

# Firing US 120mm Tank Ammunition in the Leopard 2 Main Battle Tank

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1. Overview of tanks and ammunition
  - Interoperability of the weapon and ammunition
2. Objectives of the test conducted in Denmark
3. Results of the firings in Leopard 2 with L44 and L55 weapon system
4. Conclusions

# Description of US Tank Ammunition



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## US 120mm Tank Ammunition Types



Several US ammunition types with interoperability maintained through International JCB by controlling interface features (ICD)

# Abrams and Leopard 2 MBT With 120mm Smoothbore Cannon



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## Abrams Tanks



M1A1 Abrams  
(M256 ~ L44 Weapon)



M1A2 Abrams  
(M256 ~ L44 Weapon)

## Leopard 2 Tanks

Leo2A6  
L55 Weapon  
(Dutch)



Leo2A5  
L44 Weapon  
(Danish)



Leo2A4  
L44 Weapon



Several MBT configurations with 120mm weapon. Interoperability is maintained through international JCB by controlling interface features (ICD)

# 120mm Smoothbore Compatible Platforms



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Platform Picture	Type and Country	Caliber	Basic Load	Tactical Rounds	Training Rounds	Comments
 	<p><b>M1A1 Abrams</b> USA, Australia, Kuwait, Egypt</p> <p><b>M1A2 Abrams</b> USA, Saudi Arabia</p>	44	40 rounds	M829A3 M829A2 M829A1 M830 M830A1 M1028 KEW, KEWA1, KEWA2	M865 M831A1 M1002	Training and Tactical designed for 120mm Compatible Weapon systems
	<p><b>Leopard 2 A4 or A5</b> Germany, Austria, Chile, Denmark, Norway, Finland, Switzerland, Sweden, Greece</p>	44	42 rounds	DM33 DM53 DM63 DM12A1 DM11 DM31	DM48 DM18	Training and Tactical designed for 120mm Compatible Weapon systems
	<p><b>Leopard 2 A6</b> Germany, Canada, Netherlands, Spain, Greece</p>	55	42 rounds	DM33 DM53 DM63 DM12A2	DM38/A1-5 DM48 DM18 M865 M865C1	Training and Tactical designed for 120mm Compatible Weapon systems

1. Ammunition meets the requirements of NATO STANAG 4385
  - Designed, tested and manufactured to this standard from beginning.
  - Interoperability is maintained by the Interface Control Document (ICD)
  - ICD is maintained by International Joint Configuration Board
  
2. Ammunition interoperability is demonstrated when fired from the compatible platform.

## Where US Tank Ammunition has been fired

	L44 (M256)	L55	Countries that have fired the ammunition
M830 HEAT-MP-T	✓		USA, Egypt, Kuwait, Saudi Arabia
M830A1 HEAT-MP-T	✓	✓	USA, Australia, Denmark, The Netherlands
M831A1 TP-T	✓		USA, Australia, Austria, Denmark, Egypt, Finland, Kuwait, Saudi Arabia
M865 TPCSDS-T	✓	✓	USA, Australia, Austria, Denmark, Egypt, Finland, Kuwait, Norway, The Netherlands, Saudi Arabia
M908 HE-OR-T	✓		USA
M1002 TPMP-T	✓	✓	USA, Denmark, The Netherlands
M1028 Canister	✓	✓	USA, Australia, Denmark, The Netherlands
KEWA1 APFSDS-T	✓		USA, Egypt, Kuwait, Saudi Arabia
KEWA2 APFSDS-T	✓	✓	USA, Australia, Egypt, Kuwait, Denmark, The Netherlands

## Purpose of test firing

1. Support NATO Allies for deployment in Afghanistan
2. Demonstrate the interoperability of US ammunition in the Leopard 2 tank with L44 and L55 weapon system
  - M865 and M831A1 training ammunition is already used by countries with Leopard 2 tanks
3. Check ammunition performance across temperature and distance using the existing Leopard 2 firing control
4. Demonstrate functional performance against targets when fired from the L44 and L55 weapon system

**Demonstrate the interoperability in the Leopard 2 Tanks**

# How We Arranged the Demonstration Test



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- The Danish Army hosted the event in Oksboel Training Center
  - Provided the test range, targets, Leopard 2/A5 MBT, test crew and instrumentation, facilities and transportation on site, and focal point for logistics.
- The Dutch Army provided the Leopard 2/A6 MBT, test crew and instrumentation, and assisted in coordination and logistics
- The ammunition producers, ATK and GD-OTS, provided the ammunition and assisted in logistics and support.
- US Army provided on site support at the test

The Demonstration Test took several months of planning. As cooperation and enthusiasm grew we decided to invite other 120 user nations to witness the test. 12 Countries were able to attend the test.

