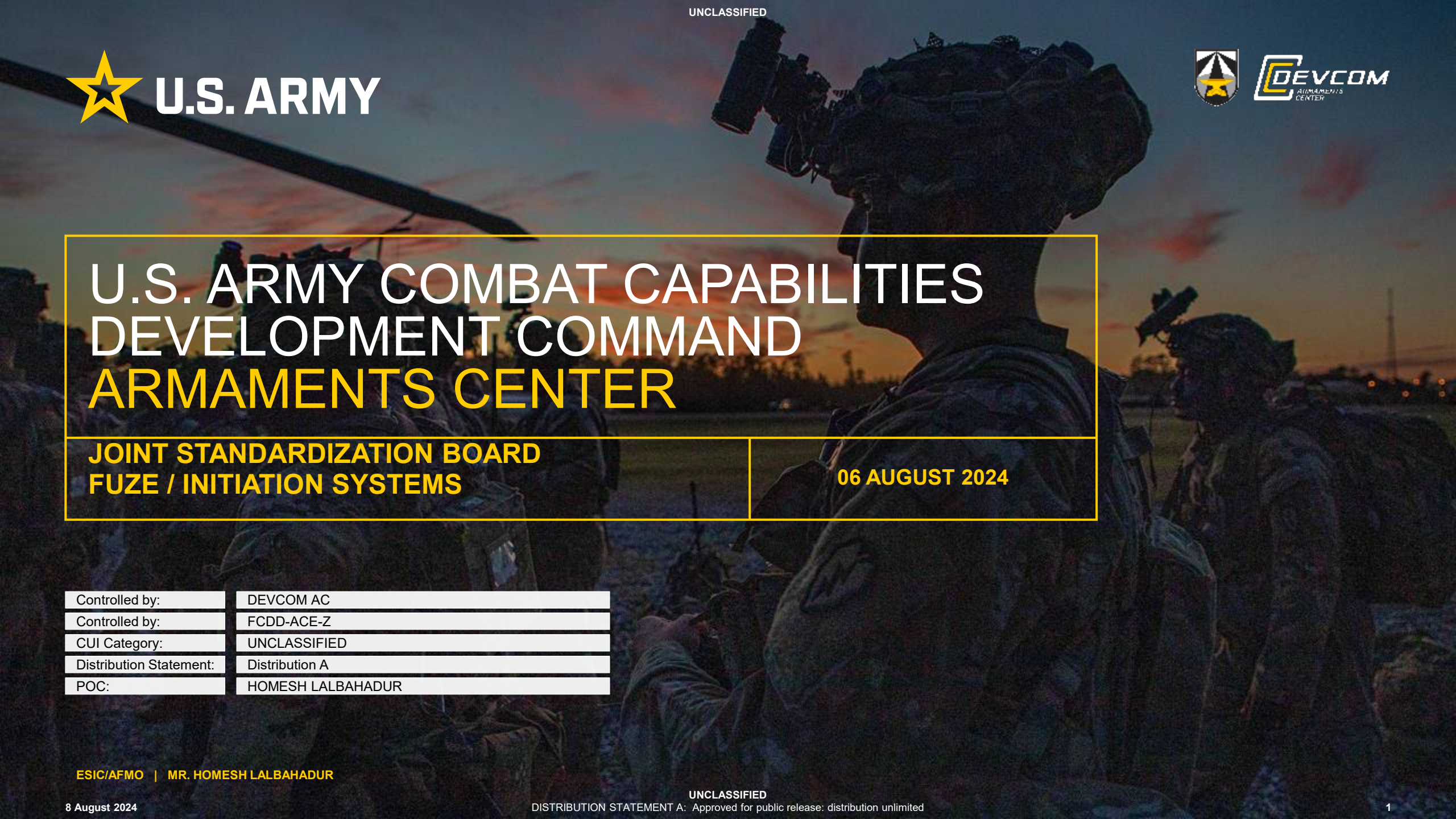

U.S. ARMY

DEVCOM ARMAMENTS CENTER

U.S. ARMY COMBAT CAPABILITIES DEVELOPMENT COMMAND ARMAMENTS CENTER

JOINT STANDARDIZATION BOARD FUZE / INITIATION SYSTEMS

06 AUGUST 2024

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AGENDA

- JSB for Fuze / Initiation Systems Overview
  - Mission
  - Significant Milestones
  - Membership
- Program Of Work
  - DoD Standards
    - Overview and Status
  - NATO Standards
    - NATO Organization & Document Structure
    - STANAG Status
- Summary and Key Takeaways

