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Can Systems Engineering Support An Owner-Operator To Be A Design Authority?

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Introduction

- Shift in design authority roles and tasks from customer to supplier
  - High risk strategy, especially with novel and complex programmes
  - Requires requirements to be defined and for them not to change

- The customer needs to take responsibility for the design as it matures due to:
  - Regulatory practice of holding the operating company responsible for the design as well as for its safe operation;
  - The legal position taken to hold the operator solely liable for damages in the event of an accident;
  - Or the risks of project failure is so large it needs to be shared across the extended enterprise

Terminology Minefield

Design Assessment

Intelligent Customer

Design Authority

Operator / Owner

Designer / Supplier

Approving Authority

Technical Assurance

Quality Assurance

Fitness For Purpose

Technical Authority

Independent Advice

Governance

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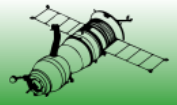
Responsible Designer

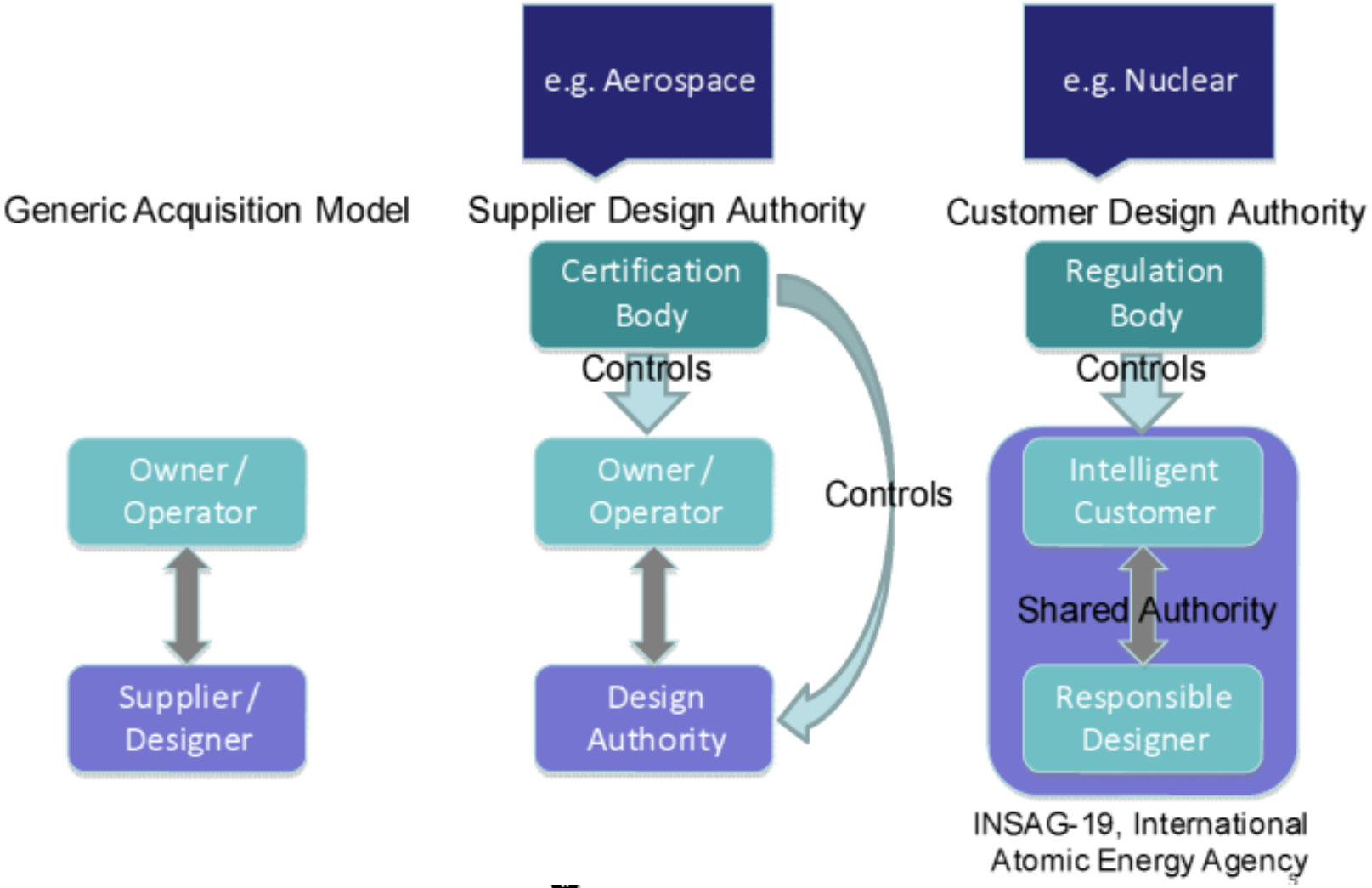
Regulation

Qualification

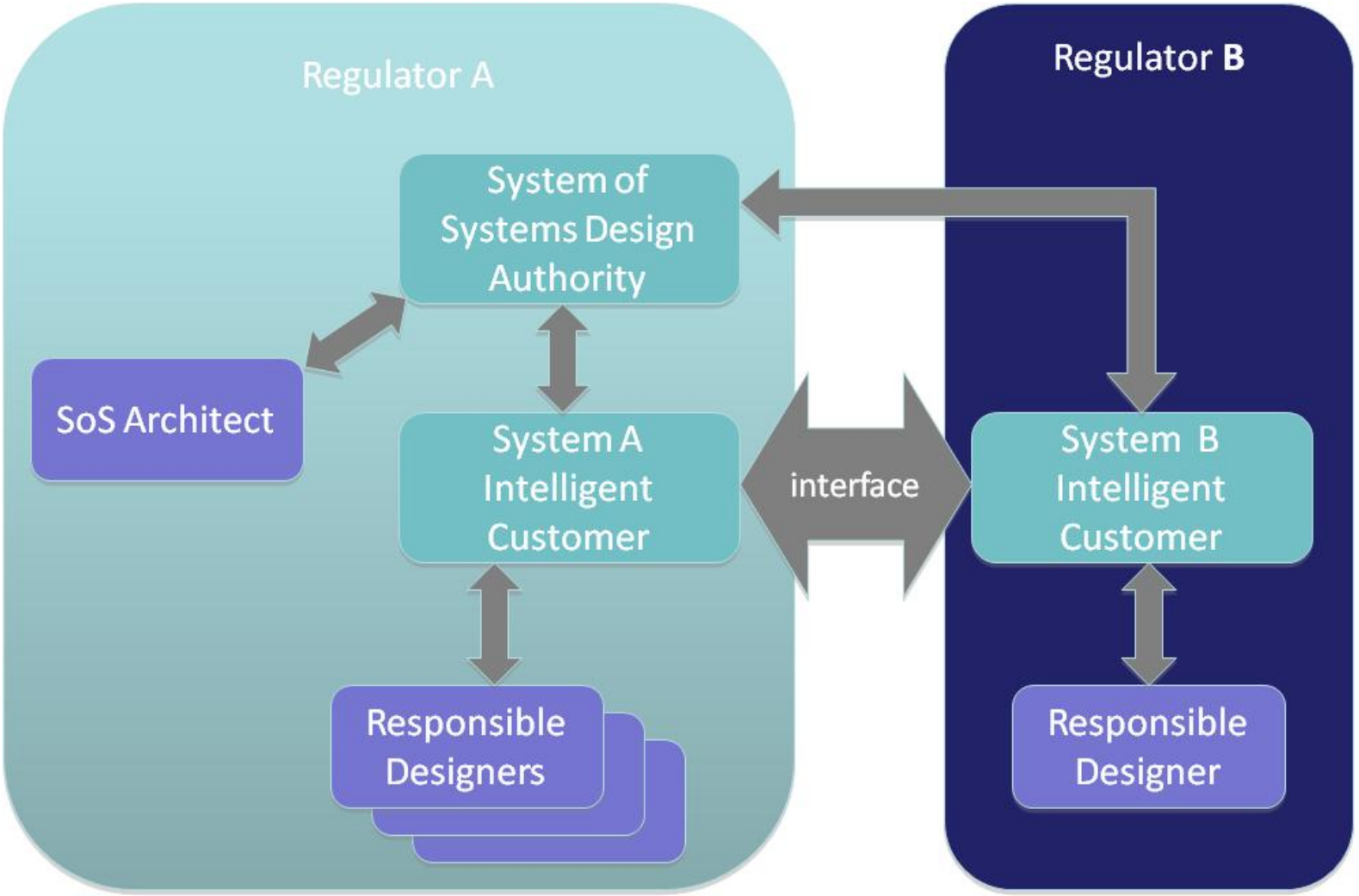
Certification


Design Authority Models

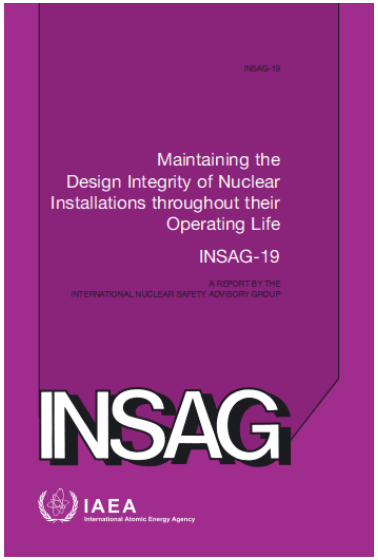


Complex Design Management Arrangements



Design Authority Responsibilities

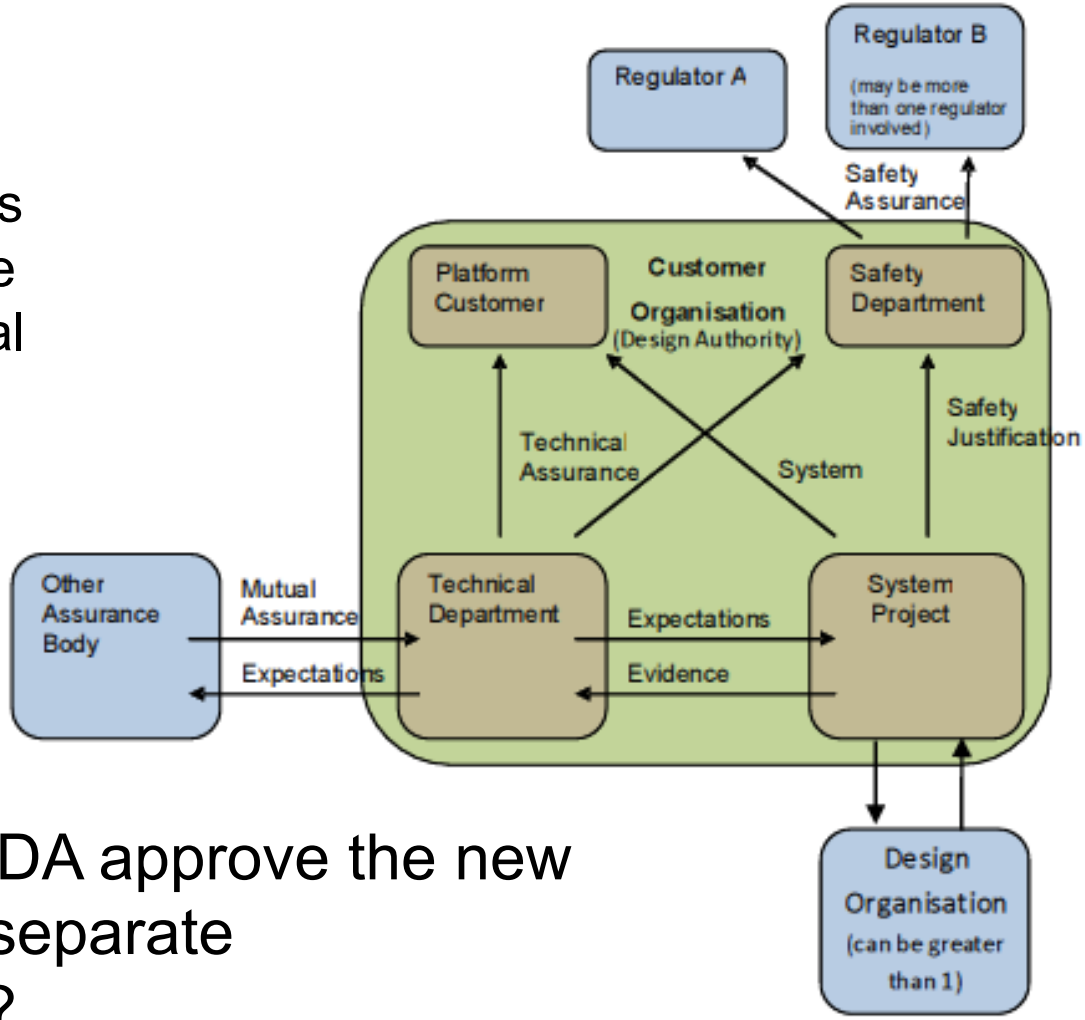
- A Design Authority is responsible for:
  - Establishing, preserving and expanding the design knowledge base and its recovery should it become lost
  - Quality Assurance
  - Requirements
  - Reviewing, verifying and approving (or rejecting) design changes
  - Maintaining design integrity
  - Design configuration control (e.g. Drawings, specifications, manuals, design standards, engineering calculations, supporting data)
  - Controlling interfaces with designers and suppliers of design work
  - Maintaining SQEP skills & knowledge (including research programmes)



INSAG-19, International Atomic Energy Agency

Technical Governance

- Activity which is undertaken to:
  - ensure a design remains Fit for Purpose and Safe throughout is operational life
  - maintain control of design.
- An owner-operator is unlikely to be “design capable”
- Therefore how does a DA approve the new design produced by a separate Responsible Designer?

