



Systems Engineering Your MBSE and Digital Engineering Deployment

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Why on one hand...



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Image credit Tennen-Gas

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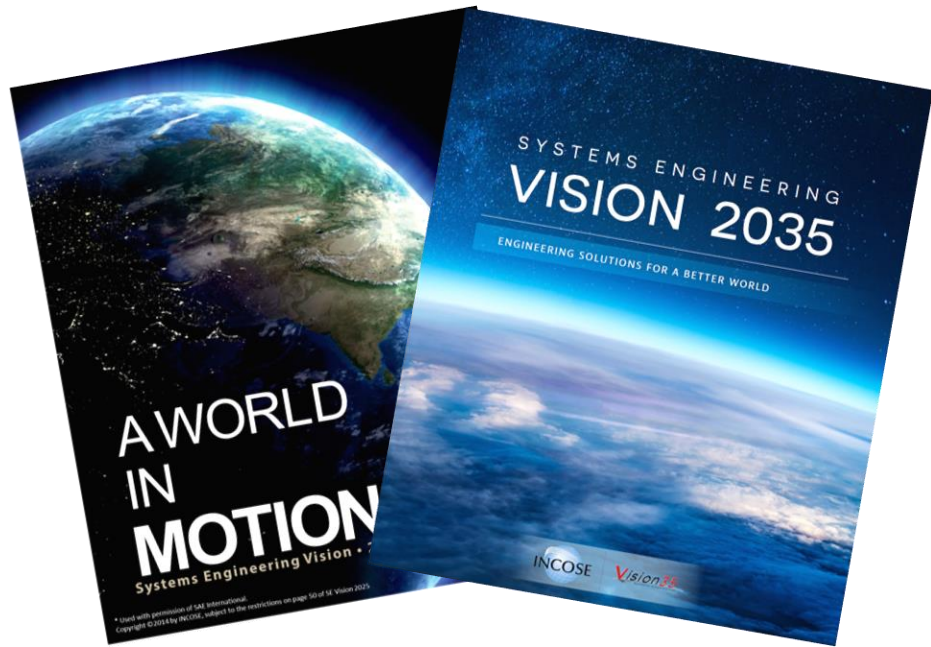


