Approach to IM Policy – Defining the Need

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ABSTRACT:

The story and history of munitions is filled with incidences where our own munitions through unintended reactions have caused great hazards and damage to our forces, our personnel, and our vessels and equipment. This chapter's paper and presentation will present and discuss some of the more historically current incidences, causative factors, and the resulting desires and actions to define and reduce the inherent hazards of munitions to owning and using forces. This chapter will define the need and value of Insensitive Munitions (IM); i.e., safer munitions to individual Nations and to collectives of Nations - NATO.

1.0 APPROACH TO IM POLICY – DEFINING THE NEED

History is replete with accidents and incidents that involved or were caused by the unintended functioning or reaction of munitions, which resulted in hazardous consequences to the owning or using forces and Nation. The emphasis arose within the US Navy, due to several large self-inflicted and in some cases combat related incidents and their catastrophic consequences; to define, develop, produce, test, and utilize munitions with less sensitivity to adverse stimuli that could produce the unintended functioning or reaction of munitions. This desire to have munitions that are less sensitive to commonly defined, and ultimately agreed upon, threat stimuli lead to the development of the concept of Insensitive Munitions (IM).

The concept behind IM; is that through research, development, and technology the inherent sensitivity and hazards of munitions to adverse stimuli can be reduced significantly. The driving factors to achieve this reduction are the needs to minimize the hazards to our forces and to minimize the consequences; Human, Financial, Political, and Legal and ultimately the Loss of National Capabilities to any one Nation or collective of allied Nations. The first four consequences are significant in and of themselves; however to a Nation the loss of National capabilities to defend or to project power is even more significant as in the worst case it could be existential to that Nation. And, just as obvious, a significant loss of capabilities to one Nation could also be significant to a coalition of Allies. Therefore, the value of IM is multi-fold as it is of importance not only to the immediate vessel (ship, tank, or aircraft), facility, building, pier, or situation and immediately associated humans but to the international community of allied Nations.

A case in point and an example of catastrophic loss of material (ship), personnel (dead and injured), and capability (anti-submarine prosecution if called upon), refer to Figure 1, is the USS Solar Before & After photos. The USS Solar was docked at the pier in Colts Neck (Naval Ammunition Depot Earle, now Naval Weapons Station Earle) New Jersey in April 1946. She had survived World War II where she performed anti-submarine duties. On 30 April 1946, she was unloading Hedgehog anti- submarine munitions; somehow a Hedgehog (see Figure 2), which is a surface launched anti-submarine bomb that detonates upon contact with the submarine being prosecuted, exploded in the forward below decks portion of the USS Solar. The most common understanding is that one Hedgehog was somehow dropped and multiple other Hedgehogs sympathetically reacted; i.e., detonated. Seven sailors were immediately killed and 125 individuals injured. This is an example of failure of the first round to pass the 12 meter drop test and failure of the other rounds to pass the now Sympathetic Reaction (SR) IM test. If the Hedgehog was an IM round it might have prevented the loss of the ship and the deaths and injuries.

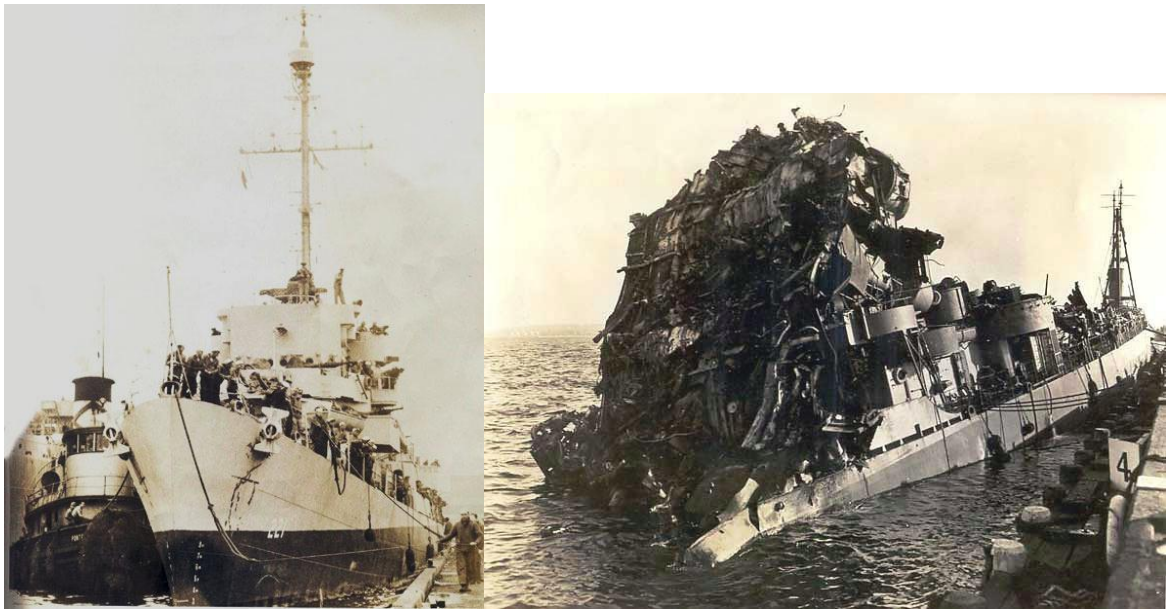

Figure 1

Figure 2

A second case in point is that of the USS Forrestal, a USS Naval aircraft carrier. In July 1967, she was conducting combat operations in the waters near Vietnam. Refer to Figure 3 for a nice photo of the ship.

