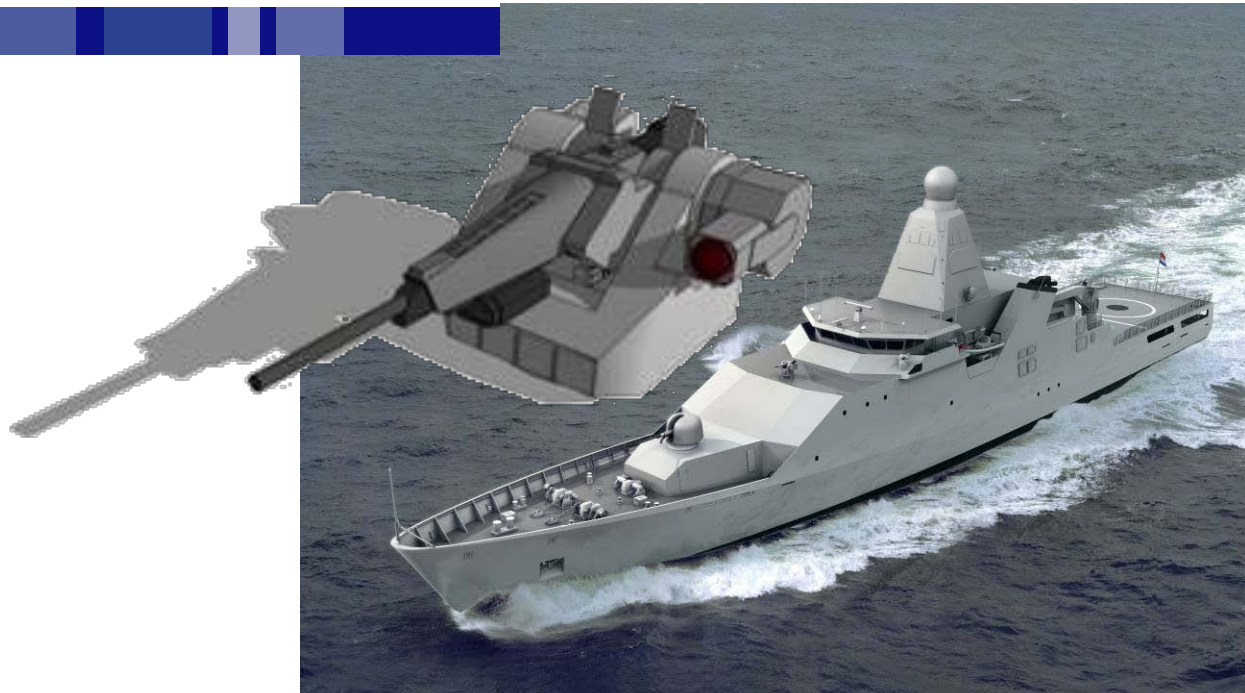
Warfare has changed:

Research into performance and use of weapon systems and ammunition in Maritime Environment

NDIA Joint Armaments Conference (May 2010)

TNO | Knowledge for business



Outline

- Warfare has changed: operations in littoral areas
- Change in demands within RNLN: new ship classes
- Research topics
- Summary

Warfare has changed:
Transition from in the open ('Cold War role') …

Hunting Warschaupact Subs

CIWS

Warfare has changed:

… to operations in littoral areas

Anti Piracy

Coast guard & security

As a result: a change in requirements to the fleet

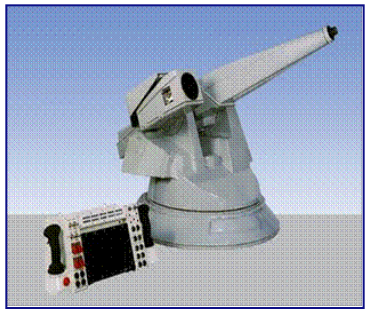
Introduction of two new ship classes in RNLN

Off Shore Patrol Vessel
- 4 ship class
- low intensity conflicts
- **asymmetric** threat
- (2010 – 2012)

