



# Bulletin

## IN THIS ISSUE



- [PMs Final Perspective](#) 1
- [2019 MS Awards](#) 2
- [Check out ...](#) 3
- [Save the dates for...](#) 3
- [2020 Workshop: Defects](#) 4
- [United Colors of MTM](#) 5
- [MSIAC QD Tool](#) 5
- [Welcome new PM Chuck Denham](#) 6
- [Setback WG](#) 6
- [USA Huntsville Country Visit](#) 6
- [MSIAC Courses](#) 7
- [EM Qualification Technical Meeting](#) 7
- [Armaments 2019](#) 8
- [The French Chronicle](#) 8
- [Summer Students](#) 8
- [R.I.P. Ray Beauregard](#) 9

## PM'S FINAL PERSPECTIVE

Well this is my last opportunity to write the MSIAC PM perspective. It's been 6 years since I took over as project manager and during that time I have very much enjoyed working with the nations to help them achieve their munition safety goals.

During this time, one of the most enjoyable activities that I was involved in was workshops. Although these involve a huge amount of effort on the side of the MSIAC staff, they are very rewarding and we all learn from them. The next workshop on Defects promises to be another excellent opportunity for the nations to come together, work collaboratively, and to share knowledge and information, as well as ideas. I may get the opportunity in my new role to attend, but if not will eagerly await the reports.

I have had the privilege of working with some exceptional people whilst at MSIAC, both on the team and in the member nations; individuals who are committed to progressing munition safety for the benefit of the war fighter and those handling and using munitions. Although I am leaving MSIAC in December, I certainly intend to keep in touch with the community in my new role. Indeed, I will likely become a demanding customer (subject to access being granted by my NFPO!).

I wish the team and my replacement, Chuck Denham, all the best for the future. Finally, thank you very much to the Steering Committee for their continued support of MSIAC and the trust that they placed in me as project manager. It's been a great experience and one I will fondly remember.

**Dr Michael Sharp**  
Project Manager



Issue 3 - 2019

### CONTACT INFORMATION

☎ 32-2-707.54.16

🌐 <http://www.msiac.nato.int>  
✉ [info@msiac.nato.int](mailto:info@msiac.nato.int)



# 2019 MUNITION SAFETY AWARDS

One of my last duties as project manager was to present the 2019 awards for Munition Safety, which were awarded this week. The awards are an opportunity to recognise excellence in Munitions Safety (MS) with MSIAC Awards for Technical and Career Achievements being given. The winners are chosen by the MSIAC Steering Committee on the basis of proposals made by MSIAC staff and by Steering Committee members, NFPOs, or any other interested parties. MSIAC has been presenting awards at NDIA IM/EM Technology Symposia since 1997 and a long list of deserving individuals and teams can be seen on the MSIAC website here.

*A reminder on the two award types:*

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

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

This year I had the honour to present three Career Achievement Awards and a Technical Achievement Award.

**The Career Achievement Award:** Michael Swisdak, Dr. Jerry Ward, and Edward Daugherty

It was a privilege to be able to present the Career Achievement Award to these three individuals in recognition of their major contributions to the Explosive Safety and IM community.

⊕ **Michael Swisdak** is now a Senior Scientist in the Explosives Safety and Testing Division at APT Research after having retired from Indian Head Division (NSWC) after 45 years of service. During this time, he was a key contributor to explosives storage safety though improved understanding of explosive effects. He was instrumental in



developing tools such as the blast effects computer and helped author well known DDESB technical papers (TP 16 - primary fragment characteristics, TP 17 - blast effects calculator, and TP21 - debris collection procedures in explosives tests). In addition, he was author or co-author of over 150 technical publications in the field of airblast and related phenomenology as it relates to explosives safety and the effects on explosive-safety quantity-distance.

