



September 2021

Bulletin

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PM'S PERSPECTIVE

Now that the summer holidays are coming to an end, MSIAC will be busy preparing for the fall Steering Committee Meeting and a number of other planned activities to close out 2021. In addition to our usual body of work (answering technical questions and supporting the technical community's efforts related to explosive safety), MSIAC will be participating in the larger of the Cuira tests involving full scale detonation tests in Earth Covered Magazines (2,000 kg detonation) sponsored by Switzerland in October to help out with debris pick-up and prediction and assessment efforts. The Cuira tests are organized by Switzerland but will be carried out in Alvdalen, Sweden. There will be test teams from various nations participating in the event.

MSIAC is planning a country visit to the US that will include stops at the Naval Surface Warfare Centers located in Indian Head, Maryland and Dahlgren, Virginia and also stops at Picatinny, NJ and Eglin Air Force Base in Florida. This is the first physical country visit to be conducted by MSIAC since the start of COVID-19. I would also mention that MSIAC is in the process of planning additional country visits for the fall of 2021 and into 2022.

MSIAC is also planning its next AASTP-1 & -5 "in-person" training course to be held on the 15th through the 19th of November at Ramstein AFB, Germany, if travel restrictions allow. We are keeping our fingers crossed but look for details on this event on the MSIAC website.

Our ongoing series of technical workshops is one of MSIAC's core outputs, and gives subject matter experts from across the technical community the chance to collectively discuss matters of mutual importance, and to cooperate on developing solutions to common problems. Concerning our ongoing plan for workshops and technical meetings, we are currently reviewing what topics are likely to be of interest to the community, and will soon present this to the Steering Committee for approval. However, I can mention three technical meetings for late 2021:

1. A technical meeting to discuss the basis of Hazard Division 1.3 (focusing on the criteria for storage sub-divisions and the basis for QDs). Our objectives here are improved QD and risk analysis for HD 1.3, input for future editions of AASTP-1 and AASTP-3, and the harmonisation of the "approach" between the US and our other member nations. The virtual meeting is scheduled for the 7th and 8th of December with a follow-on in-person meeting in 2022.
2. We are planning a technical meeting on the novel approaches to S3 assessment (an MSIAC Work Element) and energetic material qualification, which will explore amongst other things, the issues associated with mutual assurance and likely lead to discussions on trusted partners and perhaps include other Safety & Suitability for Service test series. Dates TBD.
3. A Hazards of Electromagnetic Radiation to Ordnance (HERO) technical meeting is planned to discuss the derivation and application of safe separation distances, policy and guidance and HERO philosophy for testing, surveys and operational guidance, how the electromagnetic environment is characterized (HERO surveys), the conduct of HERO testing, the derivation of EME tables in MIL-STD-464 and AECTP-250, the



application of safety margins, no-fire and all-fire currents, and the derivation of the HERO curves for E-filed and H-field. There is a lot to cover here as there has recently been a lot of interest in this topic. This meeting was requested to support TQs from some member nations. Date TBD.

Also for the fall of 2021, MSIAC will be working with the officer responsible for NATO-EU relations in the Defence Investment, Defence Policy and Planning (DPP) Division to include ammunition safety in the structured dialogue on "Military Mobility" already in place at the staff level within the European Union. There was an expressed interest in including ammunition safety as an issue for discussion with EU staff (fall 2021) as part of the "questions-based discussions" in the context of military mobility established at the expert level. The aim of the question based discussion is to facilitate opportunities to engage with experts in respective fields, seek their views on how to achieve progress, promote these views and, thereby, foster a greater level of awareness and common understanding of each subject field by the staffs. Thus, the objective is ultimately to contribute to coherence. In the end, I see this as a means for ensuring ammunition safety contributes to interoperability/readiness for the Military Mobility plans for the EU. MSIAC was asked to provide a topic and aim for the discussion germane to ammunition safety. MSIAC initially suggested:

Ammunition safety starts with the material acquisition efforts (munitions design, S3 qualification and testing, etc.) and continues into the operational life-cycle management phases (storage and transportation safety, Explosives Safety Munitions Risk Management, Hazards of Electromagnetic Radiation to Ordnance (HERO) management, munitions surveillance programs, etc.). MSIAC will support AC/326 and DPP discussions with the EU and suggests exploring the challenges facing the technical community and the Military Forces within the Alliance in these areas related to ammunition safety to help ensure ammunition safety is better understood and implemented to support Military Mobility and to enhance interoperability and readiness.

