Unique Partnership to Provide Precision and Lethality to Tomorrows Warfighter

Teaming for Performance

US Army, Alliant Techsystems and Rheinmetall Nitrochemie

2010 Joint Armaments Conference
Guns and Missile Systems - 17-20 May 2010
Presenter: Kelly Brown Moran kelly.moran@atk.com

ATK

RHEINMETALL NITROCHEMIE

Bringing Advanced Propellants to the US DOD Market

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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

Advanced Products – Plan to Transition

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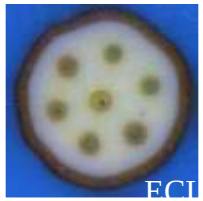
Manufacturing License provides the exclusive ability to transition production of the following advanced propelling solutions: EI, ECL, SCDB, R-Type and Combustible Cartridge Cases

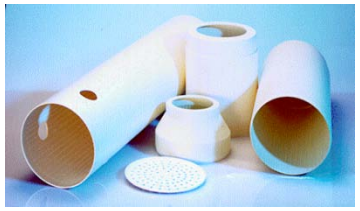
EI

ECL

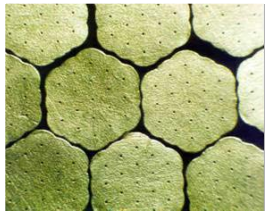


SCDB

CCC



R Type



Current Projects with DOD

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

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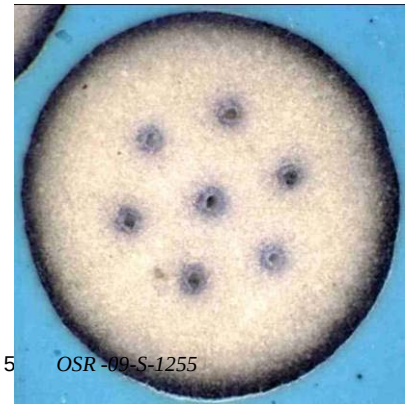
Improved Characteristic's of ECL®	Translates to…
High energy density formulations High thermal conversion Tuneable performance and force	Improved ballistic performance and efficiency Flat, tuneable ballistic profile across temperatures Improved dispersion, repeatability
No mobile plasticizers, non-nitrogylcerin	No migration of NG into cases Improved system compatability Improved safety during manufacture
Enhananced IM properties	Higher cook off temps - improved crew survival Less sensitive/no reaction to impact
Non-toxic, "green" formulation	Better for the environment Better for the user/manufacturer
Chemical stability Ballistic stability	Ammunition can be deployed to extreme climates with no degredation in performance Longer service life for ammunition