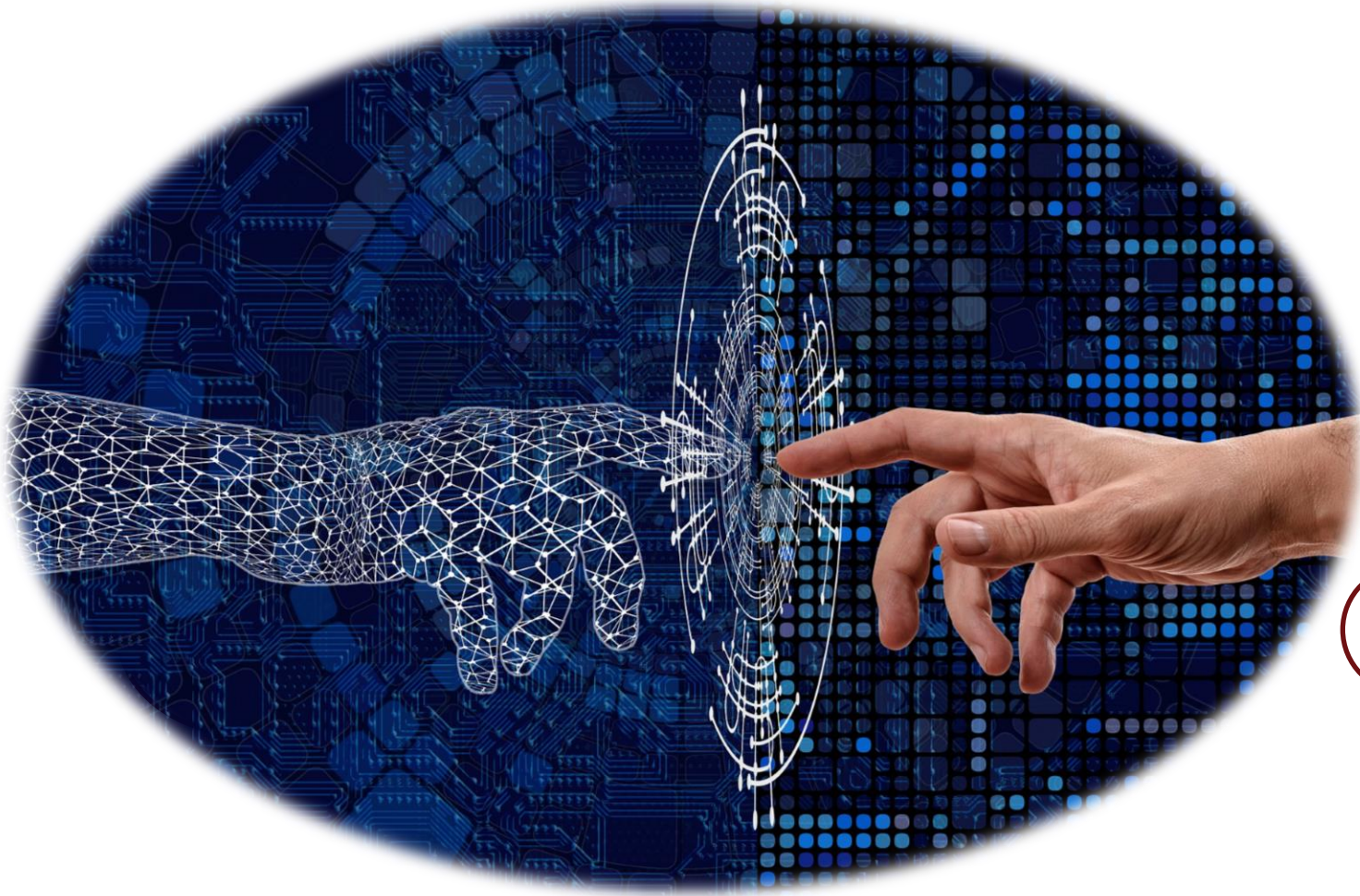
Image credit Craig James

...yet on the other hand



How Trouble Begins...