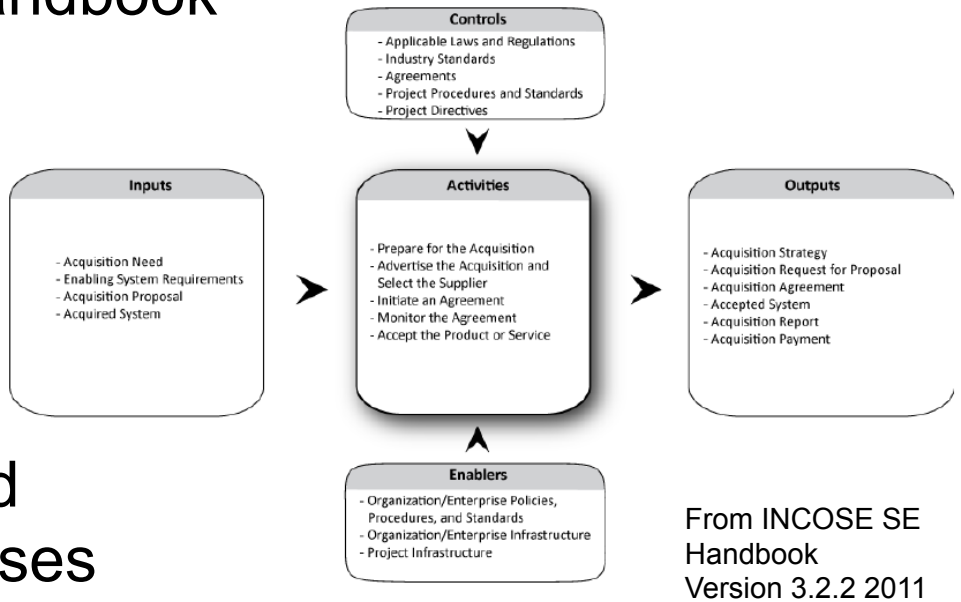


Lack of Guidance

So where can a DA turn to for help?

- Agreement processes of ISO 15288 and the INCOSE Systems Engineering Handbook

  only discuss:
  - Negotiating,
  - Monitoring
  - Confirming Delivery

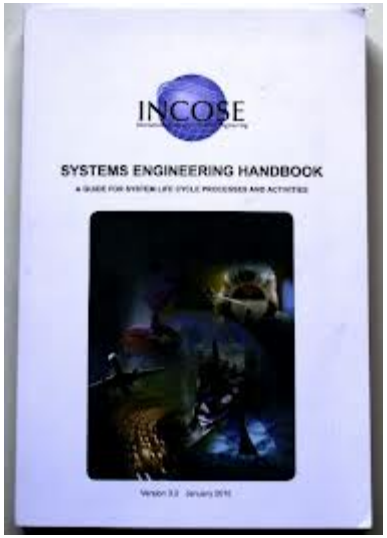


From INCOSE SE Handbook Version 3.2.2 2011

- Decision management and Risk management processes provide good guidance:
  - technical decision making,
  - technical risk management.