In early 2021, MSIAC issued and awarded a contract for an Explosive Safety Munitions Risk Management (ESMRM) Consultant to support munitions safety efforts through the institutionalization and operationalization of ESMRM within the Allied Command for Operations (ACO), Joint Support and Enabling Command (JSEC), and their subordinate component commands. Kane Lear is the individual supporting this effort and he is currently updating ALP-16 and reviewing the ESMRM training that is provided at NATO School Oberammergau (ESMRM module within NATO Logistics Operational Planning Course - NLOPC). He is reviewing the content of the training material and will also provide ACO Commands with a general ESMRM briefing pack to be used for on-site training of their personnel. Overall, the effort will include promoting policy and working with the AC/305 Logistics Committee, ACO, JSEC, and subordinate component commands on policy development/revision, providing guidance on the ESMRM process and information, providing education/training and providing ESMRM advice and guidance to NATO/MSIAC member planning. We welcome Kane to our MSIAC team.

Finally, I would also like to mention that **Ms. Angeline Liekens**, our Information Analyst & Data Manager, who joined MSIAC (originally named NIMIC) in 1992, will be retiring in November and we would like to wish her the best. For those who know her or have had the pleasure to work with her know that she has been an amazing person to work with and an integral part of MSIAC's success over the

years and she will be missed. I would also mention that her replacement has been chosen and we look forward to welcoming **Ms. Trinh Vo** to MSIAC. She comes to us from NATO's Arms Control, Disarmament, WMD Non-Proliferation Center (ACDC) Political Affairs and Security Policy (PASP) and we feel that she will bring a lot of expertise to the position.

As always, I would like to encourage you to get involved in our program of work during 2021 and to have a look at our website for details on our activities. Please feel free to send us an e-mail requesting more information or to be kept informed or involved on any of our work elements.

Chuck Denham
Project Manager



MSIAC CELEBRATES 3,000 TECHNICAL QUESTIONS ANSWERED !

Since MSIAC was established in 1991 as the NATO IM Information Center (NIMIC), one of our core services to our member nations has been the answering of technical questions. Over the last 30 years, over 3,000 technical questions have been received from our member nations on a wide range of topics related to munitions safety; our answers to these questions have not only proved of use to the requesting nation, but have also helped to shape and influence the wider munitions safety community.

To mark the occasion of our 3,000th technical question, the MSIAC staff have answered a special technical question posed by Dr Brian Fuchs (MSIAC Steering Committee Chairman), exploring the trends in the technical questions received and answered over the last 30 years; the importance of this service to the technical community; and our predictions for the next 3,000 questions. You can read our response at the following link:

<https://www.msiac.nato.int/news/3000th-msiac-technical-question>

Don't forget, if your nation or organization has a technical question it needs answered, you can submit it to us using the form on our website:

<https://www.msiac.nato.int/products-services/msiac-technical-question-form>

Once we have received approval from your national MSIAC representative, we will do our best to answer it for you. We look forward to the challenges that the next 3,000 technical questions will bring as we continue to support munition safety.

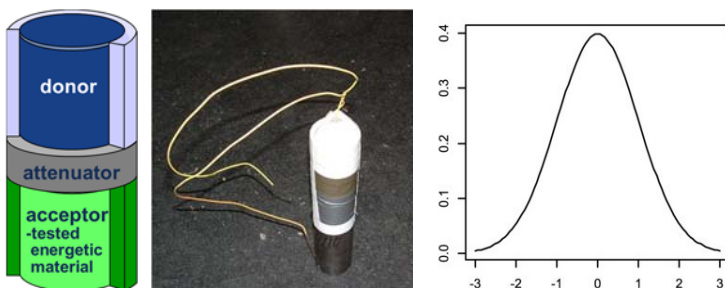
MSIAC Staff

GAP TESTING SURVEY

Please find a survey on Gap Testing (STANAG 4488) at this url: <https://www.msiac.nato.int/msiac-stanag-4488-gap-testing-survey>. The survey will close on 30 SEP 2021.

The survey on Gap Testing (STANAG 4488) is in support of the Shock Sensitivity Test Methodologies Custodial Working Group (CWG) that is led by Erik Wrobel (USA) under NATO AC/326 Sub-Group A. Dr. Ernie Baker is the MSIAC POC providing technical support to E. Wrobel and the POC for this survey. Your help in completing this survey by 30 SEP 2021 is greatly appreciated. The survey has been sent to MSIAC and NATO AC/326 email lists. Please feel free to forward this survey announcement as appropriate. After analysis of the survey, MSIAC will provide a report and a briefing to the STANAG 4488 Custodial Working Group and AC/326 SG/A. The recent MSIAC report O216 – An Overview of Single Event Testing Methods and Analysis provides background information on single event testing methods and analysis applicable to shock sensitivity go/no-go gap testing.

The first Shock Sensitivity Test Methodologies CWG meeting is planned to be held virtually in November 2021. NATO country SMEs participation is encouraged.