Envisioning the Possible

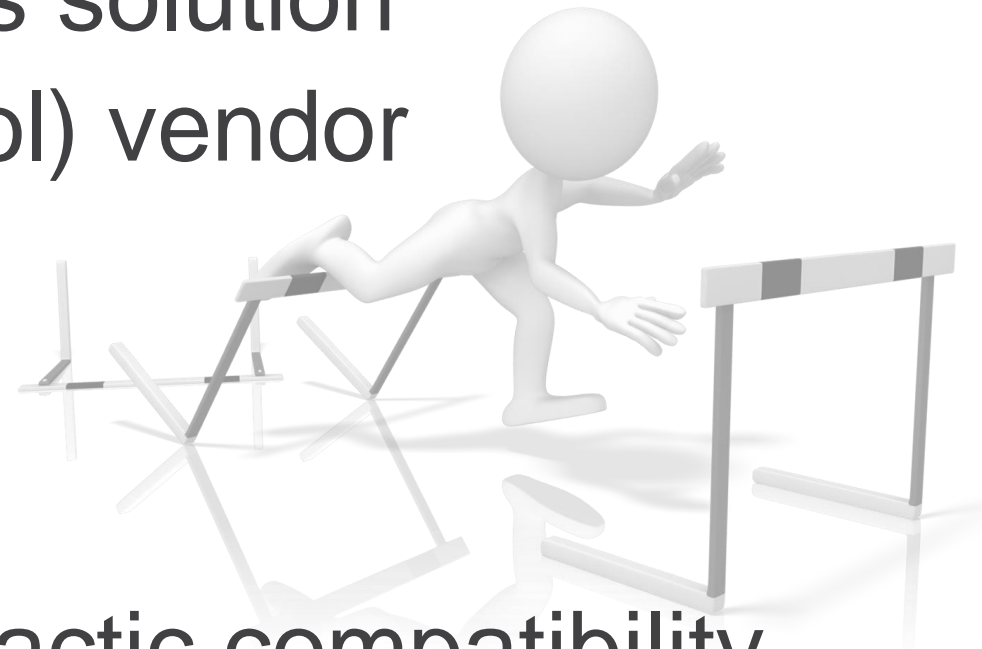
Transforming through Digital Engineering



