



30th Annual **INCOSE**
international symposium

Virtual Event
July 20 - 22, 2020

Integrating Process Standards for System Safety Analysis to Enhance Efficiency in Initial Airworthiness Certification of Military Aircraft

A Systems Engineering Perspective

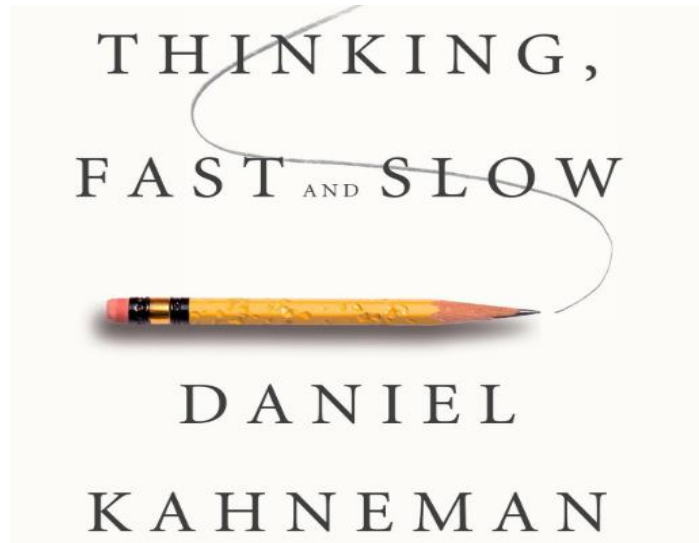
Morten Reinfjord Guldal



Overview

- Introduction
- Research question
- System Safety Standards
- Integrating System Safety and Systems Engineering
- Conclusion

Introduction



EMAR 21

CERTIFICATION OF MILITARY AIRCRAFT AND
RELATED PRODUCTS, PARTS AND APPLIANCES,
AND DESIGN AND PRODUCTION ORGANISATIONS

**EUROPEAN MILITARY AIRWORTHINESS
CERTIFICATION CRITERIA (EMACC)**

EMACC Handbook

Research question



MIL-STD-882

SAE ARP4754

SAE ARP4761



**ISO/IEC/
IEEE
15288**



System Safety Standards



MIL-STD-882E
11 May 2012

SUPERSEDING
MIL-STD-882D
10 February 2000

- Risk-based approach: ALARP
- Process – how to document
- Scope: Mishap result criteria



DEPARTMENT OF DEFENSE
STANDARD PRACTICE

SYSTEM SAFETY

SAE Aerospace <i>An SAE International Group</i>	AEROSPACE RECOMMENDED PRACTICE	SAE ARP4754	REV. A
		Issued 1996-11 Revised 2010-12	
		Superseding ARP4754	
(R) Guidelines for Development of Civil Aircraft and Systems			

- Goal-based approach
- Processes – SE ish
- Scope: based on severity

Tool/method
Scope: based on phase

 <p>SAE The Engineering Society For Advancing Mobility Land Sea Air and Space® INTERNATIONAL</p> <p>400 Commonwealth Drive, Warrendale, PA 15096-0001</p>	AEROSPACE RECOMMENDED PRACTICE	 ARP4761
		Issued 1996-12
GUIDELINES AND METHODS FOR CONDUCTING THE SAFETY ASSESSMENT PROCESS ON CIVIL AIRBORNE SYSTEMS AND EQUIPMENT		

Integrating System Safety and Systems Engineering



ARP4754

- 1.0 Planning
- 2.0 Development and Requirements capture
- 3.0 Safety Assessment
- 4.0 Requirements Validation
- 5.0 Implementation Verification
- 6.0 Configuration Management
- 7.0 Process Assurance
- 8.0 Certification and Regulatory Authority Coordination

ISO 15288

- 6.1 Agreement
- 6.2 Organization project-enabling
- 6.3 Technical management
- 6.4 Technical processes

