Tactical Effectiveness
14 May 2014 Small Arms Ammunition

Fredrik Erninge
Market Director
Nammo SCD
NAMMØ Overview
- A Technology Driven Aerospace & Defense Group

- Corporate HQ in Norway
  - Presence in 9 countries
  - 2200 employees
  - Revenue $620 million (2013)
  - 85% defense / 15% civil

- Nammo Inc HQ in Virginia
  - Nammo Talley (SSA)
  - Nammo Pocal
  - Nammo Tactical Ammunition
  - Nammo Demilitarization
  - Nammo Composite Solutions

~ 1/3 USA & Americas

~ 1/3 Nordic

~ 1/3 Europe & ROW
Core Business & Technologies

• Ammunition
  – Specialty producer of small, medium and large caliber ammunition

• Shoulder-Launched Munitions
  – Advanced multi-purpose SLMs for current and emerging warfighter missions

• Missile Products
  – Highly engineered rocket motors, warheads, composite/metallic cases and actuation systems

• Demilitarization
  – World leader in safe and environmentally responsible recycling of ammunition and energetic materials
Nammo; Supporting the US War Fighter

- M993 & M995 AP
  - Qualified by US Army 1996
  - 140M rounds delivered over the last 18 years
  - Current ID/IQ Contract

- 5.56 Dim Trace Mk301
  - Qualified by US Navy 2008
  - Qualified by US Army 2013

- 2:nd Source via Olin Winchester
  - Ongoing deliveries of Trace projectiles M856 & M62
  - Development of M62A1 projectile

- 2011: Nammo Tactical Ammunition established
  - Small quantity sniper ammunition assembly
  - Special Loads/Configurations
  - Research and Development Support
  - Improved Logistics Support (Foreign Trade Zone)
Nammo Small Caliber Specialty Ammunition

5.56 and 7.62 mm

- Non Toxic (lead free)
- High Performance
- Tracer
- Dim Tracer
- Armour Piercing
- Long Range
- Reduced Range

Improved Soldier Capability
- Enhanced Performance
- Enhanced Lethality

All military specified for safe and reliable function in automatic weapons in the full temperature range (-65° F to 126° F)
5.56 mm
High Performance
Nammo 5.56 mm Ball High Performance

- Meets all requirements in relevant STANAG and MOPI
- Reduced drag
  - Less wind sensitiveness
  - Flatter trajectory
  - Increased impact energy
- Improved lethality
- Improved penetration
- 100% Lead free
- Reduced emissions
- Cost effective design

- FMJ
- Double steel core
- Lead free
- Optimized for:
  - Reduced drag
  - Reduced emission
  - Improved Penetration
  - Improved Lethality

- Lead free Non Toxic primer
Penetration Performance – NATO Steel Plate

<table>
<thead>
<tr>
<th>NATO Test Target</th>
<th>3.5 mm NATO plate at 0° obliquity</th>
</tr>
</thead>
<tbody>
<tr>
<td>M855 Ball</td>
<td>Penetration at 570 m</td>
</tr>
<tr>
<td>Nammo High Performance Ball</td>
<td>Penetration at 725 m</td>
</tr>
</tbody>
</table>

+ 27%
## Penetration Performance – NATO Crisat Vest

### Pk-values at 550 m

<table>
<thead>
<tr>
<th>Cartridge</th>
<th>P(kill)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Ball M855</td>
<td>0.349</td>
</tr>
<tr>
<td>2 Nammo High Performance</td>
<td>0.425</td>
</tr>
</tbody>
</table>

+ 22%
Improved Lethality

5.56 mm Ball High Performance

5.56 mm Ball M855
Barrel Erosion

- NATO MOPI requirement
- 20 000 Rounds in HK416
- Pressure values as M855
Optimized for Reduced Emission

- Normalized values for comparison
- Gases and airborne metal particles

![Bar Chart]

- NH3
- HCN
- CO
- Cu
- Zn
- Pb

Legend:
- Nammo High Performance
- M855 Ball

Presentation for the NDIA Joint Armaments Forum 2014
7.62 mm High Performance
BNT 9 HP – Penetration NATO Test Target

