

IM DAY 2013 – Industry Presentation

- **RPGs & Shaped Charges:** What Standard?
- **IM & Green Issues:** The Case of Fuel Fire
- **Modeling of IM:** Can we Predict?
- **Ageing of IM:** Is Signature for Life?
- **Economics of IM:** What Costs for What Benefits?

IMEMG Expert Working Groups

- 5 Expert Working Groups
- 48 People involved
- 20 member Companies
- 6 European Countries



RPGs & Shaped Charges: What Standard?



Courtesy Saab Bofors Test Centre



RPGs & Shaped Charges: What Standard?

- The promulgated STANAG 4526 (ed2) cannot be used as a standardized reference for the following reasons:
 - Document is not ratified by all Nations
 - 50 mm Rockeye Shaped Charge is not available out of US
 - Performance of 50 mm Rockeye is not properly defined for determination of an equivalent Shaped Charge
 - Test set-up is not clearly defined (conditioning plate ...)
 - Test Centers use their own replacement shaped charge and test procedure



RPGs & Shaped Charges: What Standard?

- Recent feedback from Afghanistan and Iraq has led to a Threat Hazard Analysis review
- National Authorities tend to choose or design **specific Standard Shaped Charges** which do not represent the same aggression level, e.g.:
 - USA MIL-STD-2105(D) specifies a standardized 81 mm Shaped Charge
 - France has selected CCEB 62 Shaped Charge
 - Germany is developing a PG-7 replica

RPGs & Shaped Charges: What Standard?

- IMEMG intends to support current harmonization efforts
- STANAG 4526 should list a very limited number of approved Shaped Charge types and test set-ups:
 - Select shaped charges diameter sufficiently close to generate comparable aggressions, with performances precisely defined
 - Define conditioning plate thickness and precise quality
 - Specify a standardized stimulus in terms of V^2d

Hazard Assessment & Classification

Expert Working Group Membership

Dr Werner Arnold	MBDA – TDW GmbH	Germany
Dr Massimo Castiglia	RWM Italia	Italy
Raymond Coleno	ROXEL France	France
Frank David-Quillot	CEA-DAM	France
Helen Flower	AWE	UK
Carole Fournier	TDA Armements SAS	France
Yves Guengant (chair)	EURENCO	France
Dr John Hand	CHEMRING Energetics	UK
Dr Gerhard Hubricht	RHEINMETALL WM GmbH	Germany
Charles Marshall	BAE Systems Munitions	UK
Sean Randall	MBDA (UK) Ltd	UK
To be nominated	NEXTER Munitions	France
Michel Vives	MBDA France	France
Dr Alexander Weigand	MBDA - Bayern Chemie	Germany

IM & Green Issues: The Case of Fuel Fire



IM & Green Issues: The Case of Fuel Fire

- STANAG 4240 for Fuel Fire requires the use of Kerosene/Jet A1
- This comes from origins of IM when the threat referred to accidents with aircrafts



IM & Green Issues: The Case of Fuel Fire

- Jet Fuel raises environmental issues like:
 - Heavy dark Smoke with particles
 - Ground pollution
- Jet Fuel has other drawbacks:
 - Sensitivity to wind conditions
 - Somewhat difficult to handle before and after testing