Falling Prey to Traps along the Way

Classic Errors on the Journey to MBSE and Digital Engineering

- Thinking it's a tool (or a technical) issue
- Implementing someone else's solution
- Ceding responsibility to a (tool) vendor
- Starting too big
- Starting too small
- Modeling everything
- Confusing semantic and syntactic compatibility



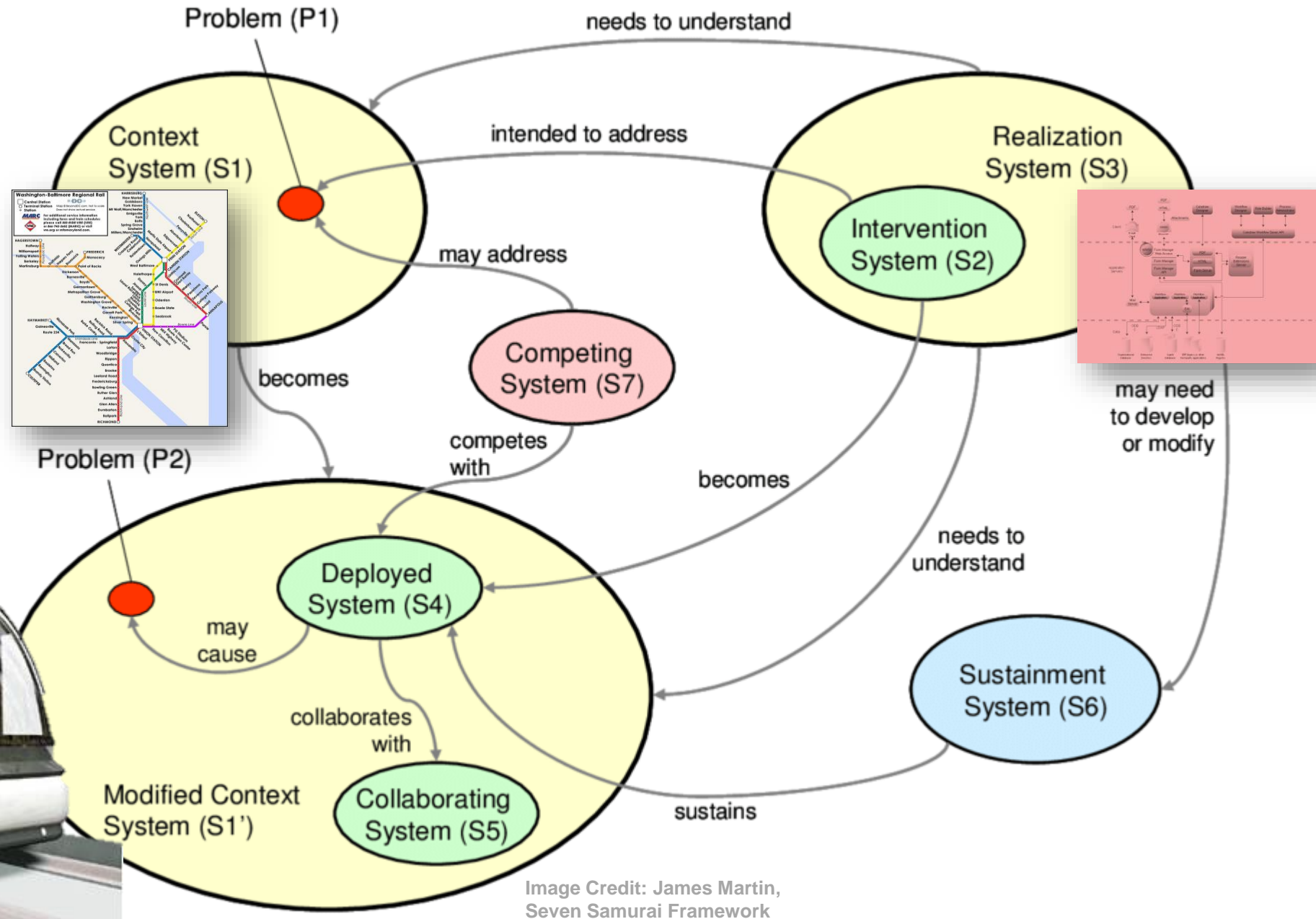
Improving the Outcome and the Journey

Applying our first principles to deliver success



Seeing the Systems Perspective