Joint Support Ship
- 1 ship class
- full violence spectrum with
- **asymmetric** component
- (2014)

As a result: a change in requirements to the fleet (II)

OPV : 1 * 30mm WS & 2 * .50 WS per ship
JSS : 2 * 30mm WS & 4 * .50 WS per ship


.50 WS

<u>Requirements for RCWS</u>

- Specific threat set
- 30 mm – preferable dual feed
- TV / IR / LRF
- Controls integrated in CMS


30mm WS

<u>Contract OPV</u> signed July 2008

- OTO Melara (It): 30mm MARLIN WS with Mk44
- Systems JSS as options

Task of platform

present → new

Weapon system / Ammunition type

present → new

Research topics

1. Choice of Ammunition *vs* asymetric threat

short term advice

- Advice on first buy operational ammo
  - ✓ Off-the-shelf ammunition
  - ✓ No system modifications
- Limited budget & Quick
  - ✓ Use existing research data
  - ✓ Expert judgement

long term advice

- Full operational potential
  - ✓ Current & near future ammunition
  - ✓ System modifications allowed
- Bigger budget
  - ✓ detailed study
  - ✓ use of international agreements for data exchange

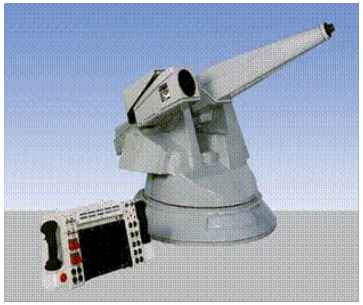
2. Self Defence Capability *vs* asymetric threat

Advice on:

- Tactical guidelines
- Control from CMS
- Optimal allocation of tasks

Initial choice of ammunition for Offshore Patrol Vessels

- Objective: ‘ranking’ of ammunition type performance for possible use in 0.50” and 30mm WS of OPV.



- Ranking based on:
  - SSPK (single shot probability of kill)
  - Burst (average # of rounds to achieve succes)

- Restrictions / Freedoms of choice
  - Ammunition (Availability, no modification on gun configuration)
  - Target set & range: what when to expect what kind of kill !!!
    - *mobility kill*
    - *catastrophic kill*.

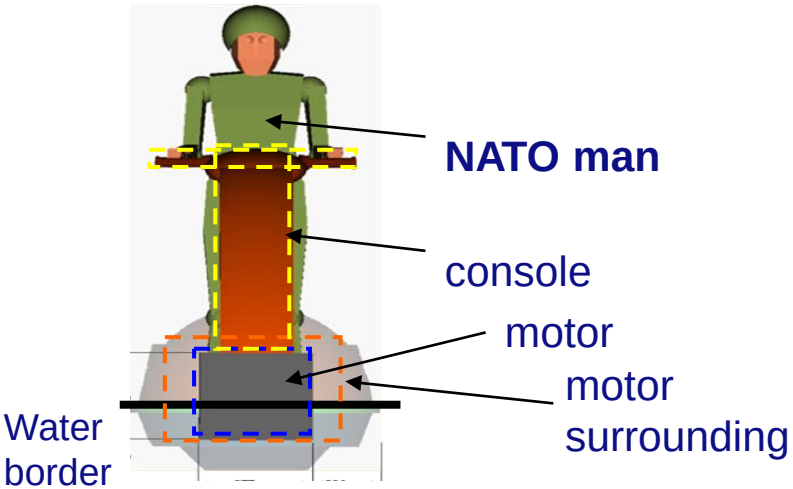
  - Time schedule & budget

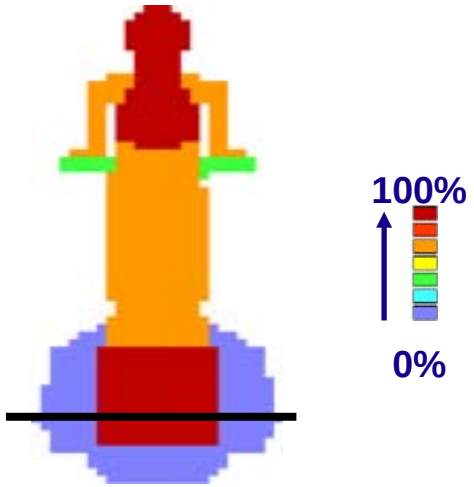
Quick scan methodology

- Build up of ~~detailed~~ target model(s)
  - Transformation in geometric models using Google Sketch-up
  - Introduction of critical components

