

ASSIM:

THE HELP-TO-DECISION TOOL  
TO OPTIMISE IM SIGNATURE SPECIFICATION

Written by Expert Working Group on  
Cost Benefit Analysis (CBA)

*From IMEMG*

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- IM / MURAT benefits
  - Increased safety and survivability
  - Opportunities to realise logistical benefits
- A need to improve the analysis supporting IM introduction
  - Cost Benefit Analysis (CBA) to consider pros and cons of IM
  - Justification of the cost and the content of any new project
- CBA: What for?
  - Make the relation between IM introduction and costs
  - Evaluate different technical solutions that are available vs feasible/achievable
  - Establish the cost of ownership according to a specified IM level

## Cost and Benefit Analysis Background

- Tools developed implementing CBA methods

- 2 main tools : CBAM (MSIAC) and ACB (IMEMG)
- Based on NIMIC methodology (F. Möller)
- User-created life cycle of the munition

- Generally, the models are able to:

- Calculate the complete ownership cost over the entire life cycle
- Compare non-IM with IM, IM versus full-IM
- Give an explanation of the costs 
- Help identifying the key cost drivers:
  - » Life cycle stage
  - » Statistical relations between the outputs

- But CBA...

- Is used occasionally
- Can "freeze" the approach (difficult to discuss the costs of a specific system...)

The studied case



The sequence



The elementary situation



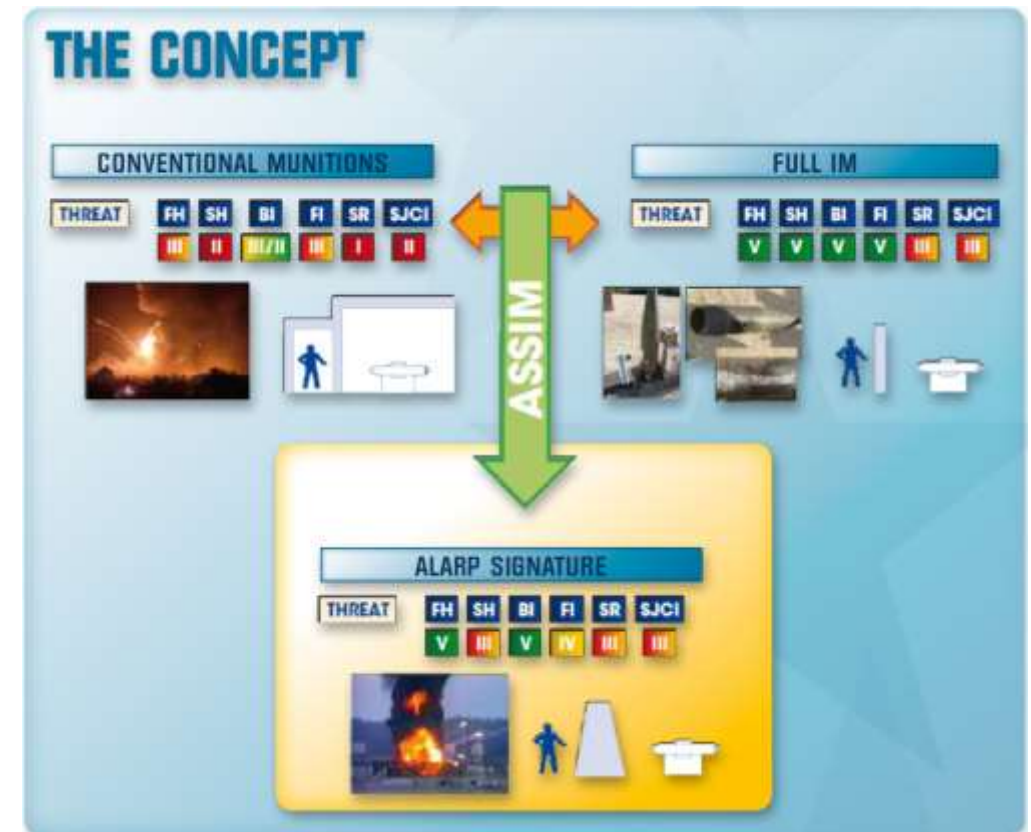
The event (threat)



...