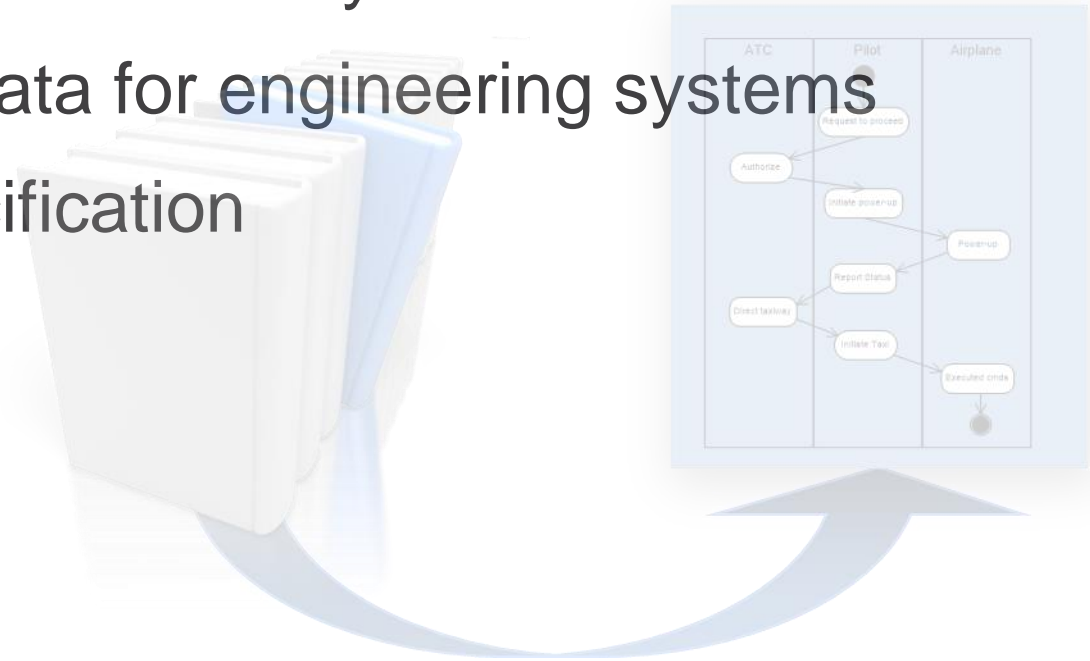
A System is a System is a System



Begin with Understanding

What MBSE is All About

- Making system architectural and analytical models **explicit**, **coherent**, **consistent**, and **actionable**
- Leveraging models for communication and analysis
- Developing and using authoritative data for engineering systems
- Ensuring consistent design and specification (when done well)
- Providing an explicit system model to engineering teams