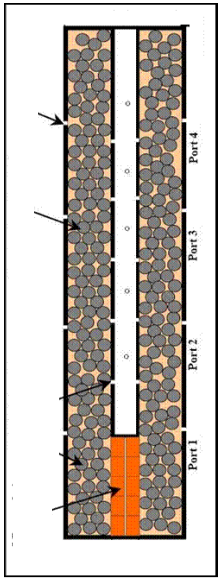


Future Path of Mortar Propellants – Synergy of System

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

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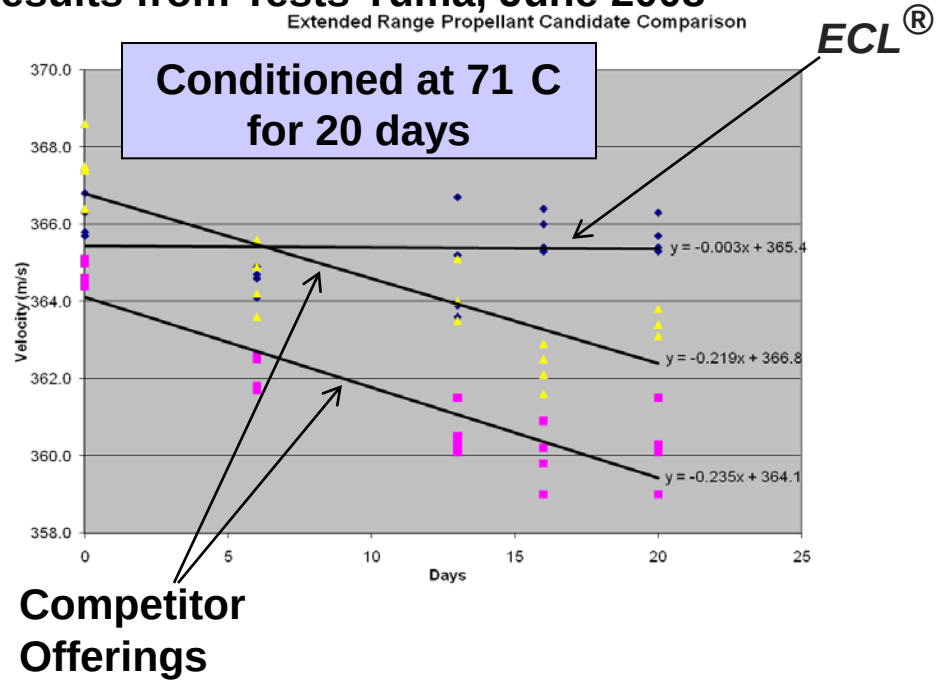
ECL® ➢ Excellent Ballistic Stability and Performance

Results from Tests Yuma, June 2008



ECL®	+70 F	+145 F
Velocity	8190 m	8460 m
ToF	43.9 s	44.8 s
Pressure	14.4 kpsi	17.1 kpsi
Range	8.2 km	8.5 km

- 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

XM350 – Concept 2009

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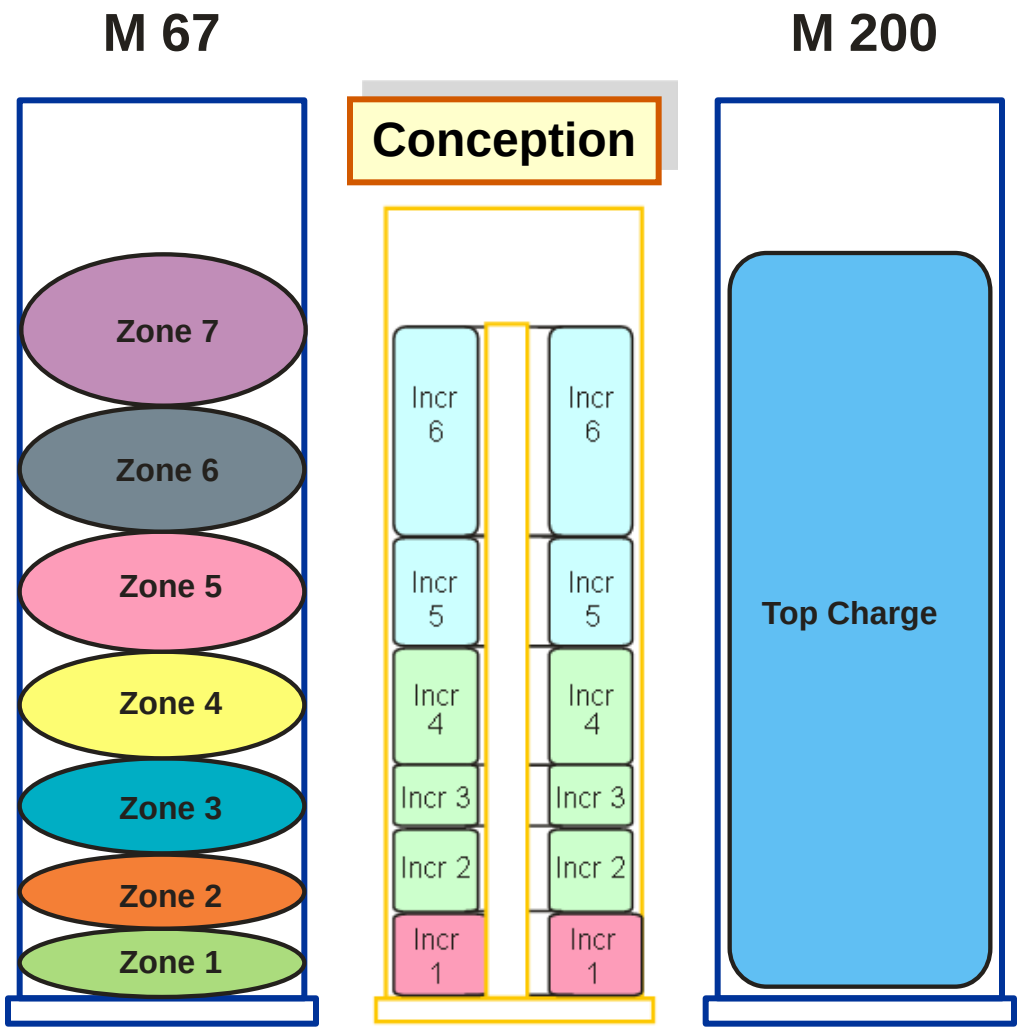
Gun
- M119A2