## A New Concept for Cost Benefit Analysis

- Aspiration to use additional tools
  - Excluding quantitative aspects
  - To get greater flexibility in exchange
  - To push forward IM implementation



- A new methodology proposed by IMEMG EWG on CBA to compare:
  - A specified signature (by default baseline is STANAG 4439)
  - The best possible signature that can be achieved with available technologies

**=> Use this comparison to identify an acceptable compromise based on analysed risks**

## A New Concept for Cost Benefit Analysis

Assitant to **S**pecify a **S**ignature for an **IM** / MURAT

Aide à la **S**pécification d'une **S**ignature IM / **MURAT**

- **ASSIM: a new tool for CBA**

- A new methodology to justify the specification of an ALARP IM signature

- **ASSIM concept and main functions researched (1/2)**

- Follow a structured approach to identify an achievable IM signature

- » See "specification process" part

- **No cost entry needed**

- Determine raw signature

- » For a given threat: maybe different and several reaction levels assigned

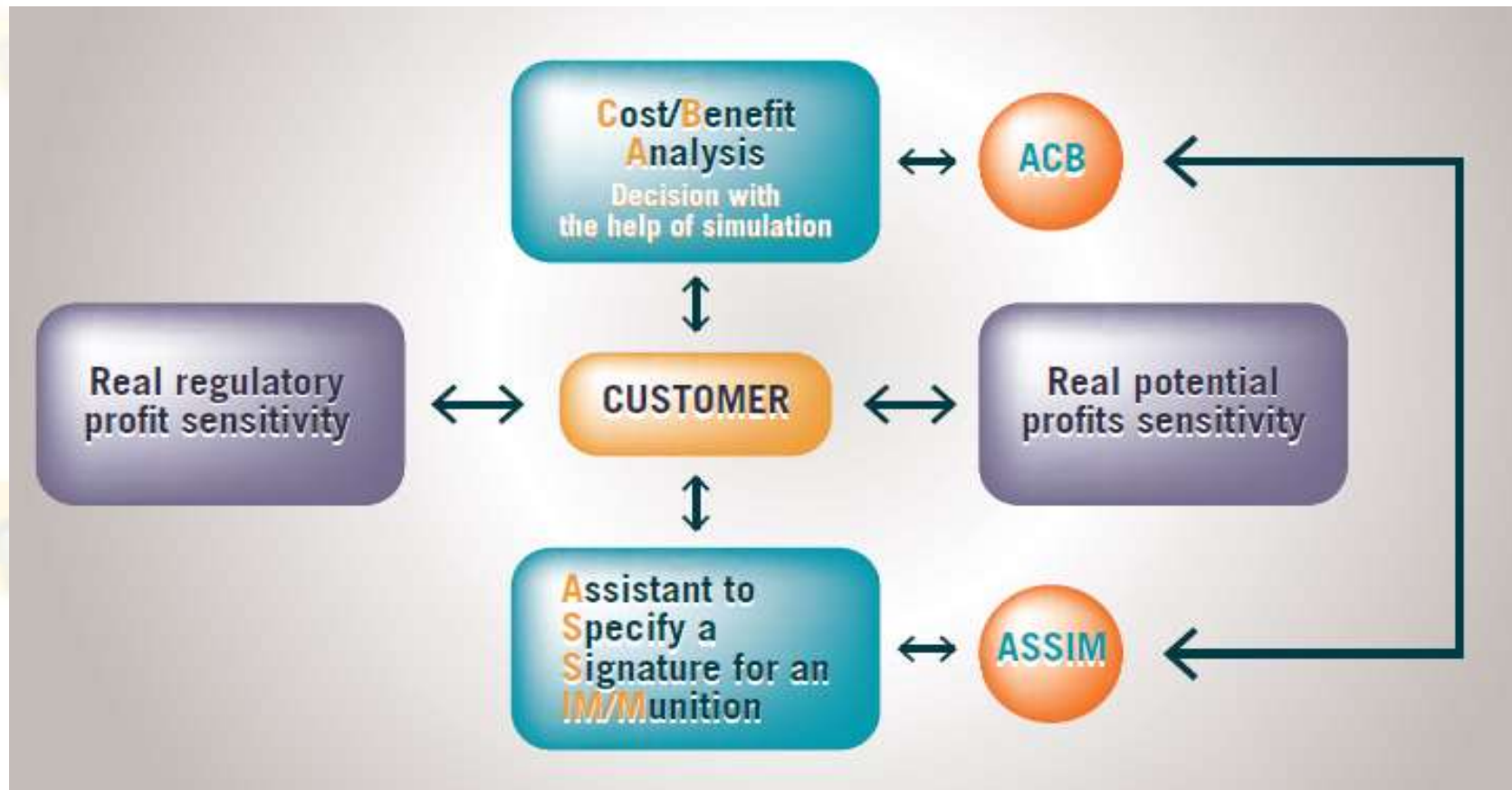
- » Aim: to select the least violent response

