IEC 63187

Systems engineering — System safety
Complex systems in defence programmes

"A speciality engineering view of ISO/IEC/IEEE 15288"

65A/1187/CDV

COMMITTEE DRAFT FOR VOTE (CDV)

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IEC SC 65A : SYSTEM ASPECTS

SECRETARIAT: United Kingdom	SECRETARY: Ms Stephanie Lavy
OF INTEREST TO THE FOLLOWING COMMITTEES: TC 65,ACOS	HORIZONTAL FUNCTION(S): TC 65/SC 65A Horizontal Basic Safety
ASPECTS CONCERNED: Safety	
☒ SUBMITTED FOR CENELEC PARALLEL VOTING	☐ NOT SUBMITTED FOR CENELEC PARALLEL VOTING

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TITLE:
Systems engineering – System safety – Complex systems in defence programmes Part 1 – Concepts, terminology and requirements

PROPOSED STABILITY DATE: 2030

NOTE FROM TC/SC OFFICERS:

IEC 63187-1 is currently at the Committee Draft for Vote development stage. Publication as an international standard is planned in 2026, subject to international approval.

IEC TR 63187-2 is being drafted as a Technical Report to support implementation of IEC 63187-1.

Motivation for a new standard

The market is evolving towards:
- More **complex** systems with **complex** functions and **complex** architectures
- **New technologies** and new applications of existing technology
- **Fewer humans in the loop** to handle safety
- **Dynamically evolving risks**

Existing safety standards do not:
- Align with **system engineering**
- Address **multi-layered systems** recursively
- Capture **emergent properties** at system level (without failure)
- Fully allow interaction with other **engineering domains**

Objectives

Safety:
- Propose a comprehensive approach for **adapting safety requirements to risk**
- Propose an approach for **risk control** across the layers of a system
- Propose an approach to control situations of **dynamic risk**
- Maintain an open approach towards activities and assurance **outcomes**
- **Account for traditional approaches**, in particular quantitative, for **realised system elements**

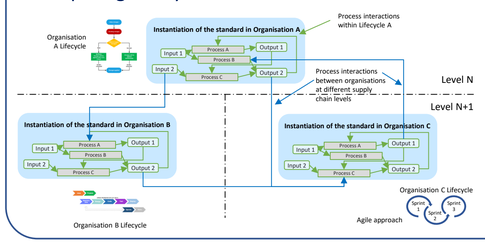
Systems engineering:
- Propose a way to **embed safety engineering** in systems engineering (ISO/IEC/IEEE 15288)
- Propose an approach enabling **instantiation between system layers** and between supply chain levels **without limitations**
- Distinguish the system conceptual activities from the realisation of the system physical and logical elements
- Propose a seamless **interface to existing safety standards** for realising physical and logical system elements

Fundamental principles

- **Risk-based** (ISO 31000): focus on hazards and their consequences rather than quantitative probability; risk is the effect of uncertainty on objectives
- **Systems-based** (ISO/IEC/IEEE 15288): recursively applying systems engineering principles at multiple levels in the systems hierarchy and supply chain
- **Systems theory** and **control theory**: considering interacting system elements that can lead to detrimental effects without component failure
- **Integrating safety into systems engineering** as a fundamental part of engineering the system, with the flexibility to trade requirements
- **Appropriateness of approach:** addressing threats to safety from sources with different types of characteristic
- **Supply chain considerations**: addressed to apply proportionately over organisational boundaries
- **Solution independent**: regardless of the origin or lifecycle stage of realised system elements
- **Goal-based:** providing a framework to identify and achieve safety objectives, rather than a prescriptive set of rules or specifications

Acquisition viewpoint

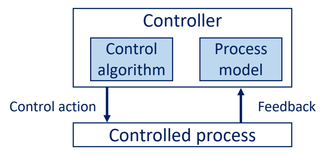
- Defence applications are subject to dynamic risks: detriments (harms), safety objectives and compromises depend on the operational context (CONOPS)
- Risk acceptability can only be determined on a case-by-case basis, by the organisation acquiring the system
- Definition of detriments from the acquirer's own viewpoint (i.e. "what is important")
- Convergence and control of Measures of Importance (MoI) through schemes agreed between parties (i.e. "how important is that?")
- IEC 63187 is applied by organisations across the supply chain, giving a consistent approach
- Each organisation defines its own suitable life cycle on the basis of the generic ISO/IEC/IEEE 12207 life cycles
- Organisations agree on interface arrangements, allowing consistent and traceable engineering



Systems engineering viewpoint

Control theory:
- Detriments from all domains of interest (mission, safety, security, …) can be considered in decision making
- Centred on the Perception–Interpretation–Decision–Action loop.
- Safety viewed as the robustness of control under internal and external perturbations
- Modelling control structures allows scenarios that lead to undesired system states to be identified
- Humans are integrated in the control structures

