

SWISSED22

From Design to Reality - Walking up the "V"

Frontloading or not frontloading, that is the question

By

Leardi Carlo

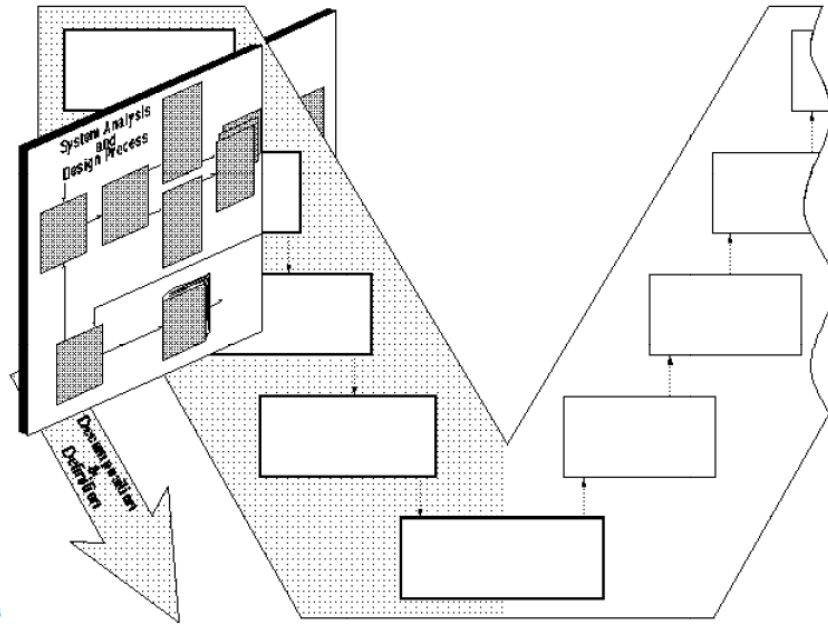
AISE, INCOSE Italian Chapter, Director of Events



Carlo Leardi, graduated in electronic engineering in Genova Italy.

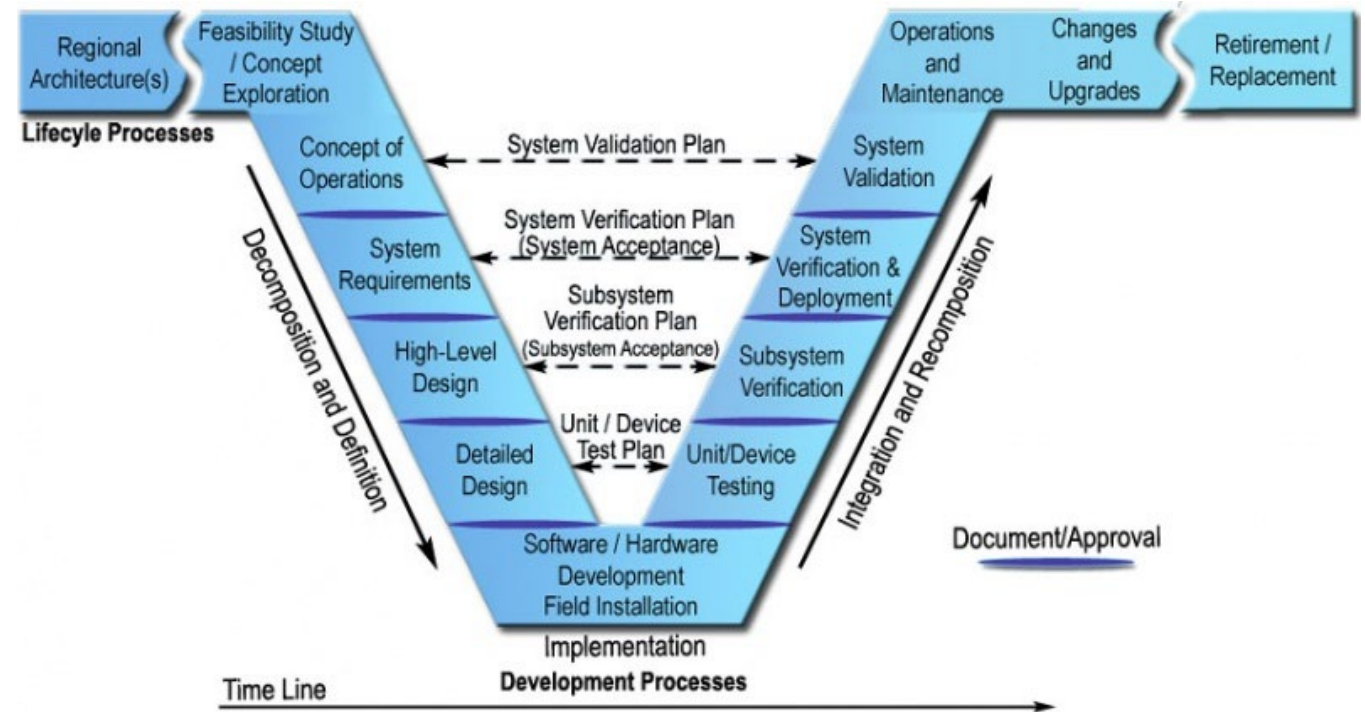
His professional background starts with quality assurance responsibility evolving in the last years to full verification, validation and testing commitment within complex systems development deployment projects in the following areas: automotive, freight railways and packaging industry. As a passion before and today as a full job, he is dealing with Quantitative Systems Engineering on a day-to-day application and coaching of a full range of statistical and simulation methodologies supporting the decisional process. He published several articles in Engineering and Systems Engineering journals. He is certified CSEP, one of the founders and past President of the INCOSE Italian Chapter and founder of AISE, the Italian association of Systems Engineering. He taught at the Systems Engineering Masters in Tor Vergata and ForteMare in La Spezia. He is serving the Incose Italian Chapter as director of events and coordinator of the Verification, Validation and Operation working group.

