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

NDIA Joint Armaments, 17-20 May 2010

TNO | Knowledge for business

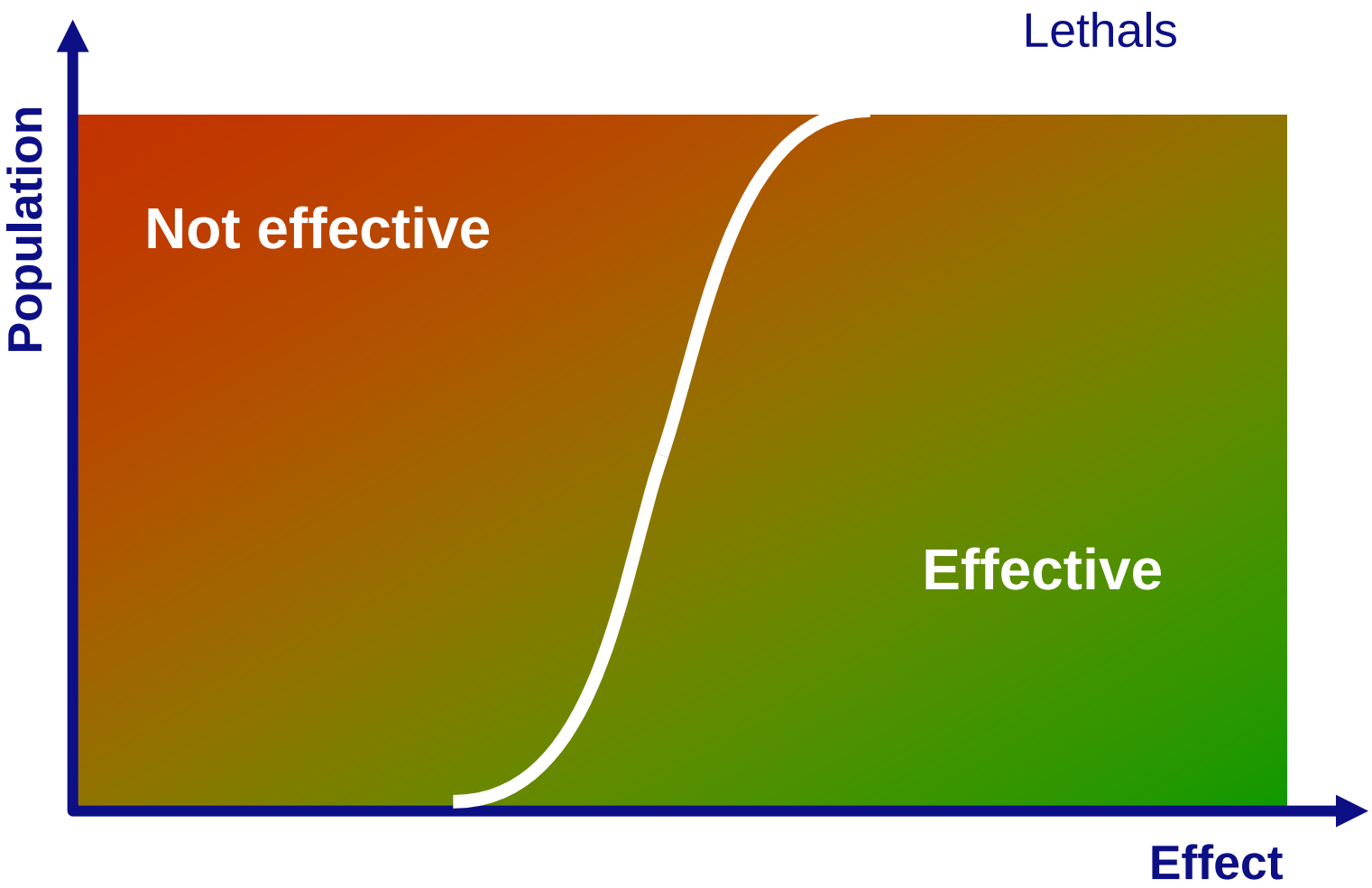
Pascal Paulissen

What are non-lethals?

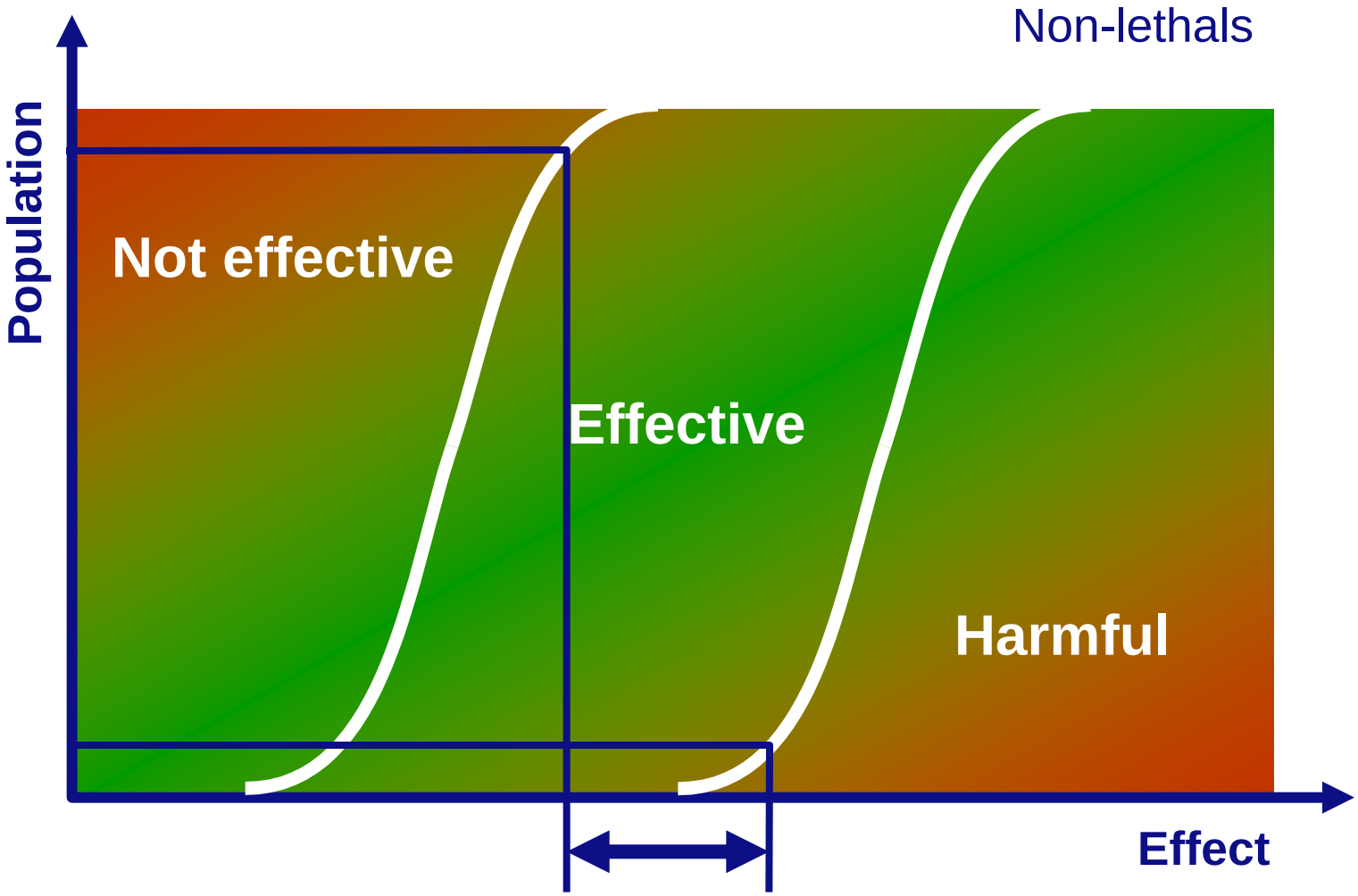
“Non-lethal weapons are weapons which are explicitly designed and developed to incapacitate or repel personnel, with a low probability of fatality or permanent injury, or to disable equipment, with minimal undesired damage or impact on the environment.”

