- M30 (NG, NQN)

Range
- 14 km
Results of Velocity Measurements – Yuma PG

Highest pressure at ambient, pressure drop at hot!

Future Efforts include:
- Modelling of propellant design (coating and process parameters)
- Slight correction of temperature behaviour for highest zone
- Evaluate advantages of a 7 Zone solution
- Work towards Qualification Program
Failures in Field Lead to New Propellant Qual

**Current LW-30 Ammunition Family**

- M789 HEDP/ M788 TP
- Fired from the M230 on the AH-64 Apache
- Propulsion: PA520 primer + 3 FT pellets + WC 855 BALL POWDER®

**Investigation identified propulsion system weaknesses as one root cause for hang fire signature**

- Propellant Aging – propellant becomes chemically and ballistically unstable
- Ignition System – nitrocellulose lacquer seal failure
ECL® Propellant Superior Stability Response

A premier aerospace and defense company

**ECL® Propellant Superior Stability Response**

- Large variation in ballistic stability response for WC-855 after hot temp storage
- Propellant lot ‘X’ reaches upper spec limit for pressure after 7 days at 71 C

**Safety Concern for User!**

No change in ballistic performance of ECL after 33 days at 71 C!

- Ball propellant analyzed 0% stabilizer after 18 days at 71 C
- ECL propellant analyzed 1.1% stabilizer after 18 days at 71 C

After 33 days, ECL analyzed with 83% primary stabilizer
• Extreme pressures (> 500 MPa) measured with ammunition that suffered from ignition failure coupled with propellant

• To demonstrate superiority of ECL, M592 ammo container loaded with 20 rounds (ball propellant) and 90 ECL rounds subjected to vibration testing

• Vibration testing consisted of 500+ hours of vibration across 3 axes coupled with over 350 hours of temperature cycling (-40 to +65 C) in the M592 container

• ECL rounds tested at ambient, hot +71 C and cold -54 C

• Ball propellant rounds only tested at ambient due to high pressure ~ Pressure increase of approximately 40%
ECL® Exceeds Ballistic Performance of Ball Powder WC 855:

✓ Lower Charge Weight ~ -5%
✓ Higher Velocity ~ +15 m/s
✓ Reduced Pressure ~ -20% at hot

Extra Efficiency of ECL Translates to:

✓ Extended Range
✓ Increased Lethality
✓ Cost Savings
✓ Ballistic Margin
Innovation ... Delivered.

ECL is currently undergoing qualification testing for 30mm Apache ammunition.

Extruded Composite Low-sensitivity (ECL) gun propellant allows 30mm Apache ammunition to provide low dispersion at cold, ambient and hot operating temperatures. ATK.

www.atk.com
Same high performance as predecessor DM53 but SCDB offers:

- 3 times lower gun barrel wear
- Temperature-independent peak pressure, velocity, projectile acceleration, and projectile trajectory
- Perfect for all climatic regions: full function from -46 C to +63 C
- Lower dispersion / higher hit probability
- Reduced peak pressure and recoil impulse
- Excellent IM properties due to optimized formulation and surface coating
- Qualified and in series production since 2005; introduced in Germany, Netherlands, Finland, Denmark, Austria, Canada, Turkey
Thanks and Questions?

Thanks for your attention!

Questions???

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