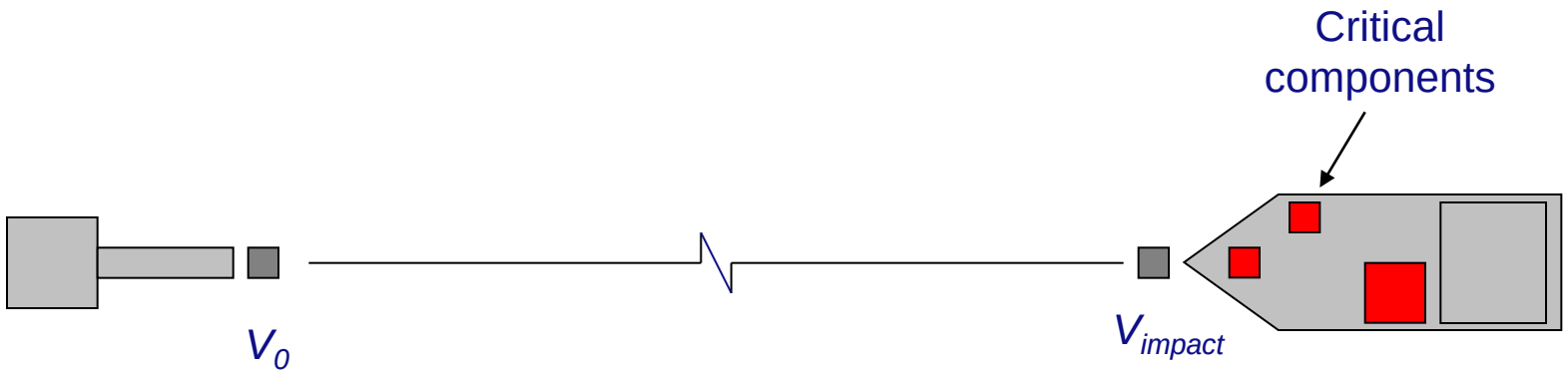
- ~~build up of detailed~~ ammunition model(s)
  - direct translation into expected effect on component level (Pk/c)

- computations with standard software

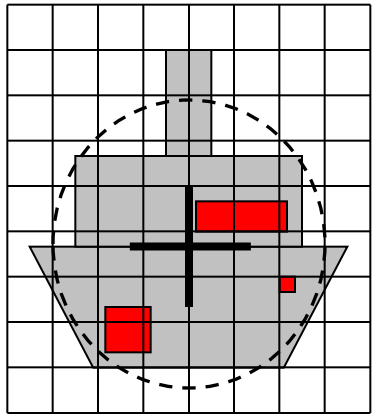




Sketch of quick scan methodology



Gun and ammunition dispersion determine the hit probability (*Ph,s*) of each critical component.

