

MSIAC and its CONTRIBUTIONS TO MUNITIONS SAFETY

This paper and its accompanying presentation provides an overview and discussion of the NATO Munitions Safety Information Analysis Center (MSIAC); its roles and responsibilities, its foundation and history, its staff and services, and how it helps member Nations and the overall NATO and associated community to enhance munitions safety throughout the life cycle.

Munitions Safety:

Most, if not all, nations and international organizations of nations have long recognized the value and importance to their national, coalition, or collective defense capabilities of munitions safety. By munitions, I generally refer to the various categories of ammunition, ordnance, weapons, arms, and explosives used by national military or defensive organizations. However, in general, the concepts of munitions safety also apply to all devices and/or systems that utilize energetic materials; examples include cartridge or propellant activated devices (CADs/PADs), automatic inflation devices (air bags to flotation vests), pyrotechnic signaling devices, etc.

In very broad terms, munitions safety, which is considered by many to be a national defensive capability enhancer, is the ability to safely acquire, maintain, and utilize stocks of munitions (energetic materials based devices or systems) through out their life cycle. The life cycle of munitions includes the requirement to handle, store, and transport such munitions or devices to where they are required/needed; utilize them in training or actual demand situations; and to, ultimately, dispose of such devices or systems in a manner that is safe and consistent with national and/or agreed international standards.

Munitions safety is a national defensive capability enhancer by its ability to assure that munitions can fulfill their life cycle requirements in a cost effective manner. The cost effectiveness analysis for munitions must include the costs of acquiring the munitions and the costs of ensuring safety vice the costs that could be incurred if a safety failure occurs. Examples of costs associated with safety failures include unnecessary replacement of stocks, platforms (ships, planes, tanks, etc.), or facilities due to accidents/incidents, loss of ability to achieve a defensive or offensive object due to accidents/incidents, loss of lives either from the accidents/incidents or from the failure to achieve objectives, loss of national reputation, and/or loss of national confidence.

In addition, in our ever more interdependent and interrelated world (allies, coalitions, defensive and/or humanitarian task groups, etc), it is clear that collaborating, as a Multi-National partner, in ensuring munitions safety and interoperability is also a national defensive capability enabler. For example, in a coalition environment common munitions safety policies, precepts, and practices can lead to greater interoperability among the coalition members, reduced operational footprints, and reduced costs.

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History:

In the late 1970's the idea of an organization to help NATO Members improve the safety and suitability for service of munitions and explosives was developed. This organization was created in 1979 and officially chartered as the NATO Cadre Group AC/310 to address design principles, criteria, and tests for the assessment of the safety and suitability for service of munitions. In the mid 1980's AC/310 recognized the concept of Insensitive Munitions (IM) that was started by the US Navy and that was gaining currency in several Nations. AC/310 established an Information Exchange Working Group (IEWG) to foster IM information interactions between NATO Members. The IEWG soon recognized that the existing international methods were inadequate to ensure efficient and productive exchange technical data and information concerning a new, developing, growing, and technically complex field such as IM.

AC/310 and its IEWG concluded that some sort of a new structure needed to be created to facilitate and foster the growing need for IM information and exchange. As the IEWG and AC/310 noted that, the current exchange methods were inadequate for productive exchange, they also recognized a need existed to help Nations understand and utilize the information that was available and expected to be available in the future. In this analysis, the IEWG and AC/310 determined and proposed that an information analysis center should be created within the NATO structure. In 1986, AC/310 approved the development of a NATO Insensitive Munitions Information Center (NIMIC). To create this NIMIC, AC/310 established a Working Group to define and develop a Pilot NIMIC. The Pilot NIMIC was approved, officially created, and staffed in 1988 and given three years to prove its worth to its Member Nations or be disbanded. At that time, Pilot NIMIC had five Member Nations. In 1991, Pilot NIMIC became NIMIC and was established at NATO Headquarters as a NATO Project Office under the Conference of National Armament Directors (CNAD).

The NATO Munitions Safety Information Analysis Center (MSIAC) was the logical next step for the NATO Insensitive Munitions Information Center (NIMIC) which grew out of a pilot project (Pilot-NIMIC) among a very few Nations. MSIAC, like NIMIC and Pilot NIMIC, is directly funded by its Member Nations, to help develop and enhance munitions safety understanding, value, knowledge, and actual development and fielding on munitions that exhibit enhanced or improved safety properties. The need to develop munitions that exhibit IM properties came from the analysis of various munitions explosions and incidents in several Nation's militaries in both storage and operational employment. However, it has long been recognized by munitions developers that a balance is desired mainly between performance (power), ability to handle and use (safety), and ability to store/keep (longevity or aging). It should be noted that in addition to the three power, safety, and longevity noted immediately above; cost, technological maturity, material availability and qualification, and the environmental consequences of production, training use, and disposal are of concern and are drivers in a Nation's munitions decisions.

However, in the late 1990s and the early 2000s, it was becoming evident to some that a greater emphasis was needed on safety, specifically in the operational environment where the traditional logistical means of ensuring safety by the separation of munitions stocks from each other and personnel via large distances were not practical. Examples of situations where separation of munitions is difficult or sometime operationally impracticable to achieve, can and do, include; forward storage or operating bases, mass transportation situations (trains and ships), and operational scenarios on aircraft carriers or other large combatant ships. It was this background that led to the development, and ultimately codification in many Nations national legal systems, of the requirement to advance the understanding, development, and fielding of munitions that exhibit not only greater IM properties and which also exhibit and present a greater ability to prevent or reduce the hazard to personnel and other stores.

This was the path that during the 1980's lead to the development, creation, and utilization of the NATO Insensitive Munitions Information Center (NIMIC). In fact, NIMIC under its current embodiment of MSIAC will celebrate its 20th Anniversary next spring (2011). Partly because of NIMIC's successes and partly because of the successes of many Nations in the development and fielding of munitions exhibiting greater IM properties, a decision was made by the NIMIC member Nations to slightly re-focus NIMIC into the broader field of munitions safety throughout the life cycle. It was recognized by the member Nations of NIMIC that while IM is very important, it is one of several important aspects of the broader field of munitions safety. Thus over the time period of 2003 to 2004, NIMIC was officially changed into MSIAC with a goal that "An understanding of complex phenomena associated with energetic materials, designing safe munitions, and standards for all aspects of safety during the life cycle of munitions, is essential for ensuring acceptable levels of munitions safety".