Propellant
- M1 (DNT, DBP, DPA)

Range
- 11,5 km

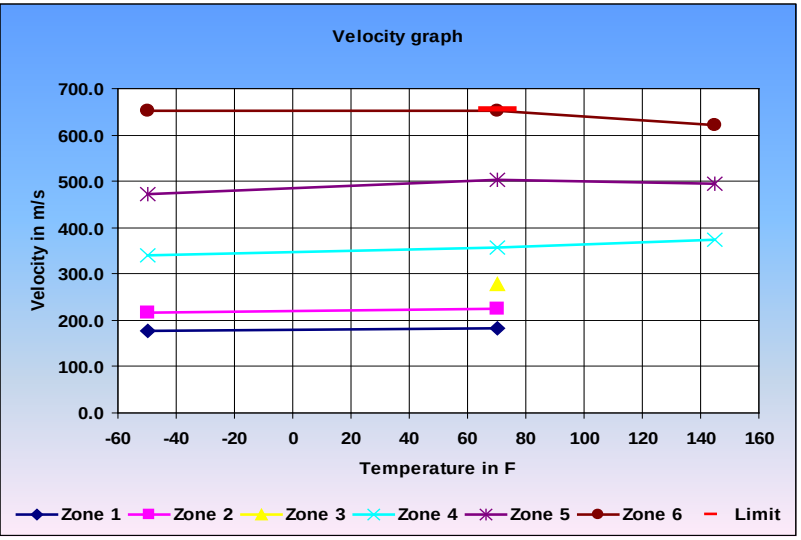


Gun
- M119A2

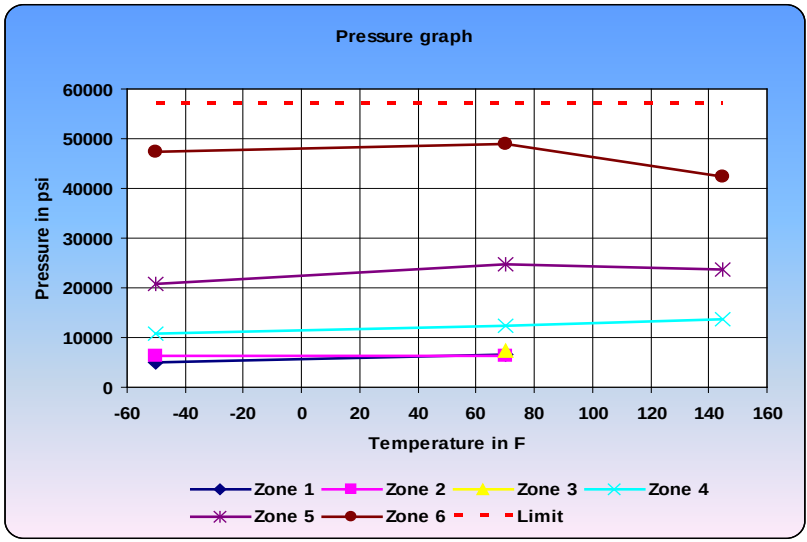
Propellant
- M30 (NG, NQN)