JOINT STANDARDIZATION BOARD FOR FUZE / INITIATION SYSTEMS

- Under the Defense Standardization Program, the Joint Standardization Boards includes requirements for munition **Fuze / Initiation Systems** represented by **DoD Fuze Engineering Standardization Working Group (FESWG)**

- **FESWG is chartered with the purpose to:**
  - Maintain a DOD-wide working arrangement to prepare and review, in an effective and timely manner, the US and NATO standards, guidelines, and handbooks for fuzes and other initiation systems employed in munitions.

  - Serve as a continuing group to facilitate standardization of fuzes and initiation systems, inclusive of associated design concepts, evolving technologies, packaging and logistics techniques, testing and evaluation procedures, with emphasis on assuring ***design safety and interoperability.***

DOD FESWG OVERVIEW

- **FESWG Significate Milestones - In operation for over 50 years**
  - 2003: Formally chartered under DSP (signed by DoD Standardization Executive)
  - 2006: Formally chartered under the Joint Standardization Board
  - 2024: Updated Charter in-staffing
  - 109th meeting in November 2024
- **FESWG Membership well diverse**
  - Chaired by – Army Fuze Management Office (AFMO)
  - Membership Includes Executive Secretary, Tri-service member leads, National Laboratories, and Subject Matter Experts. Industry & Academia can also be invited for guest appearances when there are new products of interest or specific expertise of interest needed.
- **Serves as the US body for Fuze & Initiation Systems Standardization.**
  - Establish and Maintain Fuze & Initiation Systems Engineering Standards
    - US Documents
    - NATO Documents
  - Review and Standardize new technologies for safety
  - Interact with Industry
  - Advise the Munition Safety Boards
- **Meetings**
  - Two formal position meetings held each year
  - Ad Hoc working groups meet as needed.

FUZE / INITIATION SYSTEMS IN DOD MUNITIONS






Critical technologies for safety, effectiveness, versatility, and operational efficiency

WHAT ARE FUZE AND INITIATION SYSTEMS?

Fuze / Fuzing System

- A physical system designed to sense a target or respond to one or more prescribed conditions, such as acceleration, elapsed time, pressure, or command, and initiate a train of fire or detonation of a munition's payload. Safety and arming are primary roles performed by a fuze to preclude initiation of the munition's payload before the desired position or time.

Initiation Systems

- A physical system to initiate an explosive train or component in a munition.
- Examples include ignition systems, active hazard mitigation devices, demolition systems, countermeasures devices, etc.

Fuze systems for warhead detonation

Ignition systems for rocket launch

JOINT STANDARDIZATION BOARD FOR FUZE / INITIATION SYSTEMS

DoD FESWG

- Fuze & Initiation Systems standardization authority for DOD
- Chaired by:
  Army Fuze Management Office
- Membership:
  - ✓ Army
  - ✓ Air Force
  - ✓ Navy
  - ✓ Guests and Other Govt Agencies

AC326 SG/A (IST)

- Fuze & Initiation Systems standardization authority for NATO
- Chaired by:
  Army Fuze Management Office
- Membership:
  - ✓ NATO Nations
  - ✓ Partner for Peace Nations
  - ✓ Other NATO affiliated Nations

ARMY FUZE MANAGEMENT OFFICE MISSION

Provide centralized oversight of all non-nuclear Army fuzing throughout the lifecycle

Fuze Technology & Fuze/Munitions Industrial Base	Joint Standardization Board Fuze & Initiation Systems	Fuze Safety Board
Propose, recommend and support actions directed towards ensuring fuze technology and the fuze industrial base are properly maintained • DoD Fuze Integrated Product Team • Joint Enhanced Munitions Tech Program (JEMTP) and Joint Munitions Program (JMP) • Fuze Technology Integration Program (FTI)	DoD's focal point for multi-service and international Fuze and Initiation systems standardization • Chair of the DoD Fuze Engineering Standardization Working Group (FESWG) for over 50 years • Chair of the NATO AC326 Subgroup A on Fuzing and Initiation Systems for over 30 years	Chairs and manages the Army Fuze Safety Review Board providing an Independent technical design safety review and Safety Certification authority • Facilitator & host of the Joint Service Fuze & Ignition Systems Safety Review Board