Shock Sensitivity Gap Testing

Ernie Baker
TSO Warheads

MSIAC TECHNICAL MEETING ON HD 1.3 ISSUES

In recent years, a number of questions have arisen in relation to the handling and storage of HD 1.3 ammunition and explosives. New empirical evidence from the US, related to the confined combustion of propellants, as well as the 2018 MSIAC workshop on Improved Explosives and Munitions Risk Management (IEMRM), provide relevant information that may help answer these questions. MSIAC was requested by AC/326 SGC to organize a technical meeting and bring the community together. More specifically, the questions are:



- Is it possible to develop more quantitative criteria to distinguish between the HD 1.3 Storage subdivisions: SsD 1.3.1 and SsD 1.3.2?
- What is the basis of current NATO and US HD 1.3 Quantity Distance (QD) criteria?
 - ⊕ What are the assumed or implied lethality and injury criteria?
 - ⊕ Is it possible to remove or reduce the large minimum distances?
 - ⊕ Is it necessary or possible to redefine HD 1.3 QD in

- terms of burning rate?
- How should HD 1.3 and confinement be addressed in QD and risk analysis?
 - ⊕ Is the approach taken by the US suitable for other MSIAC member nations?
 - ⊕ Are confined propellant burns also relevant for other HD?
- Can the assessment of Insensitive Munition (IM) thermal effects be improved, including thermal measurements in IM tests?

This technical meeting will be divided into two: a virtual meeting scheduled for 7 and 8 December 2021, daily between 14:00 CET and 19:00 CET, and a second meeting to be held in-person at NATO HQ in 2022 with dates TBD. The meeting will bring together government and industry representatives from MSIAC member nations involved with hazard classification, QD, and risk analysis of HD 1.3 ammunition and explosives. A detailed program as well as a repository with relevant literature will be made available closer to the meeting.

If you or colleagues have an interest to participate and contribute to the meetings, please register here and fill out the survey!

<https://www.msiac.nato.int/workshop/technical-meeting-hd-13-issues>

Martijn van der Voort
Munitions Transport and Storage Safety TSO

MSIAC WORKSHOP: DEFECTS – CAUSES, CLASSIFICATION & CRITICALITY

FINDINGS FROM VIRTUAL PLENARY SESSIONS

In March 2021 MSIAC hosted the latest in our ongoing series of technical workshops, this time focusing on defects in energetic materials and munition systems, and the ways in which we can assess their significance. The virtual plenary sessions were held over three days using the GoToMeeting platform. During these sessions, we were delighted to welcome over 100 delegates from across the MSIAC member nations, and 24 technical presentations were delivered.

Since the virtual plenary sessions were held, MSIAC staff have reviewed the presentations that were delivered, along with the associated Q&A sessions and post-meeting survey, to identify common themes and areas of interest for further investigation. Our findings have been compiled as four technical reports, each one corresponding to one of the four Focus Areas of the workshop:

- L-270: Origin of Defects**
- L-271: Detection of Defects**
- L-272: Consequences of Defects**
- L-273: Criticality of Defects**



These reports will soon be available for download by registered users of our website.

We will now start work on considering which of the workshop findings might be of greatest interest to the technical community. This may in turn lead to establishment of internal MSIAC research tasks, as well as focused technical meetings on specific topic areas.

We would like to thank all those involved in the workshop so

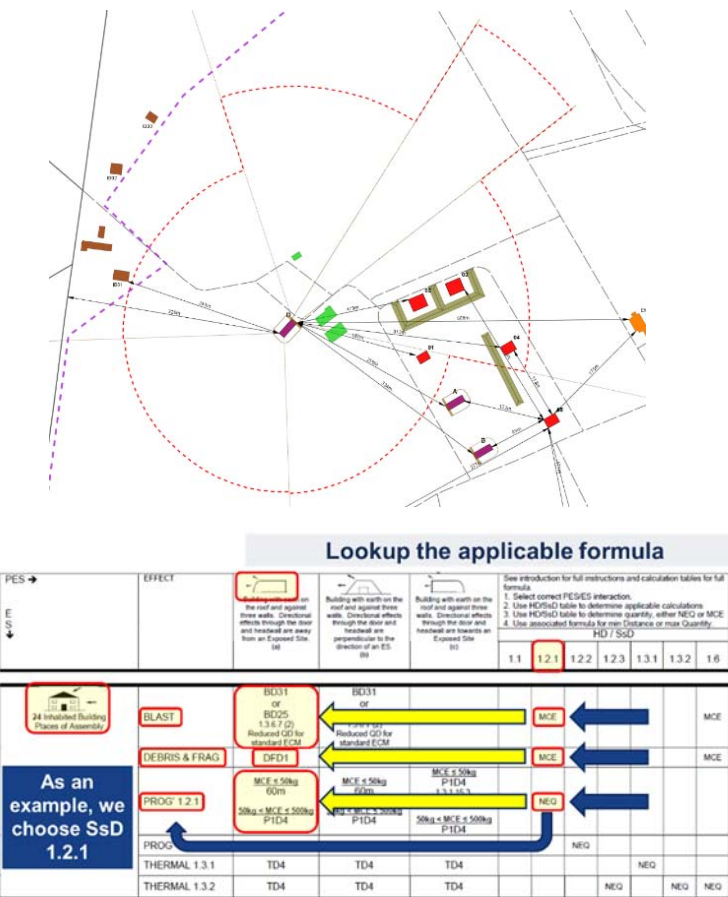
far, and look forward to your ongoing contributions as we progress with this work.