Figure 3

During preparations for a combat sortie, a forward firing unguided rocket flew across the deck of the carrier which was loaded with planes fully fuelled and armed for the day's combat sorties. The missile struck another plane and its external fuel tank spilling and igniting the aircraft fuel (known as JP-5). The flowing river of burning fuel engulfed additional planes and within minutes caused a M-117 750 pound bomb to explode, causing additional fuel tanks to spill and ignite and ultimately more 8 bombs and several missile warheads to explode. These actions and reactions resulted in 134 deaths, 161 injuries, 21 aircraft destroyed, 39 aircraft damaged, and the ship removed from combat actions or use for approximately one year; i.e., loss of National capabilities to defend or to project power. Refer to Figure 4 for a photo of sailors attempting to fight the fires during the incident.

Figure 4

The basic questions to be asked and answered by the paper and its accompanying presentation are:

- Why is there a need for a Nation or a collection of Nations (Allies) to have, use, or require policies relating to Insensitive Munitions? What are the individual or collective impacts of lack of IM?
- What are the legal responsibilities?
- Why have policies?
- Why can't Nations just require / mandate that munitions be safe?
- If munitions are IM does that mean they are inert?
- Will Insensitive Munitions perform as required?

As can be learned from the Forestall (1967) incident and the incidents on the USS Oriskany (1966), USS Nimitz (1981), and USS Enterprise (1969); explosive incidents cause great damage. Two hundred and twenty (220) sailors and aviators killed, seven hundred (700) plus individuals injured, and the ships and their air wings taken out of action. In addition, 1.3 billion dollars, at those times, of repairs required to the ships. In todays (2013) dollars that is equivalent to $20-25 + billion. For any Nation that is significant. And, those incidents were to individual ships.

The USS Mt Hood incident in 1944, was it an IM incident, was not only catastrophic to the crew of the Mt Hood it was also catastrophic to the USS Mindanao, USS Alhena (AKA-9), USS Oberrender (DE-344), and seven motor minesweepers (YMS). The flying fragments from Mount Hood smashed into some 30 other ships and harbor craft bringing the total casualties to nearly 1000 killed or wounded. Some of the harbor craft simply vanished with all hands....From "The Mt. Hood Explosion", by CDR Chester Gile, USNR,Ret., (published in the US Naval Institute Proceedings, Feb., 1963) Refer to Figure 5 from the US Navy Archives.

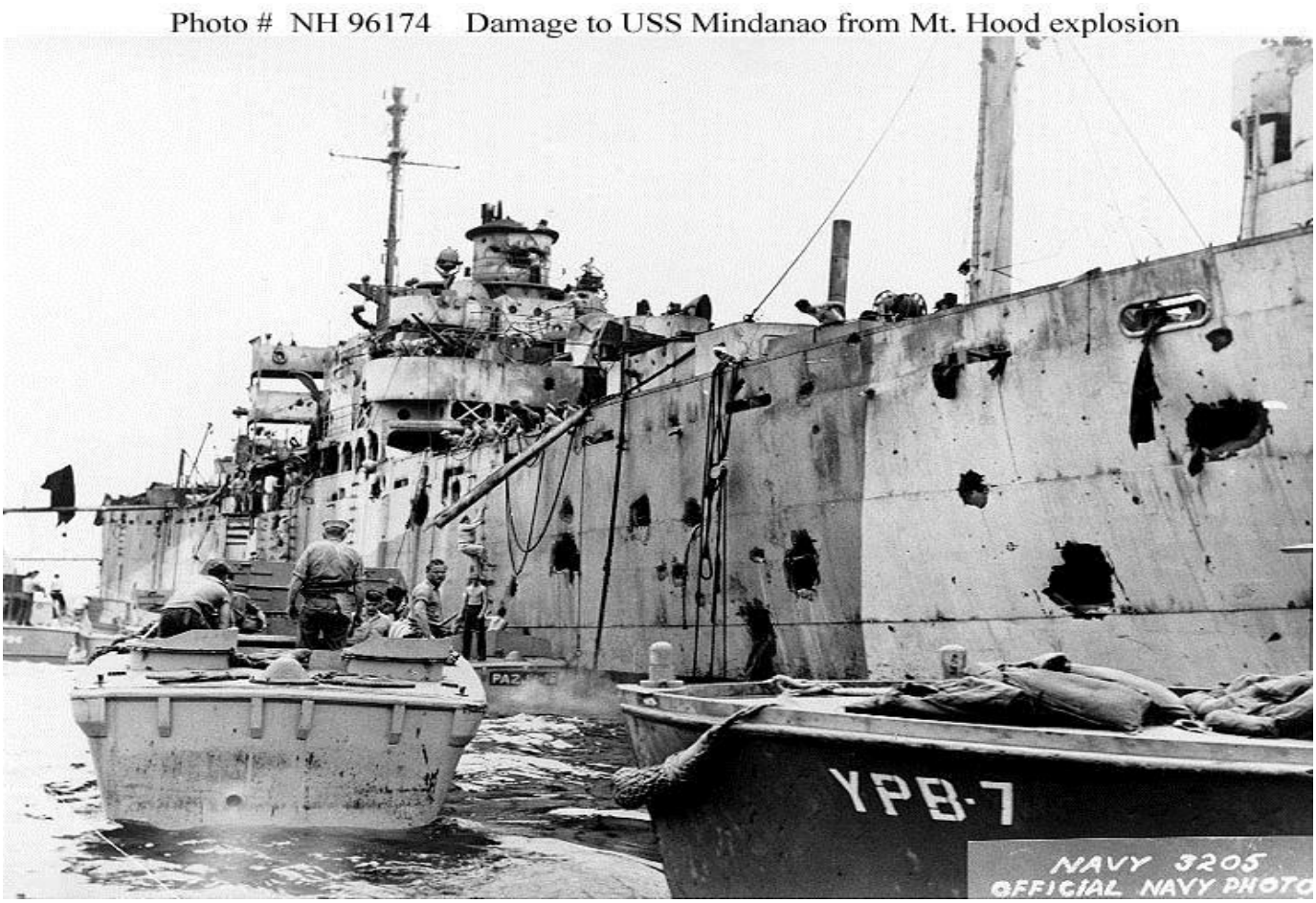

Figure 5

That collateral damage to other ships in the harbor was with World War II munitions which are actually less powerful than today's munitions. Image what would happen in a current situation. Refer to Figures 6 & 7 for a schematic of a real life scenario that was almost a catastrophic incident.