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Exhibit 8—Application of the System Analysis and Design Process to the Technical Aspect of the Project Cycle



Three dimensional view of the technical aspect of the **Project cycle**

Test and facilities are **implied!**

Test philosophy and planning **IDENTIFIED EARLIER: Frontloading → EXECUTED!**

- The Relationship of System Engineering to the Project Cycle by Kevin Forsberg and Harold Mooz – NCOSE 1995
- Caltrans and USDOT. 2005. Systems Engineering Guidebook for Intelligent Transportation Systems (ITS), version 1.1. Sacramento, CA, USA: California Department of Transportation (Caltrans)

Frontloading or not frontloading, that is the question

Reasons for frontloading:

- *Identify asap, before integration, transfer and use, flaws*
- *Establish budget allocation during development, and, why not, during overall system life-cycle*
- *Manage supply chain by confirm the system architecture*
- *Evaluate concurrently alternative concepts*

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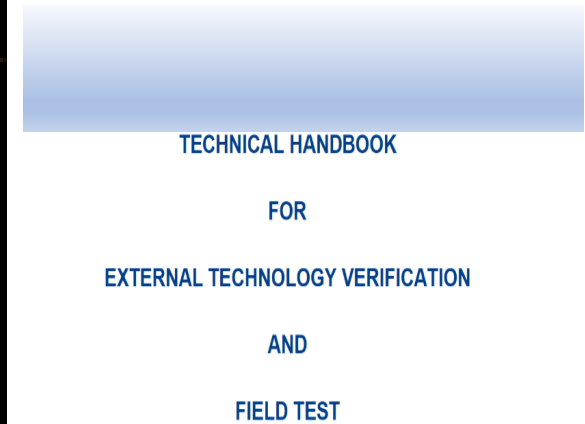
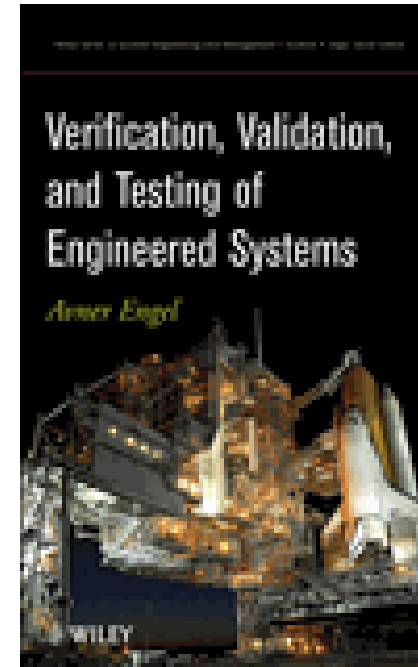
SysTest: Developing Methodology for Advanced Systems Testing

“Frontloading VVT activities:

... frontloading of VVT activities will reduce uncertainty earlier, decreasing failure and rework, thereby reducing quality costs. *”

SysTest: Improving the Verification, Validation, and Testing Process— Assessing Six Industrial Pilot Projects

Markus Hoppe,¹ * Avner Engel,² and Shalom Shachar³



1 Purpose

This handbook addresses the key aspects of all the validation activities including Internal Validation / Long Runs, Field Tests, and extended monitoring. Although the actual version of the handbook covers a limited part of the Archetypes, it still aims to foster product success on the market by focusing on E2E, customer value and non-negotiable attributes concepts. The System Architects, Technical Integrators, Product Owners will and shall find methodological guide and pragmatic support for planning, selecting, preparing, executing, collecting, documenting, storing, and communicating the acquired knowledge.

