Testing non-lethals: Finding the right tools for the job

NDIA Joint Armaments, 17-20 May 2010
What are non-lethals?

“Non-lethal weapons are weapons which are explicitly designed and developed to incapacitate or repel personnel, with a low probability of fatality or permanent injury, or to disable equipment, with minimal undesired damage or impact on the environment.”

_NATO NLW Policy document C-M(99)44, 28 September 1999_
What makes them different? (1/2)

![Graph showing the comparison between Population and Effect with two categories: Not effective and Effective. The Lethals section is on the top right side.]
What makes them different? (2/2)

- Effective
- Harmful
- Not effective
- Non-lethals

(population vs. effect)
A multitude of options...

Regarding military effects:
- Warn
- Divert
- Disrupt
- Disperse
- Disorient
- Deny
- Repel
- Incapacitate

Regarding means to achieve effects:
How the find the right one?

- It is all about effectiveness, bounded by risk
- Effectiveness starts with employment options (scenarios)

Crowd and riot control
Checkpoint operations
Force protection
Room entry
Covert operations
Combat operations
“Each person is, in certain respects, like all other persons, like some other persons, and like no other person.” [Larsen, R.J., Buss, D.M., Personality psychology]
International co-operation (1/3)

- Essential!

- NATO arena
  - NAAG TG/3
  - DAT PoW Item 11 (DAT-11)
  - RTO SAS-078

- Bilateral agreements

- Civil-military co-operation

- …
Case: flash-bang effectiveness (1/3)

Employment: room entry

Technology specific

NLW

Environment

Impact

dB(A)
lux
...

Target

Response

Blinding
Startle
Escape
...

Target specific

Behaviour

Shoots back
Does not shoot back

Process
Case: flash-bang effectiveness (2/3)

Complexity

Intensity

Solution
Case: flash-bang effectiveness

Stacking effects
Case: impact projectiles risk (1/3)

- Skin penetration thresholds:
  - Army Research Laboratory: 79 J/cm² (“serious injury”)
  - Walter Reed: 16-22 J/cm²
  - US Marines Corps: 6 J/cm² (“pain”)
  - Wayne State University: 26 J/cm² (“50% upper thigh”)
  - Wayne State University: 24 J/cm² (“50% anterior rib”)

Recommended threshold: 22 J/cm²
Internal injury thresholds

E/D = 23 J/cm
E/D = 36 J/cm

12 gauge rubber bullet
12 gauge beanbag sock

Muzzle velocities:
M1006: 36.8 J/cm
60-cal pellet: 6.0 J/cm
FN303: 18.3 J/cm

Bir, C.A., Viano, D.C.,
Design and injury assessment criteria for blunt ballistic impacts
Journal of trauma injury, infection and critical care
Vol.57 No.6, December 2004.
Case: impact projectiles risk (3/3)

- Development of biomechanical tests:
  - Skin penetration
  - Chest impact
  - Abdomen impact
  - Head impact

A test for desired effects (e.g. pain) still needs to be developed...
Case: eye-safe laser effectiveness (1/2)

- Safeness according to standard IEC60825-1
- Dazzling deemed effective when:
  - Glare luminescence of source > background luminescence
  - Vision impaired over sufficiently large FOV angle

Employment: checkpoint operations

![Diagram showing an eye-safe laser effectiveness case with dimensions and angles labeled: d = 50 m, b = 3 m, and 3.4° effective dazzling zone.](image-url)
Case: eye-safe laser effectiveness (2/2)

In this case:
No dazzling without eye safeness risk on a sunny day
Case: vessel stopping/deterrence (1/2)

Employment: maritime security

- Non-lethals are a potential solution in force protection concept
- Target are manned vessels (fast, small)
- Intent is often unclear

Concept + Requirements + Means = Candidates
Case: vessel stopping/deterrence (2/2)

- Short-term solutions
  - Identified

- Range issue:
  - Stand-off or carried

- Response issue:
  - Behavioural modeling

Tests required here
International co-operation (2/3)

- Many tests, mostly on weapon functioning and risk
- Few tests on intended effects

- Non-lethal Capability Based Assessment underway (SAS-078)
- Including work on experimentation:

  “To substantiate claimed effectiveness in the Capability Based Assessment”
International co-operation (3/3)

• Joint experimentation framework established 2009
  • 1st dimension: impact – response – behaviour - effectiveness
  • 2nd dimension: specificity and generalizability

• Tests from nations to be put in joint framework (2010/2011)
  • Peer review from nations
  • Establishing best practice for range of non-lethals
  • To be consolidated in experimentation guidebook

• Basis for future standardization (STANAG/ITOP) within NATO

To date, there is no internationally agreed test for qualifying non-lethals
In summary (1/2)

- Military value of non-lethals depends on:
  - Knowing risk of unintended effect
  - Knowing effectiveness of intended effect

- Risk related tests are technology-specific
- Risk related tests do not predict mission success
In summary (2/2)

• So, how to find the right tools for the job?

• Know your environment

• Know your task
  • Effectiveness is defined by objective
  • Effectiveness follows from impact – response - behaviour

• Know your non-lethal
  • Limitations
  • Types of effects it can produce
Let’s get started!

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