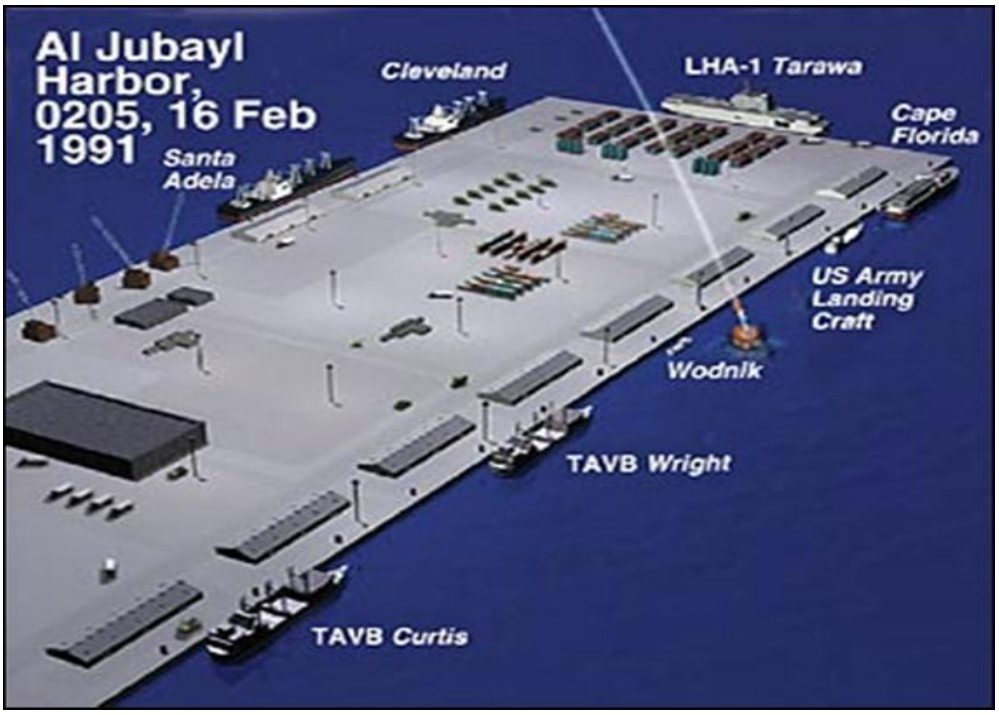

Figure 6

Figure 7

The real life 1991 incident is that a Scud missile landed in the water next to an ammunition pier where several ships were off loading munitions for the 1991 Gulf War. If that Scud missile had hit one of the ammunition ships or the munitions positioned on the dock, refer to Figure 8 below, the results would have been catastrophic for several of the Allied Nations ships shown around that same ammunition pier.

Figure 8

Figure 9 shows the aftermath of an incident that occurred, again during World War II, while two ammunition ships were being loaded at a California, USA Naval base. Somehow, and there are several theories, one or more munitions being on-loaded from the pier unto one of the two ships involved in the incident were dropped from the crane moving the munitions from the pier to the ship. The munitions exploded upon the impact and caused munitions already loaded into the first ship to explode which caused some of the munitions in the second ship to also explode. Result; 320 individuals killed, 390 individuals injured, the two US Navy ships destroyed, the pier complex destroyed, and the ability to load munitions from the Naval bases stopped for a significant time period. Obviously, this incident caused delays in the prosecution of the war in the Pacific during World War II.