NATO NLW Policy document C-M(99)44, 28 September 1999

What makes them different? (1/2)



What makes them different? (2/2)



A multitude of options...

Regarding military effects:

Warn
Divert
Disrupt
Disperse
Disorient
Deny
Repel
Incapacitate
....

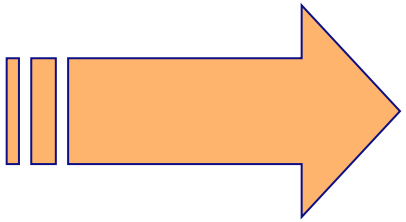
Regarding means to achieve effects:

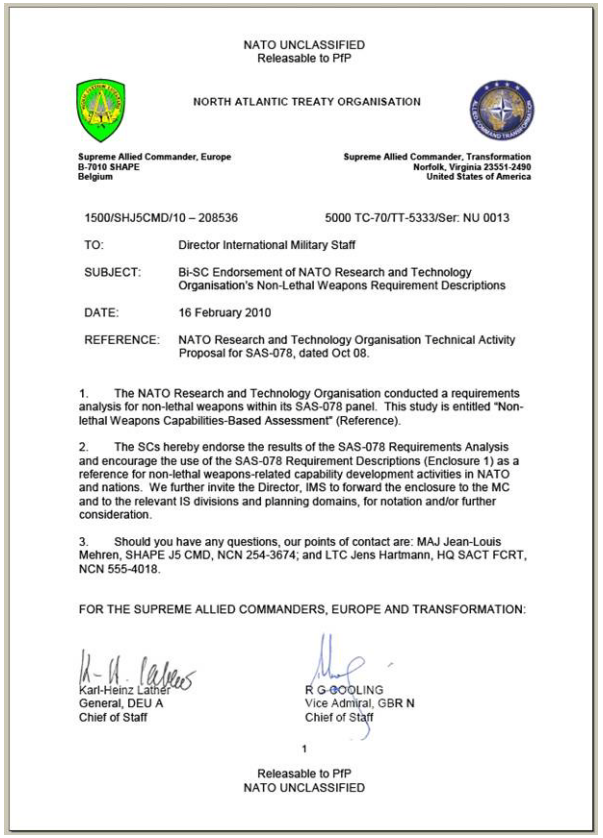
How the find the right one?

- 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
....

Requirement descriptions





NATO UNCLASSIFIED
Releasable to PfP

NORTH ATLANTIC TREATY ORGANISATION

Supreme Allied Commander, Europe
B-7010 SHAPE
Belgium

Supreme Allied Commander, Transformation
Norfolk, Virginia 23551-2490
United States of America

1500/SHJ5CMD/10 – 208536 5000 TC-70/TT-5333/Ser: NU 0013

TO: Director International Military Staff

SUBJECT: Bi-SC Endorsement of NATO Research and Technology Organisation's Non-Lethal Weapons Requirement Descriptions

DATE: 16 February 2010

REFERENCE: NATO Research and Technology Organisation Technical Activity Proposal for SAS-078, dated Oct 08.

1. The NATO Research and Technology Organisation conducted a requirements analysis for non-lethal weapons within its SAS-078 panel. This study is entitled "Non-lethal Weapons Capabilities-Based Assessment" (Reference).

2. The SCs hereby endorse the results of the SAS-078 Requirements Analysis and encourage the use of the SAS-078 Requirement Descriptions (Enclosure 1) as a reference for non-lethal weapons-related capability development activities in NATO and nations. We further invite the Director, IMS to forward the enclosure to the MC and to the relevant IS divisions and planning domains, for notation and/or further consideration.

3. Should you have any questions, our points of contact are: MAJ Jean-Louis Mehren, SHAPE J5 CMD, NCN 254-3674; and LTC Jens Hartmann, HQ SACT FCRT, NCN 555-4018.

FOR THE SUPREME ALLIED COMMANDERS, EUROPE AND TRANSFORMATION:

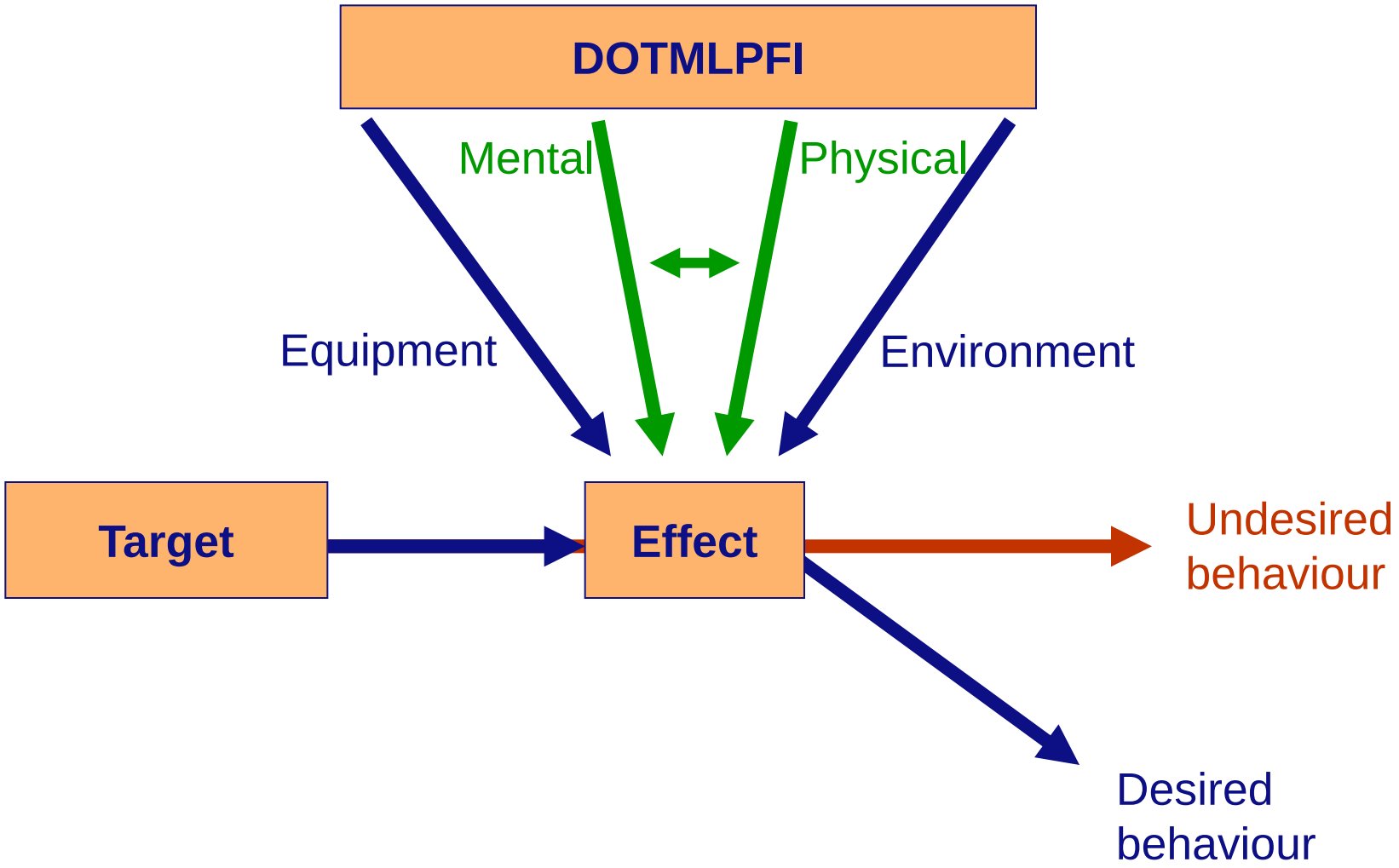
Karl-Heinz Lather
General, DEU A
Chief of Staff

R G GOOLING
Vice Admiral, GBR N
Chief of Staff

1

Releasable to PfP
NATO UNCLASSIFIED

Employment framework



“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
- …

NATO OTAN

NLW EWG

WAYNE STATE UNIVERSITY

POLITIE

AIR FORCE RESEARCH LABORATORY

ARMAMENT RESEARCH, DEVELOPMENT AND ENGINEERING CENTER PICATINNY ARSENAL, NJ

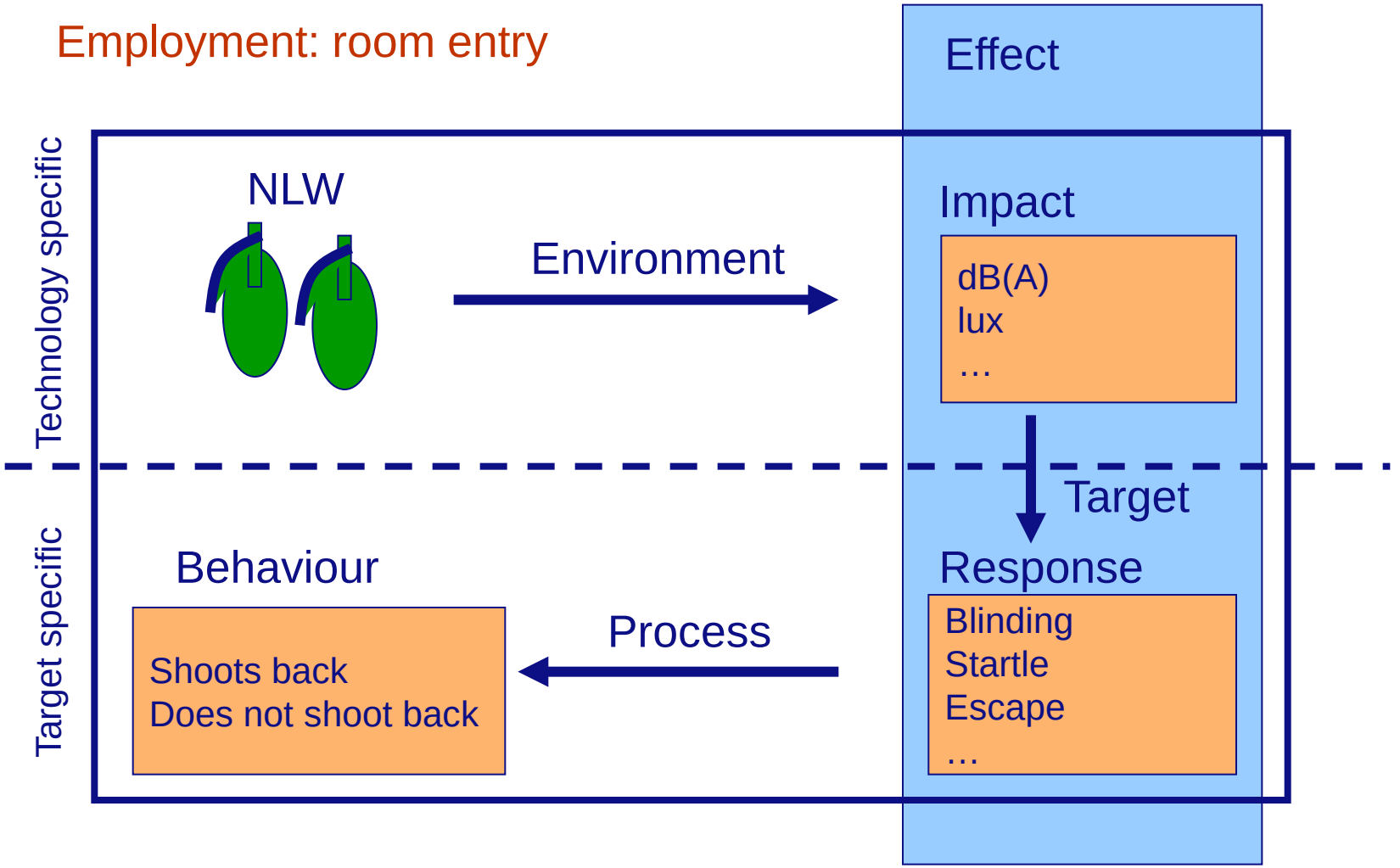
FFI Forsvarets forskningsinstitutt
Norwegian Defence Research Establishment