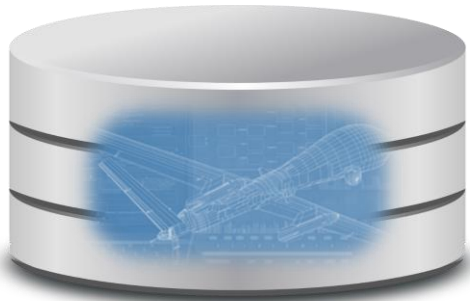


Begin with Understanding

Recognizing the Foundations of Digital Engineering



Digital Engineering *a critical enabler for the modern engineering enterprise*



MBSE
*connective tissue of the
Digital Engineering environment*

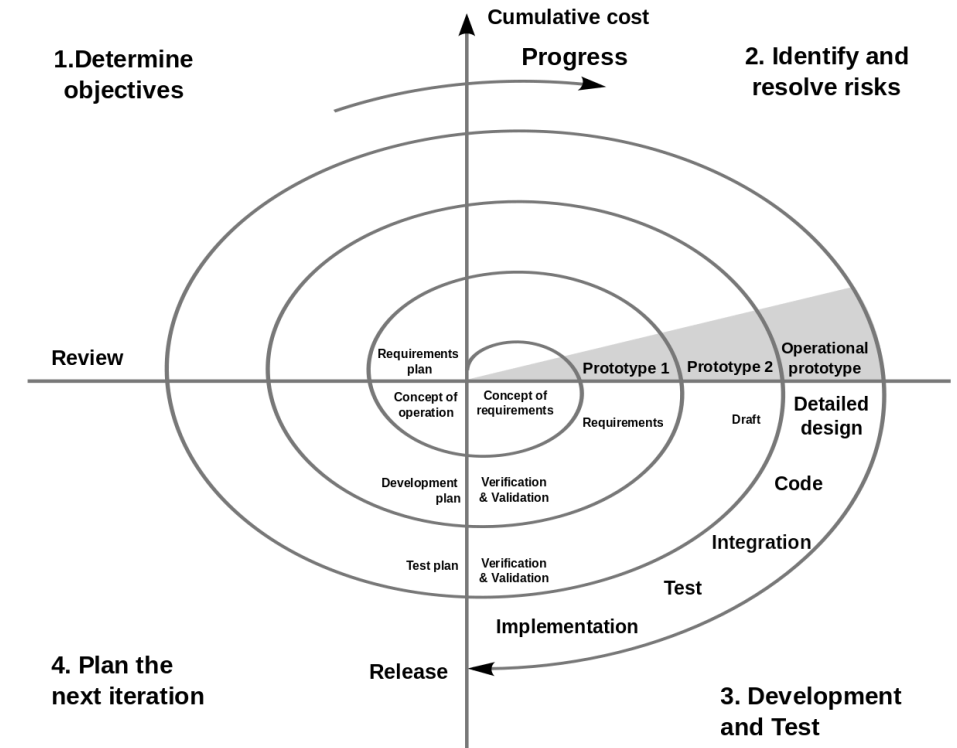
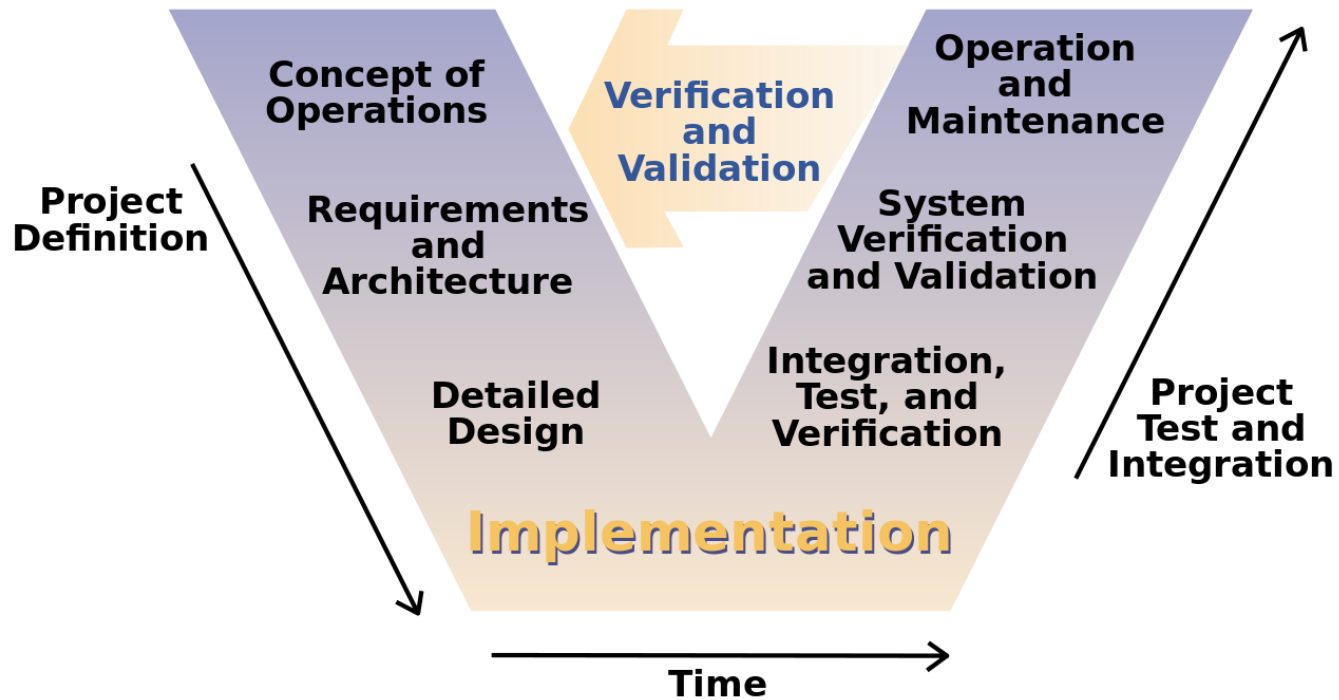