Oversight of Fuze Technology, Fuze Standards, and Fuze Design Safety involving DoD, Industry Partners, Academia & International Partners

FUZE / INITIATION SYSTEMS STANDARDS OVERVIEW

- Continuous evolution of Standardization Documents due to emerging needs & technologies
  - Existing documents being updated
  - New documents in process

- Frequent Coordination with Industry Partners
  - NDIA 4th Annual Future Force Capabilities Conference & Exhibition; 24-27 Sept 2024
    - “Impact of technology advancements on Fuze and Initiation Systems standards”
    - “JOTP-056 Inline Initiator Qualification”

- Recent accomplishments
  - Publication of Joint Ordnance Test Procedure (JOTP) - 055; Criteria for Submunition Advanced Features to Meet the 2017 DOD Policy on Cluster Munitions

Fuze / Initiation Systems Standards are well positioned to support DoD Modernization and Interoperability Priorities

STATUS OF FUZE / INITIATION SYSTEMS STANDARDS

DEPARTMENT OF DEFENSE STANDARDS	ACCOMPLISHMENTS
MIL-STD-1316 (Fuze safety design requirements)	***Revision F published on 18 Aug 2017***
MIL-STD-331 (Fuze safety test procedures)	***Revision D published on 31 May 2017***
MIL-DTL-23659 (Qualification tests for electric initiators)	***Revision F published on 10 June 2010***
MIL-STD-1901 (Launch ignition system safety design)	***Revision B in process***
MIL-STD-1911 (Hand-emplaced ordnance design safety)	***Revision B started***
MIL-HDBK-145 (US Fuze catalog)	***Revision D published on 9 June 2015 (This is continuously being updated)***
MIL-HDBK-504 Guidance on Safety Criteria for Initiation Systems	***Published on 10 February 2004***
MIL-HDBK-777 Fuze Catalog Procurement Standard and Development Fuze Explosive Components	***Published on 1 October 1985 (This is continuously being updated)***

STATUS OF FUZE / INITIATION SYSTEMS STANDARDS

JOINT ORDNANCE TEST PROCEDURE (JOTP)	ACCOMPLISHMENTS
JOTP-050 (Active Hazard Mitigation Device)	*Revision A published on 24 June 2019*
JOTP-051 (Logic devices)	*Revision A in process*
JOTP-052 (Fuze safety qualification test program)	*Published on 17 March 2012*
JOTP-053 (Electrical stress test)	*Published on 03 Nov 2015*
JOTP-054 (Low Voltage Command Arm)	*Published on 17 Oct 2019*
JOTP-055 (Criteria for Submunition Advanced Features to Meet the 2017 DOD Policy on Cluster Munitions)	*Published on 26 Jan 2023*
JOTP-056 (In-line Initiator Qualification)	*New in process*
JOTP-057 (Safety Design Guidelines (Criteria) for Remotely Controlled Fuzing Systems used in Munitions	*New in process*
JOTP-05x (Fault Tree Analysis)	*New in process*

FUZE / INITIATION SYSTEMS STANDARDS IN WORK

STANDARDS in work - FOCUS OF THIS PRESENTATION
MIL-STD-331E (Fuze Safety Test Procedures)
JOTP-052A (Fuze safety qualification test program)
MIL-STD-1901B (Launch ignition system safety design)
MIL-STD-1316G (Fuze safety design requirements)
JOTP-056 (In-line Initiator Qualification)
JOTP-057 (Safety Design Criteria for Remotely Controlled Fuzing Systems used in Munitions)
JOTP-05x (Fault Tree Analysis)
JOTP-055 (Criteria for Submunition Advanced Features to Meet the 2017 DOD Policy on Cluster Munitions) - (NEW)
Directed Energy Weapons (DEW) Firing Circuit Safety Design Criteria – (ON HOLD)

STANDARDS – IN WORK

MIL-STD-331, Revision E

- Describes tests used by the DoD to determine the safety, reliability and performance characteristics of weapon initiation systems, ignition safety devices, fuzes and their components at any stage in their lifecycle.
- Changes include:
  - Tests that can no longer be performed due to loss of testing facilities (Holloman AFB rain field).
  - Updates to vibration section.
  - Updates consistent with JOTP-052.