Munitions Safety Information Analysis Center:

MSIAC, like its predecessors NIMIC and Pilot NIMIC, as a safety information and analysis center, specifically supports its member Nations (membership will be addressed later in this paper) and the NATO Conference of National Armament Directors (CNAD) via its Ammunition Safety Group (CASG). The NATO CASG, here after referred to as AC/326, consists of a Main Group and six Sub-Groups. AC/326 is the natural growth and combination of the old AC/310 that championed Pilot NIMIC and NIMIC and the old NATO Cadre Group AC/258 that was focused on the storage and transportation of munitions. NATO recognized the synergistic value of combining the two groups (AC/310 and AC/258) into a new overarching munitions group, AC/326 Ammunition Safety Group.

All 28 NATO member Nations are represented at AC/326; as well as the NATO Partners for Peace (PfP) Nations, the NATO Mediterranean Dialogue (MD) Nations, the NATO Istanbul Cooperative Initiative (ICI) Nations, the NATO Contact Nations, and various invited Nations. Nations may also request to participate via NATO CNAD to learn how NATO and specifically AC/326 develops munitions safety precepts, practices, and standards. The AC/326 Main Group and its six Sub-Groups can and often do involve

and provide munitions safety information and standards to very wide audience of Nations, which can literally be from around the globe.

MSIAC provides munitions technical information and support to AC/326 (Main Group and all of its 6 Sub-Groups) and is quite responsive to AC/326 needs via a cooperative support arrangement with the expressed consent, on a task-by-task basis, of the MSIAC Steering Committee. This was one of the founding principles expressed in the Memorandum of Understanding (MOU) that established NIMIC, now MSIAC, and this supports continues unabated. The MOU, which is still the guiding document of MSIAC is signed by all Member Nations and will have to be signed by any new Nations that desire to become Members. The second amendment to the MSIAC MOU allows other nations, whether members of the North Atlantic Alliance or not, to join MSIAC subject to approval by the North Atlantic Alliance and then by the MSIAC Steering Committee. Currently, MSIAC has three member Nations that are not members of NATO. Two are PfP Nations and one is a Contact Nation, all three are very active members and contributors to both MSIAC and AC/326.

According to the MSIAC MOU, the objectives and scope of MSIAC are as follows:

- The Participants have identified a national need to design, develop, procure, and use safe munitions (with an emphasis on IM) and recognize the benefits of establishing a focal point within the NATO Alliance to assist national and NATO munitions development programs to address the problems associated with achieving MS. The Participants recognize that the establishment of a permanent NATO-wide MS Information Analysis Center that achieves the pooling of information on this subject would make a significant contribution to the efficient and expeditious development of safe munitions.

- Accordingly, the objective of this co-operative effort is to establish, operate, manage, and support a permanent MSIAC to provide a focal point to assist national and NATO munitions developers and logisticians in efficiently and expeditiously addressing the problems associated with achieving MS requirements.

- MSIAC will achieve a pooling of information related to MS. Analysis of this information will be conducted by a cadre of Technical Specialists to provide design recommendations to munitions developers and logisticians.

- In carrying out the activities under this MOU, MSIAC will develop an important source of expertise in the field of MS, thereby creating the ability to add value to technical information which it receives and to provide a greater understanding of the subject.

- MSIAC will be involved with information concerning four major areas as they relate to Munitions life cycle safety: Threats; Explosives and Munitions; related Technical areas; and related Logistical areas. Examples of specific subjects under each of these areas are as follows:

- Threats – Slow cook-off, fast cook-off, fragment impact, bullet impact, sympathetic detonation, electromagnetic pulse and electrostatic discharge
 - Since the MOU was drafted Shape Charged Jets (SCJs) and Explosively Formed Projectiles (EFPs) have been identified as significant threats and will be the focus of a MSIAC IM Workshop next year.

- Explosives and Munitions - Rockets, missiles, guns, mortars, warheads, bombs, fuzes, gas generators, ammunition, propellants, high explosives and pyrotechnics
- Related Technical Areas - Ignition, thermal explosion, deflagration to detonation transition, shock to detonation transition, ignition/detonation caused by set-back forces, and mitigation/elimination of these areas
- Related Logistics areas – Storage, transportation, hazard classification, disposal, risk/cost benefit analysis.
- MSIAC, within the above areas of interest will:
 - Collect, store and disseminate scientific and technical information on MS;
 - Provide and maintain a comprehensive data collection so as to facilitate design efforts for safe munitions and minimize the cost of research and development efforts;
 - Respond to technical inquiries;
 - Analyze technical requirements for MS and assess methods and systems for improving munitions to meet these requirements;
 - Recommend solutions or design approaches to meet MS requirements;
 - Identify technology deficiencies that prevent requirements from being achieved and make proposals for remedial actions; and
 - Analyze data provided to MSIAC and prepare data books and state-of-the-art reports on MS.

MSIAC Organization and Staff:

The NATO Munitions Safety Information Analysis Center is a multi-national Information Analysis Center (IAC) that collects, stores, and analyses Technical Information (TI) related to Munitions Safety (MS) and Insensitive Munitions (IM). Traditionally an IAC is more a focal point for information flow than necessarily an information development point. However, as MSIAC is staffed with Technical Specialist Officers (TSOs) either civilian or military officers from its member Nations who are international subject matter experts in their fields, MSIAC can and often is an information development point. MSIAC uses a policy of limited duration contracts (~ 3 to 5 years) and planned rotation for its TSOs and for its Project Manager/Technical Director. This policy helps to keep the knowledge of the MSIAC staff fresh and helps to spread, embed, and return that knowledge to and throughout its member Nations.

The MSIAC TSOs are actively recruited and staffed from Nations who have and are making great strides in improving their IM and their Munitions Safety (MS) postures, but also are seen in the international community as leaders in the overall MS field. The majority of TSOs over the NIMIC and MSIAC years have held, and most will return to, senior engineering, scientific, or logistics positions in their respective Nations munitions design, development, fielding, and/or national munitions safety oversight or regulatory organizations. With few exceptions, the vast majority of TSOs hold advanced degrees (Masters and Doctorates) from highly recognized universities that specialize in the science and engineering disciplines that influence advances in IM or MS. This is stated in this manner as MSIAC, like NIMIC before it, also recruits promising senior level university students or junior personnel for internships and fellowships to further their

development and to help spread the knowledge of munitions safety precepts and practices.

MSIAC has a specific fellowship program named after one of our past TSOs, Benjamin (Bo) Stokes, who along with his wife died in a tragic automobile accident. The Bo Stokes Fellowship program is available to MSIAC member nations, with a preference for smaller nations and for those nations that do not currently have technical personnel (TSOs) on the MSIAC staff. The Stokes Fellow receives partial financial support from MSIAC. Student trainees are invited to work at MSIAC if their nation is willing to pay the costs for the training period. Both trainees and Stokes Fellows are encouraged and provide numerous opportunities to participate in a variety of on-going MSIAC activities. MSIAC internships, fellowships, trainee opportunities are not limited to military or governmental personnel; e.g., there is currently an intern from the US Maritime Merchant Academy, and next year we are anticipating receiving a couple post-masters or post-doctorate intern applications from several Nations.