- Foster transparency during planning through visualizing the VVT strategy as a process model
- Foster the effective use of historical project data during V&V strategy planning through process modeling
- Support the optimal selection and scheduling of the right VVT activities for given VVT and project goals
- Provide stochastic estimates for cost-, schedule- and technical performance risk reduction through a certain VVT strategy

* Verification, validation and testing cover over 60% of development cost

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AMISA: Architecting Manufacturing Industries and Systems for Adaptability

How can **adaptability** be introduced into **systems' architectures** so that they will provide **maximum value** to overall stakeholders chain throughout their lifetime?

Methodology



Problem statement

- Definition of the Adaptability Business case
- Change Mechanism
- Constraints and boundary conditions



System Modelling

- Functions, Components, Interfaces



Cost Evaluation

- Option Cost
- Upgrade cost



Value Evaluation

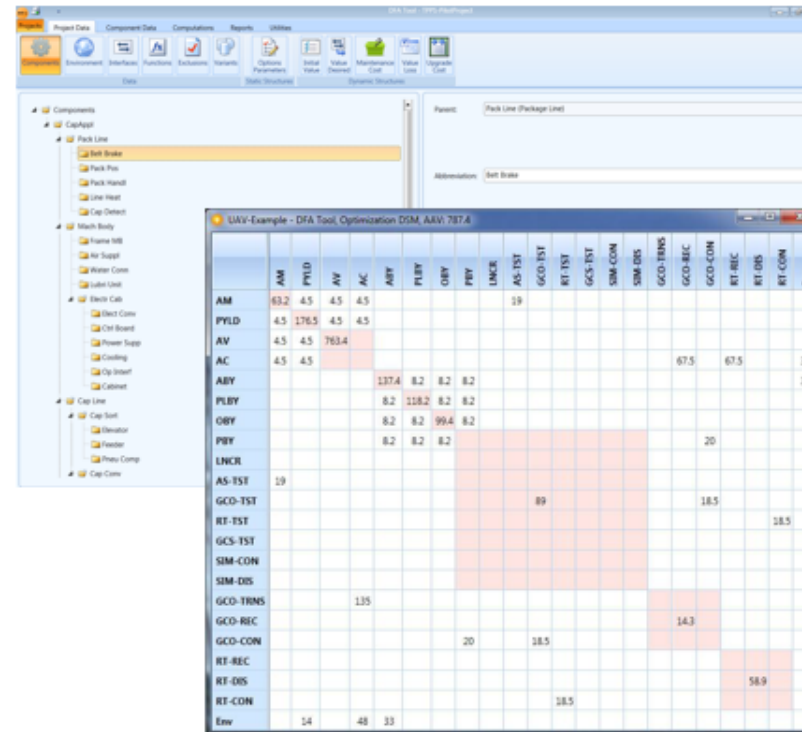
- Technology Forecasting (TRIZ)
- Option Value