- Perform an analysis to converge towards an IM signature

- **Provide illustrations to support discussion between stakeholders and specification of the required IM signature**

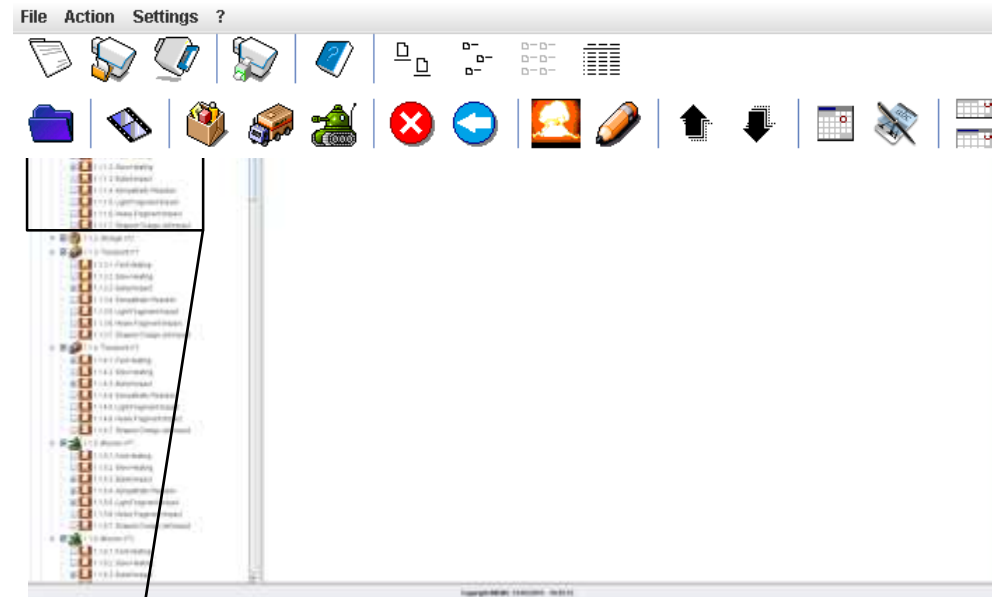
## A New Concept for Cost Benefit Analysis

- ASSIM concept and functions researched (2/2)
  - Able to be used in parallel with a CBA tool



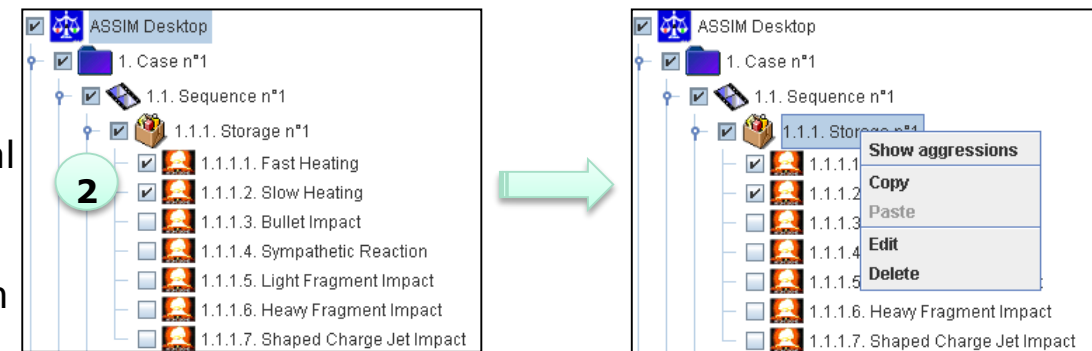
## • Software main characteristics

- Software developed: prototype level
- Flexibility regarding:
  - » Portability: JAVA
  - » Use: both English and French interfaces available (other language implemented easily!)
- Share common functions with ACB



