MSIAC
Munitions Safety Information Analysis Center

Supporting Munitions Safety

AOP-15 – Updates to the NATO Process for Assessment of Safety & Suitability for Service (S3)

PARARI 2024

Kevin Jaansalu
TSO Materials Technology
k.jaansalu@msiac.nato.int

Matt Ferran
TSO Munition Systems
m.ferran@msiac.nato.int

Overview

- What is S3 assessment and why do we need it?
- AOP-15 – the NATO process for S3 assessment
- What changes are being made to the NATO S3 assessment process – and why?
- How does this affect national safety management processes?
- What are MSIAC doing to support the S3 assessment community?

Context

Munition systems are ***unique*** – they are not like other items of supply because they are ***inherently hazardous***:

- They are designed to kill or injure or are capable of doing so by virtue of their required function – even when functioning in design mode (e.g. flares)
- Response to accidents / intentional attack may cause death or injury to personnel, or cause severe damage to platforms and systems
- Energetic materials are thermodynamically unstable chemicals
  - May be initiated through a relatively small input of energy - mechanical, thermal, electrical or electromagnetic (such as experienced throughout lifecycle)
  - They degrade or decompose as a function of time and exposure to the service environment – may become more hazardous over their service life

Context

Bottom line:

We need a method to understand the ***unique*** through-life safety hazards posed by munitions so that we can do something about them (IAW requirements of national legislation / policy)

That method is S3 assessment.

What is S3 Assessment?

NATO Definition for “Safe & Suitable for Service” (S3):

> *For a munition to be regarded as Safe and Suitable for Service it must be demonstrably expected to remain safe… throughout its planned life cycle, remain acceptably free from hazard due to enemy attack or accident… and the explosive materials should function within acceptable safe parameters. Safe and suitable for service* ***does not imply that the item will meet all performance requirements****.*

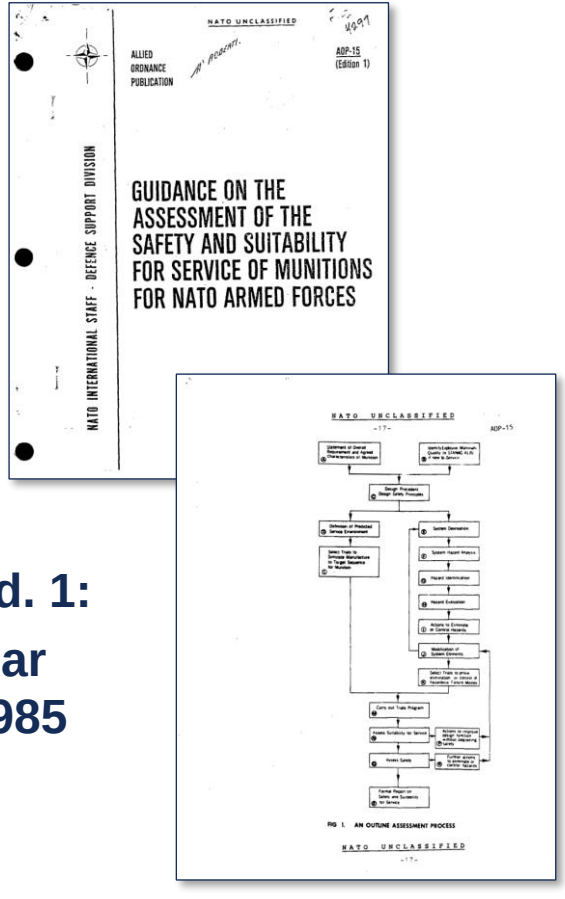
“S3 assessment” is then simply the process by which we assess S3

What is S3 Assessment?

S3 assessment usually integrated into national policy / procedures for introduction-into-service and through-life safety management of munitions – sometimes referred to as "**qualification**".

