



CEN Workshop 10 – European Handbook for Defence Procurement

**Expert Group 13
Life Cycle (Project) Management**

Final Report

Brussels, April 21, 2008

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1 Introduction

The CEN WS 10 phase two initiative introduced 8 new key areas in the EHDP. In this frame, EG13 was allocated the subject area "*Life cycle management (Service life management, integrated logistic support)*" This subject area was discussed at the first EG13 meeting and re-named for clarity as "**Life Cycle Project Management**". This was subsequently endorsed at the first WS10 plenary.

Working period: April 2007 – April 2008

Difficulties:

- The work area assigned to EG13 was too 'Imprecise' and lacked definition;
- It was difficult to determine an appropriate, acceptable and achievable scope;
- Despite setting priorities, we still concluded a large scope - resulting in;
- Time constraints and lack of specialist knowledge for all subjects.

2 Expert Group 13 Members

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3 Scope

In considering 'best practice' standards for project management, EG13 was faced with a potentially huge scope, given that 'Project Management' is an all encompassing term and 'lifecycle' requires a view from concept through to the disposal of a defence system. Our approach was to focus on high level 'management' standards that could be applied to Project Management activities. During our first meeting we decided that a consistent and coherent approach could be followed by identifying the main project management activities detailed in the **ISO 15288** standard '**Systems engineering — System life cycle processes**'.

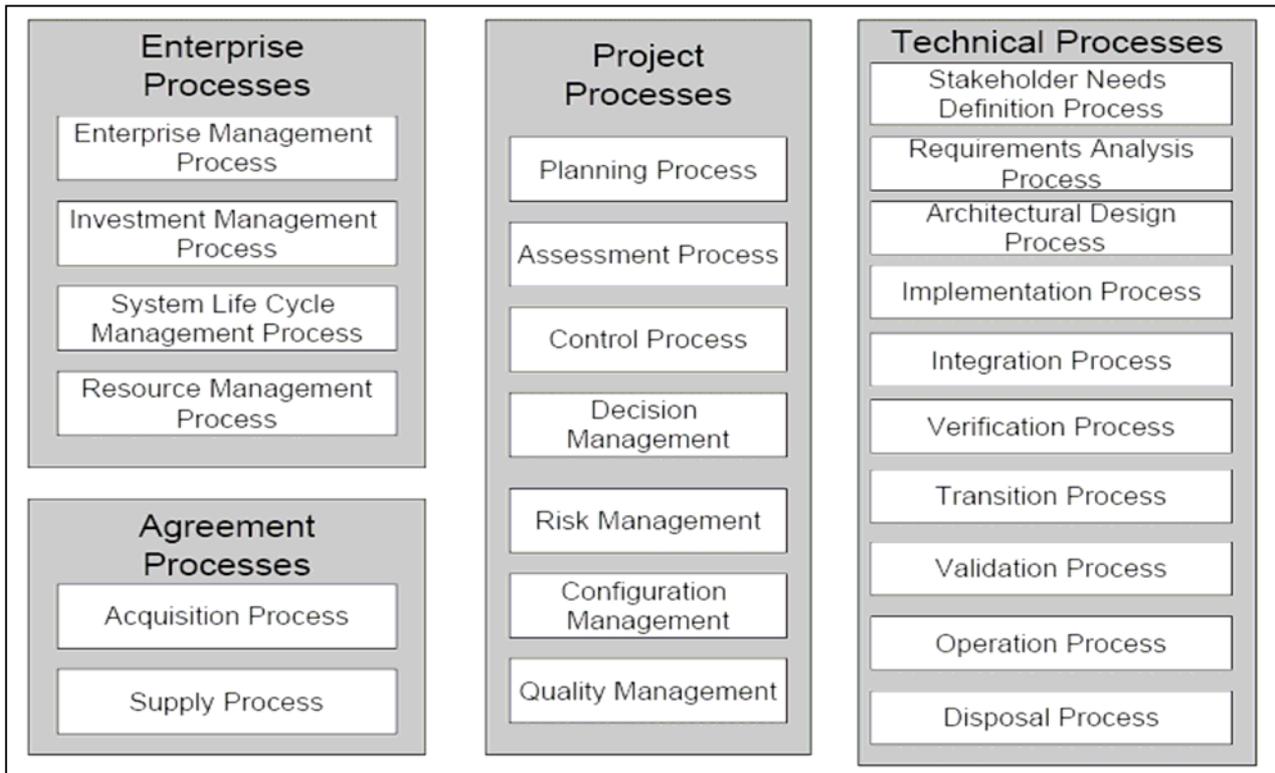


Diagram showing the ISO 15288 Framework

ISO 15288 was approved in 2002 and was developed to meet the following requirements:

- A common and integrated process framework for systems engineering and project management;
- The integration of project management disciplines and technical processes;
- The integration of project management across the full life cycle;
- The interaction between organisations/enterprise.

The standard provides a common, comprehensive and integrated framework for describing and managing the full life cycle of systems and is applicable to most Industry domains including defence and military systems.

The ISO 15288 life cycle is illustrated below and provides the 'life cycle' viewpoint of project management as tasked by WS10.

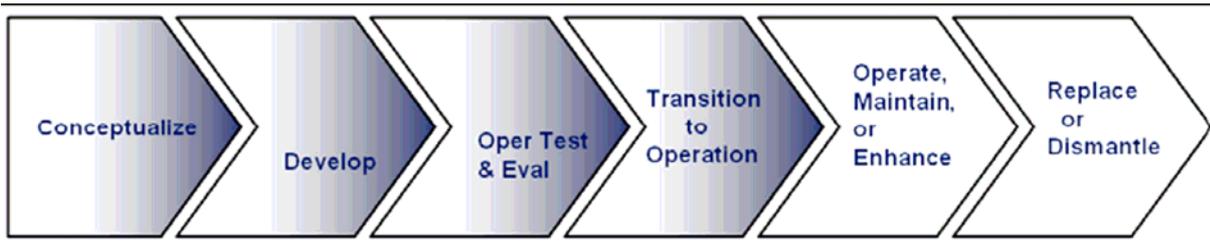


Diagram showing ISO 15288 Lifecycle

Therefore, by basing its scope on ISO 15288, EG13 has adopted a logical and coherent way of conducting its work:

- It aligns EG13’s recommendations to an ISO Standard that is widely accepted and recognised Internationally;
- It provides a lifecycle that can be applied to the management of defence systems;
- ISO 15288 can be considered as an integrating standard for ISO/IEC standards (quality and systems engineering for example) and a ‘unifying’ standard with other standardisation Organisations such as the IEEE, EIA / ANSI, NSA etc.

The EG13’s scope is illustrated in the following diagram, which ‘maps’ project management disciplines to ISO 15288 processes. The mapping is not claimed to be exact however it is useful in showing the logic for our scope and resulting EHDP recommendations.

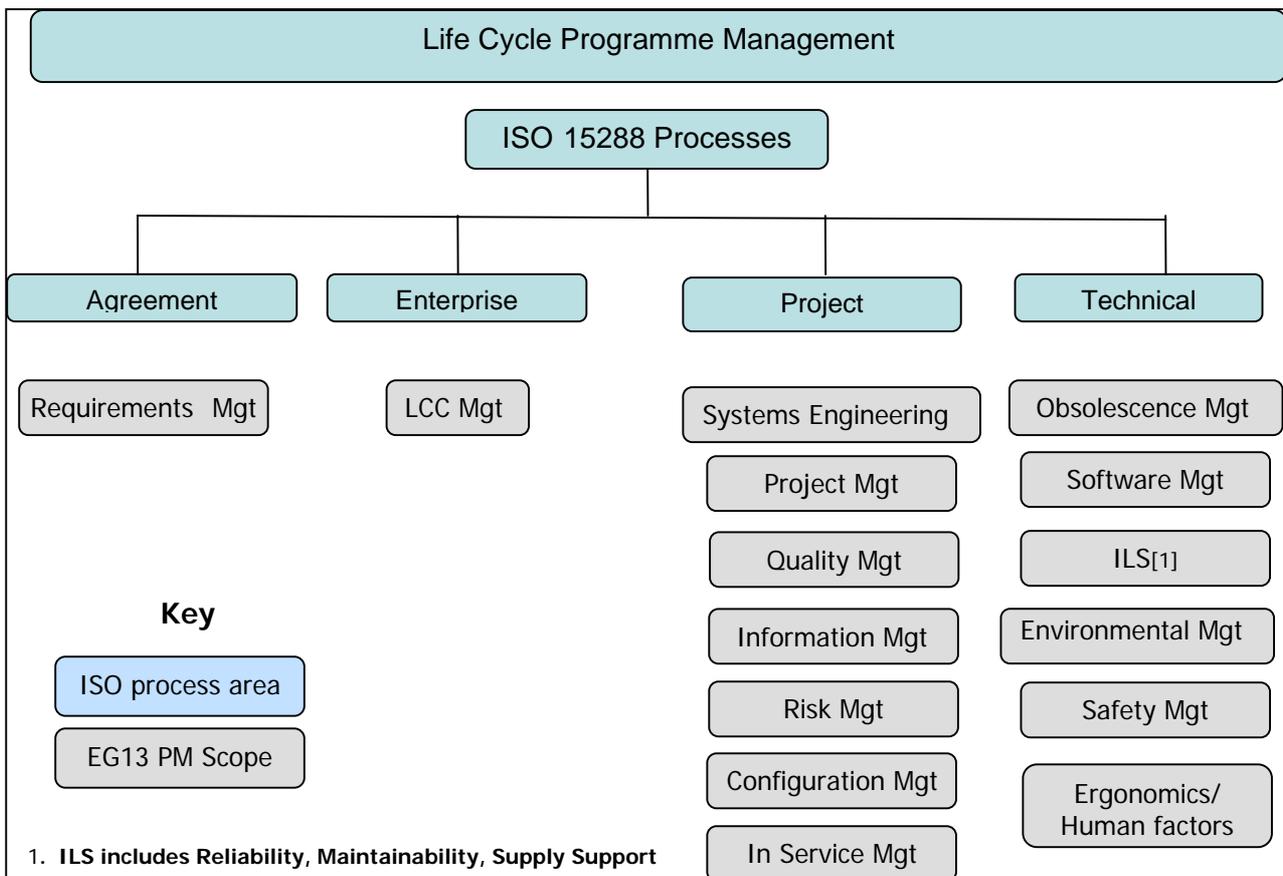


Diagram showing the EG13 Project Management scope within the 15288 Framework

4 Selection of standards

Approximately 500 standards were identified and reviewed within the above scope. The standards were taken from the published outputs of the following standardisation organisations;

ISO; IEC; NATO; STANAG (and APs); IEEE; ASD; ECSS; EIA; US MIL-STDs; National military standards; National civilian standards.

Additionally we looked at guidance that was internationally recognised and considered best practice, for example the Project Management Book of Knowledge (PMBOK) published by the Project Management Institute (PMI) pmi.org

This above selection led to EG13's final scope for Project Management Standards:

Project Management Activity	ISO 15288 Process area	Comment
Requirements Management	Agreement	Requirements Mgt is also considered to be a technical process
Life Cycle Cost Management	Enterprise	The 'mapping' of project management disciplines to ISO 15288 'enterprise' 'project' and 'technical' processes is subjective. The division shown is the view of EG13 based experience and judgment
Systems Engineering	Project	
Project Management		
Quality Management		
Information Management		
Risk Management		
Configuration Management		
In Service Management		
Obsolescence Management		
Software Management		
Integrated Logistic Support (ILS)		
Environmental Management		
Safety Management		
Ergonomic/Human Factors Management		

5 Reduction process

This above scope is still very large but it reflects the breadth and diversity of disciplines and activities covered in 'Life Cycle Project Management'. EG13 selected the 'best practice' standards for each of these disciplines by the following logic:

- Professional experience and specialist subject knowledge;
- The hierarchy of standards as directed by WS10;
- Those standards frequently or typically applied in contracts for defence systems;
- Those standards considered to be higher 'management level' standards (whilst recognising there is a significant number of supporting 'specialist or functional' level standards¹).

It should be noted that EG13 has not reduced the range of standards to a single best practice selection. In most cases we have recommended a selection that can be used singularly, or together to ensure comprehensive guidance on the subject. If applicable there are also normative standards referenced and supporting standards where they were considered essential or useful.

It should also be noted that **Life Cycle Technical Documentation**², (subject area for EG14) is strongly linked to the discipline of **Integrated Logistic Support** which is in the scope of EG13. Some standards are relevant to both EG13 and EG14 and those considered core to EG14's scope are not described in detail in this report.

6 Recommendations

6.1 General

The following pages detail the 15 project management disciplines determined as EG13's scope. For each discipline one or more 'best practice' standards have been identified. For each best practice standard selected, EG13 has provided a description and a rationale³ in accordance with the WS 10 "Template for Recommendations". These are made up as follows:

- The standard's description: Identification, scope and information on the source from where the listed standards can be obtained, with a link to the relevant website of the entity (Standardization Organisation or Governmental Agency) which has issued the particular document for ordering or downloading it;
- Why a particular standard has been considered by experts as a best-practice standard;
- How to use the standards in the best way in armament contracts; advice about the tailored use of those best-practice standards in the specification activity;
- What is missing? Possible identification of further needs of standardization action revealed in analysing the relevant normative content related to the considered key area.

For all standards with dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

The following standards and guidance are considered key supporting documents for every discipline in EG13's scope:

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¹ For example we are aware of approximately 160 'functional level' standards applying to Reliability Engineering alone. Therefore we have recommended that the supporting standards should be considered for a 'phase three' review of the EHDP).

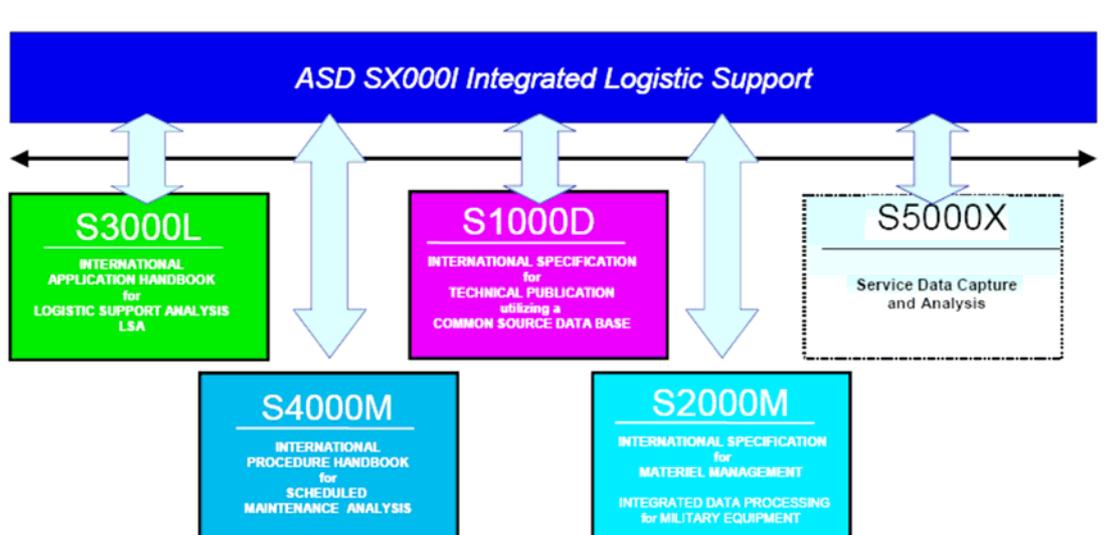
² EG14 recommends 3 best practice standards for life cycle documentation –S1000D; ASD-STI 100 and SCORM.

³ **EG13 Conveners Note:** Whilst every effort has been made to provide a comprehensive set of information for each standard, due to the very large scope of EG13, some of the information and rationale proposed by WS10 may be incomplete in this initial draft.

- **ISO 15288** provides the framework and scope for EG13's work. It provides a common, comprehensive and integrated framework for describing and managing the full life cycle of defence systems
- **ISO/IEC TR 19760:2003 - System Engineering** – A guide for the application of ISO/IEC 15288 (System life cycle processes) This Technical Report provides guidance for application of the International Standard ISO/IEC 15288 Systems Engineering - System life cycle processes in regard to systems and projects irrespective of size and type.
- **ISO 9000 Quality Assurance**, This standard is dedicated to assuring conformity of products and services with their specified requirements. This process provides the framework for independently and objectively assuring (the acquirer or the customer) of compliance of products or services with their contractual requirements and adherence to their established plans
- **PMBOK Guide (IEEE STD 1490-2003)** – Project management Institute (PMI - <http://www.pmi.org/>) Guide to the Project Management Body of Knowledge. PMBOK is an internationally recognized standard that provides the fundamentals of project management as they apply to a wide range of projects, including construction, software, engineering, automotive, etc. The Guide describes work as being accomplished by processes and is consistent with other management standards such as ISO 9000.

Relevant Standardisation work currently under Development

EG13 recognises the standardisation work being carried out by the **ASD** and **ECSS**. The AeroSpace and Defence Industries Association of Europe (ASD -<http://www.asd-europe.org/>) are developing a set of ILS standards that are highly relevant to EG13's scope. Two standards already exist; S1000D, S2000M and are recommended by EG14 and EG13 respectively. Two more standards are under development S3000L and S4000M. A further standard is planned shown as S5000X in the diagram but likely to be designated S5000F. EG13 recommends that S3000L, S4000M and S5000F are considered as potential 'best practice' for the EHDP when they are published.



ASD Suite of ILS Standards diagram

The European Cooperation for Space Standardisation (ECSS - <http://www.ecss.nl/>) produces standards specifically for the space environment. It is understood that there are plans to translate some of the project management standards into European standards to enable their wider use. If

this objective is achieved, EG13 recommends that the standards within the scope of EG13 and listed below are reviewed for possible inclusion in future EHDP updates:

ECSS-M-60B Cost and schedule management. Cost and schedule management is defined as a collective system of organized processes and actions in support of project management. It allows optimal use to be made of human resources, facilities, materials and funds, thereby achieving a successful completion of the space project.

ECSS-Q-40. Safety This Standard defines the safety programme and the technical safety requirements that are implemented in order to comply with the ECSS safety policy as defined in ECSS-Q-00. It is intended to protect flight and ground personnel, the launch vehicle, associated payloads, ground support equipment, the general public, public and private property, and the environment from hazards associated with European space systems. “

ECSS-M-00-03B (ISO 17666:2003) - Risk Identification extends the requirements of ECSS-M-00 (ISO 14300-1), the principles and requirements for integrated risk management on a space project. It explains what is needed to implement a project-integrated risk management policy by any project actor, at any level. It contains a summary of the general risk management process and states the risk management process requires information exchange among all project domains and provides visibility over risks, with a ranking according to their criticality for the project.

ECSS-M-40A - Configuration management - The formulation of this Standard takes into account the existing ISO 9000 family of documents and describes the definition of configuration management processes' flow with consequent review and updating of existing requirements. It introduces the concept of 'unique requirements identification', the update of product life cycle versus project reviews and configuration verification. New requirements related to configuration item selection, hardware identification marking, digital files and data, and operational phase of a product.

ECSS-M-70 - Integrated logistic Support - This standard is mainly of concern to large or software-intensive systems

ECSS-E-10 - System engineering – This standard is intended to guide the development of systems (including hardware, software, man-in-the-loop, facilities and services) for space applications.

ECSS-M-50 - Information/documentation management - This standard ensures the accessibility of information to all parties of the project and to ensure the coherence of this information.

ECSS-E-40 – Space System Software Engineering - The context of space software engineering is the overall space system engineering process. This clause 4 defines the general relationships between the software engineering processes and the general engineering processes of space systems.

Standards not included in EG13 scope but considered relevant for further review

The following disciplines related to ISO 15288 processes were not included in EG13's scope but should be considered for future revisions of the EHDP:

- **Stakeholder Management** (Defence customers and defence suppliers are increasingly considering partnering and longer term relationships to meet the challenges of life cycle management. This requires a step-change in the way all stakeholders relate and work with one another. A key requirement is the need for open and trust based relationships between all stakeholders. We understand that the **CMMI** (Capability Maturity Model-Integration) covers aspects of stakeholder management.

- **Architectural Design** - EG13 did not have any members with specialist knowledge in this area.)
- **Transition Management** - EGG 13 believes this area merits further consideration because a 'phased' or 'staged' approach to project management needs robust transition management to ensure continuity of requirements and traceability of management and technical decisions. Transition management could be considered in the context of '**Through Life Management**'⁴ or '**Through Life Support**' - EG13 is aware of work being carried out by the UK MoD and other European actors to develop a Through Life Support Standard, which could be 'Internationalised' at some point but it is not mature enough at this time to be assessed for the EHDP.
- **Disposal** - Disposal is discussed in Environmental Management at chapter 6.14, however environmental legislation and regulation is constantly developing and becoming increasingly complex. At present a large number of international environmental conventions are either in force or being negotiated such as:
 - **Montreal Protocol** - addresses depletion of the ozone layer through human action, particularly the use of synthetic chemicals;
 - **Framework Convention on Climate Change** - anthropogenic factors affecting climate.
 - **Kyoto Protocol** - a subsidiary protocol to the FCCC;
 - **Basel Convention** - significantly restricts movement of broadly defined hazardous wastes across international borders (e.g. bans export from developed world to developing countries)

EG13 considers the subject should be investigated further to see if a stand-alone defence related standard or guidance is required.

- '**Contracting**' ('**Agreement processes**' in ISO 15288). Intelligent contracting is fundamental if defence projects are to be 'win – win' for the customer (user) and the supplier (Defence Contractors). A poorly defined contract will almost certainly result in a confrontational project environment, overruns in budget and schedule and reduced in service capability. ISO 15288 describes the contracting (agreement processes) in a systematic way, however there is an increasing trend in defence to develop complex contracts based on availability/capability and long term 'partnering' approaches. In this report EG13 have introduced **In Service Management** as an important project management domain. This acknowledges the need for new contracting approaches but we believe there is scope for WS10 to consider the development of best practice guidance in contracting practice.

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⁴ Through Life Management is a term adopted by the UK MoD and defined as "an integrated approach to all Acquisition processes, planning and costing activities across the whole system and whole life of a project".

