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Motivations for North Atlantic Treaty Organization Standardization of Hazard Classification Procedures

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Introduction

- This and the next presentation form a pair

- Next presentation will provide the status a Hazard Classification (HC), Insensitive Munitions (IM) and Hazard Frequency initiative that a NATO AC/326 working group has been tasked to pursue
  - Was previously presented at NDIA IM & Energetic Materials Technology Symposium in April 2018 in Portland, Oregon

- Based on that experience this prefacing paper and presentation was created for this NDIA symposium & exhibition, and for MSIAC's upcoming Improved Explosives and Munitions Risk Management (IEMRM) Workshop

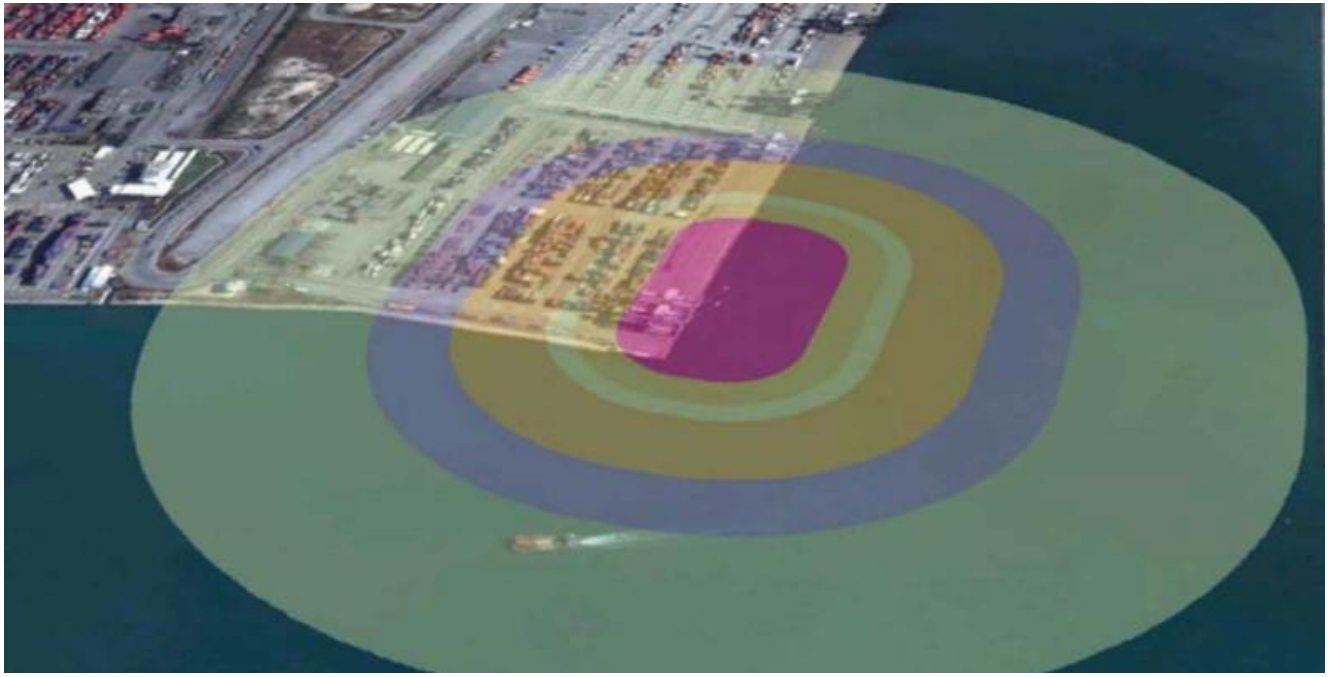
- This presentation explains the primary impetus for that NATO AC/326 initiative was HC procedure standardization
  - As a consequence, IM became unavoidably involved in the NATO AC/326 initiative due to the harmonized manner in which the U.S. DoD executes its HC and IM business

Why Standardize NATO HC Procedures?