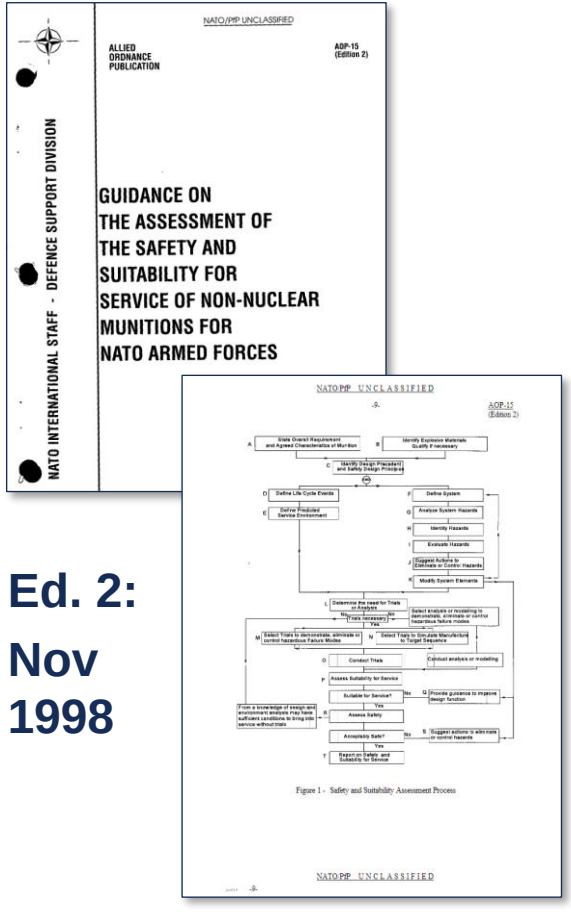
This usually involves some consideration of the tolerability / acceptability of a risk in the national context, and some formal statement of acceptance by identified "risk owners".

AOP-15 – NATO Process for S3 Assessment



Ed. 1:

Mar 1985



Ed. 2:

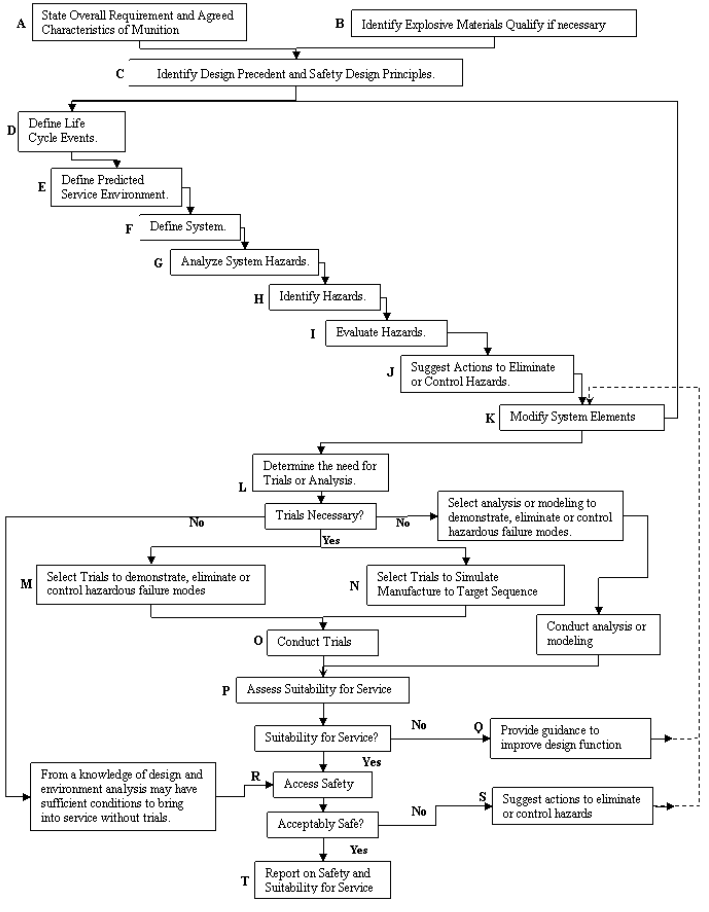
Nov 1998

Ed. 3:

Apr 2009

AOP-15 – NATO Process for S3 Assessment

- Describes a logical flow of tasks designed to enable a judgement of S3 to be made
- Brings together different disciplines to make an S3 determination:
  - System Safety
  - Environmental engineering
  - Munition life assessment
- S3 assessment must consider:
  - Capability requirement
  - Lifecycle activities
  - Design safety
  - Materiel condition
  - Environmental exposure
  - Threat response
  - Hazards & controls



