MSIAC Munitions Safety Information Analysis Center
Supporting Member Nations in the Enhancement of their Munitions Life Cycle Safety

Bulletin

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EXPLOSIVES SAFETY MUNITIONS RISK MANAGEMENT (ESMRM)

The following is an introduction to a informative paper on an important piece of work which has been conducted in recent years to address the need for NATO Munitions Risk Management policy and procedures. The paper has kindly been provided by Mr Thierry Chiapello, Executive Director, US DoD Explosives Safety Board (DDESB). I recommend reading the full article by clicking on the link at the end.

Dr Michael Sharp

Over a decade of NATO coalition operations in Afghanistan involving military munitions demonstrated that established NATO explosives safety requirements did not effectively support NATO Commanders or the mission during planning, training, and operations. Several audits conducted between 2002-2010 in Afghanistan revealed that the deployment of multi-national forces, in close proximity operating under different ammunition safety standards resulted in increased levels of munition-related risks and potential for accidents.

Munitions-related risks were often neither identified nor communicated to the appropriate level of leadership for risk decision and possible consequence acceptance. This directly resulted in increased munitions-related risks to the NATO mission, personnel, equipment, infrastructure as well as unidentified risks to surrounding host-nation personnel and infrastructure.

Although NATO nations through the Conference for National Armaments Directors (CNAD) Ammunition Safety Group (CASG) AC/326, developed and maintain technical explosives safety requirements in AASTP 1 and 5, the absence of key elements such as a clearly defined NATO chain of command (within operational channels) responsible for munitions-related risk decisions. In NATO planning operational and logistics policy or doctrine, hamper their use in operations when it matters most.

The ESMRM assessment process results in a standardized report that provides the NATO Commander the necessary tools to support as informed risk decision for any remaining munitions-related risks that cannot be suitably addressed.
The ESMRM report is enhanced by a combination of government-developed risk calculation tools and commercially modified Geographic Information System (GIS) technology that results in an easily understood graphic. Figure 1 illustrates the output, which clearly defines the affected areas and details potential personnel casualties and infrastructure consequences.

(Continued on page 2)

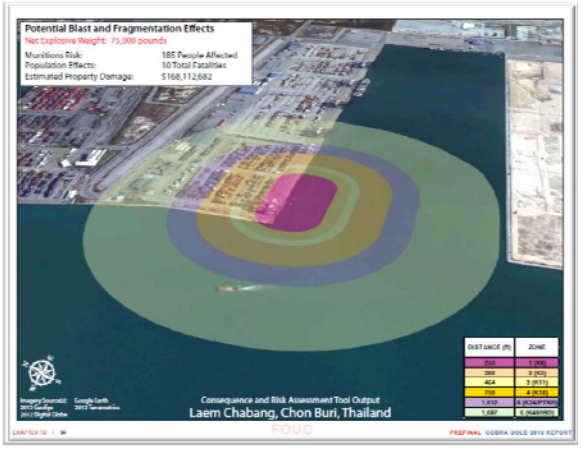

Figure 1: ESMRM Output in support of the NATO Commander's Risk Decision

The result of the ESMRM work is the development of NATO standard STANAG 2617 and ALP-16.

Click here to read the full paper.

Thierry L. Chiapello

THE PM'S PERSPECTIVE

MSIAC attended the 2015 Insensitive Munitions and Energetic Materials Symposium in Rome, 18-21st May. The European meeting is supported by the Insensitive Munitions European Manufacturers Group (IMEMG), National Defense Industrial Association (NDIA), with MSIAC also providing support. IMEMG, in particular, play a key role in organising the European meetings and must be congratulated on providing an excellent venue and well organised event. MSIAC sent 4 technical specialists, along with myself, and we all thought the meeting was a great success; there was the right combination of good technical papers and excellent networking opportunities . MSIAC staff presented 8 technical papers and contributed to at least another paper. These will be published on the MSIAC Secure Web environment as open reports as well as being included in the proceedings (which MSIAC provides in support of the meeting).

The meeting also provided the opportunity to recognise excellence in Munitions Safety (MS) with MSIAC awards for Technical and Career achievements given. MSIAC has been presenting Awards at NDIA IM/EM Technology Symposia since 1997. The winners are chosen by the Steering Committee on the basis of proposals made by MSIAC and by Steering Committee Members, NFPOs, or any other interested parties.

