SMART ASSESSMENT & TESTING

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BACKGROUND

- Smart assessment & testing of munition safety requirements has been a major objective of DOSG for several years
- Smart assessment & testing is defined as the assessment of intelligent data by competent staff
- Intelligent data are defined as results which help to achieve a desired aim or objective
- Don’t do the same old tests just because we have always done them
- Do not ‘gold plate’ assessments; set pragmatic levels of confidence for particular objectives
- This presentation is a first review of issues that have arisen in trying to achieve smart assessment and testing

THEMES FOR THIS PRESENTATION

- The first part of this presentation examines the problem of obtaining OME safety data from overseas munition manufacturing nations – which leads to a lack of (horizontal) confidence in munition safety assessments

- The second part of this presentation describes the UK IM assessment ‘whole body of evidence’ approach to build up levels of (vertical) confidence

REQUIREMENTS FOR SAFETY INFORMATION

- National safety authorities require safety information to complete S3 assessments for munitions. Most of this information is stipulated in international documents eg STANAGs
- In an ideal world, all required safety information would be supplied when required. At present this does not happen
- Complex munition safety case reports require sufficient data to support pragmatic but adequate assessment of safety
- Need to avoid duplication of effort when similar data can meet more than one objective eg IM / HC and H&S / 'Environmental'
- UK procurement from overseas is likely to increase, supply of safety data likely to become more problematic – but is critical for current in-theatre deployments

ISSUES LEADING TO LACK OF CONFIDENCE IN SAFETY ASSESSMENTS

- The manufacturing nation may incorporate novel EM or components into the munition, about which the procuring nation has no knowledge
- Testing, eg IM trials, may have been carried out at facilities for which the procuring nation has no knowledge
- The ‘remoteness’ of the manufacturing nation can be a problem
- Surveillance testing may be carried out in the manufacturing nation, with little customer influence
- EU ‘environmental’ legislation does not apply to non-EU manufacturing nations
- Testing (eg qualification) may have been carried out on an early version of the munition which bears little resemblance to the asset procured

REASONS FOR THIS LACK OF INFORMATION

- The testing may not have been carried out, the project manager may not have planned for any additional testing

- The manufacturer may be unwilling to transfer the data since there is lack of confidence that the information will not end up the hands of competitors

LACK OF CONFIDENCE IN DATA SUPPLIED FROM OVERSEAS MANUFACTURERS

- The Swedish MoD vision of ‘in safety we share, in technology we compete’ has not been realised
- Munition safety information is not being transferred internationally on a regular basis despite this being one of the original intentions of STANAGs.
  - Perhaps AOP-15 should prescribe a data pack of essential munition-related information which has to be supplied
- Results from the Round Robin RS-RDX programme highlighted concerns over consistency of results from standard laboratory tests carried in different laboratories.
  - The question is: are the contents of the STANAGs in question sufficiently clear or prescriptive? Or are there bulk sampling problems?

LACK OF CONFIDENCE IN IM ASSESSMENTS

- 2 interrelated points from the 2006 IMEMTS in Bristol are highlighted as the basis for a recommendation to improve the UN Test Series 7 and enhance confidence in IM assessments:
  - Emphasis on the cost of EM and need to load EM using existing melt cast filling facilities – what confidence can IM assessors (eg IMAP, the UK national authority for IM assessments) have that munitions incorporating cheap melt-cast compositions will ever be truly IM?
  - The need to agree internationally a ‘smart’ set of tests to ensure that only genuine low-vulnerability compositions will be incorporated into potential IM solutions

BUILDING UP CONFIDENCE IN IM ASSESSMENTS - SUMMARY

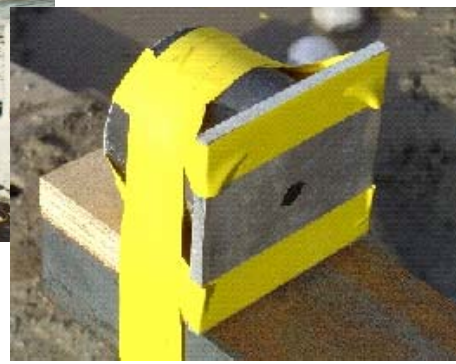
- The UK MoD IMAP has traditionally focused on the role of the UK burning tube (explosiveness) small-scale charge tests to build confidence in IM assessments
- The UK acknowledges the usefulness of other explosiveness tests such as the French Friability test
- UK IM assessment sees problems in relying solely on all up round tests eg lack of reproducibility
- Some of the UN Series 7 tests are now considered NOT to give intelligent data and prevent munitions that fully satisfy IM requirements from being categorised HD 1.6
- Current limitations of the UK IM assessment process include infrequent use of modelling & simulation and lack of understanding of XDT