Wehrtechnische Dienststelle für Schutz- und Sondertechnik

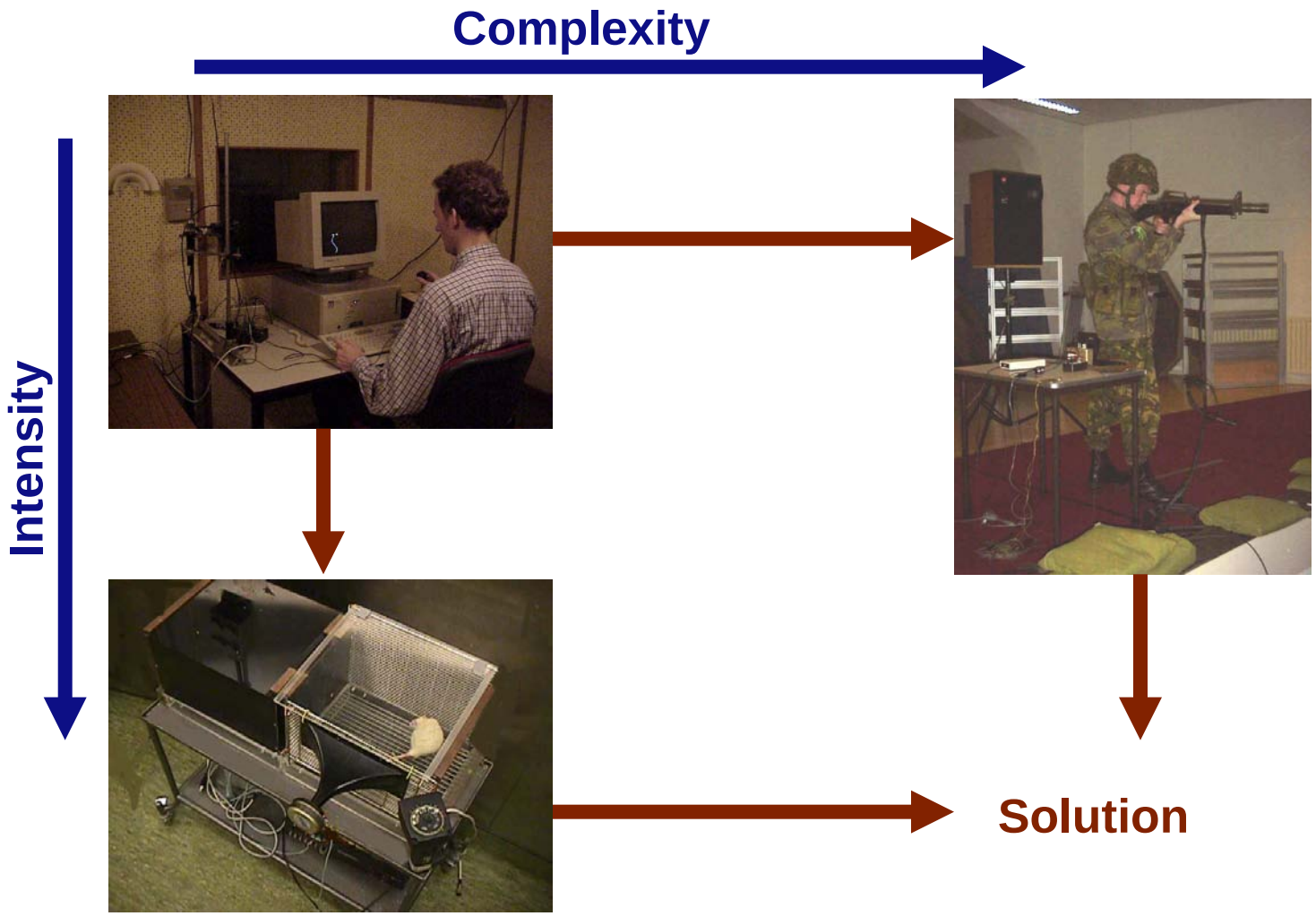
TNO

Case: flash-bang effectiveness (1/3)

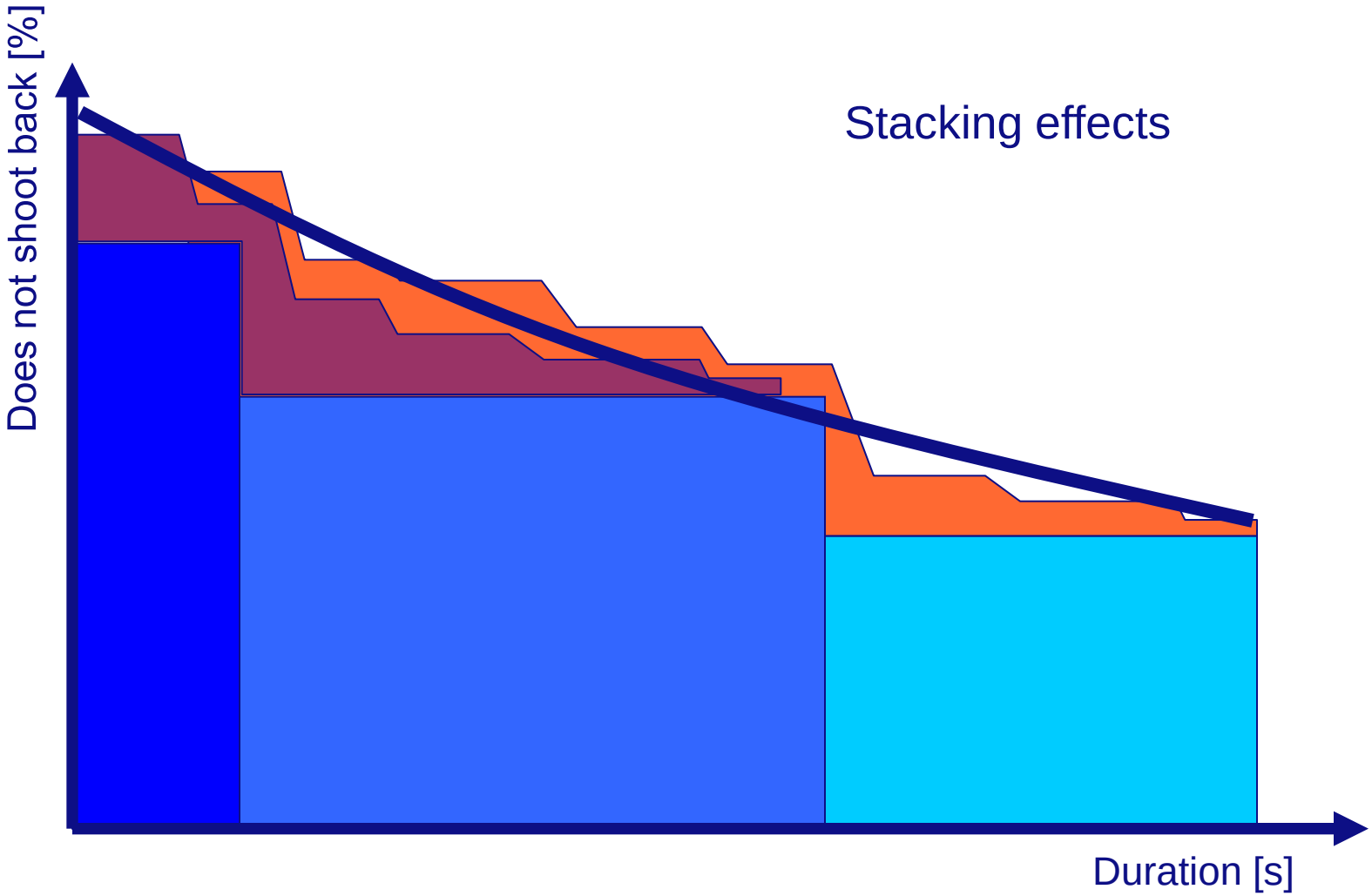
Employment: room entry



Case: flash-bang effectiveness (2/3)