A short note on the two award types

MSIAC MS Award for Technical Achievements - Individuals or teams who have made significant contributions in research and/or engineering related to the field of munitions safety.

MSIAC MS Award for Career Achievements - Individuals who have made consistent contributions in research, engineering, production, procurement, fielding, standardisation, policy, etc. related to MS, over an extended period.

This year I had the honour to present a Technical achievement award and 3 career achievement awards.

The first award was presented to team **PM-CAS, PEO-AMMO, ARDEC and BAE Systems**, for Higher Energy Insensitive Munition Fill Implementation into Mortars. There are a number of notable achievements:

- Qualification of IMX-104 for mortar application, as well as the venting design and new auxiliary booster.
- 60 and 81mm mortars rounds qualified and transitioned to the Warfighter
- It delvers substantial benefits; mortar rounds often contribute significantly to the total NEQ of forward opening bases.
- The IMX-104 loaded mortar cartridges achieved a Hazard Classification of 1.2.1 (no mass explosion), allowing significantly less quantity/distance requirements.

The IM Signature of the 81mm mortar round indicates the progress that has been made when compared to the legacy comp B filled projectile:

81mm Mortar Cartridge IM (IMX-104)										
	FCO		SCO	BI		FI		SR		SCJ
	Tactical	Logistical		Tactical	Logistical	Tactical	Logistical	Unconfined	Confined	
M821A2	(V)	(V)	(V)	IV	(V)	(I)	(IV)	(Pass)	(Pass)	(F)
M889A2	V	(V)	V	IV	V	I	IV	Pass	Pass	(F)
M889A1	V	V	V	IV	V	V	V	(Pass)	(Pass)	(F)

Compared to the legacy system.

81mm Mortar Cartridge Baseline (Comp B)						
	FCO	SCO	BI	FI	SR	SCJ
M821A2	(III)	(I)	(IV)	(I)	(F)	(F)
M889A2	(III)	(I)	(IV)	(I)	(F)	(F)
M889A1	(II)	(II)	(II)	(II)	(F)	(F)

One should not forget the challenges involved in developing and qualifying tube launched munitions which have to survive severe launch stresses. Introduction of the round into service has brought reductions to the risk to warfighters, and those storing and transporting rounds.

The award was presented to representatives from the team which included the following individuals:

- ★ PM-CAS – James Chang, Charlie Patel, Leila Zunino, Dan Napolitano;
- ★ PEO-AMMO – Seham Salazar
- ★ ARDEC – Nick Baldwin, Philip Samuels, Daniel Zaloga, Keyur Patel;
- ★ BAE Systems Ordnance Systems Incorporated - Virgil Fung, Mike Ervin, David Price, Brian Alexander

Phil Samuels accepted the award on behalf of the team

The three Career Achievement awards were presented to:

★ **Ms Vicki Brady,** US Navy, spent her career supporting the development of safe weapons. She started work in propellant, explosive and pyrotechnic research which resulted in at least 5 patents and 30 technical papers. The technologies Vicki has worked over the last 25 years and transitioned have provided improved IM ratings for numerous weapons including bombs and guided missiles. These improvements have had impact across the service life of these weapons lessening weapons responses to IM stimuli. She was instrumental in leading the Blue Tube program run by China Lake, to evaluate/"qualify" composite cased rocket motors. More recently, she has supported the Tomahawk, SLAM-ER, Sidewinder and Bombs programmes. Vicki is a well know and respected manager and leader of IM programmes for the US DOD. She also contributed to MSIAC workshops and international symposium, and is know by many in the international community. Colleague also recognised the time and energy she has spent over the years in the developing the next generation of scientists and engineers.

Ms. Vicki Brady accepting a MSIAC Career Achievement award.

★**Dr. Ernest Baker, US Army** started as a bench-level engineer in warheads and is now the Senior Research Scientist for Insensitive Munitions for US Army. Ernie is responsible for leading the Army's assessments and application of new theories & technologies to advance the state-of-the-art in IM, and for setting the Army's program goals and priorities. He is internationally known and respected as an advocate for Munition Safety and IM, contributing to many international symposia. His technical contribution over the years is immense with some 200 papers that he has primary authored, or contributed to, to date. They cover a wide range of topics including: IM threats, reaction mechanisms, detonics, modelling, characterisation of energetic materials (to name a few).