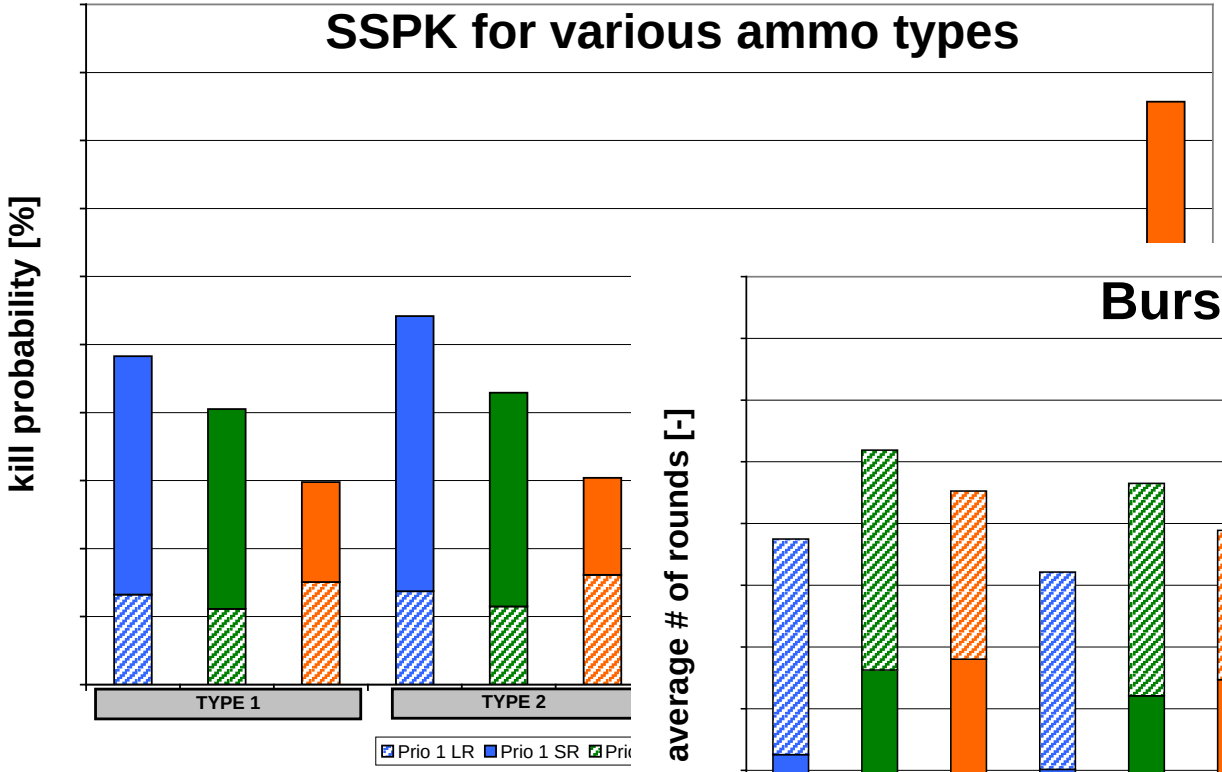


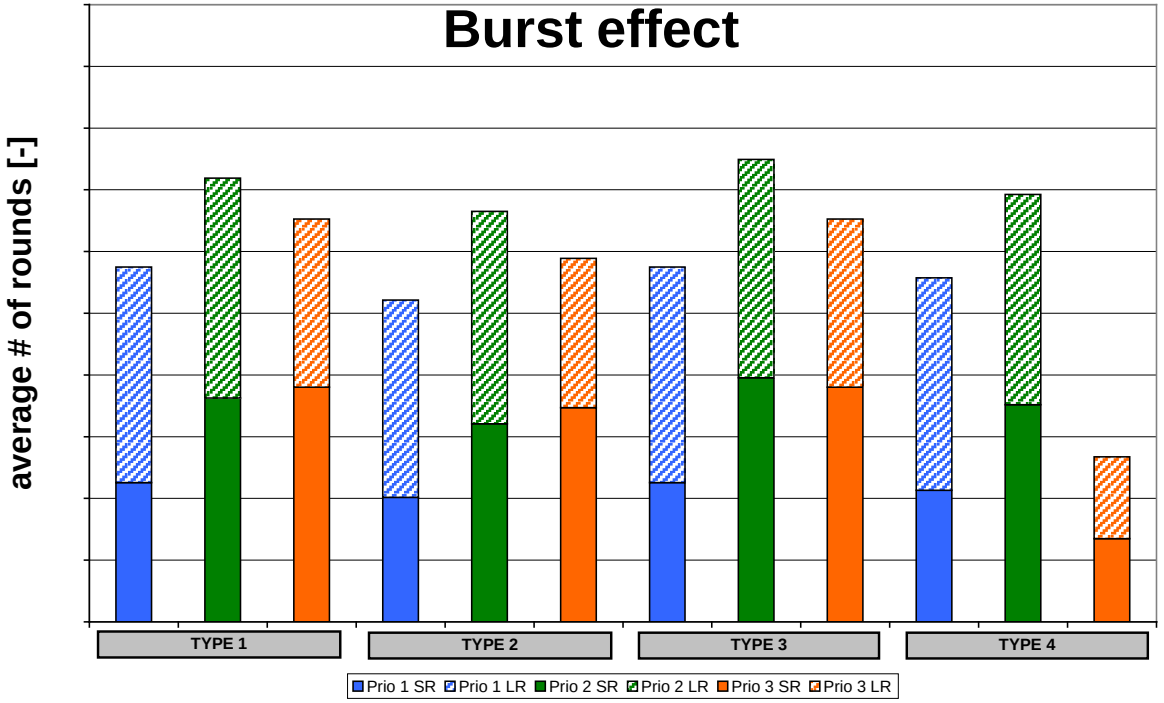
Ammuntion type, V_{impact}, impact angle and target information result in perforation capacity and damaging effect