AOP-15 – NATO Process for S3 Assessment

S3 Assessment

- Universal methodology
- Understand & assess risk
- Informs a decision

Qualification

- Nation specific
- Accept / tolerate the risk
- ***Is*** the decision – and the ultimate goal of S3 assessment

AOP-15 deliberately does not discuss Qualification – this must be done within the context of a nation's legislative framework – significant variation between nations, which NATO cannot possibly account for

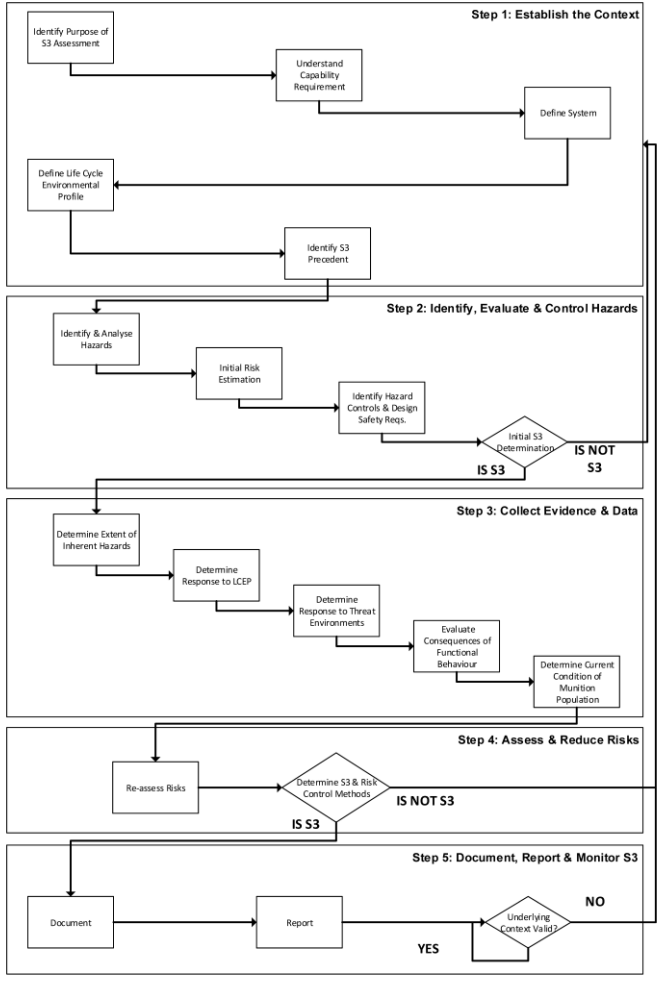
AOP-15 Edition D

- Since publication of Ed. 1 in 1985, overall principles and process of AOP-15 have been largely unchanged; NATO requires all standards be reviewed every 5 years
- In 2019 AC/326 SG/B stood up a Custodial Working Group to review AOP-15 and determine need for an update:
  - Initial survey of national S3 practitioners and policy makers revealed issues incl. lack of through-life perspective, lack of consideration of different procurement methodologies, and no assessment of design safety requirements.
  - Sufficient to justify initiation of development of AOP-15 Ed. D - a first-principles review “starting again from scratch” based on common agreement of AOP-15 function and structure
- AOP-15 Ed. D is 99% complete – intended to enter ratification process early 2025 for promulgation ~Sep 2025

What follows is the S3 assessment process described in AOP-15 Ed. D, as agreed by AC/326 SG/B