# Demonstration Test Firing in Oksboel, Denmark



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Test fired 4 types of US ammunition across temperatures in the

- Danish Leopard 2/A5 with L44 weapon system
- Dutch Leopard 2/A6 with L55 weapon system (longer gun)



**M1002  
TPMP-T**



**KEWA2™  
APFSDS-T**



**M830A1  
HEAT-MP-T**



**M1028  
Canister**

# M1002 MPTP-T Training Round NSN 1315-01-509-3555

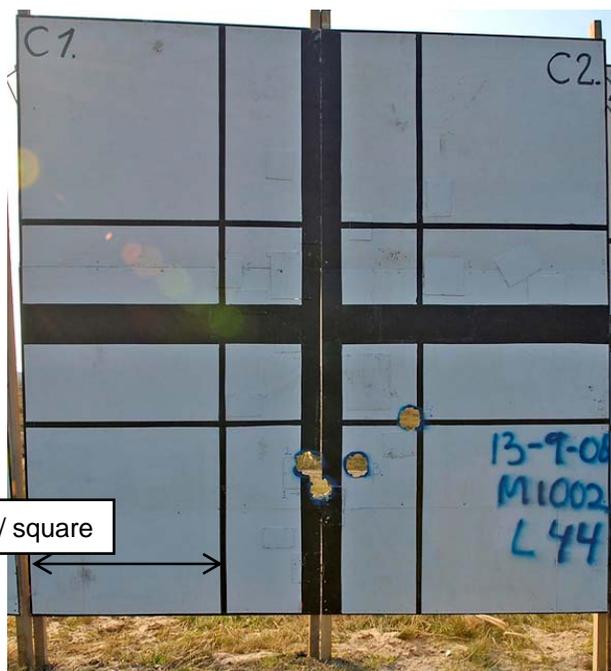


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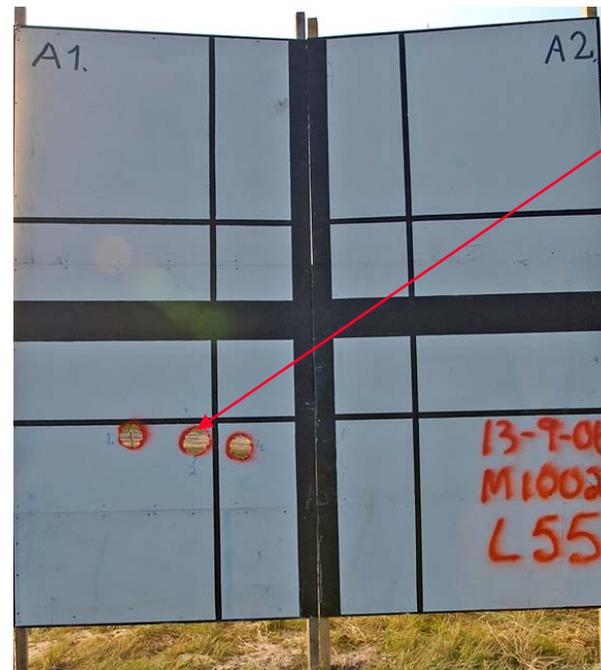
Test Fired 20 rounds to verify fire control across temperatures:

- 6 from each tank at temperature -32C, +21C, +50C tracking projectile to tank fire control
- 4 from each tank using the existing Leopard 2 tank Ballistic setting, A2 of fire control system, at +21C for zeroing on a target at 1,000m measured for precision
- Results (H X V mils) L44 = 0.14 X 0.22 , L55 = 0.20 x 0.03