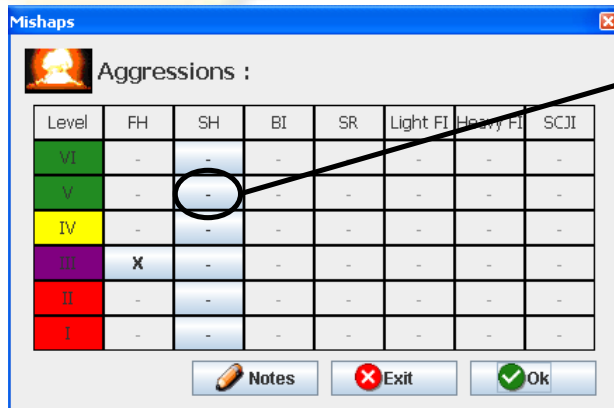
## • Steps of specification process (1/2)

- 1** - User-created life cycle: tree structure
  - Identify elementary situations leading to a potential event
- 2** - Choose the threats causing the munition to react in this(ese) situation(s)

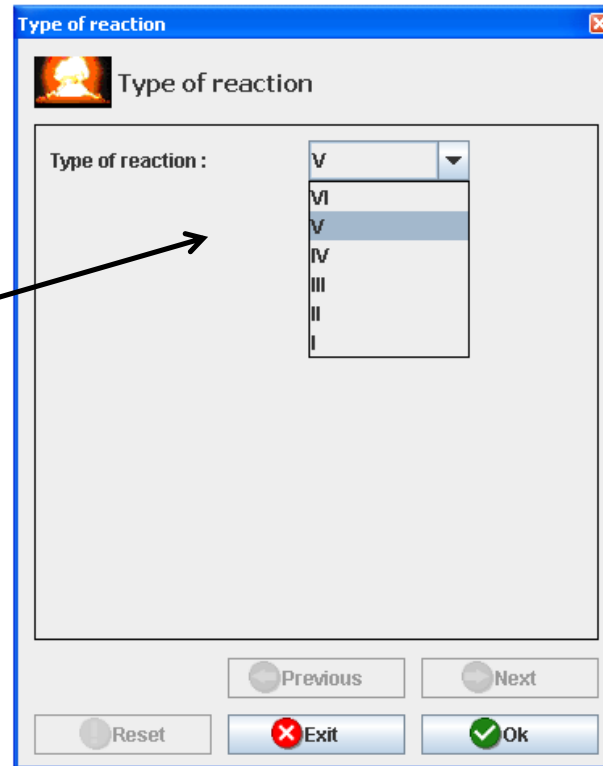


- Steps of specification process (2/2)
  - Assign an acceptable reaction level for each threat and situation

**Storage n°1**



Level	FH	SH	BI	SR	Light FI	Heavy FI	SCJI
VI	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-
IV	-	-	-	-	-	-	-
III	X	-	-	-	-	-	-
II	-	-	-	-	-	-	-
I	-	-	-	-	-	-	-

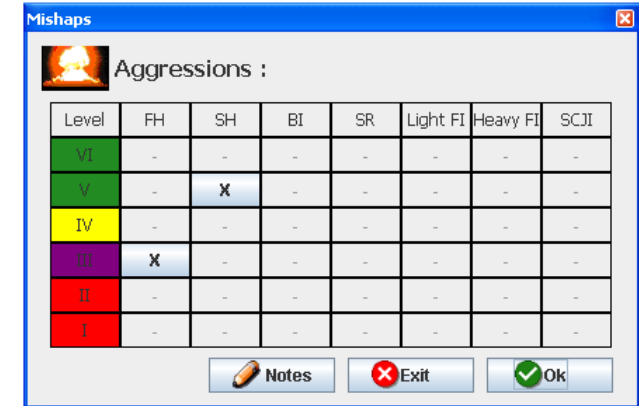


Type of reaction

Type of reaction :

V  
VI  
V  
IV  
III  
II  
I

Previous Next  
Reset Exit Ok



Level	FH	SH	BI	SR	Light FI	Heavy FI	SCJI
VI	-	-	-	-	-	-	-
V	-	X	-	-	-	-	-
IV	-	-	-	-	-	-	-
III	X	-	-	-	-	-	-
II	-	-	-	-	-	-	-
I	-	-	-	-	-	-	-

