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

Bulletin

In this issue

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SCIENCE OF COOK OFF ATLANTA 25-29 | APRIL | 2016

Executive Summary

MSIAC hosted a five day workshop at the end of April 2016 to discuss the science and understanding of, to quote Blaine Asay, "a very complex series of events" that is cook off. The workshop was held at the Executive Management Center, located in the business-focused midtown area of Atlanta, Georgia.

Interest in the workshop was high; more than 90 people applied for the 75 available places at the workshop and the attendees came from ten of the thirteen MSIAC countries: Australia, Canada, Finland, France, Germany, the Netherlands, Norway, Sweden, the United Kingdom and the United States. Attendees represented government, industry and academia, and participated in an open forum for cook off discussions to take place between scientists from both the conventional and nuclear laboratories. People involved in testing, qualification and programme management were also present to provide balance to the deep technical discussions.

The workshop's objectives were to improve the understanding of cook off of energetic materials and their systems. These objectives were achieved through discussions and presentations on chemical and physical changes, heating rate and heating conditions, critical ignition and growth conditions, reaction phenomenology, models and modelling, and sub-scale testing to system-level tests.

In reviewing the science of cook-off, the workshop participants would:

- Identify gaps in understanding
- Identify how we can apply our collective knowledge and tools (tests and models) to improve design and assessment of munition response to cook off today and in the future
- Understand the affect of heating rate (which may have future implications on full scale testing policy)

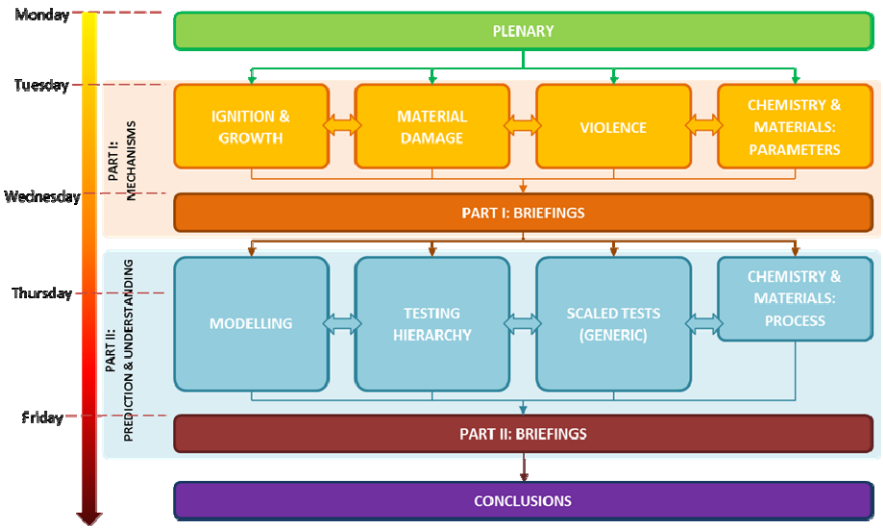


Figure 1 Workshop Structure

The workshop was spread over five days and opened with a plenary session designed to provide key discussion points for the remainder of the week. Participants were then split into two key areas: mechanisms and prediction & understanding (see Figure 1). To facilitate discussions, each key area was further sub-divided into four focus areas (see Figure 1), each led by a chair with support from an MSIAC staff member. Each focus area had specific goals and objectives that related to the main workshop goals.

Plenary Session

The session was opened by the MSIAC PM Dr Michael Sharp who welcomed the attendees to the meeting and provided a recap on the workshop's objectives and how the output could influence a number of areas associated with cook off. Dr Matt Andrews then provided a welcome and administrative points for the week, followed by a brief history of cook off and thermal understanding from previous NIMIC and MSIAC workshops. It was highlighted that more than 13 years had elapsed since focused discussion had taken place in this area.

Dr Kerry Clark provided a review of work to understand the effect of heating rate and scale through FEA modelling. It highlighted that boundary conditions were as important as the size when determining ignition location. This was then followed by Albert Bouma and Dr David Hubble who provided an overview of the NATO Fast Cook Off (FCO) custodial working group work into understanding the complex problem of thermal flux within fuel and propane fires. At the opposite end of the heating range Dr Kevin Ford provided a summary of a recent JANNAF workshop on Slow Cook Off (SCO), which provided excellent points for discussion in a number of focus areas.