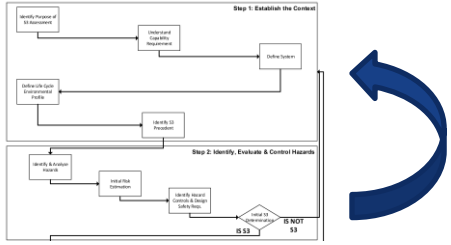
AOP-15 Edition D

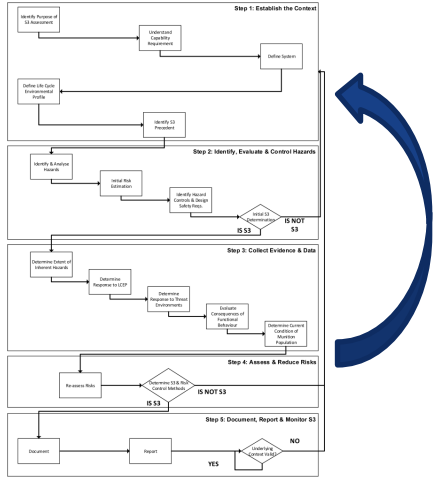
- AOP-15 Ed. D proposes a 5-step process for S3 assessment:
  - **Step 1:** establish the context
  - **Step 2:** identify, evaluate & control hazards
  - **Step 3:** collect evidence & data
  - **Step 4:** assess & reduce risks
  - **Step 5:** document, report & monitor
- Iterative process – various decision points
  - Could go through several loops before entry into service as knowledge develops
- Applicable throughout lifecycle of system

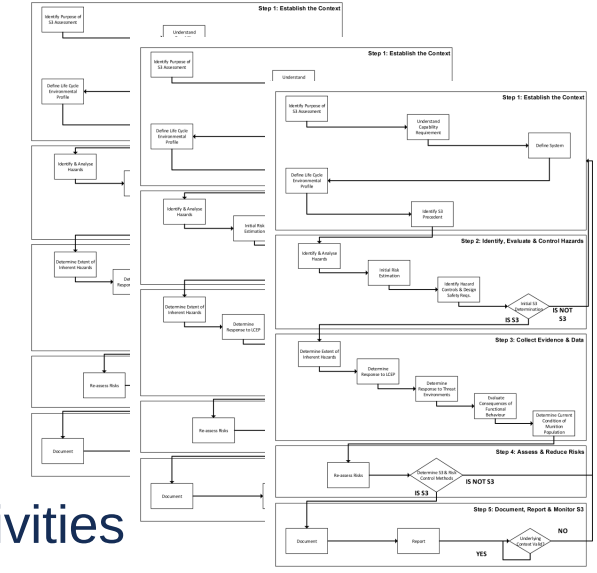


AOP-15 Edition D

Pre Concept | Concept | Development | Production | Utilisation / Support | Retirement



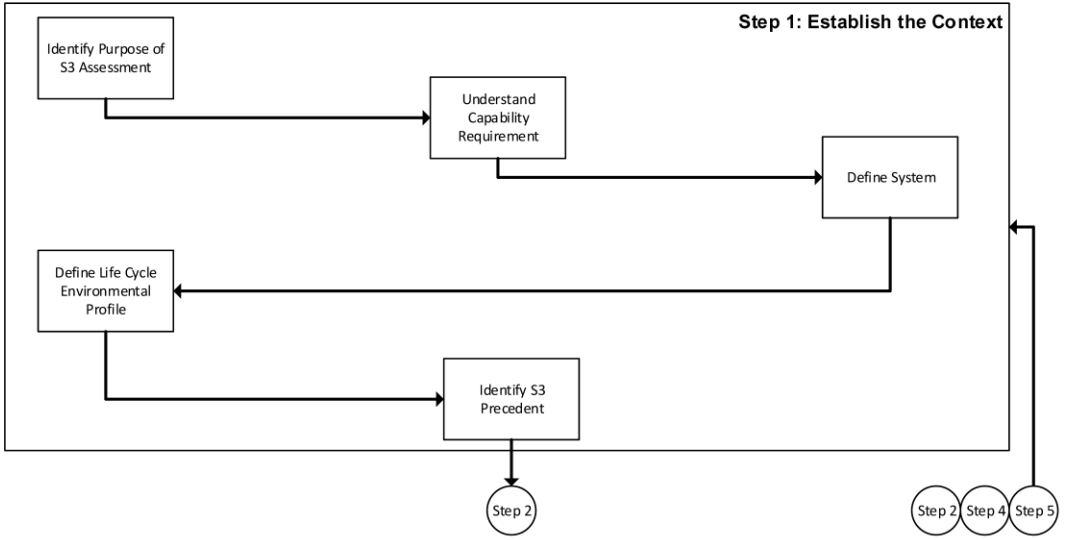




- No 1:1 relationship between S3 assessment & SLC activities
- S3 assessment process is not an iterative design process (but may inform design activities during development)

