MSIAC
Munitions Safety Information Analysis Center

Supporting Munitions Safety

May 2022

Bulletin

In This Issue

Belgian Royal Military Academy Students pay MSIAC & NATO a visit!

On the afternoon of the 24th of January, 2022, a visit to the new NATO Headquarters building was organized by MSIAC for a delegation of military students from the Royal Military Academy of Belgium. The goal of this visit was to raise awareness of NATO and of MSIAC activities regarding energetic materials and munition safety.

The agenda included a brief by MSIAC staff on current and future MSIAC activities followed by an interactive quiz. This was followed by a tour of the NATO building: the Agora, the conference center, and the office of the Permanent Representation of Belgium to NATO where the students had the opportunity to meet high-ranking delegates and ask them questions. The visit ended with a group picture taken in front of the NATO building and under the blue sky of Brussels.

The feedback from the students and their supervisors was all very positive. It is thus expected that this visit will be organized again on a regular basis.

Finally, if you want to challenge your knowledge on energetic materials and munition safety, do not hesitate to request the quiz questions at info@msiac.nato.int.

Christelle Collet, Kevin Jaansalu
TSO Propulsion Technology, TSO Materials Technology

Upcoming Opportunities at MSIAC

In June, we will be starting two recruitment activities for TSO positions at MSIAC! One is for the position of TSO Warhead Technology and the other position is for the TSO Munitions Transport and Storage Safety.

We will be sending out specific announcements when each process starts so check your mailbox and the MSIAC website regularly!!! Are you interested in either vacancy? Then make sure to apply.

Do not hesite to visit our website for more information on MSIAC and the concerned areas of expertise.

TSO Warhead Technology

To provide advice and expertise on Warhead Technology related munitions safety topics!

For more info, click here.

TSO Munitions Transport & Storage Safety

To provide advice and expertise on risk management including explosives effects modelling, consequence analysis, risk modelling, prevention and mitigation throughout the life cycle of munitions.
For more info, click here.

MSIAC Country Visit to Bydgoszcz, Poland

Col. Piotr Korneluk and Lt.Col. Katarzyna Prusko invited MSIAC for a meeting at the Inspectorate for Armed Forces Support (IAFS) in Bydgoszcz, 9-11 March. The topic of the meeting was Quantitative Risk Analysis (QRA) in relation to storage and handling of munitions. Poland currently applies Quantity Distance (QD) standards to site its ammunition storage, and does not yet adopt QRA when QD cannot be met.

The theory and benefits of QRA were discussed. The benefits include the large number of options that can be exploited to reduce risk to an acceptable level. Whereas QD are primarily based on consequence levels, QRA can take into account measures related to prevention and exposure reduction. A possible roadmap was discussed for introducing QRA in the necessary policy documents. Furthermore, possibilities for enhancing the knowledge about QRA within Poland were discussed. In relation to QRA models and software, there is an important choice to be made between developing a national code or adopting available international approaches. The selection of a benchmark for illustrating the benefits of QRA within Poland was also discussed.

I was kindly invited to visit the officer's mess of the inspectorate where a NATO flag is always on display!

After an interesting weekend in Bydgoszcz, I continued my journey to the other side of Poland to teach the AASTP-1 and 5 course (see accompanying article on page 4).

Martijn van der Voort
TSO Munitions Transport and Storage Safety

Fulmination 2022

M. Ferran and E. Baker represented MSIAC at the Fulmination 2022 Conference held near Reading, UK on 4-6 April 2022. Fulmination 2022 was an "All-In-One Event" incorporating the Ordnance Munitions & Explosives Conference, the IExpE Annual Conference, and the Early Careers Symposium. Fulmination 2022 was well attended by the UK ordnance and explosives community.