Results showed ammunition works well in Leopard 2 Tank System



L44 Gun



L55 Gun

2 rounds went through the same hole

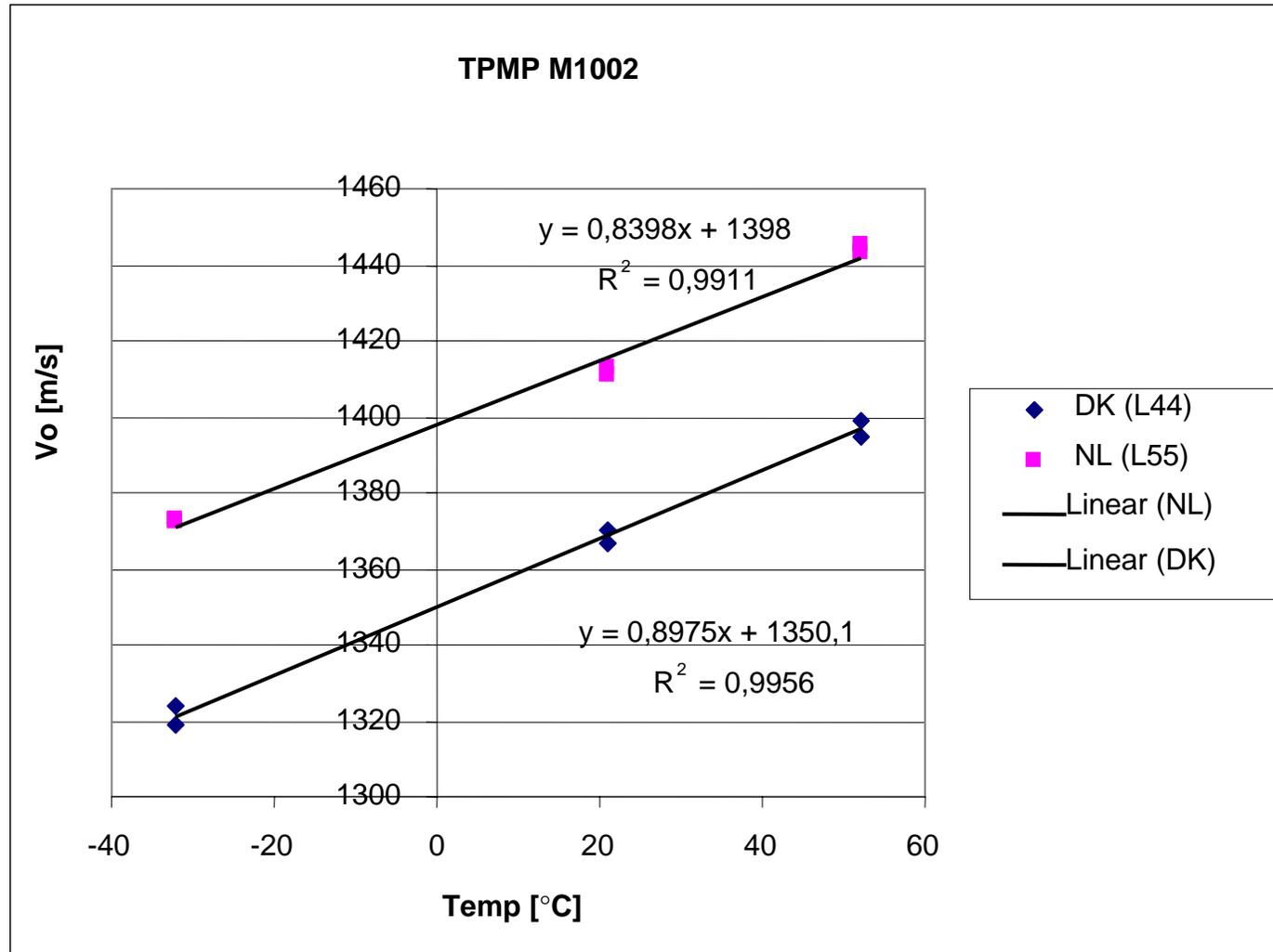


# M1002 Training Round Velocity Data



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Velocity versus temperature in L44 and L55 Weapon.