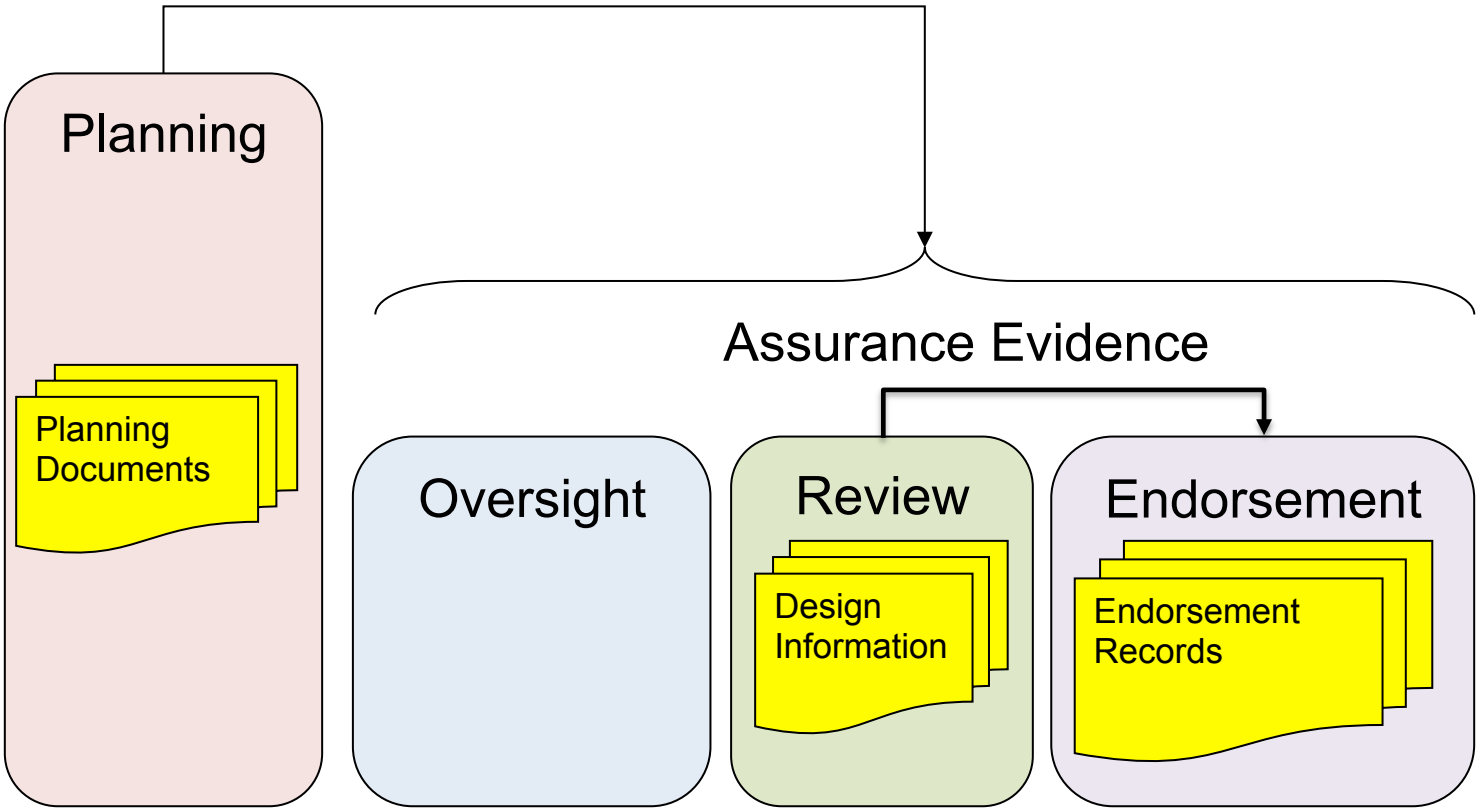
Lack of Guidance

- ISO 15288 and INCOSE Systems Engineering Handbook are focused towards the DO rather than the DA.