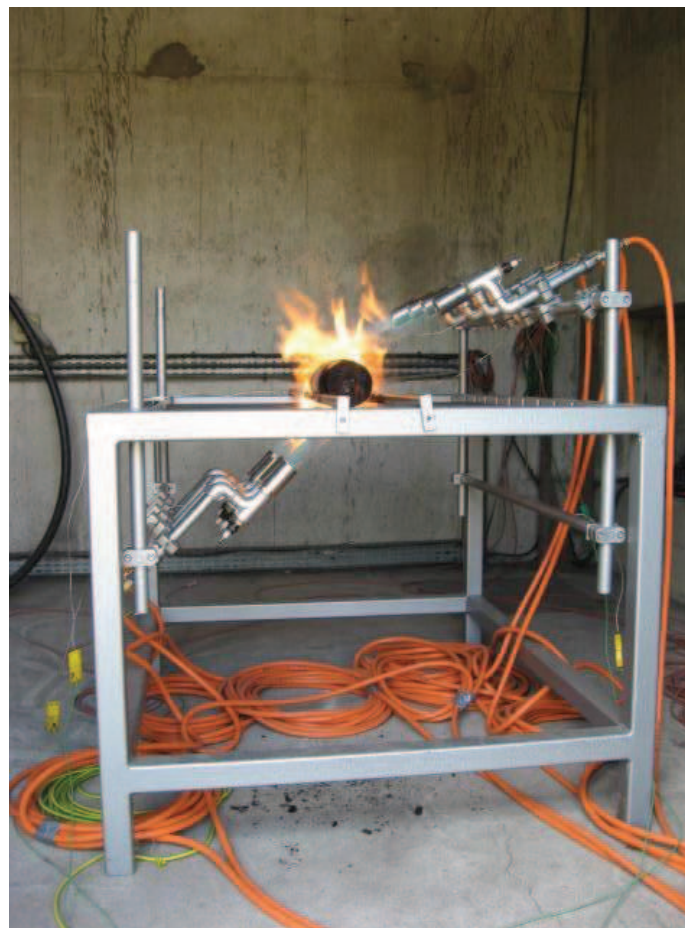


IM & Green Issues: The Case of Fuel Fire

Is it time to change direction?

“Where environmental concerns dictate, alternative fuel such as **propane (LPG)**, or **natural gas** may be used...

(NATO Nations Proceedings of the Fuel Fire Experts II Meeting held in France in Sept. 2012)



IM & Green Issues: The Case of Fuel Fire

- Advantages of LPG:
 - Clean (no residue, clear smoke)
 - Easy to handle (on/off burners, reduced space)
 - Cheap (propane is commercial off-the-shelf, set up is basic)
 - Less sensitive to wind conditions



IM & Green Issues: The Case of Fuel Fire

Is it time to change direction?

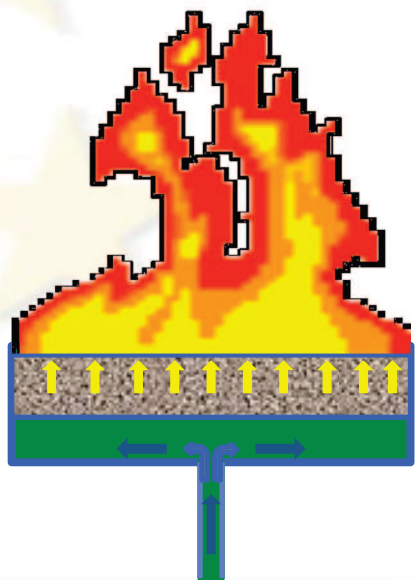
“... if testing verifies that the overall test item **heating rate, uniformity of spatial heating** to the test item and type of radiation **heat transfer** duplicate those of the hydrocarbon fuel fire”.



IM & Green Issues: The Case of Fuel Fire

- IMEMG activities:

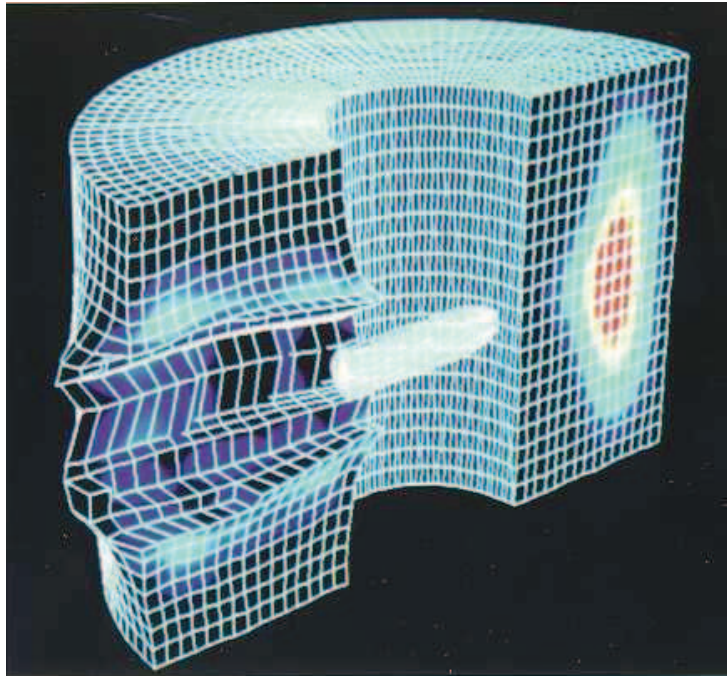
- Compare LPG and Jet Fuel Fire (type of heating)
- Build up a Data Base of LPG test results
- Provide Recommendations for the use of LPG in STANAG 4240