⊕

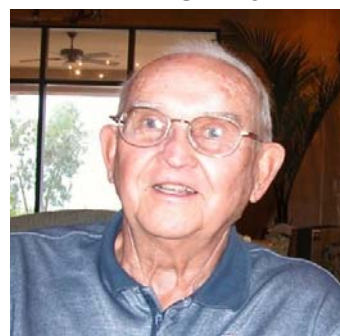
**Dr. Jerry Ward** was responsible for many US munition safety initiatives through his work and leadership at DDESB. He served as the US representative to NATO subgroups AC 310 and 258 both in Hazard Classification and



IM. He was also the lead for efforts harmonizing UN HC article tests with IM article tests, and harmonizing UN HC substance tests with qualification tests, which is still an on-going priority at this time. He was a keen contributor to many international MS efforts, authoring and co-authoring many technical and policy papers. As a strong supporter of MSIAC activities and workshops, he contributed to outcomes as a participant and session chair. He retired from the DDESB in 2011 and for the past eight years he supported the Navy IM program as a contractor at Booz Allen Hamilton. I have had the privilege on occasion to work with Jerry and continue to value his background knowledge and ability to recount the history and reasoning of decisions particularly related to Hazard Classification and IM testing (which is very gratefully appreciated).

⊕

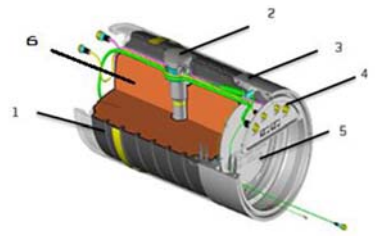
**Edward Daugherty** was a NAVAIR member of the Navy Weapon System Explosives Safety Review Board (WSESRB) during its formation, and played a key role in the development of policy, procedures and organization of the WSESRB. He assisted with the



implementation of recommendations that came from the USS FORRESTAL Board of Inquiry, also known as the Russell Report. Having had the opportunity to discuss this with him recently, he recalled some of the issues demonstrating a continuing passion to ensure that the right decisions were taken to ensure that such catastrophic accidents are avoided in the future. In the years following the Russell Report, he helped conceive the Navy Insensitive Munitions Program and played a key role in coordinating US Navy expertise to develop safer energetic materials (PBXW formulations) and to introduce other technologies to reduce weapon vulnerability. Perhaps not so well known by the community today, he was nominated by those who recognized that he had played a fundamental role in leading and steering the development of some key technologies, working behind the scenes but not seeking or wanting recognition for his efforts. This award provides overdue recognition of his efforts which form the basis of our IM activities.



⊕ **Technical Achievement - F21 IM Heavyweight Torpedo Warhead Development (Team)**



The award for technical achievement in 2019 is awarded for the F21 IM Heavyweight Torpedo Warhead Development (Team) in recognition of a system which delivers on performance whilst delivering benefits in reduced vulnerability. This large heavyweight torpedo warhead features IM and safety characteristics that allow it to fully comply with the highly demanding safety requirements demanded for systems to be used in French nuclear-powered submarines. To achieve this, the warhead uses a number of technologies including: B2211D (AP/Al/I-RDX®) insensitive high explosive, an internal rubber liner providing thermal protection, and a thermal fuse (PETN-based venting device). These led to very good results in the IM tests, which were presented at the last IMEMTS meeting in Portland:

STANAG 4439		FH	SH	BI	SR	FI-L	FI-H	SCJI
Requirements								
IM Signature	NR							
	V	●		○		○		
	IV		●					●
	III				○		○	
	II							
	I							

Members of the French team which contributed to this effort include:

**Damien Courrillaud (NAVAL GROUP), Rodolphe Fougeyrollas (NAVAL GROUP), Bruno Nouguez (EURENCO), Luc Chaffois (EURENCO), Vincent Coison (EURENCO) and Philippe Chabin (EURENCO)**

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

**Dr Michael Sharp**  
Project Manager

*Do you want to know what's going on in AC/326 and its SUB-GROUPS? Check it out [here!](#)*

*Check out the series of ACCIDENT POSTERS on some of the most significant munitions or explosives accidents in history on our [website!](#)*

*Check out the updated reported ACCIDENTS via this [hyperlink](#).*

*You can find all Technical PUBLICATIONS via this [hyperlink](#).*

**Save-the-Date**  
May 18 – 21, 2020

Lansdowne Resort  
Leesburg, Virginia  
USA

An international forum to discuss technical-scientific aspects of nitrocellulose production, safety, performance, and characterization.



**International Explosives Conference 2020**  
30 June-2 July 2020  
Victory Services Club, Marble Arch, London, UK

An international conference on the fundamental science of explosives and other energetic materials for the research community

For more information visit:  
[iec-2020.com](http://iec-2020.com)

*"Future Developments in Explosives and other Energetics"*





## 2020 Workshop: Defects - Causes, Characterisation and Criticality

We are pleased to announce the date and location of our 2020 workshop “Defects – Causes, Classification and Criticality”, which will be held from the 15<sup>th</sup> to the 19<sup>th</sup> June 2020 at the Crowne Plaza Den Haag Promenade Hotel in The Hague, The Netherlands.