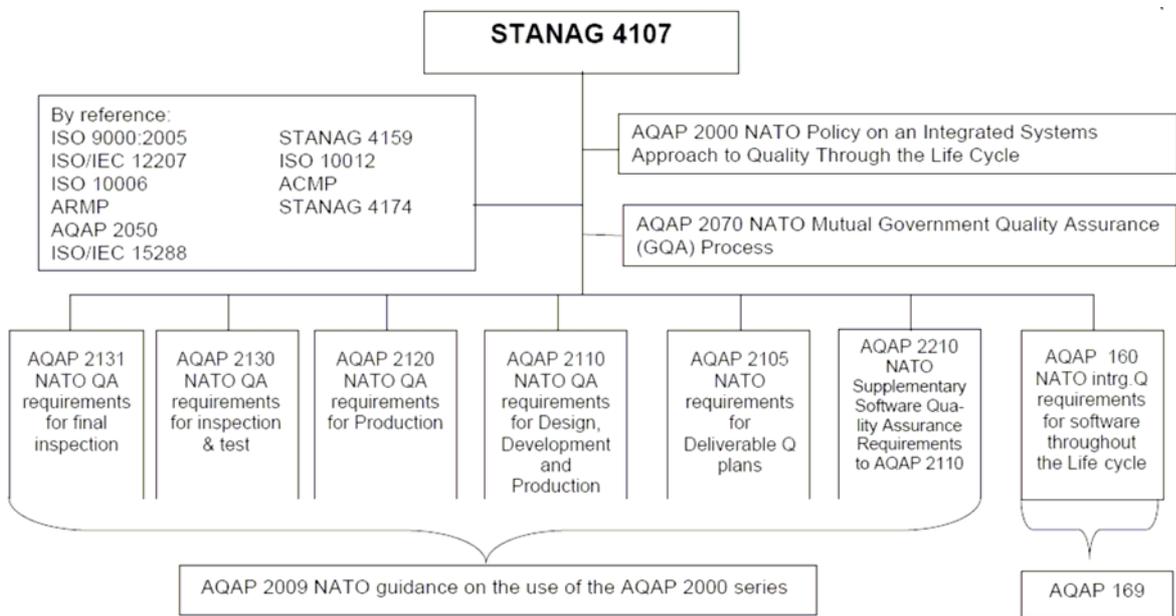
6.2 Requirements Management

<p>Description</p> <p>Requirements Management</p> <p>Definition</p> <p>Requirements management may be defined as:</p> <p>[1] “The administration and control of the information needs of users. In order to achieve business objectives within an organization via information systems, user requirements must be defined in a consistent manner, prioritized and monitored”.</p> <p>[2] “The management of requirements of a project and identification of inconsistencies between those requirements and the project's plans and work products. Requirements management practices include change management and traceability”.</p> <p>The overall objective of requirements management is:</p> <p>“to define the requirements stakeholders for a system that can provide the services needed by users and other stakeholders in a defined environment” and:</p> <ul style="list-style-type: none">• To transform the stakeholder, requirement-driven view of desired services into a technical view of a required product that could deliver those services.• Products or services obtained in accordance with the acquirer's requirements must be verified and/or validated. <p>Requirement may be defined as: “Need or expectation that is stated, generally implied or obligatory”</p> <p>Verification may be defined as: “confirmation, through the provision of objective evidence, that specified requirements have been fulfilled”.</p> <p>Validation may be defined as: “confirmation, through the provision of objective evidence, that the requirements for a specific intended use or application have been fulfilled”</p> <p>Qualification may be defined as: “process to demonstrate the ability to fulfil specified requirements”.</p>
<p>Context</p> <p>Poor requirements management is a major root cause of project failures in terms of significant cost and schedule overruns, failures to deliver all of the functionality specified, and systems that do not have adequate quality. Requirements definition and analysis are the first technical activities during which major mistakes can be made, and these mistakes can impact all downstream activities such as design, implementation, and testing. Poor-quality requirements greatly increase development and support costs and often cause major schedule overruns. A defect discovered once a defence system is fielded can cost up to 100 times more to correct than it would have if it had been found during requirements evaluations. Industry data suggests that approximately 50 percent of product defects originate in the requirements and around 80 percent of the rework effort on a development project can be traced to requirements defects</p> <p>The requirements management process for defence systems can be specified by customers or by the organisation in anticipation of customer requirements, or by regulation. The requirements for</p>

<p>products and in some cases associated processes can be contained in, for example, technical specifications, product standards, process standards, contractual agreements and regulatory requirements.</p> <p>In order to achieve these processes we identify IVVQ (integration validation verification qualification process which includes requirements traceability).</p>
<p>Recommended Best Practice Standard</p> <p>ISO 10 006: 2003 - Quality management - Guidelines to quality in project management</p> <p>Stanag 4107: 1997 - Mutual acceptance of government quality assurance and usage of the allied quality assurance publications (AQAP)</p> <p>AQAP 2110: - Requirements for design, development and production</p> <p>AQAP 160: - NATO Integrated quality requirements for software throughout the life cycle</p> <p>FD X 50-410: 1999 - General recommendation for the programme management specification</p>
<p>Link to Standardisation Organisation</p> <p>www.iso.org</p> <p>www.nato.int</p>
<p>Normative references (if any)</p> <p>N/A</p>
<p>Supporting or additional relevant standards (if any)</p> <p>ISO 15 288 (Ed. 2002) - Systems engineering — System life cycle processes</p> <p>AAP 48 (Ed.2005) - NATO System Life Cycle Stages and Processes</p> <p>ISO 12 207 (Amdt 2 – 2004) Information technology — Software Life Cycle processes</p> <p>ISO 9 001: 2000 Quality management systems</p> <p>EN 9 100: 2003 Quality management systems – requirements (based on ISO 9001 : 2000) and quality systems Model for quality assurance in design, development, production, installation and servicing (based on ISO 9001: 1994) (Aerospace)</p> <p>EN 9 200: 2004 Programme management (Aerospace and Defence) Guidelines for project management specification</p> <p>ESA PSS-05-02 Guide to the User Requirements Definition Phase (spatial)</p> <p>Note: ISO/IEC 15288, ISO/IEC TR 19760:2003, ISO 9001:2000,PMBOK Guide (IEEE Std 1490-2003) can be considered as transversal standards and guidance that support all EG13 recommendations</p>
<p>Scope of the recommended standard</p> <p>These are general documents and give recommendations for project management. Only (some) parts of these reference documents are available for requirements management.</p> <p>The ISO 10006 is a general and high level standard on Quality management (Q.M.), agreed internationally in civilian and defence fields. This document is a guideline to quality in project</p>

management and shows on § 5.2.1 the importance of the satisfaction of the customer's and other stakeholders' stated and implied needs and on § 5.4 the projects processes implementation.

Figure 1



The **Stanag 4107** is expanded in several AQAPs as seen at figure 1. The main documents for requirement management are the AQAP 2110, AQAP 160 and AQAP 2070:

- **AQAP 2110** gives stipulations to a contractor for the managing, development and verification of products. It is based on ISO 9001 which contains stipulations on requirement management in § 7.2 “Customer-related processes”.
- **AQAP 160** gives stipulations to a contractor for the managing, development and verification of software products. It is mainly issued from ISO 12207 and partly from ISO 9001, with some NATO additions. It contains stipulations toward the contractors for requirements management in its chapter 3.1 “supply process (§ 5.2 of ISO 12207), 3.2 customer review (ISO 9001: 2000 § 5.2 & 7.2), 3.2.1 to 3.2.3 Acquisition process (ISO 12 207 § 5.2.1 to 5.2.3), parts § 3.3 Development Process [3.3. 2 (ISO 12 207 § 5.3.2.1), parts of 3.3.3 (ISO 12 207 § 5.3.3.2), 3.3.4.1 (ISO 12 207 § 5.3.4.1), 3.3.4.2 (ISO 12 207 § 5.3.4.2). In addition, a more simple requirement on software requirements management is given in STANAG 2210 (which cancel STANAG 150) (§ 2.2.3 Identification and review of software requirements and partly in § 2.2.4.1 Software development process)

AQAP 2070 define a mutual government quality assurance (GQA) process in order to insure that contractor applied specification management processes in the right way.

The FD X 50-410 is the main document which describe with more details the steps needed to insure that the requirements stakeholders for a system is “well” define, agreed by contractor who decline and justify the requirements achievement. For more detail, see § 3.1 “Performance management” which allows, in a permanent way, the verification of the compliance of the performance with the technical specification and to control their evolution during the product life cycle. Based on the agreement between the customer and the supplier, the management requirements specify the requested files for verification and validation, justification and

qualification, see § 3.1.1. And the performances to be optimised, see § 3.1.2.

Note: The European Standard EN 9200 is an aerospace series, which is a guideline for project management specification. You find the same purpose than FD X 50-410, above, on § 12.1 “Technical performance control”.

Rationale for selection

These documents are general ones and give recommendations for project management. They are the highest level of acquisition management, describing the processes of acquisition under sequential (in V) scheme or incremental of AAP 48 (NATO).

How to apply/key points

The recommended standards should be applied to ensure robust and systematic requirements management is applied to the acquisition of defence systems.

Due to the complexity of requirements management it is recommend using a requirements management tool that enables the storing of requirements metadata, requirements traceability, and a requirements modelling tool to capture requirements diagrams and associated text. Requirements management must be integrated with configuration, data and information management.

Stakeholder identification is necessary to identify stakeholders who have a legitimate interest in the system throughout its life cycle. This includes, but is not limited to, users, supporters, developers, producers, trainers, maintainers, disposers, acquirer and supplier organizations, regulatory bodies.

Stakeholder requirements are expressed in terms of the needs, wants, desires, expectations and perceived constraints of identified stakeholders. These requirements are the stated outputs or results that the users require from the defence system.

Requirements must be actionable, measurable, testable, related to identified business needs or opportunities, and defined to a level of detail sufficient for system design.

Requirements analysis is the process of determining whether the stated requirements are unclear, incomplete, ambiguous, or contradictory, and then resolving these issues.

Requirements Analysis process transforms the stakeholder, needs-driven view of desired system services into a technical view of a required system product or products that could deliver those services. The resulting system requirements specify, from the developer’s perspective, what the system is required to do in order to satisfy stakeholder needs. The objective is to build a representation of a future system product or set of ‘products’ that will meet stakeholder needs and that, as far as constraints permit, does not imply any specific implementation. The system requirements are the basis for verifying the conformance of a supplied system.

Requirements traceability is concerned with documenting the life of a requirement. It should be possible to trace back to the origin of each requirement and every change made to the requirement should therefore be documented in order to achieve traceability. Even the use of the requirement after the implemented features have been deployed and used should be traceable

Requirements evolve throughout the life of a project. Requirements refinement is based on justified and controlled changes coupled with an understanding of the implications. Requirements creep is the unjustified or subjective changes based on illegitimate justifications and must be avoided.

Need for tailoring

Tailoring is an obligation, each standard giving only elements, as can be seen in the scope.

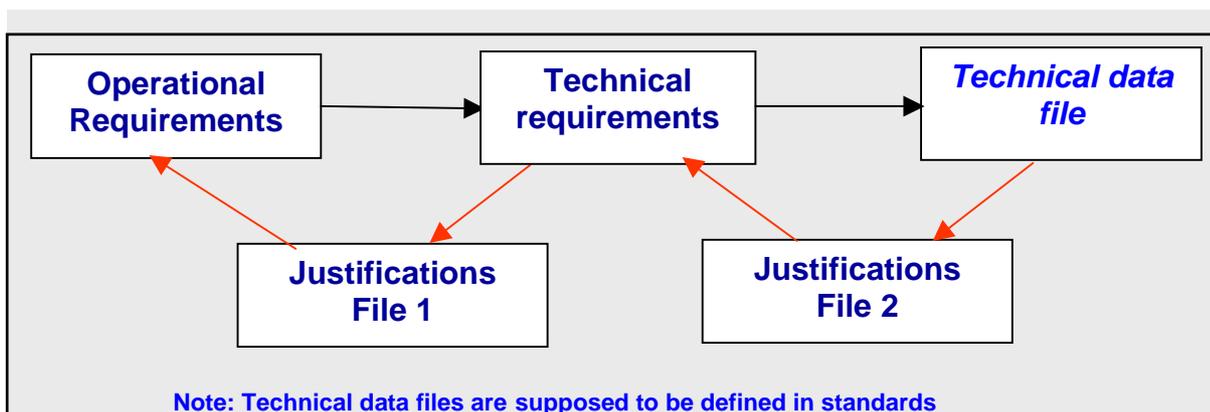
What is missing – need for further standardisation activity?

The FD X 50-410 is expanded in more particular documents needed to write the performance specification "RG Aero 008" and design justification data "RG Aero 015"; these two recommendations documents are only available in French.

EG13 notes that only the French AFNOR standard exists for requirements management and recommends the following guidance/standards for defence procurement are considered for further development:

- A document written by users (Army, Navy, Airforce) which define operational requirements,
- A document written by the Project team, which decline operational requirements in technical requirements and on which industry will work,
- A justification file between operational requirements and technical requirements;
- A justification file between technical requirements and the technical data files, result of the industrial works.

The following diagram illustrates the further standards EG13 recommend for defence procurement.



6.3 Life Cycle Cost

Description

Life Cycle Cost Management

Definition

Life Cycle Cost (LCC) may be defined as:

[1] “The sum of direct, indirect, recurring, non-recurring, & other related costs, which are estimated to be incurred in a system over its complete life cycle” (that is, the total of procurement and ownership cost).

[2] **LCC** of a system consists of all costs to be made by the owner of the system to acquire, to exploit against the required performance requirements and to dispose of the system.

Life Cycle Costing may be defined as “a set of techniques for modelling, predicting and analyzing the LCC of a system at any stage of its life”

LCC consists of all **direct costs** plus **indirect-variable costs** associated with the procurement, O&S and disposal of the system. Indirect costs may include linked costs such as additional common support equipment, additional administrative personnel and non-linked costs such as new recruiters to recruit additional personnel. All indirect costs related to activities or resources that are not affected by the introduction of the system are not part of LCC

LCC = Direct costs + Indirect Variable costs

LCC is an essential management discipline for procuring costly products (e.g. commercial aircraft, military systems). The life cycle of a system will cover several phases: design, research & development, investment, operations, maintenance, support and disposal.

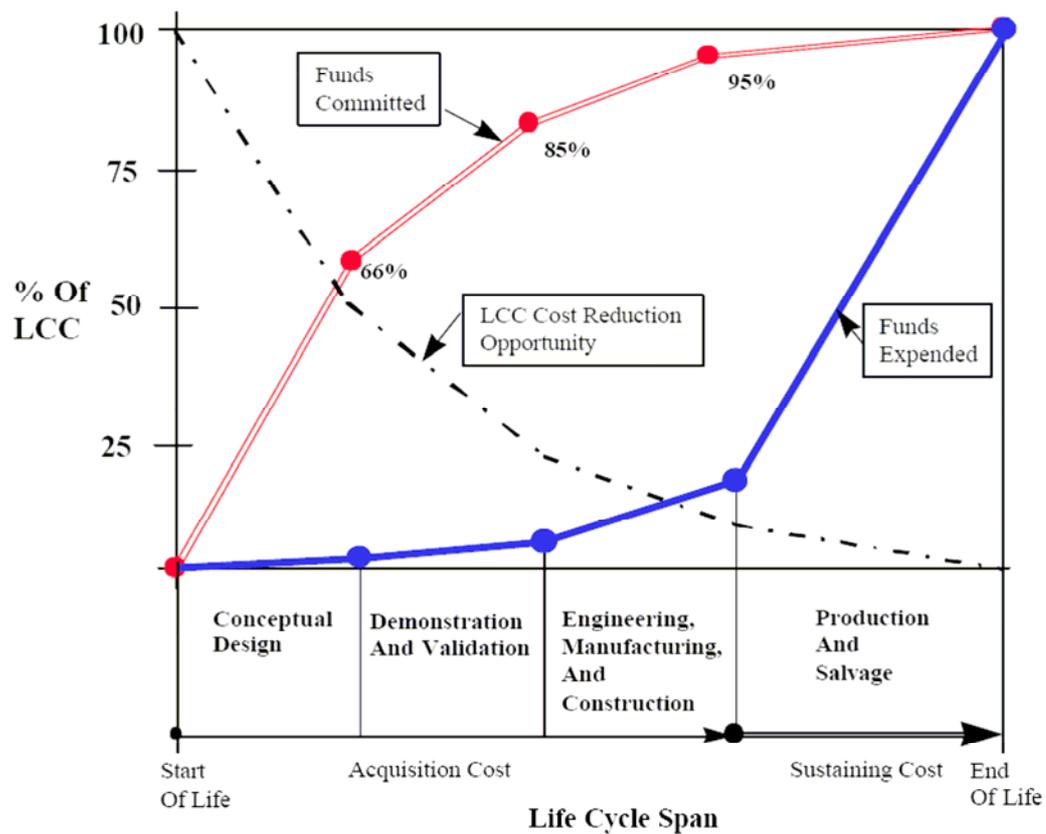
To effectively implement a LCC analysis, many parameters must be taken into consideration. Parameters of different nature and gathered from different source should be taken into account and should be understood in the same way. (Different interpretation could lead to erroneous calculations). Using LCC as a management decision tool:

- Provides a costing discipline
- Useful for procurement strategies
- Balances acquisition costs and operating costs
- Useful for trade-off studies based on facts

LCC is not an exact science, and practitioners will arrive at different answers. These answers cannot be categorised as right or wrong – however experience plus supporting evidence will show them to be reasonable or unreasonable. LCC is typically used for:

- Affordability studies;
- Source selection studies;
- Design trade-off studies;
- Repair level analysis studies;
- Warranty and repair cost studies;

- Supplier sales strategies;
- Configuring for lowest long term cost of ownership;



Context

There is a long and documented history of both cost growth and estimating optimism within military projects. The process of generating realistic cost estimates is based on the application of appropriate methods and models. It is essential that projects have a framework within which to start generating realistic and consistent life cycle cost estimates

Life Cycle cost analysis looks at the cost for the defence system over its whole life cycle. These costs could include but are not limited to:

- Studies and planning;
- Research and development; and Production;
- Training, operation, maintenance;
- Fuel, spares, repair and overhaul
- Modifications and technical updates;
- Cost of replacement and disposal.

The use of life cycle costing must, whatever the phase of the project, inform the process by which managers can make the best decisions on options presented to them. These options can include evaluation of future expenditure, management of existing budgets, options for procurement and evaluation of cost reduction opportunities.

Life cycle costing must be used as a benchmark against which options can be measured for 'value for money' during the acquisition and in-services phases. However, it must be appreciated that the greatest opportunities to reduce life cycle costs usually occur during the early phases of the project. It follows therefore that life cycle costing is used as a decision and optimisation criterion in the search of the best compromise between performance, cost and time.

Recommended Best Practice Standard

EG13 note the lack of an international standard in the area of defence LCC. The two documents listed here are Air and Space specific, but provide some insight and can be considered best practice whilst recognising the limitations of their specificity.

RTG SAS-028 -NATO Research Task Group "Cost Structures and Life Cycle Costs for Military Systems" have developed a Generic Life Cycle Cost Breakdown Structure (GCBS) and associated definitions that could be used in any military project to construct its own Cost Breakdown Structure. It has also conducted an analysis on the way to use life cycle costs in the decision-making process and a new Task Group SAS-054 is developing guidance on "Methods and Models for Life Cycle Costing" which will probably become a STANAG and become best practice for defence systems LCC.

ECSS-M-60B - Cost and schedule management

SAE AIR 1939 - Aircraft engine life cycle cost guide" (Not a standard but recommended by the EG 13)

Link to Standardisation Organisation

www.sae.org

Normative references (if any)

N/A

Supporting or additional relevant standards (if any)

SAE AIR 1939 "Aircraft engine life cycle cost guide" (Not a standard but recommended by the EG 13)

MIL-HDBK-259. Life cycle cost in navy acquisition

This handbook provides information on the use of life cycle costing in system and equipment acquisitions. It makes no attempt to develop a LCC standard but rather describes the general methodology and procedures which help make life cycle costing a productive in-house tool as well as a means of program or project evaluation. As inroads are made in the usage of LCC analysis, estimating and implementation techniques should improve, particularly in the operating and support (O&S) cost areas. To maximize their usefulness, LCC analyses should be tailored to the particular needs of an acquisition.

MIL-HDBK-276/1. Life cycle cost model for defence materiel systems data collection workbook

This handbook provides information on the cost elements and structure of the Marine Corps Life Cycle Cost Model for Defence Materiel systems. It makes no attempt to prescribe how the analyst

should go about determining the various costs and cost factors which make up individual estimates. It can be used in conjunction with MIL-HDBK-276-2 (Military Handbook, Life Cycle cost Model for Defence Material Systems Operating Instructions, Global).

Note: ISO/IEC 15288, ISO/IEC TR 19760:2003, ISO 9001:2000, PMBOK Guide (IEEE Std 1490-2003) can be considered as transversal standards and guidance that support all EG13 recommendations.

Scope of the recommended standard

SAE AIR 1939 Aircraft engine life cycle cost guide. Provides guidelines for LCC calculations in military aircraft engines. AIR 1939 addresses communication of LCC data between equipment suppliers, aircraft engine producers, aircraft manufacturers, and users. While inputs and output formats are suggested, calculation procedures and cost methodology are specifically excluded since many LCC models preferred by the industry are company sensitive or proprietary. The relationship of LCC input data to the program phase is described. Ground rules and assumptions are addressed. A glossary of LCC terms is provided”.

The evolution of LCC estimation has resulted in many different approaches, definitions, directives and procedures. Consequently, a need has arisen to achieve consistency in the exchange of LCC data without specifying methods to calculate these costs. This AIR responds to this need for consistent format and definitions for LCC inputs and outputs”.

ECSS-M-60B Cost and schedule management. Cost and schedule management is defined as a collective system of organized processes and actions in support of project management. It allows optimal use to be made of human resources, facilities, materials and funds, thereby achieving a successful completion of the space project.

Rationale for selection

SAE AIR 1939 Aircraft engine life cycle cost guide Defines the nomenclature and the different input/outputs parameters. It is intended to provide consistency for the exchange and comparison of LCC data, but do not specify calculating methods. It can be used in conjunction with the:

SAE ARP 4292: "Data formats and practices for Life Cycle Cost Information". The last one provides specific LCC breakdown and formats that should be tailored to the specific project needs. It helps in structuring the cost and avoids that some costs could be forgotten. Both guides help in the understanding and exchange of LCC information.

How to apply/key points

The recommend standards should be applied to ensure LCC management is implemented at the inception of a project and constantly updated throughout it's life cycle. Early in the project life cycle, studies need to address the capability gap, the numbers of equipment or platforms required and the technologies that can help to fill the gap at lowest cost. This requires a 'strategic' approach that can provide a capability to look at the 'big picture'. At this phase in the life cycle it is unlikely that the costs can be identified in a great deal of detail, rather an understanding of the holistic values in terms of the primary cost breakdown structure elements and the uncertainty surrounding these figures is required.

Once a project team has been formed the focus turns to the performance, cost and time envelope of various options that will meet the user's requirement. Forecasts of the likely life cycle costs are needed so that the cost breakdown structure can be developed and extended to reflect the acquired knowledge of the expected system characteristics and associated costs.

Assessments of bids to develop the system are conducted on life cycle cost analysis and need to

address all the economic and financial requirements. At this stage the cost breakdown structure should be fully developed such that all the cost elements are identified.

For in-service equipment a forecast of the costs for the remaining life is required. This will assist in any budget adjustment studies and provide a realistic baseline upon which to measure and compare with the effect of incremental updates, overhauls or even the procurement on new equipment.

In summary, it is not possible or desirable to collect and analyse information at the same level of detail throughout the life cycle although there should be a common thread in terms of project phases, cost breakdown structure grouping and resource consumption.

The dominant emphasis of SAE AIR 1939 is to present an LCC guide for the consistent exchange of data for use in the achievement of affordable and cost effective total systems and related RDT&E, acquisition and O&S cost elements. This guide serves as basis for Aircraft engine system LCC data exchanges.

Need for tailoring

N/A

What is missing – need for further standardisation activity?