There are currently five TSOs, who specialize in the following areas: Propulsion Technology, Energetic Materials, Warhead Technology, Munitions Logistics, and Munitions Systems. While each of the TSOs seem to address specific weapons or ordnance components or technology area they are all interactive and inter-related with the overall field of munitions safety and they all maintain a sub-focus on continuing the advancement of Insensitive Munitions. The TSOs are supported by a staff of data and information specialists and an administrative staff. These positions are important due to the rotational nature of the TSO positions (3 to 5 years) and the longevity nature and needs of the knowledge and technology (20 to 50 years). As such, MSIAC maintains a quite extensive database and archive of IM and MS information, which is growing at a rate of ~700 citations per month. This information library includes accident/incident reports, technical journals, presentations, reports, standards, national laws, patents, etc. from around the world that impact munitions safety or IM.

MSIAC Value, Services, and Products:

As noted, a few paragraphs above, MSIAC is a multi-national Information Analysis Center (IAC) that collects, stores, and analyses Technical Information (TI) related to Munitions Safety (MS) and Insensitive Munitions (IM). That is one of MSIAC's great values; each Nation could maintain for its own uses such an expansive library and the ability to archive, analysis, and disseminate such information, or a Nation can utilize the economies of scale that MSIAC provides. In addition, MSIAC can quite often gather information or data (unclassified and open source) that a particular Nation or their safety organization might have a difficult time acquiring due to various reasons not the least of which could be a limited perception of need or political realities. MSIAC as an independent, non-direct government organization, can attend conferences, symposia, or seminars and make presented information (if releasable) available to its Member Nations at a fraction of the time and travel costs of multiple engineers and scientists from each Member Nation directly participating and acquiring the information. In addition,

MSIAC is often the recipient of information from both Member and non-member Nations that is freely shared to advance the fields of IM or Munitions Safety.

The next value of MSIAC is the ability of its TSOs to analyze information and data from the vast MSIAC library, their personal knowledge, and their interactions with their or other member Nations' safety organizations and generate new or original understandings, information, or concepts that impact munitions safety. In effect, MSIAC can and does act like an extension of the munitions safety organizations of many member Nations. Current examples include the work of the MSIAC Munitions Systems TSO in spearheading, from both his previous position with the United Kingdom Defence Ordnance Safety Group (DOSG) and his current position within MSIAC, the development of new language for the United Nations (UN) Orange Book regarding Hazard Classification 1.6 and the specific tests and terminology of UN Test Series #7.

This body of work is focused on rationalizing and harmonizing the specific tests of UN Test Series # 7 and the underlying rationale and concept of Hazard Classification (HC) 1.6. The rationale and concept behind the creation of HC 1.6 was to create an achievable goal for developers of safer (e.g., consistent or compliant with IM definition) munitions that recognized that while these potential safer munitions were still overall Hazard Classification 1, they were not likely ("negligible probability") to cause a significant mass incident if exposed to transportation and storage threats.

While the original intent and language of HC 1.6 was laudable and a giant leap and an outstanding goal for the developers of safer munitions, very few items attained this classification. This is in spite of the fact there coexists a number of newer substances and articles being developed and transported which have Division 1.6 characteristics although some of their specific features and individual designs do not exactly align with criteria. The overall insensitivity and safety in transport of those newer articles is believed to be equivalent with the intent of the originators of Test Series #7. Therefore, work is ongoing through a UN informal working group to accommodate the new developments in article design and construction and understanding of article response mechanisms.

Additionally, there are some ambiguities in its language due to technical advances in energetic materials and components in munitions and in test and evaluation technologies since its codification. One specific example is the term Extremely Insensitive Detonating Substance (EIDS) to describe the characteristics of an energetic material used in a HC 1.6 munition. However, over the intervening years energetic material scientists have developed quite a few energetic materials that while not "detonating" materials are still highly energetic.

Therefore, one of the simpler recommended changes is to change EIDS to Extremely Insensitive Substances (EIS), thus HC 1.6 will no longer be exclusively for Articles which only contain substances that detonate. The UN uses the generic term "Articles" for objects, devices, system, etc. that contain explosive materials. In our military or defense language, we typically refer to items that contain explosive materials

as munitions (or ammunition, ordnance, weapons, etc.). In addition, most people in our line of work have started or are exclusively using the term “energetic” materials as so many new materials have been developed and are being developed that are not traditional explosives but still contain a tremendous amount of energy and destructive power.

Another example of munitions safety work engaged in by a different TSO with a more operational focus, an individual seconded to MSIAC by the US Army, is our work in support of AC/326 Sub-Group 6. Sub-Group (SG) 6 is the “Operational Storage” sub-group of CNAD Ammunition Safety Group (CASG or AC/326) and their focus is on creating and codifying the policies and more importantly the practices to be employed by operational forces in NATO and NATO/Coalition Forces deployed munitions storage and operational sites, camps, bases, facilities, etc. for the safe and efficient storage of munitions. The work of SG 6, which is strongly supported by MSIAC, is to help AC/326 coalesce or fuse the existing policies into a simple, succinct, and easily understood and utilized manual for the operational forces who may not have embedded engineering support to efficiently organize and set-up their munitions storage facilities.

This is desired as NATO/Coalition Forces operational camps or bases may be required to be established or relocated due to operational demands in a short order but must also be established to facilitate and ensure munitions safety; i.e., ensure the risks to personnel and important capabilities from own stocks of munitions are reduced or managed to an acceptable level. This concept dovetails very nicely with MSIAC’s stated charter of helping member Nations and NATO “to design, develop, procure, and use safe munitions”. Which is also, why we have an emphasis on IM development? A Nation or Coalition with a stockpile of IM compliant munitions or HC 1.6 munitions will have an easier path to storing and managing their munitions.

Another example of munitions safety work engaged in by a different TSO with a more Insensitive Munitions operational focus is the development and organization of an international workshop to focus some IM technology gaps that are more related to the operational phase of a munitions’ life cycle than the transportation and storage phases. Insensitive Munitions (IM) are now recognized as one of the key considerations when designing and/or procuring munitions.

The IM goals defined in STANAG 4439 and AOP 39 have provided much of the drive behind the progress made. As such, there is now a wide range of technologies and techniques that can be employed to reduce the vulnerability and response of munitions to unplanned stimuli. However, some IM shortfalls still perceived, specifically in the context of deployed operations vice traditional storage and transportation scenarios. An MSIAC workshop was held in May 2009, to identify and prioritize the perceived IM shortfalls, with emphasis on the end user’s, i.e. the warfighter’s, experience and needs.