A page has been launched on the MSIAC website with further details: <https://msiac.nato.int/defects>.

Those interested in attending can register interest, and we have also opened the call for abstracts related to the goals and focus areas of the workshops, which aims to understand:

- ⊕ The types of structural defects and property changes which might occur in different types of munition systems (e.g. based on energetic material, role, service environment, age etc.) and the processes which leads to their creation and growth
- ⊕ Techniques for the detection and characterisation of structural defects and property changes, including their limitations
- ⊕ The impact of structural defects and property changes on Safety and Suitability for Service (S3) for different munition systems, energetic materials, roles and service environments
- ⊕ The information that is required to support the decision making process, including tools that can be used to develop risk based arguments and the risk controls that can be implemented at various points in the Capability Life Cycle (CLC).

A more detailed discussion of the workshop goals, structure and background work can be found in [MSIAC Open Report O-214](#).

Matt Ferran  
TSO Munition Systems



# UNITED COLORS OF MTM

Thanks to the fantastic job done by Aurihona Wolff, our brilliant MSIAC trainee from ENSTA Bretagne in France, some great improvements were realized during this summer in the MSIAC online database on Mitigation Techniques for Munitions (MTM). As a reminder, MTM is a searchable database containing the state of the art of mitigation technologies with regards to less sensitive storage configurations and Insensitive Munitions (IM) design methods. It is intended to support munitions designers, IM boards, program managers and the military by offering a source of potential options or solutions to satisfy today's munitions IM Requirements.

Recently, this database was populated with many new examples and references. To be more precise, 112 new examples of mitigation techniques were added to the previous 277 ones, which comes to a total of 389 examples. Related to these new examples, 224 new references have also been added in MTM. The new examples mostly concern mitigation techniques applicable to rocket motors, small caliber munitions and flares. The MTM database is now covering an extended range of munition types.



In addition to the new examples and references, a colorization of the columns was done, in order to better identify to which component the mitigation technique is applied, for which threat, when and where the technique is applied, and to which category the mitigation technique belongs. For a better understanding of the color code, a new page named "Definitions" was created, which explains everything. Rather than spoiling you, we strongly encourage you to go have a look at it!

**Christelle Collet**  
TSO Propulsion Technology

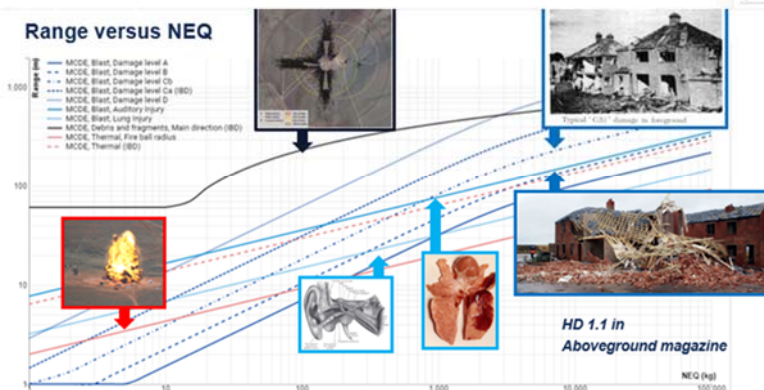
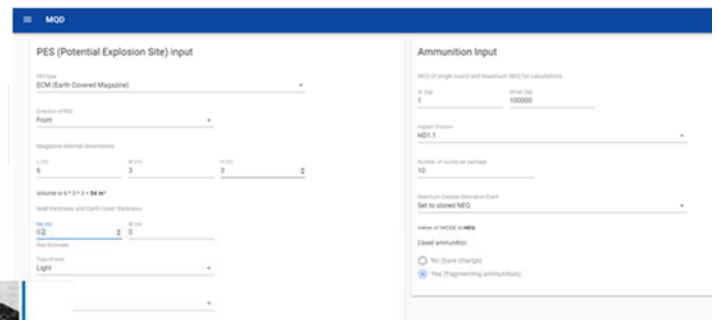
## MSIAC QUANTITY DISTANCE (MQD) TOOL

After the summer an important report was published about the "Experimental and theoretical basis of NATO standards for safe storage of munitions and explosives – final report" (L-229). This 155 page report is an extension of an earlier paper from 2016 with a much more detailed background and analysis.