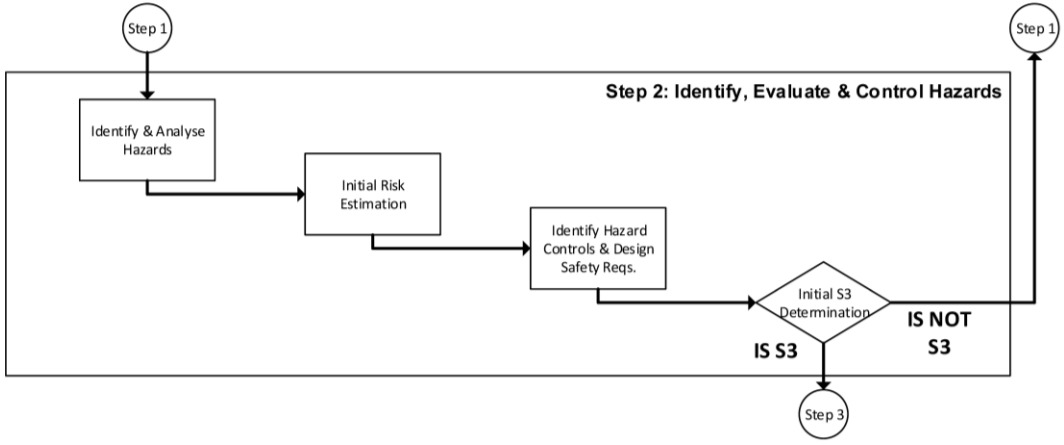
Step 1: Establish the Context

- Identify purpose:
  - IIS? Reassessment?
  - Procurement strategy – COTS, MOTS, FMS etc.
- Capability requirement
  - What; when; where; how often
- Define system
- Define Life Cycle Environmental Profile (LCEP)
  - Define life cycle events
  - Associated environments
- S3 precedent



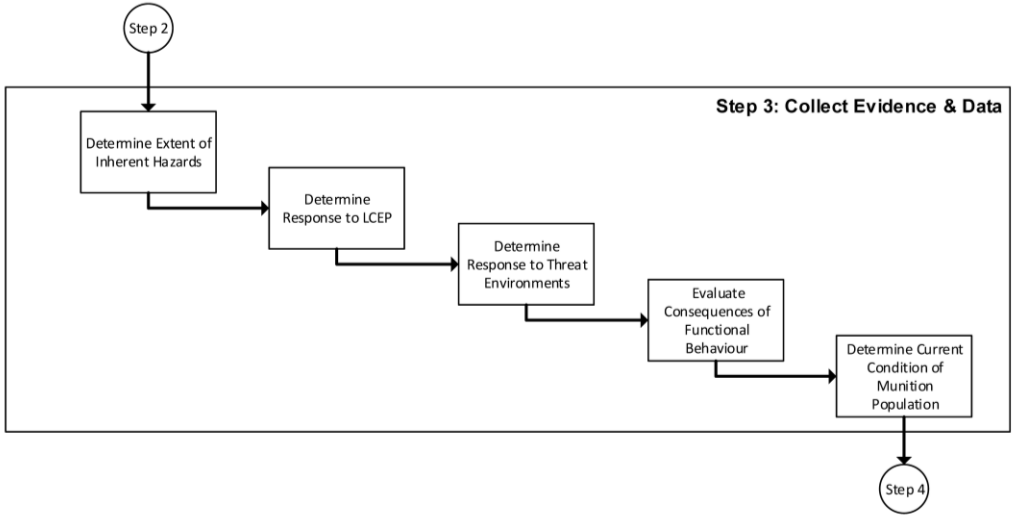
Step 2: Identify, Evaluate & Control Hazards

- Significant integration with system safety
  - Often specified by national policy / legislation
  - AOP-15 highlights general principles & considerations relevant to munition S3
- Identify design safety requirements
  - Act as controls to hazards
- Decision point: initial S3 determination
  - Revisit Step 1



