

Lettre du



MSIAC
Munitions Safety Information Analysis Center

Newsletter



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REPORT ON THE REVIEW OF SLOW COOK-OFF RATE FOR INSENSITIVE MUNITIONS TESTING WORKSHOP

*JANNAF, 18 April 2011, Crystal City, VA
Dr Brian E. Fuchs*

Insensitive Munitions (IM) minimize the probability of inadvertent initiation and the severity of subsequent damage as a result of unplanned, external stimuli. These stimuli may be the result of accident, combat, or terrorist actions. IM is mandated by federal law, USC, Title 10, Chapter 141, Section 2389 December 2001: "The Secretary of Defense shall ensure, to the extent practicable, that insensitive munitions under development or procurement are safe throughout development and fielding when subject to unplanned stimuli."

IM programs were started by the US Navy after several disastrous shipboard events, such as the USS Forrestal aircraft fire during the Vietnam conflict. The IM program has since been embraced by all US defense services and is characterized by joint interservice efforts to reduce the threat from countries' munitions to the warfighter, manufacturers, and the general public.

The Department of Defense has defined six standardized threats and testing for each in order to evaluate the compliance of munitions with IM law. The defined threats to munitions are: Fast Cook-off, Slow Cook-off, Bullet Impact, Fragment Impact, Sympathetic Detonation, and Shaped Charge Jet Impact.

The Department of Defense has expended significant funding to find solutions to each of these threats, through various programs such as the Joint Services Insensitive Munitions Technical Panel, the Army's Program Executive Office Ammunition IM thrust program, Navy's IM Advanced Development, and funding spent by programs on the systems in the design and development phases. The improvements gained so far have not been universally applied to all munitions and many of the new systems being fielded are not immune to all of the defined threats. However a number of notable non-events have been reported from IM

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improved munitions. Two recent examples from the US Army are fires at a production plant, and in the field. A fire at a production plant of the Modular Artillery Charge System left the fire damaged steel structure standing after the event. An MRAP (Mine Resistant Ambush Protected) armored vehicle in Afghanistan was hit with an improvised Explosive Device and in the ensuing fire the 60 MM mortars burned, but did not detonate or explode, averting a greater disaster.

In order to develop solutions to the threats that exist for munitions, these threats must be defined properly. These definitions are standardized for all services, although additional threats and testing can be specified by each individual service. These standardized threats include the type of bullets and fragments and their velocity, the fuels used for fires, etc. These threats must be periodically reviewed in order to assure their applicability. For this reason JANNAF April 2011 meeting in Crystal City held a workshop for the "Review of Slow Cook-off rate for Insensitive Munitions".

The slow cook-off threat is one where the munitions are being heated by a fire, but not directly in it. Examples include a shipboard fire in a compartment next to the magazine, or a fire outside a storage magazine. Slow cook-off events are characterized by the munition being heated to a high temperature before the chemical reaction begins. The high temperature of the energetic materials frequently causes the results to be more catastrophic than a munition being placed directly into a fire.



Afghanistan, MRAP hit by an Improvised Explosive Device, igniting fuel. 60 mm mortar munitions inside ignited, but did not explode.

For a slow cook-off test, the results and technical solutions can change depending upon the heating rate selected. Complicating the problem is that real world events are unpredictable and cannot be simulated by a single test condition. Additionally, some of the proposed solutions, such as pre-igniting the munitions at a lower temperature, where reactions are less violent, have their own safety related concerns. The determination of a heating rate that best exemplifies the threats and improves munitions design to improve safety is required.



Modular Artillery Charge Plant after a fire. There is significant fire damage but no blast or fragmentation damage due to the improved Insensitive Munitions design.

The JANNAF sponsored April workshop in Crystal City VA was co-chaired by Dr. Kerry A. Clark of the Naval Ordnance Safety and Security Activity at Indian Head, MD and Dr. Brian E. Fuchs of the Army Armament Research, Development and Engineering Center at Picatinny Arsenal, NJ. The meeting was attended by 70 people representing all services, the DoD Explosives Safety Board, the Department of Energy, and commercial munition developers and manufacturers.

The stated purpose of the meeting was to review the current standard heating rate for the slow cook-off (SCO) test, which is currently 6°F per hour; a heating rate known to be slower than in real world situations. The review was prompted by concerns that munition developers are designing rounds specifically to pass this test instead of improving munitions for all slow heating rates. The objectives of this workshop were to consider what the proper heating rate (or rates) for SCO testing should be, to develop methods to improve data collection in order to better analyze the SCO response of munitions, and to organize the community toward development of a joint consensus. Presentations given at the workshop examined the current science and understanding of slow cook-off events, as well as historical accounts of slow-cook off accidents.

The event was successful in opening the dialog and increasing the communities' understanding of the problem, although it did not come to a final conclusion as to the proper heating rate. The next workshop, in May 2012, will present information that the community is gathering from real life scenarios, updated modeling, fire fighters' perspectives, and current research on the issue.



www.parari.com.au
www.defence.gov.au/jlc/parari.html

PARARI 2011, an international explosive ordnance symposium hosted jointly by the Australian Department of Defence Directorate of Ordnance Safety and Thales, will be held at the Sofitel Hotel Brisbane, Queensland, Australia from 8-10 November 2011.

MSIAC will be there and will be presenting eight papers. These will be available as open publications downloadable from our weblink. We will also have a booth where we will be available to answer your questions and inform you of our services.

The following are the MSIAC papers with abstracts:

IMPLEMENTING NATO GUIDANCE IN MULTI-NATIONAL OPERATIONS

by Tom Taylor and Lt Col (Retd) G. John Lawrence

The NATO Alliance has invested a lot of time and energy to produce AASTP-5 which is designed to be the standard for Nations to use on NATO deployed missions and operations. The CNAD Ammunition Safety Group, AC/326 Subgroup 6, is an international body of specialists tasked to produce the NATO guidance. This international group meets twice a year with an overall objective to enhance safety thereby making multi-national operations more effective. The majority of NATO nations have ratified the Standardization Agreement (STANAG) 4657 which serves as the policy document to implement AASTP-5. But some Nations are not implementing AASTP-5 so the question is; what standard or guidance are they using when deployed on a NATO led mission? Should an allied Nation that is co-located in a Multi-National Camp/Airfield use a standard other than that promulgated by NATO? This paper will answer those questions and provide the reader with insight into the complexities of selecting the appropriate NATO standard to implement, and offer recommendations for the future development of AASTP-5.