Matt Ferran
TSO Munition Systems

DEVELOPMENT OF SRD FOR AASTP-1 ON EXPLOSIVES SAFETY SITE PLANS

MSIAC has been very much involved with the development of the upcoming AASTP-1 Edition C Version 1, which will have a new procedure to determine QD. The assessment has become more transparent and has a better empirical basis. Still, it may also be more complex and time-consuming when conducted manually.

To assist the user, MSIAC has developed the Standards Related Document (SRD) AASTP-1.1: Manual for the Development of an Explosives Safety Site Plan (ESSP) based on AASTP-1. The SRD discusses in detail the four phases: Data collection, Development, Review and approval, and Oversight and management. This is done by discussing theory and using an example throughout the document. The SRD will also contain links to automated tools for doing the assessment.



Above 1: Example of a footprint of an IBD safety zone for an ECM.

Above 2: explanation of using the new QD tables.

Before publication, the document will be reviewed by the AC/326 SGC. A special thanks goes to Mr. Johnny de Roos who carried out the main part of the work!

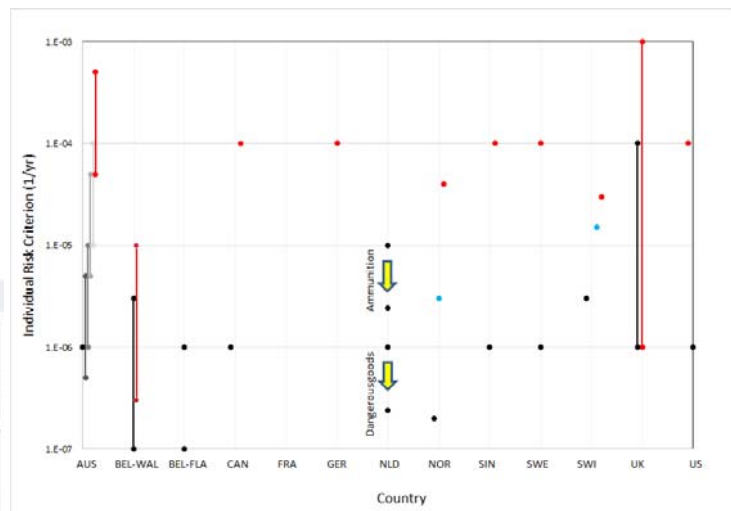
Martijn van der Voort
TSO Ammunition Transport and Storage Safety

RISK TOLERABILITY FOR AMMUNITION STORAGE AND RANGE SAFETY

MSIAC is gathering and comparing risk tolerability criteria with respect to munitions safety related topics. This work will consider the national and international legislative context within which risk tolerability decisions are made; risk tolerability considerations in munition system design and safety assessment; and a study into national criteria for Ammunition and Explosives (AE) storage and Range Safety (RS). This final aspect will soon be completed.

AE storage and RS have a number of parallels. Firstly, the consequence-based Quantity Distances (QD) have an analogy to the deterministic approach to Weapon Danger Areas (WDA). When QD cannot be met the next step is a risk analysis. When WDA do not fulfil the needs, a probabilistic methodology may provide a solution. AE storage and RS can be directly compared when expressed in terms of Individual Risk (IR). Accidental explosions in AE storage are typically low probability, high consequence events, whereas RS accidents have relatively high probabilities and usually limited consequences.

National differences exist in procedures, terminology, measures, methods and tolerability criteria. Various aspects are considered, such as risk definitions, the As Low As Reasonably Practicable (ALARP) principle, FN-curves and risk aversion. Numerical values for risk criteria have been based on statistics of fatality from a broader range of accidents, e.g. from traffic and other industries. This gives a good support for an IR acceptance criterion in the order of 1E-4/year for workers and 1E-6/year for the public. A comparison of national individual risk criteria is given in the figure below.



Comparison of Individual Risk criteria from various nations. Information from Australia was recently withdrawn from AASTP-4. The Netherlands employs "Plaatsgebonden Risico", an alternative to IR which assumes a continuous presence of a person. ALARP regions are indicated by a solid line.

Please let us know if you have relevant information to share about current risk tolerability criteria of your nation or organization, or any planned changes in your national policies.