WHOLE BODY OF EVIDENCE APPROACH

- IMAP considers basing an IM signature on AUR trials alone as problematic
  - Number of tests is statistically insignificant
  - Known variability in behaviour of TNT-based energetics
- IMAP's solution is to build up confidence from various elements:
  - Assessment of the energetic materials – intrinsic hazard properties
  - Analysis of the weapon system design, including mitigation features
  - Analysis of the role of packaging – tactical and logistic
  - All up round testing
- Further confidence from read across from similar munitions and expert judgement
  - BUT a major limitation is the lack of use of modelling & simulation to gain confidence in the assessments

SMALL SCALE TESTING OF ENERGETIC MATERIALS

- IMAP uses small scale testing to make predictions of:
  - DDT – by using the UK tube test
  - SDT – through small scale fragment impact testing



UK BURNING TUBE - RESULTS

Explosive	Tests	Response Level†					Fragments
		0	1	2	3	4	
Torpex 4D	16	5	3	2	4	2	>100
HMX/TNT 85/15	10				4	6	>100
LX14	10				8	2	>100
EDC1S	4		2		1	1	>100
PE4	10		1	2	2	5	>100
HNS II + binder	10				6	4	>100
RT 60/40	5			3		2	>100
KS33	10		9			1	1,>100
PBXN-9	10			10			4
KS32	10		9	1			1,2
PBXN-111	10	4	6				1
Rowanex 1001	10		10				1
Rowanex 1301	8		8				1
Rowanex 1400	10		10				1
Rowanex 2000	10		10				1

Demonstrate Propensity to DDT

Demonstrate Good IM Response in the AUR

Table 1. Tube test fast heating test results for some commonly used high explosives

† Response Levels: 0 - No Reaction, 0/1 - Burning /Decomposition, 1 - Pressure burst due to burning/decomposition, 2 - Deflagration, 3- Explosion, 4 – Detonation.

MUNITION REACTION MECHANISMS TO THREAT STIMULI

- IMAP uses the results of the burning tube tests to determine whether or not an EM has an unacceptable propensity to DDT
- SDT threshold curves are obtained from the small scale FI tests
- For Bullet Impact and Fast & Slow Heating, DDT is the key response mechanism
- For Sympathetic Reaction and Fragment Impact, both prompt shock to detonation (SDT) and burn to violent reaction (DDT) are important
- LIMITATION – we need to understand the role of XDT
  - This is important for bullet and fragment impact (below the SDT limit) against explosive charges with internal cavities (eg rocket motors and shaped charges) – some responses have resulted in delayed detonation

IM & Series 7 Tests

- What prevents genuine IM (eg Storm Shadow) from being classified HD 1.6 is the confusion between ‘substance’ and ‘article’

- HD1.6 is the only division which requires an article to pass an additional series of substance tests and imposes an additional requirement that the substances within that article must show an arbitrary level of insensitiveness

- In particular the EIDS gap test is anomalous as the explosive (substance) in the article will never be exposed to direct shock, the article casing and packaging will always provide attenuation

PROPOSED CHANGES TO UN SERIES 7 TESTS

CURRENT	PROPOSED
EIDS cap test	EIDS cap test
EIDS Gap test	Tube test (internal ignition)
Susan or Friability test	Susan or Friability test
EIDS BI or Friability test	Tube test (fast heating)
EIDS external fire	Tube test (slow heating)
EIDS external Slow cook off	
HD1.6 article, external fire	HD1.6 article, external fire
SCO, BI & stack tests	SCO, FI & Stack tests

DOSG INTERNATIONAL EFFORTS

- DOSG & DGA have agreed joint certification for the qualification of EM, and joint IM assessment, for common use munitions, eg
  - SCALP/Storm Shadow, PAAMS, Meteor
- DOSG & OSD are discussing the science behind many of the S cubed requirements
- DOSG staff have had significant input to the development of the 2nd Editions of STANAG 4439 and AOP-39
- DOSG & DGA will carry out an audit of the Spanish IM trials facility for Meteor as a prototype exercise for MSIAC
- DOSG has close liaison with NSWC IHD who are leading on lessons to be learnt from the RS-RDX Round Robin exercise
- At the UN 'Sub-Committee of Experts on the Transport of Dangerous Goods', July 2007 meeting, there was wide international support for DOSG proposals to review the 'Orange Book' Series 7 tests

CONCLUSIONS

- Sharing of munition safety information does NOT occur on a regular bass
- Best value is NOT being made of international organisations (eg MSIAC & NATO) and their documentation eg STANAGS
- The theme of ‘test once assess jointly’ has NOT materialised
- Some ‘Smart assessment and testing’ initiatives do exist but we need to do better
- We are all here at this conference to share information – we need a mechanism to do this more formally

QUESTIONS?