A DISCUSSION ON THE SERVICES, TOOLS AND VALUE MSIAC PROVIDES TO THE INTERNATIONAL ARENA OF MUNITIONS SAFETY

by Roger L. Swanson

This paper and presentation will provide an overview of the NATO Munitions Safety Information Analysis Center (MSIAC) and the services, databases, design and analytical tools, and values it provides to its Member Nations, NATO, and the total international Munitions Safety (MS) community. MSIAC was created over 20 years ago as the NATO Insensitive Munitions Information Center (NIMIC) with the goal of spreading knowledge and facilitating and supporting developments in the international community regarding Insensitive Munitions. In 2002-2004, the Nations comprising NIMIC directed that it become MSIAC with an enhanced focus on the total life cycle Munitions Safety aspects. This paper will address the rationale behind the transition from an IM centric organization to an overarching MS focused organization and the resulting changes in structure and goals. The paper will also address issues, concerns, or threats that MSIAC perceives as the emerging areas of interest for the international MS community and offer ideas for collaboration, development, or standardization of approaches to tests and assessment practices.

MARKING OF MUNITIONS

by Tom Taylor

Recent discussions about marking munitions that contain an insensitive high explosive fill appear to be gaining support in the US Explosive Ordnance Disposal (EOD) personnel have expressed their desire to know if munitions contain an explosive fill that is less sensitive to detonate. Experience in the field by EOD technicians has shown

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that as much as twice the amount of explosive donor material is needed to successfully and cleanly destroy (detonate) insensitive high explosives than their legacy (e.g. TNT, Comp B) high explosive counterparts. EOD personnel at the Explosive Ordnance Disposal Technology Center (EODTC) have expressed a concern that not knowing the explosive fill leads to incomplete detonation, secondary detonation attempts, imprecise (over or under) application of donor material, and increased risk to EOD personnel in field applications. This concern appears to be shared throughout the US EOD community and therefore MSIAC was asked to express their opinion on the matter.

COST BENEFIT ANALYSIS AND INSENSITIVE MUNITIONS – A CRITICAL REVIEW OF PROGRESS

by Michael W. Sharp

This purpose of this paper is to provide a critical review on the Cost Benefits Analysis of Insensitive Munitions (IM). Over the years there has been considerable interest in the use of cost benefit analysis as a tool to help decision makers. As a consequence, MSIAC was tasked to hold a workshop in 2001 to bring together experts from the nations to discuss and develop methodology and tools. Recently, there has been renewed interest in this topic from a number of nations, which are engaged in reviewing national IM policy and implementation strategy. This paper discusses progress with the purpose of reviewing trends, findings and methodologies used. The paper reviews the role of cost benefit analysis in national IM policy and offers suggestions on a way ahead.

MSIAC SUPPORTING THE MUNITION SYSTEM SAFETY

by Michael W. Sharp

This purpose of this paper is to review some of the ongoing efforts within MSIAC to support its member nations work with the myriad of munition safety related design requirements and standards. Issues such as standards applicability, relevance for emerging technologies, and ability to 'qualify once' are discussed with details being given on specific projects. In the area of applicability of standards, MSIAC has developed Safety Assessment Software (SAS) which directs munition safety professionals to relevant national and international munitions standards tailored to their munition type. The SAS tool is described briefly and its role for potential users is explored. Concerning emerging technologies, MSIAC has initiated work to help support the introduction of new energetic materials and systems for artillery application as well as providing assistance on the applicability of standards and assessment methodology for mitigation devices. The paper will highlight the issues involved and the direction that these efforts are taking. Finally, the paper will touch on the value of efforts to help nations address their desire to be able 'qualify once' through international harmonisation of the safety and suitability for service assessment process.

INVESTIGATION OF 4f-METALS EUROPIUM, SAMARIUM, THULIUM AND YTTERBIUM AS METALLIC FUELS IN REACTIVE FRAGMENTS FOR ENHANCED TARGET EFFECTS

by Ernst-Christian Koch

and

*Volker Weiser, Evelin Roth, Stefan Kelzenberg -
Fraunhofer Institut für Chemische Technologie,*

Samarium, europium, thulium and ytterbium and their alloys merit consideration as fuels in reactive material fragments. The metals exhibit higher density than both Mg and Al, lower gravimetric and volumetric enthalpy of vaporization (tab. 1) and unlike aluminium undergo vapour phase combustion when ignited in air, oxygen or halogen based atmospheres. The combustion temperature of both Eu and Sm in oxygen are depicted in Fig.1 and out-perform vapour phase burning Mg by ~700 °C.

Table 1 *Physical and thermochemical properties of Mg and Sm, Eu, Tm and Yb*

Metal	m_r	ρ g cm ⁻³	mp °C	bp °C	$\Delta_{\text{melt}}H$ kJ mol ⁻¹	$\Delta_{\text{vap}}H$ kJ mol ⁻¹	Oxide*		Fluoride*	
							mp °C	bp °C	mp °C	bp °C
Mg	24.305	1.738	649	1105	9.0	127.6	2832	3600	1263	2264
Sm	150.36	7.520	1072	1804	10.9	164.8	2335	4024	1299	2331
Eu	151.965	5.243	822	1439	10.5	176	2100	3840	1377	2389
Tm	168.9342	9.321	1545	1725	18.4	247	2425	3945	1158	2312
Yb	173.04	6.965	824	1193	9.2	159	2277	4070	1162	2307

* oxidation state (III) for the lanthanides

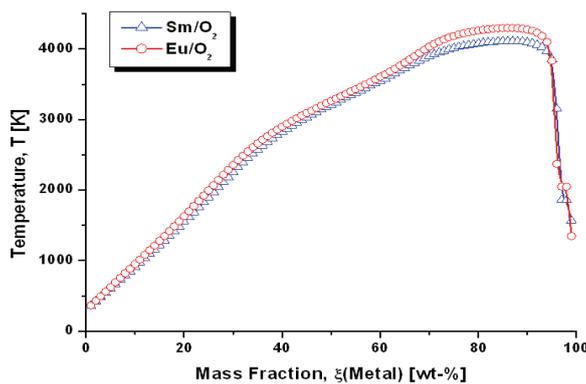
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Table 2 Thermochemical properties of the oxides and fluorides of Mg and Sm, Eu, Tm and Yb

Oxide	$\Delta_f H$ kJ mol ⁻¹	Cp J K ⁻¹ mol ⁻¹	$\Delta_{\text{melt}} H$ kJ mol ⁻¹	Fluoride	$\Delta_f H$ kJ mol ⁻¹	Cp J K ⁻¹ mol ⁻¹	$\Delta_{\text{melt}} H$ kJ mol ⁻¹	$\Delta_{\text{vap}} H$ kJ mol ⁻¹	$\Delta_{\text{sub}} H^\circ$ kJ mol ⁻¹
MgO	-602	37	78	MgF ₂	-1124	62	59	274	
Sm ₂ O ₃	-1827	116	84	SmF ₃	-1669	96	52		435
Eu ₂ O ₃	-1663	125		EuF ₃	-1584	100	53		384
Tm ₂ O ₃	-1889	117		TmF ₃	-1656	95	29		454
Yb ₂ O ₃	-1815	115		YbF ₃	-1467	92	30	251	457

Thus blast effects upon fragment perforation of target structures are expected to be much stronger than from commonly used non volatile reactive materials. These and other possible advantages of these metals and alloys over common reactive materials are discussed.