Notes Exit Ok

Same process to carry on  
for next elementary situation

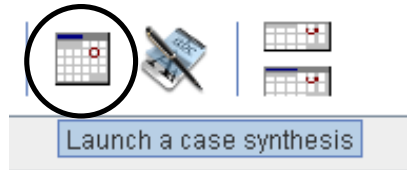
**Transport n°1**





## • ASSIM Results

- Synthesis table: 7 threats considered
- For each threat
  - » Node number with corresponding elementary situation
  - » Reaction level required for each elementary situation
  - » Comments



Synthesis

Name of the current case : Case n°1

Light Fragment Impact		Heavy Fragment Impact		Shaped Charge Jet Impact	
Fast Heating		Slow Heating		Bullet Impact	
Number	Elementary Situation	Type of reaction desired	Sympathetic Reaction		
1.1.2.	Sequence n°1 / Storage n°2 /	V	Rogatus ad ultimum admiss...		
1.3.3.	Sequence n°3 / Mission n°4 /	V	Rogatus ad ultimum admiss...		
1.1.4.	Sequence n°1 / Transport n°2 /	IV	Rogatus ad ultimum admiss...		
1.1.1.	Sequence n°1 / Storage n°1 /	III	Rogatus ad ultimum admiss...		

Signature Ok

Synthesis

Name of the current case : Case n°1

Light Fragment Impact		Heavy Fragment Impact		Shaped Charge Jet Impact	
Fast Heating		Slow Heating		Bullet Impact	
Number	Elementary Situation	Type of reaction desired	Sympathetic Reaction		
1.1.3.	Sequence n°1 / Transport n°1 /	IV	Rogatus ad ultimum admiss...		
1.1.5.	Sequence n°1 / Mission n°1 /	IV	Rogatus ad ultimum admiss...		
1.1.6.	Sequence n°1 / Mission n°2 /	IV	Rogatus ad ultimum admiss...		
1.2.3.	Sequence n°2 / Transport n°3 /	IV	Rogatus ad ultimum admiss...		
1.3.1.	Sequence n°3 / Transport n°4 /	IV	Rogatus ad ultimum admiss...		
1.1.4.	Sequence n°1 / Transport n°2 /	V	Rogatus ad ultimum admiss...		
1.3.2.	Sequence n°3 / Mission n°3 /	V	Rogatus ad ultimum admiss...		
1.3.3.	Sequence n°3 / Mission n°4 /	V	Rogatus ad ultimum admiss...		

Signature Ok

## • ASSIM Results

### – Determine raw signature

- » Compilation of the least violent response for each threat
- » Comparison to IM requirements (STANAG 4439)
- » Number of situations associated to the different threats (*Synthesis table*)



Unique signature

Unique raw signature

level	FH	SH	BI	SR	Light FI	Heavy FI	SCJI
VI		●			●		
V	●		●	●		●	
IV							●
III							
II							
I							

Label: STANAG 4439

Details

Exit

*In order to go to the tab which generates the signature, click on this icon*

Unique signature

Unique raw sign

level	FH	SH	BI	SR	Light FI	Heavy FI	SCJI
VI		●					
V	●						
IV							
III							
II							
I							

Label: Murat \*\*\*

Murat \*

Murat \*\*

Murat \*\*\*

STANAG 4439

SSD 1.2.3

Unique signature

Unique raw signature

level	FH	SH	BI	SR	Light FI	Heavy FI	SCJI
VI		1			2		
V	2	3	3	4	1	1	
IV	1		5	1	2	1	1
III	1						
II							
I							

Label: STANAG 4439

Signature

Exit

*In order to go to the tab which generates the signature, click on this icon*

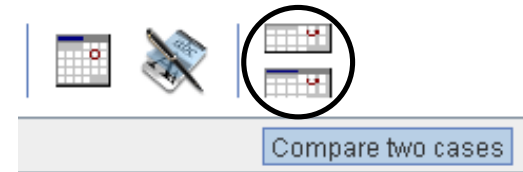
## • ASSIM Results

– Build a new case:

- » Which follow specification steps described
- » Which copy baseline case

– Second case example to follow: IM solution offered by a manufacturer

– Compare two cases



Signature comparison

Raw signature comparison

Level	FH	SH	BI	SR	Light FI	Heavy FI	SCJI
VI	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-
IV	-	-	-	-	-	-	-
III	-	-	-	-	-	-	-
II	-	-	-	-	-	-	-
I	-	-	-	-	-	-	-