It was been established during this workshop that some munitions currently in use on operations are vulnerable to attack by fragments, shaped charge jet weapons and explosively formed projectiles. Via the 2009 workshop, priority munition components were identified: gun propellant charge systems; high performance rocket motors;

minimum signature rocket motors; anti-armour warheads; and blast/fragment and general purpose warheads. These priority munition components and the perceived IM technology gaps will be the subject of an MSIAC-sponsored workshop next year.

IM Technology Gaps Workshop will deal with how to reduce the vulnerability of key munitions, packaged and unpackaged, against fragments, shaped charge jets (SCJ) and explosively formed projectiles (EFP). Briefings, presentations, and discussions will include both existing munitions and new/upgraded munitions in development. The workshop will in particular address issues encountered to reduce the vulnerability of munitions on operations, related mitigation shortfalls based on credible aggression scenarios and potential remediation options.

Three categories of munition components will be considered: gun propellant charge systems; rocket motor; and warheads. For each of these categories, the workshop will aim to:

- Provide an IM state-of-the-art analysis covering reaction mechanisms (from type I to type V) to the selected threats and available IM mitigations.
- Identify shortfalls in technology (munition components including initiation/ignition systems) and potential remediation options.
- Identify non-technical hindrances to IM devices implementation such as cost, manufacturing, toxicity, logistics and impact on the environment and potential remediation options,
- Identify systems level mitigation methods that could be applied to munitions on operations,
- Identify areas for multi-national collaboration.

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

Until 2009, MSIAC had three databases reporting munitions responses to Bullet Impact (BIRD), Fragment Impact (FRAID), and Sympathetic Reaction (SYR) stimuli were available. MSIAC has just expanded its IM testing results database suite by adding two other databases, one for munitions exposed to thermal threats such as Liquid Fuel/ External Fire or Slow Heating (HEAT) and the other one for shaped charge jet impact (DARTS). These databases were originally developed in electronic format under Excel2003 to ease their use and take advantage of Excel search features. However, as will be discussed a few paragraphs later, this approach has been modified.

Test set-ups, results and analyses are also reported in detail and interpretation of results is made easier by the inclusion of pictures, graphs, comments, and references. Together these databases compile data from 500 publications and comprise more than

5,500 test results. They represent an opportunity for the IM and munitions safety communities to easily and quickly assess; e.g., the IM relevance of an explosive for a particular application or the achievable IM signature for a certain type of warhead.

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

- Energetic Material Compendium (EMC) that compiles information on more than 1,200 energetic materials.
- Database on gap tests (NEWGATES) that includes 1,450 gap test results.
- TEMPER software that takes into account two IM threats (STANAG 4496 conical-ended fragment and sympathetic reaction) and helps to assess the influence of various parameters (body thickness, EM shock sensitivity, etc) to avoid a detonation.
- Mitigation Methods for Munitions (M3), which describes various mitigation (packaging and other logistical) techniques that can be applied to munitions to reduce or mitigate responses to threats.

This collection of database has a large number of applications. For instance, people in a procurement agency can assess the level of IMness that is currently achieved for a particular type of munitions before writing their own requirements. A design engineer can evaluate the potential vulnerability reduction brought by an explosive composition, a casing thickness, etc. A tester can have a first estimate of a munition reaction level in an IM test based on existing results in a similar configuration. At the moment, users have to search individually each database and to adapt their criteria to the specificities of these databases.

This method of searching is somewhat time consuming and not as user friendly as we desire, therefore our next step will be to federate all the IM databases with a unique interface through which the user could search one or several databases and select his search criteria. Excel was not well adapted for such a project as desired so we examined a Web based environment. The Web based environment was considered as a good option as it proved to be effective to handle complex databases and is not in conflict with several Nations' IT security rules about software installation. A first step has been successfully completed by migrating SYR database while maintaining the result legibility and enhancing the search capability with advanced criteria such as weight % of an energetic material ingredient. This work will go on and progressively add the other databases to the existing web based structure and create a unique interface that will manage all the databases.

Another area is the development of an Audit Procedure for IM Test Organizations to self assess their technical and facility capabilities in accordance with the IM test requirements of AOP-39. The purpose of this audit procedure is to help lead from a technical quality assurance viewpoint to internationally acceptable IM test results, reports, and IM signatures as well helping IM test organizations in the facilitation or exchange of IM test data and perhaps ultimately to reduce test duplication.

Summation:

MSIAC, like NIMIC and Pilot NIMIC before it, has proven and continues to prove its value to its Member Nations by providing sound technical advice, information, databases, and interpolation or analysis of munitions safety information. In addition, as can be seen by the information presented above, MSIAC is continuing to develop and provide new and innovative services to our Member Nations and to the overall NATO munitions community via the work MSIAC does in support of the Conference of National Armament directors and its Ammunition Safety Group (AC/326).

Our services (responding to questions/tasks/assessments) are provided to our 12 Member Nations at no additional cost beyond a small yearly national fee. As such, any member of the government/military of our Member Nations can request/task MSIAC to provide a technical review and/or assessments of munitions safety (IM, aging, E3, ESQD, etc.) issues. These technical reviews/assessments are of existing data/information that our Member Nations have provided or we have developed to populate our database, which is quite extensive. For general info, any contractor in any of our Member Nations can ask also for support but they have to go through their Nation's Steering Committee (SC) Member or National Focal Point Officer (NFPO) for MSIAC. This is to ensure that our Member Nations' military/DoD receive priority.

Questions to be raised are; "What is the Vision for the Future of MSIAC"? What safety technical areas are we not addressing? What technical areas would our Member Nations desire that we address? What will be the future safety questions/issues that all Nations who utilize munitions will face? These questions and many more will, in my opinion, keep MSIAC gainfully occupied supporting our Member Nations. However, MSIAC like all service organization will continue to be challenged to show relevance and results to its Members. As munitions safety professionals we embrace these challenges and welcome your remarks, communications, and the opportunities to continue to serve our Member Nations.