Range
- 14 km

Results of Velocity Measurements – Yuma PG



Zone	Goal	Actual
1	185	190
2	225	225
3	279	280
4	353	355
5	498	500
6	656	652



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

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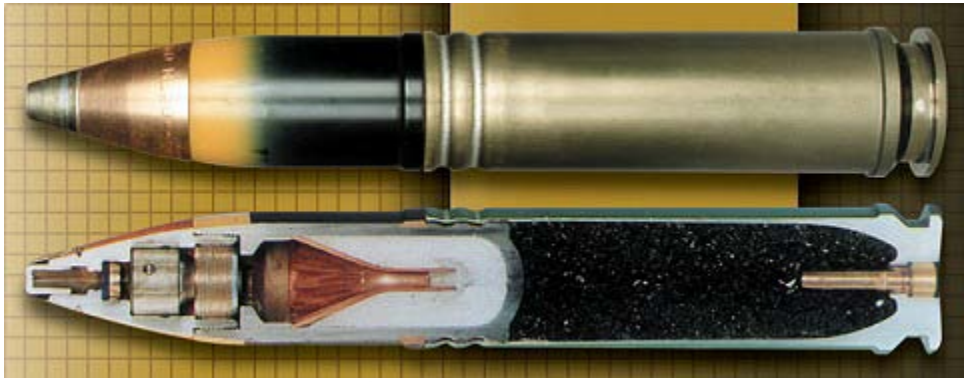
Current LW-30 Ammunition Family

- 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

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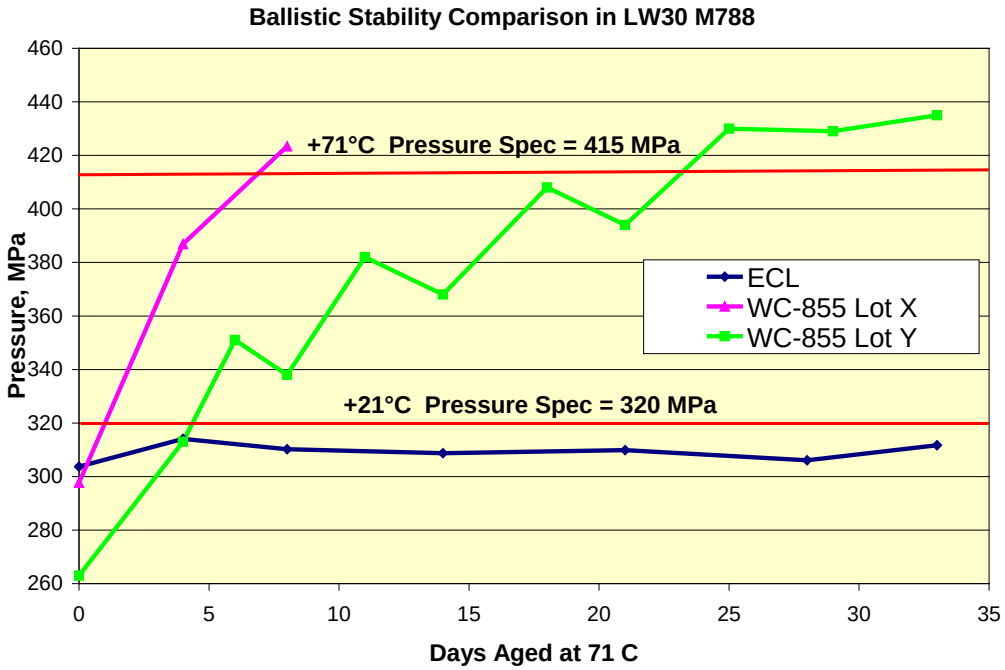
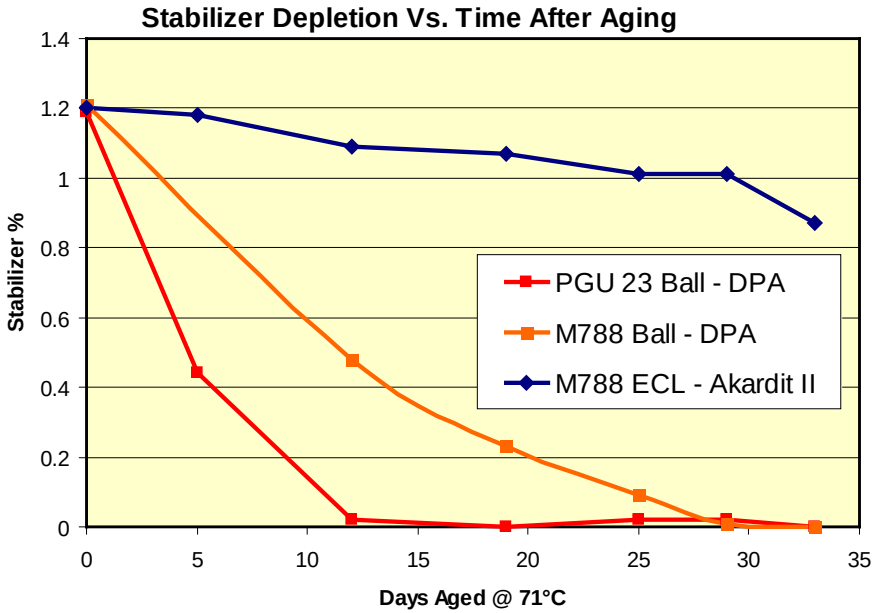