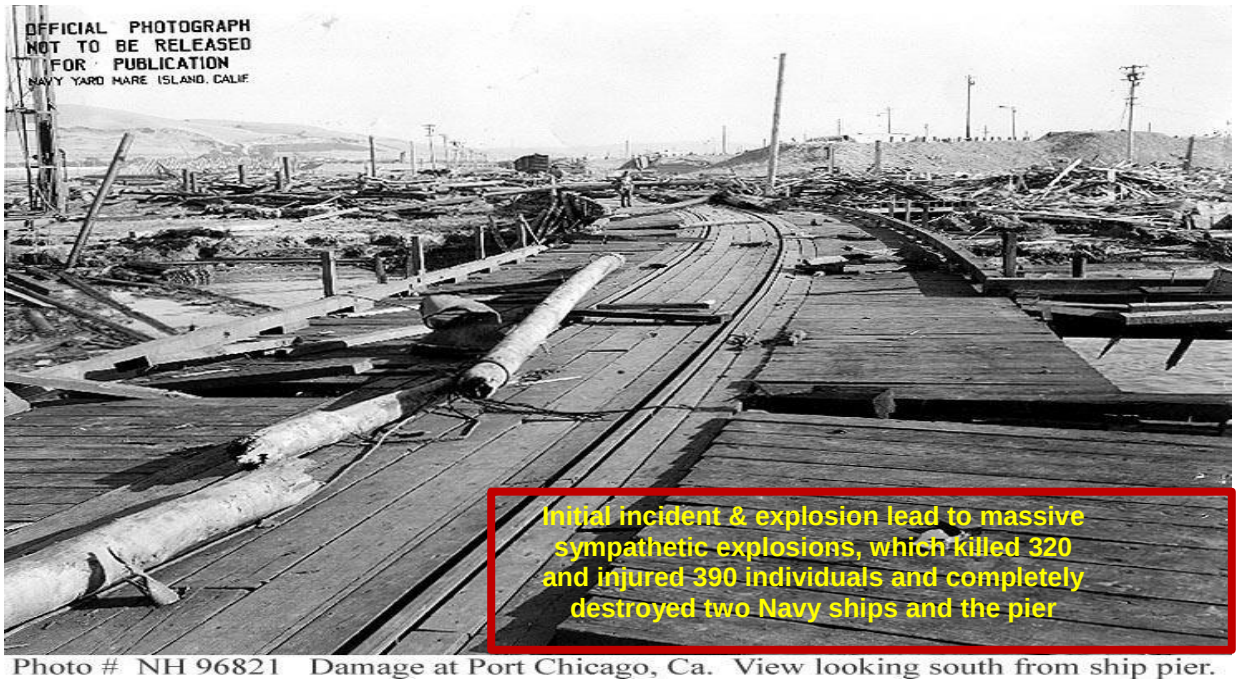

Figure 9

The above are examples of why Insensitive Munitions are vitally important to individual platforms and to collectives of platforms and to the infrastructure where they are berthed, parked, loaded, and unloaded. In the immediately above cases, the first one of the USS Mt Hood affected a major evolution during World War II, the second could have seriously impacted evolutions during the 1991 Gulf War, and the third was a major disaster for the California Naval base and a logistics disaster for the US war efforts in the Pacific.

The above incidents were associated with or in close proximity to war time operations; however accidents continue to happen all across the world. Refer to Figure 10 which uses information form a Small Arms Survey report of November 2012. As can be seen the Small Arms Survey group reported, using publically available information, that since 1998 there have been 325 accidents or unplanned explosions of military munitions. An unplanned explosion of military munitions is a nice way of saying incident. Some of these incidents obviously are minor, however some are major with significant consequences not only to the vessels and individuals involved but also to the Nations in control of the vessels, areas, or facilities involved. The three incidents below are all quite recent and were catastrophic in their nature and consequences.

The first is the incident of the KURSK, Russian Class 949a Antey submarine. The destruction of the KURSK occurred effectively 12 August 2000 when an initial fire caused by what is assumed to be the fuel of one of its torpedoes caused the warheads of approximately 5 to 7 of the remaining torpedoes in the forward torpedo room to explode. This appears to be a classic IM or more accurately a lack of IM event. This incident resulted in the death of 118 individuals, the complete loss of a nuclear powered submarine Refer to Figure 10 for before and after photos of the KURSK.

Figure 10

The second is a much more straightforward incident but one which caused great harm to the citizens of the town / village in close proximity to the munitions storage facility where the incident occurred. While there has been no firm analysis of the incident published, it appears to have included the cook-off of large quantities of stored munitions. The incident caused destruction of homes and schools, the death of 25 individuals, and injuries to at least 140 individuals. Refer to Figure 11.

Figure 11

Incidents like these, especially the immediately above incident, cause not only grave consequences to those killed and injured, but also legal consequences to the Nation owning or responsible for the munitions. Most Nations have a legal culture that recognizes a Duty of Care that must be executed with Due Diligence. Duty of Care is a legal philosophy that says a Nation, Government, or Employer has a Duty or Responsibility to Care (i.e., not place in undue risk or harm) for those individuals under their responsibility. This includes not only militaries & those working with or for militaries but also includes civilians in proximity to where governmental actions or often inactions occur. Governmental actions or inactions also include those of its subordinates or employees. This is very similar to the military concept that a senior officer can pass authority down to subordinates but can never pass final accountability down. The senior officer may hold subordinates accountable for their actions or inactions, but the final accountability always remains with the senior officer.

Due Diligence is a legal concept that implies that the Nation, Government, or Employer must execute their Duties or Responsibilities faithfully; i.e., not negligently. Negligence is knowingly executing a Duty or Responsibility wrongly and to the harm of someone. Harm of someone can be physical harm (injury or death) to an individual, financial harm to an individual, or harm to those associated with the harmed individual. Individual, in this discussion, includes groups of individuals; i.e., families, villages, financial associations (organizations or companies) of individuals, etc. Negligence results in legal liabilities; i.e., costs to make the injured person whole or criminal punishment to those held accountable by the Nation's legal system. This holding of accountability will be determined by the Nations legal system using their laws and culture and can have significant consequences to those held accountable.

The incident in Zygi Cyprus on 11 July 2011 and its ramifications are a prime example of not only immediate consequences (death and injuries) resulting from a munitions incident but also of the legal consequences to those in authority who should have and were in positions of authority to have taken actions to prevent or at a minimum mitigate the potential immediate consequences. The incident was the mass detonation of approximately 89 ISO container containing nitroglycerine and nitrocellulose based propellants. Refer to Figure 12 for photos of the Cyprus Naval base where the ISO containers were stored (left side photo) and the Cyprus electrical power plant (right side photo), which is located adjacent to the Naval base.

The immediate consequences were 13 individuals killed, 62 injured, and the sever damage and destruction to the Cyprus power plant and resulting black out of half of the Nation. The damage and destruction to the Cyprus power plant has been estimated at over 3 Billion Euro (~4 Billion US Dollars). That is significant to any Nation.