Expert Working Group Membership

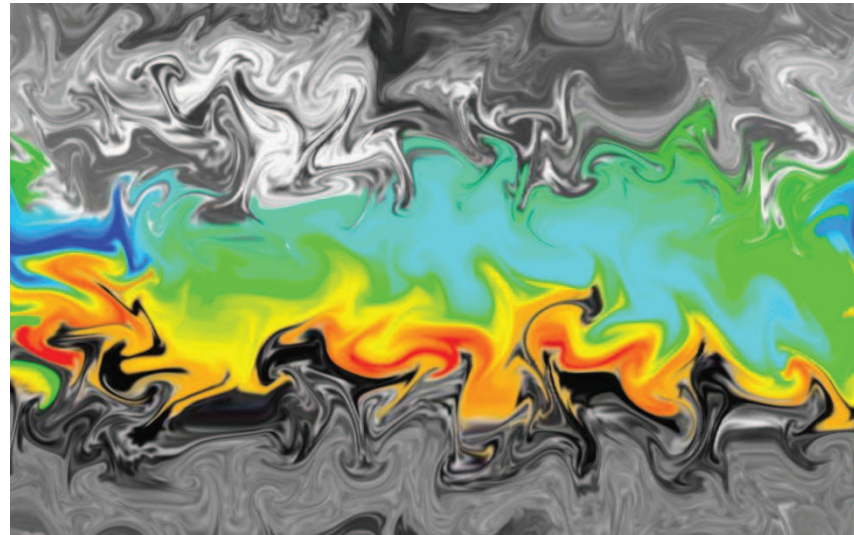
Hans Göran Ohlsson (Chairman)	SAAB Dynamics	Sweden
Dr Gerhard Hubricht	RHEINMETALL WM GmbH	Germany
Marie De Bats	MBDA France	France
Dr Peter Jacob	MBDA - Bayern chemie	Germany
Christopher <u>Bob</u> Hughes	AWE	UK
Volker Komanschek	MBDA - TDW GmbH	Germany
Christian Maurer	DIEHL BGT Defence	Germany
Frédéric Saulnier	NEXTER Munitions	France
Eroan Benade	TDA-Armements	France
Ole Martin Heiberg	NAMMO Raufoss	Norway
Tobias Wölfle	JUNGHANS Microtec GmbH	Germany
Karl Edwards	BAE Systems Munitions	UK
Gabriele Bicci	OTO MELARA SpA	Italy
Nicolas Daly	HERAKLES Group Safran	France

Modelling of IM: Can we Predict?



Modelling of IM: Can we Predict?

- Using Computer Models to predict IM response of an explosive item can be of great interest:
 - Time saving
 - Cost saving
 - Risk reduction



Modelling of IM: Can we Predict?