The technical presentations started with Dr Bryan Henson describing the thermal response of secondary explosives and providing insight into each stage of the process. This was followed by Dr Michael Hobbs highlighting the role of pressure during cook off of explosives through the use of bespoke instrumented test vessels. Dr Malcolm Cook then presented work on scaled tests used to understand violence of reaction and on advanced cook off experiments which enabled the visualisation of reaction progression.

Gert Scholtes provided an historical perspective to cook off work at TNO and within the community. Dr Libby Glascoe then discussed lab-scale cook off experiments used to explore mechanisms and develop high fidelity models. This led into the discussion by Dr Keo H. Springer on the current capabilities and future challenges of cook off modelling of explosives.

The final presentations then moved to discussing the hierarchy and applying this to the system level. The first of these was given by Alice Atwood who discussed the need to relate scaled tests to a working hierarchy process and challenged the participants to put their thinking caps on. The second presentation was given by Dr Fabien Chassagne who discussed the key factors and differences in reaction violence to thermal threats when testing solid rocket motors.

The plenary session was concluded with two National perspectives from the United Kingdom and Norway. Gunnar Nevstad provided an overview of Norwegian activities and Dr Phil Cheese highlighted the challenges in understanding and predicting aspects of cook off and provided motivation for the following days' sessions.

Session Output

The subsequent three days provided time for some focussed discussions on all the areas of cook off. Below we have captured several key conclusions from each focus area; a more detailed review will be provided in the final report.

Ignition & Growth

The understanding of ignition location within an energetic material has become more complex than previous understanding; i.e. centre for slow heating and edge for fast heating. Experimental results showed that the physical state of a material greatly affects the ignition location, with molten materials being the most complex state to understand. It was observed that binder type influenced burning velocity and pressure but further work is needed to understand the mechanisms.

Experimental techniques exist to determine time to ignition and now this is complimented by new techniques to allow the visualisation of ignition and growth. Experimental techniques have also been developed to understand the effect of both pressure and temperature on burning rate of a range of energetic materials. This data is important as input parameters into models.

The understanding of thermally damaged material was identified as a gap and the need to develop tools to access this space was discussed. New models are also required to describe molten materials that are stable below the ignition temperature.

Material Damage

The current understanding of material damage, from individual components of formulations to the system, were captured. Mechanisms, material constraints, experimental techniques, and gaps were all covered.

The key outputs from the group highlighted the importance of both ullage and voids in affecting the rate of reaction. It was discussed that, within a thermally damaged material, many mechanisms exist for the formation of voids within a material and this in turn leads to increased porosity, cracks and permeability. The physical state of the material was discussed as melting leads to convection and turbulent mixing, and the orientation of an item will greatly affect the response.

The formation of decomposition products and their location within a material/system needs to be understood; including the subsequent effect on swelling, ullage formation, and venting. The work highlighted the information required for constitutive models to describe the reactions.

Violence

Participants captured a current understanding of the factors influencing reaction violence with respect to force and area. A range of experimental techniques were described that are currently used to measure the initial stages of case expansion. The complexity of these techniques varied from optical methods to fast x-ray systems. It was noted that less techniques existed for determining pressurisation of the test item.

A number of gaps associated with data capture were highlighted, including measuring internal and external pressure, pressurisation response and collection, tracking and assessment of fragments.

Relating reaction violence back to system parameters was still seen as a step too far. No quantifiable metrics exist providing a confidence level in measuring reaction violence.

Chemistry & Material Parameters

Physical, chemical and mechanical properties required to model and understand cook off were defined. It was highlighted that macroscopic information, e.g. particle size, morphology, was also required to aid the modellers.

Material properties were well understood across mild temperatures but less so as temperatures approached cook off ignition temperatures. Information and experimental techniques exist to determine the effect of pressure on a material parameter, yet little information is actually available.

It was highlighted that gaps in knowledge exist for both ingredients and formulations at elevated temperature, pressure and specifically in damaged materials. Critical to modellers are reaction pathways and parameters which have only been derived for 2 – 3 materials. Ab initio experiments exist to fill this gap but are resource intensive.

The reporting of experimental errors and boundary conditions were highlighted as an immediate solution to improving fidelity to models.