NATO SAS 028 study report on cost structure and Life Cycle Costs for military projects

NATO SAS 054 study report Methods and Models for Life Cycle Costing

(Both reports will be used in the future NATO guidance and probably become STANAGs and will be regarded as best practice guidance for defence LCC management)

EG13 also note the following additional guidance:

ANEP 41 on Allied Naval Engineering Publication on ship costing (not yet published)

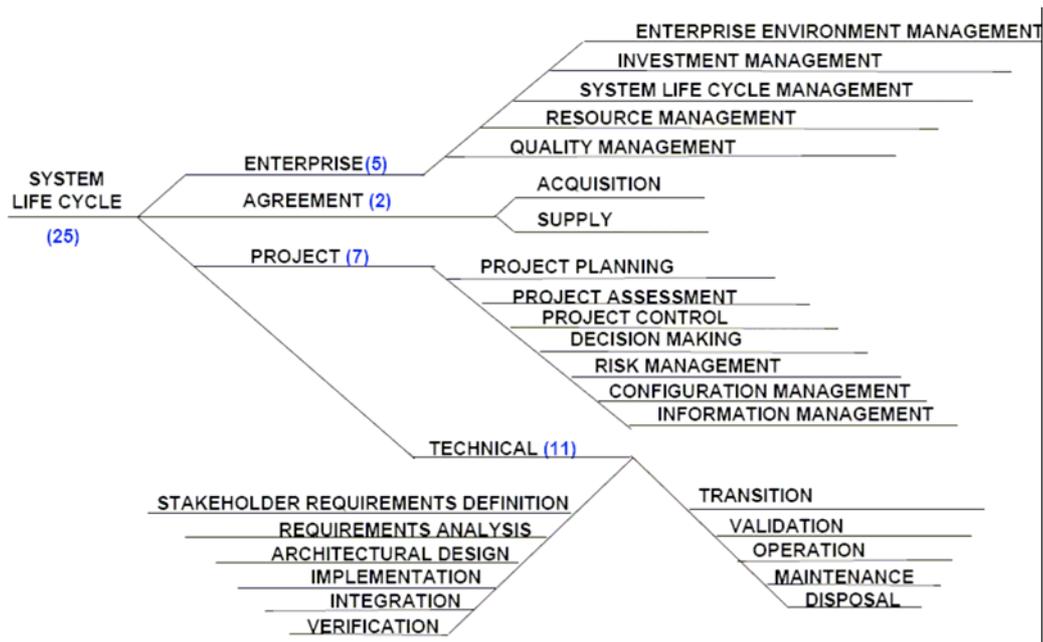
VIVACE (Value Improvement through a Virtual Aeronautical Collaborative Enterprise) report on Life Cycle Modelling within the Virtual Engine Enterprise

6.4 Systems Engineering

Description
Systems Engineering
Definition
<p>Systems Engineering may be defined as:</p> <p>[1] “an engineering discipline whose responsibility is creating and executing an interdisciplinary process to ensure that the customer and stakeholder's needs are satisfied in a high quality, trustworthy, cost efficient and schedule compliant manner throughout a system's entire life cycle”</p> <p>[2] “Systems Engineering is the set of activities which control the overall design, implementation, and integration of a complex set of interacting components or systems in order to meet the needs of all users and other stakeholders”.</p> <p>This makes the point that systems engineering is concerned fundamentally with dealing, in a systematic and integrated manner, with the understanding of user needs and the co-ordination of all the essential technical activities needed to bring into existence a new capability in its operating environment which satisfies these needs.</p> <p>Systems engineering bases its approach on common sense and practicality. The approach has grown up and been refined, based on the lessons learned from success and failure in numerous projects, many from the defence and aerospace sectors. The strength of systems engineering comes from this background, through its ability to minimise the kinds of problems which have been repeatedly encountered in projects who do not apply robust system engineering practices.</p>
Context
<p>The complexity of defence systems has increased to an unprecedented level. This has led to new capabilities and improved performance but also to increased challenges for the organisations creating and utilising those systems. These challenges exist throughout the life cycle of a system and at all levels of structural detail and include:</p> <ul style="list-style-type: none">• The inherent differences between the hardware, software and human elements that constitute a defence system;• The dependency most defence systems have on software and computer systems;• the challenges of harmonising and integrating science, engineering, management and finance;• The frequently changing threat and hence changing capability requirements for defence systems;• The inevitable balance and trade off required between cost, time and performance;• The issues of obsolescence for systems in use for 20-30 years. <p>The Systems Engineering and Project Management functions interact intensively throughout the life of a project. Many of their concerns are shared or closely linked. However, it is possible to differentiate the principal functions as follows:</p> <p>Systems engineering is a top down, iterative process that aims to provide a common framework to improve communication and co-operation among all stakeholders involved in creating and utilizing defence systems so that they can work in an integrated, coherent fashion. It is a key enabler to developing complex defence systems that are required to operate effectively over long life cycles.</p> <p>Project Management (PM): has overall responsibility for leading the project and delivering results to the customer. PM is in charge of planning, spending, budgeting and cost estimation, also for negotiating all agreements outside the project, for example with suppliers. PM is ultimately</p>

responsible for managing the project and the interests, requirements and interfaces between relevant stakeholders.

Systems Engineering is responsible for the technical integrity of the project; application of appropriate SE processes; preparation for and conduct of technical reviews; creation and maintenance of the project information base; linkages between the project and support systems; design of subsidiary technical activities and their integration; choice and maintenance of appropriate tools and methods; technical risk estimation and reduction. In the later stages, SE will oversee the integration of the system of interest and its final installation into its operational environment.



The systems engineering processes from ISO 15288

Recommended Best Practice Standard

ISO/IEC 15288 - Systems engineering — System life cycle processes

ISO/IEC 12207 - Software Life Cycle Processes

AAP 48 - Allied Administrative Publication-48 "NATO System Life Cycle Stages and Processes"

Link to Standardisation Organisation

www.iso.org

Normative references (if any)

ISO/IEC TR 19760:2003 - System Engineering – A guide for the application of ISO/IEC 15288 (System life cycle processes)

ISO/IEC 12207:1995/AMD.1:2002 Information technology — Software life cycle processes — Amendment 1

Supporting or additional relevant standards (if any)

ISO 10006 - Quality Management (Guidelines to Quality in Project Management);

ISO 10303-239 - STEP Part 239: Product Life Cycle Support;

ISO 13407 - Human - Centred Design Processes for Interactive Systems;

ARMP1 - NATO Requirements for Reliability and Maintainability;

ARMP4 - Guidance for Writing NATO R&M Requirements Documents;

ARMP7 - NATO R&M Terminology applicable to ARMPs;

IEC 60300 - Dependability Management;

ISO 15408 - Information Technology - Security Techniques - Evaluation Criteria for IT Security;

ISO 15504 - Information Technology - Process Assessment;

ISO 16085 - Information Technology – Software Life Cycle Processes – Risk Management

ISO 9241 - Ergonomic Requirements for Office Work with Visual Display Terminals (VDTS) -Part 11: Guidance on Usability

STANAG 4107 - Mutual Acceptance of Government Quality Assurance and Usage of the Allied Quality Assurance Publications

STANAG 4159 - NATO Materiel Configuration Management Policy and Procedures for Multinational Joint Projects

STANAG 4427 - Introduction of Allied Configuration Management Publications (ACMPs)

STANAG 4457 - Engineering Documentation in a Multinational Joint Project – AEDP 01

EIA 632 - Processes for Engineering a system

STANAG 4427 is expanded by:

- **ACMP-1** - NATO Requirements for the Preparation of Configuration Management Plans;
- **ACMP-2** - NATO Requirements for Configuration Identification;
- **ACMP-3** - NATO Requirements for Configuration Control, Engineering Changes, Deviations and Waivers;
- **ACMP-4** - NATO Requirements for Configuration Status Accounting;
- **ACMP-5** - NATO Requirements for Configuration Audits;
- **ACMP-6** - NATO Configuration Management Terms and Definitions;
- **ACMP-7** - NATO Configuration Management - Guidance on Application of ACMPs 1 to 6;

AQAP 2210 - NATO Supplementary S/W Quality assurance Requirements to AQAP 2110;

AQAP 160 - NATO Integrated Quality Requirements for S/W throughout the Life Cycle;

AQAP 2000 - NATO Policy Integrated Systems Approach to Quality through the Life Cycle;

AQAP 2009 - NATO Guidance on the Use of the AQAP 2000 Series;

AQAP 2050 - NATO Project Assessment Model;

AQAP 2110 - NATO Quality Assurance Requirements for Design, Development and Production;

AQAP 2120 - NATO Quality Assurance Requirements for Production;

AQAP 2130 - NATO Quality Assurance Requirements for Inspection and Test;

AQAP 2131 - NATO Quality Assurance Requirements for Final Inspection;

Note: ISO/IEC TR 19760:2003, ISO 9001:2000, PMBOK Guide (IEEE Std 1490-2003) can be considered as transversal standards and guidance that support all EG13 recommendations

Scope of the recommended standard

ISO/IEC 15288 establishes a common framework for describing the life cycle of systems created by humans. It defines a set of processes and associated terminology. These processes can be applied at any level in the hierarchy of a system's structure. Selected sets of these processes can be applied throughout the life cycle for managing and performing the stages of a system's life cycle. This is accomplished through the involvement of all interested parties with the ultimate goal of achieving customer satisfaction.

ISO/IEC 15288 makes reference to ISO/IEC 12207 and provides a mapping between the processes described in both standards to show the relationship between the standards.

AAP – 48 Allied Administrative Publication-48 serves as guidance for implementing NATO's System Life Cycle Management (SLCM) Policy. It establishes a common framework for describing and implementing life cycle management for NATO defence related capabilities.

It is part of the NATO Policy for SLCM that the ISO/IEC 15288 standard is used as the basis for implementing SLCM in NATO.

Rationale for selection

ISO/IEC 15288 is the worldwide recognised standard, which provides a common framework to improve communication and co-operation among the parties that create, utilize and manage modern systems in order that they can work in an integrated, coherent fashion.

This International Standard provides a common process framework covering the life cycle of systems from their conception through to retirement.

ISO/IEC 15288 makes reference to ISO/IEC 12207; hence the Life Cycle Processes for Software are also covered.

AAP-48 defines NATO's System Life Cycle Management (SLCM) framework and provides guidance for implementing the standard ISO/IEC 15288 to achieve an integrated approach to the delivery of defence related capabilities.

How to apply/key points

The fundamental systems engineering objective is to provide high-quality products and services, with the correct people and performance features, at an affordable price, and on time. The application of the recommended standards will ensure that systems engineering is conducted as

an integral part of project management. This involves developing, producing, testing, and supporting an integrated set of products (hardware, software, people, data, facilities, and material) and processes (services and techniques) that is acceptable to stakeholders, satisfies enterprise and external constraints, and considers and defines the processes for developing, producing, testing, handling, operating, and supporting the products and life cycle processes. This objective is achieved by simultaneous treatment of product and process content to focus project resources and design decisions for the establishment of an effective system design. This involves an integrated handling of all elements of a system, including those related to manufacturing, test, distribution, operations, support, training, and disposal.

Systems engineering places strong emphasis on risk management, and a range of activities which have been found by experience to be essential in coping with the complexity already referred to. These include:

- capturing and thoroughly analysing stakeholders' needs and expectations;
- considering the full life cycle in terms of key technical activities in support of decision making;
- providing linkages between all technical supporting activities - modelling, prototyping and analysis - and the main development;
- considering and managing the system's intended operating environment and its interfaces with other systems (both co-operating and competing);
- providing visibility and control internally and externally to projects, so that the characteristics of the proposed capability are known and understood, and progress towards realisation can be measured at all stages;
- ensuring that alternative solutions at all levels are both proposed and assessed;
- providing traceability links between all project products, including information and documentation as well as tangible artefacts;
- Ensuring that all decisions and their rationale are recorded and may be revisited.

The case for adopting a systems engineering approach should provide the following benefits:

- reduced overall procurement time and cost;
- far less re-work and nugatory activity arising from avoidable change originating from within the project;
- a greater resilience to unavoidable changes imposed from the outside sources;
- greater likelihood of systems meeting real needs and providing worthwhile operational capability;
- Reduced overall life cycle costs, including the costs of modifications and technical updates.

ISO/IEC 15288 (together with its reference to ISO/IEC 12207) can be used as written as a reference document in the EHDP.

Need for tailoring

Allied Administrative Publication-48 (AAP-48) could be used from its technical contents as a reference document in the EHDP.

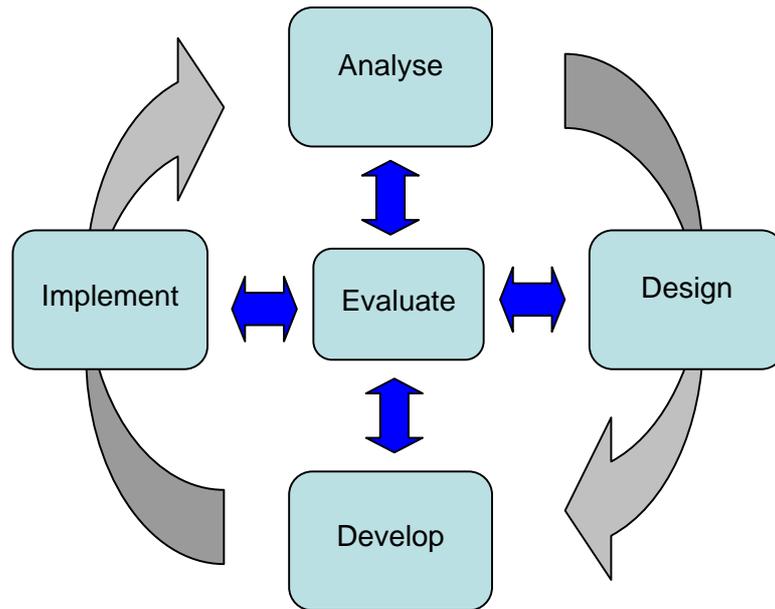
Since AAP-48 is a NATO Document its use for other than NATO applications within the scope of the European EHDP requires further investigation and may result in the need for tailoring.

What is missing – need for further standardisation activity?

N/A

6.5 Project Management

Description Project Management
Definition <p>Project Management may be defined as: “the planning, monitoring and control of all aspects of a project, and the motivation of all those involved in it, to achieve the project objectives, on time and to the specified cost, quality and performance”.</p> <p>Project may be defined as “a unique process consisting of co-ordinated and controlled activities, with start and finish dates, undertaken to achieve an objective conforming to specific requirements including constraints of time cost and performance”</p>
Context <p>Project Management is the key discipline in coordinating, integrating, implementing and controlling all activities during a defence system Life Cycle.</p> <p>Project management includes the optimising and controlling of technical performance, cost and schedule objectives such as the:</p> <ul style="list-style-type: none">• Definition of all PM activities;• Roles and the responsibilities of all the stakeholders;• Consistency and coordination between their respective activities;• Project planning, communication, analysis, reporting;• Creation of a stable and rigorous project organisation;• Creation and application of rules and guidance;• Project performance and performance measurement criteria;• Dispute resolution framework;• Risk management activities;• Budget and resource management;• Contract management. <p>Project management involves the iterative design and development of user requirements into a deliverable that meets those requirements. The following model represents the iterative process central to project management:</p>



Iterative project management process

Recommended Best Practice Standard

EN 9200:2004 (European standard) Programme Management – Guidelines for project management specification

BS 6079 Guide to project management

RG.Aéro 000 40 - Recommandation générale pour la spécification de management de programme

ISO/IEC TR 16326 - Guide for the Application of ISO/IEC 12207 to Project Management

ISO 10006 - Quality management guidelines to quality in project management

Link to Standardisation Organisation

Project Management Institute (PMI) <http://www.pmi.org/>

Normative references (if any)

EG13 understands that work is currently undertaken by the "Programme Management" working Group of the ISO, to standardise the Programme Management activity worldwide.

Supporting or additional relevant standards (if any)

BS 6079-1:2002 (British standard)
Project management - Guide to project management

FD X50_410: 1999 (French standard – English version)
General recommendation for the Programme Management specification

PMBOK Guide (IEEE Std 1490-2003) – Project management Institute (PMI - <http://www.pmi.org/>)
Guide to the Project Management Body of Knowledge. PMBOK is an internationally recognized standard that provides the fundamentals of project management as they apply to a wide range of projects, including construction, software, engineering, automotive, etc. The Guide describes work as being accomplished by processes and is consistent with other management standards such as

ISO 9000.

Note: ISO/IEC 15288, ISO/IEC TR 19760:2003, ISO 9001:2000, can be considered as transversal standards and guidance that support all EG13 recommendations

Scope of the recommended standard

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the European countries⁵ are bound to implement **EN 9200:2004**. This European Standard is intended to be used as a reference to current best practices. These can be used as a guideline for the creation and negotiation of the project management specification between a customer and a supplier, and hence lead to the creation of the project management plan. It may be used for any project utilising several actors at different levels. And It provides recommendations for the management of large projects.

Rationale for selection

The EN 9200:2004 standard is a European standard agreed for application by most of the EC nations

It is considered as one of the reference standards by the "Programme Management" working Group of the ISO, to issue a PM international standard.

How to apply/key points

The recommended standards should be applied to ensure a structured and systematic approach to project management. The project manager is ultimately responsible for project success. Project success, simply stated is the completion of all project deliverables on **time**, within **budget**, and to a level of **quality** that is acceptable to sponsors and stakeholders. The project manager must keep the team's attention focused on achieving these broad goals. A robust and disciplined approach to all project activities is essential and the following principles apply to all projects:

- The ability of a project manager and his team to produce results both effectively and efficiently is highly dependent upon the cultural environment. This 'cultural environment' involves both internal and external project relations and values. Internally, the management style of the team leader must be suited to the type of project and its phase in the project life cycle. Externally, the management of the organization in which the project takes place must be supportive and the environment free of obstacles.
- Identifying all project stakeholders and understanding their roles and needs will ensure everyone is working towards the same project goals.
- Policies and procedures that are effective and efficient must be in place for the conduct and control of the project.
- Capturing and understanding the customer/users requirements, documenting them and maintaining them under version identification and change control. Requirements management is the leading success factor for systems development projects.

1. _____

2.

⁵ Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France (where it supersedes the RG Aero 0040), Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom

- Planning is the most important activity for project managers, and fundamental to project success. Planning is not a one off activity. It must be adapted and aligned to take into account changes and risks that occur during the project lifecycle.
- Projects must be completed within time cost and performance parameters and project managers must motivate the team and maintain a focus on the final objectives through regular status checks, meetings, and reminders.
- The measures of project success, in terms of both process and product, must be defined at the beginning of the project as a basis for project management decision making and post-project evaluation. The project success criteria must be established and agreed. These measures should be verified and reinforced throughout the project life cycle or it will not be possible to measure project's ultimate success.
- Project success is closely linked to opportunity and risk. Projects by their nature are risky endeavours and some project hazards cannot be entirely avoided or mitigated even when identified. Since project success may be impacted by risk events, it follows that both opportunity and risk are necessarily shared amongst the participants.
- Using standards, tools and models will encourage good practices are used and support quality and minimize rework. Projects must have enough time to "do it right the first time." and avoid the possibility of time or budget pressures leading to risky short cuts.
- It is too costly to redesign and rework deliverables that have been rushed into production. As design and development lead to production, systematic prototyping, incremental reviews and approvals, will maintain a controlled evolution. Clear approval points, accompanied by formal sign-off by customers and other key stakeholders should be built into the project plan.
- Project managers must have the authority to acquire and coordinate resources, request additional resources and make appropriate, binding decisions which have an impact on the success of the project
- Highly skilled and experienced people can compensate for too little time or money or other project constraints. Project managers should 'protect' these valuable team members from external influences and provide the necessary tools and working environment to allow them to apply their talents.
- A key role of the project manager is to focus on the life cycle of a defence system and plan not only for delivery but to ensure that supportability aspects are designed into system so as to optimise performance against the life cycle costs envisaged for the 20-30 year life of the system. The project manager will also have to plan the disposal of the defence system so as to avoid the utilisation of dangerous or environmentally harmful materials in the production of the system.

The EN 9200:2004 standard addresses the following :

- project organisation;
- work breakdown structure;
- phasing and scheduling;
- risk management;
- configuration management;
- documentation management;
- interfaces with other disciplines;
- project monitoring and control (technical performance control, cost control, schedule

- control);
- resource management;
 - quality assurance;
 - Project closure.

Need for tailoring

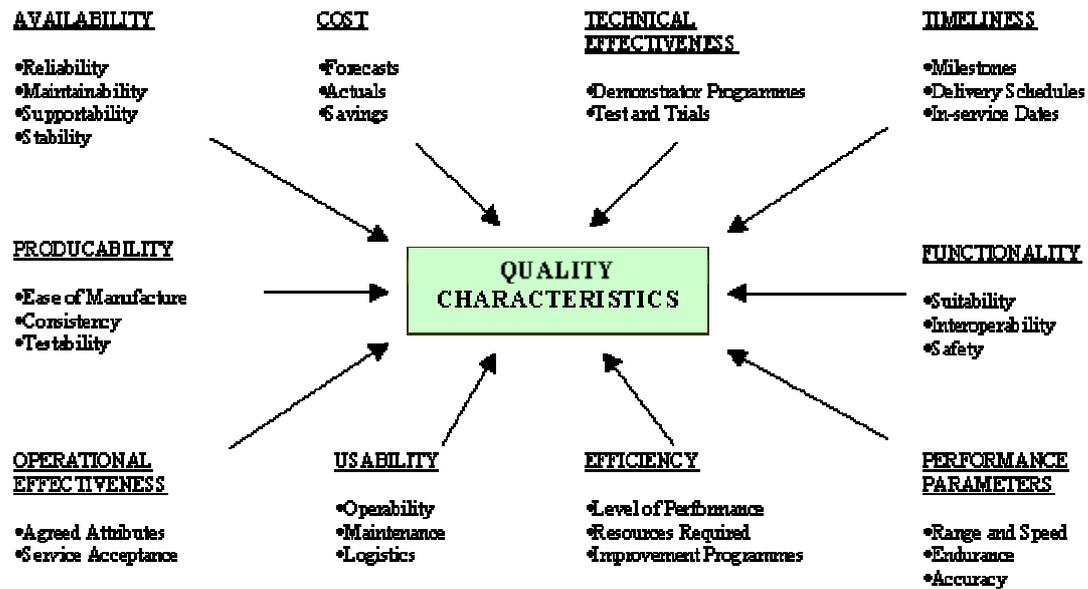
N/A

What is missing – need for further standardisation activity?

A more detailed ISO PM standard based upon EN 9200:2004 would be a valuable addition to the internationally recognised PM principles.

6.6 Quality Management

Description Quality Management
Definition <p>Quality management may be defined as “a method for ensuring that all the activities necessary to design, develop and implement a product or service are effective and efficient with respect to the system and its performance”.</p> <p>Quality management can be considered to have three main components: quality control, quality assurance and quality improvement.</p> <p>Quality management is focused not only on product quality, but also the means to achieve it.</p> <p>Quality management therefore uses quality assurance and control of processes as well as products to achieve more consistent quality.</p>
Context <p>Quality management is an essential element in the process of acquiring defence systems and services that meet the customer’s requirements and expectations. Not only does effective quality assurance lead to the achievement of customer satisfaction, but it also makes a significant contribution towards managing costs, time, performance and risks.</p> <p>Key activities that support the realization of quality products and services include planning for quality; having effective internal quality management; selecting competent Suppliers with the capability to deliver fully compliant products; specifying appropriate contractual quality management requirements; and conducting quality assurance surveillance.</p> <p>The quality management principles can be summarised as follows:</p> <ul style="list-style-type: none">• Identify the key characteristics that define the product’s quality.• Define acceptance criteria for the key characteristics.• Monitor the key characteristics throughout the life of the product.