Systems Engineering
*technical connective tissue of
the project team*

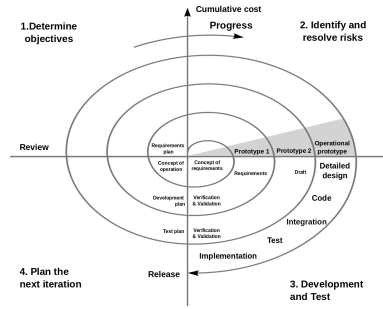


Data
*oxygen fueling 21st century
engineering and operations*

Return to Our Roots



Find Your Customer *aka Your Champion*

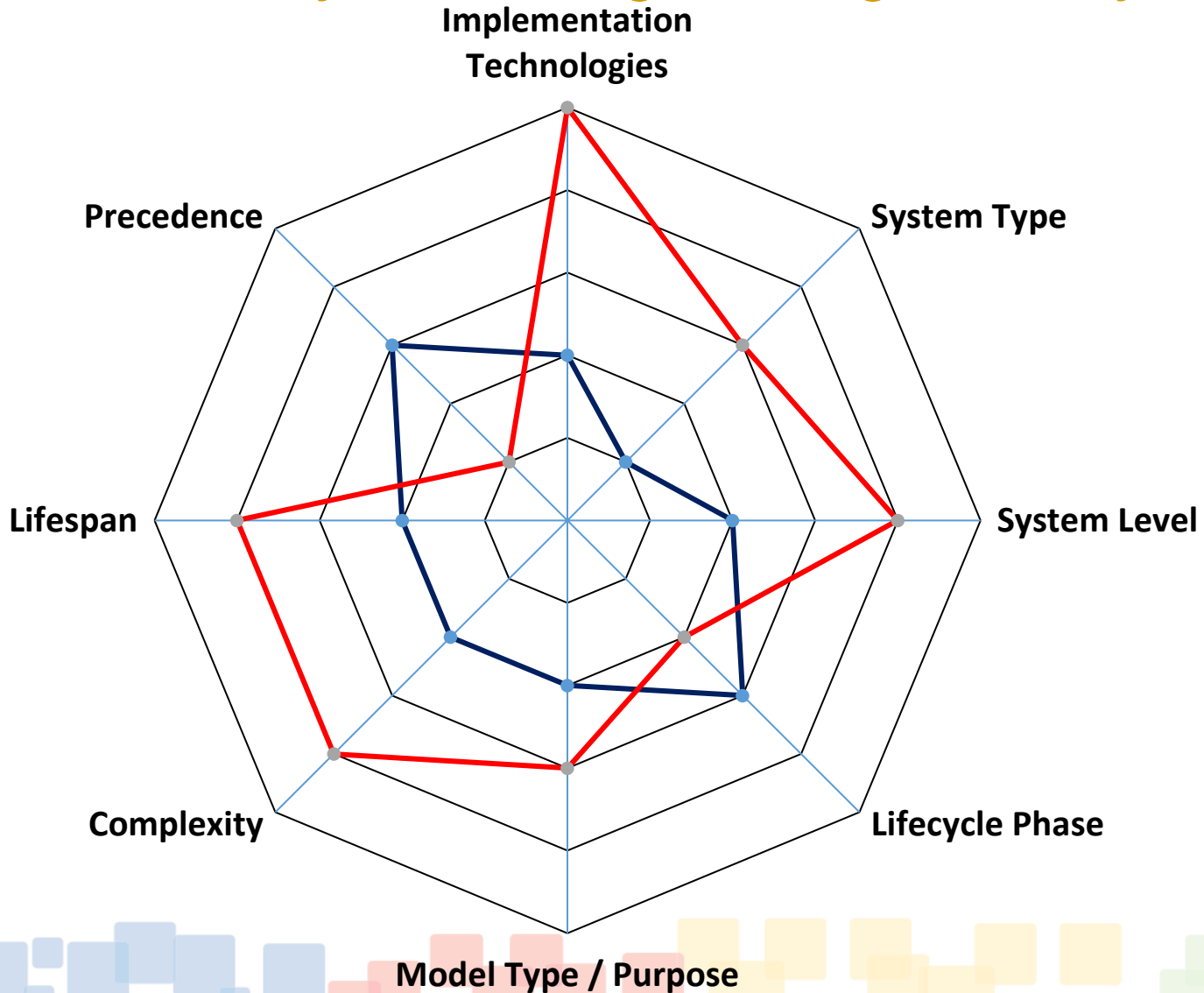
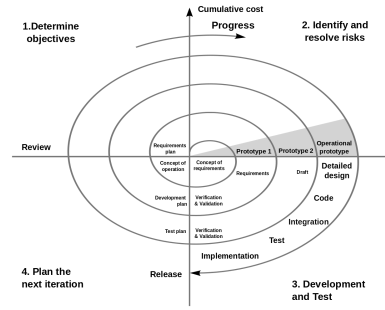


Find the people in your system most susceptible to having their situation improved. Focus on them, not technology.