Martijn van der Voort - TSO Ammunition Transport and Storage Safety & Matt Ferran- TSO Munition Systems

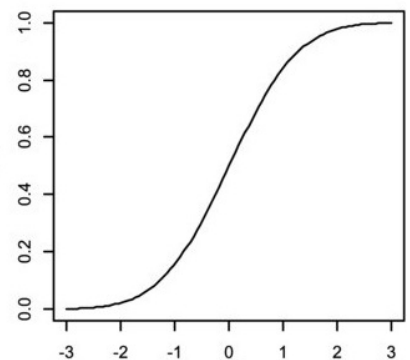
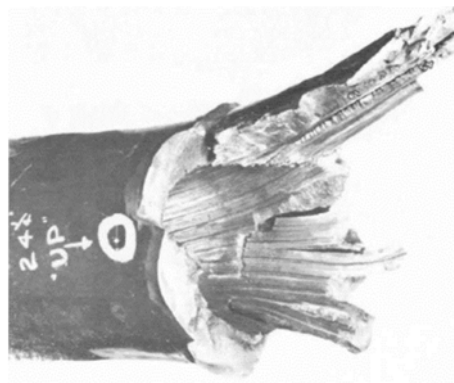
GUN LAUNCH SETBACK IGNITION STUDY WORKING GROUP UPDATE

The Gun Launch Setback Ignition Study Working Group (WG) was initiated by NATO AC/326 SG/A – Energetic Materials and is being led by the USA, with Sean Swaszek from US Army CCDC-Armaments Center overseeing the process. The goal of the working group is to develop a new STANREC and AOP - Suitability of Energetic Material Survivability under Setback Loading for standardizing the approach to testing and evaluating the safety of energetic materials and munitions to setback loading. Dr. Ernie Baker from MSIAC has been providing technical support to the group.

MSIAC has an associated work element that has developed a lexicon of terms for munitions defects, including gun launched projectiles. Several members of the Gun Launch Setback Ignition Study WG participated in the MSIAC workshop, Defects – Causes, Classification and Criticality, that was held virtually 9 – 11 March 2021.

Dr. Baker has recently researched and summarized single event testing methods and analysis which are applicable to laboratory setback actuator and gun launch ignition testing. Single event testing methods and analysis are applicable to a broad range of go/no-go testing performed under AC/326 test procedures. The associated MSIAC report is: O216 – An Overview of Single Event Testing Methods and Analysis.

The 7th Gun Launch Setback Ignition Study WG meeting was held virtually on 27-28 April 2021. The next Gun Launch Setback Ignition Study WG meeting is planned to be held virtually in November 2021. NATO country SMEs participation is encouraged.



Ernie Baker
TSO Warheads

WHAT'S NEW ON MUNITIONS HEALTH MANAGEMENT (MHM)?

Since the successful Cooperative Demonstration of Technologies on MHM organised in October 2019 at NATO headquarters (for more information, see MSIAC Newsletter 2020 – Issue 1), the COVID pandemic disrupted the plans and not much was communicated on MHM in this newsletter. Here is an update of the recent progress on those MHM activities where MSIAC is involved.

One major MHM achievement of 2020 was the completion of the new AOP-4844 “NATO Handbook for Munitions Health Management”. This document was developed in the frame of a Smart Defence Initiative project that started in 2017 under the supervision of AC/326 SG/B. The goals for the representatives of the ten participating nations (BEL, CAN, DNK, FRA, GBR, NLD, NOR, SPA, TUR, USA) were to define a common understanding for MHM and to develop an implementation guide. This guide is ready and will hopefully be promulgated this year.


The other main recent activity on MHM is the new STO AVT-ET-209 working group titled “MHM Technologies - Enabling Early Adopters” that started in January 2021 with the contribution of 22 experts from ten NATO nations. During 2021, the activities of this working group aim to raise the awareness of MHM in the nations, but also within NATO, thanks to the new participation of NSPA. The first meeting, organised in March 2021, was to collect the points of view of the contributors. It was up to the co-chairs (Peter Hooijmeijer, TNO, and Christelle Collet, MSIAC) to analyse this input and to discuss the way forward with the group in preparation of the AVT Panel Business Meeting scheduled in May 2021.

NATO STANDARD

AOP-4844

NATO Handbook for Munitions Health Management

FINAL DRAFT Edition A Version 1
MONTH YEAR



NORTH ATLANTIC TREATY ORGANIZATION

ALLIED ORDNANCE PUBLICATION

Published by the
NATO STANDARDIZATION OFFICE (NSO)
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Related to this MHM STO activity, an NSPA-MSIAC meeting was organized in Capellen, Luxembourg on 1st July. The discussion during the meeting was fruitful. MSIAC increased the awareness within NSPA technical personnel on innovative approaches for MHM, which is an area of focus set in the NSPA Strategic Direction for the next five years.

On the other hand, NSPA informed MSIAC representatives on its capabilities and current portfolio.