- **Large variation in ballistic stability response for WC-855 after hot temp storage**
- **Propellant lot 'X' reaches upper spec limit for pressure after 7 days at 71 C**

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

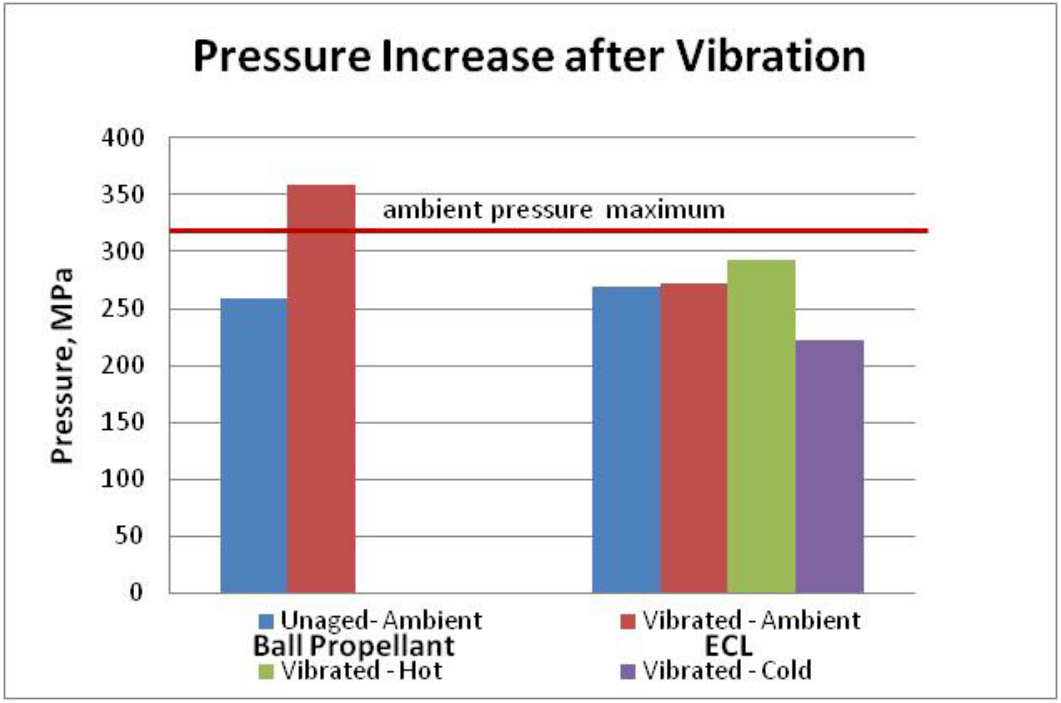
Safety Concern for User!