**NATO Test Target**
3.5 mm NATO plate at 0° obliquity

<table>
<thead>
<tr>
<th>Standard Ball M80 Type</th>
<th>Nammo Ball High Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penetration at 550 m</td>
<td>Penetration at 950 m</td>
</tr>
</tbody>
</table>

+ 73%
Real Target – 5” Concrete

Ball M80
23 rounds
Two bursts

Nammo High Performance
10 rounds
One burst
Lethality – Ballistic Gelatin

Ball M80

Yaw starts @ 6” (15 cm)

Nammo High Performance

Yaw starts @ 5” (12.5 cm)
Tungsten Carbide Core
Armour Piercing
M993 & M995 Armor Piercing

- World leading military specified Armor Piercing in caliber 5.56 and 7.62 mm
- Designed by Nammo Vanäsverken 20 years ago
- Kennametal has been sole supplier of the Tungsten Carbide core

- 150 million Armor Piercing cartridges produced
- Qualified as M993 respectively M995 by US Army 1996
Nammo AP - Cartridge Design

- Copper Plated Steel
- Tungsten Carbide Core
- Aluminum Cup

Projectile Weight:
- 7.62 mm - 8.3 g
- 5.56 mm - 3.4 g

M995
M993

Presentation for the NDIA Joint Armaments Forum 2014
Live fire penetration test; 7.62 mm AP M993

- 18 mm Armor Steel 300 HB
- Target distance 100 m
- Impact angle 0° Nato
Armour Piercing
New Developments

- 5.56 mm AP 45
- 7.62 mm AP 10
- 5.56 & 7.62 mm AP Long Range
5.56 mm AP 45 – A Cost Effective Design

- Based on Nammo 5.56 mm High Performance Ball
- Powered by Nammo penetrator technology
- Synergy effect
  - Armour Piercing
  - Long Range performance
  - Cost effective

4.5g / 69 grains
5.56 mm AP 45 – Penetration Performance

- 7 mm RHA 400HB at 0° impact angle at 200 m
- 7 mm RHA 400HB at 30° impact angle at 100 m
- 7 mm RHA 500HB at 0° impact angle at 100 m
5.56 mm AP 45 – NATO Crisat Vest

**Pk-values at 550 m**

<table>
<thead>
<tr>
<th>Cartridge</th>
<th>P(kill)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M855</td>
<td>0.349</td>
</tr>
<tr>
<td>AP 45</td>
<td>0.488</td>
</tr>
</tbody>
</table>

+ 40%
Impact Energy

Increased effective combat distance

Projectile Energy vs. Range

Nammo AP 45/ Ball M855 [%]

Percentage difference

<table>
<thead>
<tr>
<th>Range (m)</th>
<th>Difference</th>
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</thead>
<tbody>
<tr>
<td>0</td>
<td>10.68</td>
</tr>
<tr>
<td>100</td>
<td>12.75</td>
</tr>
<tr>
<td>200</td>
<td>17.67</td>
</tr>
<tr>
<td>300</td>
<td>22.17</td>
</tr>
<tr>
<td>400</td>
<td>28.66</td>
</tr>
<tr>
<td>500</td>
<td>36.22</td>
</tr>
<tr>
<td>600</td>
<td>43.84</td>
</tr>
<tr>
<td>700</td>
<td>54.58</td>
</tr>
</tbody>
</table>
Summary

Nammo Specialty Small Arms Ammo

- Increasing the soldier performance
- High Performance Ball
- Tungsten carbide Armour Piercing
- Enhanced Performance
  - Hard targets
  - Soft targets
- Cost effective designs
Questions
Speaker information

Fredrik Erninge
M&P Manager
+46 505 182 07
Nammo Small Caliber Division
fredrik.erninge@nammo.com

Bruce Webb
Vice President Specialty Ammunition
(571) 641 9874
Nammo Inc.
bwebb@nammoinc.com