Case: flash-bang effectiveness



Case: impact projectiles risk (1/3)

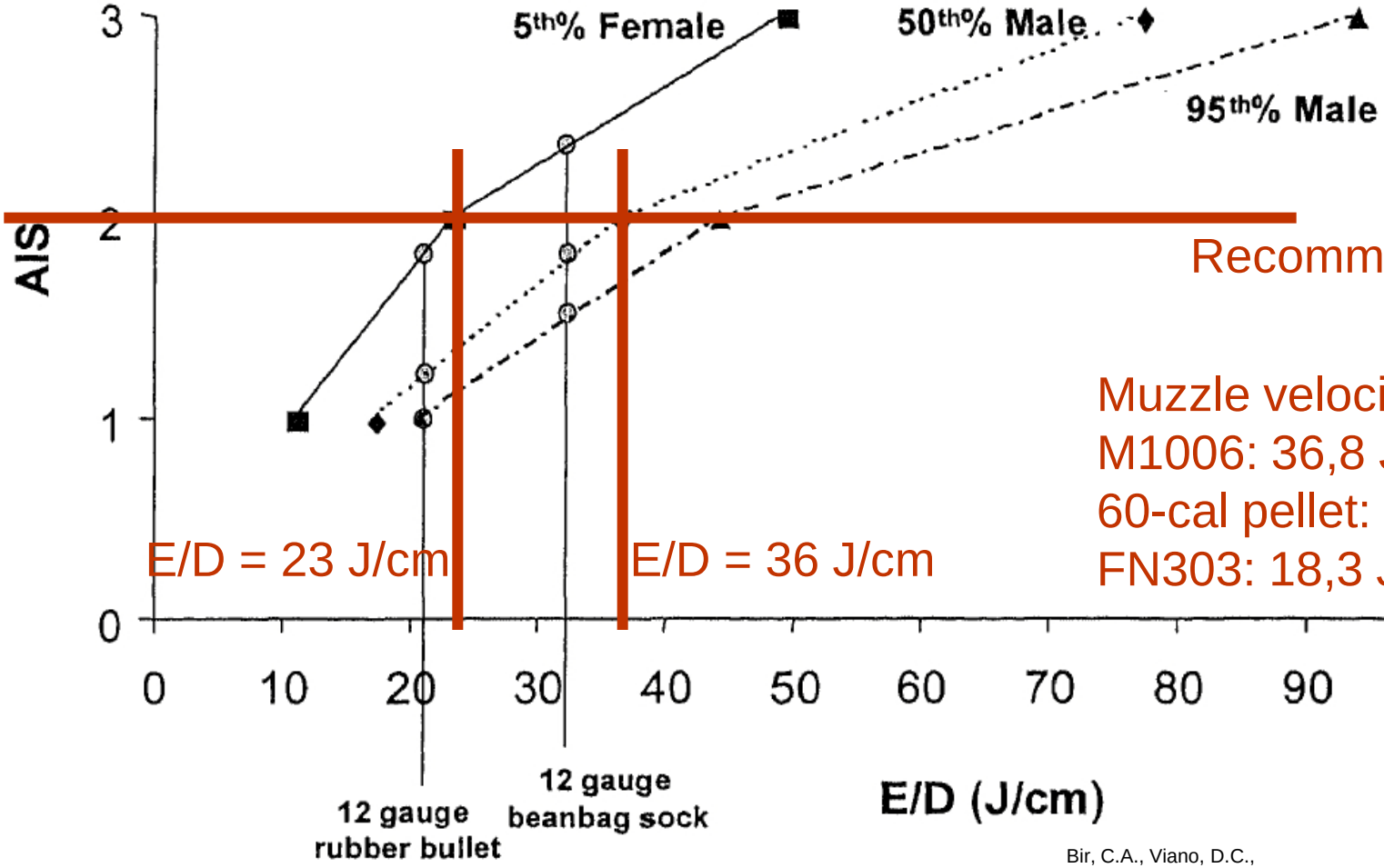
Employment: CRC

- Skin penetration thresholds:
  - Army Research Laboratory: 79 J/cm^2 (“serious injury”)
  - Walter Reed: 16-22 J/cm^2
  - US Marines Corps: 6 J/cm^2 (“pain”)
  - Wayne State University: 26 J/cm^2 (“50% upper thigh”)
  - Wayne State University: 24 J/cm^2 (“50% anterior rib”)

Recommended threshold: 22 J/cm^2

Case: impact projectiles risk (2/3)

Internal injury thresholds



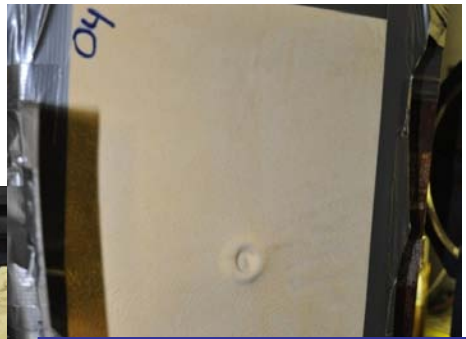
Muzzle velocities:
M1006: 36,8 J/cm
60-cal pellet: 6,0 J/cm
FN303: 18,3 J/cm

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.

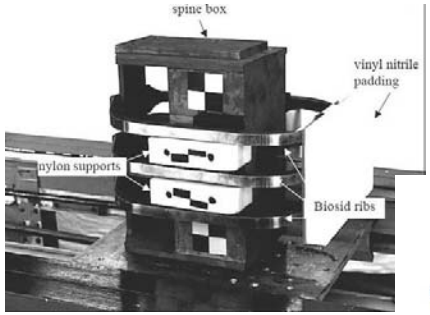
Case: impact projectiles risk (3/3)

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

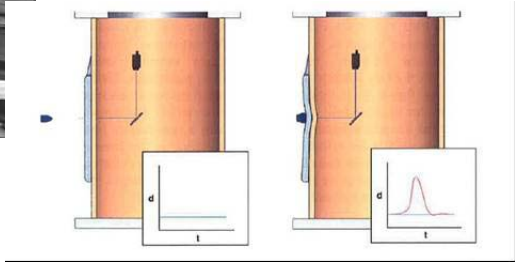
???