- Most of the time, developer's approach consists of using commercial available backbone software's like CFDs and customizing them through testing protocols
- This subject can be competition sensitive given the advantage these Computer Models can provide to the owner if proven effective

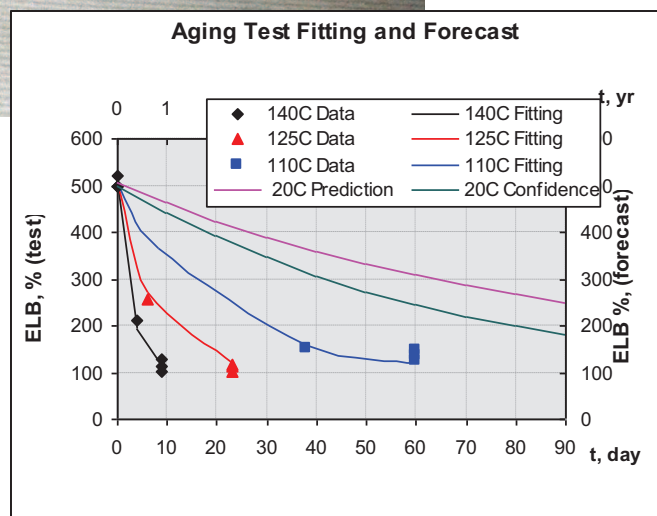
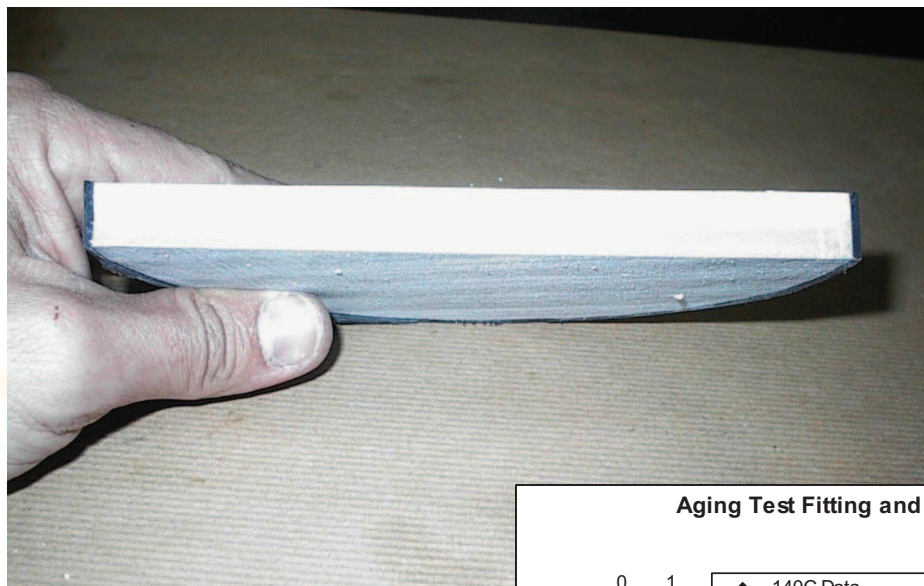
Modelling of IM: Can we Predict?

- However, IMEMG is convinced there are grounds to promote a collaborative approach with the following action plan:
 - Map the areas where Computer Models could be relevant in the design and assessment of IM performance and make a list of available computer models
 - Explore the opportunities for knowledge exchange with official technical organizations (TNO, DGA, BAAINBW, MSIAC, etc)
 - Specifically assess MSIAC TEMPER and FDS (Fire Dynamics Simulator) software as potential inter-companies comparative simulation tools
 - Advise on the applicability and capability of each model including a strengths and weaknesses assessment
 - Publish recommendations on gap analysis of the available computer models against above map

Expert Working Group Membership

CASTAGNA, Alan	RWM Italia
LAMY_BRACQ, Peggy	NEXTER-Group
LOCKING, Paul	BAE Systems Munitions
PRYTZ, Anne Kathrine	NAMMO Raufoss AS
ØDEGÅRDSTUEN, Gard	NAMMO Raufoss AS
UNTERHUBER, Georg (Chairman)	MBDA Bayern-Chemie GmbH
VIVES, Michel	MBDA France
WINKLER, Erik	SAAB Dynamics AB
WÖLFLE, Tobias	JUNGHANS-Microtec GmbH

Ageing of IM: Is Signature for Life?



