Non-Lethal Fuzing Requirements

May 13, 2010
NDIA 54th Fuze Conference – Kansas City
• Non-Lethal requirements need to be understood to progress and refine a fuze design.
  – How is the fuze required to perform?
  – How will the munition be used?
  – How will it be identified as non-lethal?

• What is non-lethal?
  – What effect will non-lethal requirements have on fuzing?

• XM1158 fuze has been designed for non-lethal use.
  – For the XM1112 Airburst Non-Lethal Munition (ANLM)
  – Proximity function
What are the Military’s Escalation of Force options?

Shout......then Shoot?
Weapons, devices, and munitions that are **explicitly designed** and primarily employed to **in incapacitate targeted personnel or materiel immediately**, while minimizing fatalities, permanent injury to personnel, and undesired damage to property in the target area or environment. Non-lethal weapons are intended to have **reversible effects** on personnel or materiel. (paraphrased from DoDD 3000.3)
"NLWs Provide Operating Forces Needed Capabilities"

"Increasing RANGE increases OPTIONS"

Target selected individuals  Clear personnel  Control group movements  Secure without Destroying
Non-Lethal Weapons have two competing objectives: cause desired effect, while minimizing permanent injury.

Understanding human effects is critical for legal/treaty reviews, policy acceptability, and warfighter awareness.

Human Effects Center of Excellence (HECOE), Brooks AFB, provides human effects models & expertise.
Established by DoDD 3000.3 (1996)
The U.S. Army Military Police School* located at Ft. Leonard Wood, MO, has the overall lead for all Army Non-Lethal capabilities and corresponding combat developments and concepts.

The Project Manager – Close Combat Systems located at Picatinny, NJ, has program management responsibility for Army Non-Lethal Materiel programs, and fielding the Army’s Non-Lethal Capabilities Sets.

* Army Nonlethal Scaleable Effects Center (ANSEC)
DoD NON-LETHAL TECHNOLOGIES

Technology Bins

Vehicle Stopping
- Nets
- Spikes
- High Power Microwave (HPM) or Radio Frequency (RF) Based
- Laser Based
- High Voltage Based
- Obscurants

Warning Devices
- Ocular
- Acoustics

Launcher Systems
- Human Electro-Muscular Incapacitation (HEMI)
- NL Capable Launchers
- NL Capable Remote Weapon Systems (RWS)
- Active Denial Technology

Non-Lethal Munitions
- Blunt Impact
- Flash Bang
- Air Burst
- HEMI
- HPM/RF

NL Systems (Examples)

Portable Vehicle Arresting Device

Acoustic Hailing Device

X26 Taser

FN303

12 Ga, 40mm & 66mm Munitions, Hand Grenades, and NL “Claymore”

Single Net Solution (SNS)

Green Laser Dazzler effect on driver windshield

ADS/ADT

Distribution Statement A. Approved for public release; distribution is unlimited.
• The XM1112 Airburst Non-Lethal Munition (ANLM)
  – Provides selective area denial, crowd dispersion, or individual/crowd behavior control capability
    • Two mode operation: proximity & proximity delay
  – The system will provide consistent non-lethal effects & increase range capabilities.
  – The XM1158 proximity fuze enables airburst delivery of NL payloads throughout the operational range

• Program Sponsors
  – DoD Non-Lethal Executive Agent: Joint Non-Lethal Weapons Directorate (JNLWD)
  – U.S. Army PM Soldier Weapons

• The XM1112 Program Management - US Army Lead Service
  – Until MS C - PM Soldier Weapons
  – After MS C - PM Close Combat Systems
• Emphasis on leveraging existing technologies from other fuzes
  – Proximity technology for use in Direct-Fire scenario (EX433 & M734A1)
  – Existing mechanical S&A – M550
  – Lithium liquid reserve-cell battery
  – Piston actuator

• U.S. Army ARDEC Fuze Division developed, designed, and demonstrated this proximity fuze.

• Transitioned the ARDEC XM1158 Fuze Design in 2008 to Savit Corp for design refinements

• The XM1112 ANLM is the first low velocity 40mm non-lethal munition with a fuze.
  – Consistent standoff distance provides consistent non-lethal effect
  – Munition identified by lime green projectile nose – proposed non-lethal color standard
Desire for Increased Range Capability

- Current Capability
- Future/Objective Capability

- 3x increase over current Low Velocity
- 7x

XM1158 – 40mm Proximity Fuze – Non-Lethal Fuzing Requirements
U.S. ARMY NON-LETHAL MUNITIONS
MAXIMUM RANGE COMPARISON

66mm Launchers

Grenades
X26 TASER
FN303
12 Ga Shotgun
40mm, Low Velocity
40mm, High Velocity
XM1158 – 40mm Proximity Fuze – Non-Lethal Fuzing Requirements

ANLM SEQUENCE OF OPERATION

Prox Mod

Battery Activated (Setback)

Prox Circuit Active

Target Detected

Fire Command Issued (Instant)

Piston Actuator drives Firing pin, which stabs and initiates M55 detonator

Igniter Mix Activated by M55 Output – NL Mix ejected forward

NL Mix Ignites on Air Contact – NL Effect “Flash Bang”

Prox Delay Mode

Fire Command Issued (Delay)

Electronic Timer issues fire command upon $t = 30s$

(Mechanical Backup)

(Two Independent Modes of Self-Neutralization)

Impact collapses Fuze, Driving PA into Firing Pin, initiating M55 (or jams rotor if OOL)

Mechanical Backup

Gun Launch

Min. Target Engagement

“All-Arm” = 28m

Battery Rise Time

Mech. Arming

Dud?

$t = 0$
• Non-lethal fuzing requirements are the same as lethal but must take into account additional non-lethal requirements

• Requirements that are the same as lethal munitions
  – Fuze safety to shooter & weapon
    • MIL-STD-1316
    • MIL-STD-1911
  – Munition unique Requirement Document(s)
    • CDD, CPD, etc. - Key Performance Parameter & Key System Attribute

• Requirements that are unique to non-lethal munitions
  – Munition unique Requirement Document(s)
    • $P(nle/s)$: probability of non-lethal effect per shot
    • Non-lethal effect duration
    • $P(RSI)$: probability of risk of significant injury
  – Human Effect Center of Excellence (HECOE)
    • Defining non-lethal effect & duration models
      – Different targets will experience different effects
    • Developing non-lethal standard for Risk of Significant Injury
      – Plan Tri-Service Validation
• Non-Lethal Weapons
  – Employed against personnel, material, and capabilities
  – Immediate & reversible effect (temporary disable)
  – Expands military’s escalation of force options

• Non-lethal fuze safety requirements are currently the same for lethal applications plus
  – Non-lethal munition unique Requirement(s)
  – Non-lethal standard being developed

• XM1158 Fuze will provide
  – Fuzing to the XM1112 Airburst Non-Lethal Munition
  – Uniform proximity initiation resulting in a consistent non-lethal effect

• DoD Joint Non-Lethal Weapons Program  [DoD Joint Non-Lethal Weapons Program](https://www.jnlwp.com/)

• USAF AFRL Human Effect Center of Excellence (HECOE), Brooks AFB, TX  [USAF AFRL Human Effect Center of Excellence (HECOE), Brooks AFB, TX](https://www.jnlwp.com/future_capabilities/organizations.asp)  
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• NLW Tactical Employment of Nonlethal Weapons, 15 JAN 2003  

• TRADOC Pam 525-99 - Concept for NL in Army Ops