- All Quantity-Distance (QD) applications are based on HC
  - Individual QD table for each HC
- If using wrong QD tables due to incorrect HC assignments, then arcs are either under- or over-sized
  - Not providing intended explosives safety protectiveness; or
  - Encumbering real property unnecessarily
- Any inconsistencies in HC assignments by various nations that exist during NATO multi-national Explosives Safety and Munitions Risk Management (ESMRM) situations can directly effect appropriate leadership's risk acceptability decision-making

NATO Multi-National ESMRM Situations

- Military operations compel consideration of deviations from the explosives safety standards
- Risks posed will be higher than ordinarily acceptable
- Risks must be specifically analyzed and then communicated to appropriate leadership for a risk acceptability decision
- Depiction of risk situation based on aggregation of underlying HCs assigned by multiple nations to their munitions at the site



Which HC Aspects Need Standardizing?

- Ambiguities within United Nations (UN) Recommendations on the Transport of Dangerous Goods Model Regulations* & Manual of Tests and Criteria** (hereafter referred to as the Orange Books (OBs))
  - Division 1.1 mass explosion
  - Division 1.1 declared from outset
  - From QD perspective, Division 1.6 (and NATO Storage sub-Division (SsD) 1.2.3) is unneeded if Division 1.3 assignment is attainable for high explosive (HE) military munitions using UN Test Series (TS) 6
  - Broad leeway provided to Competent Authorities (CA) in executing HC assignments

- Mismatch between Division 1.2 HC assignment criteria and current basis for Division 1.2 QD

* Volumes I and II, *Twentieth revised edition,* Copyright © United Nations, 2017.
** *Sixth revised edition,* Copyright © United Nations, 2015; & *Sixth revised edition Amendment 1,* Copyright © United Nations, 2017.

Division 1.1 Mass Explosion Ambiguity

- The OBs define a Division 1.1 mass explosion as one that effects almost an entire load virtually instantaneously
  - Subjective

- The OBs also state test results indicative of a mass explosion following UN TS 6(a) Single Package testing are a **crater** or **damage to the witness plate beneath the package**, **blast measurement**, or **disruption and scattering of the confining material**
  - In UN TS 6(a) Single Package testing a donor munition, within its transportation packaging and under an additional confinement burden, is purposefully functioned in its design mode
  - That act of intentionally detonating any typically sized HE military munition will unquestionably create all those effects supposedly indicative of a mass explosion
  - But those indicative effects are actually not relevant to whether almost an entire load of those packaged military munitions will explode virtually instantaneously

Division 1.1 Declared from Outset

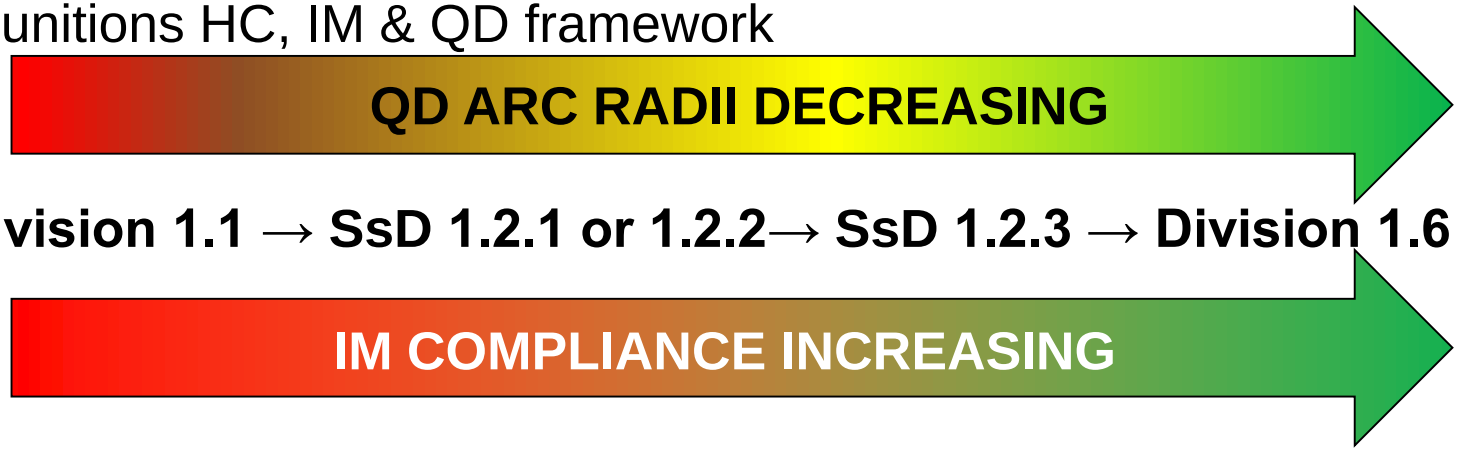
- The OBs permit explosives to not go through the normal HC assignment procedure when an explosive has been declared from the outset to be in Division 1.1