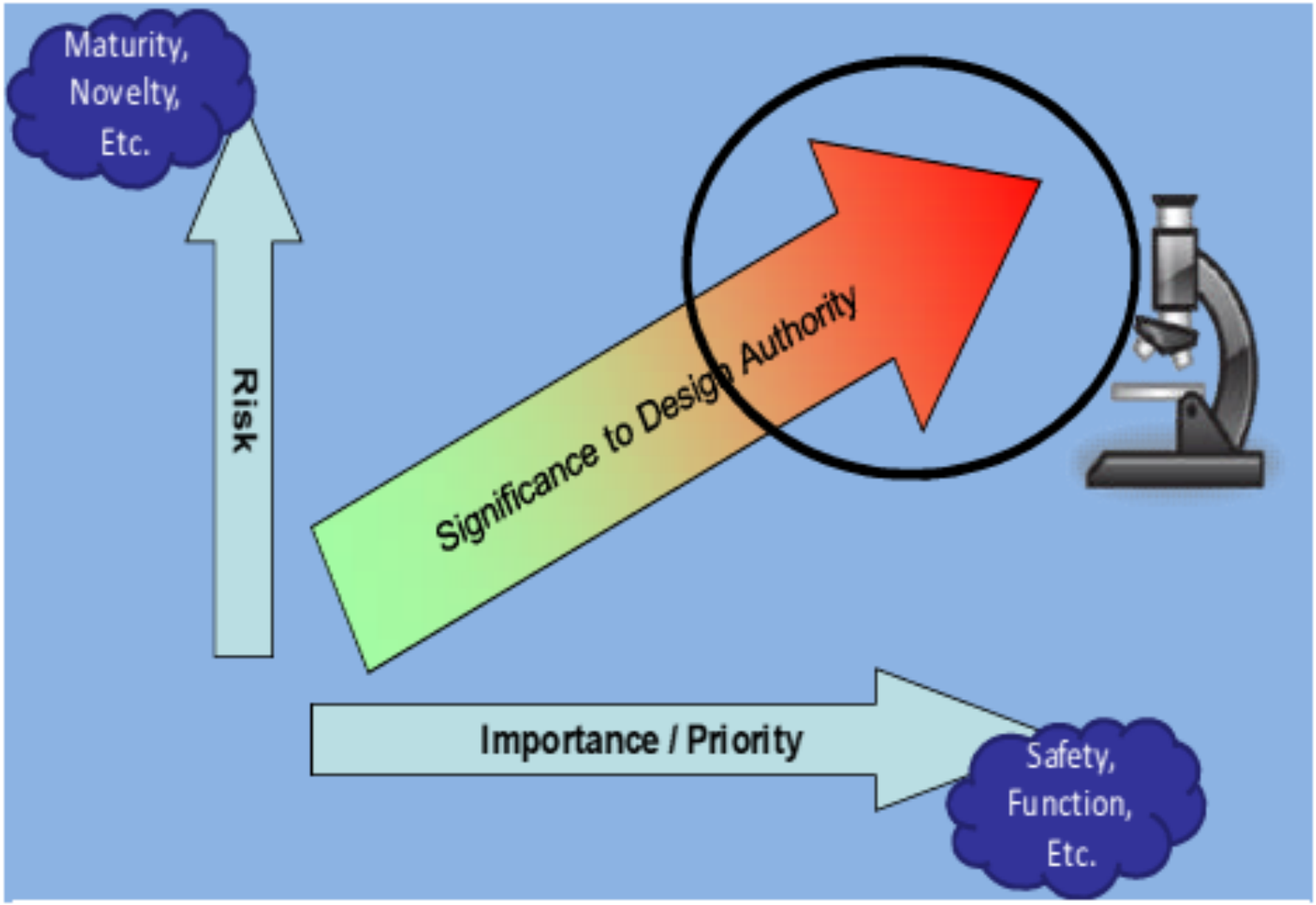


- The DA is responsible for much more than what is contained within ISO15288.
- One of the weaknesses of ISO15288, when used in regulated/non prescriptive industries, is that it does not have coverage of all the elements needed to support engineering judgment and the ability to justify the case for the end output.
- The authors believe that there is scope here for INCOSE to provide this guidance.

Proposed Approach



A Graded Approach



Mutual Assurance

- The means by which one organisation is able to take credit for another's assurance activities without having to repeat them.
- For an owner / operator who is the Design Authority, they need to
  - be satisfied that the Design Organisation's assurance process meet the DA's and any Regulator's requirements
  - and that they are following these processes.
- Mutual Assurance must not be confused with a passive, unquestioning approach.

How SE Technical Processes Support The DA

- Not exploring new approaches to SE but
- How You As A Systems Engineer Can Help
- SE addresses two key points:
  1. Assurance of engineering processes to ensure control of design;
  2. Provide evidence to allow technical governance to happen.


INTERNATIONAL STANDARD ISO/IEC 15288

First edition 2002-10-15

Systems engineering — System life cycle processes

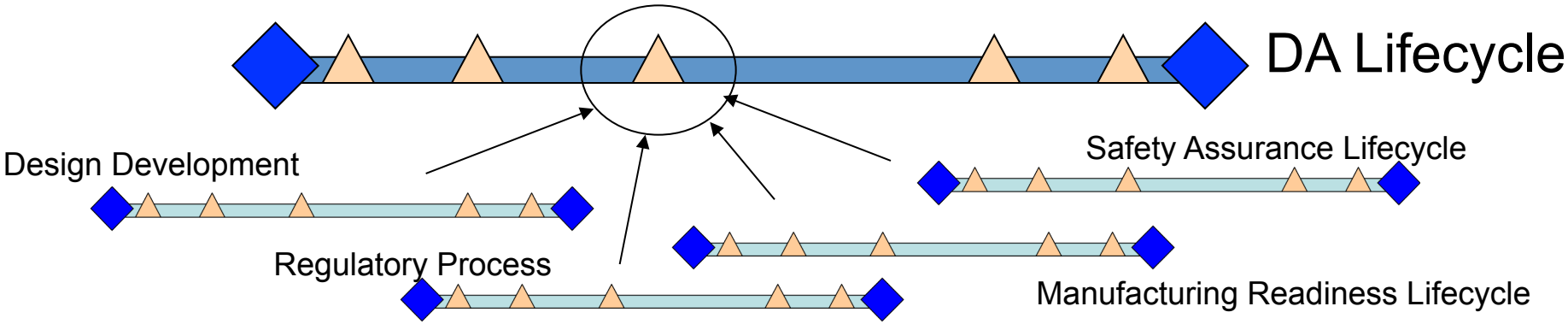
Ingénierie systèmes — Processus de cycle de vie des systèmes

Reference number ISO/IEC 15288:2002(E)