JOTP-052, Revision A

- Guidance on qualification test plan definition of fuzes, S&As and ignition safety devices.
- Changes include:
  - Subverted testing, addition of 5-ft drop tests, temperature track mixing and updates consistent with MIL-STD-331

STANDARDS – IN WORK

MIL-STD-1901, Revision B

- Design safety criteria for ignition systems & ignition safety devices for use with munition rocket and missile motors.
- Changes include:
  - New definitions, updates consistent with MIL-STD-1316F requirements, multiple-stage initiation systems and qualification requirements.
  - Changes are also being vetted with NATO SG/A for STANAG 4368 for commonality.

MIL-STD-1316, Revision G

- Design safety criteria for fuzes and Safety and Arming devices that are subsystems of fuzes.
- Changes include:
  - Updates consistent with MIL-STD-1901B updates, new reference documents, and new arming delay requirements.

STANDARDS – IN WORK

JOTP-056 (In-line Initiator Qualification)

- Establishes the qualification criteria for In-Line Initiators (ILI) used in safety sensitive, non-interrupted energetic materials train.
  - ILI includes both Exploding Foil Initiators (EFI) that are used for warhead initiation applications and Deflagrating In-Line Initiators (DILI) that are used in ignition systems with deflagrating or pyrotechnic outputs.

- Leverages from MIL-DTL-23659 – Maintains the general design requirements for all other initiators (i.e., hot wire initiators, exploding bridgewire initiators, conductive mix initiators, etc.).

- Organizes qualifications tests into the following grouping:
  - Foundational (Bare minimum tests to qualify the ILI at component level)
  - Application Specific (Tests to qualify the electrical characteristics of ILI within a munition)
  - Reliability(Tests for unique program reliability requirements)

- Updates Maximum Allowable Electrical Sensitivity Fireset parameters and Electrical cookoff test.

STANDARDS – IN WORK

JOTP-057 – (Guidelines for Safety Design Criteria for Remotely Controlled Fuzing Systems Used in Munitions)

- Establishes the design safety criteria for fuzes and Safety and Arming devices that are remotely controlled to permit capabilities for safe passage, recovery, and overhead safety operations.

- Supplemental to MIL-STD-1316 and MIL-STD-1911 for those munitions that have a remote-control capability.
  - Require multiple arm enable and safe transitions during operation (i.e., on-off-on)
  - Post deployment/emplacement activities such as safe passage, maintenance and recovery (aka User approaching deployed munition system)

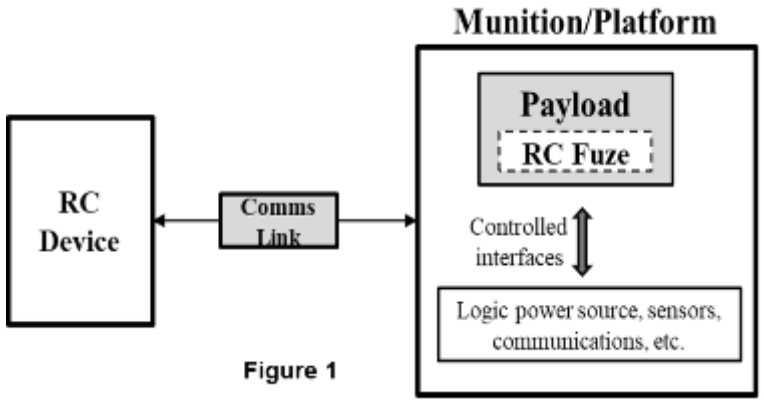


Figure 1

STANDARDS – IN WORK

JOTP-05x - Fault Tree Analysis

- Establishes the requirements and guidelines for the accomplishment of Fault Tree Analyses (FTAs) on safety critical systems. The methodology identified herein is to provide a basis for delivery of FTAs to Service Safety Authorities (SSA).