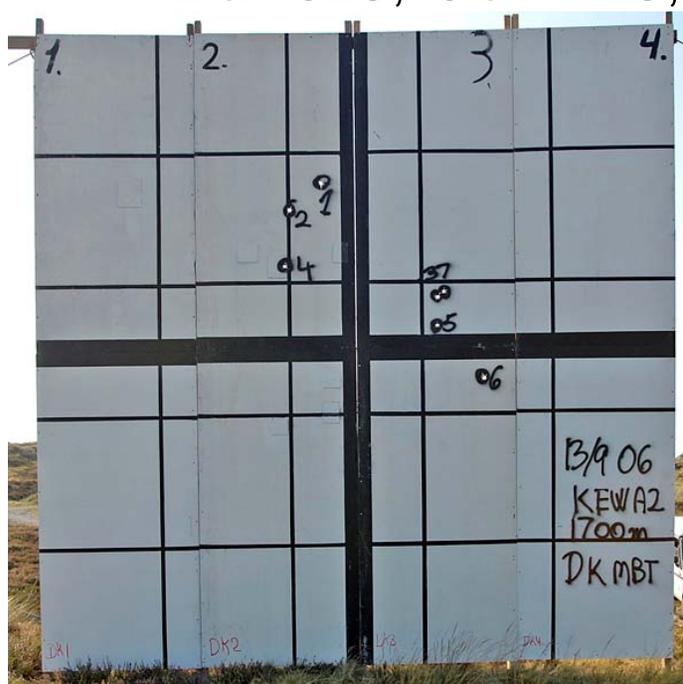


# KEWA2™ APFSDS-T NSN 1395-01-524-9642

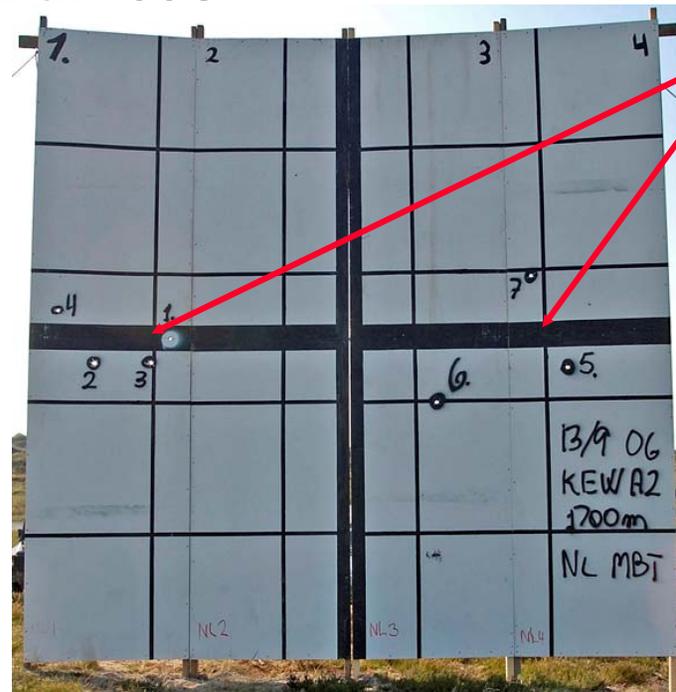


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- 14 rounds fired across temperatures
- 7 rounds in each tank across temperatures at 1700 meters
  - 2 at -32C, 3 at +21C, 2 at +50C