Dr Baker accepting a MSIAC Career Achievement award and recognising the support he has received from others during the course of his career.

★**Dr Werner Arnold**, MBDA-TDW Missile Systems, has worked more than 30 years on research and development in the field of high explosives and modern warhead technologies. During this time he has published more than 80 scientific papers, many of which are deal with IM. For the last 15 years Werner has been working on MS and IM technology. His work does not only cover the development and testing of IM but also delves into improving the fundamental understanding of the reaction mechanisms. He shares his findings with the community, e.g. in the "Expert Working Group (EWG)" within the "Insensitive Munitions European Manufacturers Group (IMEMG)", which he is a member of for more than 10 years, or in his more than a dozen contributions to the IMEMTS since 2006. He is a respected and valuable member of the international community. Those of you who attended the MSIAC SCJ assessment workshop will be aware of the importance of his work on response mechanisms. Although Werner was not present, there was considerable discussion on papers he has published in this area. A further paper at the IMEMTS 2015 on this topic also elicited further discussion after his presentation and in the margins of the meeting!

Dr Arnold accepting a MSIAC Career Achievement award.

I would like to congratulate each of the winners again for the important work that they have undertaken over the years to support Munition Safety efforts. Further, MSIAC and the Steering Committee would like to thank all those that took the effort to recognize the hard work and commitment of others by submitting nominations, and in particular all those who were the subject of a nomination.

Dr Michael W. Sharp
MSIAC Project Manager

TRAINING TO NATO STANDARD

MSIAC has undertaken four training sessions this calendar year on the NATO Ammunition Storage Standards AASTP-1 and AASTP-5.

The training was conducted in Canberra, Australia on 23 -27 February, in Rome, Italy on 23-27 March, in Washington, D.C. on 20-24 April, and lastly in McAlester, Oklahoma on 27 April- 1 May.

Rome, Italy

The course lectures and exercises continues to evolve based on feedback received and changes in the standard thereby remaining current. The presentations thoroughly cover all aspects of the standards, but most popular according to the feedback received are the practical exercises on Hazard Class/Division, Barricades, Quantity Distance and Explosive Safety Munitions Risk Management.

A total of 79 students have so far successfully completed the training in 2015. MSIAC's Mr. Tom Taylor serves as the course manager and is a co-instructor together with former Belgian MOD Ammunition Technical Officer, Mr. Johan De Roos.

Washington D.C., USA

McAlester, USA

All students that undertake the training are awarded a signed certificate from MSIAC, and now receive a Compact Disc that includes the week's presentations.

Mr Thomas Taylor
MSIAC Transport & Storage Specialist

All PUBLICATIONS on can be found in the Technical Reports section on our Website via this hyperlink .

MSIAC 2016
Science of Cook-Off

MSIAC are in the process of planning the next workshop to be held in **April/May 2016**. The location at the moment will be the East Coast of America and further details will be released soon.

The overall objective of the workshop will be to update the nations knowledge and understanding of cook-off by focusing on how the role of the heating rate and surrounding conditions effects determining reaction violence. It will be achieved by understanding chemical and physical changes that lead to critical ignition and growth, reaction phenomenology and linking this, via scaled testing, to system level tests.

The secondary objective will be to advance methodologies in predicting response mechanisms including modelling and updates to AOP-39 protocols.

RESODYN ACOUSTIC MIXER (RAM) SURVEY

YOUR HELP IS STILL NEEDED!

In the last newsletter (Feb 2015) we sent out a request for all users of the RAM to help the nations provide information to MSIAC on their experiences using this technology. We have received a number of inputs but there is still time to contribute.

Should you be currently using a RAM, or similar technology, and are you willing to discuss the approach you have taken please download this questionnaire.

The information you provide us will remain restricted to MSIAC nations. The output of the survey/questionnaire will form the basis of a report with the aim of improving the current understanding of safety requirements for the RAM with nation members. It is understood that this is a snap shot in time but will aid new players in the field of acoustic mixing.

We would like to hear from as many users from all MSIAC nations as possible, covering all areas of energetics technology by the end of **June 2015**. Please point people in the direction of either our website to find the questionnaire or contact the Energetic Materials TSO directly: (m.andrews@msiac.nato.int).