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

After 33 days, ECL analyzed with 83% primary stabilizer

LW30 Vibration Testing

- **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%**



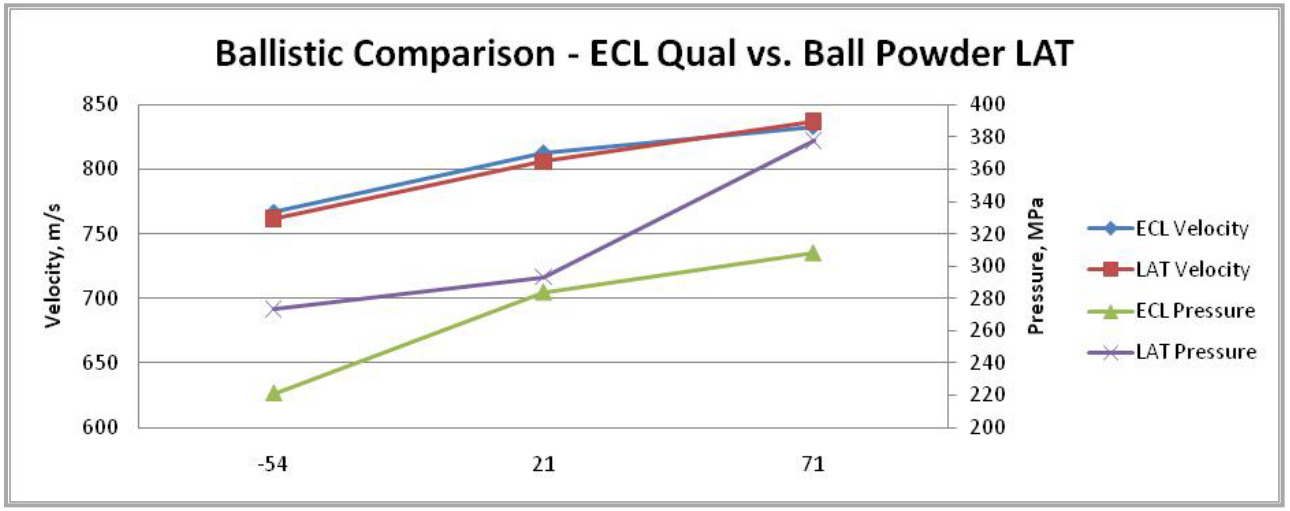
LW30 PVAT Advantages

ECL® Exceeds Ballistic Performance of Ball Powder WC 855:

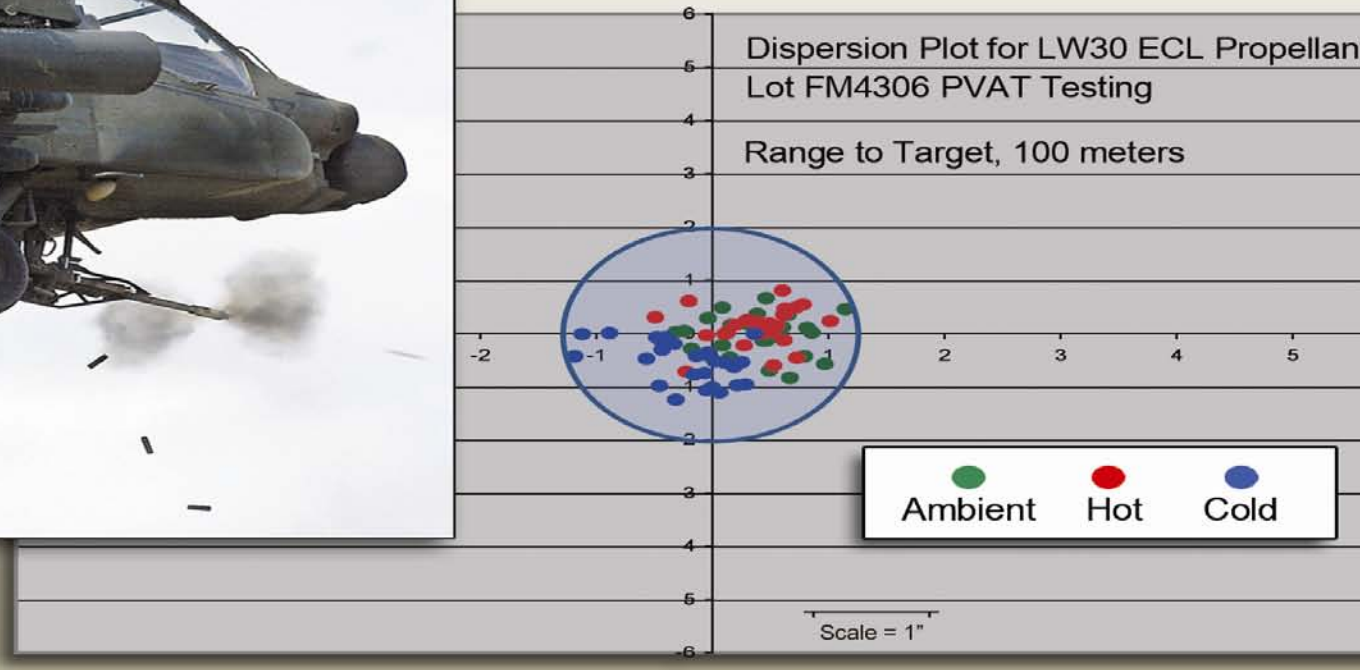
- ✓ Lower Charge Weight ~ -5%
- ✓ Higher Velocity ~ +15 m/s
- ✓ Reduced Pressure ~ -20% at hot