Following these discussions, a new STO Technical Activity Proposal (TAP) was drafted and submitted in August 2021 for a Research Lecture Series entitled “MHM – Implementation Challenges” during the 2022-2024 timeframe. Meaning that there will be things to say about MHM in the future; be sure that we will keep you updated.

Christelle Collet
TSO Propulsion Technology

A VIRTUAL MS AWARDS CEREMONY, BUT NOT A VIRTUAL AWARD!

As detailed in the last edition of this newsletter, the munition safety awards were presented at the IMEMTS virtual conference in April 2021. The awardees are:

1. For the Career Achievement Award: Patrick Lamy
2. For the Technical Achievement Award – Efforts in the assessment of HD 1.3 (a US Team of thirteen people led by Josephine Covino, DDESB)

Despite the virtual ceremony, the awards are real and they had to be delivered to each one of the awardees as it was not possible to present them in person at the IMEMTS ceremony.



The delivery of the parcels to all American awardees from the HD 1.3 team was completed during the summer time.



Clint Guymon (SMS) with his award



And we are now waiting for Patrick Lamy to collect his award in person the next time he has the opportunity to visit us in Brussels.

Once again, on behalf of the MSIAC team and the MSIAC steering committee, congratulations to all the winners!

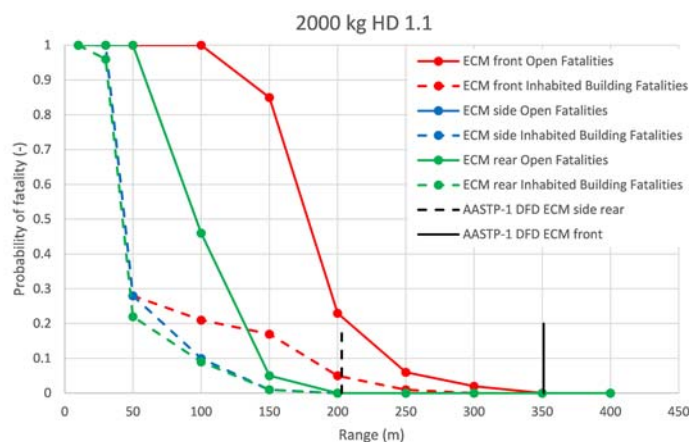
Christelle Collet
TSO Propulsion Technology

This was the opportunity for the MSIAC staff to meet together in the office for a packing activity!

MQDCAT—VERIFICATION AND VALIDATION

After the MSIAC QD Consequence Analysis Tool (MQDCAT) V2.4 was issued, the community was asked at various meetings to provide their feedback. The aim was to prepare for the next update of MQDCAT towards Version 3.0. Useful feedback was received from Belgium, Canada, Germany, Norway, Republic of Korea, and the United States, with various suggestions for further improvement and development.

A number of comments dealt with Verification and Validation (V&V), and involved a comparison with other consequence and risk analysis models, as well as accidents and tests. In the meantime, comparisons have been made with major accidents such as those in Enschede (2000) and Beirut (2020). Observed blast damage levels are reasonably well reproduced by MQDCAT using TNT equivalency values for these events reported in the literature (e.g. 1.1 kt for Beirut). A prediction of fatalities and injuries remains challenging given the many uncertainties, and should be called a sanity check rather than a validation. Nevertheless, based on population density data, a rough estimate of the number of fatalities and injuries is in the right order of magnitude. Furthermore, model comparisons will be proposed internationally, for example for a detonation in an Earth Covered Magazine.



Top: Observed damage after the Beirut accident (G. Valsamos, et al., Beirut explosion 2020: A case study for a large-scale urban blast simulation, Safety Science (2021)). Bottom: Probability of fatality in the open and inhabited buildings due to a detonation of 2,000 kg HD 1.1 in and Earth Covered Magazine (ECM front, side and rear), predicted by MQDCAT.

Further feedback was received about clarification (e.g. terminology, addition of a tutorial), functionality (e.g. calculation of Individual and Collective Risk), and accuracy (addition of more advanced effect and consequence models, more detailed specification of exposed sites). These aspects will also be addressed.

Martijn van der Voort
Munitions Transport and Storage Safety TSO

RECENTLY PUBLISHED MSIAC REPORTS

Due to the pandemic and the lack of travel and country visits, the time MSIAC staff allocated to drafting technical questions and reports significantly increased since last year, resulting in a decent number of new MSIAC reports being published earlier than expected. Here are the limited and open reports that have been published since January 2021, by chronological order:

⊕ **Resonant Acoustic® Mixing: Qualification Challenges (L-267)** by Dr Matthew Andrews (MSIAC), Christelle Collet (MSIAC), Aurihona Wolff (ENSTA Bretagne, FRA), Christopher Hollands (MSIAC) – January 2021: With the introduction of new technologies it is imperative that users, managers and national bodies provide the resources and time to determine, understand and provide guidance associated within the safe operating envelope. While these changes are positive for both supply and demand, they raise a number of questions with respect to assurance and the current concepts for energetic material qualification, munitions qualification and life assessment. This paper provides a summary of recent technical discussions and recommendations and invites the wider community to comment and consider the implications for munitions safety.