- The aim is to provide a conservative approach to develop FTAs that demonstrate the design robustness of the safety critical system by ensuring the safety design architecture does not contain single point failure modes and SSA agreed allowable safety failure rates are satisfied. The FTAs accomplished are not intended to demonstrate the adequacy or robustness of quality assurance requirements and manufacturing processes.

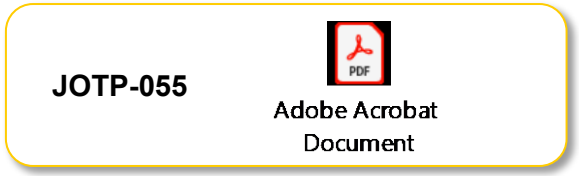
STANDARDS – NEW

JOTP-055, Criteria for Submunition Advanced Features to Meet the 2017 DOD Policy on Cluster Munition

- SCOPE
  - Provides clarification and criteria for the implementation of fuzing system features used to meet the characteristics specified in paragraph 5.b in the Technical Specifications for the 2017 DoD Policy on Cluster Munitions (CM).

- Coordinated with OSD Policy and Tri-services.
- Ratified on 26 January 2023.

- Available in DoD ASSIST:
  - https://assist.dla.mil/ (CAC)
  - http://quicksearch.dla.mil/ (Non-CAC)



STANDARDS – ON HOLD

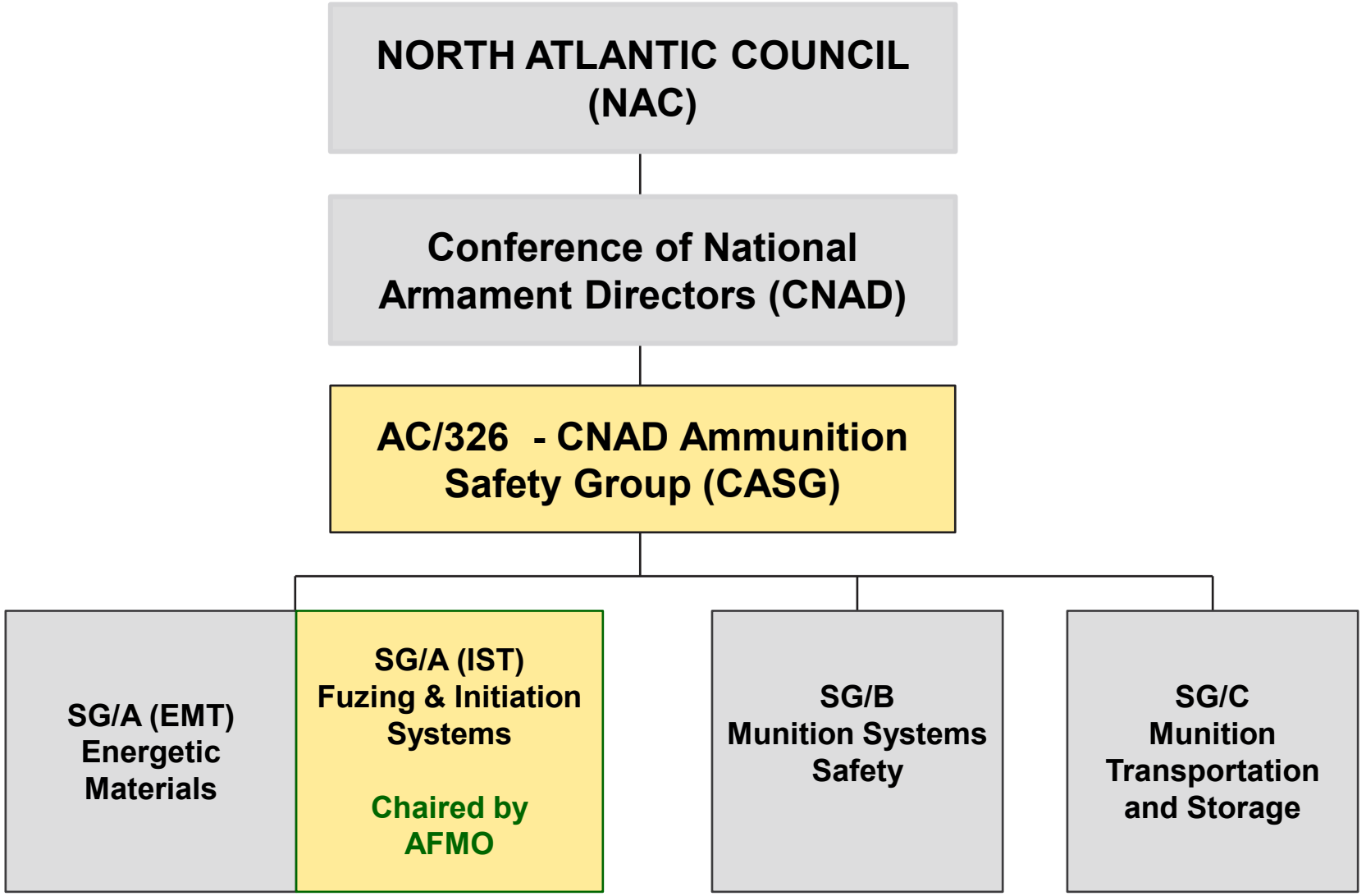
Directed Energy Weapons (DEW) Firing Circuit Safety Design Criteria