Typical Quality Characteristics of a Defence System

Recommended Best Practice Standard

STANAG 4107 - Mutual Acceptance of Government Quality Assurance and Usage of the Allied Quality Assurance Publications"

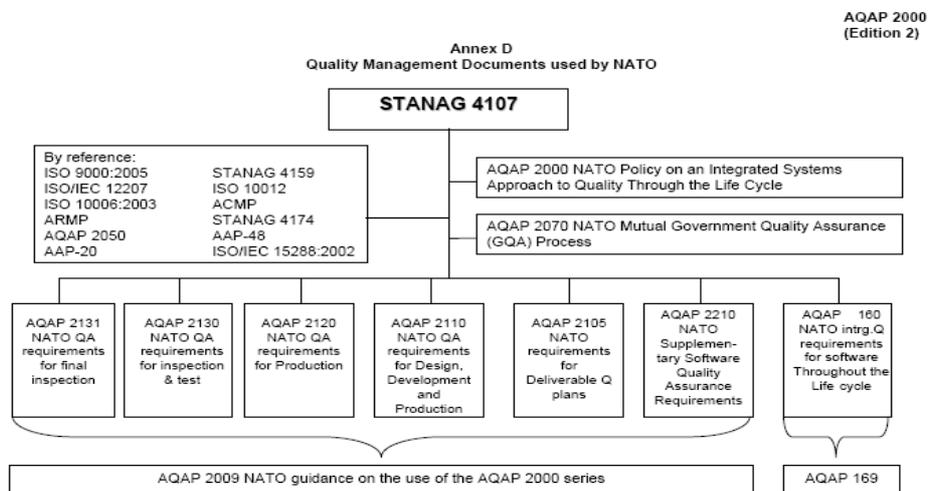
AQAP 2000 -NATO Policy on an Integrated Systems Approach to Quality through the Life Cycle"

ISO 9000 - Quality management systems - Fundamentals and vocabulary

ISO 9001 - Quality management systems – Requirements

EN 9100 - Quality management systems - Aerospace requirements

The following diagram shows the interrelation between the documents:



<p>Link to Standardisation Organisation</p> <p>www.iso.org</p>
<p>Normative references (if any)</p> <p>N/A</p>
<p>Supporting or additional relevant standards (if any)</p> <p>STANAG 4107 - Mutual Acceptance of Government Quality Assurance and Usage of the Allied Quality Assurance Publications is expanded in the following AQAPs:</p> <ul style="list-style-type: none"> • AQAP 2009 - NATO Guidance on the Use of the AQAP 2000 Series. • AQAP 2070 - NATO Mutual Government Quality Assurance (GQA) Process. • AQAP 160 - NATO Integrated Quality Requirements for Software throughout the Life Cycle • AQAP 169 - NATO Guidance on the Use of AQAP 160 Ed.1 • AQAP 2000 - NATO Policy on an Integrated Systems Approach to Quality through the Life Cycle • AQAP 2050 NATO Project Assessment Model • AQAP 2070 - NATO Mutual Government Quality Assurance (GQA) Process • AQAP 2105 - NATO Requirements for Deliverable Quality Plans • AQAP 2110 - NATO Quality Assurance Requirements for Design, Development and Production • AQAP 2120 - NATO Quality Assurance Requirements for Production • AQAP 2130 NATO Quality Assurance Requirements for Inspection and Test • AQAP 2131 - NATO Quality Assurance Requirements for Final Inspection • AQAP 2210 - NATO Supplementary Software Quality Assurance Requirements to AQAP 2110 <p>ISO 9004 - Quality management systems - Guidelines for performance improvements</p> <p>ISO/IEC 12207 - Information technology - Software life cycle processes 1995</p> <p>ISO/IEC TR15504 - “Software Process Assessment”</p> <p>ISO10006 Quality management – Guidelines to quality in project management</p> <p>AAP-48 NATO System Life Cycle Stages and Processes</p> <p>Note: ISO/IEC 15288, ISO/IEC TR 19760:2003, PMBOK Guide (IEEE Std 1490-2003) can be</p>

considered as transversal standards and guidance that support all EG13 recommendations

Scope of the recommended standard

STANAG 4107 sets forth the process, procedures, terms and conditions under which Mutual Government Quality Assurance of defence products is to be performed by the appropriate National Authority of one NATO member nation, at the request of another NATO member nation or NATO Organization. The aim is to standardize the development, updating and application of Allied Quality Assurance Publications (AQAPs) on the basis of the concept of quality assurance in the procurement of defence products.

AQAP 2000 provides the framework for an integrated systems approach to the achievement of quality in products and services throughout the life cycle.

ISO 9000/9001 is intended for use in any organization which designs, develops, manufactures, installs and/or services any product or provides any form of service. It provides a number of requirements which an organization needs to fulfil if it is to achieve customer satisfaction through consistent products and services which meet customer expectations.

Rationale for selection

The performance of Mutual Government Quality Assurance is considered a key element in the European Handbook For Defence Procurement. STANAG 4107 defines the rules for the implementation of this requirement.

AQAP 2000 is one of the key policy documents referred to in STANAG 4107

ISO 9000 and **ISO 9001** are the key international documents describing the main requirements for a Quality Management System, e.g.

- A set of procedures that cover all key processes in the business;
- Monitoring processes to ensure they are effective;
- Keeping adequate records;
- Checking output for defects, with appropriate corrective action where necessary;
- Regularly reviewing individual processes and the quality system itself for effectiveness;
- Facilitating continued improvement.

How to apply/key points

Quality management is fundamental to all projects and compliance with ISO 9000 and ISO 9001 is essential. ISO 9000 and ISO 9001 can be applied as written as reference documents in the European Handbook For Defence Procurement.

All defence stakeholders need to focus their efforts on delivering operational capability and striving for continual improvement of its processes and procedures. Therefore quality management is a key feature of defence procurement.

Although project managers are responsible for the achievement of quality in the defence systems procured by their project team, defence system contractors are totally responsible for the quality of

their products, and are required to maintain adequate control of their suppliers. This responsibility extends to all levels of subcontractor activity.

Contractors are expected to have certificated quality management systems, which are applied to their products. Evidence of this application will provide the project manager confidence in the contractors' performance and the quality of the defence system being developed and finally delivered.

It is essential that defence system requirements, characteristics and limitations are clearly defined, agreed, translated into the appropriate project/procurement documentation and have defined measurable acceptance criteria.

Project managers should:

- Define a Quality Strategy that describes how requirements are to be achieved and the quality activities to be undertaken from concept to disposal.
- Develop a Quality Management Plan (QMP) describing how the strategy will be implemented in terms of who is responsible for doing what, where and when; including outputs, controls, feedback and review mechanisms;
- Identify the stakeholders involved in quality management and obtain their commitment to the QMP. All agreements, limitations and constraints should be formally recorded;
- Monitor the implementation of project quality requirements as detailed in the project documentation and record reasons for non-implementation in the project history.

Need for tailoring

STANAG 4107 and AQAP 2000 could be used from its technical contents as a reference document in the European Handbook For Defence Procurement.

Since STANAG 4107 and AQAP 2000 are NATO Documents, their use for other than NATO applications within the scope of the European Handbook For Defence Procurement requires further investigation and may result in the need for tailoring.

What is missing – need for further standardisation activity?

N/A

6.7 Information Management

Description

Information Management

Definition

Information Management may be defined as:

[1] "The function of managing the organisation's information resources. Includes creating, capturing, registering, classifying, indexing, storing, retrieving and disposing of records and developing strategies to manage records. Also includes the acquisition, control and disposal of library and other information products, items kept for reference purposes, and the provision of services to internal and external customers, based on information resources".

[2] "The provision of relevant information to the right person at the right time in a usable form to facilitate situational understanding and decision making. It uses procedures and information systems to collect, process, store, display, and disseminate information".

[3] "Information management is the handling of knowledge acquired by one or many disparate sources in a way that optimizes access by all who have a share in that knowledge or a right to that knowledge".

[4] "Information is an asset to an organisation and where appropriate it should be managed throughout a project or organisation's entire life cycle. Information management should enable everyone to know what documents exist regarding a particular subject, where they are located, what media they are stored on, who owns them, and when they should be destroyed. Information management encompasses document management, records management, imaging, and knowledge management systems".

Information may be defined as:

The characteristics of the output of a process, these being informative about the process and the input".

[2] "One or more statements or facts that are received by a human and that have some form of worth to the recipient".

[3] "Knowledge derived from study, experience, or instruction".

[4] "Knowledge of specific events or situations that has been gathered or received by communication; intelligence or news".

[5] A collection of facts or data: for example statistical information.

As can be seen from the plethora of definitions, Information and Information Management is a complex but essential discipline in project management. However the common theme is the importance and criticality of information to projects and the need to manage information in a robust, systematic and structured way through the life cycle of a project.

Information must be managed for the whole life of a defence system and a driving principle is that it should be created once, maintained and used many times. The creation, application and sharing of information and knowledge improves operational and business efficiency throughout the life cycle.

Context

From the very beginning of a project, vast quantities of data, information and knowledge are created. Information management is required to enable the provision of this information to the right person at the right time in a usable form to facilitate understanding and decision making. Information Management provides the means to enable all other project activities to take place such as project organisation and communication; work breakdown structure; phasing and scheduling; risk management; configuration management; documentation management; interfaces with other disciplines; project monitoring and control, reporting; resource management etc. Timely, accurate and relevant information is vital for cost effective project management and operations particularly because in the European and global defence environment stakeholders are geographically separated, and Users will be operating their defence systems world wide.

The Information Management supporting process is the set of activities required to provide and support the applications, data and infrastructure needed to run the business processes. The customers of the Information Management process are primarily internal, but also include external customers and 3rd party vendors who interface with the support systems.

The process covers the entire life cycle of activities - from requirements gathering, to planning/standards, development, deployment, operations, support, administration, and retirement/disposal.

The deliverables of this process include the policy, systems (hardware, software) and services to support the business processes. Included within this scope are business specific software, IT work places, workgroup and communication software, and data security, as well as the services required to manage and support these on a daily basis.

Excluded from this process are the networking processes, voice communications and specific data centre operations that are required to support internal and external customers.



Recommended Best Practice Standard

ISO/IEC 15288 - Systems engineering — System life cycle processes

ISO/IEC 12207 - Software Life Cycle Processes

ISO 10303 - STEP Standard for Exchange of Product data

Link to Standardisation Organisation

www.iso.org

Normative references (if any)

N/A

Supporting or additional relevant standards (if any)

MIL-PRF-49506 – Performance Specification Logistics Management Information

Def Stan 00-60 - Integrated Logistics Support

ISO 10303-AP 239 - Product Lifecycle Support (PLCS) data

ACod P-1 - NATO Manual on Codification

Stanag 4457 - Engineering Documentation in Multi national Joint Projects

IEEE 1220 Section 3.1.1.1 Integrated Repository. Describes the implementation of the project's information repository. Includes a description of how information will be captured, traced, and maintained. Provides a description of the provisioning for any design-capture data, which includes domain models (processes, technologies, etc.);

ISO/IEC 15408 Information security – security techniques – evaluation criteria for IT security

Note: ISO/IEC 15288, ISO/IEC TR 19760:2003, ISO 9001:2000, PMBOK Guide (IEEE Std 1490-2003) can be considered as transversal standards and guidance that support all EG13 recommendations

Scope of the recommended standard

ISO/IEC 15288 - Systems engineering — System life cycle processes. Provides the framework and scope for EG13's work. It provides a common, comprehensive and integrated framework for describing and managing the full life cycle of defence systems

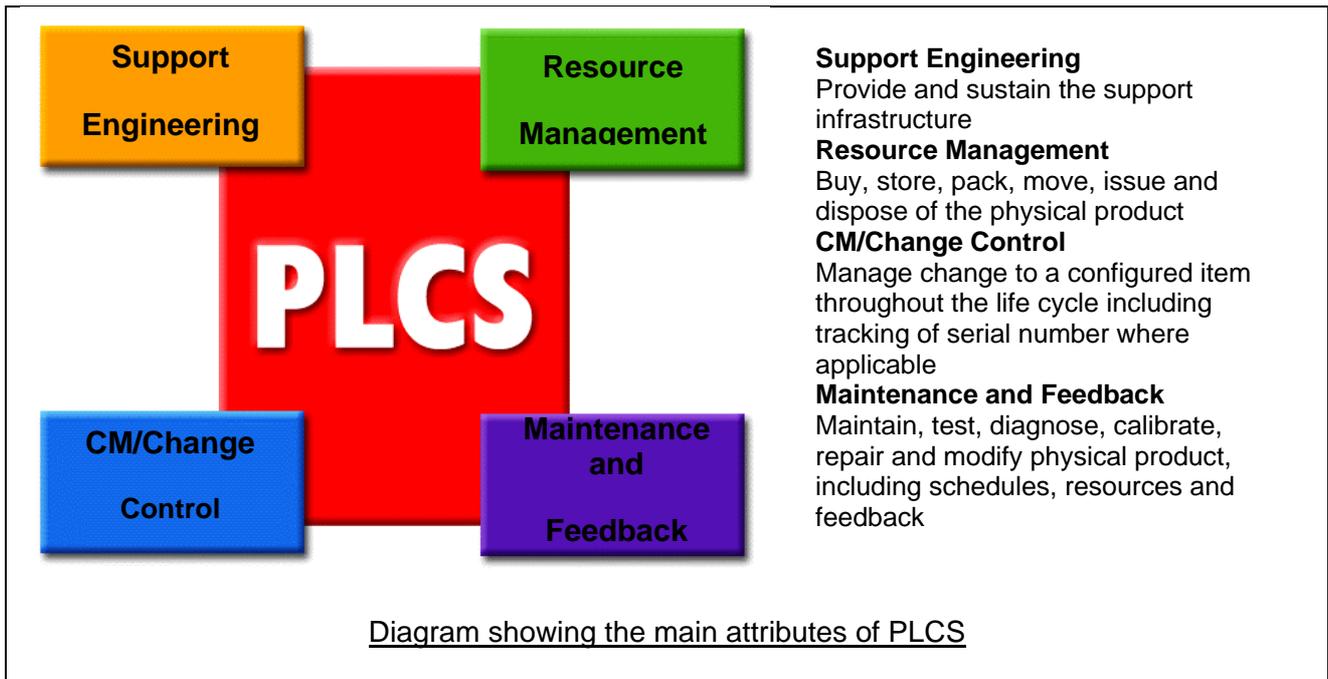
ISO/IEC 12207 - Software Life Cycle Processes

ISO 1030 STEP - Standard for Exchange of Product data - This standard enables the Exchange, sharing and archiving of defence system information. It utilises as software neutral mechanism, is system independent and Life cycle applicable.

ISO 10303-AP 239 - PLCS Product Lifecycle Support (extends ISO 10303 STEP)

PLCS ensures support information is aligned to the evolving product definition over the entire life cycle. With the increasing reliance on Contractor Logistic Support contracts and investment in Shared Data Environments and Collaborative Working Environments, the need to be able to access a consistent set of data is vital. PLCS supports the logistics processes across the whole life-cycle of an equipment providing better decision making through the access of better information and allows:

- Coordination between Design, Manufacture and Support processes and information;
- Version and change management;
- Handling of many customers and many variants;
- Project vs. Enterprise needs;
- Reusability;
- Coordination in the Supply Chain (Support Chain);
- Use of Configuration Controlled 3D CAD models in support/maintenance simulation; Verification and justification;
- Alignment of Technical Information and Physical Product;
- Link between Support Information and Product Information;
- Lower support costs through improved knowledge management;
- Improved Product Quality through linking and feedback of operations and support data;
- Flexible Shared Data Environment to facilitate;
- Vendor Neutral Data Model and Definitions;
- Process Independence and Data Longevity;
- Tailoring through reference data libraries.



Rationale for selection

.Information and data are to be managed as corporate assets. Data standards are fundamental to minimise internal and external interface information exchange requirements

ISO/IEC 15288 is the worldwide recognised standard, which provides a common framework to improve communication and co-operation among the parties that create, utilize and manage modern systems in order that they can work in an integrated, coherent fashion This International Standard provides a common process framework covering the life cycle of systems from their conception through to retirement.

ISO/IEC 12207 is referenced by ISO/IEC 15288, hence the Life Cycle Processes for Software are also covered.

ISO10303 (STEP) is the Internationally recognised standard for electronic exchange of product data.

How to apply/key points

Timely, accurate and relevant information is vital for effective project management and the recommended standards should be applied to ensure information is exchanged, shared and exploited throughout the project life cycle.

Project managers should implement and Information Management Plan and where feasible appoint an information manager to oversee the day to day management of information both internally and externally to the project. Because more projects will adopt new contracting approaches for the support of defence systems, the contractor or selected service provider will be reliant upon the quality of data to support their business decisions and meet their contractual payment milestones or performance based agreements such as availability or operation of defence systems. Therefore all parties need to be able to trust the quality of the data,

Additionally the in service phase of defence systems will span several decades and product design may undergo numerous iterations during the life of the product or a related project, and the retention of the full history of product design data is likely to be both a contractual and legal requirement. Similarly, large amounts of commercial data will be generated over the life of a programme. The challenge is to develop innovative and future-proof solutions to enable the reliable

storage and retrieval of these large quantities of information.

Information management will involve the following activities:

- Collected, identified, classified and stored and maintained and archived for the life cycle of the project;
- Exchanged between parties, systems, people and organisations. This includes ensuring that the meaning of the information exchanged is contained and understood by the
- Shared between stakeholders, information systems or organisations
- Hosted in data repositories – managing and presenting data and information for stakeholders and information systems
- Subject to quality control in order to maintain and improve information quality e.g. verification of data and information accuracy
- Safeguarded in accordance with laws and regulations for security of repositories, transmissions and distribution.
- Managed within laws and regulations – governing the content of information. (Personal protection, commercial protection – other legal issues for information)
- Managed in accordance with methods and procedures for Information governance including information owners, information management routines, information accessibility

ISO/IEC 15288 (together with its reference to ISO/IEC 12207) can be used as written as a reference document in the European Handbook For Defence Procurement. PLCS will provide the life cycle management process for Support Engineering, Resource Management, Configuration Management including Change Control and defence system Maintenance and feedback.

Need for tailoring

Tailoring is made by the other processes of the Product Life Cycle. Information Management as such is not subject to any tailoring.

Note: EG13 recognises the large body of work represented by the NATO CALS (Continuous Acquisition and Life-cycle Support) Handbook. CALS aimed to reduce defence system time to market, reduce total ownership cost, and improve quality, across the life-cycle. Information Technology (IT) is an enabler used to support the adoption and use of a shared data environment based on international standards to manage defence system technical information. Embedded in the CALS philosophy is the adoption of a rational approach to manage the production, access, management, maintenance, distribution and reuse of digital technical information. This will enable more effective creation, exchange, and use of defence system and equipment technical information over the life-cycle. In this context, information is of vital importance and must be treated as a valuable asset.

EG13 is not sure of the current status of CALS or if it is still supported by NATO therefore it has not been recommended in this report. However the subject matter is clearly relevant to Information management life cycle management of defence systems.

What is missing – need for further standardisation activity?

The following work being considered by ASD should be considered as a reference for Information Management in the future:

ASD S5000F – Application handbook for operational and maintenance data feedback

6.8 Risk Management

Description
Risk Management
Definition Risk Management may be defined as “the systematic application of management policies, procedures and practices to the tasks of establishing the context, identifying, analysing, planning and managing Risks in a way that will enable organisations to minimise threats and maximise opportunities in a cost-effective way”
Context Risk Management is a structured approach to managing uncertainty in project management through, risk assessment, developing strategies, to manage it, and mitigation of risk using managerial resources. The strategies include transferring the risk to another party, avoiding the risk, reducing the negative effect of the risk, and accepting some or all of the consequences of a particular risk. Risk Management allows an informed judgment to be made on the degree of risk in project proposals, and provides confirmation that the balance struck between performance, life cycle cost, timescale, and risk represents value for money. Its application throughout the project life-cycle makes an essential contribution to the aim of delivering on time, and to cost, defence equipment that meets its performance objectives and is value for money, reliable and supportable throughout its service life.
Recommended Best Practice Standard BS 6079-3 - “Project management - guide to the management of business related project risk” This British Standard, a part of the BS 6079 series, provides guidance on the identification and control of business related risks encountered when managing projects. It is aimed at project managers and provides guidance on the management of risk in all business sectors including defence. FD X50-117 – “Project management - Risk management - Management of the risks of a project” Note this Standard is only available in French. This standard describes the main points for project risk management.. It represents a methodological way to manage the risks of a project. This document might be applied by all types of organisations to implement project risk management, independent of size, business, product or services offered.
Link to Standardisation Organisation www.bsi-global.com
Normative references (if any) It is recommended that BS 6079-3 is used in conjunction with the following associated standards: BS 6079-1:2002 – “Project Management. Guide to Project Management.” BS 6079-1 describes a full range of project management procedures, techniques and tools that the user can select as appropriate to the project being considered. It gives guidance on the planning

and execution of projects and the application of project management techniques. It aims to provide guidance for relative newcomers to project management and to act as an aide-mémoire for more experienced practitioners and those who interact with project management teams.

BS 6079-2:2000 - "Project Management. Vocabulary"

This standard defines the terms used in project management and network planning. It has a broad relevance to projects in many industries, commerce and the public sector and was prepared in support of the other parts of BS 6079.

Supporting or additional relevant standards (if any)

Risk should be managed in the overall framework of the following key standards:

ISO/IEC Guide 73:2002 - Risk management - Vocabulary - Guidelines for use in standards

Many ISO and IEC technical committees develop standards with risk management aspects. The guide is intended to promote a coherent approach to the description of risk management activities and the use of risk management terminology, as well as contribute to a common understanding of risk management amongst standards-developing organisations.

IEC 62198 - Project Risk Management

Applicable to any project with a technological content. Provides a general introduction to project risk management, its sub processes and influencing factors. Guidelines are provided on the organizational requirements for implementing the process of risk management appropriate to the various phases of a project.

IRM - The Institute of Risk Management - Risk Management Standard

This is a free standard that is not intended to be prescriptive or to establish a certifiable process. It represents risk practice against which organisations can use to measure their risk management activities. The standard uses the terminology for risk set out by the ISO/IEC Guide 73 Risk Management - Vocabulary - Guidelines for use in standards.

ECSS-M-00-03B - Risk Identification - Space System Risk Management

Describes the principles and requirements for integrated risk management on a space project. It explains what is needed to implement a project-integrated risk management policy by any project actor, at any level. It contains general risk management principles that could be adopted by defence projects.

ECSS-M-000 3 - Risk Identification

Note: ISO/IEC 15288, ISO/IEC TR 19760:2003, ISO 9001:2000, PMBOK Guide (IEEE Std 1490-2003) can be considered as transversal standards and guidance that support all EG13 recommendations

Scope of the recommended standard

BS 6079-3 - "Project management - guide to the management of business related project risk"

Provides guidance on the identification and control of business related risks encountered when undertaking projects. It is applicable to a wide spectrum of project organisations operating in the industrial, commercial, defence or voluntary sectors. It is written for project sponsors and project managers, either or both of whom are almost always responsible to higher levels of authority for

one or more projects of various types and sizes.

Rationale for selection

1. The acquisition of defence systems is a high risk business due to the inherent complexity of developing and operating defence equipment. Technology, processes and materials are constantly changing. Defence systems are typically in service for 20-30 years. There is a high risk of obsolescence and reduced capability;

There are many standards relating to Risk Management (RM) or containing elements of Risk Management. At the time of providing this recommendation, EG13 is not aware of any RM standard that is completely suitable for certification or contractual purposes. EG13 recommends the application of **BS 6079-3** or as the most suitable and adaptable risk standard given this constraint. BS 6079-3 is not intended as a substitute for specific standards that address risk assessment in distinct applications, such as health and safety, or areas of technological risk.

How to apply/key points

The recommended standards should be applied to ensure risk management is embedded and applied to every project management activity. All managers involved in the acquisition of defence systems have to manage complex and sometimes large number of risks. RM aims to identify the key cost, schedule and performance drivers and allows actions to be focused where they will be most effective. The challenges are;

- Constantly evolving threats impacting the effectiveness of defence system capability;
- Changing political environments and defence priorities impacting defence decisions;
- Funding for defence projects critical and subject to change;
- Commitment of funds before the nature and scale of the risks are understood;
- The expenditure of more public funds than originally planned and budgeted for;
- Late delivery of a defence system due to time cost or performance issues;
- Delivery of a defence system into service without the required capability in terms of, for example; reliability, maintainability, availability or materiel support.

