



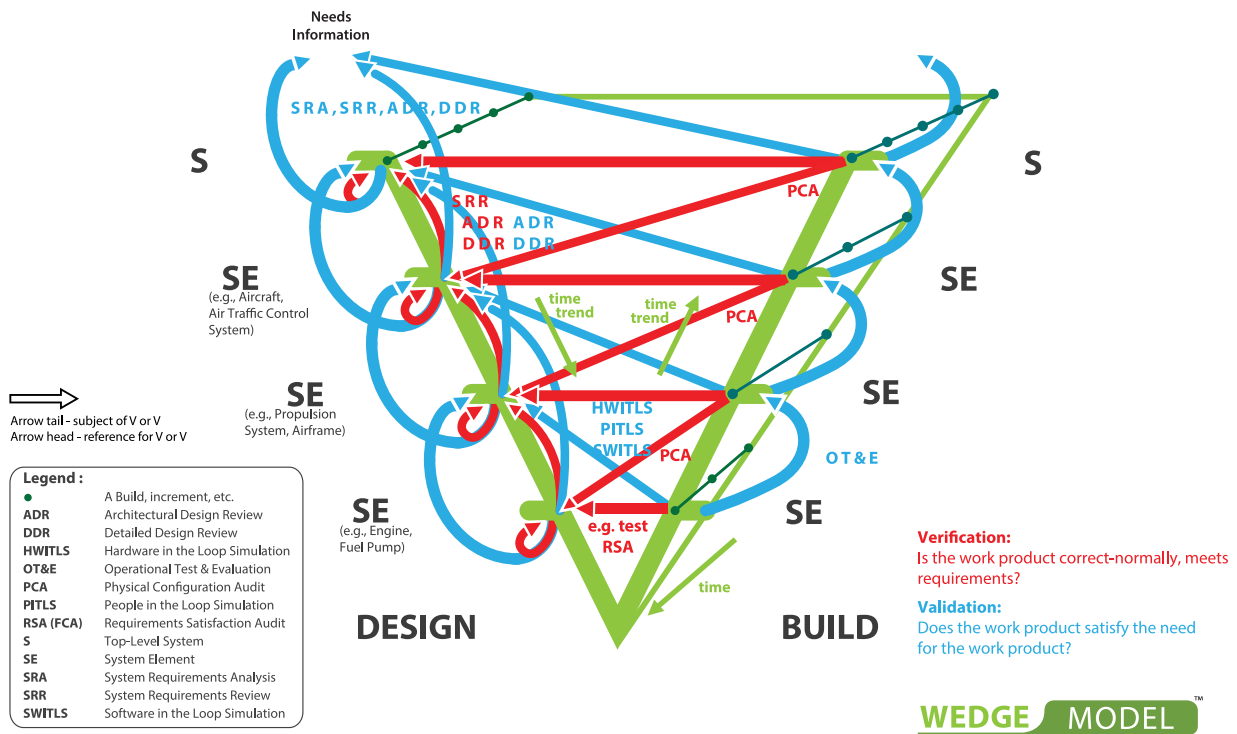
# SYSTEMS ENGINEERING OVERVIEW

LEARN ENOUGH ABOUT SYSTEMS ENGINEERING TO INTERFACE AND INTERACT WITH ...

3-DAY COURSE

... SYSTEMS ENGINEERING ACTIVITIES, WITHOUT NECESSARILY PRACTICING SYSTEMS ENGINEERING YOURSELF.

This 3-day Systems Engineering short course provides an overview of the principles and methods of systems engineering: an interdisciplinary, collaborative approach to the engineering of system solutions, adopted by leading enterprises worldwide, that aims to capture stakeholder needs, objectives and values, and to transform this problem definition into a holistic, lifecycle balanced system solution. This overview course is intended for participants and other stakeholders in technical projects who seek familiarity with systems engineering without themselves applying the principles and tools to engineering activities.



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"The best thing about the course was the interactive component and the presenter's extensive knowledge (and vocabulary) on the subject."