IEC 63187 considers all the system life cycle processes from a safety viewpoint:
- Implementing a "Safety View" (as an aspect of speciality engineering, as per ISO/IEC/IEEE 24748-1:2024 annex D4)
- Supplementing ISO/IEC/IEEE 15288 process outcomes with specialised requirements, criteria and informative notes, to clarify what is needed from the safety viewpoint



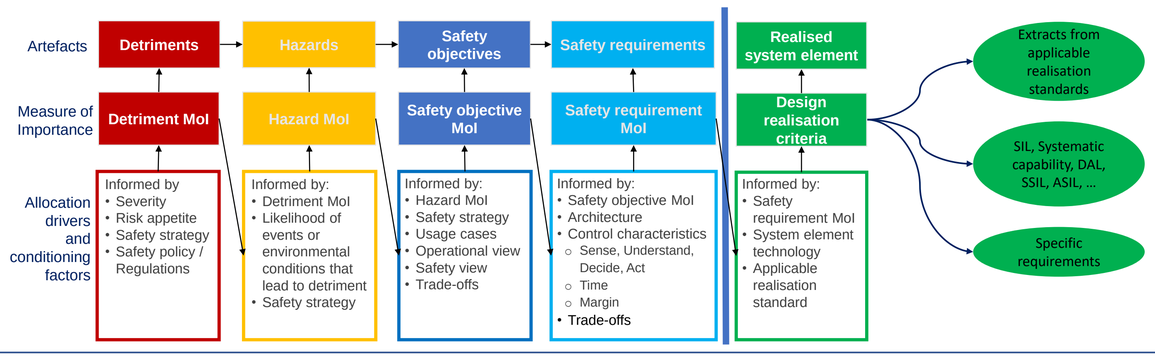
Implementation viewpoint

- The actual production of system elements is not in the scope of IEC 63187. The standard is limited to their specification and acceptance, not the detail of their realisation
- The requirements of IEC 63187-1 do not interfere with the prescriptive standards for the production of system elements (e.g. for E/E/PE: DO178C, IEC 61508-3, IEC 61508-2)
- Inputs to realisation work will be defined based on the detriments, hazards, safety objectives and safety requirements; and the design constraints will integrate the elements necessary for the realisation

	Visibility of design and configuration	No visibility of design and configuration
Controllability of the design	Route to realisation 1_R	Route to realisation 3_R
No controllability of the design	Route to realisation 2_R	Route to realisation 4_R

Safety engineering viewpoint

- No split imposed between the system under control and the safety functions, as is the case with IEC 61508
- The IEC 63187 approach remains compatible with the fundamental principles of IEC 61508 and MIL-STD-882E
- The Measure of Importance (MoI) concept allows classifying various artefacts according to associated criteria/parameters and moderation factors to reflect how much they matter to the stakeholder
- Defining a MoI makes it possible to avoid the saturation of integrity levels that can occur when allocating requirements mechanically



Takeaway points

Systems engineering
- No mandated safety deliverables; safety outcomes are embedded in the systems engineering outcomes, open life cycle adaptable by each stakeholder organisation

Hazards, risks and detriments
- Principles of control theory
- Based on a unique concept to express objectives from all specialities and allow arbitration when necessary

Safety objectives and safety requirements
- Dissociation of constraints on the system of interest (objectives) from the solutions satisfying them (safety requirements) and allows identification of emerging aspects

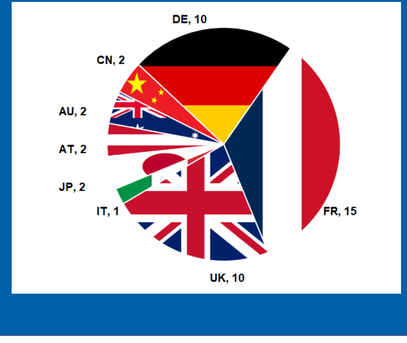
Measures of Importance
- No predefined index (no equivalent to SIL, DAL, ASIL, etc.)
- Definition of normative requirements to allow stakeholders to define ad hoc Measures of Importance in a consistent global framework

Safety performance
- Accounts for the fact that the system safety performance, if expressed only quantitatively as the sum of the realised system element failures, cannot represent the overall system safety

Safety assurance
- Accounts for the fundamental difference between the necessary means to deliver system safety and the necessary means to guarantee their effectiveness

IEC 63187 development ecosystem

50+ Participants from 11 contributing nations



IEC 63187 is being developed by Working Group 18 of the IEC's TC65/SC65A technical subcommittee: Industrial-process measurement, control and automation – Systems Aspects. Members of the international working group are experts nominated by the national standards organisation of each country that takes part.

For more information, contact james.inge@scsc.uk