Project Managers should adopt a formal, systematic and open RM approach. A project Risk manager should be appointed and a RM Strategy and RM Plan should be produced for all Projects. RM should be an integral part of the project management process and should inform project decisions and forecasts. It should also inform an organisation's Corporate RM activities. RM should be conducted within the overall framework of through life management and should include the activities of Identify, Analyse, Plan and Manage.

Project Managers and the defence system contractor should, when appropriate, operate a common RM process that utilises common Risk information and risk ownership should be assigned to the party best able to manage the risk. Robust RM will:

- Enable the Project team to manage and control uncertain events that may impact on the achievement of Project Objectives;
- Enhance communication by improving the basis for strategy setting, performance management and decision making;
- Added realism by providing a better basis for the allocation of resources;
- Increase Visibility Involving all stakeholders, thus raising risk awareness and enhancing accountability;
- Improve the likelihood of success and encouraging forward thinking, thus minimising uncertainty and unwelcome surprises;

Need for tailoring N/A
What is missing – need for further standardisation activity? EG13 proposes that further investigation should be carried out into the possible requirement for a Risk management standard that can be called up in defence contracts.

6.9 Configuration Management

<p>Description</p> <p>Configuration Management</p>
<p>Definition</p> <p>Configuration Management may be defined as</p> <p>[1] “Coordinated activities to direct and control configuration”. (ISO 10 007 (2003.11))</p> <p>[1] “The discipline applying technical and administrative direction and surveillance to the following activities: configuration identification and documentation, configuration control, configuration status accounting, configuration audits” (STANAG 4159 (Ed.2)</p> <p>[3] “Is the process of managing products, facilities and processes by managing the information about them, including changes, and ensuring they are what they are supposed to be in every case. It includes managing changes to the Defence system in terms of hardware, software, firmware and documentation and the processes required to manage the building, testing, acceptance, operation installation, maintenance and support of a System throughout its life”.</p> <p>Configuration may be defined as “the functional and physical characteristics of a materiel as described in its technical documentation and later achieved in the materiel”.</p> <p>NOTE: Configuration management generally concentrates on technical and organisational activities that establish and maintain control of a product and its product configuration information throughout the life cycle of the defence system.</p>
<p>Context</p> <p>The objective of CM is to provide full visibility of the defence systems previous and present configuration and the status of its physical and functional requirements throughout its life cycle. It is a key process within through life management⁶/through life support of a defence system as it captures the technical and operational requirements in documentation that is standard for both the customer and the defence contractor. It maintains consistency of the defence system’s requirements, design, functional and physical attributes, performance and operational information and ensures that the internal and external interfaces and the various parts of a complete system remains compatible, including spares, test equipment, tools, ancillaries and support documentation. Configuration baselines are established by defining materiel both functionally and physically by means of drawings, specifications and other relevant data and documentation to a level of detail necessary to assess the potential impacts of any proposed changes on, for example, LCC, availability, safety, survivability, supportability and interoperability and to manage the implementation of changes that are subsequently agreed.</p> <p>The In service phase of a defence system accounts for up to 70% of total life cycle cost and is the major source of uncontrolled expenditure by customers. Adopting a robust Configuration control strategy and applying it through life will keep the number of configuration changes to an optimum through:</p>

1. _____

2.

⁶ Through Life Management is a term adopted by the UK MoD and defined as “an integrated approach to all Acquisition processes, planning and costing activities across the whole system and whole life of a project

- Maintaining rigid budget commitment/control. (any change/modification proposals must provide complete visibility on the impact and associated costs that the subsequent embodiment will have);
- Exercising robust technical control;
- Forecasting or pre-planning defence system configuration improvements;
- Exercising robust obsolescence assessment (Assessment of obsolescence health of Proposed new products, Configuration Items etc);
- Pre-planning life cycle cost goals and available budget for modifications;
- Assessing all technical impacts on ILS (Publications, training, maintenance etc);
- Assessing costs, timescales and manpower required for producing and embodying modification Kits.

Configuration management is one of the core disciplines of System Engineering and Life cycle project management of Defence systems.

Recommended Best Practice Standard

ISO10 007 : 2003 - Quality management systems - Guidelines for configuration management

Stanag 4159 Ed02 1991 - NATO Materiel Configuration Management policy and procedures for multinational joint projects

Stanag 4427 Ed02 1997- NATO Introduction of allied configuration management publications (ACMP) expanded in:

- **ACMP-1** - NATO requirements for the preparation of configuration management plans;
- **ACMP-2** - NATO requirements for configuration management;
- **ACMP-3** - NATO requirements for configuration control - engineering changes, deviations and waivers;
- **ACMP-4** - NATO requirements for configuration status accounting;
- **ACMP-5** - NATO requirements for configuration audits;
- **ACMP-6** - NATO configuration management terms and definitions;
- **ACMP-7** - NATO configuration management guidance on the application of ACMP-1 to 6

Link to Standardisation Organisation

www.iso.org

Normative references (if any)

ANSI/EIA-649 - National Consensus Standard for Configuration Management.

MIL STD 961 - Defence specification, detailed specification

This Military Standard sets forth practices for the preparation, interpretation, change, and revision

<p>of program-peculiar specifications prepared by or for the Departments and Agencies of the Department of Defence. This Military Standard was prepared to establish uniform specification practices and in recognition of the configuration identification concepts of the DOD Configuration Management Program established by DOD Directive 5010.19 and DOD Instruction 5010.21.</p>
<p>Supporting or additional relevant standards (if any)</p> <p>MIL HDBK 61A - Guidance for configuration management</p> <p>ECSS-M-40A - Configuration management</p> <p>Note: ISO/IEC 15288, ISO/IEC TR 19760:2003, ISO 9001:2000, PMBOK Guide (IEEE Std 1490-2003) can be considered as transversal standards and guidance that support all EG13 recommendations.</p>
<p>Scope of the recommended standard</p> <p>ISO10 007 : 2003</p> <p>This International Standard gives guidance on the use of configuration management within an organisation and its application to a project. It is applicable to the support of defence systems from concept to disposal. It first outlines the responsibilities and authorities before describing the configuration management process.</p> <p>Since this International Standard is a guidance document, it is not intended to be used for certification/registration purposes.</p> <p>Stanag 4159 Ed02 1991 - This STANAG provides NATO Configuration Management (CM) Policy and Procedures to be used in multinational joint projects. It is recommended to reference this STANAG in the applicable Memoranda of Understanding (MOU).</p> <p>Note: This Stanag is under revision.</p> <p>Stanag 4427 Ed02 1997 - STANAG 4427 has been developed to provide Government Project Managers (PMs) of Multinational Joint Projects with a vehicle by which they can contractually invoke a tailorable set of requirements for the preparation and maintenance of Configuration Management Plans (CMPs) by contractors, declining STANAG 4159.</p> <p>The aim of the agreement is to register national acceptance of the series of ACMP (allied configuration management publications) 1 to 7.</p>
<p>Rationale for selection</p> <p>Only two standards have been selected as best practice by EG13): ISO 10007 and NATO STANAG 4159 referential.</p> <p>The ISO 10 007 is a general and high level CM standard that is agreed internationally in civilian and defence fields. It gives recommendations for the use of C.M. within the organisation and it is applicable to support products from their design until their service withdrawal.</p> <p>It can't be use directly in a contractual way, and provides a set of rules (mandatory) and recommendations (non mandatory).</p> <p>The standard defines a CM glossary, in accordance with ISO 9001 / 2000 (§3) and structures CM</p>

around five processes, succinctly described :

- Configuration management planning;
- Configuration identification;
- Change control;
- Configuration status accounting;
- Configuration audit;

C.M. needs to have more details about organisation, process implementation and linked data. These details can be found in the STANAG 4159 and 4427.

STANAG 4159 and **STANAG 4427** (and the ACMP) are only agreed in the defence field.

STANAG 4159 is mainly a guide. It shows how CM is included in project management objectives and main rules of C.M. and the policy between participating nations and committee (refer to annexe B).

4159 is more complete than ISO 10 007 on joint CM committee (annexe B), technical reviews (annexe F), selection of joint configuration items (annexe D) and relationships between accountabilities and activities for life cycle (annexe J).

CM processes include configuration identification and documentation (refer annexe E), configuration control (annexe G), configuration status accounting (annexe H) and configuration audits (annexe I).

As seen before, processes are not fully compliant with ISO 10 007 and need adaptations. This is the same for:

- Terms and definitions,
- Level of visibility on configuration item (which goes with level of confidence in industry).

Warning : this STANAG is under revision.

STANAG 4427 has been developed to provide Government Project Managers (PMs) of Multinational Joint Projects with a vehicle by which they can contractually invoke a tailorable set of requirements for the preparation and maintenance of Configuration Management Plans (CMPs) by contractors, declining STANAG 4159.

This document introduce 7 allied configuration management publications (ACMP), for the four *NATO processes (ACMP 2 to 5), one for preparation of a CMP by contractor (ACMP 1), one for the glossary (ACMP 6) and one as a guidance for ACMP 1 to 6 application :

- **ACMP 1:** NATO requirements for the preparation of configuration management plans.
- **ACMP 2:** NATO requirements for Configuration identification
- **ACMP 3:** NATO requirements for Configuration control – Engineering changes, deviations and waivers
- **ACMP 4:** NATO requirements for Configuration status accounting and configuration data

management

- **ACMP 5:** NATO requirements for Configuration audits
- **ACMP 6:** NATO Configuration management terms and definitions
- **ACMP 7:** NATO Configuration management – guidance on the application of ACMP 1 to 6.
- **ACMP 1 - 5** give an exhaustive set of specifications, eventually with multiple choices, in order to help the IPT team to define the relevant specifications, adapted to the project and introduce them in the contract
- **ACMP 7** gives example of data and forms applicable for engineering change proposal (ECP) and concessions (deviation/waiver)

How to apply/key points

The application of the recommended standards will ensure that configuration management (CM) is undertaken in a structured and systematic way throughout the project life cycle. CM is a management discipline that influences and uses elements of many established management and technical activities. During the early phases CM may require an increase in management costs. However, cost savings during the defence system life cycle will follow if CM is practiced in concert with established projects.

As early as possible during the initial phase of a project agreement should be reached on how to handle CM. The Contractor shall develop a Configuration Management Plan (CMP), as the basis for all the subsequent activities. The Project manager will also need to develop a CMP and a robust CM process that must control, and provide a record of, changes throughout the project life cycle and identify any dependencies between system level and sub-systems and component

CM must be applied to the defence system, including its component parts, in all its versions and:

- The Technical Information and Data (TID);
- The Ground Support Equipment (GSE), including specific and COTS software;
- The Training Aids;
- The software, including User Modifiable Data and Parameters (UMDP)

The number of Configuration Items (CI) will be dependent on the complexity of the defence system and on the requirements for in-service monitoring of its configuration. The following selection criteria may be used for the identification of the CI:

- Statutory and regulatory requirements;
- Criticality in terms of risks and safety;
- New or modified technology, design or development;
- Interfaces with other configuration items and/or GSE;

CM applies by implication to all associated parts and equipment. As such, the impact of every new requirement on all these systems will have to be considered at the same time and in parallel. For instance, a new requirement for the defence system will have an impact on its TID, but could also have an impact on the required Spares, GSE, on Training Aids and on training activities. This procedure also applies to maintenance activities that affect the Configuration Baseline of the defence system.

The In service phase of a defence system accounts for more than 70% of total life cycle cost and is the major source of uncontrolled expenditure. Adopting a robust Configuration control strategy will

reduce LCC by minimizing changes to the defence systems configuration. Where modifications are required to restore, maintain or improve defence system performance a full analysis on the life cycle costs should be carried out in order to optimise the configuration changes.

Need for tailoring

N/A Each program must define its own procedure, and it's the level of visibility needed through the configuration items and the linked technical documentation.

What is missing – need for further standardisation activity?

N/A.

6.10 In Service Management

Description In Service Management
Definition <p>In Service Management (ISM) may be defined as “the activities dedicated to the delivery of the support services during the in service phase”.</p> <p>Therefore ISM covers all type of support services activities such as ‘front office’⁷, maintenance, fleet management, repairs, spares replenishment, technical assistance, obsolescence management, documentation updates, continuation and ‘refresh’, software support.</p> <p>EG13 recognises that the ISM phase follows the design (See Chapter 6.13) development and production phases and these phases apply Integrated Logistic Support (ILS) and Logistic Support Analysis (LSA) to define, analyse and quantify logistics support requirements and services, and to influence design for supportability. These supportability requirements are implemented during the In Service support phase and managed through ISM.</p>
Context <p>ILS is clearly the mechanism for determining the support Requirements for a defence system during its utilisation (In Service) phase. The primary objective of ILS is to ensure that performance and supportability considerations (such as Reliability and Maintainability) influence the defence system design, in order to optimise system availability whilst reducing through life costs. However the management principles of ILS have evolved to focus on the acquisition phase of a project, and less attention is paid to the need to integrate support information with the changing product configuration over the life cycle.</p> <p>EG13 believes the In Service phase merits specific attention particularly due to ‘new’ and evolving methods of defence contracting where Industry becomes more and more involved in the operation and direct support of defence systems. Industry commits itself (through Service Level Agreements, or contracts based on availability or capability⁸) to ensure part or all of the maintenance activities and other support activities (even direct operation of the system) are carried out on behalf of the customer. ISM focuses on:</p> <ul style="list-style-type: none">• Emerging requirements to contract for “levels of service”• The need to enable collaboration on International acquisition and support programs, to enable data exchange with international defence ministries and industry;

1. _____

2.

⁷ ‘Front office’ in this context is used to describe the customer services offered by the contractor such as helpdesk, internet portal etc

⁸ The Availability of a system is determined by 3 crucial factors: Reliability (R), Maintainability (M) and Logistic Delay, which are mathematically linked. In simple terms: **Availability**: Enables a system to start a mission. **Reliability**: Enables a system to complete a mission; **Maintainability & Logistics**: Enable Availability to be restored. Almost any level of Availability can be achieved if sufficient resources are committed to a task, although costs will rise exponentially beyond the optimum level. In general, the higher the Reliability of a system, the less critical Maintainability and Logistics become and the less costly it will be to sustain a given level of Availability

- Recognition of the need for a systems approach to life cycle management to:
 - Optimise capability for the whole life cycle;
 - Optimise maintenance⁹ through planning and review of system maintenance activities including corrective maintenance and scheduled/preventative maintenance;
 - Manage obsolescence and technology insertion;
 - Enable continuous improvement of support;
 - Improve the management of logistic risks;
 - Allow Life cycle cost calculations;
 - Exploit new information management capabilities, including the Internet and Web Services technology;
 - Exploit new capabilities for identifying and tracking supply items(e.g. RFI tags, UID markings);
 - Reduce support costs within the MoD and industry.

Recommended Best Practice Standard

ASD S2000M chap 2 to 5 - International specification for materiel management integrated data processing for military equipment

MIL-STD-2155 + not 1 – FRACAS

ISO 10303-239 – Product Life Cycle Support

STANAG 4570 / AECTP600 - Evaluating the ability of materiel to meet extended life requirements

MIL-STD-2073-1D - Standard practice for military packaging

MIL-STD- 2173(AS) - Reliability Centered Maintenance for Aircraft, Weapons Systems, and Support Equipment

Link to Standardisation Organisation

www.asd-europe.org

Normative references (if any)

N/A

Supporting or additional relevant standards (if any)

IEC 60300-3-10: 2001 Dependability management. Part 3: Application guide. Section 10: Maintainability and maintenance support

STANAG 4174 - ARMP Allied Reliability and Maintainability publications expanded in:

- **ARMP 1** NATO requirements for reliability and maintainability
- **ARMP 2** General application guidance on the use of ARMP 1

4. _____

5.

⁹ All action taken to retain materiel in or to restore it to a specified condition. It includes inspection, testing, servicing, classification as to serviceability, repair, rebuilding and reclamation

- **ARMP6** - In service R&M

MIL-STD- 2173(AS) Reliability Centered Maintenance for Aircraft, Weapons Systems, and Support Equipment

Scope of the recommended standard

ASD S2000M chap 2 to 5 This specification is designed to cover all Material Management activities. The procedures describe the interfaces between Industry and Customer, which, when based upon contractual agreements, will provide the typical products of the Logistic Material Management:

- Chapter 2 - Procurement Planning. This chapter defines methods for Industry to provide updated information on parts offered for sale and for the quotation process, wherever it is applicable.
- Chapter 3 - Order Administration. Order Administration covers the process of order placement, and the flow of information concerning the progress of orders and deliveries. It also embraces the process of requesting that information.
- Chapter 4 – Invoicing. Invoicing provides a standard process of transmitting invoice data from Industry to Customer, in a manner designed to simplify and expedite that activity.
- Chapter 5 - Repair Administration. The Repair Administration Chapter covers Repair Order Management, Repair Order Consumption reporting and Repair Planning forecast information.

MIL-STD-2155 + not 1 - FRACAS (Failure Reporting, Analysis, and Corrective Action System) is intended to provide management visibility and control for reliability and maintainability Improvement of hardware and associated software by timely and disciplined utilization of failure and maintenance data to generate and Implement effective corrective actions to prevent failure recurrence and to simplify or reduce the maintenance tasks.

ISO 10303-239 (PLCS) is an international standard that specifies an information model that defines what information can be exchanged and represented to support a product through life.

STANAG 4570 / AECTP600 Equipment systems are often too complex to easily determine the success of a life extension program. The methodology provides a structured and economical procedure to promote conformity and documentation of life extension requirements. The process is known as the Ten Step Method.

MIL-STD-2073-1D This document outlines standard processes for the development and documentation of military packaging, as distinct from commercial packaging. This standard covers methods of preservation to protect materiel against environmentally induced corrosion and deterioration, physical and mechanical damage, and other forms of degradation during storage, multiple handling, and shipment associated with the military distribution system

Note: ISO/IEC 15288, ISO/IEC TR 19760:2003, ISO 9001:2000, PMBOK Guide (IEEE Std 1490-2003) can be considered as transversal standards and guidance that support all EG13 recommendations

Rationale for selection

These standards are recommended as being known already as references for years throughout

the In Service Support community.

ISO 10303-239 is more recent. It features a key element even the backbone of today and future support services: data exchange between the different parties involved in systems operations and maintenance.

How to apply/key points

The In service support (ISS) phase of a defence system accounts for up to 70% of total life cycle cost and must be managed proactively to ensure that the required capability is maintained and the associated support costs are kept to a minimum. The application of the recommended standards and guidance will provide a framework within in which to manage the ISS phase and ensure that activities such as maintenance, supply, and other support services are continuously assessed and where necessary re-optimised. When the defence system is in service its operating costs are driven by many factors such as:

- Operations
- Personnel
- Training
- Infrastructure/Facilities
- Consumables
- Maintenance
- Personnel
- Spares
- Documentation
- Test & support
- Packaging

Whatever ISS contracts are in place between the customer (user) and contractor (service supplier) there are many ways to optimise the defence system support costs.

For availability based contracts the availability of a system is determined by 3 crucial factors: Reliability (R), Maintainability (M) and Logistic Delay, which are mathematically linked. In simple terms:

- **Availability** - Enables a system to start a mission.
- **Reliability** - Enables a system to complete a mission;
- **Maintainability & Logistics** - Enable Availability to be restored.

Almost any level of Availability can be achieved if sufficient resources are committed to a task, although costs will rise exponentially beyond the optimum level. In general, the higher the Reliability of a system, the less critical Maintainability and Logistics become and the less costly it will be to sustain a given level of Availability. However, given that system reliability is inherent and can only be improved by redesign, the areas that can be improved to reduce in service costs include maintenance and logistics.

'Intelligent' contracting can provide win-win outcomes for the customer and supplier during the ISS phase support but it requires a change of practice and culture over more traditional contracting methods. Longer term contracts and partnering require greater trust, transparency and cooperation between stakeholders and contracts need to be written in such a way to safeguard defence system performance and shareholder value. Incentives for improved performance, based on agreed performance measurement criteria (availability or capability for example) should be considered and mechanisms to address under-performance are also required. Exit strategies' need to be constructed for both parties.

Innovative maintenance planning and execution can reduce costs and extend the useful life of a system. To accomplish this, project managers must plan for and execute preventive and corrective maintenance based on an in-depth understanding of system performance. It is not sufficient or competitive to develop a maintenance plan in development, and implement that plan without change over the defence system life cycle.

Modern, proven concepts such as:

- Failure Reporting Analysis and Corrective Action Systems (FRACAS);
- Scheduled Maintenance Analysis/Reliability Centered Maintenance (RCM). RCM optimises maintenance effort against availability targets and is an integral part of ILS and ISM. However, it can also be used independently to determine cost effective preventive maintenance regimes. It has the advantage of being equally useful for new projects and legacy systems. RCM seeks to limit preventive maintenance tasks to those which are truly necessary to reduce the risk of system failure and group them to minimise the effects of servicing on operations;
- Just-In-Time logistics;
- Information models (PLCS)

These methods aligned to powerful communications, computer-based information systems and analytical tools enable dynamic and iterative maintenance planning and logistic optimisation over the life cycle of a defence system.

Need for tailoring

MIL-STD-2155 + not 1

What is missing – need for further standardisation activity?

The following standards are under development by ASD and will be recommended as best practice once published:

S3000L - Application handbook for logistic support analysis

S4000M Procedure handbook for the development of scheduled maintenance programs

ASD S5000F – Application handbook for operational and maintenance data feedback

EG13 believes that new contracting guidance is required for 'new' and evolving methods of defence contracting where Industry becomes more and more involved in the operation and direct support of defence systems. Industry and the customer are committing to long term partnerships and Service Level Agreements, or performance based agreements such as availability or capability or commitments to provide direct services such as maintenance and other support activities (even direct operation of the system). This is a complex business and all actors would benefit from guidance in this area.

6.11 Obsolescence Management

Description OBSOLESCENCE MANAGEMENT
Definition Obsolescence Management may be defined as “an activity intended to minimize the risk of loss of supply of products on a project through the identification, quantification and resolution of obsolescence and thereby achieve optimum cost-effectiveness”. Obsolescence may be defined as: [1] “the loss, or impending loss of the manufacturers or suppliers of items, or shortages of raw materials”. [2] “the loss, or process of losing, of the last known supply or availability of an item or component”
Context Obsolescence effects all products and equipment throughout the life cycle of a system and is not limited to hardware, but includes test and support equipment, software, tools, processes, logistic products, standards, specifications and expertise. The rate of technological innovation coupled with the challenging in-service lives of defence system and services, mean that it is almost inevitable that obsolescence will impact on all defence projects at some or all stages of the defence system lifecycle. Despite this inevitability, obsolescence can be managed and mitigated. The cost of mitigation however increases significantly as the item moves closer to becoming obsolete. Obsolescence Management focuses on the system-wide application of risk management and is applicable to the entire project life cycle, becoming an integral part of the design, development, production and in-service support phases of the project. Obsolescence management should therefore be undertaken as early as possible and as an integral part of the design, production and in-service support stages in order to minimize potential remedial expenditure and thereby the overall life cycle cost.
Recommended Best Practice Standard IEC 62402 - “Obsolescence Management - Application guide” This International Standard gives guidance for establishing a framework for obsolescence management and for planning a cost-effective obsolescence management process that is applicable through all phases of the defence system life cycle. Obsolescence management is essential to achieve optimum cost-effectiveness throughout the life cycle of a defence system. The purpose of this standard is to provide guidance on planning a cost effective obsolescence management process that takes into account essential factors to ensure product life cycle costs are considered and applied.
Link to Standardisation Organisation www.iec.ch
Normative references (if any) The following referenced documents are considered indispensable for the application of this

document.