Figure 1 Adiabatic Combustion Temperature of Europium and Samarium combustion in 0.1 MPa Oxygen

HOW TO REDUCE MUNITIONS EFFECTS TO FRAGMENT, SHAPED CHARGE JET AND EXPLOSIVELY FORMED PROJECTILES AGGRESSIONS?

by Pierre-François Péron

Insensitive Munitions (IM) are now recognized as one of the key considerations when designing and/or procuring munitions. There is now a wide range of technologies and techniques that can be employed to reduce the response of munitions to unplanned stimuli.

However, IM Technology Gaps still remain. An MSIAC workshop was held in 2009 to identify and prioritize them, with emphasis on the end-user's, i.e. the warfighter's, experience and needs.

It has been established during this workshop that some munitions currently in use in operations are subject to attack by fragmentation warheads, shaped charge jet weapons and explosively formed projectiles. Priority munitions components have been identified: gun propellant charge systems; high performance rocket motors; minimum signature rocket motors; anti-armour warheads; blast/fragment and general purpose warheads.

These priority munitions and the perceived IM Technology Gaps have been the subject of an MSIAC-sponsored

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workshop on how to reduce the sensitivity of key munitions to fragments, shaped charge jets (SCJ) and explosively formed projectiles (EFP). The workshop was held in Instituut Defensie Leergangen, The Hague, The Netherlands from 20 to 24 June 2011.

Discussions included both existing munitions and new/upgraded munitions. The workshop addressed in particular issues encountered to reduce the munitions response to these threats in operational theatres, related mitigation shortfalls based on credible aggression scenarios and potential remediation options.

The participation of warfighters and people involved with deployed munitions brought a high add-on value to the discussions.

The paper will detail the workshop goals and present the discussion conclusions of the different working groups: potential IED EFP effects on munitions; existing munitions IM shortfalls to the three aggressions; potential remediation; identification of IM research efforts for the near term and long term future and potential international collaboration areas.

MSIAC IM DATABASES - AN EFFICIENT TOOLBOX TO ASSESS IM SIGNATURE

by Pierre-François Péron,

To assist the Insensitive Munitions (IM) community, the Munitions Safety Information Analysis Center (MSIAC) began in 2002 to develop a suite of databases collecting information on the six IM tests described in STANAG 4439 Policy For Introduction and Assessment of Insensitive Munitions (MURAT). These tests are: Sympathetic Reaction, Shaped Charge Jet, Fragment Impact, Bullet Impact, Liquid Fuel/ External Fire and Slow Heating.

These databases have been developed in electronic format under Excel2003 to ease their use and take advantage of Excel search features. Test set-ups, results and analyses are also reported in detail and interpretation of results is made easier by the inclusion of pictures, graphs, comments and references.

Together these databases compile data from 500 publications and comprise more than 5,500 test results. They represent an opportunity for the IM community to easily and quickly assess for instance the IM relevance of an explosive for a particular application, the achievable IM signature for a certain type of warhead.

Information provided by these databases can be combined with other MSIAC products to get a full set of parameters on energetic material performance, sensitivity and munition vulnerability:

- Energetic Material Compendium (EMC) that compiles information on more than 1,200 energetic materials;
- Database on gap tests (NEWGATES) that includes 1,450 gap test results
- TEMPER software that takes into account two IM threats (STANAG 4496 conical-ended fragment and sympathetic reaction) and helps to assess the influence of various parameters (body thickness, EM shock sensitivity, etc) to avoid a detonation.

The paper will describe the IM databases and will illustrate on particular examples the information that can be collected or used as input for TEMPER simulations. These examples will also intend to show that these databases

LATEST PUBLICATIONS

(Available on the MSIAC secure website <https://www.msiac.nato.int/weblink/Welcome.aspx>)

or on request at info@msiac.nato.int

LIMITED PUBLICATIONS

- L173 Insensitive Explosive Materials: V - New Less Sensitive Energetic Materials by Dr Ernst-Christian Koch, August 2011
- L174 Insensitive Munitions Technology Gaps Workshop Proceedings CD ROM, August 2011. On request.
MSIAC RESTRICTED.



WORKSHOP ON ENERGETIC MATERIALS QUALIFICATION

Friday, 11 November 2011
Sofitel, Brisbane, Australia



INTRODUCTION

Currently the energetic materials community faces a number of challenges.

These are:

- The loss of subject matter expertise in energetic materials. This is partly due to challenging demographics, where a high proportion of staff are reaching retirement age, which has been exacerbated by reductions in defence budgets. The consequence is that the ability of many Nations to develop, test, utilise, and evaluate energetic materials is diminishing.
- The interrelated nature of today's world and the need to rapidly and successfully assess the safety of energetic materials and the systems employing those materials requires the ability to use, with confidence, qualification data from diverse, allied, or non-national sources.
- The attempted use of allied, foreign, or non-national qualification data in joint or cross-national developments or procurements without confidence in such data results greatly hinders the acquisition projects and forces additional expenditures by the participating Nations.

MSIAC supports our member nations in the enhancement of their munitions life cycle safety. We assist our member nations and support the NATO CNAD (Conference of National Armaments Directors) Ammunition Safety Group (AC/326) with advice on all aspects of munitions safety from cradle to grave.

In view of the above issues the MSIAC Steering Committee has decided to address the problem via two inter-related workshops to maximise the opportunities for participation. The first will be held conjointly with the Australian Explosive Ordnance Symposium (PARARI) in Brisbane, Australia and at the same venue. The second Workshop will be held in Europe in 2012.