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**Munitions Safety Information
Analysis Center**

**DDESB SEMINAR
13-15 JULY 2010**



HISTORICAL INCIDENT

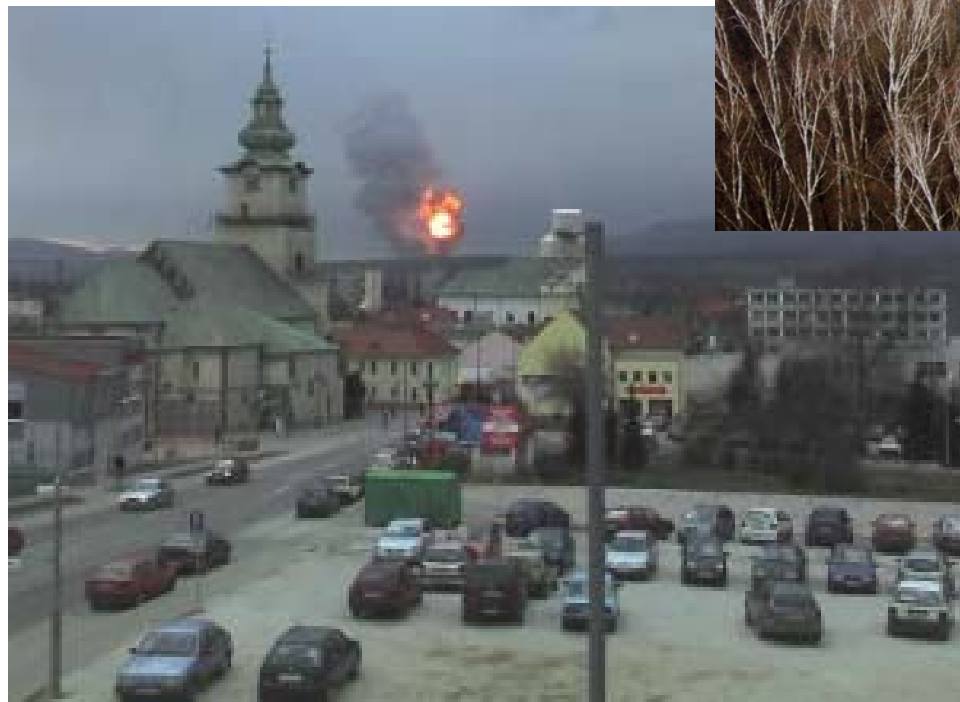


AN ONGOING CONCERN

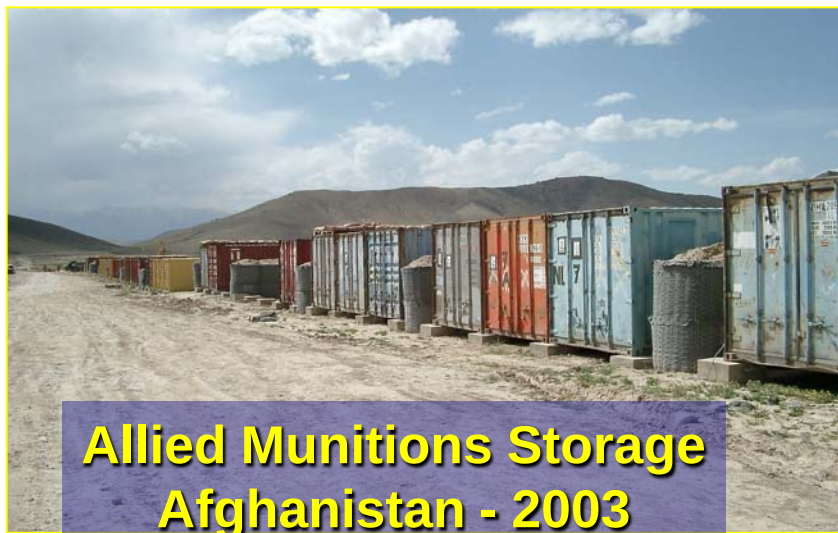


Kirkuk, Iraq, 02/06/04 – USAF Base Attack

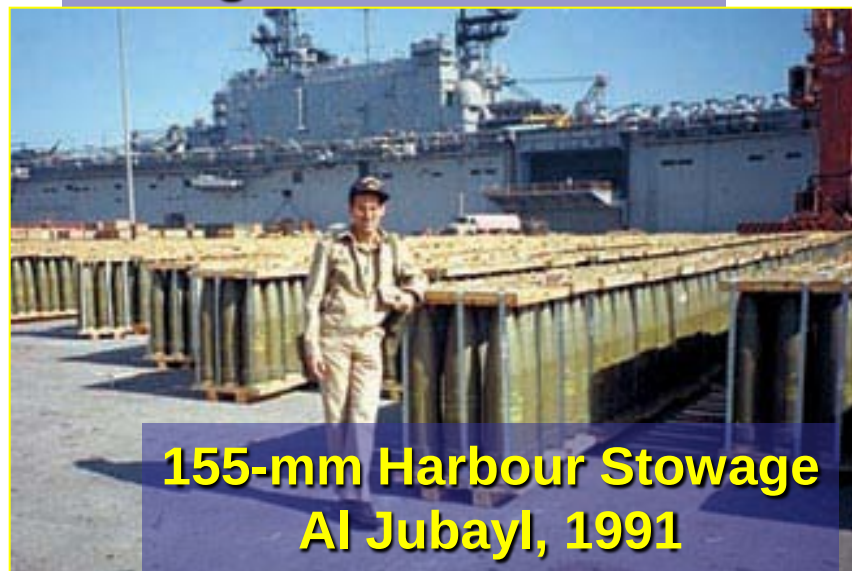
DISPOSAL OPERATIONS SLOVAKIA – 2006



TARGETS OF CHOICE?



**US Aircraft Carrier Deck:
Armed Aircraft - 2003**





USS Forrestal



Roseville Ca.

**We need safer
munitions**

**"We have lost more tanks today
than during the entire Gulf War"**



Camp Doha

HISTORY

- 1979 Creation of NATO AC/310 from AC/258
- 1986 Creation of AC/310 IM-Specific Working Group
- 1988 Creation of Pilot NIMIC (CA, FR, NL, NO, UK, US)
- 1991 Establishment and Transition of NIMIC to NATO HQ (CA, FR, NL, UK, US)
- 1994 Entry of Spain & Australia (NATO Contact Nation)
- 1995 Entry of Portugal (later withdrew), Norway, and Italy

Growth, Change, Growth?

- 1999 Entry of Denmark (later withdrew)
- 2002 Entry of Sweden and Finland (Partners for Peace Nations)
- 2003 Merger of NATO Cadre Groups AC/258 and AC/310 into AC/326 Ammunition Safety Group
- 2003 Creation of Pilot MSIAC within NIMIC
- 2004 Transition from NIMIC to MSIAC Completed
- 2005 Entry of Germany
- 2010 & Beyond ?