IEC 60050-191 - International Electrotechnical Vocabulary (IEV) – Part 191: Dependability and quality of service

IEC 60300-1 - Dependability management – Part 1: Dependability management systems

IEC 60300-2:2004 - Dependability management – Part 2: Guidelines for dependability management

IEC 62198 - Project risk management – Application guidelines

IEC 62258 (all parts) - Semiconductor die products

IEC 62309 - Dependability of products containing reused parts – Requirements for functionality and tests

Supporting or additional relevant standards (if any)

Note: ISO/IEC 15288, ISO/IEC TR 19760:2003, ISO 9001:2000, PMBOK Guide (IEEE Std 1490-2003) can be considered as transversal standards and guidance that support all EG13 recommendations

Scope of the recommended standard

IEC 62402 provides an overview of the obsolescence management process and its relationships with other project management processes. It provides guidance on planning, strategies and options described for hardware and its integrated software and guidance for software that is separable from its hardware. It covers the design of new systems, technology insertion into existing systems and support and maintenance of legacy systems

Rationale for selection

EG 13 recommend that guidelines provided by IEC 62402 shall be fully integrated into all defence projects in order to ensure systematic obsolescence management is conducted through the defence system lifecycle. The Project Manager should ensure a systematic approach to managing obsolescence and consider the operational risks over the operational life of the defence system associated with obsolescence such as:

- The impact of the defence system being unavailable or degraded due to lack of spares?
- What would be the impact of degraded performance due to substituted parts?
- The likely cost of premature replacement or any other mitigating actions taken to circumvent obsolescence?
- The probability of obsolescence occurring?
- How will the rate of technological advancement and/or new legislation impact on the ability to support the defence system?

The Project Manager should work closely with the defence system Contractor to ensure the Contractor plans for obsolescence from the very beginning of their design process and include “obsolescence prevention” as a specific objective of supportability engineering and logistics activities.

How to apply/key points

Applying the recommended standards will ensure obsolescence is addressed effectively at all

stages of the defence system life cycle. If applicable/feasible, a Project Obsolescence Manager should be appointed and ensure that:

- The Obsolescence Management (OM) plan is developed and managed;
- The OM plan is linked to the Risk management activity;
- The OM costs are budgeted into the project;
- A proactive strategy is taken from the earliest project phases;
- The OM strategy includes the maintenance of the relevant knowledge and skill base sets.

This objective should be maintained in all the phases of the project through the following:

- Defence system Contractor shall produce an OM Plan;
- Defence system Contractor should conduct Obsolescence Critical Analysis in the project to identify the system items with the highest risk of obsolescence and in accordance with a predefined criteria;
- Defence system Contractor should adopt a pragmatic approach by putting into practice, as a continuous effort with all levels of industry participants, timely and cost-effective obsolescence engineering practices, management tools, methods and practices to avoid the negative effects of obsolescence in the project;
- Obsolescence risk mitigation strategies are prepared for incorporation in the defence system statement of work for all provisioning contracts during the system life cycle;
- OM data requirements are clearly detailed within the statement work and rights of access are addressed during commercial negotiations;
- Defence system Contractor determines the obsolescence status of parts before its procurement;
- All Stakeholders plan the most cost effective time scales for in service technology updates/upgrades (technology road maps), managing obsolescence in existing defence system to extend their service life;
- When applicable/feasible, the defence system Contractor's internal processes for Obsolescence should be evaluated in the pre-contract award phase as an important element to judge the capability of industries to deliver their contractual obligations.

Need for tailoring

N/A

What is missing – need for further standardisation activity?

N/A

6.12 Software Management

Description
Software Management
Definition <p>Software project management may be defined as “a sub-discipline of project management in which software projects are planned, monitored and controlled”.</p> <p>Software may be defined as:</p> <p>(1) “consisting of the programs, documentation and operating procedures by which computers can be made useful to man”;</p> <p>(2) “a general term used to describe a collection of computer projects, procedures and documentation that perform some tasks on a computer system. The term includes: system software, programming software and application software”.</p> <p>Software Engineering may be defined as “the application of a systematic, disciplined and quantifiable approach to the development, operation and maintenance of software - it is the application of engineering to software development”.</p>
Context <p>Managing a software projects is a complex and demanding activity. Systems are becoming larger and more complex. The hardware and software that makes up systems grow capacity and complexity annually. Software is providing an ever-increasing percentage of many systems' functionality resulting in:</p> <ul style="list-style-type: none">• Increased software complexity, driven by increased system complexity;• Customers demanding more reliable and usable software systems;• Customers requiring the flexibility offered by software-based solutions. <p>As a result, software development costs are growing in both absolute and relative terms and it is not uncommon for the cost of the software of a system to be several times that of the hardware. Disciplined project management using lifecycle and software engineering practice is essential to ensuring the software produced in the course of a project is correct, reliable, maintainable and affordable. (i.e. supportable)</p>
Recommended Best Practice Standard <p>ISO/IEC 12207 – Software Life Cycle Processes This International Standard provides a common framework that can be used by software practitioners to manage and engineer software. It establishes a top-level architecture of the life cycle of software. The life cycle begins with an idea or a need that can be satisfied wholly or partly by software and ends with the retirement of the software.</p> <p>RTCA-178B - Software lifecycle process for safety related systems This standard defines the guidelines for development of aviation software. It focuses on project management and software engineering and extends across all life cycle activities to ensure controllable and manageable, high integrity software development process. RTCA-178B is a good process guide for developing high integrity code and when applied within a rigorous safety culture, covers all aspects of software functional safety requirements.</p>

Link to Standardisation Organisation

www.iso.org

Normative references (if any)

ISO/IEC TR 15271 - Guide for ISO/IEC 12207 (Software Life Cycle Processes)

The purpose of this technical report is to provide guidance to the application of ISO 12207. This Technical Report elaborates on factors which should be considered when applying ISO/IEC 12207.

ISO 9001:2000, Quality systems - Models for quality assurance in design/development, production, installation and servicing.

This standard is dedicated to assuring conformity of products and services with their specified requirements. This process provides the framework for independently and objectively assuring (the acquirer or the customer) of the compliance of products or services with their contractual requirements and adherence to their established plans

Supporting or additional relevant standards

ISO/IEC 90003:2004 - Software engineering - Guidelines for the application of ISO 9001:2000 to computer software

ISO/IEC 90003:2004 - Software engineering - Guidelines for the application of ISO 9001:2000 to computer software

SWEBOK - Software engineering Book of Knowledge . The Body of Knowledge is subdivided into ten software engineering Knowledge Areas (KA). Emphases on engineering practice lead the Guide toward a strong relationship with the normative literature.

IEEE - Software Standards - IEEE Software Engineering standards are used throughout industry today to maximize software development investments. Covering software engineering terminology, processes, tools, reuse, project management, plans, documentation and measurement, IEEE Software Engineering standards are implemented in an array of disciplines, including: Computer science, Quality management, and Project management, Systems Engineering, Dependability and Safety. IEEE aims to adopt the ISO/IEC 15288 software and systems engineering standard and by incorporating this standard into its family of standards, the IEEE will share the same reference set of systems and software engineering processes. The following IEEE standards are commonly applied to software projects:

- **IEEE 610** - Glossary of software engineering terminology;
- **IEEE 730** - Software Quality Assurance Plan;
- **IEEE 828** - Software Configuration Management Plan;
- **IEEE 829** - Software Test Documentation;
- **IEEE 830** - Software requirements Specification;
- **IEEE 1012** - Software Validation and Verification Plan;
- **IEEE 1016** - Software Design Description;
- **IEEE 1028** -Software Reviews;
- **IEEE 1058** - Standard for Software Project Management Plans;
- **IEEE 1058** - Software Project Management Plan;
- **IEEE 1042** - Guide to Software Configuration Management;
- **IEEE 1061** - Software quality metrics methodology;

- **IEEE 1063**- software user documentation;
- **IEEE 1074** - Developing a Software Project Life Cycle Process;
- **IEEE 1219** - IEEE Standard for Software Maintenance.

ISO/IEC 15504 - Software Process Improvement and Capability Determination

This standard provides a framework for assessing proposed suppliers, as assessed either by the organization itself, or by an independent assessor. The organization can determine a target capability for suppliers, based on the organization's needs, and then assess suppliers against this profile. This is particularly important in contexts where the organization (for example, a government department) is required to accept the cheapest qualifying tender. This also enables suppliers to identify gaps between their current capability and the level required by a potential customer, and to undertake improvement to make the contract.

DEF STAN 00-60 Integrated Logistic Support - Part 3: Guidance for Application Software Support Integrated Logistic Support (ILS) is the accepted discipline for causing support considerations to influence the design, including maintainability or selection of defence systems and for delivering and monitoring a consistent support environment for defence systems. This standard describes UK MoD policy and requirements for the application of Logistic Support Analysis (LSA) to software aspects of systems. It provides an introduction, defines terms and abbreviations, and introduces the software life-cycle. It emphasizes the management and planning of Logistic support analysis for systems that include software in order to ensure software supportability.

ISO/IEC TR 15504 Software process assessment defines clear criteria for successful and effective organisations engaged in producing software and can be used to evaluate the maturity of those organisations.

CMMI (Capability Maturity Model Integration) defines a set of proven practices carried out by mature software producing organisations, which can be used to improve software processes and quality.

Note: ISO/IEC 15288, ISO/IEC TR 19760:2003, PMBOK Guide (IEEE Std 1490-2003) can be considered as transversal standards and guidance that support all EG13 recommendations

Additional Standards for completeness

Due to the complex nature of Software and software management the following standards related are listed for completeness:

ISO/IEC 61508 - Functional safety of electrical/electronic/programmable, electronic safety-related systems

ISO/IEC 19770-1:2006 - Information technology - Software asset management

ISO/IEC 42010:2007 - Systems and software engineering Recommended practice for architectural description of software-intensive systems

ISO/IEC 15939:2007 - Systems and software engineering Measurement process

ISO/IEC 26702:2007 - Systems engineering -- Application and management of the systems engineering process

MIL –STD- 2167A Defence system software development (this is obsolete but still used as reference)

<p>MIL-STD- 498 - Software development and documentation</p> <p>ECSS-E-40 – Space System Software Engineering</p>
<p>Scope of the recommended standard</p> <p>ISO/IEC 12207 provides a common framework that can be used by software practitioners to manage and engineer software. It establishes a top-level architecture of the life cycle of software. The life cycle begins with an idea or a need that can be satisfied wholly or partly by software and ends with the retirement of the software.</p>
<p>Rationale for selection</p> <p>There are many software standards available dependant on the nature of the software system that is to be developed. EG13 recommends project managers adopt a system engineering approach to development, wherein the development of software is treated as but one facet of the whole; in this way, all relevant (and, most importantly, interconnecting processes i.e. quality, configuration, support, reliability, interfaces and life cycle management etc are covered.</p> <p>EG13 recommends the ISO/IEC 12207 Software Life Cycle Processes standard as it integrates quality into the life cycle and provides the requirements for a comprehensive set of processes to be applied. RTCA-178B software lifecycle process for safety related systems is of specific relevance for development of aviation software.</p> <p>The IEEE suite of software standards provides detailed ‘best practice’ software management guidance. Additionally the SWEBOK provides the collected knowledge of the SW industry and aims to assist project managers in applying the IEEE standards.</p>
<p>How to apply/key points</p> <p>The application of the recommended standards will ensure software is managed in a structured and systematic way throughout the defence system life cycle. Software is a key enabler of complex military systems, the development of which can often be a major contributor to the risk of projects not meeting their cost and performance targets. Software differs from hardware due, in part, to the higher levels of complexity associated with the millions (if not billions) of possible logical paths through a software-intensive system. The twin disciplines of systems and software engineering should be used throughout the life cycle, to establish fundamental objectives and technical plans and then, during the later parts of the life cycle, to verify whether the objectives have been achieved and the system is maintainable and supportable. Quality management and risk management principles are closely associated with software management. Post development support of software can amount to as much as 75% of the total cost of a defence system; therefore ensuring that software is designed with supportability in mind is one of the most important criteria for project success.</p> <p>There are many software standards available dependant on the nature of the software system that is to be developed. EG13 recommends that the best course of action is to adopt a systems engineering approach to development, wherein the development of software is treated as but one facet of the whole; in this way all relevant, and, most importantly, all interconnecting processes e.g. quality management, configuration management, support infrastructure management, reliability, interfaces and life cycle management etc are covered. EG13 recommends the ISO/IEC 12207 Software Life Cycle Processes standard as it integrates quality into the life cycle and provides the requirements for a comprehensive set of processes to be applied. The IEEE suite of software standards provides detailed ‘best practice’ software management guidance. Additionally the SWEBOK provides the collected knowledge of the SW industry and aims to assist project managers in applying the IEEE standards.</p>

SWEBOK addresses three key management areas for software management:

- Software systems engineering;
- Processes for developing software products and
- Planning and control of software project activities.

SWEBOK details 10 essential 'knowledge areas '(KA) , based directly on the processes described in the **ISO 12207** Software Life Cycle standard. The ten KAs are:

- Software Configuration Management;
- Software Construction;
- Software Design;
- Software engineering infrastructure;
- Software Engineering Management;
- Software Engineering Process;
- Software evolution and maintenance;
- Software Quality Analysis;
- Software Requirements analysis;
- Software Testing.

Def Stan 00.60 Part 3 - Guidance for Application Software Support provides the supportability aspects essential for supporting defence systems. LSA should be undertaken in order to determine the most appropriate and cost effective software support solution for the customer.

Where feasible and applicable **ISO/IEC 15504** should be applied by project managers to assess the:

- Defence systems contractor capability and tenders;
- Technical assessment of any proposed system architecture or design;
- Proposed development process;
- Contractor's technical capabilities;
- Provision for project monitoring.

Need for tailoring

Tailoring (standard selection and application) is likely to be required and will depend on the size and complexity of the defence project and the complexity, criticality of its associated software.

What is missing – need for further standardisation activity?

N/A

6.13 Integrated Logistic Support (ILS)

<p>Description</p> <p>Integrated Logistic support (ILS)</p>
<p>Definition</p> <p>Integrated Logistic support can be defined as:</p> <p>[1] “a group of practices, processes and standards that ensure supportability is considered early in the acquisition lifecycle, with the aim of optimising the life cycle costs.</p> <p>[2] “the co-ordinated and iterative set of technical and management tasks whose objectives are the following:</p> <ul style="list-style-type: none">• To express the logistics support requirements and the environmental constraints associated with defence system operations;• to contribute to obtaining a system design that includes the support elements;• allowing the optimisation and maintenance of system effectiveness for all its life time, in consistency with the user resources;• Allowing total optimisation of “performance, cost and timescales/schedules”;• To realise, set up and to renew the support elements, according to defence system exploitation and associated maintenance costs. <p>ILS is closely linked with In Service Management (see chapter 6.10) which is described in this report. ISM takes over support arrangements put in place by ILS and manages them for the remaining life cycle of the defence system.</p>
<p>Context</p> <p>The support costs associated with the operation (utilisation) and support a defence system are far greater than those for the design development and production phases. Typical estimates show support costs account for approximately 60 – 70 % of total life cycle costs. ILS aims to get the supportability requirements right during the design and development phases as it avoid costly and rework during the in service phase. Design changes to correct performance problems during the in service phase is estimated to cost 10-20 times more than in the design and development phases.</p> <p>ILS provides a methodology for ensuring that supportability issues and cost factors are considered throughout the lifecycle of a defence system so that the equipment design is appropriately influenced by such factors to enable optimum availability and life cycle cost.</p> <p>ILS is a disciplined and systematic approach to the design, development and production of a defence system and includes the activities necessary to:</p> <ul style="list-style-type: none">• Ensure performance attributes such as reliability and maintainability are designed into the defence system• Identify the life cycle support requirements for the defence system through planned management and analytical tasks;• Develop and integrate support considerations into the defence system design;• Provide the support required to sustain system's availability, in the intended environment, according to the intended use and during the life of the project;

- Provide the required support in time for the defence system's In service date;

Design Influence is achieved through Logistic Support Analysis which is the principal tool of ILS. It is the primary means by which the objectives of ILS are achieved. LSA activities consist of a series of analytical tasks which Identify support planning and management requirements for a defence system. It defines the support requirements for the defence system y identifying major cost drivers and risks and developing alternative support solutions.

Recommended Best Practice Standard

ASD S1000D - International Specification for Technical Publications Utilising a Common Source Database **Important Note** this specification and its application is covered in detail in the report of EG14

ASD S2000M chap 1 - International specification for materiel management integrated data processing for military equipment

ACodP-1 - NATO Manual on Codification

STANAG 4174 - ARMP Allied Reliability and Maintainability publications expanded in:

- **ARMP 1** NATO requirements for reliability and maintainability
- **ARMP 2** General application guidance on the use of ARMP 1

SCORM – Sharable Content Object Reference Model **Important Note** this model and its application is covered in detail in the report of EG14

Def Stan 00-40(Part 1) (Issue 5) - Reliability & Maintainability (R&M). Part 1 - Management responsibilities and requirements for programmes & plans

Link to Standardisation Organisation

www.asd-europe.org

Normative references (if any)

IEC 60300-3-10: 2001 – dependability management. Part 3: Application guide. Section 10: Maintainability and maintenance support.

MIL-STD-1388 1 A NOT 5 - LSA Logistics support analysis;

MIL-STD-1388 2 B NOT 2 – LSAR DoD requirements for a logistic support analysis record;

MIL-STD-1629A + not 3 – FMECA standard FMECA;

MIL-STD-1390D – LORA level of repair analysis;

MIL-STD- 2173(AS) -Reliability Centered Maintenance for Aircraft, Weapons Systems, and Support Equipment

Important Note These Mil Stds are unsupported and virtually obsolete but they are still widely used and internationally recognised as a common language and have the advantage of being completely stable. Additionally Def Stan 00-60 is UK specific but still widely used. Therefore EG13 references them out of necessity however EG13 recognises that 2 ASD specifications are in development:

- **S3000L** - Application handbook for logistic support analysis;
- **S4000M** Procedure handbook for the development of scheduled maintenance programs

And a further one is planned:

- **ASD S5000F** – Application handbook for operational and maintenance data feedback

When published these standard should be considered as best practice for ILS and ISM and the Mil Std's listed above should be removed from the catalogue and Def Stan 00-60 be listed as a supporting standard only.

Supporting or additional relevant standards (if any)

Defence Standard 00-60 (Issue 6) - Integrated Logistic Support.

MIL-HDBK-470A - maintainability guide -Designing and developing maintainable products and systems

MIL-HDBK-2165 - testability guide -Testability handbook for systems and equipment

MIL-HDBK- 217 F not 2 - Reliability guide¹⁰ - Reliability Prediction of electronic equipment

UTE C80-810 – Reliability guide - Recueil de données de fiabilité (composants, cartes et équipements électroniques)

FIDES – Reliability guide Reliability Methodology for Electronic Systems

MIL-STD-1390D Level of Repair Analysis (LORA)

Note: ISO/IEC 15288, ISO/IEC TR 19760:2003, ISO 9001:2000, PMBOK Guide (IEEE Std 1490-2003) can be considered as transversal standards and guidance that support all EG13 recommendations

Scope of the recommended standard

The recommended standards cover the main activities of ILS. The ASD **S1000D** and **ASD S2000M** specifications are internationally recognised. **ACodP-1** is essential to enable NATO Codification of defence systems. **STANAG 4174** details the important discipline of Reliability & Maintainability (R&M) and **SCORM** deals with the creation of reusable learning content for training.

Note The. **Def Stan 00-60** is a UK tailored standard (based on **Mil Std 1388**) and still widely referenced in defence projects. It is not in the recommended list but should be considered as it is still supported by the UK MoD and contains useful source data for ILS management principles.

Rationale for selection

These standards are recommended as being known already as references for years throughout

1. _____

2.

1. ¹⁰ (Not updated since 1997)

the ILS community. They have been selected with a goal to have wherever possible one standard for each of the key activities included in the ILS perimeter.

How to apply/key points

The recommended standards should be applied to ensure supportability can influence design and defence systems are supportable throughout their life cycle. ILS aims to influence the design of a defence system through the timely application of informed influence to the design of the hardware, software and human aspects of a system in order to minimise support related risks and any potentially adverse effects of the design of the system on the support requirements, costs and operational readiness'.

From a more technical perspective, ILS addresses the design aspects that may affect:

- The Reliability characteristics of the system (whether due to hardware, software or human limitations);
- The Maintainability or Testability characteristics of the system;
- The requirement for specialised training, tools, facilities or test equipment;
- The ability to update or extend the operational life of the system.

Key to successful ILS is the capture and agreement of the defence system operational requirements. This is done through the development of a Use Study which captures all the information relevant to how, when and where the defence system is intended to be operated

The Project manager is responsible for identifying the most cost effective support arrangements for the defence system through its life cycle with specific emphasis on influencing the design. Where feasible an ILS manager should be appointed who will be responsible for developing an ILS plan and performing the day to day ILS management activities.

An ILS plan should include the following activities:

- **Maintenance Engineering** - establishes the maintenance concepts and requirements for equipment using analysis tools and methodologies such as Failure Mode and Effects Analysis (FMECA), Reliability Centred Maintenance (RCM), Level Of Repair Analysis (LORA).
- **Reliability and Maintainability (R&M)** - R&M are vital characteristics of defence systems. They affect the sustained delivery of the required performance in the field and are major drivers of LCC and a significant contributor to user morale and safety. R&M must be designed and built into a system during development and manufacture, if high levels of sustainability are to be achieved in-service.
- **Supply Support** – Ensures the timely positioning, distribution and replenishment of spares, repair parts and special or consumable supplies.
- **Support And Test Equipment (S&TE)** - Comprises the equipment (mobile or fixed) required to support the operation and maintenance of the defence system equipment and includes tools, maintenance equipment, associated multi-use end items, metrology and calibration equipment, test equipment and automatic test equipment
- **Facilities** - Comprises the physical infrastructure required to integrate, operate and maintain equipment;
- **Manpower and Human Factors** - Manpower is concerned with 'how many people are required and when', Human Factors focuses on human beings and their interaction with

technology and the environment. The capabilities and limitations of the military and civilian personnel required to operate and maintain the defence system or facility in-service are used to define requirements.

- **Training and Training Equipment** - Trained, qualified operators and maintainers are required to support equipment in service. Good training reduces through life costs and increases system efficiency, safety capability and availability. The provision of training and training equipment impacts system effectiveness through higher safety, increased efficiency, greater Availability, lower Through Life Costs and more Capability (by consideration of the effectiveness of both operational and support functions);
- **Technical Information and Data** - Technical is the information necessary to install, operate, maintain, repair and support equipment throughout its life;
- **Packaging, Handling, Storage and Transportation (PHS&T)** - the technical aspect of managing the defence systems PHS&T. Should identify the provision of new technology such as RIF to aid the physical logistics of defence system;
- **Software Support** - Software support is an intrinsic aspect of the support for any system with software content. It is managed and controlled to ensure that equipment fit, form and function is not compromised.
- **Logistic Performance Monitoring** - In service monitoring. is comparison of anticipated and actual performance and In-service costs permits decisions to be made which allow changes in the support strategy. This allows whole life costs to be managed by improving the design and/or supportability characteristics as appropriate
- **Obsolescence** - the loss or impending loss of the manufacturers or suppliers of items, or shortages of raw materials. The rate of technological innovation coupled with the long life cycles of defence systems, mean that it is almost inevitable that obsolescence will impact on all defence projects at some stage.
- **Disposal** - The efficient, effective and safe disposal of equipment and its spares and consumables, throughout its life. Disposal needs to consider the possibilities of re-deployment, sale, waste disposal, environmental impacts and the possible disposal of recovered material by sale.