© ISO/IEC 2002

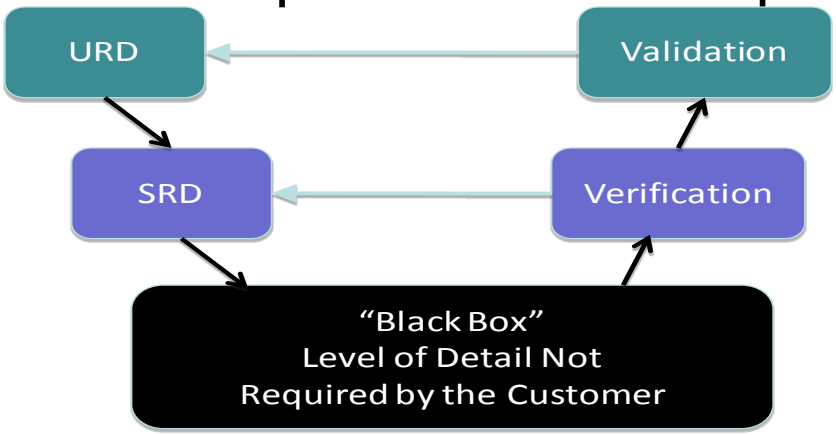
Managing Different Assurance Life Cycles

- Issues:
  - Aligning multiple life cycles from differing responsibilities across different organisations
  - Definition and purpose of reviews
  - Long lead items
  - Maintaining design integrity across the life cycle
  - Differing alignment of maturity points
- DA Customer needs to
  - Set their own purpose for decision gates and criteria
  - Take mutual assurance credit to DO reviews to avoid duplication

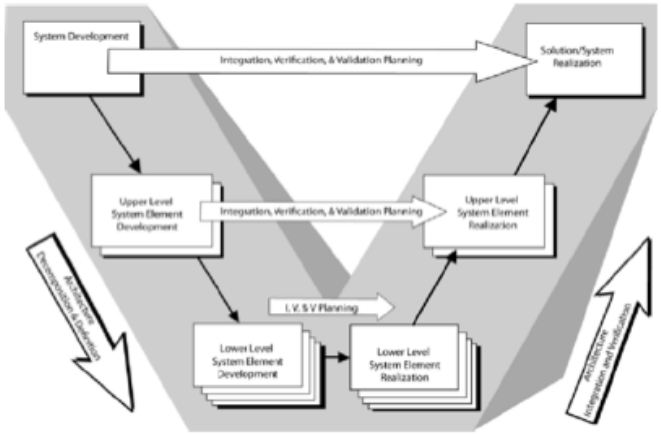


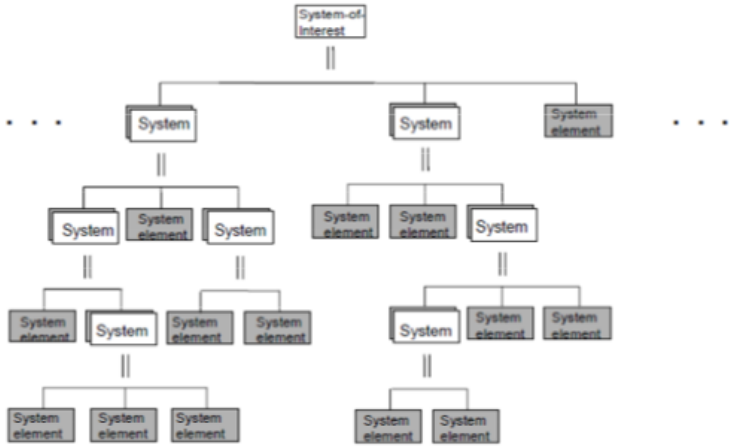
Setting Requirements & Specifications

Black Box View of Requirements and Specifications



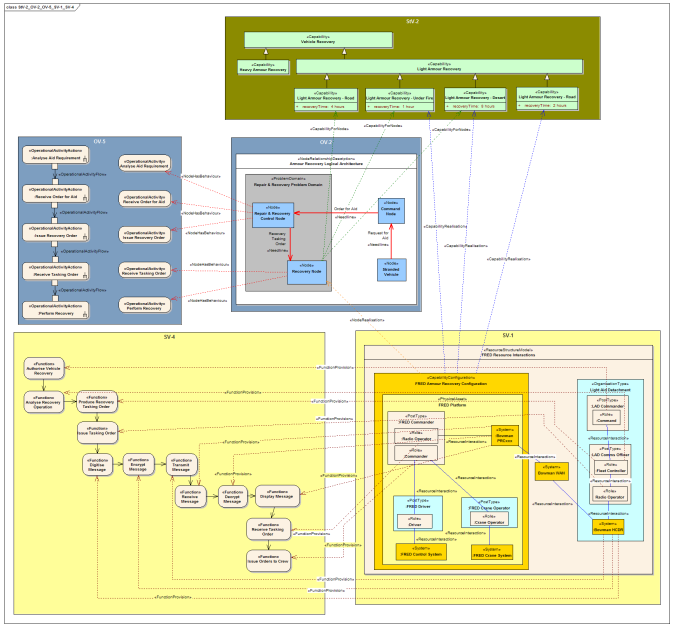
vs. Design Authority / Intelligent Customer View