M. Ferran provided a presentation entitled "Application of herd immunity to munitions safety / Approaches to lifing algorithms". It was theorized that the overall aggregate reaction of larger stores of munitions in accident scenarios might be lessened with the introduction of IM rounds, even when only a portion of the store was replaced in an interim transition period. A theoretical method, based on herd immunity, to determine a critical amount or fraction of IM that may avoid escalation of accident scenarios was presented. In the second half of the presentation, the factors affecting the ageing of materials within a munition system, different national approaches to munition lifing, and how various ageing algorithms may then be implemented within this context were presented.

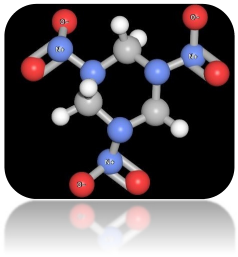
E. Baker provided a presentation entitled "Insensitive Munitions Technology: Career reflections and international perspective". The presentation included a short narrative of his career, an overview of the NATO MSIAC, a discussion of IM

international policy and standards, some IM technology success examples and the identification of current IM technology gaps. J. Toreheim from Bofors Test Centre (Sweden) provided a presentation entitled “Insensitive Munitions” that was complimentary and coordinated with E. Baker’s presentation.

Ernie Baker
TSO Warhead Technology

MSIAC Energetic Material Qualification Technical Meeting

MSIAC is pleased to announce the Energetic Material Qualification (EMQ) Technical Meeting for Industrial Partners, Academia and Small/Medium Enterprises to be held at NATO HQ on 13-15 September 2022. This meeting will discuss the concerns and issues surrounding EMQ from a non-government perspective. MSIAC wishes to listen to the concerns surrounding EMQ and what could be done to improve the EMQ process. Furthermore, MSIAC wishes to facilitate a discussion on new and novel processing technologies and their impact on the future of EMQ.



You can register for the Technical Meeting via the MSIAC website or at this link:

https://www.msiac.nato.int/workshop/technical-meeting-energetic-material-qualification

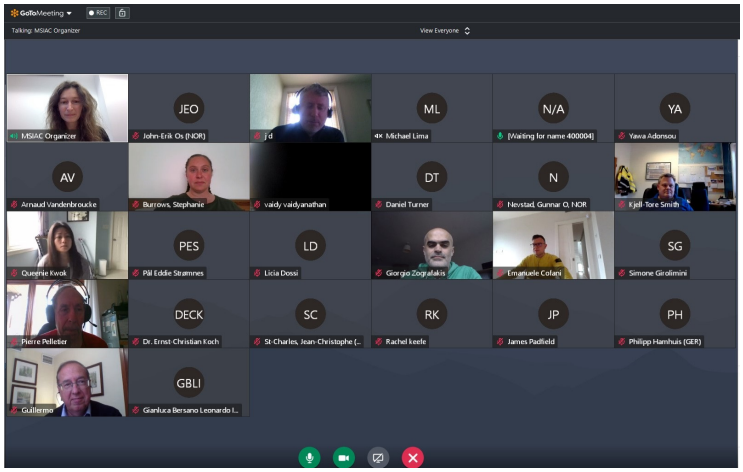
Cranfield University, Design for Vulnerability Course, IM Design Lecture

E. Baker provided a lecture on IM Design for Cranfield University’s Design for Vulnerability Course on 25 January 2022 at the Shrivenham, UK campus. The lecture outlines the IM design processes for energetic material selection, munition design, and packaging for reduced response violence to IM threats. The lecture outlines current databases, technology, theory, design tools, and appropriate experimental characterization for each of the IM threats: Shaped Charge Jet Impact (SCJI), Fast Cook-Off (FCO), Slow Cook-Off (SCO), Bullet Impact (BI), Fragment Impact (FI) and Sympathetic Reaction (SR). An expanded and more comprehensive version of this lecture is available to the MSIAC member nations through the IM Design Webinar.

Ernie Baker
TSO Warhead Technology

Feedback from the MSIAC IM Design Tools Webinar

A new edition of the MSIAC IM Design Tools Webinar took place on Tuesday, 3 May 2022, with the participation of 27 individuals from 8 MSIAC nations.



