IMEMG MURAT
EUROPEAN MANUFACTURERS GROUP

The 3rd European IM Day

Amsterdam, 18-19th May 2017

SESSION 3

EUROPEAN INDUSTRY CONTRIBUTION

Session chair

Arno von der Fecht

IMEMG

Dr. Ron E Hollands

President

IMEMG Industry Contribution

"Priorities for IM"

The 3rd European IM Day

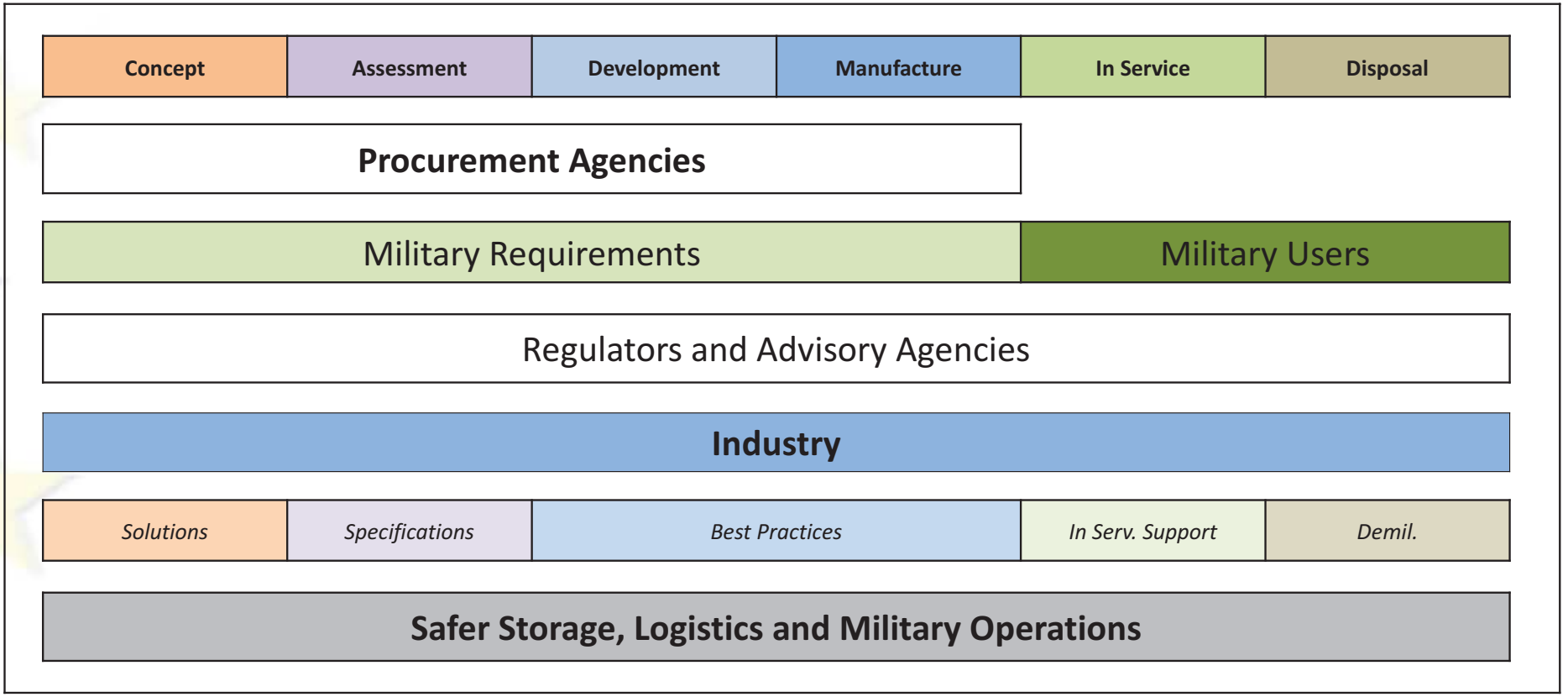
Ron Hollands
President IMEMG

Membership

21 Companies from 8 countries (as of January 2017):

Our Commitment

To Support IM Stakeholders throughout the product lifecycle:



Expert Working Group Overview

- Active technical collaboration between IMEMG member companies
- Pooling of extensive expertise and knowledge
- Cooperation with MSIAC

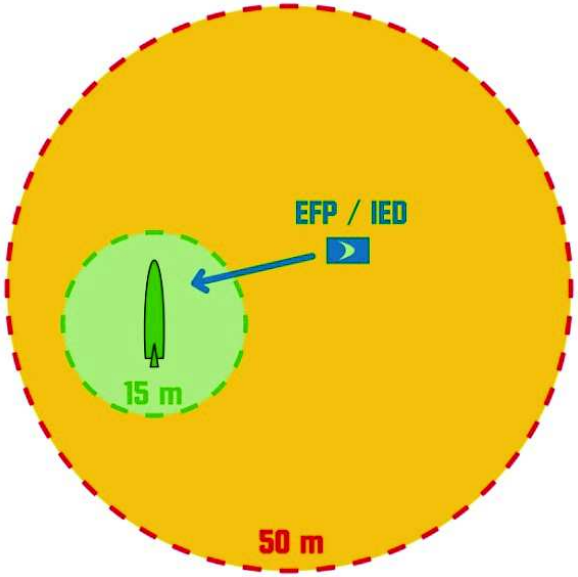
- Focused effort in five key areas
  - **Hazard Assessment and Classification**
    - » **STANAG and AOP Revisions**
  - **STANAG 4240 Fast Cook Off Procedure**
    - » **Jet fuel versus greener alternatives**
  - **Effect of Ageing on IM Response**
    - » **Linking IM response, IM stimulus and energetic material failure modes**
  - **IM Modelling**
    - » **How can we predict IM response? Where are the Gaps in capability?**
  - **Cost Benefit Analysis**
    - » **ASSIM Decision Tool for IM Signature**

Hazard Assessment and Classification EWG(1)

- STANAG and and AOP Improvements
- IMEMG study prompted and by fed by MSIAC surveys and reports on IM response descriptors
- Main topics
  - **Fragment Impact and mandatory Type V response taking into account STANAG 4496 test conditions**
  - **Projection criterion to pass Type V response**
  - **Propulsion effect assessment to pass Type V response**
  - **Slow Cook off and mandatory Type V response for "fire in an adjacent magazine , store or vehicle**

Hazard Assessment and Classification EWG(2)

- Fragment Impact STANAG 4496
  - **18.6g Fragment @ 2530m/s can only be produced by IED or a few specialised missile warheads**
  - **Blast and fragment threat from incoming detonating "donor" will cause severe damage and injuries to people out to a 50m radius**
  - **STANAG 4439**
    - » **Maximum response allowed Type V requires no projection further than 15m**
  - **Recommendations**
    - » **Change the maximum allowed response from Type V to Type III (or IV)**
    - » **Hazardous effects of incoming threat itself overwhelm all tolerated effects of a Type V response**

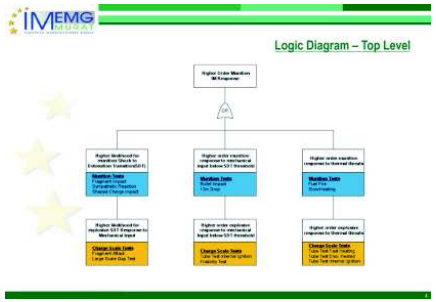


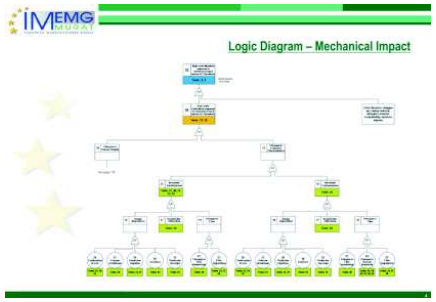
IM and Ageing EWG(1)