Related to that report we made available the MSIAC QD (MQD) tool v2, and asked users for their feedback. The objective of the MQD tool is to perform an experimentally validated consequence analysis of the initiation of various types and quantities of munitions in various types of magazines, and with possible mitigation measures in place. The results of the MQD tool can be compared with QD regulations for all Hazard Divisions (HD) over the full range of NEQ. This will give insight into which consequences are to be expected at the QDs. Also it supports further development of QDs, making use of up to date experimental results. The MQD tool does not deal with mixed storage; it performs calculations for one HD at a time. A software specification document will be issued towards the end of 2019.

It should be noted that the MQD tool has a different objective than a number of existing QD tools (Explosive storage capacity calculator, (N)ASAP-X, ESS) which are aimed to reproduce QDs provided in guidelines. Future updates to MQD beyond the current version are planned with:

- ✦ Addition of links to references and pictures to indicate the expected damage
- ✦ Addition of engineering models for some of the physical effects
- ✦ Addition of QD from AASTP-1 and other documents to compare results



An impression of the MQD tool is given in the screenshots below. Both the report L-229 and MQD tool are in line with the new AASTP-1 EdC V1 which is expected end of 2020.

**Martijn van der Voort**  
TSO Safety of Transport and Storage



# WELCOME CHUCK DENHAM !



Mr. Charles Denham joins MSIAC on the 4<sup>th</sup> of November 2019 as the Project Manager. He holds a degree in Physics and a Master's Degree in Information Systems. Prior to joining MSIAC, he served 9 years as the Director of Weapons Assessment at the Naval Ordnance Safety and Security Activity (NOSSA) in Indian Head, Maryland. As the Director, he was responsible for oversight and policy and program management functions for the Department of the Navy (DON) Explosive Safety Programs [i.e., Hazards of Electromagnetic Radiation to Ordnance (HERO), lithium battery, Electrostatic Discharge (ESD), Lightning Protection Systems (LPS), Hazard Classification/Insensitive Munitions, and Arms, Ammunition & Explosives Transportation Safety and Physical Security].

From 1999 to 2010, Mr. Denham worked at the Naval Surface Warfare Center, Dahlgren Division (NSWCDD) Dahlgren, Virginia as the NSWCDD RADHAZ Program Manager and as a HERO Test engineer. Additionally, he served as a Branch Head and Acting Division Head responsible for managing and coordinating the NSWCDD E3 test facilities (2 Reverberation Chambers, 2 Anechoic Chambers, 2 open-air Ground Planes, a DC Magnetics Facility, and HERO instrumentation and MIL-STD-461 labs) that principally supported the Navy's E3 Test and Evaluation (T&E) efforts to support ordnance and weapon systems safety.

Mr. Denham has 18 years of program management experience directly related to Explosive Safety programs to include Safety and Suitability for Service testing, risk assessments and operational guidance and policy development for munitions and weapon systems.

## GUN LAUNCH SETBACK IGNITION STUDY WG

The 4<sup>th</sup> Gun Launch Setback Ignition Study Working Group (WG) was held 17 September 2019 at the WTD 91, Bundeswehr, Meppen, Germany. The Gun Launch Setback Ignition Study Working Group was initiated by the NATO AC/326 SG/A – Energetic Materials and is being led by the USA, with Sean Swaszek from US Army ARDEC overseeing the process.

The goal of the working group is to develop a new Allied Ordnance Publication for standardizing the approach to testing and evaluating the safety of energetic materials and munitions to setback loading. The meeting was attended by 14 subject matter experts (SMEs) representing USA, Norway, and United Kingdom. Dr. Ernie Baker from MSIAC has been providing technical support to the group.

Technical presentations were also provided by USA and German representatives. E. Caravaca (USA) provided an overview of propulsion effects on projectile acceleration. He discussed negative differential pressure (NDP) and its effects during projectile launch. Guns can fail, sometimes catastrophically, when NDPs are observed. N. Heider (GER) provided a presentation on

computational development for the safety assessment of PBX filled ammunition. The group has begun development of an assessment protocols NATO STANREC for: acceptability of explosive for gun launch; acceptable defect types, sizes, distributions; and acceptable defect identification methods.