- New document to establish the requirements and guidelines for Directed Energy Weapons Initiation System Safety requirements.

- Temporarily on hold until:
  - Awaiting letter from Joint Weapons Safety Working Group to formally task Fuze / Initiation Systems Joint Standardization Board to develop subject document.
  - Awaiting MIL-STD-1901B draft since many of the design architecture principles are anticipated to directly translate into this standard.

DSP 2024 PRESENTATION ON NATO AC326 SG/A INITIATION SYSTEMS TEAM (IST)

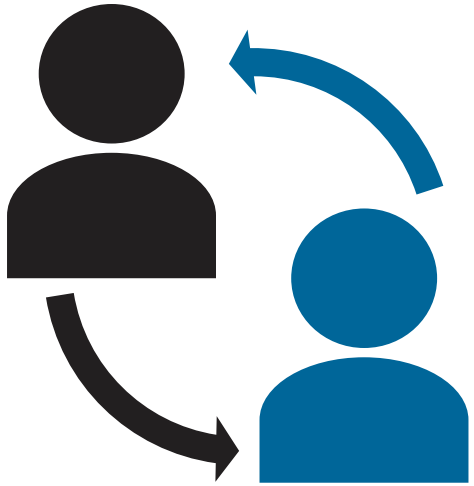
NATO STANDARDIZATION



NATO STANDARDIZATION

SG/A Co-Chair Arrangement:

- Chair for Energetic Materials Team (Chaired by Türkiye)
- Chair for Initiation Systems Team *(Chaired by AFMO)*



Two Meetings Each Year

- Each group meets separately

NATO DOCUMENT STRUCTURE

Allied Publications (AP)

Covering Documents

- **STANAG**
- **STANREC**

Allied Standards

- **NATO STD**
- **Non-NATO STD (Civil or National Defense)**

Standard-Related Documents (SRDs)

- **Implementation Guide**
- **Catalogue of National Data**
- **Etc.**

Document types are defined in the back-up slides.

AC/326 CASG STANDARDIZATION

OBJECTIVES

In support of NATO deployed MISSIONS and OPERATIONS

For the complete Munitions Life Cycle

1 Improve Interoperability and Interchangeability with commonly agreed

- Safety Requirements
- Assessment Tools (Tests & Methodologies)
- Catalog of munitions and fuzes