Figure 12

However, the consequences of the incident have not stopped. As reported by the Associated Press (AP) on 9 July 2013, a "Cyprus criminal court on Tuesday found a former defense minister guilty of manslaughter for the 2011 explosion of confiscated Iranian munitions that killed 13 people and badly damaged the country's main power station.
"The three-judge panel ruled that Costas Papacostas, 73, was responsible for the safeguarding of some 80 gunpowder-filled containers and was aware of the dangers posed by the munitions, but failed to take action to prevent the detonation. The court said that nothing was done to eliminate the danger of a possible explosion, even after some of the gunpowder detonated in one container a week before the larger, fatal blast — something that a military official had warned at the time was like a heart attack foreshadowing worse things to come. The danger and the warnings were such that the fact that no measure was ever taken while it was possible indicates such indifference as to constitute willful negligence," the judges said.

> "Three top fire service officials; Fire Chief Andreas Nicolaou, his suspended deputy Charalambos Charalambous and Disaster Response Unit chief Andreas Loizides were found guilty of the lesser charge of causing death through a reckless and dangerous act.
>
> "The court said the three had "failed to deal with the dangerous situation as they ought to have done." Two other defendants, former Foreign Minister Markos Kyprianou and ex-deputy National Guard Chief Savvas Argyrou, were acquitted of all charges."

The above is a prime example where a Nation is willing and has held very senior individuals responsible for the consequences of explosive incidents. Other Nations are removing what for some Nations has been an exemption for munitions approving military or civilian officials when a non-combat incident involving or caused by those munitions causes harm. The potential reasonability exists that a munitions approving individual will be held legally accountable for an incident where the application of IM principals might reasonably have prevented the incident or greatly reduced / mitigated the consequences.

This leads us to why it is necessary and prudent for a Nation to have sound policies. Policies help a Nation define and document its' goals, the responsibilities of organizations or individuals, and the approaches it will have undertake. As such, policies are appropriate and necessary for militaries, Nations, and Allies that will work or exercise military powers in alliances. Nations also need IM policies to define in legal terms their due diligence and what they desire to achieve. Policies should also define: what is IM? When to we desire to achieve it? How do we desire to achieve it? How will we know when we have achieved it? Which munitions or which portion(s) of the national munitions stockpile? Why (this is the Duty of Care issue)?

Allies need common policies or understanding of their allies' policies to facilitate alliance interoperability, use, storage, handling, transportation of munitions, and joint or common production or procurement of munitions. Policies will be discussed in greater detail in Policy Development and Why lecture, paper, & presentation.

A report by the US Center for Naval Analysis, A Historical Perspective of Insensitive Munitions and Their Estimated Contribution to CV Safety, noted that "History has vividly demonstrated the need for safety in naval operations. It has been projected that in four aircraft carrier fires alone, an estimated 148 deaths, 577 injuries, and $1.15 billion in FY 1991 dollars [sic] in ship and aircraft damages would have been saved had IM standards been in effect. IM standards are estimated to significantly influence the magnitude of the damage, in terms of lives and material. For these specific incidents, IM standards would have reduced material loss 84% and lives 67%."

That report would probably be used in any legal case in the US if such incidents occurred again without IM munitions. That report was also released approximately the same time frame as the Camp Doha incident, refer to Figure 13. That report, the Camp Doha incident, and lots of work by senior military and civilian officials in the US Navy and the US Department of Defense lead to IM being codified in US law and policy.

Figure 13

The first result was an expression of Congressional Special Interest in that Chapter 141 of Title 10, United States Code, is amended by inserting after section 2388 the following new section: "§ 2389. Ensuring safety regarding insensitive munitions. "The Secretary of Defense shall ensure, to the extent practicable, that insensitive munitions under development or procurement are safe throughout development and fielding when subject to unplanned stimuli."

Next was development of the US Department of Defense Policy, DoD 5000.1 (Signed May 12, 2003): 1.1 Safety. This stated that "Safety shall be addressed throughout the acquisition process. Safety encompasses human (includes human/system interfaces), toxic/hazardous materials and substances, production/manufacturing, testing, facilities, logistical support, weapons, and munitions/explosives. All systems containing energetics shall comply with insensitive munitions criteria.

Third was the development and issue of the US Joint Chiefs Policy, Chairman, Joint Chiefs of Staff Instruction 3170.01B: "Requirements Generation System: J-4 will certify that all MNSs, CRDs, and ORDs for munitions, regardless of ACAT level, conform with insensitive munitions design requirements to withstand unplanned stimuli through use of the least sensitive system design. Insensitive munitions and cross-Service interoperability waiver requests require approval by the JROC. Waiver requests will be submitted to J-4 for review and forwarding to the JROC Secretariat."

MNSs are Mission Needs Statements, CRDs are Capability Requirements Documents, and ORDs are Operational Requirements Documents. These are the driving documents for the development and use of any US military system including munitions.

The JROC is the Joint Requirements Oversight Council; this is a council of senior 4-star officers from each of the US military Services. This is about as high an organizational element in the US military as possible; without actually addressing the actual Joint Chiefs of the individual Services. Other Nations have similar IM policies and oversight organizations; the US is only used as an example. Each Nation's policies and organizational structure must conform to and support their Nations legal structure and culture,

The next question often addressed by Nations and individuals is the performance of IM munitions. Some have asked if munitions are IM, does that mean they are Inert? The answer is most definitely No, IM does not mean Inert. IM munitions are still filled with energetic materials which will detonate or provide propulsion as designed.