MSIAC has an associated work element in developing a lexicon of terms for munitions defects, including gun launched projectiles. There is an associated planned workshop, Defects – Causes, Classification and Criticality, to be held in the late spring of 2020. Dr. Baker has recently researched the intentional explosive filling of munitions with the intent to not have the explosive adhere to the projectile body. An associated paper is to be presented at the 2019 Insensitive Munitions and Energetic Materials Symposium, along with WG presentation by S. Swaszek.

The 5<sup>th</sup> WG meeting is planned in Brussels, Belgium during the week of 14 April 2020. NATO country SMEs participation is encouraged, particularly with expertise in gun launch munition dynamics (acceleration and acceleration perturbations).



Dr Ernie Baker  
TSO Warheads Technology

## USA HUNTSVILLE COUNTRY VISIT

MSIAC conducted a USA country visit to Huntsville, AL during the week of 9 July 2019. The visit included the Federal Bureau of Investigation (FBI) Terrorist Explosive Device Analytic Center (TEDAC), APT Research Inc., Dynetics, Practical Energetics Research (PER) and the U.S. Army Combat Capabilities & Development Command (CCDC) Aviation & Missile Center (AVMC). The MSIAC delegation consisted of Dr. Ernie Baker and Christelle Collet.

On 9 July, Dr. Kenneth Lee hosted the delegation for a visit to the FBI TEDAC. On 10 July, Jerry Rufe hosted the delegation for a visit to APT Research Inc. On the morning of 11 July, James Miller hosted the delegation for a visit to Dynetics. That afternoon, Scott Hill hosted the delegation for a visit to PER. On 12 July, Dr. Jamie Neidert hosted the delegation for a visit to the CCDC AVMC. Attendance was good at all sites, with the attendees representing the key areas of the laboratories that would have interest in MSIAC's products, services, and programs.

FBI TEDAC, APT Research Inc., Dynetics, PER and CCDC AVMC provided overview presentations with highlights of topic areas applicable to MSIAC. MSIAC provided informational briefings including an overview of MSIAC activities, MSIAC tools, and several more technical presentations targeted for the various organizations interests. The MSIAC delegation were provided a tour of the FBI TEDAC Improvised Explosives Detection & Synthesis (TIEDS) Center facilities including energetics laboratories and testing capabilities. The



MSIAC delegation were provided a tour of the CCDC AVMC facilities including formulation, chemical analysis and mechanical testing laboratories, as well as an outdoor explosive testing range.



**Dr Ernie Baker**  
TSO Warheads Technology

## MSIAC COURSES

Since the previous newsletter we conducted an AASTP-1 and AASTP-5 lecture series in Quantico (VA) in the USA (23-27 September). We would like to thank Crane Dauksys for the great organization. The event hosted a delegation from Canada and the Netherlands.

Johnny de Roos and Eric Deschambault worked together with a new instructor; Helen Stewart. She's been the Canadian representative of AC/326 SGC for many years and recently retired from DAER. We are glad we can welcome her on the team.

Remaining for 2019 are two courses in the southern hemisphere; in Australia the week after the Parari symposium, followed by New Zealand.



Looking to the future, we have established the course program for 2020. We will provide five **AASTP-1 and AASTP-5 lecture series**, and two **Explosives Safety Munition Risk Management (ESMRM) Train the Trainer (T3) courses**. This last course has been newly developed; more information can be found in previous newsletters. The upcoming events are summarized in the following table. All courses are fully booked already but we can place you on a reserve list.

### Remaining AASTP-1 and 5 lecture series in 2019

Organizing Country	Location	Date
AUS	Canberra	11-15 November
NZ	Wellington	18-22 November
US	Ramstein (DEU)	2-6 December

### AASTP-1 and 5 lecture series in 2020

Organizing Country	Location	Date
FRA	Versailles	23-27 March
BEL	Brussels	4-8 May
DEU	Erfurt	11-15 May
USA	Albuquerque	22-26 June
POL	Wroclaw	November (TBD)

### ESMRM T3 courses in 2020

Organizing Country	Location	Date
BEL	Brussels	4-7 February
UK	TBD	Q3/Q4 (TBD)

**Martijn van der Voort**  
TSO Safety of Transport and Storage

## EM QUALIFICATION - TECHNICAL MEETING

MSIAC organised a Technical Meeting on Energetic Material Qualification (EMQ). The meeting was held in DGA Land Systems, in Bourges, France, during two half days and one full day on the 18th - 20th of June, 2019. In addition to the MSIAC organizers, Dr Matt Andrews and Christelle Collet, sixteen persons, from government, attended the meeting, from 7 nations (Germany, France, UK, Netherland, Norway, Poland and USA).