  - Can be applied to both avoid resource expenditures for testing and to save time, so usage of this allowance can be appealing to military munitions program managers keenly focused on acquisition costs, schedule and performance, with less attentiveness to life-cycle sustainment consequences

  - But if such a Division 1.1 assignment does not accurately reflect how an entire load of those explosives behaves in terms of producing a mass explosion, then all Division 1.1 QD applications downstream of that declaration from the outset become deleteriously effected in terms of their accuracy too

Assigning Div. 1.3 to HE Military Munitions Using UN TS 6

- HE munitions HC, IM & QD framework



- Division 1.1 assigned if mass explosion in UN TS 6(b) Stack OR 6(c) Bonfire testing; otherwise SsD 1.2.1 or 1.2.2
- SsD 1.2.3 assigned if no package-to-package detonation (Type I) or partial detonation (Type II) propagation in Stack, AND burning (Type V) only in Bonfire, Slow Cookoff, & Bullet Impact testing
- Division 1.6 assigned if no detonation (Type I) or partial detonation (Type II) propagation in Stack, AND burning only in Bonfire, Slow Cookoff, Bullet Impact, & Fragment Impact testing

Division 1.3 is not in HE framework since that HC assignment is intended for non-detonable military munition configurations; but, it is possible for a CA to assign Division 1.3 to HE military munitions when running UN TS 6 results in no mass explosion in Stack AND burning/fiery projections in Bonfire testing

Broad Leeway Provided to CAs Assigning HCs

- The originators of the OBs recognize that the contents do not provide all the details and precision necessary for assigning accurate classifications; CAs are ultimately responsible and must maintain their competency

- For consistency in guiding US DoD HC assignment decision-making, a Joint Technical Bulletin (TB 700-2) is maintained prescribing how to handle numerous HC situations that have arisen over time and are expected to continue to arise

- New HC decision situations also arise, and revisiting past HC situation resolutions can happen too, for example when changes to the OBs occur

The broad HC leeway afforded to CAs by the OBs, if not controlled within NATO through standardization, will typically manifest itself by someone observing that varying HCs having been independently assigned by different NATO nations' CAs to the same explosive article in the same transport packaging

Mismatch Between Division 1.2 HC Assignment Criteria and Current Basis for Division 1.2 QD

- Projection (or fragment) hazard component of established NATO QD criteria intends to afford appropriate protectiveness to people from 58 foot-pound (~79 Joule (J)) impacts

- The OBs metal projection criterion for assigning Division 1.2 is now 20J

- So a significant mismatch currently exists, and the consequence is the QD siting of military munitions being assigned Division 1.2 HCs in accordance with that OB criterion may often be unnecessarily encumbering an amount of real property commensurate with 79J projection production

