Cost Benefit Analysis Studies of the Introduction of Insensitive Munitions: Is IM Cost of Ownership Cheaper?

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CBA Studies of the Introduction of IM

• Introduction

• Brief Description of CBAM

• Cost Benefits Analyses:
  — 1st Study: Short Range Air-to Air Missile
  — 2nd Study: 155-mm Artillery Munition

• Conclusions
Introduction

• **June 2001: NIMIC organized the Costs & Benefits Analysis Workshop**
  - Definition of a set of requirements for a Cost Benefit Analysis Model
  - Development of a promotion methodology of IM to the Stakeholders

• **2002-2003: Development & Validation of the CBAM**
  - Code development
  - Validation studies
  - Release of the code to the NIMIC Nations (May 2003)
Cost Benefit Analysis Model - CBAM

• CBAM is primarily a tool to help calculate the cost differences of introducing IM into service
  – i.e. compares the cost of ownership of IM vs. Non-IM over the whole of the life of a munition

• It can also be used to calculate the cost of ownership of a munition
Description of the Model

• CBAM calculates cost differences by:
  – Aiding in the creation of a life cycle for a munition type
    ➢ Life-cycle Tree creation component
  – Providing a structured method for compiling cost data
    ➢ Modules to account for cost differences arising from:
      – Risk Assessment
      – Direct cost
  – Calculates cost by means of a Monte Carlo Simulation
    ➢ Takes into account the uncertainties
Life Cycle Component

Cost Module

Risk Module
Cost Module

Direct Cost Module

Cost
% Life Time = 0 % = 0 Year

Duration
Days 0 Years

155-mm-noIM

Cost/Year

No of Units

Calculate

Overall Cost

Clear Data

Close
Threat Database

- **Threats and Probability Database**
  - Threats and the probability of experiencing a threat

[Diagram of a database interface with columns for Threats, Lookup Box, Threat Details, and General Threat Descriptors. The descriptors include Threat Descriptors (e.g., High, Medium, Low) and Probability of the threat.]
Asset & Consequences Database

Cost or Repaired Cost of an Asset / Asset Designation

Consequence Descriptors (e.g. category I, II, III, IV – AOP-15)
Calculation

Select the Munitions to be calculated

Select the Number of Calculations

Select the Calculation Options

Progress Report
Results

Life Cycle Cost of the IM version

Life Cycle Cost of the non-IM version

% of the Population

Cost
1st Study: Short Range Air-to-Air Missile

• Why:
  – High-value munition on a high value platform
  – Data availability in NIMIC

• Life Cycle (cradle-to-grave sequences):
  – Peacetime (~24 years):
    ➢ Storage (~ 90 % of the life cycle)
    ➢ Transport (road, rail, sea and air)
    ➢ Maintenance
    ➢ Training
    ➢ Disposal
  – Crisis (6 months)
    ➢ Deployment, operational training, etc
  – Conflict (1 month)
    ➢ Platform vulnerability, Airbase and Ammo Dump vulnerability
SRAAM: CBA results

IM extra-cost: ~ + 0.6%

IM Unit Cost: ~ + 0.2%

100 % = Procurement Cost of non-IM missiles
SRAAM: CBA results

IM LCC Benefits:
Peacetime & Crisis/
Peacekeeping Only

100% = Procurement Cost
of non-IM missiles

+ 0.3%
SRAAM: CBA results

100 % = Procurement Cost of non-IM missiles

IM LCC Benefits:

+ 4.0 %

+ 70 missiles

107.00%
106.00%
105.00%
104.00%
103.00%
102.00%
101.00%
100.00%
99.00%
98.00%
97.00%

IM %

non-IM %

IM LCC Benefits:

++

70 missiles
SRAAM Cost Benefit Analysis: Lessons

• **Main lessons (Small and High value missile – High Value platform)**
  
  — Limited benefits in transport
    - No. of missiles transported limited by the volume
    - Consequences of accidents limited (low NEQ)
  
  — Limited benefits in peacetime storage
    - Peacetime storage adapted to HD 1.1
    - Consequences of accidents limited (low NEQ)

— **Main Benefits in Operations:**
  - Training
  - Crisis and Peacekeeping operations (Armed helicopter)
  - Reduced vulnerability of Air Bases
  - Reduced vulnerability of helicopters (Note: 1 or 2 % reduced vulnerability is enough to get significant cost-benefits)
2nd Study: 155-mm Artillery Ammunition

- **Why:**
  - Low-cost munition on a relatively low-cost platform
  - Data availability in NIMIC

- **Life Cycle (cradle-to-grave sequences):**
  - Peacetime (~24 years):
    - Storage (~90% of the life cycle)
    - Transport (road, rail, sea and air)
    - Maintenance
    - Training
    - Disposal
  - Crisis (6 months)
    - Deployment, operational training, etc
  - Conflict (1 month)
    - Platform vulnerability, Land base and Ammo Dump vulnerability
155-mm Artillery Ammunition: results

IM extra-cost: ~ + 0.3%

IM Unit Cost: Less than 6%

HD 1.2.3
Benefits in Storage: ~ + 0.3%
155-mm Artillery Ammunition

IM LCC Benefits:
- Peacetime & Crisis
- Peacekeeping Only

IM Benefits:
- 2.5%

+ 3%

IM Benefits:
- - 2.5%

11 March, 2003 2003 IM&EM TS
155-mm Artillery Ammunition

IM LCC Benefits:

~ 2.0 %
155-mm Artillery Ammunition

- Results presented earlier are mean value (Monte Carlo - linear distribution)

- Probability of having a benefit:
  - Variability of the input data (exposure, threat probability, munition reaction probability, consequence probability)
  - Monte Carlo Runs

Min. Rate of Return
IM Investment: > 75 %

Max. Rate of Return
IM Investment: ~ 200 %

Probability of IM Benefit: 95.5 %
CBAM/CBA Studies: Capabilities & Limitations

• Too many uncertainties may give a meaningless result

• Some IM benefits are not financial:
  – The increased flexibility in operations
  – The reduced logistics
  – Some consequences of accidents, such limited access to zones where UXOs have been spread
  – Operational, Health & Safety, Environmental and Political Benefits
Future of CBAM

• Any comments, recommendations, requirements for the Model are welcome

• Future?
  – Tool development and testing is now completed
  – A $\alpha$-version has been released early March 2003 to a limited number of testers
  – Additional improvements before distribution:
    - life saving probability
    - Direct difference cost calculation (IM and non-IM version)
  – CBAM 1.0: May 2003
Conclusions

• **Storage benefits:**
  – Peacetime: very limited
  – Conflict or Crisis: medium to high

• **Transport benefits:**
  – Munition dependent
  – Nation dependent (exposure factor)

• **Benefits in operations (crisis or conflict)**
  – Reduced platform vulnerability
  – Reduced ground base vulnerability

• **Transport accident: political consequences?**
Any Questions?

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