2 Introduce safe and reliable Munitions into Service

3 Give Guidance and Specifications to Munitions Designers

4 Give Rules and Recommendations to Logisticians

LINKING OF NATO & DOD STANDARDS

NATO	DoD FESWG
STANAG 4187 & AOP-4187	MIL-STD-1316 (Fuze safety design requirements)
STANAGS 4157, AOP-4157 & AOP-20	MIL-STD-331 (Fuze safety test procedures)
STANAG 4560 & AOP-43 Characterization tests	MIL-DTL-23659 (Qualification tests for EEDs)
STANAG 4368	MIL-STD-1901 (Launch ignition system safety design)
STANAG 4497	MIL-STD-1911 (Hand-emplaced ordnance design safety)
STANAG 4797 and AOP-4797	JOTP-050 (Active Hazard Mitigation Device)
Incorporated into STANAG 4187	JOTP-051 (Logic devices)
Incorporated into STANAG 4157	JOTP-052 (Fuze safety qualification test program)
Incorporated into AOP-20	JOTP-053 (Electrical stress test)
No NATO Standard	JOTP-056 In-line Initiator Qualification – **In process**
STANAG 4809 / AOP-67 Safety Design Requirements for Remotely Controlled SAF Systems - **In process**	JOTP-057 Safety Design Guidelines (Criteria) for Remotely Controlled Fuzing Systems used in Munitions – **In process**
No NATO Standard	JOTP-05x Fault Tree Analysis – **In process**
STANAG 4369 & AOP-22 Inductive setting for large caliber	No US document – **Use NATO Standard**
STANAG 4547 Inductive setting for medium caliber	No US document – **Use NATO Standard**
STANAG 4593 & AOP-60 Inductive setting for guided large caliber projectile	No US document – **Use NATO Standard**
STANAG 2916	No Active US document – **Use NATO Standard**
STANAG 4326 & AOP-8 NATO Fuze catalog	MIL-HDBK-145 (US Fuze catalog)
STANAG 2818 & AOP-31 Demolition Materiel Design	No US document – **US uses own process**
STANAGS 4363 & AOP-21 Testing for Assessing Detonating Explosive Components	No US document – **US uses own process**
STANAG 4873 / AOP-4873 Safety Design Requirements for Aircraft Pyrotechnic Countermeasure Devices – **In process**	No US document – **Use NATO Standard**

NATO & DoD Fuze & Initiation Systems Standards are closely linked through the work of the FESWG

SG/A (IST) PROGRAM OF WORK

RECENT ACCOMPLISHMENTS AND CURRENT WORK

- STANAG 4187 – Promulgated June 2022
- STANAG 4560 – Final draft in review. Plan to submit for ratification to the Main Group this fall.
- STANAG 4368 – Working Group In Process – complete in 2025
- STANAG 4369 – Updated and submitted to the Main Group for ratification/
- STANAG 2916 – Reviewed and submitted as still valid with no updates 2024.
- STANAG 4873 – New STANAG On Aircraft Pyro Countermeasures – 1st Working Group planned for September 2024.
- STANAG 4809 – New: Expected Completion 2025
- STANAG 2818 – 95% Complete Expect submission for ratification 2024
- STANAG 4157 – Working Group In process – expect completion in 2025
- TERMINOLOGY – Review Complete. New terms to be reviewed as needed

September 9-13 Meeting to be held in Bergen, Norway
Program of Work is reviewed and approved by the CASG yearly
Subgroups A, B and C report their work progress to CASG twice per year.

KEY TAKEAWAYS

Chaired and managed by AFMO, standardization activities are seamlessly coordinated among Domestic and NATO communities, industry partners and academia

DoD FESWG, under charter by the JSB, is the fuze and initiation systems standardization custodian for the USA

Promote interchangeability, safer munitions & interoperability

Standards Are Well Positioned To Support DoD Modernization Priorities

Promotes both DoD & NATO interoperability for munition fuzing & ignition systems

Fuze & Ignition systems Standardization products account for changes in technology, DoD Policy, DoD munition modernization efforts, and international interoperability

QUESTIONS?

FOR ADDITIONAL INFORMATION

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BACK-UP

NATO STANDARDIZATION (AAP-03 (K))

1.6.1 NATO STANDARD AGREEMENT

1. A NATO Standardization Agreement (STANAG) is a NATO standardization document that specifies the agreement of member Nations to implement a standard, in whole or in part, with or without reservation, in order to meet an interoperability requirement.

2. An Allied standard covered by a STANAG is implemented, as applicable, and complied with to the maximum extent possible by ratifying Allies, adopting partner nations and NATO bodies. Sections on “interoperability requirements” and “implementation of the agreement” are included in each STANAG. They specify the interoperability requirements substantiating the STANAG and provide guidance to assist Nations and NATO bodies with the implementation of the covered Allied standards.

NATO STANDARDIZATION (AAP-03 (K))

1.6.1.2 NATO STANDARDIZATION RECOMMENDATION (STANREC)

1. A STANREC is a NATO standardization document used exclusively in the materiel field of standardization that lists one or several NATO or non-NATO standards relevant to a specific Alliance activity unrelated to interoperability.