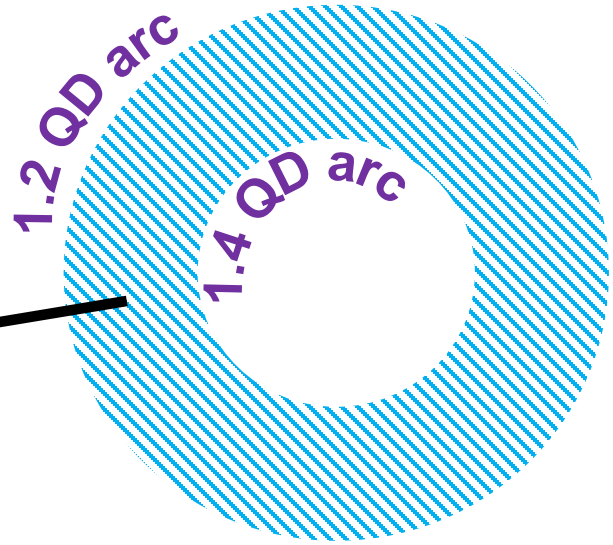
Revisiting the UN OB Division 1.2 20J HC projection energy criterion, specifically in the context of military-unique munition HC assignments, could solve the significant consequence caused by its divergence from the Division 1.2 79J QD criterion that has existed indefinitely

Example HC Test Data Outcomes

- ~ 150 metal projections > 8J
- ~ 1 dozen metal projections > 20J
- 0 metal projections > 79J
- ~ 0.1 psi maximum peak overpressure
- Irradiance < 4kW/m^2
- fiery projections > 15m

But no projections of the 79J characteristic upon which Division 1.2 QD criteria is based

Real property unnecessarily encumbered by 1.2 QD arc when >20J, but no 79J projection hazard exists



Data representative of 0.50 cal TP (with tracer) cartridges packaged ~100 per metal ammo can

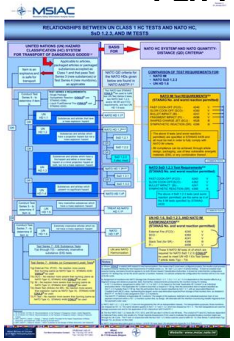
U.S. DoD's Execution of its HC Assignment & IM Assessment Business

- HC/IM test methods and Response Descriptors for assessing results imposed by United Nations (UN) Transport of Dangerous Goods (TDG) publications & by NATO STANAGs are quite duplicative
  - Equivalency is by design; not just coincidental
- Purpose of that harmonization is so one minimalized test series can be run, and from those test results the HC assignment and IM signature can be derived
  - U.S. DoD has executed in such a harmonized manner for many years
  - U.S. DoD in essence runs UN Test Series (TS) 7 on its military munitions
    - Many munitions have been assigned to Hazard Division (HD) 1.2.3, though none assigned to HD 1.6 yet
- Significant synergy established between U.S. DoD HC & IM communities

WHY DON'T OTHER NATO NATIONS OPERATE LIKE THE U.S. DoD?

Other Nations' Execution of their HC Assignment & IM Assessment Business

- It seems the national laws of other nations dictate that HC assignments must be executed in accordance with the UN TDG publications
  - Such HC laws seem to be commonly interpreted, at least by other nations' HC Competent Authorities (CA), as meaning they must assign HCs by running UN TS 6, unless assigning Division 1.6 (then run UN TS 7 instead)



  - Perhaps HC CAs, especially in civilian and not defense agencies, are totally unaware of, or quite unfamiliar with, NATO's set of STANAGs that closely duplicate the UN TDG's test methodologies
- It seems other nations independently run two overlapping test series
  - One series per UN TS 6 for HC purposes
    - Few, if any, munitions have been assigned to HD 1.2.3
  - And another series per NATO STANAGs for IM purposes
    - Relatively little synergy between HC & IM communities
    - Often refer to the "IM STANAGs" and "IM Response Descriptors"

SOLUTION: CHANGE UN TDG PUBLICATIONS TO PERMIT HC OF MILITARY MUNITIONS BY RUNNING UN TS 7

Summary

- HC procedure standardization is important and necessary
- No intention whatsoever for mandatory retroactive application of any new UN TS 7 procedures to military munitions that have already been assigned hazard classifications
- Purposefully interwoven relationship between HC, IM and QD means applicable NATO and UN standards cannot be adjusted independently without unintended consequences
  - Phase 1 – NATO agreement
  - Phase 2 – UN engagement

Requesting HC, QD and IM expert involvement in NATO initiative

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