The ILS manager should ensure that the progressive achievement of specified ILS requirements is included in the contract, and linked to appropriate contract milestone payments.

Projects should encourage the appropriate use of test methods such as HALT (Highly Accelerated Life Testing) and HASS (Highly Accelerated Stress Screening) as a means of improving the reliability of systems by driving out design flaws and weaknesses

ILS is a broad discipline and interfaces with many other project management disciplines. In particular ILS is strongly linked to the following activities:

- **Safety** - There is considerable commonality between the LSA, AR&M, RCM and Safety programmes, particularly in the FMECA;
- **Configuration Management** - Changes to the configuration of the design can have significant impact on the support requirements;
- **Risk** – ILS activities such as R&M, Supply Support, TID and Training are high cost drivers and essential to the successful deployment and operation of the defence system, therefore they must be closely risk managed.

Need for tailoring

MIL-STD-1388-1A Individual tasks contained in this standard shall be selected and the selected task descriptions tailored to specific acquisition program characteristics and life cycle phase... Refer to Appendix A of the standard

MIL-STD-1388-2B This standard shall not be specified in a contract without also specifying MIL-STD-1388-1, LSA. The requiring authority shall use MIL-STD-1388-1 in the selection of tasks for inclusion in the contract statement of work (SOW) and shall establish the LSA documentation requirements based upon the elements in those tasks. Refer to Appendix D of the standard

MIL-STD-1629A + not 3 Refer to Appendix A of the standard: Extract: Each provision of this standard should be reviewed to determine the extent of applicability. Tailoring of requirements may take the form of deletion, addition, or alteration to the statements...

MIL-STD-1390D Individual tasks contained in this standard shall be selected by the requiring authority and the selected task descriptions tailored to specific acquisition program characteristics and life cycle phases.

MIL-STD- 2173(AS) - Refer to annex F of the standard This appendix provides application and tailoring guidance to aid the procuring activity in generating the contractual requirement for RCM.

ASD S1000D - This specification has been produced to cater for many different types of Products. Therefore, to make it suitable for a given project, some aspects of tailoring will probably be required. It is recommended that the tailored version of this specification is referred to in the projects contractual documentation. This tailoring shall not affect the Document Type Definitions (DTD) or its basic philosophies but shall be restricted to tailoring within the specification. It is essential that project business rules shall be agreed between parties to document the details of the agreed tailoring of this specification. These rules shall cover the requirements for optional elements, their population from specific data sources and the use of specific values in the project configuration file. Refer to Chapter 1.4 of the standard.

ASD S2000M chap 1 - S2000M has been designed and developed to allow users to select functionality which is appropriate to their specific projects. Individual chapters may be included, or excluded, and specific messages, segments and functions may also be excluded if not required. This allows users to specifically tailor their usage of the Specification 2000M to most economically meet their project or business needs. However, in applying this flexibility, users are reminded that systems in development and use may not be fully representative of the complete set of Specification 2000M functions. An Interchange Agreement, an example of which is at Annex G to Appendix 2, is recommended as the appropriate method to clearly document the agreed scope of any particular application of the Specification.

Def Stan 00-40(Part 1) (Issue 5) Effective R&M programmes need to be tailored to fit the needs and constraints of a specific equipment programme, including availability and life cycle costs. This document is intentionally structured to discourage indiscriminate blanket application and to encourage and promote the tailoring of the R&M programme tasks.

Def Stan 00-60 Should not be used indiscriminately. It shall be tailored, as described in this Defence Standard, according to its particular application.

What is missing – need for further standardisation activity?

The following standards are under development by ASD and will be recommended as best practice once published:

S3000L - LSA guide Logistic support analysis

S4000M - RCM guide Scheduled Maintenance Analysis

S5000X - Service data capture and analysis

EG13 is aware of work being carried out by the UK MoD and other European and Industry actors to develop a Through Life Support Standard (TLSS). TLSS aims to enable a new approach to managing 'Through Life Support' and is intended to replace DEF STAN 00-60. TLSS aims to assist Project managers and defence system suppliers to contract more flexibly for support on a through life basis and to exploit improved information technology and standards to add value throughout the support chain.

6.14 Environmental Management

<p>Description</p> <p>Environmental Management</p>
<p>Definition</p> <p>The part of the overall management system that includes organizational structure, planning activities, responsibilities, practices, procedures, processes and resources for developing, implementing, achieving, reviewing and maintaining the environmental policy.</p>
<p>Context</p> <p>The specific challenges related to environmental management are to:</p> <ul style="list-style-type: none"> • Have a tool to improve environmental performance; • Provide a systematic way of managing an organization's environmental affairs; • Address immediate and long-term impacts of its products, services and processes on the environment; • Give order and consistency for organizations to address environmental concerns through the allocation of resources, assignment of responsibility and ongoing evaluation of practices, procedures and processes; • Focus on continual improvement of the system. <p>Environmental Management issue is the result of many activities performed during several years in order to propose a coordinated world response to common environmental challenges.</p>
<p>Recommended Best Practice Standard</p> <p>ISO 14001, Environmental management systems – Specification with guidance for use</p> <p>ISO 14004, Environmental management systems – General guidelines on principles, systems and supporting techniques</p>
<p>Link to Standardisation Organisation</p> <p>www.iso.org</p>
<p>Normative references (if any)</p> <p>N/A</p>
<p>Supporting or additional relevant standards (if any)</p> <p>BSI PD ISO/TR 14062, Environmental management. Integrating environmental aspects into product design and development</p> <p>Note: ISO/IEC 15288, ISO/IEC TR 19760:2003, ISO 9001:2000, PMBOK Guide (IEEE Std 1490-2003) can be considered as transversal standards and guidance that support all EG13 recommendations.</p>
<p>Scope of the recommended standard</p> <p>ISO 14001, This International Standard specifies requirements for an environmental management</p>

system to enable an organization to develop and implement a policy and objectives which take into account legal requirements and other requirements to which the organization subscribes, and information about significant environmental aspects. It applies to those environmental aspects that the organization identifies as those which it can control and those which it can influence.

All the requirements in this International Standard are intended to be incorporated into any environmental management system. The extent of the application depends on factors such as the environmental policy of the organization, the nature of its activities, products and services and the location where and the conditions in which it functions.

ISO 14004, This International Standard provides guidance on the establishment, implementation, maintenance and improvement of an environmental management system and its coordination with other management systems. The guidelines in this International Standard are applicable to any organization, regardless of its size, type, location or level of maturity. While the guidelines in this International Standard are consistent with the ISO 14001 environmental management system model, they are not intended to provide interpretations of the requirements of ISO 14001. Tailoring to application military systems has to be assessed.

Rationale for selection

The ISO 14001 and 14004 standard are today both international standard, well known all around Europe and are translated in many languages (at least in English). Furthermore the ISO 14001 is the baseline of certification activity according to environment management.

How to apply/key points

The key issues of the **ISO 14001** standard are as follows:

- Gaining of top management to the EMS;
- Development of an environmental policy;
- Planning of an EMS (identification of significant environmental aspects and associated impacts, establishment of legal and regulatory requirements to organizations activities as products and services, quantifiable objectives and targets to reduce organization's impacts on the environment, establishment and maintenance of environmental management programmes with allocation of resources and timeframes in accordance with stated objectives and targets);
- Implementation of an EMS (development of training and awareness programmes, allocation of roles and responsibilities within a pre-defined management or organisation structure, procedures and processes for handling internal and external communications, creation of supporting documentation and documentation control mechanisms, operational control procedures, emergency preparedness and response planning and testing);
- Maintenance and continual improvement of the EMS (monitoring and measurement of operations and activities, record-keeping, creation of procedures to deal with non-conformances with the requirements of the standard, company policy and legislation, development of procedures, programmes and processes to prevent any repeat of non-conformances, EMS audit procedures and programmes);
- Management review of an EMS to determine its suitability, adequacy and effectiveness to make recommendations for the achievement of continual improvements in environmental performance.

Annex A completes the main text giving additional guidance for the use of the specification. Annex

B of the standard contains information on the linkages and broad technical correspondences between ISO 14001 and ISO 9001.

ISO 14004, Key issues of the standard are :

- Internationally accepted principles of environmental management and how apply them to the design and development of all the component of an EMS,
- Practical examples of the issues an organization will need to ensure they have addressed in the design of their EMS, with guidance on how to identify the environmental aspects and impacts associated with their activities, products and services,

Practical help sections to provide an organization with assistance in navigating through the various stages of EMS design, development, implementation and maintenance.

Key words

Standard, Environmental Management System, ISO 14001, ISO 14004

Need for tailoring

For those organisations that do not have a formal EMS in place, they should undertake an initial review or preparatory review to determine how their activities, products and services interact with the environment (as precised in annex A, clause A.3.1 of standard ISO 14001).

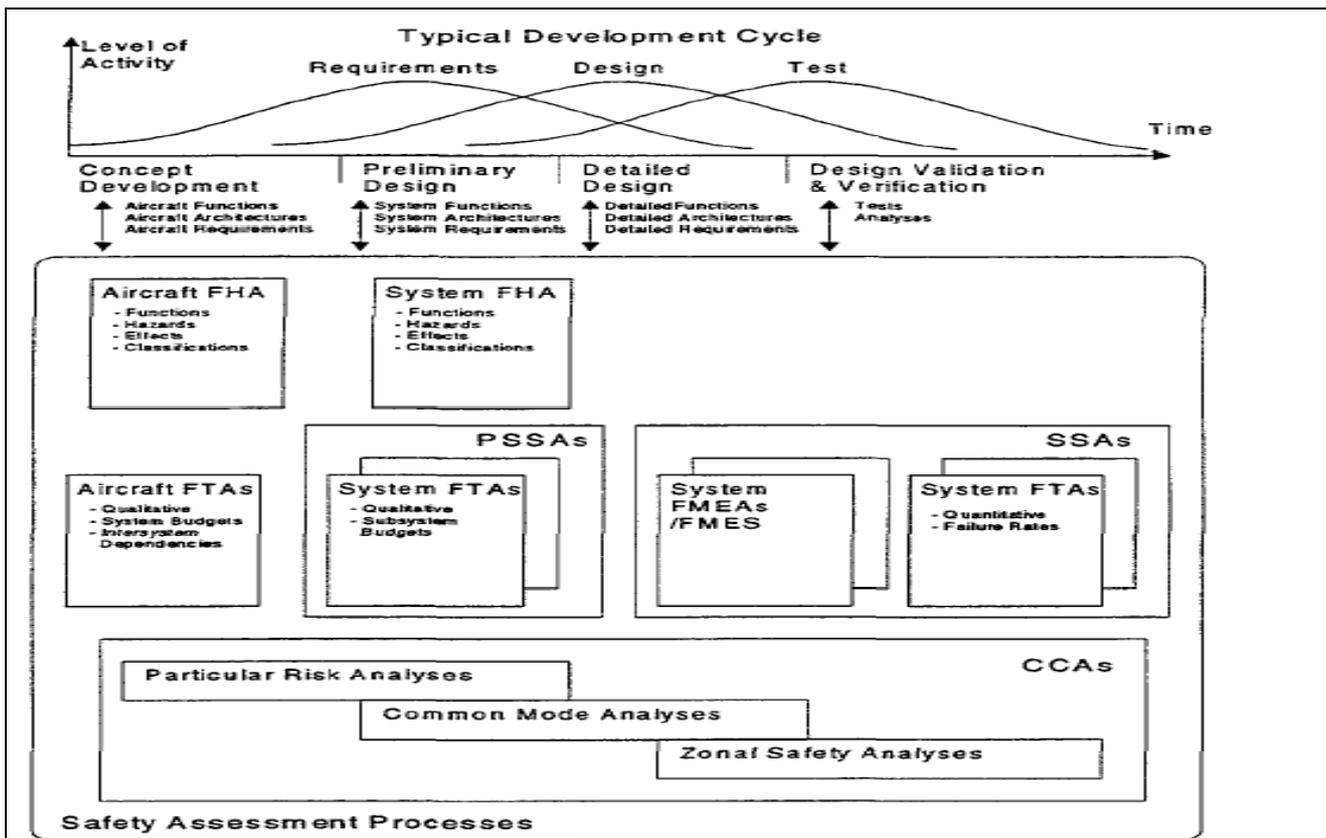
What is missing – need for further standardisation activity?

The main missing point is related to standard ISO 14004, the fact is that it is not use enough and so too few experience and feed back exist which do not give elements in order to promote its use.

6.15 Safety Management

<p>Description</p> <p>Safety Management</p>
<p>Definition</p> <p>Safety may be defined as:</p> <p>[1] "The likelihood of a product to maintain throughout its life cycle an acceptable level of risk that may cause an injury to personnel or major damage to the product or its environment". (ARMP-7)[2] "the expectation that a system does not, under defined conditions, lead to a state which may cause death, injury, environmental or material damage".</p> <p>System Safety may be defined as "Application of the rudiments, criteria and engineering techniques and management for optimal safety situation (acceptable mishap risk), within the operative efficacy, time and cost for every life cycle of the system".</p> <p>In a Safety Analysis all the hazards that could be affecting personal safety (during operation or maintenance) or causing damage or loss of equipment should be considered.</p> <p>The safety assessment process must be planned and managed to provide the necessary assurance that all relevant failure conditions have been identified and that all significant combinations of failures which could cause those failure conditions have been considered. This process applies throughout the life cycle for any system: new product, upgrade, modification, etc. For the integrated systems, the process should take into account any additional complexities and interdependencies which arise due to integration. The safety assessment process can be qualitative and quantitative.</p> <p>The management of the potential safety hazards must begin from the first design stage and continue to the final of the operative life of the product.</p>
<p>Context</p> <p>The aim of Safety management is to ensure that a level of safety is achieved which is deemed sufficient to authorise the use of the defence system with an acceptable risk. Risk in this case can be considered is "the combination of the frequency, or probability, and the consequence of an accident". The acceptability of the risk will obviously depends on the domain it impacts: human life, human health, environment or property. To ensure that the level of safety is sufficient, Safety Management is to begin at the outset of a project when the requirement is being defined and is to be carried forward through the whole life cycle of the system to disposal.</p> <p>The project manager is responsible for safety and should apply a robust safety management to ensure that safety hazards are identified, assessed and controlled such that the safety risks to the operators, other parties, property and the environment are as low as reasonably achievable and . The principle that safety risks should be reduced to as low as means that not only risks must be reduced to a tolerable level, but further risk reductions are to be obtained, provided their adverse consequences are not disproportionate to the improvement gained.</p> <p>Safety is traditionally linked to Airworthiness/certification aspects. Caution is to be taken if the standards are conformed to current regulations.</p>

<p>Safety engineering efforts are normally carried-out in unison with reliability and design engineering activities. Reliability and Maintainability engineering aims at reducing failures and improving availability whilst Safety management focuses on the failure occurrences, consequences and severities.</p>
<p>Recommended Best Practice Standard</p> <p>SAE ARP 4761. Guidelines and methods for conducting the safety assessment process on civil airborne systems and equipment</p> <p>MIL-STD-882 D. Standard practice for system safety</p>
<p>Link to Standardisation Organisation</p> <p>www.sae.org</p>
<p>Normative references (if any)</p> <p>N/A</p>
<p>Supporting or additional relevant standards (if any)</p> <p>DEF STAN 00-56. Safety management requirements for defence system</p> <p>Note: ISO/IEC 15288, ISO/IEC TR 19760:2003, ISO 9001:2000, PMBOK Guide (IEEE Std 1490-2003) can be considered as transversal standards and guidance that support all EG13 recommendations</p>
<p>Scope of the recommended standard</p> <p>SAE ARP 4761. Guidelines and methods for conducting the safety assessment process on civil airborne systems and equipment. This document describes guidelines and methods of performing the safety assessment for certification of civil aircraft. It is primarily associated with showing compliance with FAR/JAR 25.1309. The methods outlined here identify a systematic means, but not only means, to show compliance. A subset of this material may be applicable to non-25.1309. The concept of Aircraft Level Safety Assessment is introduced and the tools to accomplish this task are outlined. The overall aircraft operating environment is considered. This document presents guidelines for conducting an industry accepted safety assessment consisting of Functional Hazard Assessment (FHA), Preliminary System Safety Assessment (PSSA), and System Safety Assessment (SSA).</p> <p>This document also presents information on the safety analysis methods needed to conduct the safety assessment. These methods include the Fault Tree Analysis (FTA), Dependence Diagram (DD), Markov Analysis (MA), Failure Modes and Effects Analysis (FMEA), Failure Modes and Effects Summary (FMES) and Common Cause Analysis (CCA) [CCA is composed of Zonal Safety Analysis (ZSA), Particular Risk Analysis (PRA), and Common Mode Analysis (CMA)].”</p>



MIL-STD-882 D. Standard practice for system safety

This document delineates the minimum mandatory requirements for an acceptable system safety program for any DoD system. Section 4 defines the system safety requirements to perform throughout the life cycle for any system, new development, upgrade, modification, resolution of deficiencies, or technology development. When properly applied, these requirements should ensure the identification and understanding of all known hazards and their associated risks; and mishap risk eliminated or reduced to acceptable levels. The objective of system safety is to achieve acceptable mishap risk through a systematic approach of hazard analysis, risk assessment, and risk management.

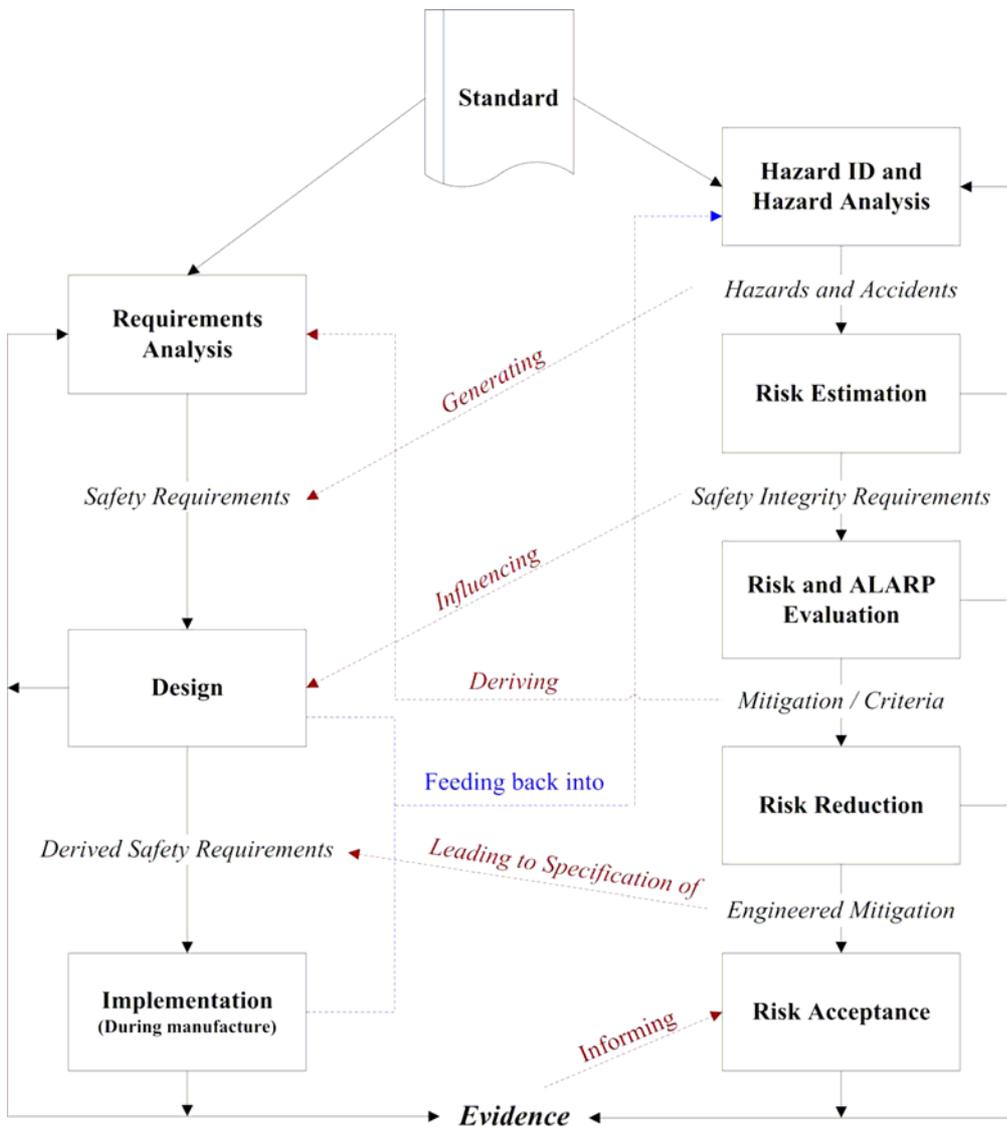
DEF STAN 00-56 Safety Management Requirements for Defence Systems

It consists of a short mandatory part (Part 1) and a longer guidance document (Part 2):

- Part 1, is mandatory, setting out the key safety management requirements, including overarching objectives and principles;
- Part 2, which is not mandatory, providing guidance on establishing a means to comply with the requirements of Part 1. Part 2 contains two Sections:
 - Section 1 – Clause by clause amplification of Part 1;
 - Section 2 – Additional Guidance Regarding Systems Containing Complex Electronic Elements.

Safety in the context of this Standard does not imply that there is an absence of risk, but that the risk has been demonstrably reduced to a level that is Broadly Acceptable or Tolerable, and As Low As Reasonably Practicable (ALARP). The demonstration of safety is achieved via a Safety Case.

The requirements of this Standard are based on a set of Key Objectives. In addition to using the standard, project teams will still be responsible for setting safety requirements appropriate to their systems.



Rationale for selection

SAE ARP 4761. "Describes the guidelines and methods of performing the safety assessment for certification of civil aircraft". It is a very comprehensive guide that specifies what to be done and how to do it. Due to the fact that in general the civil certification is more exigent that the military one in relation with safety (see CS-25.1309 requirements), this standard can be applied as well to various aspects of the military systems safety analysis. It specifies the method and the processes to follow in order to perform a safety analysis in a very detailed manner. It is easy to understand and to apply. It is a very useful guide, however particular aspects of the military certification shall be separately considered in terms of requirements as well as means of showing compliance.

MIL-STD-882 D. "This document delineates the minimum mandatory requirements for an acceptable system safety program"

It is useful for systems which do not have specific safety certification requirements. It is very generic.

The main objective is to ensure that hazards and mishaps are removed (or the risk thereof is

reduced) by design requirements and management controls.

DEF STAN 00-56 (Safety Management of Defence Systems)

The latest issue (issue 4) was released in June 2007. This new standard is focused on high-level requirements for safety assurance without defining particular methods or procedures. In this new issue it is included the development of safety-related programmable systems (previously covered by Def Stan 00-55).

The Safety Management System should be well documented and auditable in order to provide visibility that it is operating effectively.

The Safety Case Reports are key deliverables.

It is not aviation specific, applying equally to aviation, naval and land based systems, and so it is generic in its application.

The level of effort expended on safety management and the detail of the analysis should be in line with the potential risk of the system (i.e. the risk identified before any mitigation has taken place) and its complexity. (simple systems may have few safety requirements because of their limited functionality; consequently, compliance with this Standard may be easier to achieve). In general, the more complex the system and/or the more demanding the operational requirements, the greater the risk, hence more effort will be required to achieve a safe system and to demonstrate that it is safe.

The scale and depth of the safety case and Safety Case Report should be proportionate to uncertainty, not just to safety risk.