Adaptability Assessment

- DSM matrices
- Optimization algorithm

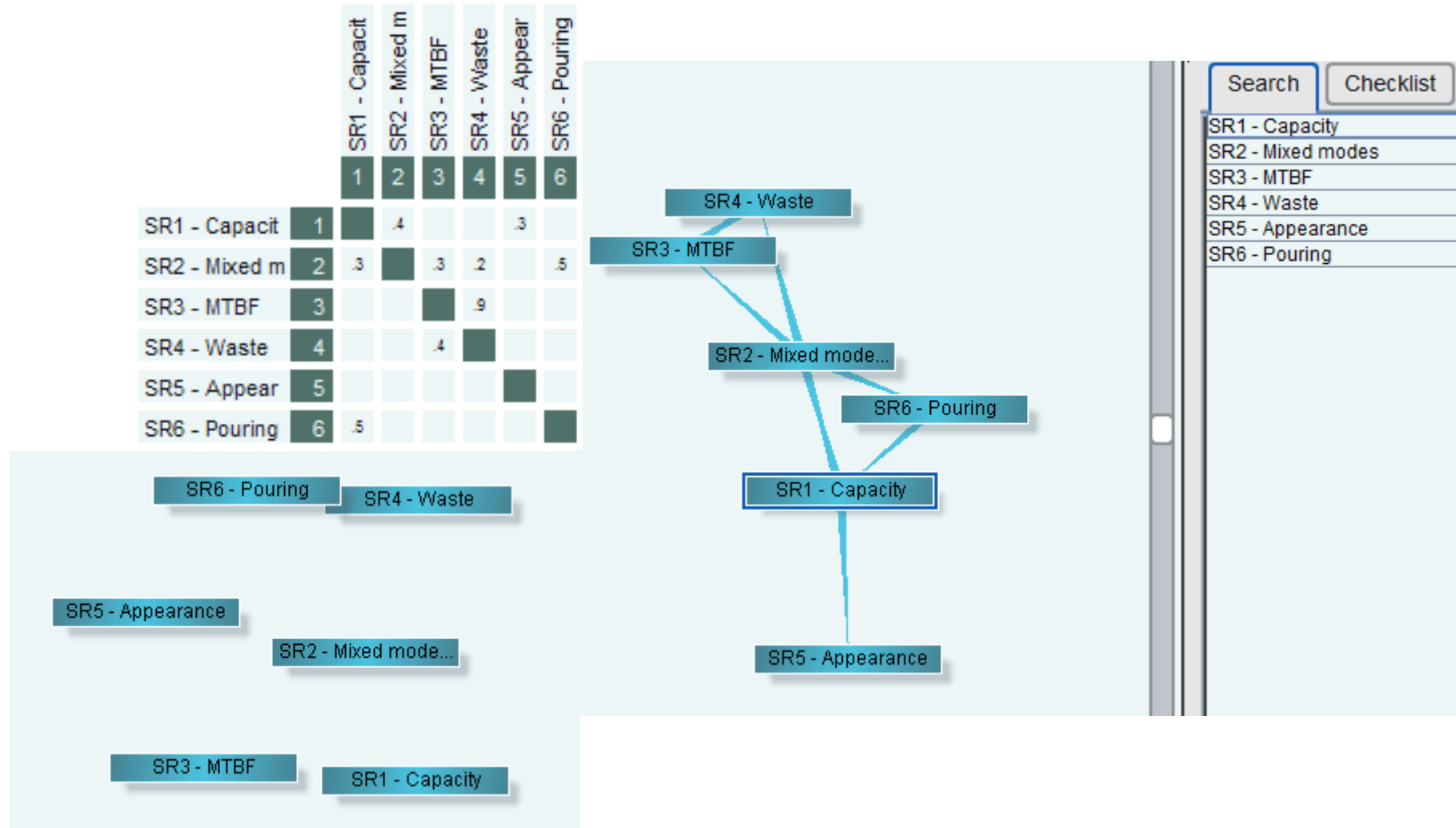
DFA Tool



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VE2: Verification Validation Effectiveness and Efficiency

Elicit needs, risks and their relations – MDM model



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Virtual Reality and AI in the liquid food industry



The traditional world of the mock-ups is revolutionized

The five senses (sight, hearing, taste, touch, even smell!) can be exercised well in advance versus any possible integration

Complicated autonomous system behaviours can be envisioned

Historical company knowledge embedded into re-usable AI models.

“Neither intelligent, nor artificial?”

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Digital transformation, Industry 4.0, MBSE and SAFe in the liquid food packaging industry



The left leg of the VEE passes from the tedious documentation work to the “holy land” of MBSE

Also models require time to be developed, a strategy and a relevant effort. Re-use is not a forgiven!
2nd Agile principle: value stream mentions programs frontloading.

Focus on value path, increased volatility of requirements: how to manage un-desired re-work?
Masses of raw data are formally available to be transformed into digital information and then into company knowledge

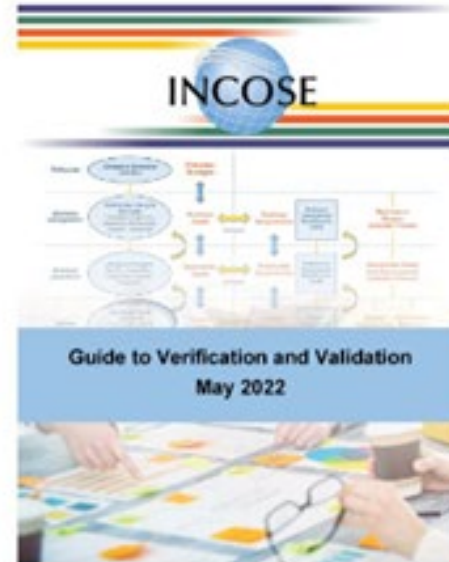
“All that glitters ain't gold!”. A new approach is necessary to developers, test engineers, data scientists and all the users during systems life-cycle (transition process relevance).