■ First case : Case n°1      ■ First and second case.  
■ Second case : Case n°2

Exit

## • Discussion of ASSIM Results (1/2)

– Gaps identification: a new example



Unique signature

Unique raw signature

level	FH	SH	BI	SR	Light FI	Heavy FI	SCJI
VI					●		
V	●	●	●	●		●	
IV							●
III							
II							
I							

Label: STANAG 4439

Details Exit

In order to go to the tab which generates the signature, click on this icon



Unique signature

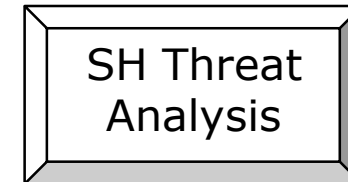
Unique raw signature

level	FH	SH	BI	SR	Light FI	Heavy FI	SCJI
VI					2		
V	2	1	3	4	1	1	
IV	1	3	5	1	2	1	1
III	1						
II							
I							

Label: STANAG 4439

Signature Exit

In order to go to the tab which generates the signature, click on this icon



Unique signature

Unique raw signature

level	FH	SH	BI	SR	Light FI	Heavy FI	SCJI
VI					2		
V	2		3	4	1	1	
IV	1	4	5	1	2	1	1
III	1						
II							
I							

Label: STANAG 4439

Signature Exit

In order to go to the tab which generates the signature, click on this icon



Unique signature

Unique raw signature

level	FH	SH	BI	SR	Light FI	Heavy FI	SCJI
VI					●		
V	●		●	●		●	
IV		●					●
III							
II							
I							

Label: STANAG 4439

Details Exit

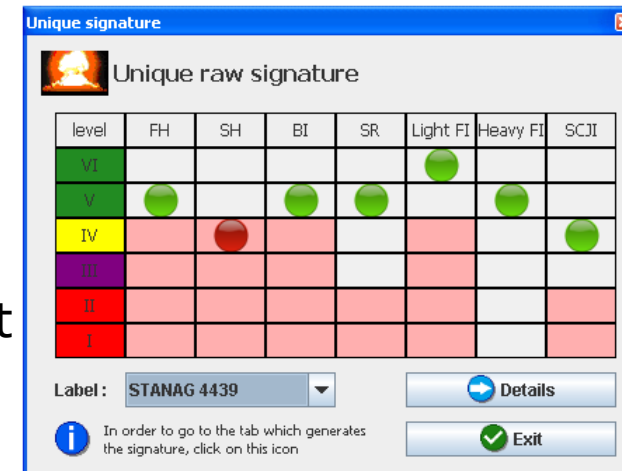
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## • Discussion of ASSIM Results (2/2)

### => Engagement between all stakeholders

- Could SH support the argument to reduce the requirement from a Type V to a Type IV response?
- Are we able to assume the risks involved by such a decision?
- The ability to review and reduce the IM performance requirements for the munition can result in **lower development and production costs for the manufacturer**

=> **lower procurement costs for the customer**



## Conclusions and Perspectives (1/2)

- The "simplest" way to specify an IM signature: STANAG 4439
  - STANAG 4439 requirements are ambitious
  - Few munitions currently manufactured or in development are fully IM compliant
- So:
  - Are there any non-essential requirements?
  - Do the costs associated outweigh the potential benefits?
  - Is there an acceptable ALARP IM specification?
- With no calculations, ASSIM can:
  - Promote discussion between all stakeholders
  - Help determining the best compromise in terms of IM requirements
  - Lead to an ALARP signature assuming a few acceptable risks
- Nevertheless:
  - A true economic analysis is necessary
  - A "conventional" CBA tool has to be used

## Conclusions and Perspectives (2/2)

- Is there an interest for ASSIM? Initial feedback:
  - New French MoD instruction for MURAT (IM) policy and its implementation (July 2011)
  - 2 signatures defined: Stabilized and Reference
  - ASSIM key functions presented to French MoD in line with MURAT assessment:
    - » Life cycle description with a tree diagram
    - » Consistency of data can be checked (Synthesis table)
    - » Typical response charts to represent IM signature
    - » Number of required reaction levels for any given threat
- ASSIM: The way ahead
  - Improve the tool (Get it stable, debugging, ...)
  - Additional functions ?
    - » Related to risks
    - » Logistic benefits provided by dedicated signatures
  - Feedback from a wider audience
    - » To include IMEMG countries
    - » At IMEMTS 2015 Symposium: come and visit IMEMG booth !