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SPEAKERS

Dr John REID, Australia
 Dr Michael SHARP, UK
 Mr Duncan WATT, Australia
 Dr Bill WILSON, Australia

After the presentations the audience and the panel will hold discussions about reviewing standards of energetic materials with respect to:

- Background
- Purpose
- Technical Limits of a specific test
- Interpretation of test results
- Review (alternative) method(s)
- Correlation of tests results
- Accurate (develop dedicated document on accuracy required)
- Appropriate (cost/benefit)
- Available

WORKSHOP DELIVERABLES

- The objective is to identify the deficiencies of existing STANAGS and other standards.
- Develop international/NATO work-packages to improve STANAGS and other standards.
- Develop proposals for new standards, as appropriate, and the identification of custodians.

REGISTRATION

Participation is free of charge and limited to MSIAC and AC/326 member countries.

Please register directly with MSIAC if you wish to attend the workshop.

POC: Dr. Ernst-Christian Koch
 TSO Energetic Materials
Tel: 32 2 707 5630
Fax: 32 2 707 5363
Email: e-c.koch@msiac.nato.int & info@msiac.nato.int

- All Participants will receive the presentations on a USB stick.
- Participants from MSIAC countries only will receive the minutes & conclusions compiled after the meeting.

TENTATIVE PROGRAMME

07:30 - 09:00	Registration and Continental Breakfast
09:00 - 12:15	Presentations
12:15 - 13:30	Lunch Break
13:30 - 16:00	Working Groups & Final Discussion
16:30	End

LASERFICHE WEBLINK

Since the beginning of November 2010 a Laserfiche weblink has been implemented and provides instant access for both MSIAC member nations and AC/326 users to a customisable weblink portal. From now on all documents should be downloaded from the weblink as the secure website is no longer updated.

Users with a previously established username and password have access.

This portal enables authorised persons to securely search, browse and retrieve read-only documents. Services provided to our member nations are based on privileges:

- SC & NFPOs
- Hazard Classification
- IM State-of-the Art
- National IM Policies
- MOU
- Software and Databases
- Workshops
- Posters
- Accidents
- MSIAC Open and Limited Publications
- Working Groups
- Special Projects

The following AC/326 information is available:

- Decision Sheets & Agenda
- IWPs by Nation
- Documents
- Notices
- Publications (STANAGs, AASTPs, AOPs etc.)
- Presentations
- Historical AC/258 and AC/310 information.

Version 8.0.1

Repository MSIAC

User Name MSIAC\xx.yyyyyyy

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<https://www.msiac.nato.int/weblink/Welcome.aspx>

LATEST PATENTS OF INTEREST



US007886667B1

(12) **United States Patent**
Baker et al.

(10) **Patent No.:** **US 7,886,667 B1**
(45) **Date of Patent:** **Feb. 15, 2011**

(54) **MORE SAFE INSENSITIVE MUNITION FOR PRODUCING A CONTROLLED FRAGMENTATION PATTERN**

(75) Inventors: **Ernest Baker**, Wantage, NJ (US);
Chuck Chin, Ledgewood, NJ (US);
Arthur Daniels, Rockaway, NJ (US);
Stanley DeFisher, Hackettstown, NJ (US);
Vladimir Gold, Hillside, NJ (US);
Jack Pincay, Union City, NJ (US); **Irene Wu**, Livingston, NJ (US)

(73) Assignee: **The United States of America as represented by the Secretary of the Army**, Washington, DC (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 257 days.

(21) Appl. No.: **12/251,611**

(22) Filed: **Oct. 15, 2008**

(51) **Int. Cl.**
F42B 12/20 (2006.01)

(52) **U.S. Cl.** **102/495; 102/481; 102/491; 102/493; 102/494; 102/497; 102/506**

(58) **Field of Classification Search** **102/481, 102/491-497, 506**
See application file for complete search history.

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Primary Examiner—Bret Hayes

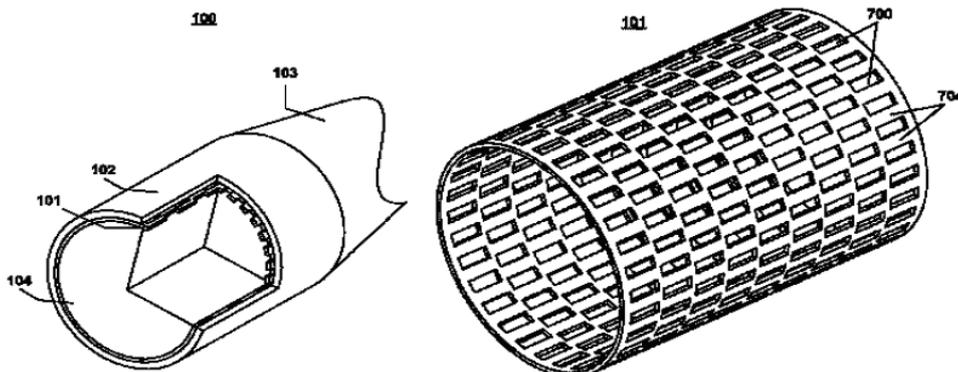
Assistant Examiner—Michael D David

(74) *Attorney, Agent, or Firm*—Michael C Sachs

(57) **ABSTRACT**

A warhead includes a body, a patterned liner made of plastic, and an explosive charge disposed within the liner. The liner pattern is formed of gaps and liner elements. The explosive charge includes a first set of sections that are disposed adjacent to the liner gaps and a second set of sections that are disposed adjacent to the liner elements. Upon detonation of the explosive charge and because of the temporal delay in transmitting the detonation energy between these two sets of sections, the warhead body is caused to shear and break into fragments with controlled size. The use of plastic as the liner material also provides a welcome safety feature for this warhead. In the event of unwanted heat ignition, the plastic (which is also low melt temperature material), would melt to seal the explosive and would also flow. Because of the plastic, neither sudden pressure nor heat/ignition inside the round, would therefore be as catastrophic.

20 Claims, 7 Drawing Sheets



PROCUREMENT ISSUES PRESS REVIEW

If you have information you consider of relevance to this section please do not hesitate to contact MSIAC at info@msiac.nato.int

CONTRACT CHEMRING ORDNANCE AWARDED FURTHER OPTION UNDER ANTI-PERSONNEL OBSTACLE BREACHING SYSTEM (APOBS)

www.chemring.co.uk – 2 September 2011)

Chemring Ordnance Inc. of Perry, Florida, US subsidiary, Chemring Ordnance, has been awarded a second option under its contract to manufacture the MK7 MOD 2 Anti-Personnel Obstacle Breaching System (“APOBS”) for the US Army and Marine Corps. The second option is worth \$52.5 million in the first year of the contract, and supplements the first \$22 million option award already received by Chemring Ordnance. The contract has a total estimated value in excess of \$150 million over three years if all option quantities are exercised.