Integrating System Safety and Systems Engineering



6.1 Agreement



ISO 15288 mention safety

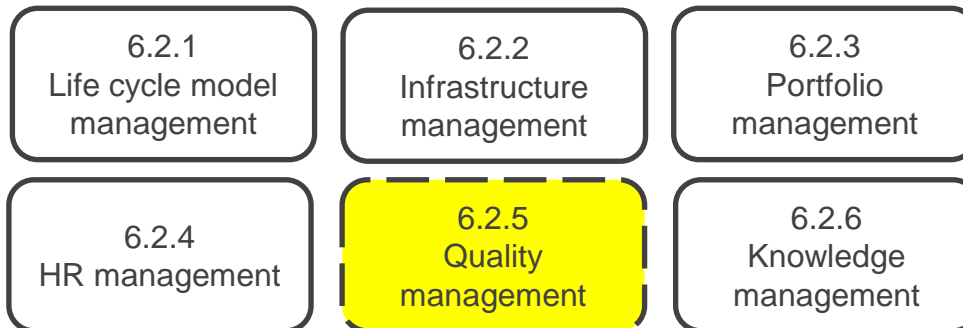
 Link with ARP4754

 No link with ARP4754

ISO 15288 does not mention safety

 Link with ARP4754

6.2 Organization project-enabling



Integrating System Safety and Systems Engineering

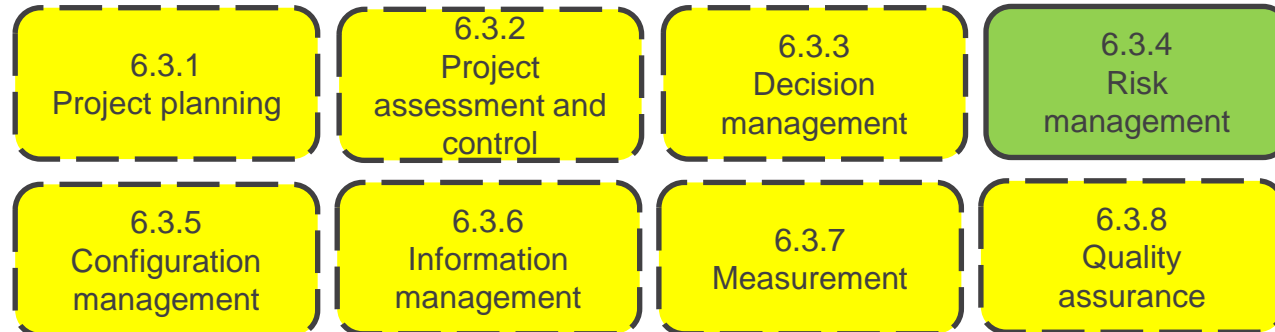


ISO 15288 mention safety

 Link with ARP4754

 No link with ARP4754