# THANK YOU FOR YOUR ATTENTION

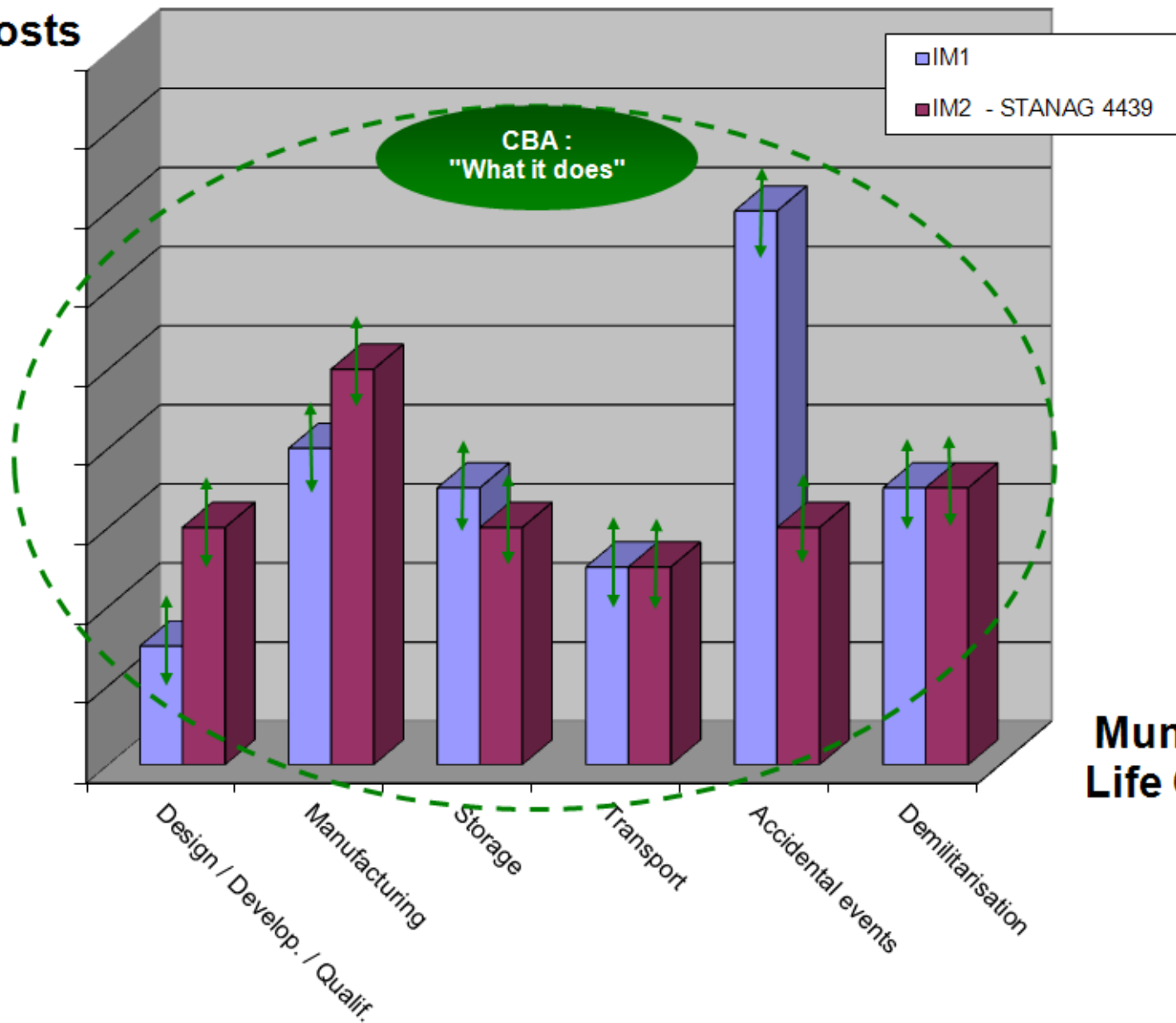
- This paper is the results of the work prepared by Cost Benefit Analysis EWG
  - Membership



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## Costs



**Muniton  
Life Cycle**