The follow-on question is usually will Insensitive Munitions perform as Required? The answer is Yes, by most Nations' and NATO's Definitions (i.e., STANAG 4439) IM munitions must Also meet their required Performance parameters. Nations, and again using the US example, require IM munitions to meet their required performance parameters as defined by their MNSs, CRDs, or ORDs.

In fact, many new IM munitions exceed the performance parameters of the munitions they replaced. This is due to new energetic materials developed under IM programs that not only have greater insensitive properties but also greater energy per mass of material than older energetic materials. Many Nations still use the term TNT equivalent which addresses the explosive power of a mass weight of TNT (trinitrotoluene). Most new energetic materials are well beyond that measure.

The NATO Munitions Safety Information Analysis Center (MSIAC) maintains a database on reduced vulnerability munitions. This database is named the IM State-Of-the-Art (IMSOA). The IMSOA is updated yearly by the MSIAC staff based upon information received from MSIAC Member Nations. The last update noted there are 16 Air Launched, 24 Ground Launched, and 9 Sea Launched munitions that are either completely IM compliant or significantly close to full compliance.

Refer to Figure 14 below for information older information out of the MSIAC IMSOA that shows the great improvements that have been made in the IM properties and performance of US general purpose bombs. The Figure shows the IM Signature has progress from complete "Red" Type I reactions, which indicates "detonation" of the round in its IM test, as defined by NATO STANAG 4439, to almost but not quite "Green" Type IV and V reactions to those same IM test.

And, note the performance of these is new IM bombs is slightly more effective than "MK 83/82 in Ground Burst and Soft Target scenarios". IM performs as required and in certain munitions performs better.

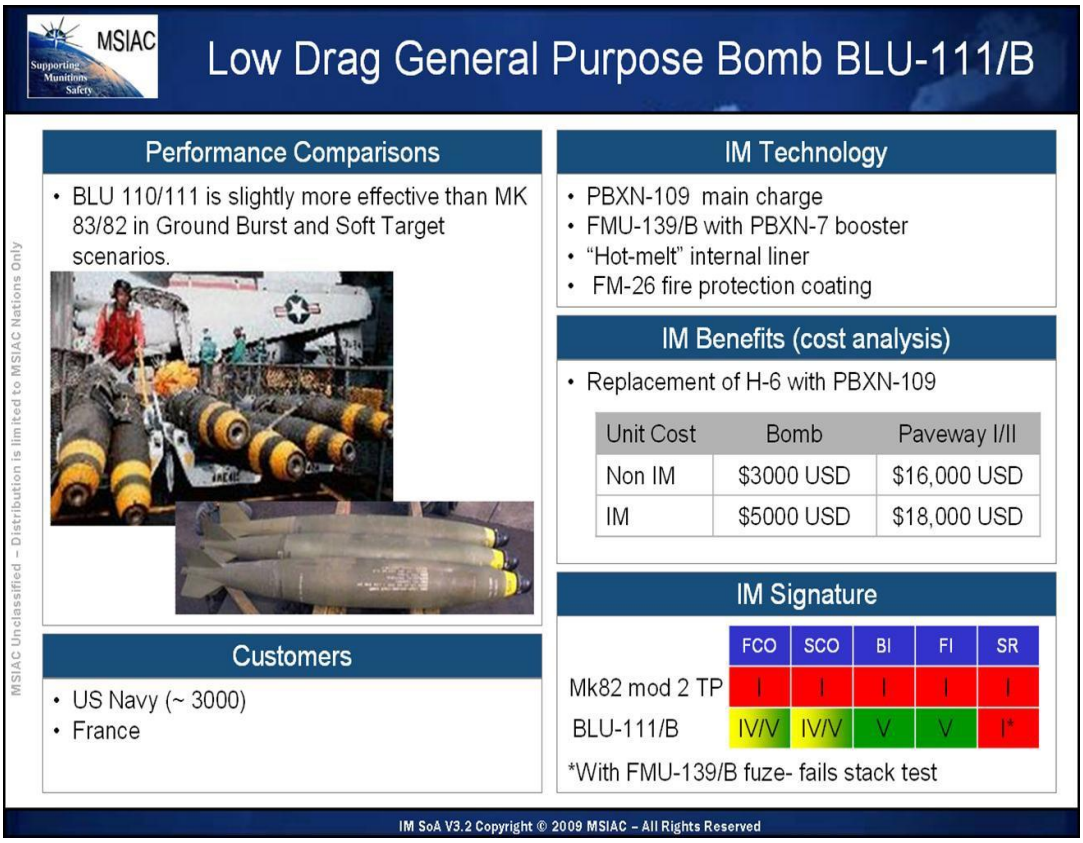

Figure 14

The next question that is usually asked when addressing IM and the need is: Why not just Mandate that Munitions be "Safer"? The obvious answer is that mandates are useless without definitions, direction, goals, authorities, responsibilities, and funding. The US examples show that Policies provide and document the National will & direction, and the Policy Development and Why lecture, paper, and presentation how that direction and will is executed.

Of course, one must also ask; What is "safer"? That really depends on what is your Nation's and culture's definition and acceptance of risk? In basic terms nothing is 100% safe & nothing is 100% unsafe. Water is necessary for life, but the drinking of too much water in too short of a time period can and has lead to death. This is not through drowning but through the destruction of your blood cells and their ability to absorb and release oxygen in a controlled manner that is useful to you body. A similar statement can be made about oxygen, which must be transferred from your lungs into your blood and to your body and its organs to sustain your life. However, too much oxygen can lead to a shut down of one of your automatic systems that cause you to breath. As such, everything has risks and benefits. The question to be asked is when do the risks outweigh the benefits?