Modelling

The modelling focus area discussed the currently available tools and their abilities and shortcomings. A typical point of discussion was the availability of tools, and the fidelity to which they are capable of resolving or predicting behaviour. It was highlighted that modelling is not one process, but an agglomeration of processes that can capture the many length and time-scale variant systems that are represented in typical cook off simulations.

One clear statement of the participants was that slow and fast cook off should not be viewed as separate processes requiring separate simulation tools or models – a well-posed model and/or simulation tool should be able to capture thermal behaviour, no matter the timescale, given the appropriate insight into material thermal damage evolution. This however was another of the critical gaps identified by the participants, as the thermal properties of materials at ambient and elevated temperatures, as well as the thermal damage evolution that occurs as materials transit through large temperature changes, are not characterized. This was also identified as a shortcoming in the experimental domain, as this type of information is just not available.

Pre-ignition simulations only use thermal behaviour, chemistry, and implicit mechanical information of pristine materials (which are assumed to be relevant throughout the heating process) and a gap exists in simulating mass transport. Ignition & post-ignition can be modelled through pressure and temperature measurements. Commercial codes lack a burn component and several models were identified to improve this area.

Chemistry & Materials Process

A review of previous presentations and focus area outputs led to an agreement on the tests that need to be performed to capture information for the modeller and fit within the hierarchy structure. It was identified whether a test could provide information at ambient, increased temperature, increased pressure and on damaged material. Many laboratories present had the capability and equipment to gather the physical and chemical properties of their energetic and non-energetic materials.

The gaps in testing echoed the need for a thermally damaged material test as a function of burning rate. It was acknowledged that high temperature performance tests, e.g. wedge test, were extremely difficult due to the effect of temperature on multiple parameters.

It was discussed that material properties are not gathered routinely despite the need for the information by the modelling community. The information should be gathered at the research level and could form part of an energetic materials requirement alongside hazard and performance information.

Scaled Testing

A number of new tests were described to account for differences in material and/or mechanism. It was concluded that there is not one small scale test that fits all, yet all scaled tests have similarities in design.

It was highlighted that heating conditions, convective air flow versus conductive heating, can influence the ignition location; characterisation and modelling of test set up is recommended.

Interpretation of reaction is currently limited to fragmentation of the vehicle and temperature of reaction. Yet a number of diagnostics are available to improve understanding, modelling and prediction.

Hierarchy

An agreement was reached on a hierarchical approach to develop understanding and assess munition response. The levels of testing were defined along with the information required from material properties, scaled testing and all up round results. It was highlighted that

modelling needed to be coupled to all levels to allow correlation of behaviour and response between levels. Other points raised on modelling included:

- Recognition that currently, there is no validated model to predict reaction violence (which is not well defined).
- Agreement that modelling should be used to develop testing capabilities

Also recognised during the discussion, was that requirements with respect to confidence of assessment are not expressed in a meaningful way.

It was agreed that a case study was required to exercise the linkages between each level in the hierarchy. There was support for munition test information to be made available and a working group created to exercise the hierarchical approach.

Overall conclusions

Overall it was felt that the workshop was successful in bringing together the current SMEs on cook off and allowing discussions to take place. The output of each group will be recorded in further detail within several MSIAC reports.

Agreement was reached on current tests, models and parameters needed to assess cook off across the scales and that a number of new tests are available to elucidate mechanisms. Several areas were identified where further experimental information was required to aid modelling and simulation.

Damage, and its evolution, are key to understanding reaction. Violence of reaction still requires a better description.

The effect of heating rate on the response of energetic materials was shown to be driven by a number of factors including time, concentration of decomposition gases, evolution of ullage and physical and chemical changes to materials. At a system level there is complex interplay between dP/dt, P_{max} and venting.

It was also concluded that work on the topic should continue through virtual space on the MSIAC ShareFile service. Reviews of the workshop reports by participants will take place during the summer. A full report on the workshop findings will be provided later in the year.

It leaves us to say that the success of a workshop can be measured by the degree of participation by its attendees. The attendees at the Science of Cook Off workshop were fully engaged and stayed on topic for the full five days to which we thank you all.

Dr Matthew Andrews, Dr Michael Sharp (PM), Emmanuel Schultz, Wade Babcock and the MSIAC team

PS. MSIAC produced a limited edition mug for the workshop which turned in to a very limited edition due an issue with delivery to the conference centre. These mugs have now arrived back in Brussels and we will do our best to get them to the attendees.