The goal of this two-hour web-based seminar is to demonstrate the IM design tools available to our member nations. The interactive session not only allows participants to see how the tools can provide answers, accelerate munitions design, and solve problems, but the session also provides hands-on demonstrations of how the MSIAC tools work. It thus represents a good way to become familiar with the MSIAC tools without moving from your office and at no cost!

This latest edition of the MSIAC IM Design Tools webinar was very much appreciated by the participants according to the first received feedback. If you missed the last session and you are interested in participating in a future edition of the IM Design Tools webinar, please notify us by email at info@msiac.nato.int. We will do our best to organize another webinar session in the near future, depending on the number of requests received.

Ernie Baker, Christelle Collet, Chris Hollands
TSO Warhead Technology, TSO Propulsion Technology, TSO Energetic Materials Technology

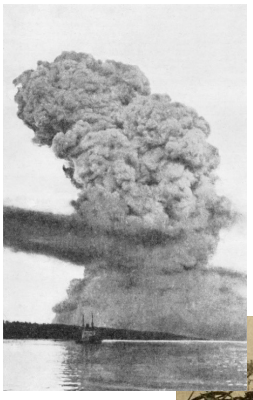
18TH UK Maritime Explosive Safety Forum

C. Collet and E. Baker represented MSIAC at the Maritime Explosives Safety Forum (MESF) that was held virtually by MOD Abbey Wood, UK on 22 March 2022.

C. Collet provided the invited briefing “The Application of Herd Immunity to Munitions Safety”. This is essentially the same presentation that was provided at Fulmination 2022 as described in the article above.

E. Baker provided the invited briefing “Bullet Impact and Munitions Crushing”. The history and potential reasoning for using the 12.7mm x 99mm AP ammunition for AOP 4241

bullet impact testing was presented. A comparison of energy and perforation performance was provided for different common ammunition threats. The 12.7mm AP ammunition is clearly not a worst case threat for all target munitions, as more severe IM responses have been reported using smaller ammunition projectiles. A study on potential explosive response caused by the crushing of munitions due to a ship collision was also presented. The potential to ignite almost any energetic material is real if the material is crushed over a long duration and ignition is nearly guaranteed if the material is pinched and ground with broken metals or grit. The study concluded that the major issue is not whether a munition or energetic material ignition and subsequent fire could happen, but rather the likelihood of a collision, magazine breech occurrence and crushing of munitions.



The 1917 Halifax explosion that occurred due to a ship collision was the largest man-made explosion in history until the atomic bomb in 1945 .

Ernie Baker
TSO Warhead Technology

MSIAC Munition Safety Awards

MUNITION SAFETY AWARDS

To acknowledge and encourage progress and achievements in munitions safety and insensitive munitions technology, MSIAC has presented awards for munition safety excellence at the NDIA IM/EM Technology Symposium (IMEMTS) since 1997. The full list of previous award winners is available on the MSIAC website: https://www.msiac.nato.int/news/ms-awards

Continuing this tradition, MSIAC will be presenting awards at the upcoming **2022 IMEMTS** in the categories of **Technical Achievement** and **Career Achievement**, and nominations are now open.

The deadline for nominations is **31st August 2022**. All nominations will be reviewed and winners selected by the MSIAC Steering Committee which is composed of government representatives from each member nation.

To make a nomination please visit the MSIAC website, where you can find further details of criteria and the required format for nominations:

https://www.msiac.nato.int/ms-awards-2022

AASTP-1 and AASTP-5 Course

We started this year with four in-person courses held in Wrocław (14-18 March), Versailles (21-25 March), RAF Cosford, UK (3-6 May) and Brussels (16-20 May).

The course in Poland was hosted by Col. Piotr Korneluk and Lt.Col. Katarzyna Prusko. Students traveled to Wrocław from different regions of the country. Furthermore, two students from Canada joined us. At the Club of the 4th Regional Logistics Base, we had an excellent meeting room at our disposal and we were surrounded by various historic military objects and art. We would like to thank Piotr and Kasia for the excellent week and for giving us a tour of the beautiful city of Wrocław.