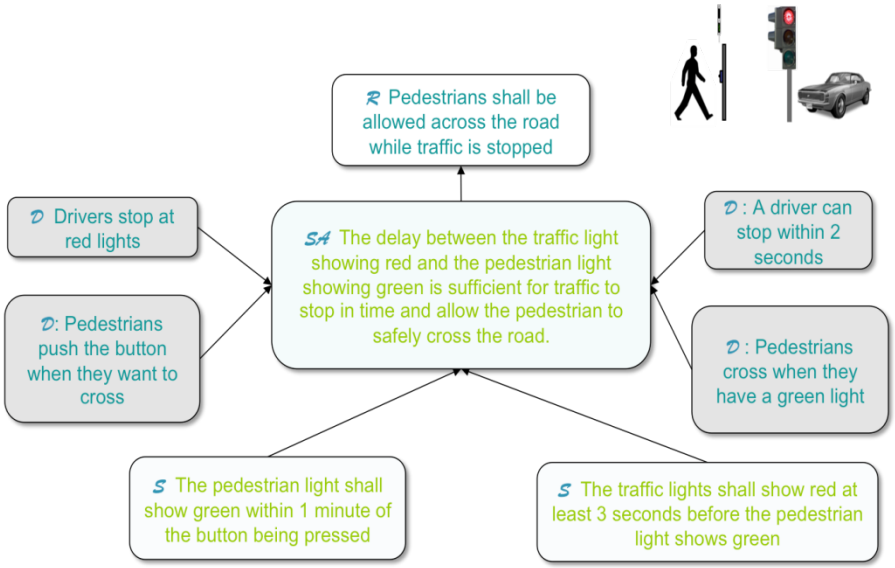
Architectural Design

- Architecture design underpins claims of compliance against top-level system requirements
- A *shared* Architectural Design supports clear definition of the boundaries of systems within the operating environment
- Design Authorities need coherent, shared & controlled Architecture Design information
- Owner / operator organisations not always knowledgeable about or comfortable with formal Architecture methods



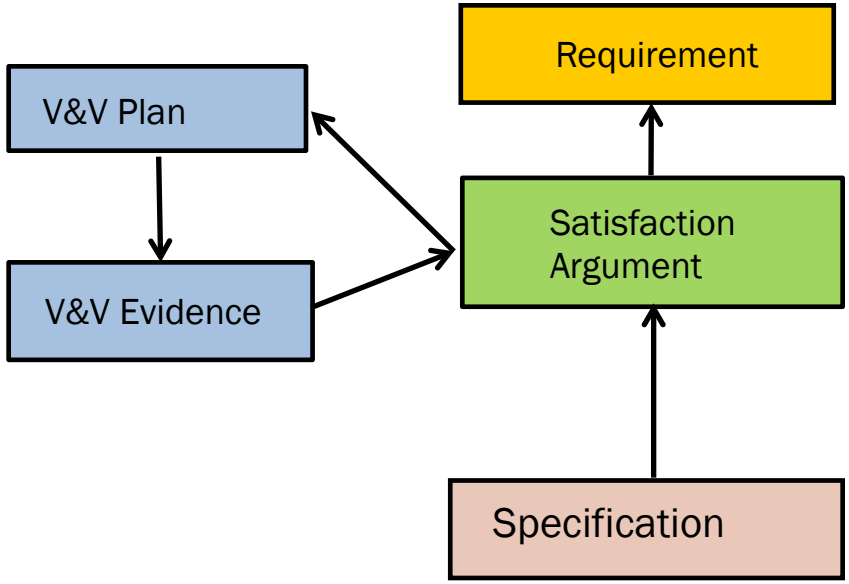
Verification

Satisfaction Arguments



Further info: Hammond, Rawlings & Hall, *Will It Work*, IEEE International Symposium on Requirement Engineering 2001

Progressive, Evidence Based-Assurance



Further Info: Dick & Russell, *Evidence Based Development*, INCOSE ASEC 2012

Challenges and Lessons

- Some of the challenges and lessons experienced on this piece of work:
  - Shared Common Vision
    - in terms of boundaries, role and responsibilities
  - Early Planning
  - Proportional Approach
    - Graded-Risk Based Approach
    - Sampling Strategy
  - Design Evidence
    - Information Sharing
    - Significant IT Investment
    - Contract for Technical Governance
  - Resource Capability, Competence and Experience
    - Aligned skills to responsibilities

Conclusions

- Supplier as DA = high risk strategy on novel and complex programmes.
- Not acceptable in regulated environments.
- Customer (DA) needs to take responsibility for the design as it matures.
- Customer as DA has implications on the capability required.
- Not a great deal of guidance available.
- Systems engineering can be used to support technical governance.
- Introducing SE in a DA environment can be challenging!

Any Questions?