Some ask; Why are munitions not ―safe enough‖ already? The answer is that the definition of‖Safe Enough‖ has changed many time through history as changes have incurred in technology, knowledge, and the value a Nation and its' peoples place on national capabilities and human life. Therefore to answer the question; What is "safe enough"? You must address what is your Nation's acceptance of risk and/or your National risk avoidance culture. That is one method of: How is "safer" measured? It is measured by test, by the history of others, by the probable consequences, and your Nation's risk acceptance and culture.

In war situations risk is always a factor, refer to slide 29 in the accompanying presentation, which shows the result of two attacks on bases in Iraq and Afghanistan. The risk is shown in both photos, enemy actions resulting in destruction. In the left photo you can see results of incoming munitions. In the right photo you

can also see the result of incoming munitions. The risk was the same in both photos; the interesting feature is in the right photo where it shows some of the mitigation to that risk. IM is another level of mitigation to that risk.

The IM technology objectives are to increase total life cycle safety, increased platform and crew survivability, increase operation safety, reduced weapon life cycle costs, facilitate reduction in hazard classification through increased storage safety which facilitates reduced quantity-distance requirements. This results in less real estate for munitions storage & handling operations. All this while maintaining or increasing performance. That is the same or greater bang for the Dollar or Euro.

Many Nations have succeeded in developing, procuring, and placing into operations munitions with improved IM properties. While Nations inventories are still not fully IM compliant, there have been significant advances in many Nations. NATO Nations are leading the way in the world in advancing IM and enhancing the safety of their munitions inventories. Figure 15 is the response of a single non-IM 155MM projectile when subjected to a bullet impact test. Quite dramatic.

Figure 15

Figure 16 is the response of 155 MM rounds from two different Nations (South Africa and France) when subjected to bullet impact tests. Note the French round on the right was hit twice and still no adverse reaction. Both rounds will reliably fulfill their intended purpose.

Figure 16

As noted earlier the reality of IM is changing. Refer to Figure 17 for a table from MSIAC's database tool SYR which shows the 155 MM projectiles that pass the IM Sympathetic Reaction Test.

Munition	Donor (D) and Acceptor (A) Charge Features					Mitigation			Test Set up			Results			
Name (Return to Front Page)	Energetic Material	Composition	External Diameter (mm)	Case Thickness (mm)	Case Material	Mitigation Material	Mitigation Thickness (mm)	ρ (g/cm³)	Distance Donor Skin to Acceptor Skin (mm)	Distance Skin of Donor to Mitigation (mm)	Distance Skin of Acceptor to Mitigation (mm)	Initiation Mechanism	Reaction Type	Configuration	Ref
155 mm Shell	TNT (D) RDX/TNT (A)	(D) 100TNT (A) 50TNT 50RDX	155		Steel	Poly-ethylene	40	-	40			SDT	IV	One on One Buffered	32
155 mm Shell	TNT (D) TNH (A)	(D) 100TNT (A) TNT HNS	155		Steel	Poly-ethylene	40	-	40	0	0	SDT	IV	One on One Buffered	32
155 mm Shell	TNT (D) TT (A)	(D) 100TNT (A) 40TNT 60NTO	155		Steel	Poly-ethylene	40	-	40	0	0	SDT	NR	One on One Buffered	32
155 mm LU-211M	XF-13333	48NTO 31TNT 14Al 7Wax	155	16.4 15 8	Steel	-	-	-	35 35 114			SDT SDT DSDT	IV	One on Many Unbuffered	15
155 mm M107	PAX-196	RDX Wax	155	20 to 23	Steel	Possibly HDPE						SDT DSDT	■	One on Many Buffered	81
155 mm M107	PBXW-108 mod	82RDX 18Wax binder	155	20 to 23	Steel	HDPE	9.53	0.95				SDT DSDT	■	One on Many Buffered	84
155 mm M795 Shell	IMX-101	DNAN NTO Other	155		Steel	-	-	-	29 29 105			DSDT	ND	One on Many Unbuffered	80
155 mm M795 Shell	IMX-102	TNT NTO Chlorinated Wax	155		Steel	-	-	-	29 29 105			DSDT	ND	One on Many Unbuffered	80
155 mm M795 Shell	IMX-103	NQ RDX DETN EDD MeNQ HBNQ	155		Steel	-	-	-	29 29 105			DSDT	ND	One on Many Unbuffered	80
155 mm M795 Shell	PAX-196	RDX Wax	155		Steel	Possibly HDPE			29 29 105	0	0	SDT DSDT	■	One on Many Buffered	81
155 mm XM0121A18 Shell (Assegai)	SPX-1 (Filling) DPX-2 (Sup. charge)	SPX-1 (Pres.) RDX Binder DPX-2 92HMX 2Hytemp 6DOA	155		Steel	Polyethy-lene	#12.7 tube around each shell	0.95	29 29 105	0	0	SDT DSDT	■	One on Many Buffered	82
155 mm XM982 Shell (Excalibur)	PBXN-9	92HMX 2Hytemp 6DOA	155		Steel	Packaging						SDT DSDT	ND	One on Many Buffered	85

Figure 17

Figure 18 shows the bullet impact to a non-IM US General Purpose (GP) bomb and the new GP bombs with an IM energetic material explosive. The dramatic difference between the top series of photos and the bottom series shows the success of IM developments and the reduction of risks.