The objectives of the meeting included

- ⊕ understanding nations qualification processes, their concerns and issues;
- ⊕ sharing of energetic material qualification data;
- ⊕ generating confidence in qualification data, and
- ⊕ promoting the importance of energetic material qualification.

Prior to the meeting we requested the completion of a survey focusing on nations concerns with EMQ. This survey covered topics such as EMQ processes, qualification issues, uses of EMQ data, certification and NATO.

An introduction to the meeting was provided by France, and subsequent national presentations provided by France and Germany. These provided insight into their qualification processes and, in the case of France, recent changes to national instructions for qualification. MSIAC then used the results of the national surveys to help guide discussions to achieve the objectives of the meeting.

The first objective was met with regards to understanding how nations undertake qualification. Subtle differences between national approaches highlighted why the sharing of technical data between NATO government organisations was not straight forward. Contractual requirements between multiple organisations can reduce or stop the exchange of information critical for the nations to provide assurance on energetic materials for a specified role. A number of routes were suggested that could help to improve confidence in qualification data received from manufacturers and other nations.



Information that was found to be specific to AOP-7, the manual of data requirements and tests for the qualification of explosive materials for military use, was consolidated and passed directly to AC/326 S/G A EMT whose program of work includes the update of this manual.

Overall the meeting was successful and provided the attendees with personal rapport between their national counter-parts. A summary of the meeting will be found within limited report (L-251); available by the end of the year.

It leaves us to thank the DGA for their excellent hosting and support of the meeting, without which the meeting would not have been quite so successful.



**Dr Matthew Andrews & Christelle Collet**  
TSO Energetic Materials and TSO Propulsion Technology

## THE FRENCH CHRONICLE

As already mentioned in previous French Chronicles, we have daily discussions in the office about the differences in language, culture, etc. We can spend a whole lunchtime discussing the subtleties of how we deal with various expressions... The purpose of this current chronicle was inspired from a Monday morning misunderstanding between Dr Matt Andrews, my respected office mate, and me. I was telling him a story that happened during the weekend, about a compromise that was found between my daughter and her friend: she would go to her friend's but the next time, the friend would come to our place. This is a compromise, a win-win, "donnant – donnant" in French: we give, they give back. And Matt had this word to qualify the situation: a quid pro quo. He saw I was doing a face, I explained him why. Of course, we do have the word "quiproquo" in French, which means that you take someone/something for someone/something else. Basically, this is a misunderstanding, and not a compromise at all, so what would this have to do with the conversation we just had?? But after searches on the internet, it turns out that although the words "quid pro quo" and "quiproquo" sound very similar, they do not mean at all the same thing in English and in French:

English definition for "**quid pro quo**": a favor or advantage granted in return for something. Synonyms: exchange, trade, trade-off, swap, switch,...

French (translated) definition for "**quiproquo**": Mistake which consists of taking one person, one thing for another; misunderstanding that results. Synonyms: stupidity, mistake, blunder,...

The good lesson learnt from this discussion was that Matt and I were misunderstanding each other on a word definition, so it was a quiproquo but as both of us learnt from each other definition of the words, it can be considered as a quid pro quo in the end!

**Christelle Collet**  
TSO Propulsion Technology

## XXII INTERNATIONAL SCIENTIFIC AND TECHNOLOGICAL CONFERENCE ARMAMENTS 2019

The XXII International Scientific and Technological Conference ARMAMENT 2019 on "The Issues of Development, Production and Maintenance of Weapon Systems" was held in Jachranka, Poland on 10-13 June, 2019 at the Hotel Warszawianka in Jachranka, Poland. The conference was organized by Military Institute of Armament Technology (Zielonka, Poland) and the Institute of Armament Technology in Military University of Technology (Warsaw, Poland). This conference brought together scientists, engineers and professionals of different fields for sharing and discussing current research and advances in the development, production and maintenance of weapon systems. A Keynote Address was presented by Dr. Baker from MSIAC: "Recent International High Explosives Achievements". A special MSIAC session was organized for attendance by Polish participants. Poland became a member of MSIAC in 2018.