SUCCESS REQUIRED EXPANDING SCOPE

- IM Technology Successes; Member Nations Called for Expanding the Scope of NIMIC
- From IM to Munitions Safety
- From Mostly R&T to the Total Life Cycle of Munitions
- IM Still is the Core Business Area
- Provide technical support to AC/326

NIMIC ^{2003 to 2004}  MSIAC

OVERARCHING GOAL

**“Risks Associated with Munitions
will NOT be due to Unintended
Reactions in the Energetic Materials”**

In Other Words:

NO



**Unscheduled Catastrophic
Disassembly, Removal, or Renovation
of Fleet Assets or Shore
Infrastructure via the Unplanned
Unconstrained Application of
Uncontrolled
Chemical Energy**

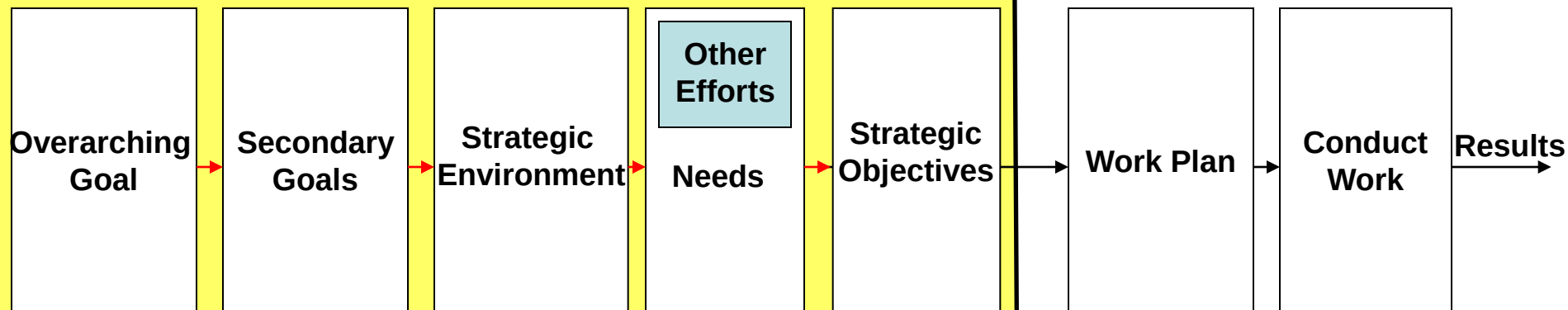
LIFE CYCLE

- **Munitions Safety is a Life Cycle Endeavour; Planned, Conceived, Executed, and Monitored from Requirement to Disposal**
- Safety is a Requirement
- Safety must be Conceived and Planned to be Successful
- Safety is Executed not an Accident
- Safety is Maintained via Monitoring Throughout the Life cycle
- Safe Disposal is Environmentally Sound

Leadership & Management

Strategic Plan (top-down)

Work Plan (bottom-up)



Regular reviews of all steps

STRATEGIC PLAN: FOUR MAJOR GOALS

Develop Member Nations'
Awareness of Munitions
Safety Precepts,
Practices, Concerns,
& Issues

Help Member Nations, &
NATO Develop Policies &
Standards
(Support AC/326)

Help Member Nations'
Develop Technical Capabilities
Research, Development, Design,
Test & Evaluation, and
Production

End Goal is Greater Knowledge
Which results in Safer & More
Interoperable Munitions
Inventories



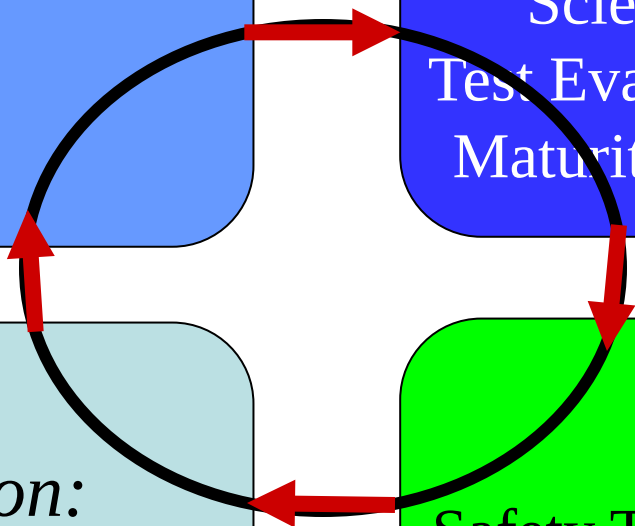
Ten Secondary Goals (and about thirty Work Elements)

Documentation:
Definition
Doctrine
Standards

Capabilities:
Modeling & Simulation
Science & Technology
Test Evaluation, & Production
Maturity of MSIAC Nations

Communication:
Education &
Promotion

Munitions:
Safety Throughout Lifecycle,
Health Management,
& Interoperability





MSIAC

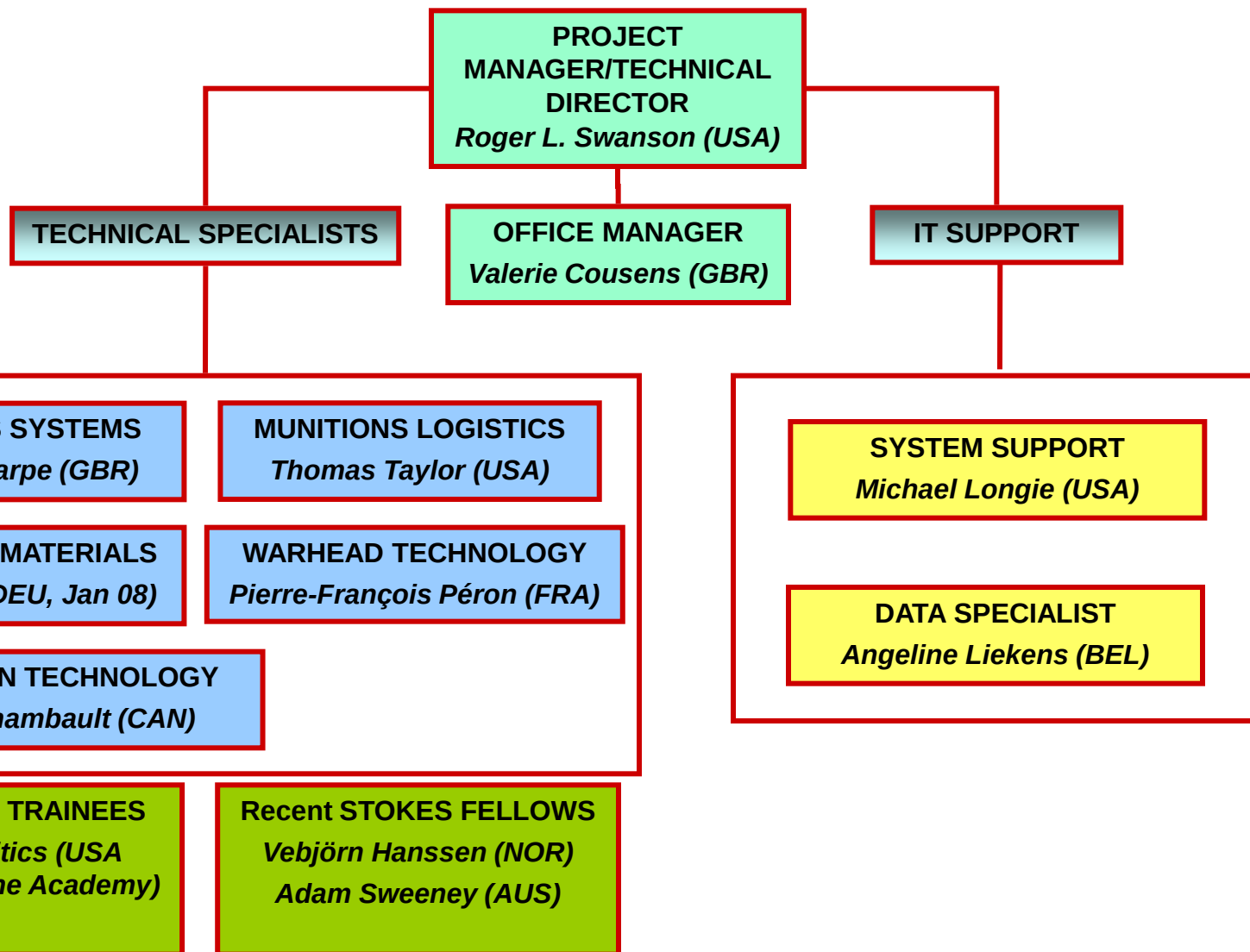
WHO CAN BENEFIT FROM MSIAC ?