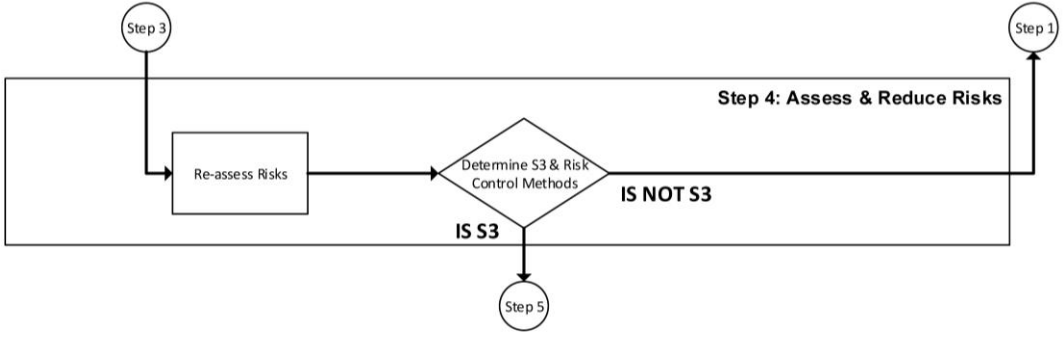
Step 3: Collect Evidence & Data

- First four activities demonstrate:
  - Hazards have been controlled / risk has been reduced
  - Response of munition system to LCEP & extreme but credible threats
- Determine current condition:
  - QC / lot acceptance / first article inspection
  - Life history determination
  - In-service surveillance / Munition Health Management (MHM)



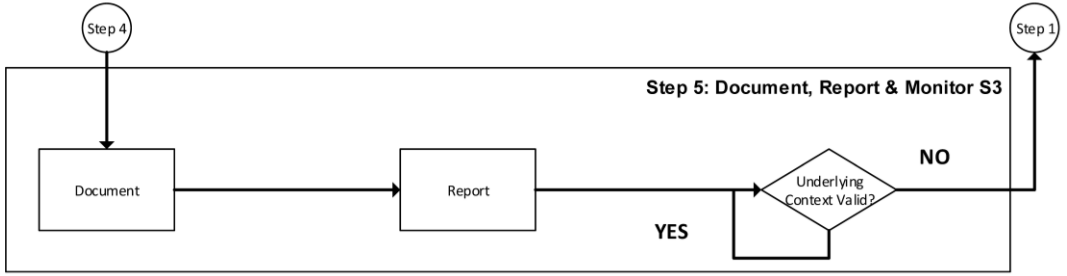
Step 4: Assess & Reduce Risks

- Once again, significant integration with system safety
  - National policy / legislation
- Risk assessment based on Step 3
- Decision point (likely) integrated with national risk acceptance procedures
- Risk control methods could
  - Be implemented now; or
  - Demand return to Step 1 and iteration of Steps 2 & 3



Step 5: Document, Report & Monitor S3

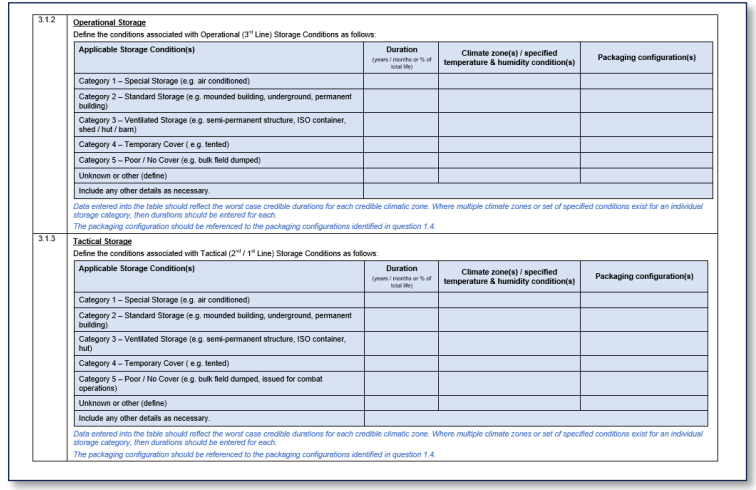
- "Document" the argument that the munition is S3
- "Report" to relevant persons (proportionally)
- "Monitor" continued validity of safety argument
  - Changes in underlying context may necessitate repetition of S3 assessment from Step 1