FOCUS
NOCSAE
Hybrid III
BABT



3RCS
BTTR

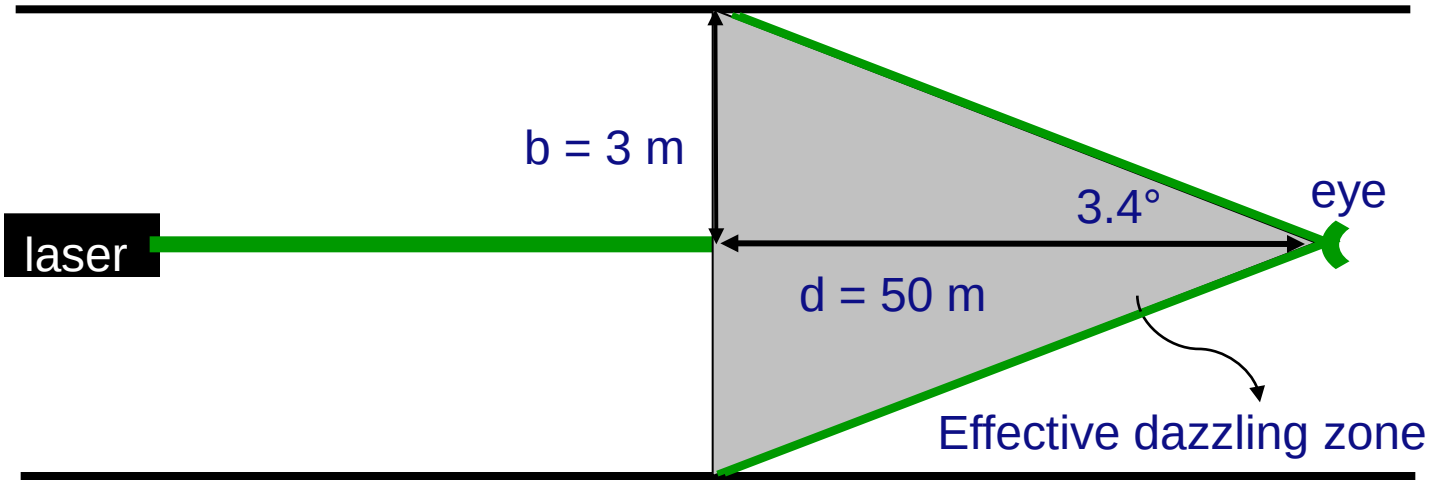


A test for desired effects (e.g. pain) still needs to be developed...

Case: eye-safe laser effectiveness (1/2)

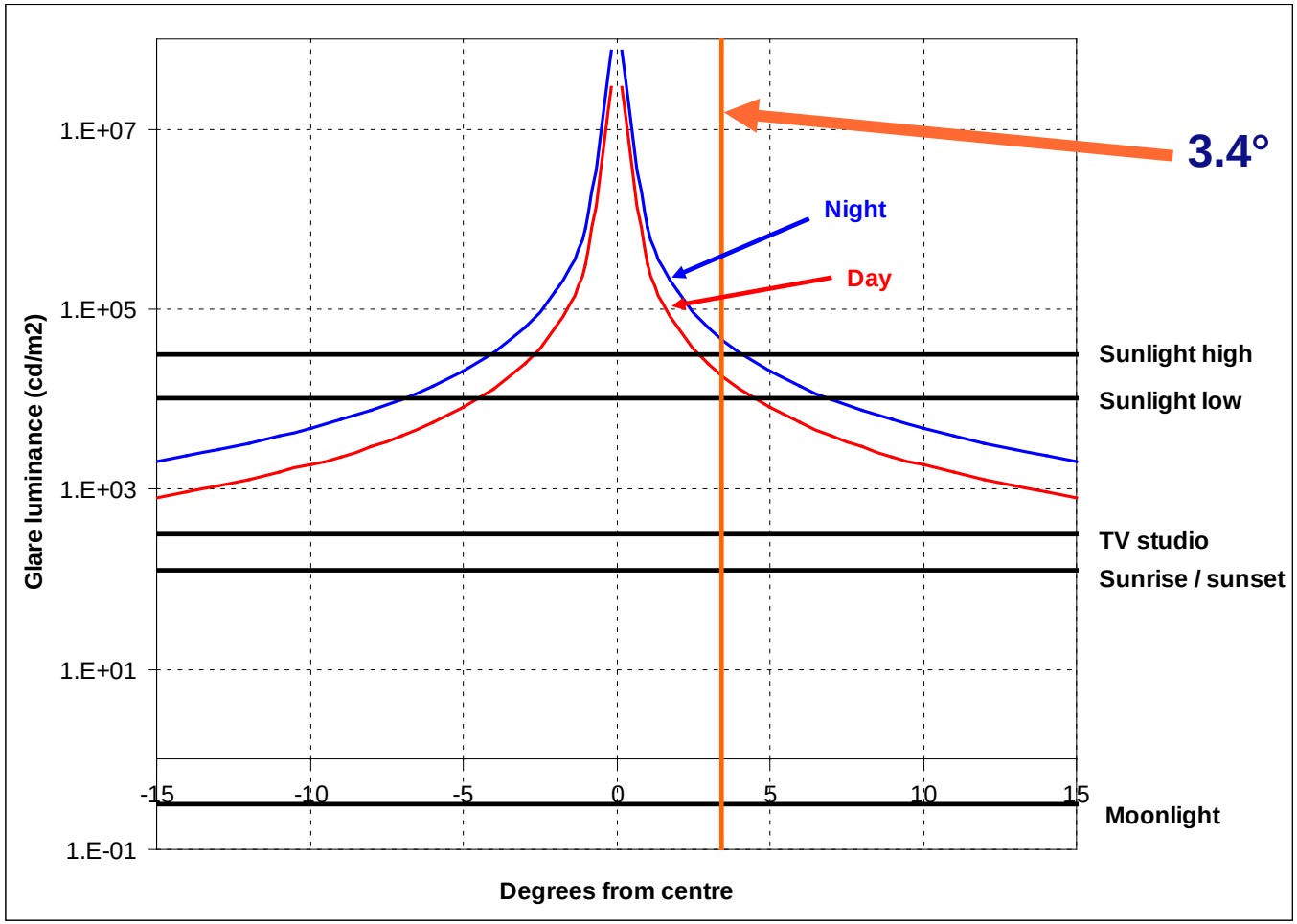
- Safeness according to standard IEC60825-1
- Dazzling deemed effective when:
  - Glare luminescence of source > background luminescence
  - Vision impaired over sufficiently large FOV angle

Employment: checkpoint operations



Case: eye-safe laser effectiveness (2/2)