Dr Matthew Andrews
MSIAC Energetic Material Specialist

INDUSTRY & TECHNOLOGY PRESS REVIEW

*If you have information that you consider of relevance to this section, contact **Manfred Becker** at MSIAC m.becker@msiac.nato.int.*

During the timeframe of this newsletter, multiple conferences and symposiums occurred of interest to our community, including Air Force Association's (AFA) Air Warfare Symposium, IDEX, EUROPYRO, NTREM and IMEMTS. Clearly lots of munitions safety relevant information was shared at these venues.
This issue of Procurements, Science and Technology begins with a number of mergers and agreements within the Munitions industries and then mentions some of the recent munitions related procurements awarded.
France made front page news with both their intended sale of 24 Dassault Rafale fighter jets / MBDA missiles to Qatar as well as their likely non-sale of their two Mistral-class amphibious assault ships (Vladivostok and Sevastopol) to Russia. The procurements section concludes with references to the planned sales of Hellfire II as well as Orbital ATK contract to add strike capability to Cessna C-208 aircraft utilizing Hellfire missiles. The technology section then highlights multiple programs completing significant milestones, including development tests, weapon launchers from new platforms or lifetime

achievements, as well as other technology accomplishments.

The section begins with two different helicopter protection systems to counter missiles or incoming RPGs, as well as recent tests firing APKWS and TOW 2A (RF) from helicopter platforms.
It also mentions a hypersonic program intending weapons that will exceed Mach 5 at altitudes of nearly 200,000 feet “designed to skip across the inside of Earth's upper atmosphere before descending on their targets”.

For high altitude missions, read about the test currently going on with the objective of a stable 110,000 feet altitude platform with a two-and-one-half-ton suspended payload for up to 100 days. That’s persistence! Our technology section concludes with a highlight from a DARPA accomplishment on their Extreme Accuracy Tasked Ordnance (EXACTO) program, which developed a self-steering bullet for difficult, long-distance shots. The project recently completed a live-fire demonstration repeatedly hitting moving and evading targets.

Click here to read more.

Manfred Becker
MSIAC Warhead Technology Specialist

APPLICABILITY OF MUNITION SAFETY STANDARDS

An example of a investigation into the need to assess fuzes systems against the rain impact.

The application of munition safety requirements, and assessment using standards, depends on many factors: the nation conducting the assessment, munition type, environmental lifecycle profile, and phase of the lifecycle. It is often the case that questions arise on the basis of a particular test standard and whether it is still required. At this point it is useful to undertake some research to understand the science behind the requirement to determine: what is the basis of a particular test and whether the threat still relevant. MSIAC was asked to look at the justification for conducting a rain or hail impact test on fuzes (e.g. MIL-STD-331or NATO AOP-20 ANNEX D Appendix D-5).

In order to assist, an assessment of the threat was undertaken to determine the relevance for artillery fuzes. The analysis, focused on impact energies of typical rain for this type of system. Assessment was then undertaken to answer the following questions:

1. Is rain and hail impact an issue?
2. What are the possible mechanisms of failure?
   - Erosion of the fuse
   - The possibility of inadvertent initiation due to misinterpretation of the rain and hail approach and /or impact as conditions for functioning.

To address these questions the analysis provided some details on the following:

1. Impact energy table for different intensities of rain and hail
2. Comparison of the energy level to other projectiles
3. An estimation of the hit probability for firing projectiles into a rain or hail storm
4. Some discussion on damage
5. A very brief extract of references on this topic

Click here to the full assessment!

DATES TO REMEMBER

9th TAMPERE INTERNATIONAL HEAT FLOW CALORIMETRY SYMPOSIUM ON ENERGETIC MATERIALS

8-10 September 2015, Tampere, Finland

http://www.hfcs2015.com/

A date for the diary, 8th – 10th September 2015, is the forthcoming HFCS on Energetic Materials, held this year in Tampere, Finland.

Abstract deadline is fast approaching,14th May 2015, so contact them soon. Topics for discussion will include decomposition kinetics, instrumentation, testing, stability and compatibility of energetic materials.

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OPEN HOUSE

12 SEPTEMBER 2015 10:00 - 17:00

YOUR OPPORTUNITY TO VISIT WTD 91

DEFENCE TECHNOLOGY SITE FOR WEAPONS & MUNITION

WTD 91 THROUGH THE AGES