Ageing of IM: Is Signature for Life?

- IMEMG claims it is of high importance to ensure that IM properties are maintained throughout the service life of munitions
- Focusing on age-related changes to the intrinsic safety properties of energetic materials, IMEMG intends to:
 - Understand how energetic materials degradation can affect IM response
 - Establish state-of-the-art with respect to ageing of energetic materials
 - Identify data with which to validate the proposed failure modes
 - Identify gaps in empirical evidence and knowledge

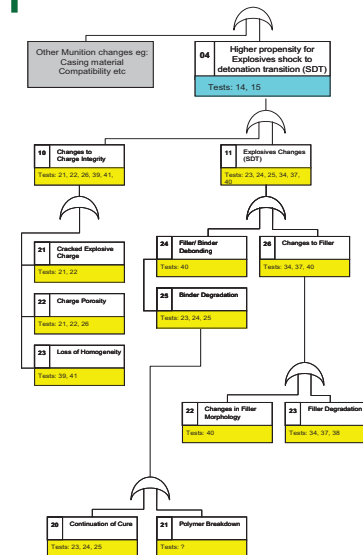


Ageing of IM: Is Signature for Life?

- A wide range of energetic materials are used in IM (cast-cure PBXs, composite propellants, melt-cast IM formulations and gun propellants);
- First study conducted on cast-cure PBXs with development of a generic approach if possible;



- **Use of well-established techniques:**
 - **Fault Tree Analysis (FTA)**
 - **Failure Modes and Effects Analysis (FMEA)**



Ageing of IM: Is Signature for Life?

- Cast-cure PBXs were developed with the intention of being chemically and physically resistant to ageing under representative conditions
- A preliminary conclusion of the work so far is that the properties of a cast-cure PBX are unlikely to change in a way that affects IM



Expert Working Group Membership

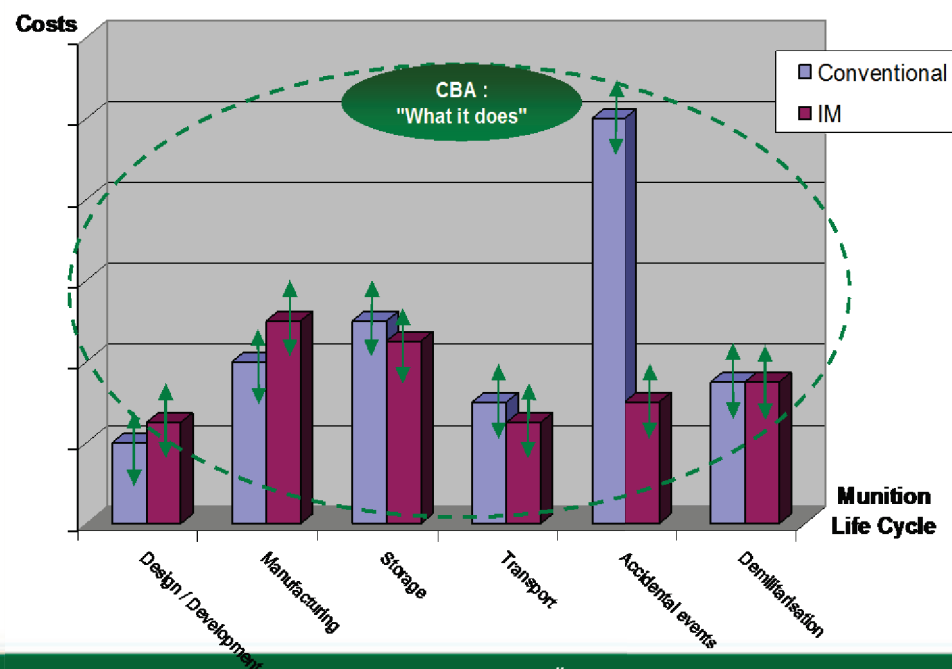
Paul Deacon (Chairman)	AWE	UK
Ron Hollands	BAE Systems Munitions	UK
Peter Milner	MBDA UK	UK
Michel Vives	MBDA France	France
Christophe Coulouarn	NEXTER Munitions	France
Raymond Coleno	ROXEL France	France
Bernard Mahe	EURENCO	France
Richard Wild	DIEHL BGT	Germany
David Jordan	RWM Italia	Italy
Stefan Borg	SAAB Dynamics	Sweden

IM: What Costs for What Benefits?