⊕ **Mitigation Techniques for Small Calibre and Flares (L-249)** by Aurihona Wolff (ENSTA Bretagne), Christelle Collet (MSIAC) – January 2021: This report focuses on mitigation techniques applied to flares and small calibre (<20 mm) munitions. It consists of an overview of safety issues with precise examples and recommendations.

⊕ **Defects Lexicon Survey Results and Agreed Terms (L-258)** by Dr. Matthew Andrews (MSIAC), Dr. Kevin Jaansalu (MSIAC), Matt Ferran (MSIAC), Aurihona Wolff (ENSTA Bretagne) – February 2021: This report provides a lexicon of 40 terms related to the structure and composition of materials with a fiche per term including definition, discussions, taxonomy identification, and references. It is acknowledged that this lexicon will require many iterations until the community can agree on a single term to describe a specific defect.

⊕ **Effects of Electromagnetic Radiation on Munitions, Part 3 Hazards of Portable Electronic Devices to Munitions (L-265)** by Matt Ferran (MSIAC) – May 2021: This report reviews the factors influencing unintentional RF-induced EID responses, and attempts to quantify the actual hazard posed by PEDs in the vicinity of munition systems. The discussion is framed in the context of national policies for management of such legitimate hazards.

⊕ ***In-Service Surveillance Practices across the Nations (L-266)*** by Christelle Collet (MSIAC) – May 2021: The report reviews how the nations deal with surveillance activities of their munitions stockpile. The information contained in the report combines the results from an international survey on ISS and stability testing, personal communications with targeted points of contact in the nations, and a literature review and is intended to provide the most possible updated vision of ISS practices across the nations.

⊕ ***An Overview of Single Event Testing Methods and Analysis (O-216)*** by Dr. Ernest L. Baker (MSIAC) – June 2021: This report outlines single event testing methodologies and analysis to support the AC/326 SG/A Setback Ignition (STANREC) and Shock Initiation (STANAG 4488) Working Groups.

⊕ ***The Application of Herd Immunity to Munitions Safety (L-268)*** by Martijn van der Voort (MSIAC), Christelle Collet (MSIAC), Matt Ferran (MSIAC), Kevin Jaansalu (MSIAC), Wade Babcock (NOSSA) – July 2021: This report provides insight into the applicability of herd immunity to munitions safety for stored munitions with varying degrees of IM and provides 2 case studies.

⊕ ***Review of Energetic Materials Qualification Tests, Part I: Friction (L-269)*** by Christelle Collet (MSIAC) – July 2021: The aim of this report is to review the different existing friction tests and how the friction sensitivity test results are affected by the test environment and the material properties. A total of 12 friction tests were analysed and their characteristics have been compared. The friction tests considered to be the most commonly used (the BAM friction, the rotary friction and the ABL sliding friction tests) are further described in dedicated sections in the report.

More details of these publications is available in our open website, as well as the full list of MSIAC publications: <https://www.msiac.nato.int/products-services/publications-technical-reports>

The full reports are downloadable from our secure website for all MSIAC users. Open reports are provided to any requestor via a simple email request to the author(s). We hope this will keep you busy reading them all until the next release...

Christelle Collet
TSO Propulsion Technology

UPCOMING EVENTS

With the rules progressively relaxing regarding the COVID situation, it is expected that some major events and conferences will be able to take place next year, after nearly two years of cancellations and postponements. Here is a selection of meetings of interest in the munition safety domain that are (so far) scheduled to Summer 2022:

[MSIAC Technical meeting on HD 1.3 issues](#) (Virtual Event)
Dates: 07-Dec-2021 through 08-Dec-2021

[24th International Seminar New Trends in Research of Energetic Materials \(NTREM\)](#), in Pardubice, Czech Republic

Dates: 06-Apr-2022 through 08-Apr-2022

[32nd International Symposium on Ballistics](#), in Reno, Nevada, USA

Dates: 08-May-2022 through 13-May-2022

[International Explosives Conference](#), in London, UK
Dates: 22-Jun-2022 through 24-Jun-2022

[17th Workshop on Pyrotechnic Combustion Mechanisms](#), in Karlsruhe, Germany

Date: 27-Jun-2022

[51st International Annual Conference of the Fraunhofer ICT](#), in Karlsruhe, Germany

Dates: 28-Jun-2022 through 01-Jul-2022

[45th International Pyrotechnics Society \(IPS\) Seminar](#), in Colorado Springs, CO, USA

Dates: 10-Jul-2022 through 15-Jul-2022

The full list of upcoming events is available in our website: <https://www.msiac.nato.int/news/meetings-of-interest>

Save the dates!