Kill probability ($P_{k,s}$) is the sum of individual *Pk,h x Ph,s f*or each component.

!No cummulative damaging effect is taken into account for burst calculations!

Results





- Target 1 at long range
- Target 2 at short range
- Target 3

Long term solution

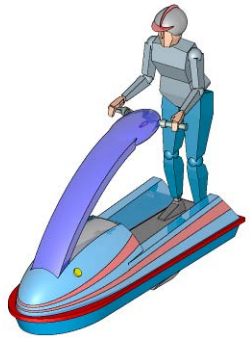
- Objective:
  selection of optimal ammunition type for 30 mm gunsystem

Normal methodology:

- build up of detailed target model(s)

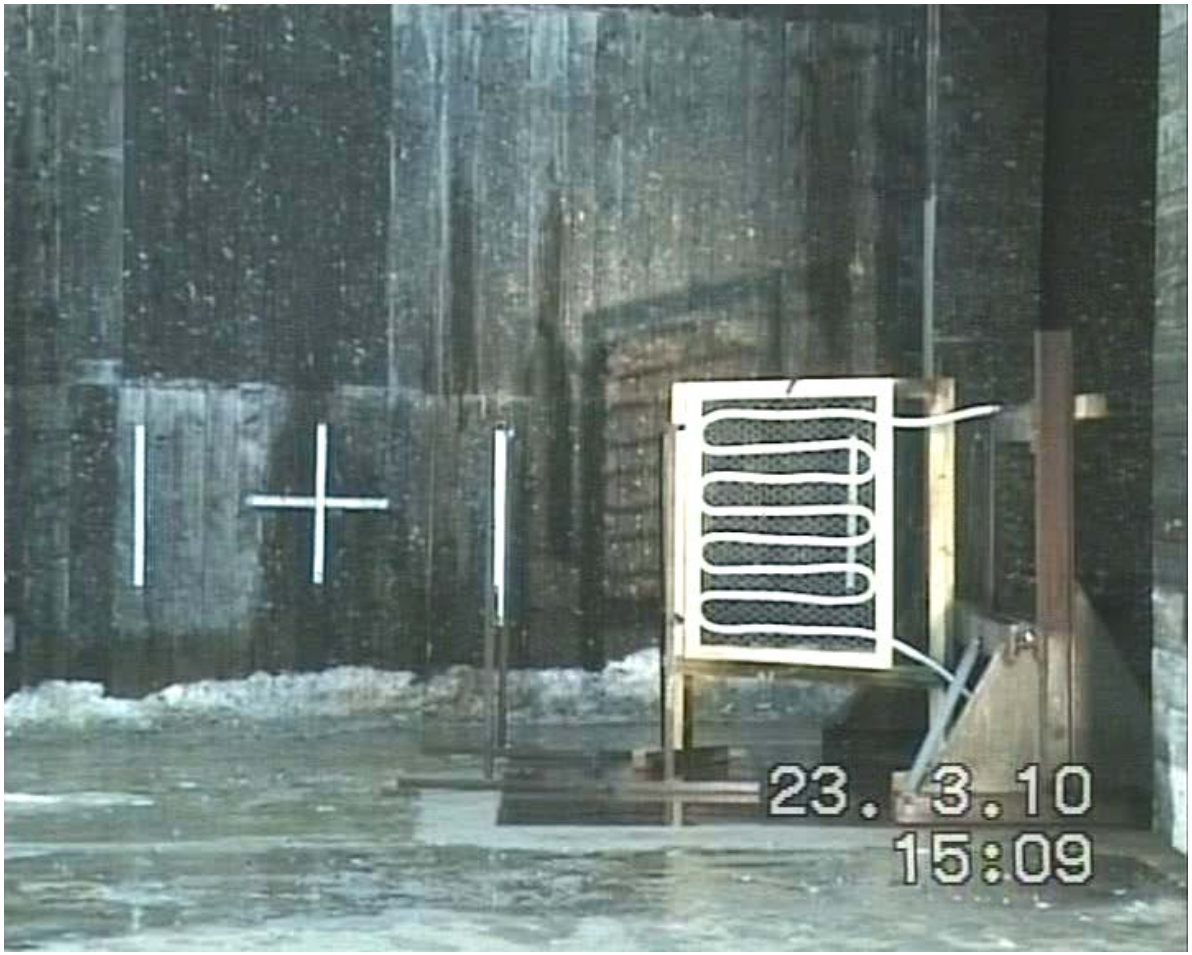
- build up of detailed ammunition model(s)

