US Navy IM and HC Testing Guidance and Integration

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Acknowledgements

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Outline

- BLUF
- Background
- Applicable Specs & Stds
- Harmonized IM/HC Tests
- Test Plan Template
- Template Organization
- Test Procedure Outline
- LF/EF (FCO) Example / Excerpt
- Concluding Remarks

BLUF

Paper

To inform the Insensitive Munitions (IM) and Munitions Safety communities on the NOSSA IM Office (IMO) initiative to develop a template for Naval programs for preparing harmonized IM/Hazard Classification (HC) Test Plans in a standard format.

Template

To provide for ease of review and timely processing by the Navy IMO and Hazard Classifier, the Naval Munitions Response Evaluation Board (MREB), the other Joint Hazard Classifiers, and the Department of Defense Explosives Safety Board (DDESB).

Background

Combined IM/HC Testing

- MIL-STD-2105B, 12 January 1994
  - Designates tests as IM tests
  - Coordinates testing with Joint Hazards Classifiers
- TB 700-2/NAVSEAINST 8020.8B/TO 11A-1-47/DLAR 8220.1, 5 January 1998
  - Recognizes selected IM tests as acceptable alternate HC tests
    - FCO (Fast Cook-off) –-- UN Test 6(c) - Bonfire
    - SCO (Slow Cook-off) -–– UN Test 7(h) - 1.6 article SCO test
    - BI (Bullet Impact) -–– UN Test 7(j) - 1.6 article BI test
    - SD/R (Sympathetic Detonation/Reaction) -–– UN Test 6(b) - Stack test

Applicable Specs & Stds

- ASTM Standard E1742/E1742M-12 (Radiographic Exam)
- MIL-STD-2105D (Hazard Assessment Tests for Non-nuclear Munitions)
- NATO STANAG 4439 (Policy for Introduction, Assessment and Testing for IM)
- NATO Test STANAGs (4240 - FCO, 4382 – SCO, 4241 – BI, 4496 – FI, 4396 – SR, 4526 – SCJ, & 4375 – Safety Drop)
- NAVSEAINSTs (8020.8C – HC Procedures & 8010.5C – IM Program Planning and Execution)

Harmonized IM/HC Tests

TEST	REFERENCE	# OF TESTS	TEST CONFIG.	MODS
LF/EF (FCO)	STANAG 4240, E2 (Revision in process)	2	1 Test Logistical 1 Test Operational	-
SLOW HEATING (SCO)	STANAG 4382,E2, Procedure 1	2	2 Tests Logistical	-
BI	STANAG 4241, E2, Procedure 1 (HD1.2.3/ 1.6) (Revision in process)	2(3)	1(2) Logistical 1 Test Operational	-
FI	STANAG 4496, E1, Standard Procedure	2	1 Test Logistical 1 Test Operational	-
SR	STANAG 4396, E2	2	2 Tests Logistical (1 Test w/confinement, 1 Test w/o confinement)	-
SCJ	STANAG 4526, E2, Procedure 2 (Revision in process)	2	1 Test Logistical 1 Test Operational	-
THERMAL STABILITY ARTICLES	NAVSEAINST 8020.8C	1	1 Test Logistical	-
40 FT DROP	NAVSEAINST 8020.8C	3	3 Tests Logistical	-

Test Plan Template

- Template is in WORD format and available for download
  - NOSSA website
  - IM Technology Tool (IMT2) on the Defense Systems and Technologies: Knowledge Online (DSTKOL)
- Combined IM/HC document in a standard format
  - Test requirements and procedures
  - Extensive notes and many sections of embedded text (blue font)
    - Readme First page
    - Applicable specifications and standards (update, if needed)
    - Guidance & best practices
    - Munition-specific tailoring
- Facilitates coordination of test plans with:
  - Navy IM/HC offices, Munitions Response Evaluation Board (MREB)
  - Joint Hazard Classifiers and DDESB

Template Organization

- Introductory Sections
  - Scope & Objectives
  - Applicable Specifications and Standards (Slide 6)
  - Munition Program Overview & System Description
- Test Approach – Harmonized IM/HC Tests (Slide 7)
- IM/HC Test Procedures
  - Common Test Requirements
    - Visual and Radiographic Inspection
    - Ambient Test Conditions
    - Air Blast Measurements and Calibration
    - Fragment Recovery
  - Six Combined IM/HC Tests
  - Two Additional HC Tests

Test Procedure Outline

- Test Objective
- Test Configuration and Required Assets
- Test Requirements

LF/EF (FCO) Example

Test Requirements

- Test Environment,
- Fuel Pan Hearth, Fuel Type, Fuel Quantity,
- Position of the Test Items, Mounting of the Test Items,
- Fuel Ignition and Flame Spread Rate, Flame Temperature Rise Time, Average Flame Temperature,
- Instrumentation – Thermocouple Type and Locations, Witness Plate, Blast Pressure Transducers, Radiometers,
- Photographic and Video Coverage
- Fragment Recovery
- Test Record