For more information see article in MSIAC Newsletter 2nd Quarter 2011

GENERAL DYNAMICS AWARDED \$9 MILLION BY US ARMY FOR MODULAR ARTILLERY CHARGE SYSTEM

www.generaldynamics.com – 27 September 2011)

General Dynamics Armament and Technical Products was awarded an \$8.6 million contract option by the U.S. Army for the load, assemble and pack of the M231 and M232A1 Modular Artillery Charge System (MACS). General Dynamics Armament and Technical Products is a business unit of General Dynamics.

The option modifies an existing contract awarded in December 2008. Production work will be performed at General Dynamics’ facility in Camden, Arkansas. Program support will occur at the company’s Williston, Vermont. Work will be completed by September 2013.

The MACS provides propelling charges with combustible cartridge cases for 155mm artillery. Its design employs a “build-a-charge” concept that eliminates the need to dispose of unused charges (unlike current bag charges, unused MACS charges can be saved for future firings). The bottom-charge, M231 is fired either singly or in pairs to engage targets from 3 to 12 kilometers. The top-charge, XM232 is fired in multiples of 3 or higher. The M231 and XM232 are never mixed, so both charges and their associated packaging have design differences to facilitate distinguishability. This enables to differentiate the two charges visually and tactilely.

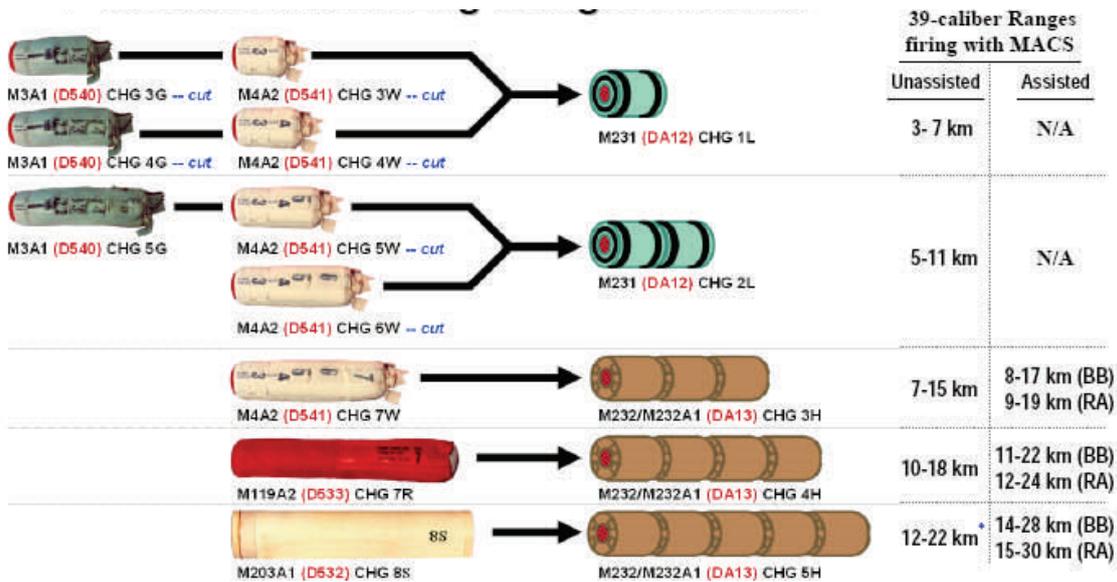
Several IM mitigation concepts have been incorporated to reduce the charge vulnerability to unplanned stimuli. The modules have a central igniter core that has a low reactivity. The charge confinement is reduced thanks to the design of a combustible case. The containers have thermo plastic end caps that melt in cook-off environment.

M231 Module	FCO	SCO	BI	FI	SR	SCJ
	V	< V	V	< V	P	P

M231 Module IM Signature (Packed)

(Continued on page 12)

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Conversion from Bag Charges to MACS Charges

BAE SYSTEMS AWARDED U.S. NAVY CONTRACT FOR 57-MM AMMUNITION FOR MK 110 GUN SYSTEMS

(www.baesystems.com – 1 September 2011)

The US Naval Surface Warfare Center awarded BAE Systems a \$23.3 million contract to provide 57-mm Mk 295 and Mk 296 ammunition for the Mk 110 gun system. This is the fourth contract awarded to BAE Systems by the Navy to deliver 57-mm ammunition and calls for 2,400 Mk 295 and 3,000 Mk 296 ammunition projectiles.

The Mk 296 TP (Training Projectile) will be used for training purposes by the Navy and US Coast Guard.

The 57-mm Mk 295 ammunition is a pre-fragmented, programmable, proximity-(3P) fuzed fixed round for use with the 57-mm Mk 110 Naval Gun system. The 57-mm Mk 295 consists of a pre-fragmented projectile shell containing PBX explosive, a brass cartridge case with a low sensitivity propellant (NL007) and an electric primer. The cartridge case has three stress risers grooves to ease propellant venting in cook-off events. The implemented IM mitigation features have considerably reduced the 57 mm Mk295 vulnerability to unplanned stimuli.

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57 mm Mk 295 Warhead Cross Section



57 mm Mk 295 Round

Pre-fragmented Body

	FCO	SCO	BI	FI	SR	SCJ
Propellant charge	IV	IV	V	V	P	P
		IV	V	II	P	

MSIAC/NIMIC 20TH ANNIVERSARY

MSIAC has created a souvenir CD of the 20th Anniversary celebrations, which were held on 5 April 2011 in Brussels.

It includes a slide show of the anniversary workshop and dinner as well as souvenirs from the Pilot NIMIC days till present day.

If you would like a copy please contact Valerie at v.cousens@msiac.nato.int.



ACCIDENTS REPORTING

23 July - 14 September 2011

(Re-printed with the permission of ility engineering (www.saunalahti.fi/ility) from their Hazards Intelligence (Hint) Journal)

23 July - Mexico

110723-02 Sanctórum de Lázaro Cárdenas, Tlaxcala. The State Institute of Civil Protection (IEPC) responded to a report of an explosion at 11:40 in a magazine, identified by registration number 793 with the Secretary of National Defense (SEDENA) on behalf of Petra Candelaria Pérez Olvera. Mateo Morales Baez, director of the IEPC, said that so far unknown causes led to the incident, but there will be experts from the Attorney General (PGR) who will determine what happened. He said that the incident caused the death of five, and injured three. The Civil Protection Director reported that nearby magazines had their roofs damaged by the blast due to the explosion.