PELE trial regarding incendiary effect and modelling



- numerous simulations with TARVAC software

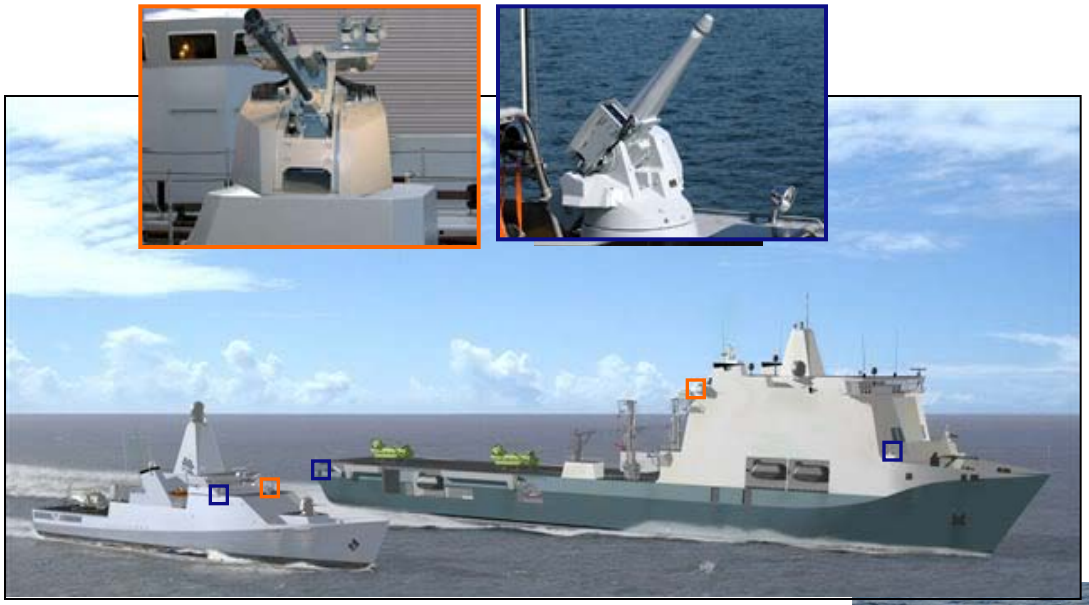
Single PELE round on ‘short target’, simulated distance @ 1 km