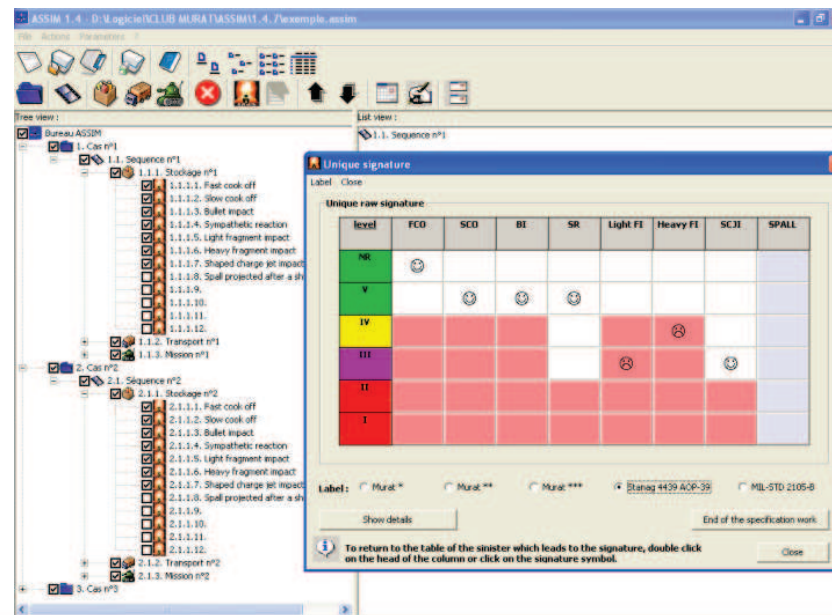
IM: What Costs for What Benefits?

- Basic principle of Costs & Benefits Analysis (CBA) is to help assessing the cost linked to IM/MURAT implementation
- CBA software tools were initially developed to calculate the cost of IM vs. non IM with consideration of total cost of ownership from "cradle to grave"



IM: What Costs for What Benefits?

- CBA approach has generated derivative tools like **ASSIM** to assist in defining the appropriate level of IM considering:
 - Life Cycle Phases
 - Peacetime or Operations
 - Logistics configuration
- ASSIM (Assistant to Specify a Signature for an IM) is **IMEMG** software



IM: What Costs for What Benefits?

- ASSIM is:
 - User friendly
 - Easily adaptable to different languages
 - Concurrent cases can be studied at the same time
 - Update for new OS platforms on-going

- ASSIM upgrade is planned to be available in 2014;

- French DGA would like to use ASSIM for supporting the new national Murat policy implementation.

Example of a 120 mm HE mortar munition: life cycle phases

Life cycle phase		Environment	Configuration
Storage	National	Peacetime (P)	Palette
	Logistical Storage	Operations (O)	Palette
	Tactical Storage	O	Tactical
Transport	Road	P	Box
	Road	P	Palette
	Road	O	Tactical
	Rail	P	Palette
	Sea	P	Palette
	Air (Aircraft)	O	Palette
	Air (Helicopter)	O	Box
Fire	Training	P	Tactical
	Combat Operation (vehicle)	O	Tactical

Expert Working Group Membership

Rémi Boulanger (Chairman)	NEXTER Munitions	France
Owain Sowden	BAE Systems Munitions	UK
Yves Guengant	EURENCO	France
Jean-Pierre Mazer	MBDA France	France
Raymond Coleno	ROXEL France	France
Jean-Michel Larrieu	SAFRAN HERAKLES	France



INMEMG
MURAT

EUROPEAN MANUFACTURERS GROUP