3 August - Switzerland

110803-05-A Walenstadt (SG). Four soldiers were injured – two severely – in an explosion at the Walenstadt training ground. The incident happened during a refresher course for explosives specialists. Daniel Reist, an army spokesman, said the accidental explosion occurred during the handling of an explosive charge.



On August 4, ATS, the principal Swiss news agency, incorrectly reported that all four soldiers – three men and one woman – were out of danger, though one remained in a critical state. A mixture of 1,5 kg of TNT and plastic explosive, typically used for breaking open doors, exploded during an exercise. Martina Hugentobler, a military justice spokeswoman, said the preliminary evidence gathering for an explosives accident would take several weeks or months. She said that because a technical defect cannot be ruled out, all explosives exercises by the army were suspended for safety reasons.

8 August - Australia

110808-12-A Koorangang Island, New South Wales. Orica Mining Services. Orica, an explosives manufacturer, shut down its ammonium nitrate plant following a leak involving hexavalent chromium. Orica Mining Services stated its regret that it did not immediately notify authorities following the hexavalent chromium leak from the Koorangang Island plant at approximately 18:15, which is believed to have exposed 20 workers to the chemicals. The New South Wales Office of Environment and Heritage was informed of the leak on August 9 and subsequently shut the plant down.



Local residents were outraged that authorities did not inform them of the situation until August 11, instead carrying out letterbox drops and door knocks. The letterbox drop included a government information sheet warning of potential health risks to the community and advising ways to minimise contamination.



Orica Mining Services general manager James Bonner said the company was initially focused on containing the spill, but added that authorities should have been contacted immediately, adding: "We regret that. It's clearly something, part of our incident review, an investigation will be trying to understand why authorities weren't notified sooner. But the following morning they were notified, ensuring that they were briefed on what has occurred".

On August 15, Orica spokeswoman Nicole Ekert said the release of

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hexavalent chromium took place during start-up at the ammonia plant. Ms Ekert said: "Orica has no licence to emit chrome VI from the vent system concerned and has not ever discharged chrome VI from this discharge point in the 40-year operation of the site. The potential cause of the incident is still to be investigated". Ms Ekert said chromium was used as a catalyst: "The chrome is mostly in the more benign chrome III form, but during the catalyst formulation process, some chrome VI – less than 1per cent of total catalyst weight – remains. During the start-up of the ammonia process the chrome in the catalyst is normally all converted to chrome III where it remains in service in this state for a period of about five years or until the catalyst is exhausted".

11 August - USA

110811-01 Wasilla, AK. A truck carrying ammonium nitrate crashed and overturned. Central Mat-Su Deputy Chief Michael Keenan said: "As far as injuries, there were no injuries, very little product as far as hazmat got on the ground. The stuff that was involved, luckily, was stable. It's a very safe and stable product. It has to be mixed with a fuel before it will readily explode". He said fire-fighters worked so quickly to contain the 10 to 15 gallons of diesel fuel mixed with motor oil that spilled out of the truck's engine and fuel tank when it tipped.



The ammonium nitrate never got out of the shipping container it was in, Keenan said: "It was still in the [shipping container], so we felt pretty comfortable about it. The company that was shipping it was on scene pretty quickly and removed the blasting caps that were in a different part of the truck". Keenan said the department called out its hazardous materials response truck and surrounded the spilled fuel with dirt then soaked it up with absorbent pads.

12 August - India

110812-03 Kukatpally, Hyderabad. IDL. A 57-year-old technician died in a chemical explosion while operating a machine at IDL factory in Kukatpally. Police said that at around 13:30 the technician was working on a specialised machine used for making detonators, when the chemical used in making explosives exploded and he suffered severe burn injuries leading to his death.

Kukatpally police inspector S Pradeep said: "The company officials informed us that Janardhan was the only person working on the machine installed in a separate room. After the accident, a huge sound was heard and Janardhan succumbed to burn injuries. The reason for the explosion is still not known since experts have to come and analyse what went wrong".

The factory is located at an isolated place and no name was seen at the entrance. Deputy commissioner Neelam P Kasni told regional media that the administration could neither identify nor establish any contact the factory owner. She said: "Due to festival of Janamshatmi there was a little scope that several more workers were present in the factory at that time. However a team of policemen is at the spot to search if more workers are trapped under the debris." She said that full inquiry would be conducted to ascertain cause of blast, functioning of the cracker factory, safety features etc.

22 August - USA

110822-09 Elk River, MN. ATK Advanced Weapons. A fire at an explosives-making plant in Elk River was contained, with no injuries reported. The fire was reported around 07:30 inside a containment building at ATK Advanced Weapons. Multiple engines were called to the scene and the fire was contained and crews cleared by 10:00.

23 August - Russia

110823-04-A Ashuluk base, Astrakhan region. Six Russian soldiers were killed and another 12 injured by an explosion during the disposal of ammunition at a firing range. Russian Defence Minister Anatoly Serdyukov said in a press statement that a commission, led by Southern Military District Commander General Alexander Galkin, had been ordered to the scene at the Ashuluk firing range. Criminal and military investigators were dispatched to the explosion site, which is located in the southern region of Astrakhan.

On August 24, Russian sources described the base as an anti-aircraft missile facility. A spokesman for military prosecutors in the Southern Military District said investigators were "not ruling out any version, but the violation of safety rules during destruction of old ammunition remains a priority one". A source in the Astrakhan police also claimed that the ammunition had been mishandled, but did not elaborate.

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24 August - Ivory Coast

110824-11 Daloa. The inhabitants of Daloa panicked on hearing explosions between 22:20 and 23:20 coming from the compound of the Second Infantry Battalion, quartered in the town.

At midnight, Lieutenant Colonel Doumbia Bakari, Commandant of the Second Legion of Gendarmerie and Colonel Kouakou Kra, Second in Command of the Second Military Region, spoke on local radio, calling for calm. Colonel Kra said: "Around 22:20, munitions stored in a room of troops of the 3rd Company, 2nd Battalion of Infantry, began to explode. Certainly, these munitions have been subject to some influence. It was not a powder store that exploded, otherwise the damage would have been enormous".