Figure 2 Rare Workshop Mug

PM's Perspective

At our recent Science of Cook Off workshop, I took a few minutes to reflect on the year to date.

First, the aforementioned workshop brought together 73 specialists from 10 MSIAC nations for four-and-a-half days of focused discussion, discovery, and problem solving. Workshops are a major undertaking with significant effort required to prepare, conduct and write up the result document. Four MSIAC limited reports (available to MSIAC member nations) were produced to collate information in advance of the workshop and facilitate discussion, references provided later. Our staff is now preparing the quick-look report of the major findings and observations from this event, which will be followed up by a more comprehensive report later in the year. My thanks go out to those in the IM community that gave their valuable time to come to Atlanta and contribute to this effort. I feel that together we accomplished much with respect to the workshop goals. I'd also like to extend a big thank you to Dr. Matt Andrews for taking on the organization of this workshop and to my team for the hard work in supporting this undertaking.

As you know, Brussels was the target of a terrorist attack a few months ago. Both bombings were a relatively short distance away from NATO HQ, at sites familiar to those who travel to Brussels to attend NATO meetings. Our thoughts go to the families of those who lost loved ones at Zaventem airport and Maalbeek metro station. Thankfully none of the MSIAC staff or family members were caught up in these atrocities. Those who have travelled to Brussels since will likely have experienced delays in passing through Zaventem airport. We can now report that some semblance of normalcy has returned to the airport over the last weeks, and delays in passing through the airport should be minimal.

Lastly, 2016 represents the 25th year of the NIMIC/ MSIAC memorandum of understanding and establishment of the project office. The current staff here at MSIAC are reflecting on the efforts of those that have come before us and how we can continue to extend and grow the efforts of our predecessors. They have left us a strong foundation of products and services that we continue to build upon, and we are looking forward to continuing the legacy.

For 25 years the dedicated practitioners in the IM and munitions safety community have had a colleague in MSIAC to assist with their efforts to improve munition safety and protect our uniformed service members. Membership has given nations access to shared skills and knowledge which is increasingly important at a time when many nations have seen their safety communities shrink. For 25 years the staff of MSIAC has found new and innovative ways to enable sharing and exchange of information among member nations to improve munitions safety and IM performance.

During this period:

- MSIAC has answered some 2600 questions over the 25 years. A review of the information that could be provided in the 1990s compared to now provides some insight into the significant progress that has been made.
- Some 200 MSIAC Limited reports and about 170 Open publications have been produced.

- MSIAC has developed 15 software tools and databases. Some of these initially started as paper documents and have now been converted to web applications. In 2016, we will add two new tools: Mitigation Technologies for Munitions (MTM), and MSIAC Accident Database Exchange (MADx)
- The MSIAC technical specialists have supported numerous conferences, country visits, technical meetings, and have facilitated over 20 workshops.
- The knowledgebase has expanded to contain some 137,000 Docs (3.3 M pages) accessible by MSIAC staff on your behalf

The efforts of the munitions safety community are ultimately directed towards keeping the warfighter and those handling explosives and munitions safe. For MSIAC member nations this equates to almost five million uniformed service members throughout our 13 member nations. That is no small challenge, and unfortunately accidents and incidents still occur which serve to remind us why we, and you, take this responsibility seriously.

As NATO prepares to leave the current HQ which has been its home for almost 50 years, MSIAC is similarly preparing to begin its next 25 years in its new HQ building.

The NATO star was moved to the new NATO HQ across the road from the current site https://youtu.be/fQeQrT1FrxQ .

MSIAC will move to the new HQ building early in 2017.

Finally, I have an **Early Job Announcement**. We are looking for a Propulsion Technology Technical Specialist Officer to join the MSIAC team. Unfortunately, Emmanuel Schultz will be leaving us in July 2017 and we are looking to recruit a replacement.

At the moment, I can tell you that we are looking for someone with a background in design and safety of gun and/or rocket propulsion; who is knowledgeable in safety testing and evaluation of propulsion units and their ignition systems. Further, knowledge of munitions response mechanisms (to accidental and combat threats) and familiarity with gun and rocket propellant formulations is required.

You will have to wait to read the full job description, once approved by our Steering Committee, to determine whether this may be an opportunity for you. Expect an announcement in the near future, July/August 2016, with details of the application process.

