MINISTÈRE DE LA DÉFENSE

THE FRENCH I.M. POLICY
10 YEARS AFTER

NDIA/NIMIC - 2003 IM&EMTS

DGA
THE FRENCH I.M./MURAT POLICY
10 YEARS AFTER

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SUMMARY

- THE FRENCH MURAT POLICY
  - HISTORICAL BACKGROUND
  - APPROACH & SPECIFICITIES
- THE ENFORCEMENT OF THE POLICY
  - THE LABELLED MUNITIONS
- THE ADVANTAGES AND NECESSARY IMPROVEMENTS
- THE WAY AHEAD
THE FRENCH MURAT POLICY

● HISTORICAL BACKGROUND

  • GENERAL POLICY ESTABLISHED IN 1992
  • POLICY IN LINE WITH STANAG 4439

  ➢ “MURAT/IM requirements shall be considered in all Munition design, development and replenishment activities”
  ➢ “MURAT will have to be introduced into service at the appropriate level”
  ➢ “New technologies have to be developed and considered for all new Programs”
THE FRENCH APPROACH

- **WHILE S3 ASSESSMENT**
  - Refers to a specific use and life cycle
  - Is only valid for well defined environments

- **IM/MURAT ASSESSMENT SHOULD**
  - Improve Interchangeability/Interoperability
  - Help cross-procurements
  - Make extension of life duration easier
  - Increase the confidence level in the risk assessment
THE FRENCH APPROACH

- MURAT ASSESSMENT
  - IS AN EVALUATION OF THE INTRINSIC SAFETY LEVEL (IMness) OF THE MUNITION, INDEPENDENTLY OF ANY SPECIFIC APPLICATION
  - IS BASED ON POSSIBLE REACTION MECHANISMS GENERATED BY MOST PROBABLE STIMULI/THREATS
  - SHOULD DEMONSTRATE THAT WORST POSSIBLE THREAT PARAMETERS ARE COVERED
THE FRENCH APPROACH

- MURAT SIGNATURE
  - IS COMPARED TO REFERENCE IMness LEVELS FOR A POSSIBLE ASSIGNMENT OF A “MURAT LABEL”

- MURAT Labels (★, ★★, ★★★)
  - Are defined to help common understanding
  - Allow an adaptation of requirements to
    - Required level of performance
    - Operational use and financial constraints
    - Available technologies
<table>
<thead>
<tr>
<th>NR</th>
<th>V</th>
<th>IV</th>
<th>III</th>
<th>II</th>
<th>I</th>
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<th>FH</th>
<th>SH</th>
<th>BI</th>
<th>SR</th>
<th>Light FI</th>
<th>Heavy FI</th>
<th>SC JI</th>
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Legend:
- **NR**: Neutral Risk
- **V**: Very Low Risk
- **IV**: Low Risk
- **III**: Medium Risk
- **II**: High Risk
- **I**: Very High Risk

- **FH**: Foot-and-Hand
- **SH**: Shoulder
- **BI**: Body
- **SR**: Skirt
- **Light FI**: Light Footwear
- **Heavy FI**: Heavy Footwear
- **SC JI**: Security Clearance
ASSIGNMENT OF LABELS

- Assignment of MURAT LABELS is under the responsibility of the “Inspecteur de l’Armement pour les Poudres et Explosifs” (IPE) acting as NATIONAL (EXPLOSIVE) SAFETY AUTHORITY
ENFORCEMENT OF THE POLICY

- First MURAT developments were for munitions to be onboard the CVN Charles de Gaulle

- Since 1993/1994, MURAT goals are more and more considered in new programs
ENFORCEMENT OF THE POLICY

- Since 1998, IPE is also NATIONAL AUTHORITY for MUNITION SAFETY QUALIFICATION: validation of the good taking into account of safety in the Program
- For MUNITION SAFETY QUALIFICATION, MURAT requirements should be clearly defined and justified in the Program Mission Need Specification
ENFORCEMENT OF THE POLICY

TO DATE, 6 LABELS WERE ASSIGNED BY IPE

- 155 mm Artillery Shell       →  MURAT ★
- 155 mm GP modular charge     →  MURAT ★
- 250 lb Penetrator Bomb       →  MURAT ★★
- Explosive Reactive Armor     →  MURAT ★
- VT1 M01 Air Defense Missile →  MURAT ★
- Apache Cruise Missile        →  MURAT ★
155 mm ARTILLERY SHELL (GIAT ind.)

- Comp. XF 1353 (NTO 65%, TNT 35%), EIDS
- Configuration: 20 palletized without fuze/gun cartridge

Figure 1 (Shell)
155 mm ARTILLERY SHELL

- **Bullet Impact**:  
  - 4 tests → 4 NR

- **Sympathetic Reaction**:  
  - Tests and/or (DYNA 2D) Modeling config.
    - Shells separated by 15 mm → Type IV (670 MPa)
    - Shells separated by 30 mm → Type IV (727 MPa)
    - 10 lb test vehicle separated by 50 mm → Type IV (770 MPa)
    - Shells separated by 85 mm → Type III (900 MPa)
    - Gap test (with PMMA) → Type III (1500 MPa)
    - Heavy FI on test vehicle → Type III (3460 MPa)
    - Nominal functioning → Type I (4460 MPa)
155 mm SHELL SIGNATURE
VT1 M01 MISSILE (THALES)