Traoré Karim, a volunteer soldier, was killed by a shell, even



though he was 500m from the building. Five other soldiers were injured, of which the most serious was Zongo Bernard, whose lower jaw was torn off. He died later in hospital. Ten troop buildings were damaged at the scene of the explosion and one building 500m away was destroyed. Colonel Doumbia Bakari said he thought the explosions might have been triggered by a short circuit, explaining: "You know, when current comes in contact with munitions, there is what we call in military parlance the sympathy effect, which can only lead to explosions. The loud noises that you heard were

probably rockets that were stored with the other munitions".

According to local media, the store-room where the initial fire broke out contained 141 shells of type LRM, which are multiple rocket projectors.

31 August - France

110831-06 Bergerac (Dordogne – 24). Bergerac NC SA (BNC), a subsidiary of SNPE. An explosion occurred shortly before noon at BNC, a site classified as High-level Seveso, in a workshop being dismantled. The incident occurred in building "DC", formerly used for drying nitrocellulose. The disconnection of a pipe containing nitrocellulose residues caused the explosion, which caused no material damage, but injured six employees. The entire site is being dismantled. It was noted that, even when the factory was operating at full production, such explosions were rare.



14 September - Croatia

110914-10 Padjene near Knin. A fire that engulfed a military barracks in Padjene was contained, but remained active on September 15. Some 40 firemen and 15 vehicles remained in the area, with several local roads and railways closed to traffic. Around 200 residents were evacuated overnight from the surrounding areas after fire detonated ammunition and grenades stored in the barracks.

Minister of Health Darko Milinovic and Croatia's President Ivo Josipovic attended a meeting of the crisis centre formed in Knin, where it was decided to test the area for radioactivity. The President said that the

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soldiers who are normally in the barracks were miraculously saved and that the most important thing is that there are no casualties.

14 September - Iraq

110914-11 Chawig, Halabja, Kurdish Iraq. An unexploded rocket carrying chemical warheads, dating back to the 1980s Halabja chemical bombardment, was discovered during excavations in the Chawig resort area in Halabja town. Halabja's Department of Health announced that eight people, including the director of the Health Department, were contaminated after the discovery of the rocket during excavation work.

Halabja Health Department director Adel Karim told "Alsumaria News": "One of the hospitals in town received seven cases of chemical contamination. Those affected are workers and staff from the Municipality who were searching for the remains of a military aircraft that crashed after the chemical bombardments in March of 1988". He noted that severe cases of skin rash were prevalent. Karim said: "The Department of Health conducted tests on the rocket and the injured and sent the cases to the Ministry of Health in Kurdistan region and the Ministry of Health in Baghdad for final testing".



Halabja Mayor Goran Adham said: "Town officials already had information about the rocket as teams from the Municipality and an excavator driver saw it by chance while digging in an area of Chawig, a resort site in Halabja town, where a public park will be built. After the rocket was found, the project was stopped and higher government officials were informed of the case. Adham asked related agencies to carefully deal with the case since chemical content of the unexploded rocket has a-ready spread in the town. Town residents who re-member the 1988 chemical bombardment mostly say that the content of the rocket must be chemicals since it has the same smell of the chemical bombs with which the former Iraqi regime attacked the town.

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Halabja is a Kurdish town in northern Iraq, located about 240 km (150 miles) northeast of Baghdad and 15km from the Iranian border. On March 16, 1988, after two days of conventional artillery attacks, Iraqi aircraft dropped gas canisters on the town. At least 5,000 people died as an immediate result of the chemical attacks and it is estimated that a further 7,000 people were injured or suffered long-term illnesses. Most of the victims of the attack on the town of Halabja were Kurdish civilians; some still suffer debilitating illnesses.

MSIAC INPUT

29 September - Toone, USA

<http://www.jacksonsun.com/article/20110930/NEWS01/109300313/Kilgore-employee-burned-2010-dies>

The youngest of three workers burned in a 2010 flash fire at Kilgore Flares died Thursday.

Erika Jarrett, 26, was working on a flare assembly line on Sept. 14, 2010, at Kilgore Flares in Toone when a highly flammable liquid made of magnesium, Teflon and other ingredients exploded and caught fire. The fire burned Jarrett on about 80 percent of her body. Her cousin Jewel Jarrett, and friend, Catrina Jones, also were caught in the fire. The three worked within a few feet of each other. Jewel Jarrett was burned on about 60 percent of his body, and Jones was burned on about 20 percent of her body. All three were air lifted to The Regional Medical Center in Memphis that day. Jones was released from that hospital on Oct. 22. Jewel Jarrett was released Feb. 4. Erika Jarrett was released sometime in the summer. Erika Jarrett then was taken to Jackson-Madison County Hospital around Aug. 4, where she remained in critical condition until she died Thursday.

Kilgore Flares employees learned about Erika's passing in a meeting Thursday, said Zdravko Zdravkov, vice president of operations. The company canceled its second shift to pay tribute to the 26-year-old mother of three. "The news of Erika's death has deeply saddened all of us in the Kilgore family", stated an official news release from the company. "Our thoughts and prayers are with her husband, children, mother and her entire family. Our community is very close, and this loss has deeply affected us all". While the cause of the fire was never determined, investigators believe it started because of an electrostatic discharge.

CALL FOR NOMINATIONS FOR THE 2011 MSIAC MS AWARDS

In order to acknowledge and encourage progress and achievements in Insensitive Munitions technology, MSIAC has been presenting Awards for IM excellence at all NDIA IM/EM Technology Symposia since 1997.

The next MSIAC IM Awards will be presented at the 2012 NDIA IM/EM Technology Symposium (May 14-17, Las Vegas, NV, USA).

HOW TO SUBMIT A NOMINATION

Any interested party may submit nominations for the MSIAC MS Award for Technical Achievements or for the MSIAC MS Award for Career Achievements (see below Criteria and Objectives).

Nominations should be emailed to MSIAC before **30 March 2012**. They should be accompanied by a written justification, not more than one side of A4/letter paper in length, excluding any list of publications, which the proposer may consider relevant to the case.

CRITERIA AND OBJECTIVES

There are two kinds of MSIAC MS Awards.

The MSIAC MS Award for Technical Achievements will be awarded to individuals or teams who have made significant contributions in research and/or engineering related to the field of munitions safety. The individuals or teams should have published open technical papers on MS related work and/or made presentations of MS related work at open symposia such as the NDIA Insensitive Munitions and Energetic Materials Technology Symposium, DDESB Seminar or Parari. This Award is intended to advance technically the options available to munitions programme managers to enhance the safety of munitions throughout the entire life cycle.