More information will eventually be posted on our website and the NATO recruitment page http://www.nato.int/cps/en/natolive/recruit-wide.htm.

Dr Michael Sharp
MSIAC Project Manager

Catalogue of Environmental Testing Facilities

MSIAC has just published a catalogue of environmental testing facilities (L-196).

During their life cycle, munitions are subjected to a large range of environmental conditions (Figure 1), including natural environment, induced environment, unplanned stimuli and handling.

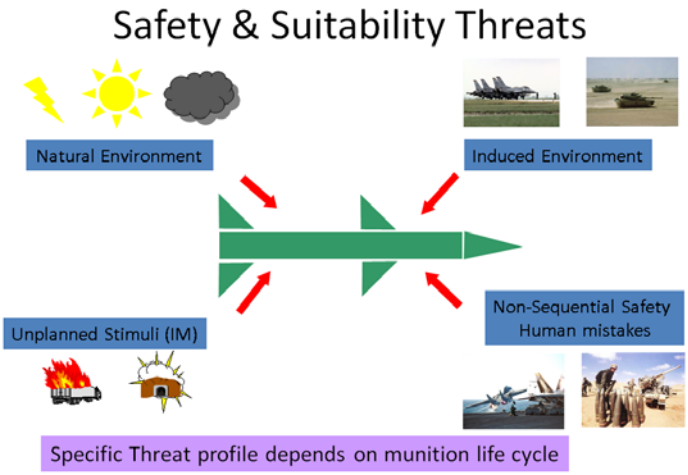


Figure 1: potential environmental conditions

This catalogue describes the test facilities that perform the climatic and mechanical environments as defined in the AECTP 300, AECTP 400 and STANAG 4157 (Fuze). MSIAC has already published a catalogue of IM test facilities (L-106). Only the electromagnetic tests (as defined in AECTP 500) are not yet covered.

The information has been directly provided by the facilities and is compiled in this catalogue.

In this first edition, 19 test centers from 10 nations (Australia, Belgium, France, Germany, the Netherlands, Norway, Spain, Sweden, the United Kingdom and the United States) are presented.

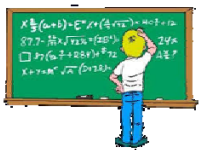
The document is organized by countries. For each facility, a fiche provides the following information:

- Contact information
- General information about the organization/test centre
- Experience and summary of the environmental testing capabilities
- Inspection capability
- Climatic testing facilities
- Mechanical testing facilities

Should you have any feedback, or if you'd like your facility to be included in a future version of the catalogue, please contact MSIAC.

Emmanuel Schultz
MSIAC Propulsion Specialist

Training to NATO Standards



In the first quarter of 2016 two AASTP-1/5 training events took place:

- one at US Army Europe in Wiesbaden, 7-11 March,

- the second in Versailles, 4-8 April.

As before, the training was well received with positive feedback. With the training we establish a useful interaction between policymakers and explosives safety officers applying the standards. The training material is regularly updated to meet the latest standards, while the feedback from students and trainers provides input for further development of the standards.

MSIAC's Mr Martijn van der Voort is the course manager and Mr Thomas Taylor and former Belgian MOD Ammunition Technical Officer, Mr Johan De Roos, are the instructors. The course slide presentations, exercises and instructor notes are also posted on the MSIAC website for downloading by Member Nations.

A third training in 2016 is planned in Rome, 24-28 October.

Martijn van der Voort
MSIAC Safety, Storage & Transport Specialist

Benefits of IM on Static and Operational Storage

Ben Keefe (UK) is a Stokes Fellow at MSIAC since 29th May.

His project is aimed at the benefits of IM on storage.

It is important to identify the potential benefits of Insensitive Munitions (IM) when compared to conventional munitions. These benefits help drive IM development throughout the explosives community allowing us to realise reduced hazard throughout the ownership cycle.

Within a munitions life cycle the two main areas where hazards and risks occur are during logistic phase and on operations. It is therefore important to review the impact of munitions with a reduced vulnerability and consequence in these areas, as these should be significant factors when choosing whether to procure munitions with reduced vulnerability and consequence.