6.3 Technical management



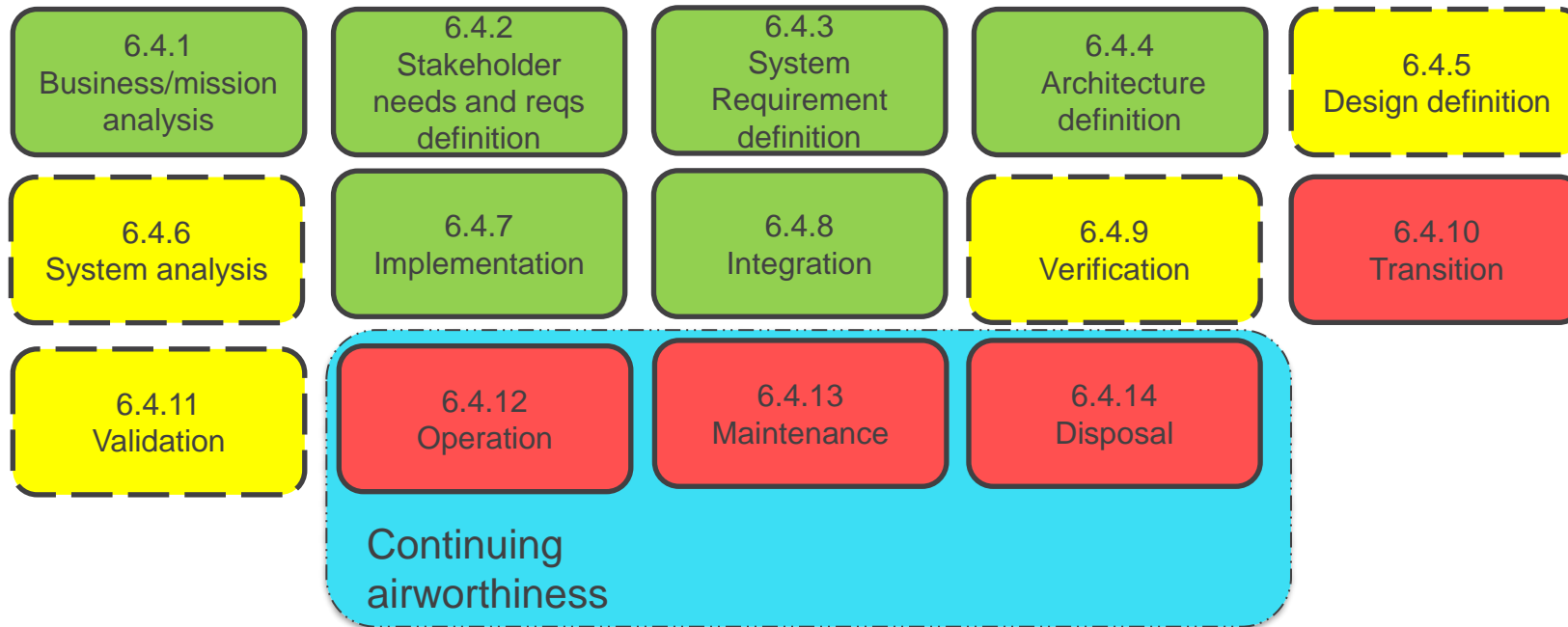
ISO 15288 does not mention safety

 Link with ARP4754

Integrating System Safety and Systems Engineering




6.4 Technical processes



ISO 15288 mention safety

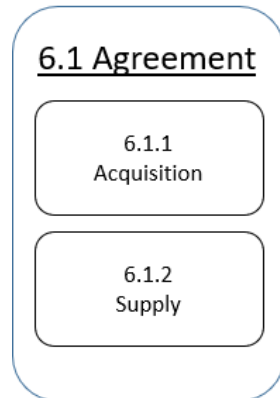
 Link with ARP4754

 No link with ARP4754

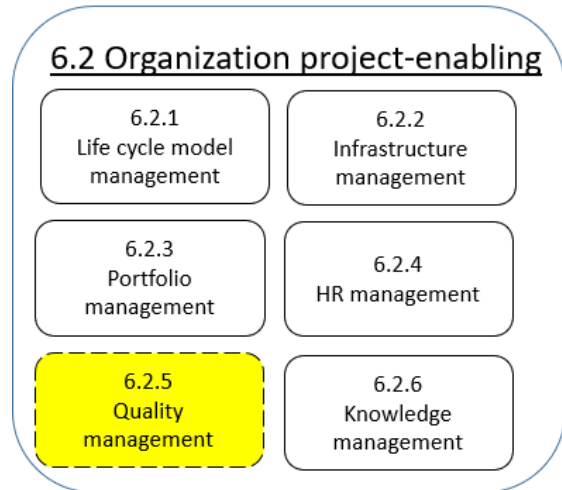
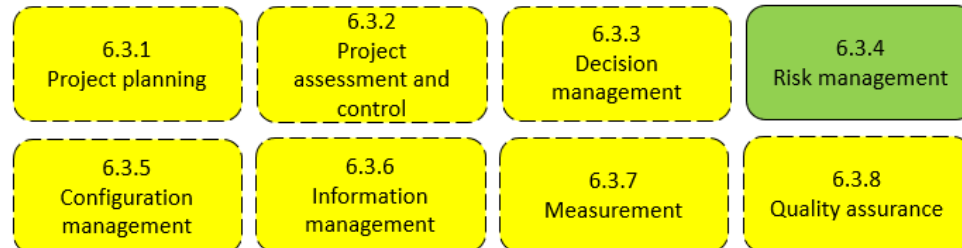
ISO 15288 does not mention safety