**Dr Ernie Baker**  
TSO Warheads Technology

## 2019 SUMMER STUDENTS

This summer, we were lucky to have four excellent trainees at MSIAC. All of them are students at the French Engineer School ENSTA Bretagne in Brest, France, and we enjoyed their presence in the team from beginning of June until end of August 2019:

- ⊕ **Rodrigue Barlerin** worked on "Defect Detection and Characterization Capability Study for Energetic Materials". This review of existing techniques is part of the preparation for the MSIAC workshop on Defects – Causes, Classification and Criticality which will be held in The Hague in June next year.
- ⊕ **Lucas Caylar** worked on "Instrumentation Techniques". Lucas completed a review on blast Measurement and on velocity of detonation. The best practice and recommendations he has found will hopefully help the MSIAC community to improve their measurements in IM and HC tests.
- ⊕ **Florian Djedis** worked on "Collation and Analysis of IM Test Results". Florian has built a tool able to determine a TNT equivalent from the blast measurements recorded for any reaction type, even for a sub-detonative event.





We are really grateful of the hard work they have done at MSIAC. The output from their respective work will be contained in limited reports to be released in the near future.

Oh wait, there are only three names in the list above... This is because there is a missing name: **Aurihona Wolff**. She has spent 11 months with us at MSIAC (from October 2018 until end of August 2019) and covered many topics: common manufacturing processes for energetic materials, Resonant Acoustic Mixing (RAM), Additive Manufacturing (AM), defects lexicon and mitigation technologies for small caliber munitions and flares. Her fabulous work at MSIAC is already available to the MSIAC community in the following reports: L-244 (*ResonantAcoustic® Mixing: Processing and Safety*), L-246 (*Resonant Acoustic Mixing Performance and Optimization for Energetic Materials*), L-247 (*Additive Manufacturing for Energetic Materials*) and O-204 (*Additive Manufacturing Processes Applied to Energetic Materials*). But more are to be released: coming soon...

In addition to their hard work at MSIAC during working hours, these trainees also brought many “out of work” opportunities, which were very much appreciated by everyone. We wish them all the best for the continuation of their studies at ENSTA Bretagne, and also for their future employment, hopefully in the munitions safety domain!



**Christelle Collet**  
TSO Propulsion Technology



## RAYMOND L. BEAUREGARD

We have some sad news: Ray Beauregard died on the 22<sup>nd</sup> of September 2019. Ray was a well-known member of the IM and energetic materials community and played a key role in helping progress US Navy IM efforts. He helped to bring the IM message to the wider international community and contributed towards the establishment of the NATO Insensitive Munitions Information Centre (NIMIC).

Ray initially served with the US Army as a tank commander. Following this he studied chemistry and then joined the Naval Ordnance Laboratory, White Oak, MD (NOL) in 1956 as a fuel and propellant chemist. He conducted research on chemical synthesis, explosive formulation, sensitivity of explosive materials, ignition of solid propellant rocket motors, and underwater rocket propulsion. In 1966, he accepted a position in the Bureau of Naval Weapons at Navy Headquarters working on the Navy's Explosives Research program. His roles included the Navy member of the Joint Logistics Commander's Working Party for Explosives (chairman for three years), and the Navy principal member of the Joint Conventional Ammunition Program, Propellants, Explosives, and Pyrotechnics Group. He also drafted and staffed the Navy Insensitive Munitions policy and technical requirements documents issued by OPNAV and NAVSEA, respectively, and coordinated the establishment of the IM Advanced Development program, which he subsequently directed.

Ray was well known for his participation and contribution to NATO ammunition safety activities. He was the principal U.S. Delegate to the NATO AC/310 (now AC/326) Sub Group A (Energetic Materials). He took the lead in drafting STANAG 4170 -- the NATO Qualification of Explosives standard and AOP-7 (editions 1 and 2).

After retiring from Civil Service in 1985, he continued to work actively in the field as a consultant, primarily to the US Navy. This included continuing to support the US representatives to NATO AC/326 Energetic Materials sub group.

Our sincere condolences to his family at this time. He is survived by his wife of 64 years, Dottie Beauregard, his sons Steve (Lee), Bob, John (Cindy), and Mike (Maura), and his 8 grandchildren.