L44 Gun



L55 Gun

Changed aim point after round #4



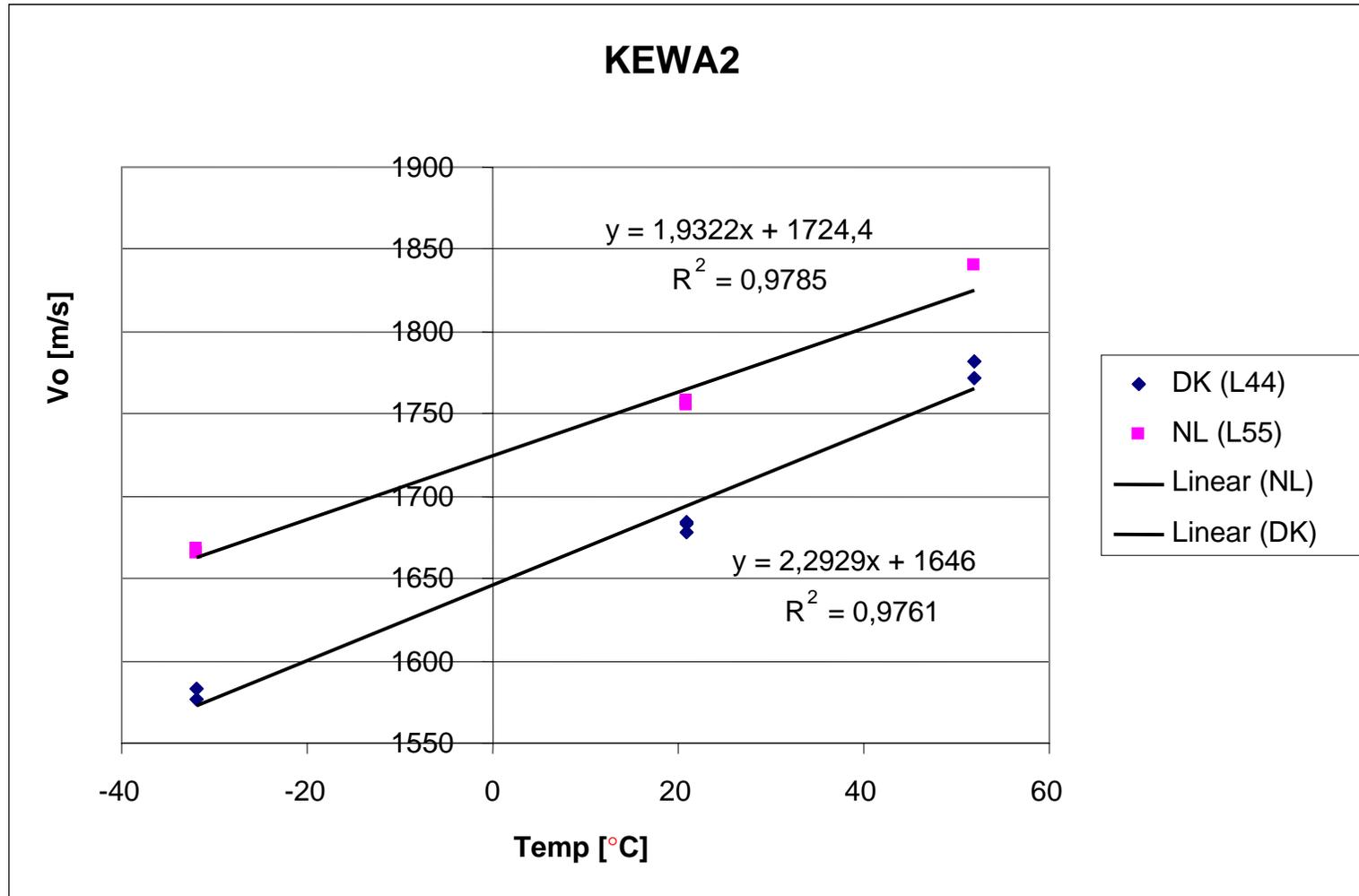
Used existing Leopard 2 tank Ballistic setting A2 of fire control system

# KEWA2™ Velocity Data



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Velocity versus temperature in L44 and L55 Weapon.



# KEWA2™ Fire for Effect on Target



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- 2 rounds fired from Danish Leopard 2/A5 Tank at +21C for effect on target
- Target is Leopard 1A5 Main Battle Tank at ~1,000 meters