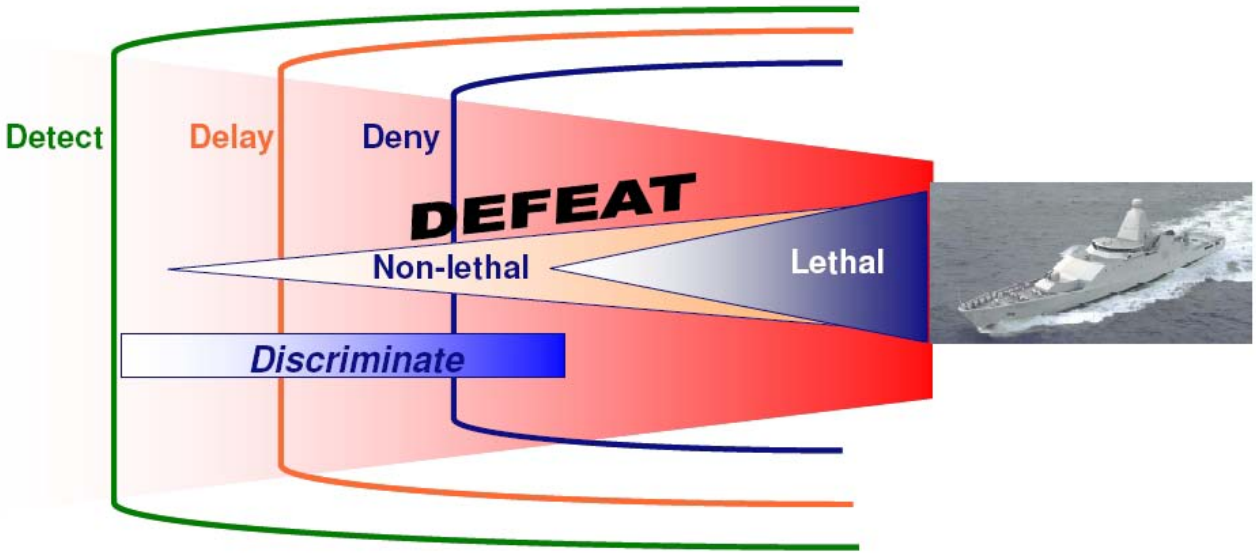
In this case:
No dazzling without eye safeness risk on a sunny day

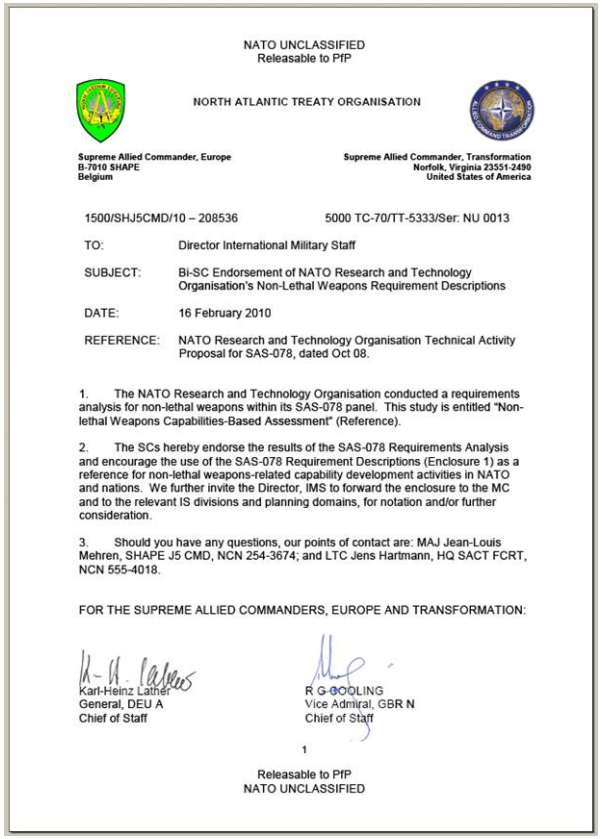


Case: vessel stopping/deterrence (1/2)

Employment: maritime security

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





NATO UNCLASSIFIED
Releasable to PfP

NORTH ATLANTIC TREATY ORGANISATION

Supreme Allied Commander, Europe
B-7010 SHAPE
Belgium

Supreme Allied Commander, Transformation
Norfolk, Virginia 23551-2490
United States of America

1500/SHJ5CMD/10 – 208536 5000 TC-70/TT-5333/Ser: NU 0013

TO: Director International Military Staff

SUBJECT: Bi-SC Endorsement of NATO Research and Technology Organisation's Non-Lethal Weapons Requirement Descriptions

DATE: 16 February 2010

REFERENCE: NATO Research and Technology Organisation Technical Activity Proposal for SAS-078, dated Oct 08.

1. The NATO Research and Technology Organisation conducted a requirements analysis for non-lethal weapons within its SAS-078 panel. This study is entitled "Non-lethal Weapons Capabilities-Based Assessment" (Reference).

2. The SCs hereby endorse the results of the SAS-078 Requirements Analysis and encourage the use of the SAS-078 Requirement Descriptions (Enclosure 1) as a reference for non-lethal weapons-related capability development activities in NATO and nations. We further invite the Director, IMS to forward the enclosure to the MC and to the relevant IS divisions and planning domains, for notation and/or further consideration.

3. Should you have any questions, our points of contact are: MAJ Jean-Louis Mehren, SHAPE J5 CMD, NCN 254-3674; and LTC Jens Hartmann, HQ SACT FCRT, NCN 555-4018.

FOR THE SUPREME ALLIED COMMANDERS, EUROPE AND TRANSFORMATION:

Karl-Heinz Lather
General, DEU A
Chief of Staff

R G GOOLING
Vice Admiral, GBR N
Chief of Staff

1

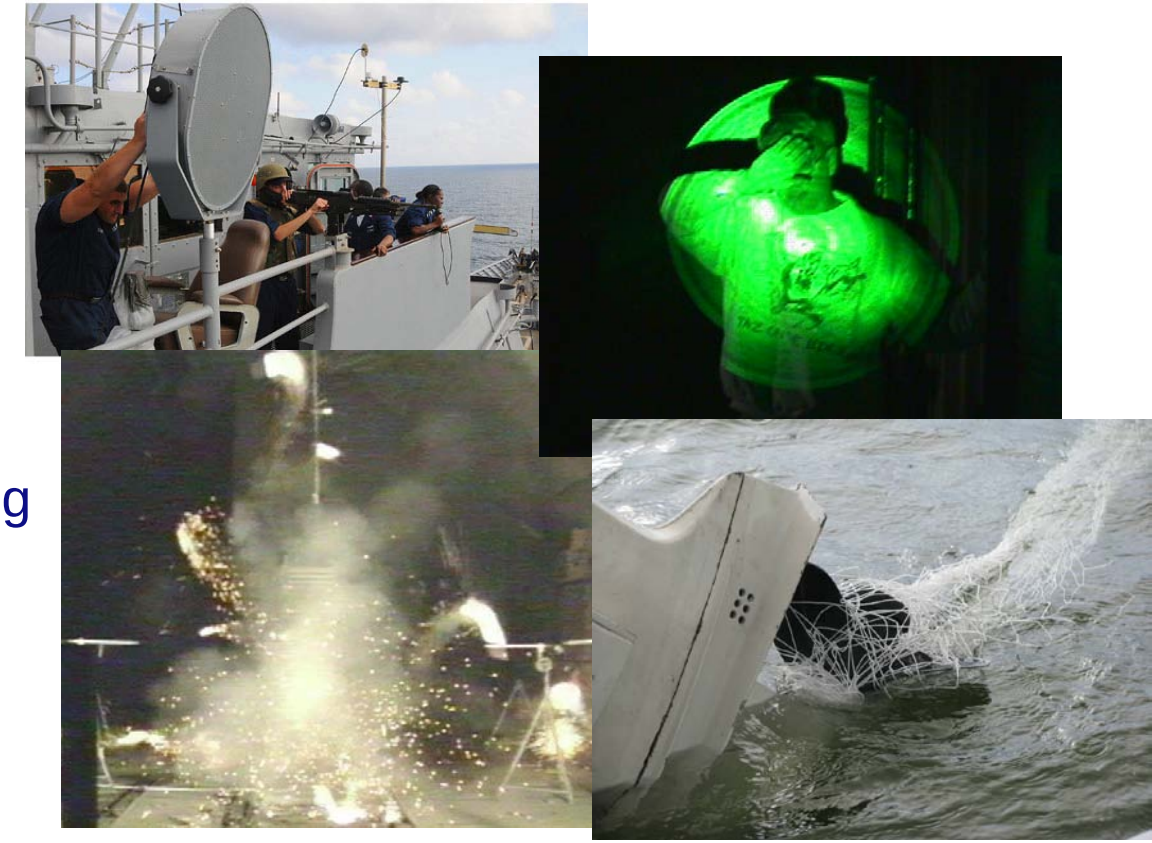
Releasable to PfP
NATO UNCLASSIFIED

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)

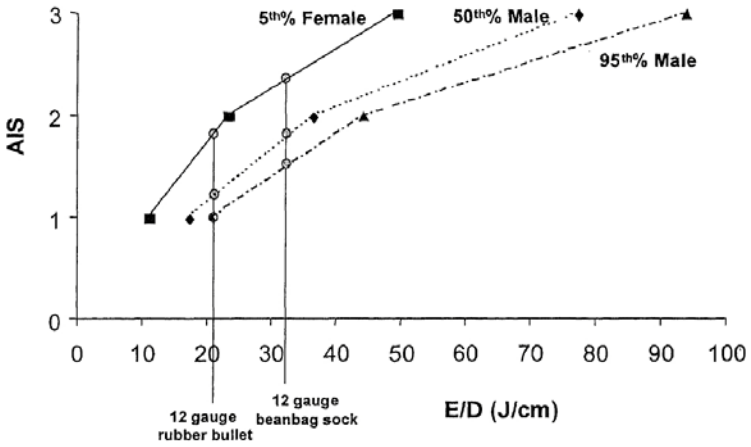
- Joint experimentation framework established 2009
  - 1st dimension: impact – response – behaviour - effectiveness
  - 2nd dimension: specificity and generalizability
- Tests from nations to be put in joint framework (2010/2011)
  - Peer review from nations
  - Establishing best practice for range of non-lethals
  - To be consolidated in experimentation guidebook
- Basis for future standardization (STANAG/ITOP) within NATO

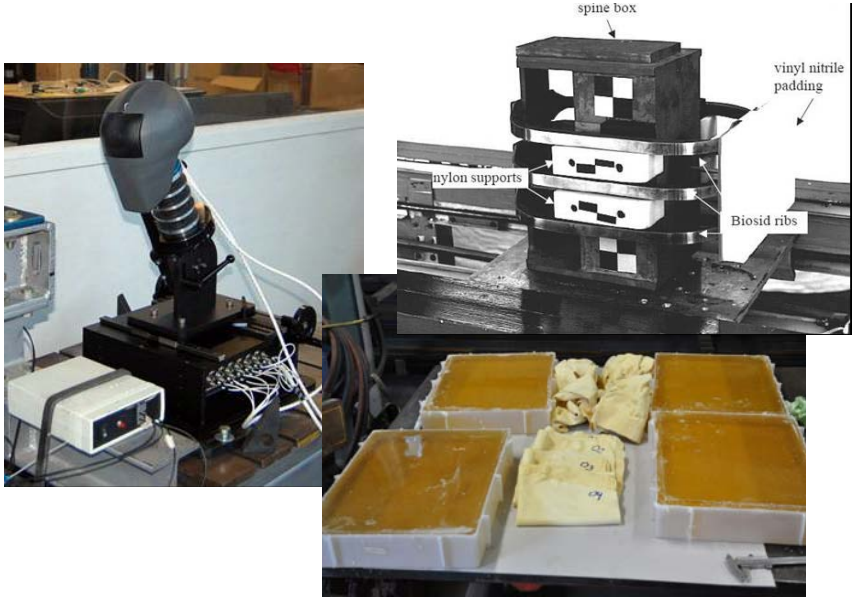
To date, there is no internationally agreed test for qualifying non-lethals

In summary (1/2)

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

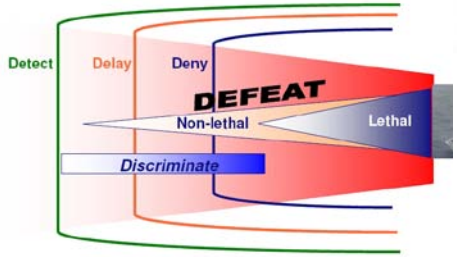
- Risk related tests are technology-specific
- Risk related tests do not predict mission success



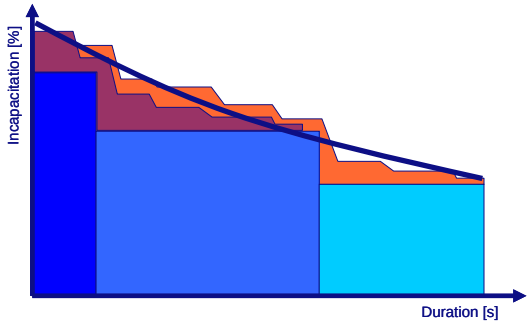


In summary (2/2)

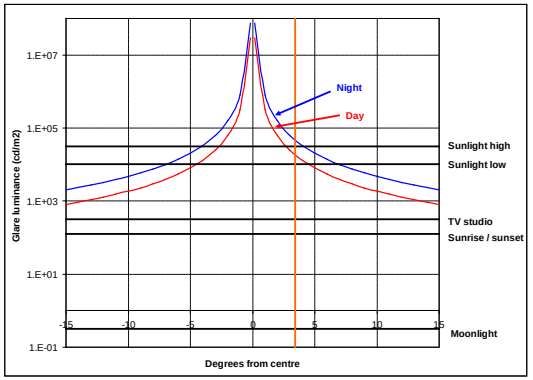
- So, how to find the right tools for the job?
- Know your environment



- 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!