- Government Organisations
 - Direct access for designated establishments (e.g. Procurement, Research, Safety Policy & Assessment agencies, Testing Centres, Forces, Military Colleges...)
- Contractors
 - Access controlled by the relevant Steering Committee Member(s) or National Focal Point Officer(s); on the basis of need-to-know, security, and reliability

KEY MSIAC DOCUMENTS

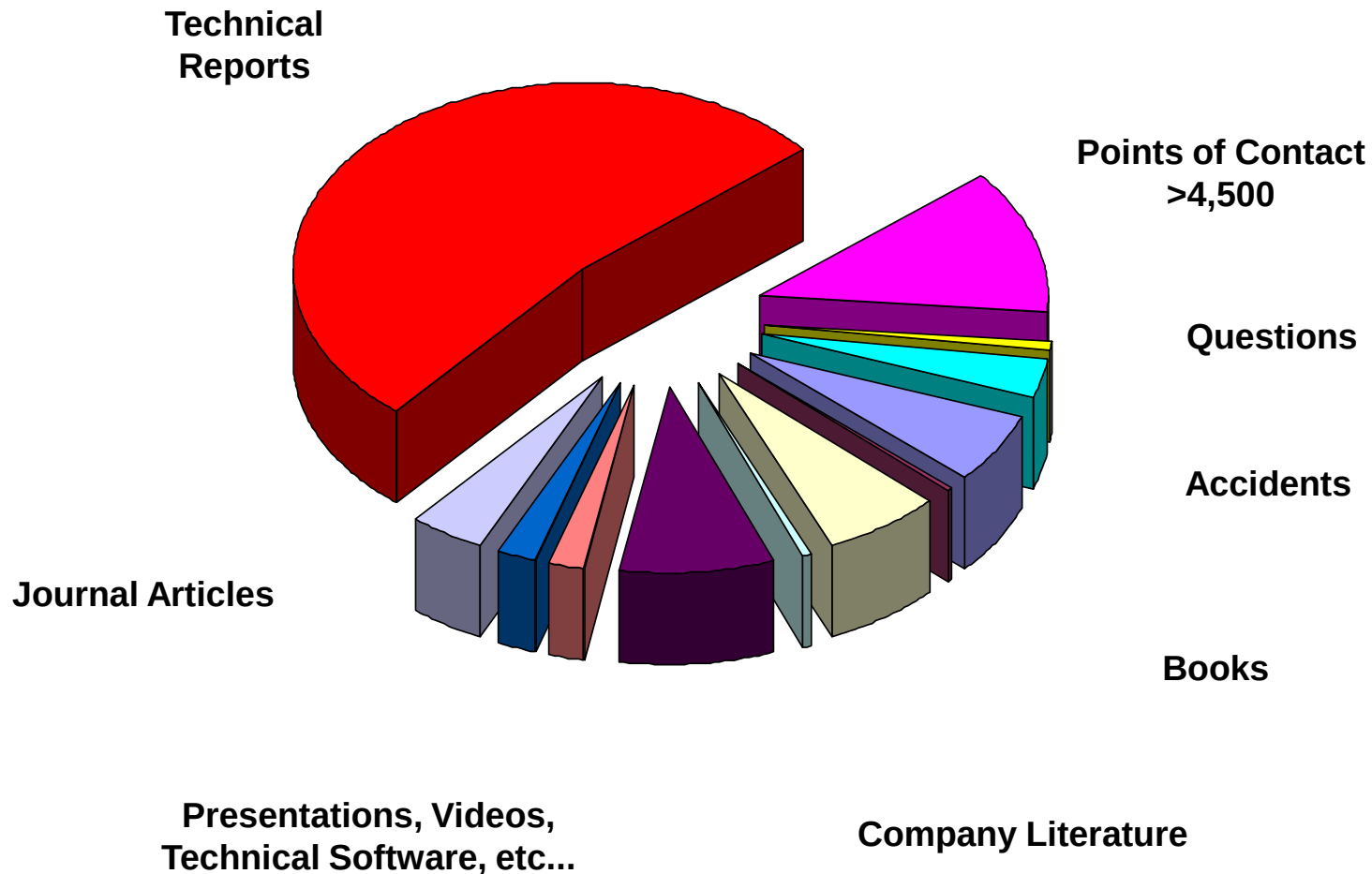
- “MSIAC Memorandum of Understanding (MOU) concerning a cooperative project for the establishment, management and support of MSIAC”
 - Signed by participating countries, generally by NAD
- MSIAC Security Instructions
 - Approved by SC, with Security Classification Guide signed by National Security Authorities
- “MOA between MSIAC and NATO regarding the provision of administrative services and facilities in support of the operation of MSIAC at NATO HQ”
 - Signed by MSIAC SC Chairman and ASG/EM

STAFF EXPERTISE



PRODUCTS & SERVICES

Electronic Library 50,000+ references



Products & Services

Answers to
Tech. Inquiries

Now > 2200 Questions Answered

Software
& Databases

15 distributable software tools and databases

Tech. Reports

Now > 120 Open reports, and > 150 Limited
distribution

Visits & Training

Country visits, Short courses, Fellows and
Trainees...