Johnny de Roos and Martijn van der Voort then hurried to France to deliver the same course the next week at the Service Interarmées des Munitions (SiMu), not far from the Chateau de Versailles. Evelyn Conradi from the Belgium MoD joined us to prepare as a future instructor and she did an excellent job. The course was hosted by Capt. Pierre Villeneuve and Theo Vandenplas and we thank them for their organization. Two guest students from Latvia also joined the course.

Matt Wingrave from the UK DOS-R organized and taught two conversion courses alongside Johnny at RAF Cosford between 3 and 6 May. In this short version of the course, the focus is on the changes to the QD tables in the new updated AASTP-1 Edition C Version 1.

Unfortunately, the next course in Madrid in the week of 16-20 May was canceled. The Belgian MoD kindly offered to reschedule this course at their HQ in Brussels on short notice. This included students from Canada, Portugal, US and UK. Sean Gardner from Canada did a great job teaching on our course for the first time.

Positive feedback was received about the courses as well as the recent development of the Standard Related Document (SRD) AASTP-1.1 on Explosives Safety Site Plans (ESSP) and a calculator version of the new QD tables. After the final risk analysis exercise for a field camp, all participants received their certificate.

As always, the most recent course materials are available for download from the MSIAC secure website. For this, please logon to MSIAC weblink and click your way to MSIAC member nations and courses. Please note that also video recordings are available from a previously held webinar.

The remaining course program for 2022 is as follows:

- Rome, Italy (24-28 October)
- Canberra, Australia (tentative dates: 14-18 November)

A limited number of students from other nations may join these two courses. Please send us a request ASAP if you are interested. Participation is free of charge for MSIAC member nations, and 1,000 EUR per person for non-MSIAC member nations. Also, we are always looking for potential future instructors. Please get in touch with us in case you or a colleague is interested!

After this busy period, we did an analysis of all the AASTP courses provided since 2012. In the past **10 years** we conducted **38 courses** with close to **1000 students** from **27 countries**. We hope that this has contributed to the safety in our member nations and that we will be able to carry out this activity for many years to come.

Martijn van der Voort
TSO Munitions Transport and Storage Safety

JUST PUBLISHED

L-280 MIXING RULES FOR EM: TRANSPORT PROPERTIES

BY

PAUL SCHRAMA & KEVIN JAANSALU

This limited report is based on the work of Paul Schrama, a student intern from the Netherlands Defence Academy, who worked at MSIAC from February to April 2020. His efforts were directed to evaluate schemes that estimate the electrical and thermal conductivity, and the dielectric constant (relative permittivity), as in a great many cases, the properties of energetic materials have not been obtained by measurement. Therefore, they have to be estimated by mixing rules from the technical literature, which are often not validated and it is often unknown which mixing rule works best.

This study provides insight and recommendations of the usage of the mixing rules for a selection of these composite properties. The recommendations are: firstly, to conduct experimental studies on the electrical conductivity to develop more sophisticated mixing rules that do take percolation into account; secondly, to use the Poon and

Shin equation for the prediction of the dielectric constant; and finally, to use the Agari and Uno equation for the prediction of the thermal conductivity.

Kevin Jaansalu
TSO Materials Technology

Wade Babcock Retires

MSIAC would like to take a moment to recognize Mr. Wade Babcock's retirement from the US Navy.

Many of us in the US and international community have worked with Wade over the years and will miss his easy going and friendly personality and, of course, his valuable expertise. Wade's US Government service began in 2005 after leaving the private sector as a materials engineer. He started at the Naval Surface Warfare Center (NSWC) Indian Head characterizing high strain rate behavior of materials to shock and explosive loading. During his career, he has worked in the areas of munition materials, sensor integration, weapon/target effects, and modeling & simulation and progressed from a project engineer to a program manager, Branch Head, and technology division Director.