AOP-15 Ed D Annexes / SRDs

Main body supported by several annexes and related Standards Related Documents (SRDs):

- **Annex A** – providing guidance on the identification of the LCEP for munitions
  - **SRD AOP-15.1** *Environmental Questionnaire to Inform Munition Threat-Hazard Assessment* – significant support from AUS DOS in preparation of PDF "smart form"
- **Annex B** – NATO standards applicable to S3 assessment
  - **SRD AOP-15.2** *Hierarchy of NATO Standards related to Munition Safety* – presented as a "flow-chart"
- **Annex C** – Munition Safety Data Package – intended to improve interoperability / interchangeability by standardizing S3 information and data collected and shared



3.1.2 Operational Storage

Define the conditions associated with Operational (3rd Line) Storage Conditions as follows:

Applicable Storage Condition(s)	Duration (years / months or % of total life)	Climate zone(s) / specified temperature & humidity condition(s)	Packaging configuration(s)
Category 1 – Special Storage (e.g. air conditioned)			
Category 2 – Standard Storage (e.g. mounded building, underground, permanent building)			
Category 3 – Ventilated Storage (e.g. semi-permanent structure, ISO container, shed / hut / barn)			
Category 4 – Temporary Cover (e.g. tented)			
Category 5 – Poor / No Cover (e.g. bulk field dumped)			
Unknown or other (define)			
Include any other details as necessary.			

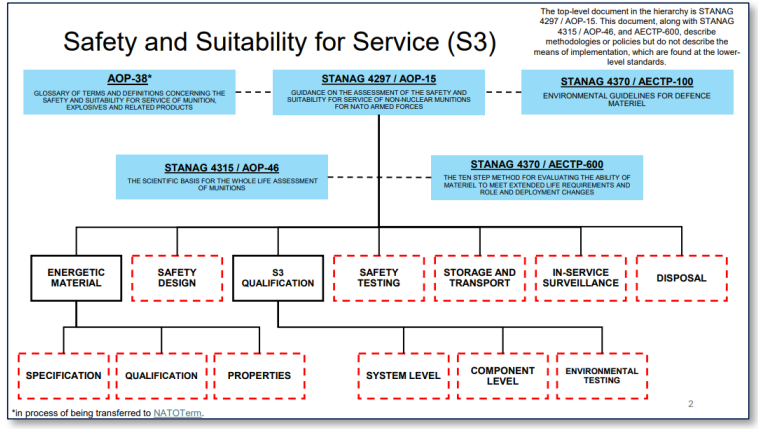
Data entered into the table should reflect the worst case credible durations for each credible climatic zone. Where multiple climate zones or set of specified conditions exist for an individual storage category, then durations should be entered for each.
The packaging configuration should be referenced to the packaging configurations identified in question 1.4.

3.1.3 Tactical Storage

Define the conditions associated with Tactical (2nd / 1st Line) Storage Conditions as follows:

Applicable Storage Condition(s)	Duration (years / months or % of total life)	Climate zone(s) / specified temperature & humidity condition(s)	Packaging configuration(s)
Category 1 – Special Storage (e.g. air conditioned)			
Category 2 – Standard Storage (e.g. mounded building, underground, permanent building)			
Category 3 – Ventilated Storage (e.g. semi-permanent structure, ISO container, hut)			
Category 4 – Temporary Cover (e.g. tented)			
Category 5 – Poor / No Cover (e.g. bulk field dumped, issued for combat operations)			
Unknown or other (define)			
Include any other details as necessary.			

Data entered into the table should reflect the worst case credible durations for each credible climatic zone. Where multiple climate zones or set of specified conditions exist for an individual storage category, then durations should be entered for each.
The packaging configuration should be referenced to the packaging configurations identified in question 1.4.