- participant, CSIR-DPSS, South Africa



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## 0. The Business Case for Systems Engineering

### 1. The System Life Cycle and Solution Development

- defining the problem domain
  - information, relationships and artifacts of problem definition
- the solution domain: key concepts, relationships, and work products
  - problem versus solution
  - architectural/conceptual/preliminary versus detail
  - “our” problem versus “their” problem
  - architectural/conceptual/preliminary versus detail
  - scalability and recursion
  - complexity
  - top down, bottom up, “in-between”
- life cycle processes and models
- classes of stakeholders
- configuration items and baselines
- why a life cycle view – need to disposal?
- waterfall, incremental, evolutionary and spiral developments
- Product Line Engineering (PLE)
- digital engineering, digital thread, digital twin
- summary of key points

### 2. Principles, Concepts and Elements

- workshop – principles of the engineering of systems**
- some more systems concepts
- why MBSE and digital engineering
- Model-Based Systems Engineering (MBSE) in the problem & solution domains
- SE process model and elements
- workshop – matching common activities to the SE process elements (shortened)**
- verification and validation related to the “V” model, the “Wedge Model”
- work product attributes
  - requirements traceability
  - design traceability
  - verification traceability
- SE and SE-related standards
- relationship of SE to other engineering disciplines
- summary of key points

### 3. Requirements Analysis – Capture and Validation

- types of requirements
- RA methodology
- workshop – context analysis**
- workshop – design requirements analysis**
- workshop – parsing analysis**
- software tools supporting requirements management and requirements analysis
- workshop – functional analysis in requirements analysis**
- common pitfalls in performing requirements analysis

### 4. Physical Solution Definition Part A

- technology and innovation in solution development
- generic influences in defining configuration items
- exercise – physical & functional design**

### 5. Logical Solution Definition

- types of logical representation
- functional analysis in design – how to do it
- functional design/architecture process
- workshop – a simple physical/functional design**
- performance threads
- behavior modeling, UML, SysML, DODAF
- software tools supporting logical and physical design

### 6. Physical Solution Definition Part B

- what next? – FMECA, FTA, ETA, ORA, ...
- object-oriented design
- interface engineering, common interfacing pitfalls
- summary of key points

### 7. Effectiveness Evaluation, Decision & Solution Optimization

- approaches: AHP, MAUT, QFD
- workshop – engineering decision-making**
- multiple stakeholders, multiple uses, event-based uncertainty
- solution optimization
- handling conflict of interest between acquirer and supplier
- software tools supporting effectiveness evaluation and decision

### 8. Requirements Specification Writing

- the ten requirement specification types and their uses
- public domain specification standards – the good, the bad, and the ugly
- specification structure principles

### 9. System Integration

- integration planning
- integration
- integration testing
- design interaction with hardware and software production
- configuration audits related to system integration – RSA (FCA), BS/BS Correspondence (PCA)
- qualification
- summary of key points

### 10. Verification and Validation

- technical reviews
  - requirements reviews
  - principles of design review
  - architectural design review (ADR – PDR)
  - detail design review (DDR – CDR)
  - requirements satisfaction audits (FCAs)
  - design description (BS-BS) audits (PCAs)
  - technical reviews and incremental builds
    - administration of technical reviews
- technical performance measurement
- test and evaluation
- other verification and validation methods and tools
- summary of key points

### 11. Engineering Management

- planning the engineering
- integrating engineering specialties
- engineering team structure
- management frameworks – Specification Tree, Project Breakdown Structure (PBS – WBS)
- managing configuration
- managing interfaces
- managing residual risk
- summary of key points

### 12. Summary

- key points revisited
- tailoring of SE methods to specific activities or projects
- getting the most out of systems engineering methods
- process improvement: using CMMs™ and other benchmarks

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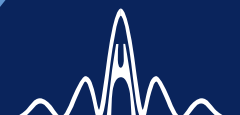
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