 Link with ARP4754

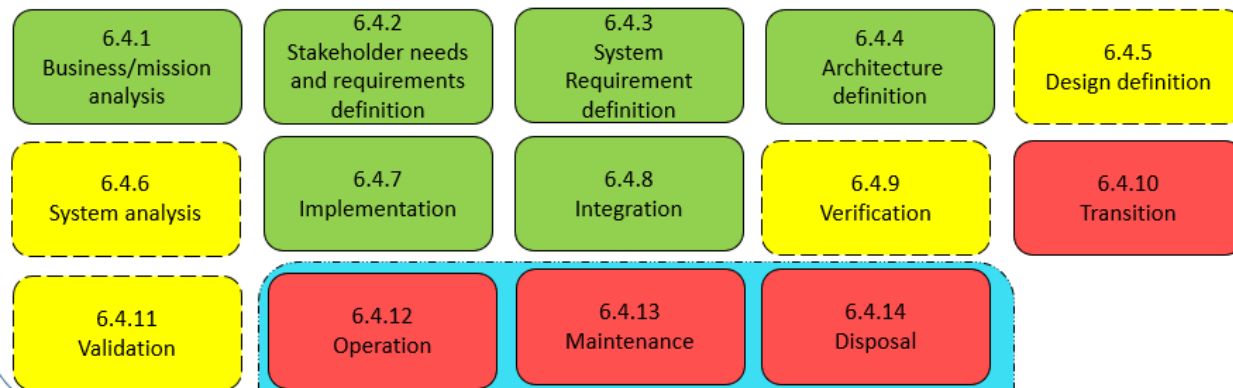
Integrating System Safety and Systems Engineering



6.3 Technical management



6.4 Technical processes



Continuing airworthiness

ISO 15288 mention safety

- Link with ARP4754
- No link with ARP4754

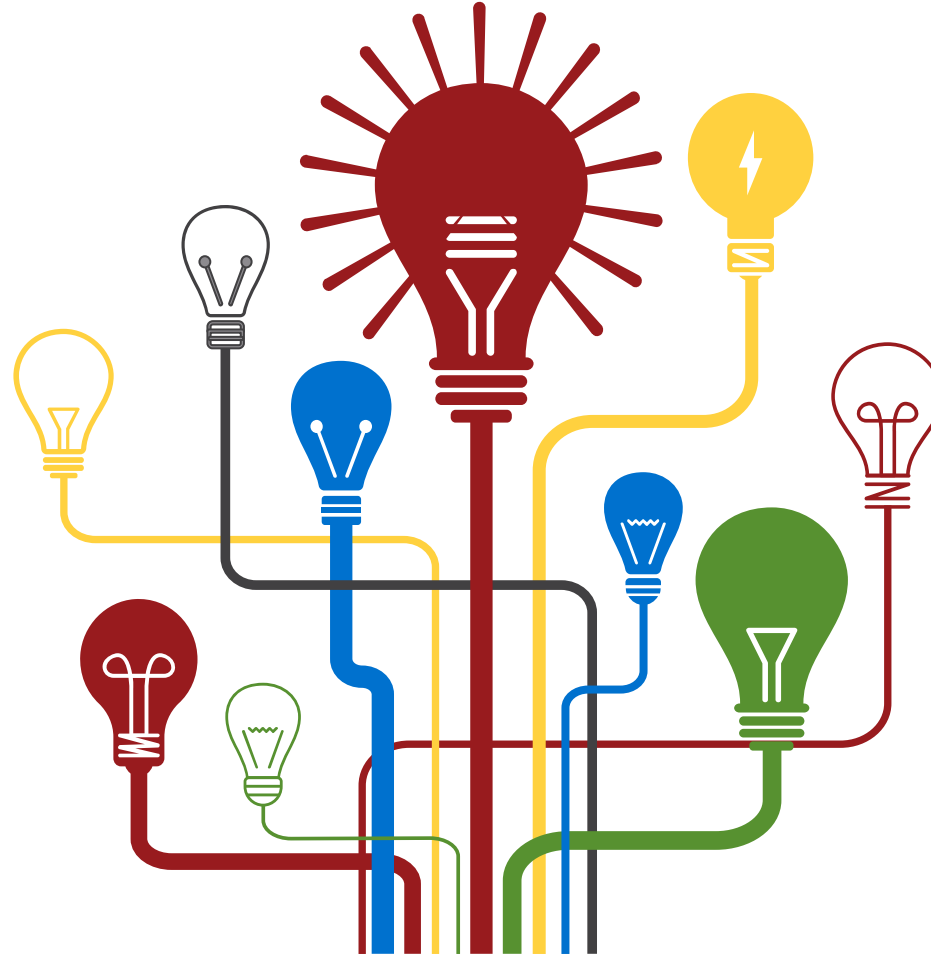
ISO 15288 does not mention safety

- Link with ARP4754

Conclusion



Scoping
Combine civilian
and military system
safety standards



Balancing risk, cost and
needed capability
Integrated approach:
ISO 15288 + ARP4754

Benefits in operational life?
Yes!



30th Annual **INCOSE**
international symposium

Virtual Event
July 20 - 22, 2020

www.incose.org/symp2020

Thank you!