- Single PELE **Zr** round on ‘short target’, simulated distance @ 2 km

- Burst of PELE rounds on ‘deep target’, simulated distance @ 1 km

Self defence capability of ship with RCWS against Asymmetric Threats



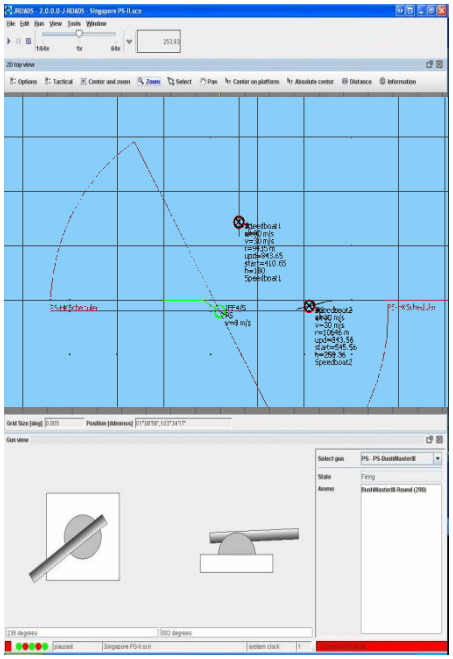
Advice on:

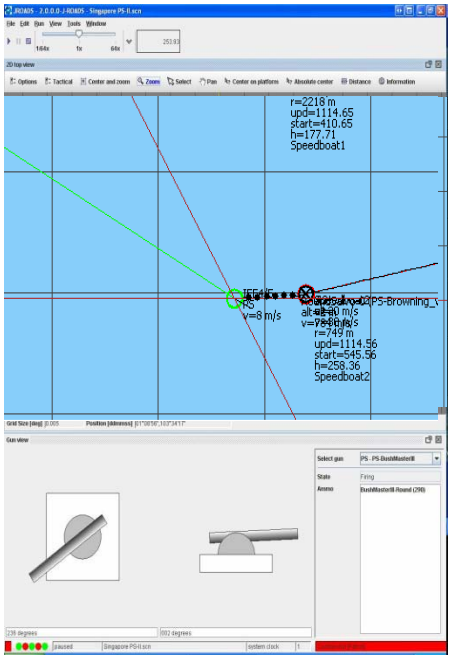
- Tactical guidelines
- Control from CMS
- Optimal allocation of tasks

Immobilised target

Self defence capability
(Tactical guidelines)