Wade joined the MSIAC team as the Technical Specialist Officer for Munitions Materials Technology in August of 2015 and served at MSIAC until December of 2018. After leaving MSIAC, he worked at the Naval Ordnance Safety and Security Activity (NOSSA) where he led the Insensitive Munitions (IM) Office.

As Wade begins his retirement, he leaves the Navy as a recognized DoD and International expert, and he will be missed by the US Navy, MSIAC, and the international community. MSIAC wishes him the best in his retirement.

Chuck Denham
MSIAC Project Manager

Check out the updated Accident Reporting here !

MSIAC Student Intern: Victor der Weduwen

This past spring, Victor der Weduwen, a well-travelled* student from The Netherlands Defence Academy, worked at MSIAC to examine mixing rules for the estimation of properties for highly filled polymer matrix composites, in this case, the estimation of the elastic properties which are required for risk analysis or modelling and simulation. There is little or no guidance for the best estimation scheme for those energetic materials that are also composites. Victor located many mixing schemes but very few would be applicable to those energetic composites of interest which are highly filled elastomers. The next step was to locate physical data within MSIAC technical resources. It was surprising to find that there is a lack of published data for energetic composites; however, there was sufficient data for Victor to test a modified estimation scheme with some success. This project is similar to the work of Paul Schrama, see the related article in this newsletter, and will be the topic of a future limited report.

Victor spent only six weeks here at MSIAC, 1 March to 15 April, and crammed a lot of thinking and a lot of work during this short period. This included briefing the Steering Committee on progress in his fourth week! Well done Victor!

We wish Victor the best of luck in his future career.

The MSIAC Team

Between the ages of 6 and 18, Victor lived in four different countries on four different continents!

The French Chronicle: Animals in French Expressions - 2ND Edition

Previously in this chronicle, those of you who are the most loyal readers may remember my call to provide me with your favorite local expressions. I was delighted to receive a feedback from Stéphanie Delisle, from Canada, who was kind enough to share with me a bunch of hilarious local Quebec expressions. With her permission, let me share with you the weather-related ones, with (and that is probably the funniest part!) the Quebec way to pronounce them.

When it is so cold that you can't put a dog outside: « Il fait

frette à ne pas mettre un chien dehors » (Y fait frett' à pas mett' un chien dewors/déwors). When it is raining "like a peeing cow" (see my previous chronicle): "Il mouille à boire debout" (Y mouill' à bwère deboutt') or "Il tombe des clous" (Y tomb' des clous), meaning that you can drink standing up or that it rains nails, respectively.

And finally, regardless of the temperature indicated by the thermometer, Quebec people have a unique gradation to describe how cold it is. Hence, the temperature provided are only indicative: frais (10°C), frisquet (5°C), froid (between 5°C and -10° C), frette (between -10°C and -20°C), "y fait frette en p'tit Jésus/maudit/mautadit" (between -20°C and -30°C) and "y fait frette en « preferred curse of the moment »" (below -30°C).

Christelle Collet
TSO Propulsion Technology, with contribution by Stéphanie Delisle

Announcing IMEMTS 2022

MSIAC is happy to announce that the next Insensitive Munitions/Energetic Materials (IMEM) Technology Symposium will be an in-person event, after the previous symposium which was only virtual due to pandemic restrictions.

The 2022 symposium will be held on 18-20 October 2022, at the Hyatt Regency Indianapolis Hotel, Indianapolis, IN, USA.

The call for abstracts and more information on this event will be soon available through the NDIA website.

Save the date, and we look forward to seeing you there!

Announcing PARARI 2022

MSIAC is pleased to announce that the next PARARI Australian Explosive Ordnance Symposium will take place from 8-10 November 2022, at the National Convention Centre, Canberra, Australia.

PARARI 2022 will be delivered in a hybrid format with both live and virtual registration options available, as well as the possibility to view recorded presentations time-shifted to accommodate differences in time zones of the delegates.

Full details can be found on the symposium website: https://www.parari.org/.

The call for abstracts will open soon, with a submission deadline of 2 August 2022.