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New Publication in the INCOSE Store

Guide to Verification and Validation

Free for INCOSE Members

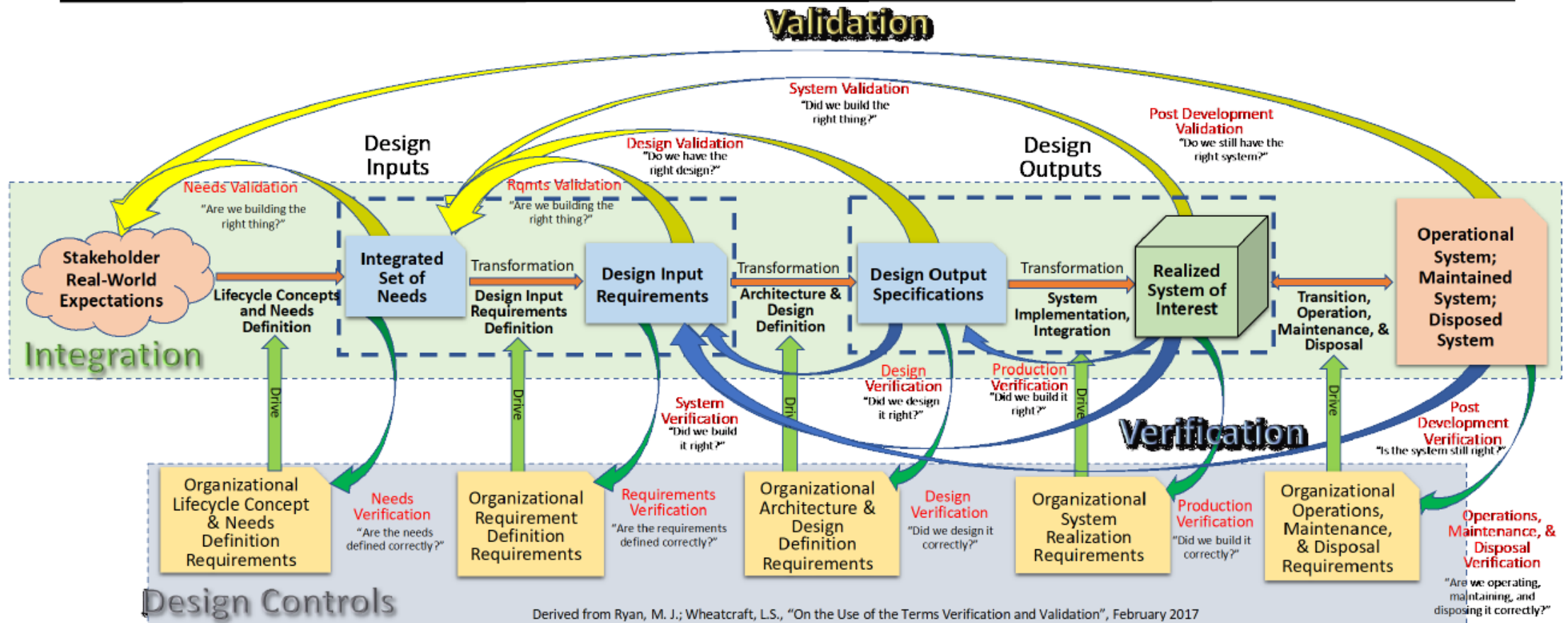


This guide provides practical guidance for successful verification and validation activities across all system lifecycle activities, as well as clarifications on misunderstandings of the true nature of verification and validation as applied to the design and the realized system of interest (SOI) – i.e., the “final product.” This guide provides concepts and processes associated with design verification, design validation, system verification, and systems validation in the context of systems engineering (SE) as described by the INCOSE Systems Engineering Handbook [1].

- Provide a practical, cross-domain “how-to” guide that will enable organizations to incorporate the design and system verification and validation guidance and concepts into their existing SE activities and plans.
- Ensure readers have a clear understanding of the importance the context in which the terms verification and validation are being used: needs, design input requirements, design, design output specifications, or system. While each shares some degree of commonality, each are distinct activities, with their own planning, execution, outcomes, and deliverables. This guide emphasizes the

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Verification and Validation in Context



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- The request for frontloading did not vanish in time, but got transformed and embedded into fast and faster value-based responses to the market.
- Several research programs contributed to build-up the basis for managing the impacts of the Verification, Validation and Architecture definition processes, well in advance towards formal validation.
- Massive changes in frontloading required the maturation of a bunch of technologies and methodologies well integrated into SE frameworks.



- It is anyhow similar to the Zeno's paradox. The faster the technologies are implemented in day-to-day life the higher is the request!