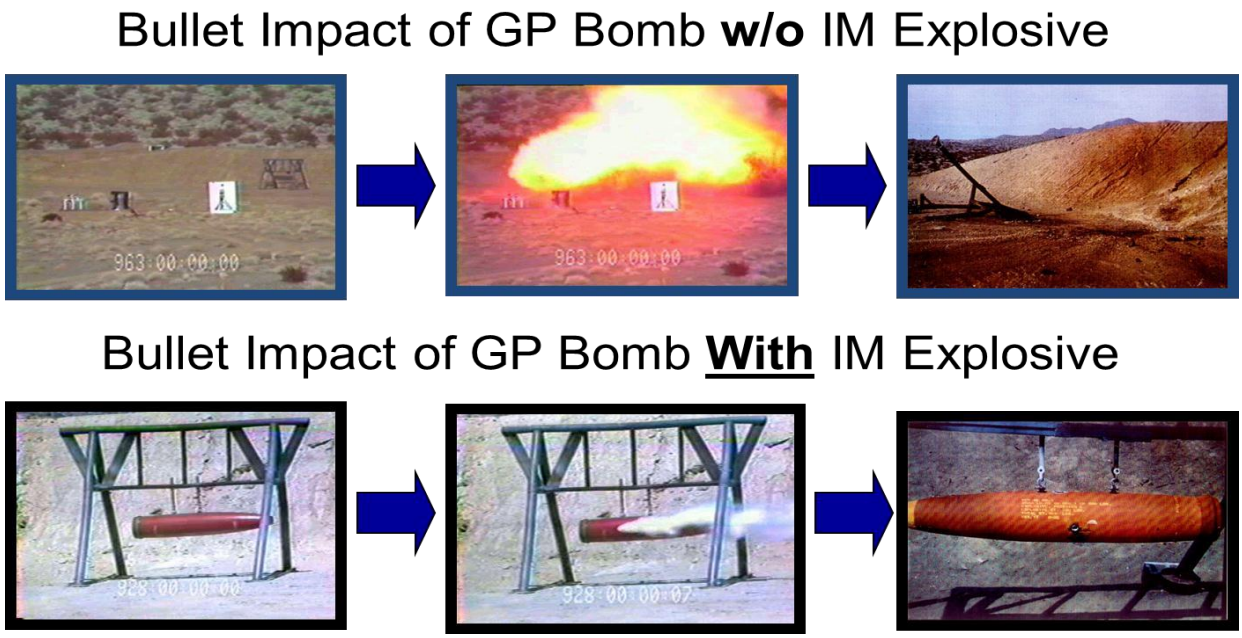

Figure 18

Figure 19 shows the operational impact of IM bombs to an aircraft career. Notice the difference IM would make and refer back to Figure 4 and the impact of non-IM bombs to the USS Forestall.

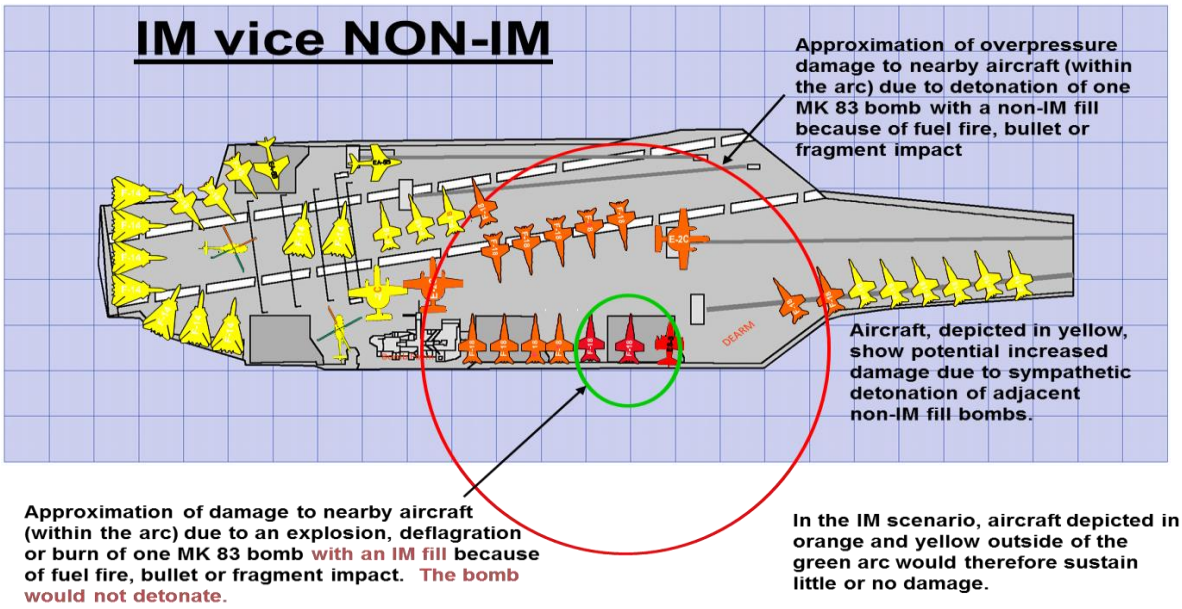

Figure 19

It is obvious that IM munitions are safer than non-IM munitions. Figure 20 shows some of the handling operations on US aircraft careers with IM bombs.

Figure 20

IM is an initiative to increase survivability. It is acquisition-driven to integrate energetic materials and munitions design technologies that reduce weapons' reaction violence and collateral damage to heat, shock and impact stimuli while maintaining performance.

IM is not a substitute for safety. IM is not Inert Munitions - IM munitions are still as or more powerful than non-IM munitions. IM is not a negative impact to National Munitions Safety Requirements, but is an enhancer to those requirements as munitions will still be transported, stored, deployed, and used, if necessary, as munitions.

The need has been answered; IM is important to protect platforms and personnel from collateral damage from our own weapons – whether through accident, combat, or terrorist activities.