AOP-15 – Summary

- S3 assessment is the means by which unique lifecycle hazards associated with munitions can be identified and assessed
- It is a combination of different disciplines incl. system safety & environmental engineering
- Applicable before introduction to service of a new capability, and then throughout lifecycle when assumptions change
- Enables “qualification” by a nation (i.e. acceptance/tolerance of risk – or equivalent)
- **AOP-15 Ed. D currently being developed by AC/326 SG/B – motivated multidisciplinary and multinational team (incl. strong AUS representation and support) will deliver new version in 2025**

MSIAC Support to S3 Assessment Community

MSIAC have been providing significant support to AC/326 SG/B for the development of AOP-15 Ed. D

In parallel, MSIAC continued to support the S3 assessment community through other initiatives incl.:

- The MSIAC S3 Seminar
- Safety Assessment Software (SASo)

MSIAC S3 Seminar

- MSIAC have developed a seminar on S3 assessment, based on upcoming AOP-15 Ed. D
- Aim of the MSIAC S3 Seminar
  - To introduce the NATO Safety and Suitability for Service (S3) process from scratch
  - In doing so:
    - Provide key points and guidance related to conduct of the “model” S3 process described in NATO Standard AOP-15
    - Reflect on the different mindsets and constraints that contribute to the specifics of the S3 process implemented by any given nation

MSIAC S3 Seminar

- ~1.5 day in-person taught seminar describing each step in the new S3 assessment process (i.e. AOP-15 Ed. D)
- 12 lectures covering the following topics:
  - 01 Introduction to S3
  - 02 NATO munition safety standards – hierarchy and relationships
  - 03 Establish S3 Assessment Context; Lifecycle Events & LCEP
  - 04 Identification, assessment & control of hazards
  - 05 S3 assessment testing
  - 06 Munition safety testing
  - 07 Introduction to energetic material qualification (EMQ)
  - 08 Assessing the condition of the munition population
  - 09 Assessment & reduction of risks
  - 10 Changes in context & reassessment of S3
  - (11 & 12 Influence of national context / international harmonization of S3 assessment)

MSIAC S3 Seminar

- Target audience: anyone involved in S3 assessment process, particularly those in munition procurement organizations
- Suitable for new starters or as a refresher course for established personnel
- Best for small to mid-sized groups to allow participation / discussion / questions etc.

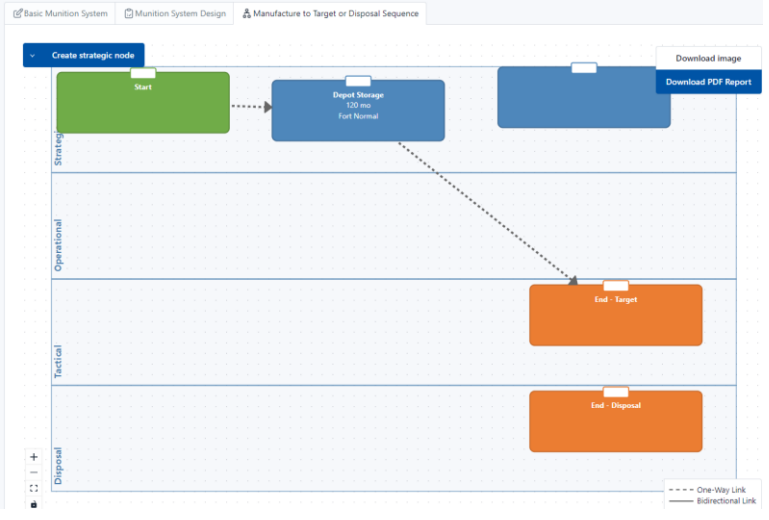
- **Free at point of delivery for MSIAC member nations**
- **No fixed schedule – delivered on request – speak to your national MSIAC Steering Committee member or National Focal Point Officer**

Safety Assessment Software (SASo)

New MSIAC software tool designed to assist munition designers and procurers in the identification of appropriate safety-related requirements and associated standards. Includes:

- Drag-and-drop GUI to construct MTDS
- On basis of MTDS, generate list of design and assessment requirements (as a PDF report and Excel sheet / V&V matrix)
- Each requirement has a NATO standard associated with it, hyperlinked for easy access

Full release before 2025



https://saso.msiac.nato.int/

Questions?