Workshops &
Tech. Meetings

Now > 20, Next is the IM Technology
Gaps Workshop in 2011

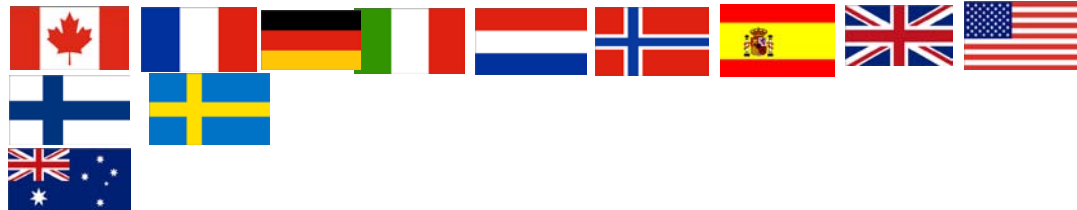
Websites

Open website, Secure website (> 500 users)

**Don't Hesitate to Ask us Questions!
We Enjoy the Challenges!**

TECHNICAL CONSULTANCY SERVICES

- A NATO Project Office
 - Funded by its Member Nations
 - Serves Government, Industry and Academia from Member Nations
 - Emphasis on Insensitive Munitions
 - Technical support to AC/326 (CNAD Ammunition Safety Group)
 - Administrative Support from NATO HQ
- Led by a Steering Committee
 - 1 Representative per Member Nation
 - SC reports to CNAD
- Currently 12 Member Nations
 - 9 NATO Nations
 - 2 PfP Nations
 - Australia



Technical Enquiries; Examples

- ✓ We are developing a new MACS, can you advise on what IM tests to do
- ✓ Provide information on casting techniques, cone geometry and experimental procedure for CD testing
- ✓ What is the current IM mortar state-of-the-art
- ✓ Give information on a demilitarization accident
- ✓ Provide assistance to help prepare national IM policy and implementation documents
- ✓ What are the QD benefits for HD 1.2.3 versus HD 1.1

SOFTWARE & DATABASES

- Design
 - EM related: “Energetic Materials Compendium” (Properties and Supplier
 - non EM related: “Mitigation Methods for Munitions”
- Requirements / Assessment
 - Applicable standards: “Safety Assessment Software”
 - Where to test: “Directory of IM Testing Facilities”
 - possible extension to auditing of Test Facilities
 - Compare/Predict test results: IM Test Results Databases (currently 3 out of 6 tests)
 - Compare/Use models: “TEMPER”
- Procurement
 - Compare cost of IM and non-IM: “Cost Benefit Analysis Method”
 - What’s on the market: “IM State-of-the-Art”
- Use / Lessons learned
 - National Hazard Classification Databases (hosting only, secure website)
 - National Accidents Databases (hosting only, secure website)

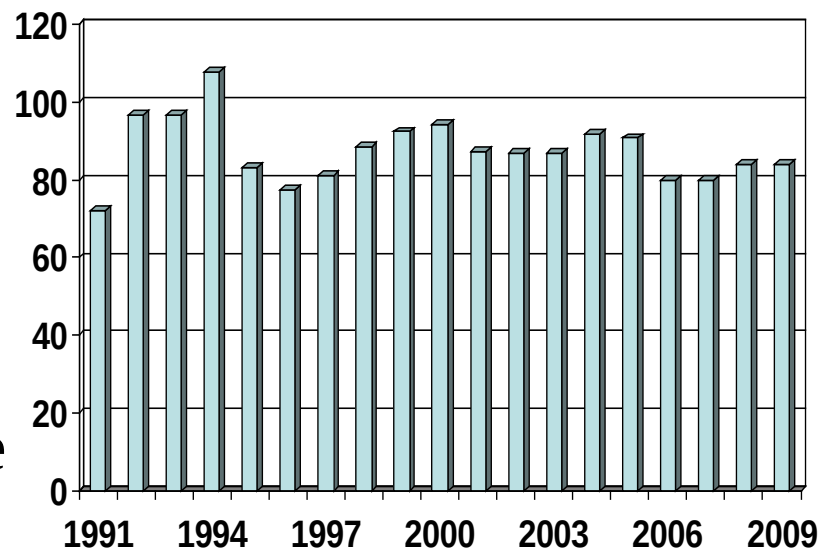
BENEFITS OF MSIAC MEMBERSHIP

- Understand/Implement NATO Standards on IM & Munitions Safety
- Get to Know the Safest Munitions on the Market, in Order to Make Acquisition Decisions
- Receive Technical Advice on Demand
- Send People to MSIAC to Receive Training
- Help Promote the Concept of IM/Safe Munitions in Your Country
- Share Top-level International Knowledge on IM & Munitions Safety
 - Develop National Expertise (S&T, Production, Testing,...)
 - Assess the Level of National Expertise Compared to Other Countries (Benchmarking)
- Promote Your Country's Activities And Products
- Influence Standardization

MEMBERSHIP: VALUE FOR MONEY

- Annual Budget 1.6 M€
- National Annual Contribution
 - Budget Share €84,000 in 2009
 - DEU, FRA, GBR, and USA Pay Two Shares
 - Other Members Pay One Share
- One-time Entry Fee
- This Covers all Expenses; Services and Products are Then Free to Customers

Budget share (kEuro)



MSIAC MEMBER NATIONS

- Want to be Leaders or at Least “Smart Buyers, Owners, and Users” in Munitions Safety
- Are Supporters of Insensitive Munitions
- Are Ready to Work Together In Order to Improve the Protection of Their People, Assets, and Capabilities

MSIAC 20th ANNIVERSARY

- MSIAC is the Second Generation of the NATO Insensitive Munitions Information Center (NIMIC)
- NIMIC was Formally Chartered in 1991
- MSIAC (NIMIC) has provided Munitions Safety and Insensitive Munitions Information and Services for 20 Years
- Our 20th Anniversary is Planned for April 2011

IM TECHNOLOGY GAPS WORKSHOP - 2011



**“Reducing Effects
from Shaped Charge Jets,
Fragments, and
Explosively Formed
Projectiles”**

June 2011 in Europe



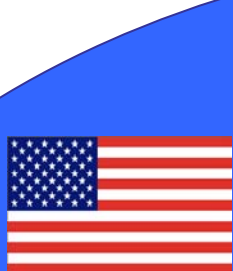


**MSIAC CAN AND HAS
HELPED NATIONS
DESIGN, PROCURE
AND FIELD SAFER
MUNITIONS**

Tel 32(0)2 707 5416

msiac@msiac.nato.int

<http://www.nato.int/related/msiac>



To Develop Relations or
Discuss Membership:



<http://www.msiac.nato.int>

Tel +32 2 707 5416



info@msiac.nato.int