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.

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Photo courtesy of the U.S. Army

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

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SCDB – Future for Advanced Tactical Tank

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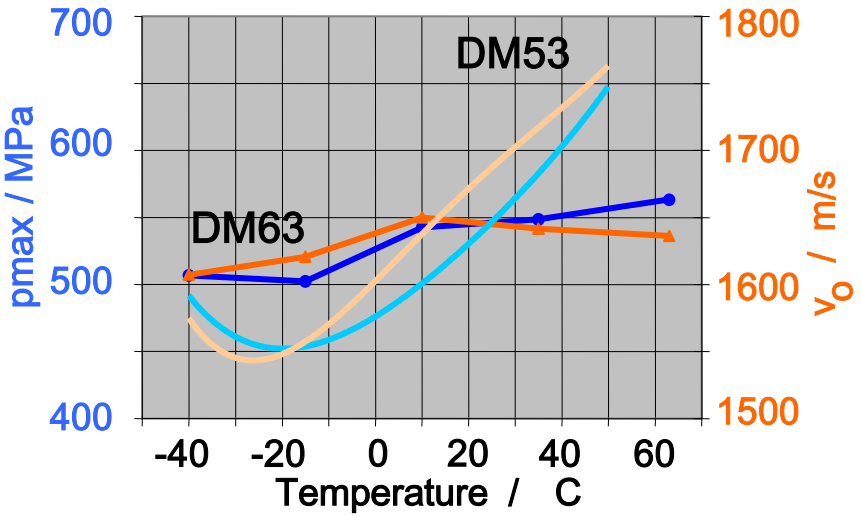
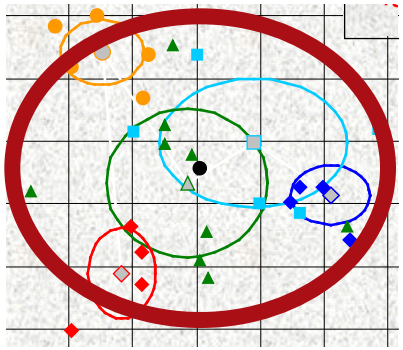
Same high performance as predecessor DM53 but SCDB offers:

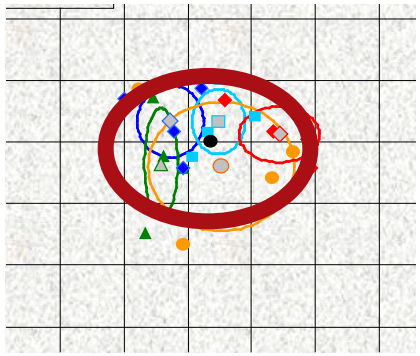
- **3 times lower gun barrel wear**
- **Temperature-independent peak pressure, velocity, projectile acceleration, and projectile trajectory**
- **Perfect for all climatic regions: full function from -46 C to +63 C**
- **Lower dispersion / higher hit probability**
- **Reduced peak pressure and recoil 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**



conventional



DM 63



Thanks and Questions?

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Thanks for your attention!

Questions???

For Sales and Technical Assistance, please contact the program offices:

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