- **WH**: 4.5 Kg HBU 88A (RDX 88%, HTPB 12%)
- **RM**: 31.5 Kg TPH 8313 (AP 82%, RDX 4%, Binder)
- **Case**: graphite epoxy
VT1 M01 MISSILE (THALES)

- Bullet Impact:
  - Friability $\rightarrow$ 17 MPa/ms
  - Test on (more confined) test vehicle $\rightarrow$ 9/10 Type III

- Sympathetic reaction:
  - Test with 4 AUR (without igniter) and 2 inert $\rightarrow$ TNT eq 8 Kg $\Rightarrow$ no SR
APACHE MISSILE (MBDA)

- 10 KRISS sub-munitions
- WH : 7.1 Kg B 2211 / V 350
- RM : 7.8 Kg TPH (AP 68%, Al 20%, Binder 12%)
- Metallic Case : NCDV16

- Analogy with MAGIC Missile
- 10 lb test vehicle testing
- No SD of sub-munitions within a Missile
- No SD of sub-munitions of adjacent Missiles
APACHE MISSILE
APACHE Missile SIGNATURE
250 lb BOMB (MBDA/SNPE)

- B 2214 (NTO 72%, HMX 12%, Binder 16%)
- Booster : HMX 86%, Binder 14%
- Intumescent coating / venting systems
- Without fuze

Figure 3 (Palettized bombs)
250 lb PENETRATOR BOMB

- Bullet Impact:
  - 5 tests (AUR, sections) → 4 NR, 1 Type V

- Sympathetic Reaction:
  - No diagonal effect
  - H.F.I. on AUR (2000 m/s) → Type V
  - S.D. Testing on 100 lb Test Vehicle → Type III

<table>
<thead>
<tr>
<th>Test Veh.</th>
<th>BOMB</th>
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<tbody>
<tr>
<td>Distance between munitions</td>
<td>0.5</td>
</tr>
<tr>
<td>Weight ratio HE/Metal</td>
<td>1.01</td>
</tr>
<tr>
<td>Fragment Velocity (Gurney)</td>
<td>1730</td>
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<tr>
<td>Shock Pressure (in the HE)</td>
<td>106 Kbar</td>
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<tr>
<td>Shock Duration (in the HE)</td>
<td>2.6 μs</td>
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250 lb BOMB SIGNATURE → ★★
ADVANTAGES & NECESSARY IMPROVEMENTS

- OBVIOUS BENEFITS OF I.M. IN TERMS OF
  - INCREASING PLATFORM SURVIVABILITY
  - DECREASING LOGISTICAL CONSTRAINTS (Handling, Storage, Maintenance)

- MILITARY USERS WANT TO QUANTIFY THOSE BENEFITS

- MUNITIONS DESIGNERS NEED CLEAR REQUIREMENTS
MILITARY USER EXPECTATIONS

- STORAGE
  - **NEED:**
    - define specific HD and QDs according to IM signature
    - allow the “mixing” of various I.M. in the same magazine
  - **Difficulties**:
    - difficulties to evolve national regulations
    - specific rules should be established by NATO for field storage
MILITARY USER EXPECTATIONS

- BENEFIT OF UNIT RISK :
  I.M. → TYPE III to F.H., S.H. and S.R.
  - BLAST (1.1) Hazards
    → QD based on NEQ of only 1 munition
  - FRAGMENTS (1.2) Hazards
    → QD based on NEQ of only 1 munition
  - THERMAL (1.3) Hazards
    → QD based on total NEQ of stored munitions

In France, QDs can be calculated taking into account the greatest of the 3 distances.
MILITARY USER EXPECTATIONS

- OPERATIONAL USE
  - NEED: increase operational capabilities by:
    - decreasing risks due to accidental or hostile threats
    - increasing interoperability/interchangeability within national and international Forces
  - *, standard requirements and assessments need to be internationally defined
  - *, standard signature should be defined for generic uses
EXAMPLE 1

250 lb penetrator bomb and Apache missile were developed for French Navy according to S3 requirements for the CVN C. de Gaulle because of their MURAT characteristics, both meet French Air Force S3 requirements and no additional assessment was necessary.
MILITARY USER EXPECTATIONS

● EXAMPLE 2

Transportation of Army weapons onboard Navy vessels

Emergency landing of allied aircraft on CVN Charles de Gaulle
  - possible without further assessment if MURAT signature shows no unacceptable risks for the platform
MUNITION DESIGNER EXPECTATIONS

- WELL DEFINED REQUIREMENTS
- SIMPLE AND WELL DEFINED ASSESSMENT TOOLS
  - TESTS, INSTRUMENTATION, PASS/FAIL CRITERIA
- TO HAVE THOSE REQUIREMENTS AND ASSESSMENT TOOLS INTERNATIONALLY AGREED
THE WAY AHEAD

- Within UN, Nations agreed to classify articles using standard procedures and a very simple protocol.
- From such a simple assessment, clear rules were defined for Transportation and Storage depending on:
  - probability and gravity of risks (HD)
  - type of risks (compatibility groups)
THE WAY AHEAD

- Such a classification and associated rules should be established by NATO for Munitions based on their IM Signatures
- This should be a major challenge for the new NATO CASG (CNAD AMMUNITION SAFETY GROUP)