Accurate and effective

1<sup>st</sup> shot  
through turret

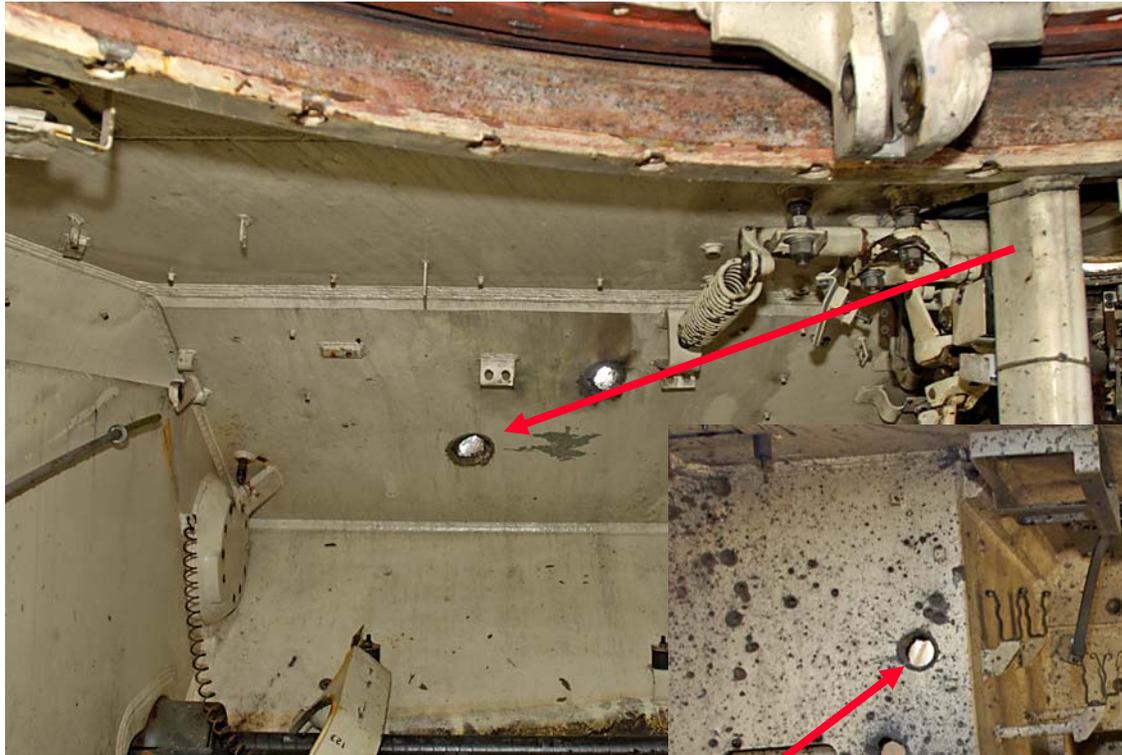
2<sup>nd</sup> shot through  
front armor



# KEWA2™ Effect on Target



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Front of vehicle  
Entrance holes



Rear of vehicle  
Exit holes

# KEWA2™ Firing on Tank Target, Gunner Sight



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# M830A1 HEAT-MP-T NSN 1315-01-333-0534



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- Fired to verify fire solution across temperatures
- 7 rounds from each tank across temperatures at 1700 meters
  - 2 at -32C, 3 at +21C, 2 at +50C