The MSIAC Team

WELCOME TO TRINH VO

Trinh Vo joined MSIAC on September 1st, 2021 as Information Analyst, replacing Angeline Liekens who is retiring. She holds a Master's degree in Political Sciences and a Master II in International Politics with a focus on East Asia. Prior to joining MSIAC, she worked from 2019 to 2021 as Executive Administrator at the NATO Arms Control, Disarmament and WMD Non-Proliferation Centre (ACDC) where she was in charge of assisting Committees and Allied countries in arms control verification activities through knowledge management, data monitoring, analysis and interpretation as well as database management.



From 2016 to 2018, she worked as Coordinator of the NATO Internship Program which, on top of providing interns with an opportunity to learn from the NATO community, contributes to strengthening the understanding of NATO's mission globally while increasing diversity among the workforce.

She has 15 years of experience working in different areas (academia, human resources, human rights and arms control and disarmament) and is thrilled to bring to MSIAC the experience and best practices developed throughout her career in data, information and knowledge management; and to contribute to its mission of helping Nations develop, implement and improve munitions safety policies.

THE FRENCH CHRONICLE

THE FRENCH ORTHOGRAPHY

September is synonymous of “back to school”, and it also reminded me of the good old time when I was doing “dictées”, the usual French torture for kids at school to make them learn how to write proper French orthography – except that I was a big fan of dictées! So let me tell you a few things about the French orthography and its subtleties.

It is largely admitted that the French language is much more complicated than English due to many historical and illogical additions, layers, and other reforms. A typical difficulty consists in a different verbal form for each pronoun in French (j’ai, tu as, il/elle a, nous avons, vous avez, ils/elles ont – 6 forms) whereas there are only a very limited number of forms in English (I have, you have, he/she has, we have, you have, they have – 2 forms).

Another difficulty is that, like in many other languages, French assigns a gender to all words. However, note that there is no neutral form like in German. And there is absolutely no relation whatsoever with a possible historical link with men and women. Men can wear ‘un

pantalon’ (trousers, masculine) and ‘une chemise’ (a shirt, feminine), and women can wear ‘une jupe’ (a skirt, feminine) and ‘un chemisier’ (a blouse, masculine). But what is probably the most puzzling for non-native French learners is the illogical mismatch between written and spoken French. For example, did you know that there are 12 different ways to write the sound [s] in French? These are ‘s’, ‘ss’, ‘c’, ‘ç’, ‘sc’, ‘t’, ‘x’, ‘z’, ‘th’, ‘sth’, ‘cc’, and ‘çç’! But when you see an ‘s’ in a French word, it does not necessarily mean that it is pronounced [s]. There are indeed 3 possibilities: [s] or [z] or mute! As an example: “Les [z] oiseaux [z] sont [s] jaunes [mute] », meaning « The birds are yellow ».

If you want to know more about other funny (or not) aspects of French orthography, I strongly encourage you to watch the excellent TED talk video “La faute de l’orthographe” by Arnaud Hoedt and Jérôme Piron (available on Youtube at the link <https://www.youtube.com/watch?v=5YO7Vg1ByA8>). But I’m afraid you will first have to learn French as it is not subtitled!

Christelle Collet
TSO Propulsion Technology

AN UNUSUAL SUMMER INTERNSHIP AT MSIAC

2021 was a challenging year for our MSIAC summer interns due to the pandemic which prevented them from being in the office. The internship was thus conducted remotely, with frequent videoconferences between MSIAC staff and the interns. Despite this constraint, our three “virtual students” from ENSTA Bretagne, France, did a fantastic job on their respective topics:

- ⊕ Hugo Chelabi, on “E3 Instrumentation Techniques” (supervised by Matt Ferran)
- ⊕ Christian Li, on “TNT Replacement Fills” (supervised by Chris Hollands)
- ⊕ Pierre-Louis Spsychala, on “Improving the MSIAC Gap Test Computational Tool and Database” (supervised by Ernie Baker)

Thanks to the improvement of the COVID situation and the vaccination roll-out in Belgium and France during summer, it was possible to welcome them for one week at the very end of their internship, at the end of August. It was the opportunity for us all to physically meet each other and the interns were able to finalize their projects with the direct help of their respective supervisors. After the traditional presentation of their projects to the MSIAC team, it was time to relax and to enjoy some Belgian specialties!

The MSIAC team is very grateful for the involvement of Hugo, Christian and Pierre-Louis and we wish them all success in their studies and future professional life.

If you or someone you know would be interested in performing an internship at MSIAC, please keep an eye at the application process and the list of topics available at the MSIAC website: <https://www.msiac.nato.int/products-services/msiac-interns-trainees> (note that this list will be updated around the beginning of November for next year).



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