Modelling ship (components), targets, interaction and scenario



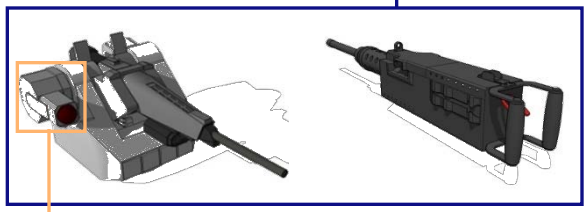


Analysis based on computational Monte Carlo runs

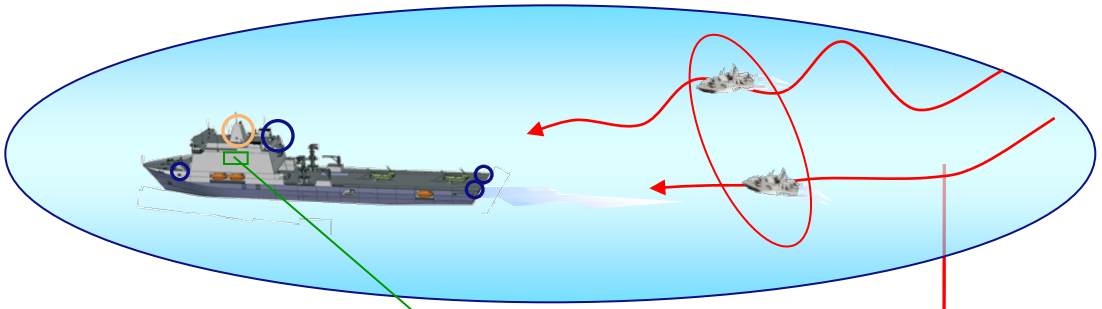
Engagements result with guns at platforms												
Gun name	Target name	# ammo	# hits	% hits	% kills	Avg kill time	Avg kill range	Avg first launch range	part 1	part 1 # hit	part 2	part 2 # hits
PS-050_1	SuicideBoat1	3	1	33.33	100	288.9	865.78	865.78	289.97			
PS-30mm	SuicideBoat1	180	21	11.67	90	232.18	1508.62	1860.45	SuicideBoat1-Hull1	17	SuicideBoat1-Hull2	4
PS-050_1	SuicideBoat2	18	1	5.56	0			956.02	338.24			
PS-30mm	SuicideBoat2	180	26	14.44	88	243.64	1445.92	1805.45	SuicideBoat2-Hull1	21	SuicideBoat2-Hull2	5
PS-30mm	SuicideBoat3	484	19	3.93	77.78	320.22	855.49	1429.01	SuicideBoat3-EngineBox	6	SuicideBoat3-Hull2	19
PS-050_2	SuicideBoat4	30	1	3.33	0			985.32	344.2			
PS-30mm	SuicideBoat4	495	19	3.84	70	299.73	1061.43	1861.32	SuicideBoat4-Hull2	19	SuicideBoat4-EngineBox	3

Self defence capability (Allocation tasks)

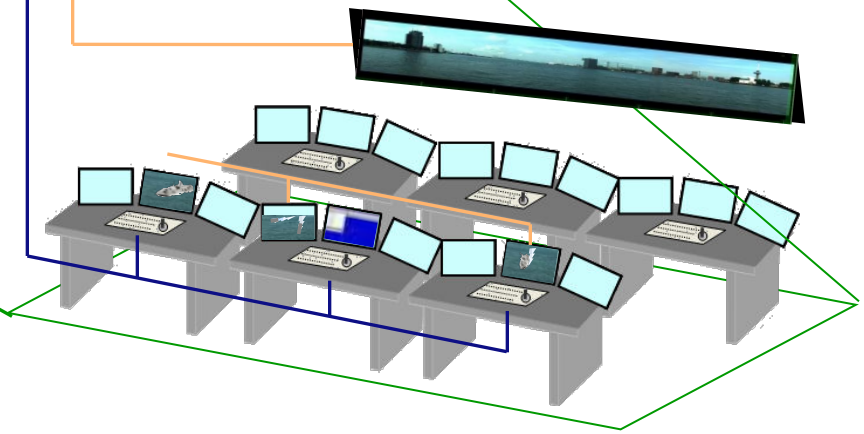
Guns & Sensors



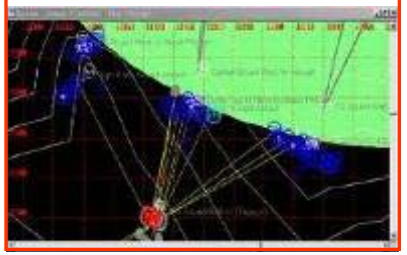
3D visual



Man Machine Interface



Comp. Generated Forces



ACE study:
Human in the Loop

Task of platform

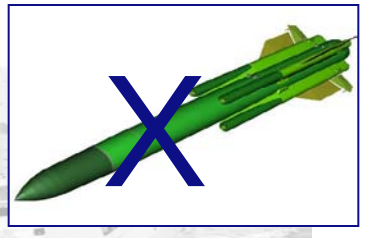
present

new

Weapon system / Ammunition type

present

new



Non lethal solutions

Summary

- Warfare has changed: operations in littoral areas
- Change in demands within RNLN: new ship classes
- Research topics
  - Choice of ammunition
    - ✓ Short term solution
    - ✓ Long term solution
    - ✓ Non lethal solution
  - Self Defence Capability of ship

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