The current area of study is based on regulations and policies based on the storage of IM. A series of documents including AASTP-1, AASTP-5, UN Orange Book, AOP-39 and AASTP-3 have been analyzed to identify how IM is defined, what testing is required, what impact IM has on storage requirements (specifically Quantity Distances), and what new and emerging policies will have an impact on IM.

This preliminary literature study has produced a series of conclusions:

- HD1.6 has extensive test requirements with limited benefits in QDs
- SsD1.2.3 has fewer test requirements than HD1.6 but offers better benefits in QDs
- Small Quantity QDs will have a future impact on both SsD1.2.3 and HD1.6
- Test Series 7 and AOP-39 IM assessment testing showing many similarities but needs harmonization
- Test requirements could be confusing due to differences between regulations and policies

This work will lead into two case studies: the first being a review of the USS Forrestal accident with an estimation on how IM could have reduced or eliminated some or all of the explosive incidents within the accident; the second case study compares QDs of conventional munitions with those of IM to highlight the impact that IM could have on both static and operational storage facilities.

Abstracts for IMEMTS and the OME Symposium have been submitted with the view of presenting the case studies at both.

We are thankful that the Klotz Group Engineering Tool was made available for the analysis of the break-up behavior of storage structures within this project. Further attention will be given to the operational impact of IM.

After this 6 month project, the aim is to present the work at relevant meetings and symposia.

Benjamin Keefe
MSIAC B. Stokes Fellow 2016

Welcome to Dr Ernie Baker

Ernie (USA) joined MSIAC on 1 June 2016 as the TSO for Warheads Technology.

Ernie retired from the US Army Armament Research, Development and Engineering Center in May 2016 after more than thirty years service. He was the Senior Research Scientist (ST) for Insensitive Munitions and was strongly involved in the US DoD Joint IM Technology Program.

Ernie was also an adjunct professor of Mechanical Engineering at Stevens Institute of Technology. Most notable, are his work and publications on IM technology, detonation products equation of state, aluminized explosives, overdriven detonation, more powerful explosives, nonlinear optimization application to explosive systems, shaped charges and multimode warheads. Ernie has developed IM and warheads technology for a broad range of U.S. Army munitions including missiles and gun fired systems.

Ernie received the MSIAC Munition Safety Award for Career Achievement in May 2015. He also received the U.S. Army Greatest Invention Award, twelve U.S. Army Research and Development Awards, the Zernow Best Paper Award at the 24th International Symposium on Ballistics, the Neill Griffiths Memorial Best Paper Award at the 23rd, 18th and 17th International Symposium on Ballistics, the Bellman Best Paper Award at the Fifth International Mathematical Modeling Conference, the Best Poster Paper Award at the 42nd Annual Denver X-ray Conference and the National Defense Industrial Society Firepower Award. Ernie is a founding member of the International Ballistics Society and is newly elected as a Board member. Dr. Baker is an invited member of the Editorial Board for the Computational Methods and Experimental Measurements journal.

Ernie earned his PhD, MS and BS in Mechanical Engineering from Washington State University.

MSIAC to Host Web-Enabled virtual Meetings & Presentations

Over the next year MSIAC will be testing a number of digital meeting enhancements to increase the availability, frequency, and ease of access to our meetings and reports. Chief among these will be an Internet-enabled virtual meeting capability which will be used to exchange information and provide briefings.

Many of MSIAC's staff and our colleagues throughout the international munitions safety community have participated in, organized, or chaired virtual meetings over the past few years. The technology offers a number of advantages and our community has been eager to embrace these, all the while recognizing shortcomings and security issues. We have been investigating the options available and discussing the security and access concerns with relevant NATO and national representatives. We believe that we have addressed the primary concerns and will begin testing the capability among some groups within our community in the coming months.

The virtual meetings we are pursuing will most often be one of these forms:

- Small groups (5-15 participants) with a shared desktop and highly interactive verbal, text, and video among participants and a moderator. This form is similar to a very interactive in-person meeting or teleconference.
- Large groups (50+) where a host's presentation material, audio, and video is available to participants (so-called one-way communication), and there is potential for participants to submit questions to the chair/moderator via a text-messaging style interface. This form is similar to a formal presentation or lecture, with more limited interaction from the audience due to the size of the group. Most participants are simply listening or attending, as opposed to actively participating.