LF/EF (FCO) Test Setup

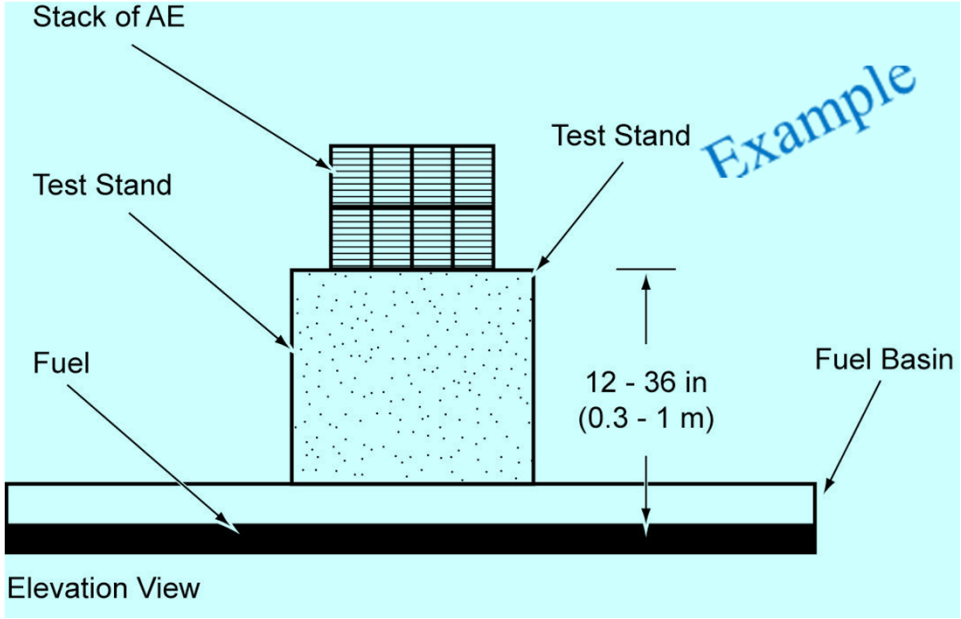

Figure (diagram) of the general LF/EF test set-up for the USN Munition (Logistical or Operational Configuration) – Show: (1) Test items on steel test stand positioned in fuel pan, (2) dimensions of the fuel pan with respect to the test items/stand, (3) vertical distance from surface of fuel to bottom of test items, and (4) Restraints for test items (locations/coordinates).

LF/EF (FCO) – Test Record

- Test date(s).
- Test article serial number(s) (S/Ns).
- Types of energetic materials and weights.
- Meteorological conditions at the time of the test (i.e., wind speed and direction, temperature, and barometric pressure).
- Quantity and type of fuel used.
- Records/descriptions of any events versus time through the end of the test.
- Blast overpressure records.
- The nature of any reactions by the test items, including indication of propulsion.
- Description of all the pieces of the test items that are recovered, including the 360^{o} fragment collection, approximate size and/or mass, condition, and location (range and azimuth relative to the test stand) of all pieces (fragment map and photographs).
- Thermocouple data (versus time) for all sensors.
- Radiometer data for all sensors.

Concluding Remarks

- Template is available on NOSSA website and IMT2 (DSTKOL).
- As U.S./NATO IM/HC tests, procedures, and requirements evolve, NOSSA will continue to update the template.
- Navy's template could be strawman for developing standard formats for Joint and NATO combined IM/HC test plan templates.

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QUESTIONS?

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BACKUP SLIDE

APPLICABLE SPECS & STDs

ASTM Standard E1742/E1742M-12	"Standard Practice for Radiographic Examination," ASTM International, West Conshohocken, PA, 1 November 2012
MIL-STD-2105D	Hazard Assessment Tests for Non-Nuclear Munitions, 19 April 2011.
NATO STANAG 4439	Policy for Introduction, Assessment and Testing for IM (MURAT), Edition 3, 17 March 2010.
NATO STANAG 4240	Liquid Fuel/External Fire, Munition Test Procedures, Edition 2, 15 April 2003.
NATO STANAG 4382	Slow Heating Munitions Test Procedures, Edition 2, 15 April 2003.
NATO STANAG 4241	Bullet Impact, Munition Test Procedures, Edition 2, 15 April 2003.
NATO STANAG 4496	Fragment Impact Munitions Test Procedure. Edition 1,13 December 2006.
NATO STANAG 4396	Sympathetic Reaction Munition Test Procedures. Edition 2, 15 April 2003.
NATO STANAG 4526	Shaped Charge Jet, Munitions Test Procedure. Edition 2, 10 December 2004.
NATO STANAG 4375	Safety Drop Munition Test Procedure, Edition 3, 15 June 2010.
NAVSEAINST8020.8C	Department of Defense Ammunition and Explosives HC Procedures, 30 July 2012.
NAVSEAINST 8010.5C	Insensitive Munitions Program Planning and Execution, 15 September 2015.