- EWG Objectives
  - **To analyse the effects of ageing of energetic materials on IM response**
  - **To establish links between energetic material failure modes and IM stimuli**
  - **To review available test results on aged explosive fillings as validation**
- Fault tree analysis (FTA) logic diagram methodology developed
- Cast PBX and melt cast explosives evaluated to date

IM and Ageing EWG(2)

- Top Level
  - **Higher order munition response to an IM stimulus is sub-divided into a number of explosive response mechanisms linked to the appropriate charge scale tests**
- Example of stimulus – mechanical impact
  - **Logic diagram in FTA format illustrates links between material properties and IM response**
  - **Provides framework for assessing test data and sharing knowledge**
- Use of logic diagram
  - **Provides hollistic approach**
  - **Can be used for purposes of characterisation (bottom up) or investigation (top down)**
  - **Can optimise the use of available small scale test data**

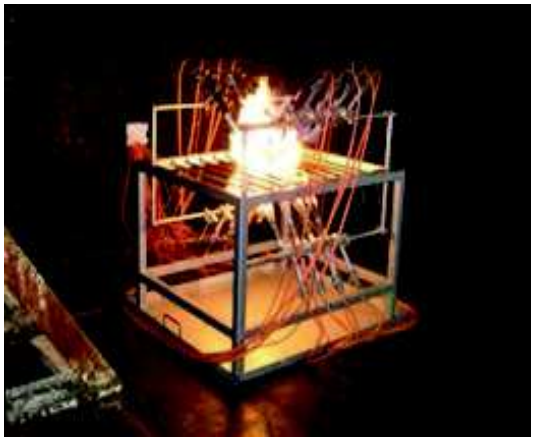




Fast Cook Off EWG(1)

- EWG Objectives
  - **Harmonisation of fast heating test procedures and acceptance criteria**
  - **Explore alternative solutions**
  - **Evaluate equivalence of liquid fuel and alternatives, eg LPG**
- Pool fire tests
  - **How standardised?**
  - **Repeatability and uniformity difficult to achieve**
  - **Wind identified as critical parameter**
- Alternative Test Configurations
  - **Opportunity to improve test repeatability**
  - **Next standard for FCO testing offers possibility of alternative means of effecting aggression**
  - **But must be proven to be representative of fuel fires**

Liquid Fuel Fire (Courtesy of SBTC, Sweden)



Propane gas burners
(Courtesy of NEXTER, France)

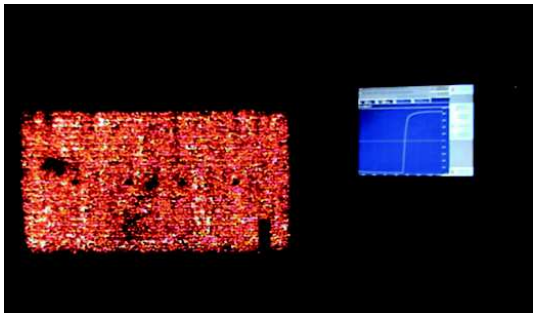
Fast Cook Off EWG(2)

- Alternatives state-of-the-art
  - **Liquefied propane gas burners**
  - **Propane jets**
  - **Sand-bed burners**
  - **Radiant panels**
- Worldwide experimental investigation
  - **Large and small facilities**
  - **To be representative or for research**
- The consistency of IM test results needs to be assured whatever the test method
- Future Challenges
  - **Equivalence between liquid fuel fires and alternatives**
  - **Comparable heat flux density**
  - **Validation for all stages of ignition and heating**
  - **Calibration devices and criteria**
  - **Harmonised apparatus necessary**

US liquid propane fueled burners
(Courtesy of NSWC - US Navy, US)

Propane gas "hell flute"
(Courtesy of BTC, Sweden)

LPG Fire (Courtesy of WTD91, Germany)



Radiant panel
(Courtesy of AIRBUS SAFRAN LAUNCHERS, France)

IMEMG Industry Contribution

- And now an example of active European industrial collaboration on the development and production of new Insensitive Munitions

- MBDA
  - **Missiles and lethal mechanisms**


IMEMG
MURAT
EUROPEAN MANUFACTURERS GROUP