2. A STANREC is a non-binding covering document used to recommend useful practices in multinational cooperation. It is employed on a voluntary basis and does not require commitment of Allies to implement the Allied standards it covers.

NATO STANDARDIZATION (AAP-03 (K))

1.6.2 ALLIED STANDARDS

Allied standards are standards developed or selected in the framework of the NATO standardization process.

NATO recognizes the following concept of a standard by ISO/IEC-: a standard is a document, established by consensus and approved by a recognized Body that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context.

NATO STANDARDIZATION (AAP-03 (K))

1.6.2.2 NATO STANDARD

A NATO STD is a standard developed by NATO and promulgated in the framework of the NATO standardization process.

1.6.2.3 NON-NATO STANDARD

A non-NATO STD is a standard developed outside NATO. Non-NATO standards include civil standards, national and multinational defence standards. Non-NATO standards might be referred to or adopted by NATO. Their content might also be reproduced in NATO standards.

1.6.3 STANDARD-RELATED DOCUMENT (SRD)

An SRD is a NATO standardization document that facilitates understanding and implementation of one or more Allied standards. It may provide additional data and information to support the management and implementation of Allied standards. Examples are national data catalogues, standards implementation guides, etc.

AC/326 CASG STANDARDIZATION

AC/326 CASG TASKS

- To develop Standards and Guidance for safe munitions
- Promote interoperability and interchangeability
- To provide Advice and Expertise

In order to guarantee that the Risks presented by Munitions to be used jointly by NATO Forces during co-operations are:

- ☑ 1. Well assessed
- ☑ 2. At an acceptable level
- ☑ 3. Reduced to a minimum

2017 DOD POLICY ON CLUSTER MUNITIONS

- **DOD issued an updated Cluster Munitions policy on 30 Nov 2017.**
- **The Department will only procure cluster munitions containing submunitions or submunition warheads that *do not result in more than one percent unexploded ordnance* across the range of intended operational environments, *or that possess advanced features* to minimize the risks posed by unexploded submunitions.**
- **Attached Technical Specifications to the policy provides guidance to ensure appropriate and consistent implementation of certain aspects of the DoD Policy on Cluster Munitions; it applies to all types of cluster munitions that are not explicitly excluded from this policy.**
- **….must meet at least one of the following three criteria, unless the Deputy Secretary of Defense approves an exemption in writing:**
  - (5.a) Not more than one percent of submunitions or submunition warheads, once properly dispensed from the non-reusable canister or delivery body, fail to detonate
  - (5.b) Each submunition or submunition warhead has all of the following characteristics: ***(required advanced features listed on next slide)***
  - (5.c) The munition is not prohibited by the Convention on Cluster Munitions as of the date of this policy
- **Fuze SMEs offered a strategy to use DoD Fuze Engineering Standardization Working Group (FESWG) to create written documentation that clarifies the 5b criteria and have the Fuze Service Safety Authorities evaluate and certify compliance for new designs.**

2017 DoD Policy on Cluster Munitions

2017 DoD Policy

TECHNICAL SPECIFICATIONS: ADVANCED FEATURES (PARAGRAPH 5.b)

Each submunition or submunition warhead has all of the following characteristics:

1. Each submunition or submunition warhead is equipped with an internal power source that is essential for arming and detonation. The submunition or submunition warhead is not designed to be detonated by mechanical means alone. Each submunition has redundant detonating mechanisms to meet the less than 1% UXO requirement.

2. Each submunition or submunition warhead is equipped with at least one automatically functioning, electronic self-destruct mechanism that is in addition to the primary arming and detonation mechanism and that is designed to destroy the submunition or submunition warhead on which it is equipped, if the submunition or submunition warhead is not detonated by the primary arming and detonation mechanism.

3. Each submunition or submunition warhead that does not detonate or self-destruct is, once armed, rendered inoperable in 15 minutes or less by means of the irreversible exhaustion of a component *(e.g.,* power source) that is essential to the operation of the submunition or submunition warhead.

4. Each submunition or submunition warhead that does not arm after being deployed from the non-reusable canister or delivery body cannot be subsequently armed or detonated by incidental handling, contact, or movement.

THANK YOU.


U.S. ARMY