For example, MSIAC's Science of Cook Off workshop in April brought together more than 70 of the leading technical performers working on munitions cook off in 10 of our member nations. During the final day of the workshop, the participants went over the most obvious technical conclusions, contributions, and gaps, but there were significant additional observations compiled in the two-to-four weeks after the workshop that the participants were not privy to.

While all of this and more will be included in the final report (tentatively to be published at the end of 2016), we have recognized the value in a quick-look summary which could be issued in the next month or two.

To increase the availability and reach of this quick-look report, we are planning to hold a virtual meeting for workshop participants and other invited guests. This Internet-hosted meeting will take the form of the large group meeting described above. Participants may interact by asking questions via a text-messaging-type interface, and the MSIAC presenters can respond either verbally or via text reply.

We are also planning to utilize this same structure to host a handful of invited presentations from leaders throughout the munitions safety and IM communities. We have a number of volunteers already, and are always looking for more! If interested, please contact TSO Wade Babcock (w.babcock@msiac.nato.int) for more information and scheduling.

The virtual meetings described here will not replace our reports, tailored presentations available through MSIAC national visits, or MSIAC invited talks at relevant technical meetings. Our intent is to find new and effective ways to get munitions safety and IM information into the hands of the community.

Wade Babcock
MSIAC Material Technology Specialist

And do not forget...

IMEMTS 2016

Takes place at the **Gaylord Opryland Hotel & Convention Center** in Nashville, TN, USA, on **12 to 15 September 2016**.

The U.S. National Defense Industrial Association (NDIA) and the NATO Munitions Safety Information Analysis Center (MSIAC) are sponsoring a joint industry/ government symposium on Insensitive Munitions (IM) and Energetic Materials (EM).

This year's theme is "Advanced IM / EM Solutions: Minimizing Risk to our Warfighters and Delivering Needed Performance, Security, and Readiness to Address Evolving Threats in our World."

New IM technologies, EM and formulations are being deployed into the field. This symposium will look at the benefits of these new solutions to the warfighter, logistics, cost and safety of operations. The 2016 IM and EM Technology Symposium is the premier international gathering for the exchange of information on advancements in IM and EM and their benefits to the warfighter.

To register and get more information, please visit the site ***http://www.ndia.org/meetings/6550/Pages/default.aspx*** or contact **Loey Bleich** at lbleich@ndia.org or +1.703.247.2588.

NDIA National Defense Industrial Association — MSIAC

There is still time to nominate your candidate for the MSIAC Munition Safety Award 2016!

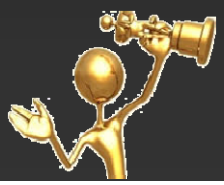
Nomination Deadline is 28 June 2016!

MSIAC is accepting nominations for the 2016 munitions safety awards, arranged in conjunction with the NDIA IM/EM Technology Symposium to be held in September this year. Look within your national technical communities, reach out to your colleagues, and help us recognize the best single and team performers working in the munition safety field today. There are plenty of worthy efforts that could be recognized through this award and this is a great opportunity to showcase their efforts and provide some well-earned recognition.

We are accepting nominations (details at the below web address) through 28 June 2016. Once the nominations are in, we will be providing the recommendations to the MSIAC Steering Committee (national representatives from the 13 MSIAC member nations) for final selection of winners.

Nomination is straightforward and details can be found here: https://www.msiac.nato.int/news/ms-awards

If you have any questions, please contact **Wade Babcock, MSIAC Materials Science TSO**.



Recent Publications

(Available on the MSIAC secure webenvironment https://sw.msiac.nato.int/SecureWeb/ or on request at info@msiac.nato.int)

Open Publications

O-166: ***Barricade Blockage and Angle Distribution***

O-167: ***Analysis of the IM type V Response Descriptor_Plus Annex***

Limited Publications

L-099: ***Revised _ Review of Ignition Mechanisms and Small-Scale Tests related to Cook Off***

L-195: ***State of the Art Overview of Cook Off Simulation***

L-196 ***Catalogue of Environmental Testing Facilities***

L-197: ***Gun Propellant Cook Off Discussion White Paper***

L-198: ***Polymer bonded Explosives (PBX) Cook Off Discussion White Paper***

All **Publications** *on can be found in the Technical Reports section on our Secure Web-environment via this hyperlink .*

You can access the latest on **Industry & Technology** *via this hyperlink .*

You can access all reported **Accidents** *via this hyperlink .*