How to apply/key points

MIL-STD 882D is very general in its application and can be used as a guide for a wide variety of projects. Issue C ("System Safety Program Requirements") was released on 19th January 1993, and Issue D ("Standard Practice for System Safety") was released on 10th February 2000. Issue C provides more detail than the issue D at hierarchy task level, and this is causing the issue C to be still in use.

Def Stan 00-56 is not aviation specific and is generic in its approach. On the other hand **ARP 4761** is aviation specific (civil aircraft) and it is focused on showing compliance with FAR/JAR (CS) 25 certification. Both standards provide similar high level guidance and comparable methods, although the Defence Standard approach is less specific.

Def Stan 00-56 is less comprehensive when dealing with the processes and doesn't cover Availability, Reliability and Maintainability issues, which are included within ARP 4761 (in the appendices). The Defence Standard refers to additional specific standards for the application of those studies. The ARP standard considers a more qualitative approach, (however quantitative methods are included as well), whereas the Def Stand is more quantitative oriented.

Need for tailoring

What is missing – need for further standardisation activity?

The globalization, the high cost of aircraft and the reducing military budgets mean that the military and commercial markets are getting closer. Companies are not longer working only for the military

market. Some kind of “standard harmonisation” is required, between civil and military approaches without safety being compromised.

Several aspects are quite different between both worlds (for example, the need to carry weapons and more demanding operating conditions of the military aircrafts). And so, the safety targets (and therefore standards) could vary. Severities being more aircraft and flight specific in the civil world as opposed to the military, which concentrate on human loss. A deeper analysis is required to harmonize the analytical methodology among these two types of applications.

6.16 Ergonomic Management

<p>Description</p> <p>Ergonomics</p>
<p>Definition</p> <p>Ergonomics (also known as Human Factors) may be defined as</p> <p>[1] “The application of scientific information concerning objects, systems and environment for human use”</p> <p>[2] “A discipline that deals with the man-machine interface. It deals with psychological, social, physical, biological and safety characteristics of a user and the system the user is in”</p> <p>Human factors Integration may be defined as “ a process to integrate human factors elements into the systems engineering process”</p> <p>Source: International Ergonomics Association 2007</p>
<p>Context</p> <p>The successful operation and capability of defence systems depends on a combination of interacting elements. Some of the most difficult issues to address lie in the ergonomics area. Defence systems are operated in very demanding circumstances and the operators can be subject to fatigue, hunger, stress and even fear. Therefore the working environment established in defence systems will determine our operational success and the ability to retain the right personnel.</p> <p>The challenge is to integrate the user and operator with the defence system in a way that maximises capability within the real operational environment. Understanding the operational environment getting ergonomics right at the outset is the key to success.</p> <p>Ergonomics can be considered in 6 domains:</p> <ul style="list-style-type: none">• Manpower - concerns the number of military and civilian personnel required, and potentially available, to operate, maintain, sustain, and train for systems;• Personnel - concerns individual characteristics (physical and cognitive, features and abilities), needed to train, operate, maintain and sustain the system effectively;•• Training - concerns the instruction or education, and on-the-job or unit training required to provide personnel with their essential job skills, knowledge, values and attitudes;•• Human factors engineering - concerns the integration of human characteristics into system definition, design, development, and evaluation to optimise human-machine performance under operational conditions;•• Health hazard assessment - concerns the short or long term hazards to health occurring as a result of normal operation of the system;•• Systems safety - concerns the safety risks occurring when the system is functioning in an abnormal manner.

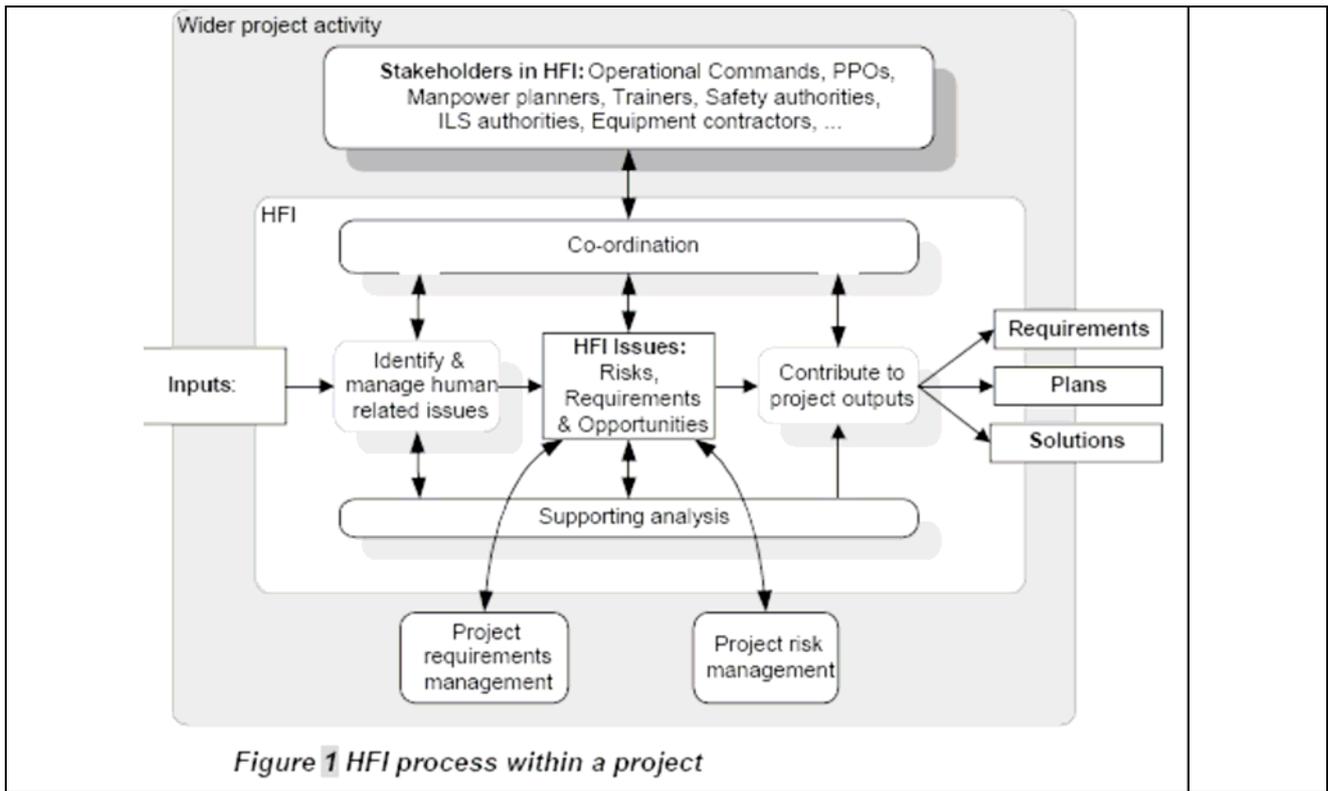


Figure 1 HFI process within a project

Recommended Best Practice Standard

MIL STD 1472F " Human Engineering"

ISO 6385 " Ergonomic principles in the design of work systems"

ISO 9241 " Ergonomics of Human System Interaction "

Link to Standardisation Organisation

Dodssp.daps.dla.mil

Normative references (if any)

N/A

Supporting or additional relevant standards (if any)

ISO 13407 Human Centred Design for Interactive Systems

ISO 2041 - Vibration and shock - Vocabulary

ISO 2631-1 - Mechanical Vibration and Shock - Evaluation of Human Exposure to Whole-body Vibration - Part I: General Requirements

ISO 2631-2 - Mechanical Vibration and Shock - Evaluation of Human Exposure to Whole-body Vibration - Part 2: Continuous and Shock-induced Vibration in Buildings (1 to 80 Hz)

ISO 5805 - Mechanical Vibration and Shock - Human Exposure - Vocabulary

ISO 9241-9 - Ergonomic Requirements for Work with Visual Display Terminals, Part 9 - Requirements for Non-Keyboard Input Devices

Mil Std 1472E Design Criteria Standard – Human Engineering

MIL-HDBK-454 - General Guidelines for Electronic Equipment

DOD-HDBK-743 - Anthropometry of US Military Personnel

MIL-HDBK-759 - Human Factors Engineering Design for Army Materiel

MIL-HDBK-1473 - Colour and Marking of Army Materiel

MIL-HDBK-1908 - Definitions of Human Factors Terms

ANSI S1.1 - Acoustical Terminology

ANSI SI.4 - Sound Level Meters, Specification for

ANSI S1.6 - Preferred Frequencies and Band Numbers for Acoustical Measurement

ANSI S3.2 - Monosyllabic Word Intelligibility, Method for Measurement of

ANSI S3.5 - Articulation Index, Method for the Calculation of

ANSI Z535.1 - Safety Colour Code

ANSI Z535.2 - Environmental and Facility Safety Signs

Note: ISO/IEC 15288, ISO/IEC TR 19760:2003, ISO 9001:2000, PMBOK Guide (IEEE Std 1490-2003) can be considered as transversal standards and guidance that support all EG13 recommendations

Scope of the recommended standard

MIL STD 1472F " Human Engineering" establishes general human engineering criteria for design and development of military systems, equipment and facilities. Its purpose is to present human engineering design criteria, principles and practices to be applied in the design of systems, equipment and facilities¹¹.

ISO 6385 establishes the fundamental principles of ergonomics as basic guidelines for the design of work systems and defines relevant basic terms. It describes an integrated approach to the design of work systems, where ergonomics will cooperate with others involved in the design, with attention to the human, the social and the technical requirements in a balanced manner during the design process.

ISO 9241 is a multi-part standard covering a number of aspects for people working with computers:

- Part 1 is a general introduction to the rest of the standard;
- Part 2 addresses task design for working with computer systems;

1. _____

2.

¹¹ This standard is no longer supported

- Parts 3–9 deal with physical characteristics of computer equipment;
- Parts 10 and parts 11–19 deal with usability aspects of software.

Rationale for selection

MIL STD 1472F " Human Engineering" provides human engineering design criteria, principles, and practices for defence applications.

It is intended to achieve mission success through integration of the human into the system, subsystem, equipment, and facility, and achieve effectiveness, simplicity, efficiency, reliability, and safety of system operation, training, and maintenance.

MIL STD 1472F refers to ISO 9241 and is therefore implicitly also covering the requirements of this standard.

ISO 6385 is covering the ergonomic requirements in the "non-military" environment and does therefore probably not fully compliant with the requirements for the European Handbook For Defence Procurement.

How to apply/key points

The application of the recommended standards will ensure that ergonomics are taken into account throughout the defence system life cycle. Getting ergonomics right is important not only from a technical, safety and cost perspective – ergonomics along with reliability greatly influences the morale and confidence of the user and his/her ability to conduct operations. Integrating ergonomics (human factors) within a project can be challenging; much subject matter relates to “soft” human issues that can be difficult to describe, measure and specify. Co-ordinating contributions from the many stakeholders with an interest in human issues can be complicated by the organisational boundaries involved.

Work to integrate ergonomics should begin as early as possible in acquisition and the project manager should create an Ergonomics Plan and start identifying major ergonomic issues as soon as possible. It is important that other specialist plans (system engineering, AR&M, training, etc) show links to ergonomics and vice versa. The project manager should Identify key ergonomic goals and agree a budget for their achievement.

Trade-off is inherent in system engineering, especially under the demanding constraints that typify military systems. Trading human issues against equipment issues can be difficult and it is important that needs of technology compromise human aspects. Human aspects often have an impact on system performance, or on legislation or on manpower costs. Consequences of trade offs must be made explicit, in terms of cost and operational impact.

Ergonomics is a complex issue and some of the issues/requirement are as follows:

- Systems to support the human operator or maintainer;
- systems needed to enhance or compensate for human performance limitations,
- systems needed to provide for human safety and well being
- Reliability Requirements to minimise the risk and impact of human errors that could cause failure. (for example inadvertent operational error,(violation of safety rules, loss of information... or maintenance error (incorrect settings, things fitted wrongly ...)
- Maintainability Requirements to reduce the demands on the time and/or skill of maintainers (to reduce manpower or training costs).
- Requirements to reduce stress and/or hazard to the maintainer (ease of access, visibility, ease of fitting) Constraints on size, weight, portability, etc (requirements to simplify loading, assembly, set-up, etc)

- Required human performance using equipment (Error, time, accuracy)
- Human interaction requirements (Legibility, comprehensibility, ability to manipulate controls, performance over extended periods, trainability, etc)
- Safety Requirements to mitigate adverse effects of the system on the people who come into contact with it (e.g. 'standards', legislation, duty of care) emergency over-rides and safeguards
- Requirements to avoid hazards caused by human action (e.g. erroneous use of confusing controls)
- Requirements relating to operator safety, stress, fatigue, boredom, (might change dramatically with changed technology)
- Requirements to accommodate human size, strength, etc (including future populations)
- Environmental Aspects that would affect performance or well being of the human component. (vibration, air quality, heat efflux)
- Interfaces to operators, maintainers, support personnel, or other people

Need for tailoring

MIL STD 1472F could be used from its technical contents as a reference document in the European Handbook For Defence Procurement. The latest issue of MIL STD 1472F available to me dates back to 1999 and it is unclear, whether it has been updated since.

It appears that major tailoring of MIL STD 1472F is necessary.

What is missing – need for further standardisation activity?

Replacement of MIL STD 1472F by a new standard should be considered

General Observations

In the defence project management environment, MIL STDs and certain National defence standards are still used widely despite the fact that many are no longer supported and are 'theoretically' obsolete. EG 13 have reservations about recommending their use but at the time of this review, we think it is necessary to reference those documents where there are no feasible alternatives. It should be noted that defence projects and defence systems have a military dimension that require specific guidance and this need is not always met by the more 'general' International project management standards. We recognise that the ASD are developing new specifications (**S3000L, S4000M**) based in part on the old MIL STDs and National defence standards. As soon as the ASD specifications are published we recommend the removal of relevant 'old' standards from the EHDP.

Recommendations

The need for future standardisation, guidance or follow-on activities has been identified by EG13:

Definitions

As a general comment, we highlight the need for commonly agreed Definitions for Defence Project Management. One of the difficulties encountered during our work was the large number of definitions available, leading to different interpretations and problems in deciding on which definition has precedence/primacy.

Life Cycle Cost

We have not identified a global document dealing with LCC. However **NATO SAS 028** is developing a study report on "Cost Structure and Life Cycle Costs for Military Projects". Additionally **NATO SAS 054** is developing a study report on "Methods and Models for Life Cycle Costing" (Both reports will be used in the future NATO guidance and will probably become STANAGs. These should be included in future updates of the EHDP.

In Service Management

ISM is emerging as a key defence management issue. It is closely linked to the ILS process. We believe that new contracting guidance is required for 'new' and evolving methods of defence contracting where Industry becomes more and more involved in the operation and direct support of defence systems. Industry and the customer are committing to long term partnerships and Service Level Agreements, or performance based agreements such as availability or capability or commitments to provide direct services such as maintenance and other support activities (even direct operation of the system). This is a complex and high risk business that requires cultural change as well as process change and all defence stakeholders would benefit from guidance in this area.

Requirements management

We recommend the need for the following guidance related to requirements in defence acquisition:

- A document written by users (Army, Navy,..) which define operational requirements;

- A document written by the project team, which describes operational requirements in technical requirements to give to the Contractor developing the defence system;
- A justification file between operational requirements and technical requirements;
- A justification file between technical requirements and the technical data files, result of the industrial works.

Project management

We believe the further availability of a Project Management ISO standard based upon EN 9200:2004 standard would be a valuable addition to international Project Management recognition and worldwide standardisation.

Risk Management

We propose that further investigation should be carried out into the possible requirement for a Risk management standard that can be called up in defence contracts.

Environmental management

We believe there is not enough experience and feedback on the application of ISO 14004 and we believe that guidance on its use and application would promote its understanding and adoption.

Safety management

The globalization, the high cost of aircraft and the reducing military budgets mean that the military and commercial markets are getting closer. Companies are no longer working only for the military market. Some kind of “standard harmonisation” is required, between civil and military approaches without safety being compromised.

Several aspects are quite different between the civilian and military world’s. Most evident being the need for defence systems to carry and deploy weapons and operate in more demanding operating conditions. Therefore the safety targets (and therefore standards) could vary. Severities are more aircraft and flight specific in the civil world which concentrate on human loss. A deeper analysis is required to harmonize the analytical methodology among these two types of applications.

Integrated Logistic Support

As highlighted in our general comments, MIL STDs and certain National defence standards are still used widely and several are related specifically to the ILS domain. Most are no longer supported and are ‘theoretically’ obsolete. The following specifications are under development by ASD and we recommended they are adopted as ‘best practice’ once published and the MII STDs and defence standards removed:

- **S3000L** - Application handbook for logistic support analysis
- **S4000M** - Procedure handbook for the development of scheduled maintenance programs
- **S5000F** – Application handbook for operational and maintenance data feedback

We are also aware of work being carried out by the UK MoD and other European actors to develop a Through Life Support Standard (TLSS). TLSS aims to enable a new approach to managing Through Life Support and is intended to replace DEF STAN 00- 60. TLSS aims to assist Project managers and defence system suppliers to contract more flexibly for support on a through life basis and to exploit improved information technology and standards to add value throughout the

support chain. This work should be monitored and assessed when more mature for possible inclusion in the EHDP.

Ergonomics/Human factors

We recommend the replacement of MIL STD 1472F by a new standard should be considered.

Stakeholder Management

Defence customers and defence suppliers are looking more to partnering and long term relationships to meet the challenges of life cycle management. This requires a step-change in the way all stakeholders relate and work with one another. A key requirement is the need for open, trusting and honest relationships between all stakeholders. We understand that the **CMMI** (Capability Maturity Model-Integration) covers aspects of stakeholder management but this has not been reviewed by EG13 during this phase of work. We recommend that stakeholder management should be reviewed for the possible inclusion in life cycle project management at the next review/update of the EHDP

Architectural Design

We did not have any members with specialist knowledge in this area but we recognise that there is a large body of work available and recommend that it should be reviewed for the possible inclusion in life cycle project management at the next review/update of the EHDP.

Transition Management

We believes this area merits further consideration because the 'phased' or 'staged' approach to project management needs robust transition management to ensure continuity of requirements, traceability of management and technical decisions. Transition management could be considered in the context of 'Through Life Management'¹² or 'Through Life Support'. EG13 is aware of work being carried out by the UK MoD and other European actors to develop a Through Life Support Standard, which could be 'Internationalised' at some point but it is not mature enough at this time to be assessed for the EHDP. We recommend that transition management should be reviewed for the possible inclusion in life cycle project management at the next review/update of the EHDP

Disposal

Disposal is addressed in other disciplines such as environmental management but environmental legislation and regulation around the world is developing fast and becoming increasingly complex. At present a large number of international environmental conventions are either in force or being negotiated such as:

- **Montreal Protocol** - addresses depletion of the ozone layer through human action, particularly the use of synthetic chemicals;
- **Framework Convention on Climate Change** - anthropogenic factors affecting climate.
- **Kyoto Protocol** - a subsidiary protocol to the FCCC;

1. _____

2.

¹² Through Life Management is a term adopted by the UK MoD and defined as "an integrated approach to all Acquisition processes, planning and costing activities across the whole system and whole life of a project".

- **Basel Convention** - significantly restricts movement of broadly defined hazardous wastes across international borders (e.g. bans export from developed world to developing countries)

We understand that S3000L covers aspects of Disposal but this has not been reviewed in this phase of work. We consider the subject should be investigated further to see if dedicated standard or guidance is required.

'Contracting'

(Agreement processes in ISO 15288) Intelligent contracting is a fundamental element if defence projects are to be 'win – win' from the perspective of both the customer (user) and supplier (Defence Contractors). A poorly defined contract will almost certainly result in a confrontational project environment, overruns in budget and schedule and reduced in service capability. ISO 15288 describes the contracting (agreement processes) in a systematic way, however there is an increasing trend in defence to develop complicated contracts based on availability/capability and long term 'partnering' approaches. We recommend that it should be reviewed for the possible inclusion in life cycle project management at the next review/update of the EHDP. Note that the same recommendation is made for the **ISM** domain.

8 Annex A – Abbreviations-

AAP	Allied Administrative Publication	International
ASD	Aerospace and Defence Industries Association of Europe	International
ANSI	American National Standards Institute	International
BS(I)	British Standards (Institute)	UK
CEN	European Committee for Standardization	European
CENELEC	European Committee for Electrotechnical Standardization	European
CMMI	Capability Maturity Model Integration	International
DEF STAN	UK Defence Standard	UK
DOD	U.S. Department of Defence	USA
EN	European Standards	European
ESA	European Space Agency	European
ECSS	European Cooperation for Space Standardisation	International
FDX	French Technical Report	FR
IEEE	Institute of Electrical and Electronics Engineers	International
IEC	International Electrotechnical Commission	International
ISO	International Organization for Standardization	International
MIL-STD	US Defence Standard	USA
NF	French Standard	FR
PMBOK	Project Management Book of Knowledge	International
RG. Aero	Aeronautical General Recommendation	FR
SAE	Society of Automotive Engineers	USA
RTCA	Radio Technical Commission for Aeronautics	International
STANAG	NATO - Standardization Agreement	NATO
SWEBOK	Software Engineering Book of Knowledge	International
TLSS	Through Life Support Standard	UK

EG13 Feedback

The following is feedback on the work carried out by EG13. It summarises the challenges and issues we encountered during our review of Life Cycle Project management for the EHDP.

Challenges faced

Work Area and Scope

We all agreed that our initial work area (designation) was not well defined and led to a lot of uncertainty and ambiguity:

“Life cycle management (Service life management, integrated logistic support)”

Because it was imprecise we spent the first 2 meetings trying to develop a scope that was logical, coherent and achievable. After considerable deliberation we chose to redefine our work area as:

“Life Cycle Project Management”

Even with this clarification we still ended up with a large scope (15 domains) and many diverse subject areas to review and make recommendations. This resulted in severe time constraints on our work. In addition, most of our members were specialists in defence logistics support (due to the original work group title) and we had no dedicated experts in several of our domains, for example:

Safety, Ergonomics, Environmental management.

In fact a work group could have been devoted just to **Safety** given its importance and criticality within defence ‘life cycle project management’.

All EG13 members felt that they would have liked more time to fully research their work areas.

Positives Aspects

Whilst we started this feedback with an overview of the challenges we faced, the overriding experience for EG13 members was a positive one and everyone was pleased to have been involved actively in the initiative. Updating the EHDP was considered to be a constructive exercise that should ultimately benefit all stakeholders involved in the European defence environment.

Despite the challenges, we believe we have produced a logical, coherent and well researched body of work. We developed a good team spirit and a working environment based on cooperation, trust and mutual support. By spending the necessary time and effort to define our scope, we had a robust and agreed ‘foundation’ on which to base our activities. We ‘benchmarked’ our work against an existing International standard (ISO 15288) and this provided us with confidence that our approach was logical, coherent and in line with agreed and accepted project management processes.

Due to the large scope each working group member had to undertake significantly more work than they first envisaged. However we adopted a structured and iterative approach and, despite the large scope, all inputs were prepared and received on schedule and the report was completed ‘just in time’!

All members felt that they, and their organisations, had benefited from taking part in the working group, particularly as a result of the exchange of experiences between specialists and through the creation of an informal EG13 'network'.

We had very good support from AFNOR in the provision of first class meeting facilities and from our excellent secretary who organised and administered our work, and who made sure we had a positive working environment for all of our meetings.

In conclusion as, the convenor of EG13, it has been a privilege and a pleasure to work with like-minded specialists from Industry, Nations, AFNOR and CEN. I have enjoyed the experience immensely and would like to thank all of the EG13 team members and the CEN and AFNOR coordinators for their contributions, support and encouragement.

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