L44 Gun



L55 Gun



M830A1  
MPAT

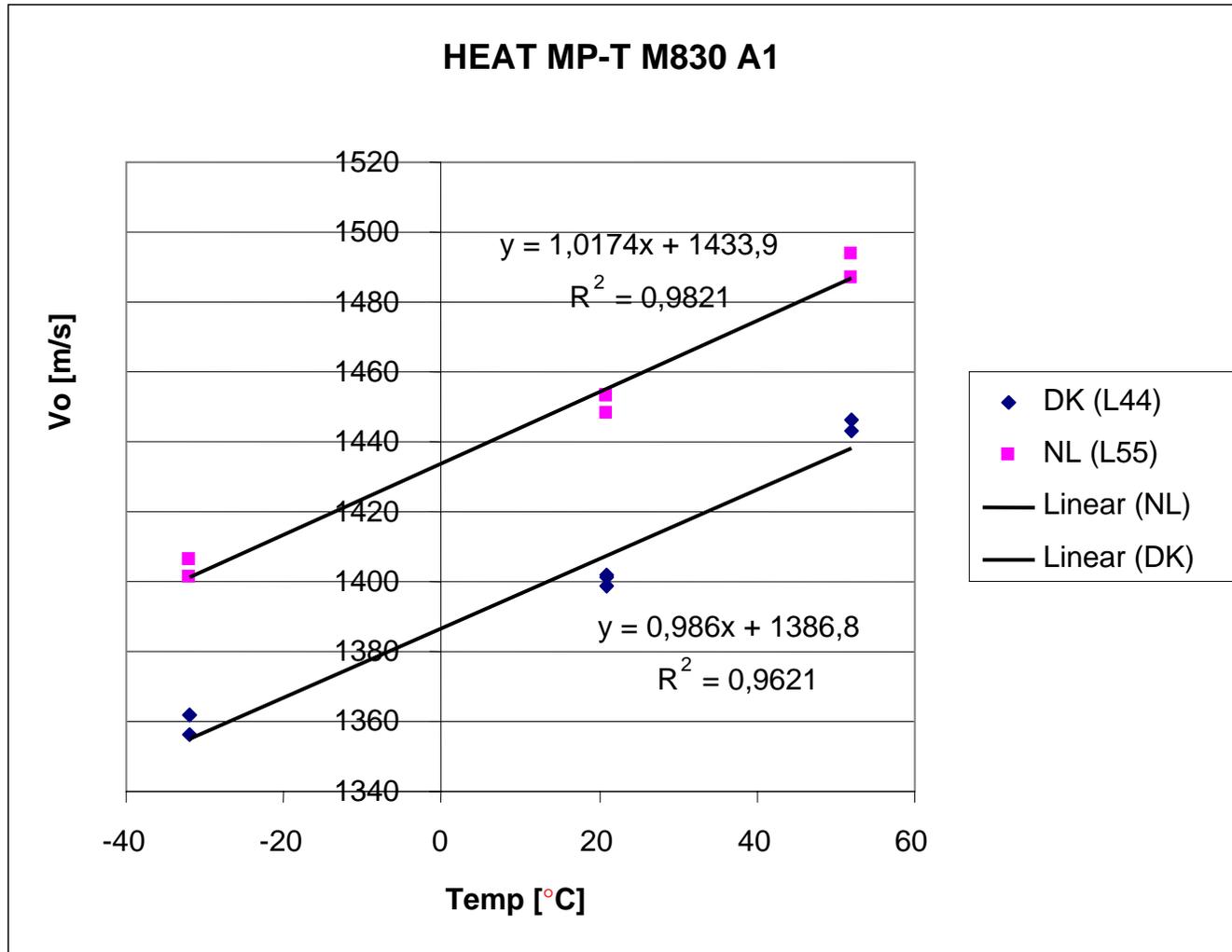
Use existing Leopard 2 tank Ballistic setting A2 of fire control system

# M830A1 Velocity Data



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Velocity versus temperature in L44 and L55 Weapon.



# M830A1 Multi-Purpose High Explosive Air Burst



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- Fired for airburst effect on target
  - Target is Simulated Helicopter at ~1,000 meters



Before



After

# M830A1 Fired on Simulated Air Target



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# M830A1 Multi-Purpose Ground Mode



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- Fired for effect on ground target
  - Target is Main Battle Tank at ~1,000 meters



Impact point on tank

# M1028 Canister NSN 1315-01-516-5248



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- Test Fired to establish aim point and check firing across temperatures
- 3 from Danish Leopard 2/A5 Tank
- 1 from Dutch Leopard 2/A6 Tank

Combined fire for effect and analysis on targets

- 1<sup>st</sup> Target is razor wire entanglement
- 2<sup>nd</sup> Target is wood plates to demonstrate dispersion of tungsten balls
- 3<sup>rd</sup> Target is a civilian vehicle at ~100 meters



# M1028 Canister Dispersion of Balls on Plywood



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Direction of fire

# M1028 Canister Fired on Vehicle



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# M1028 Canister on Simulated Suicide Vehicle



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- **Ammunition is interoperable and safe to fire in Leopard 2 Tanks (L44 / L55)**
- **Demonstration showed interoperable use of these products.**
- **Demonstration in cooperation and partnering to meet common objectives**

# Final Comments



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- Thanks to Danish, Dutch, and US Army for supporting this Test
- Members from 12 countries attended
- Demonstration in cooperation and partnering to meet common objectives