The MSIAC MS Award for Career Achievements will be awarded to individuals who have made consistent contributions in research, engineering, production, procurement, fielding, standardization, policy, etc. related to MS, over an extended period. The individuals should have a long record of open papers, presentations and achievements in the field of munitions safety. This Award is intended to acknowledge career dedication to the cause of MS throughout the entire lifecycle.

RESTRICTIONS

The MSIAC MS award will not normally be presented in recognition of activities or services rendered whilst directly participating in the MSIAC project, the team, or in the Steering Committee. The reason for this exception is to prevent the perception that the Steering Committee would be able to make awards to its own membership.

When considering this restriction, the Steering Committee is given discretion to make awards as appropriate to any individual or team, to ensure cases of significant contribution to the field of MS, outside MSIAC activities, are properly recognized.

PROCEDURES

The winners will be chosen by the Steering Committee on the basis of proposals made by MSIAC and by Steering Committee Members, NFPOs, or any other interested parties. These proposals are to be made to the PM/MSIAC, in time for preparation of a discussion at the Steering Committee Meeting immediately before the meeting at which the Awards are to be made.

Applications should be accompanied by a written justification, not more than one side of A4/Letter paper in length, excluding any list of publications, which the proposer may consider relevant to the case.

Please see the MSIAC 2nd Quarter Newsletter for additional information.

CONTACT INFORMATION

☎ 32-2-707.54.16

☎ 32-2-707.53.63

🌐 <http://www.msiac.nato.int>

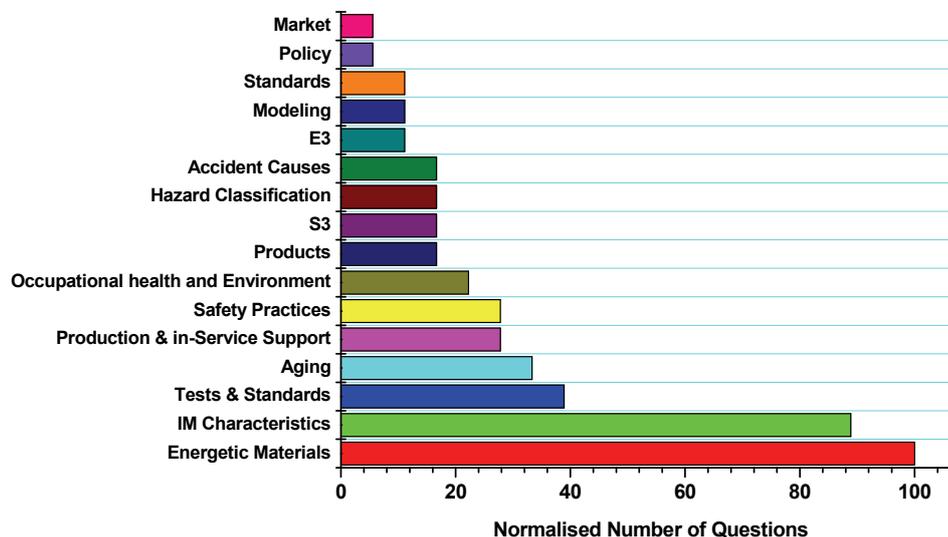
✉ info@msiac.nato.int

ANY QUESTIONS?

The MSIAC staff use their skills, the internal MSIAC databases and their extensive network to answer a wide variety of technical enquiries. Examples include:

- What is the effect of endothermic polymer decomposition on thermal ignition of PBXs?
- What is the survivability of Bradley fighting vehicles to an RPG attack?
- What are the infrastructure options for a new High Explosives plant?
- Assist in developing national IM policy/implementation plans?
- What LOVA propellants options are available?

The chart below reflects current MSIAC areas of interest in member nations.



MSIAC is involved with information concerning four major areas as they relate to Munitions life cycle safety: threats, explosives and munitions; related technical areas; and related logistic areas. These specific areas are:

1. Threats - slow cook-off, fast cook-off, fragment impact, bullet impact, sympathetic detonation, electromagnetic pulse and electrostatic discharge.
2. Energetic Materials and Munitions - high explosives, propellants, and pyrotechnics, rockets, missiles, guns, mortars, warheads, bombs, fuzes, gas generators, and ammunition, .
3. Related Technical Areas - ignition, thermal explosions, deflagration to detonation transition, shock to detonation transition and mitigation/elimination of these area.
4. Related Logistic Areas - storage, transportation, hazard classification, disposal, risk/cost benefit analysis.

We are also here to answer any non-technical questions, which can be the request of a particular paper, a document or software, which is not downloadable from our website. Although most of our documents can be downloaded from our weblink, some people have difficulty in doing this. Some publications are only available on CD or they are classified and can only be sent by mail.

All enquiries will be dealt with by contacting info@msiac.nato.int.

MSIAC NEWS

FAREWELL TO PIERRE

Pierre Archambault left MSIAC on July 31, 2011.

He and Christine returned to Canada after nearly five years in Belgium and travelling Europe.

We will miss Pierre's broad knowledge and experience, the quantity of his technical work, his ability to propose, conduct and achieve projects, and his very hard work.

We thank Pierre for his contribution to MSIAC and wish him and Christine the very best of luck for the future.



WELCOME TO EMMANUEL

Emmanuel joined MSIAC on 1 August 2011 as the Technical Specialist Officer for Propulsion Technology.

Emmanuel holds an Engineering degree in aeronautics, mechanics and energetics from ENSMA (Ecole Nationale Supérieure de Mécanique et d'Aérotechnique), Poitiers, France.

From 2003 to 2005, he worked for GIAT Industries on the development of the 120 mm HE round for the Main Battle Tank "Leclerc". He was involved in different parts of the project: propellant charge, fuze, dispersion, effectiveness and electromagnetic effects.

Until 2008, he was working for NEXTER munitions, and was responsible for the development and the qualification of the French Modular Charge System (MCS) in cooperation with EURENCO. He also assessed the performances of the Nitrochemie MCS in the 155 mm CAESAR® system.

He then joined TDA for 3 years as the design authority for the whole 120 mm rifled mortar ammunition family. There, he maintained and improved the current products (HE, Practice, ILLUM, SMOKE, RAP [Rocket Assisted Projectile]) and developed new products (IR, HE IM). He was in contact with several NATO customers, and was involved in the EFSS (Expeditionary Fire Support System) program for the US Marine Corps.