Larry Leifer
Dancing with Ambiguity
INCOSE IS 2016

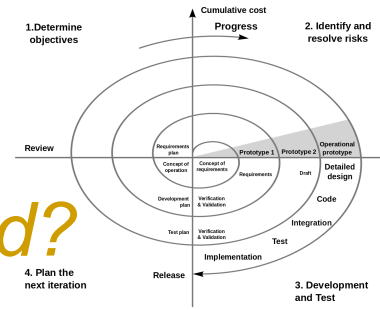
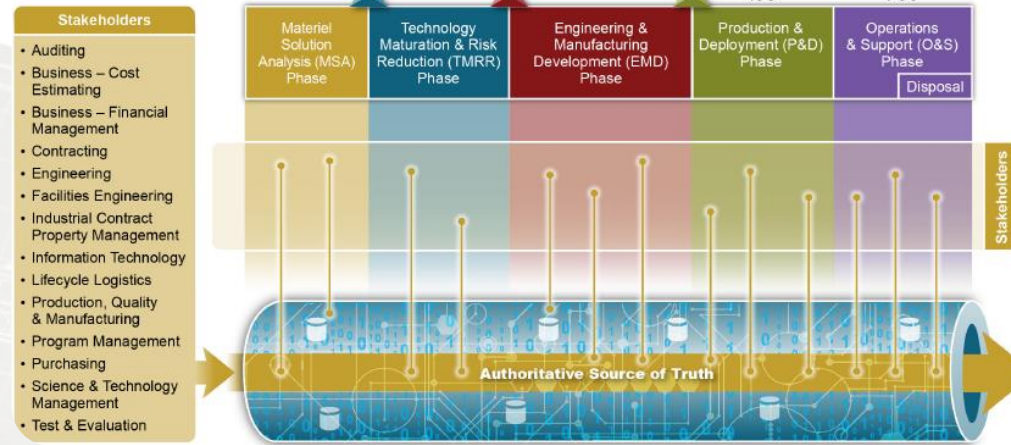
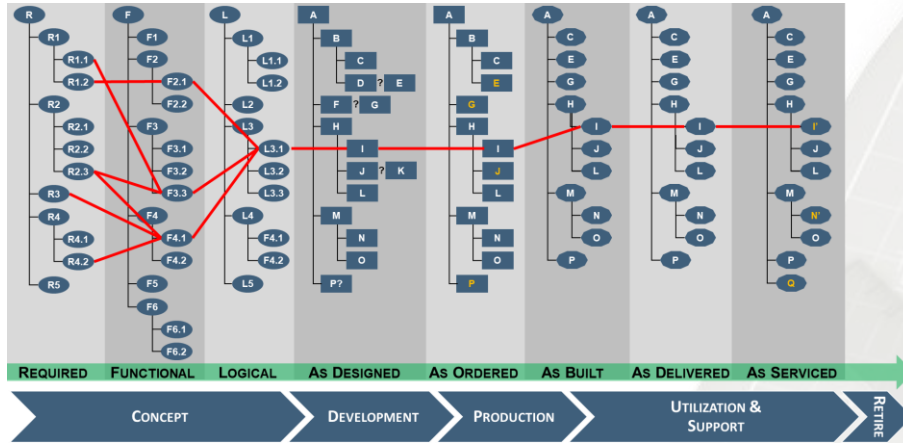


Good Systems Engineering is Always Fit-for-Purpose

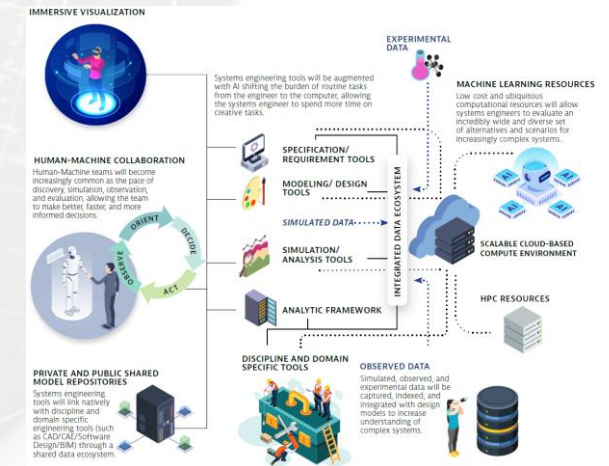


Define Your Reach for Dx

Where You Need to Be not Want to Be – SE, EoS, or Beyond?



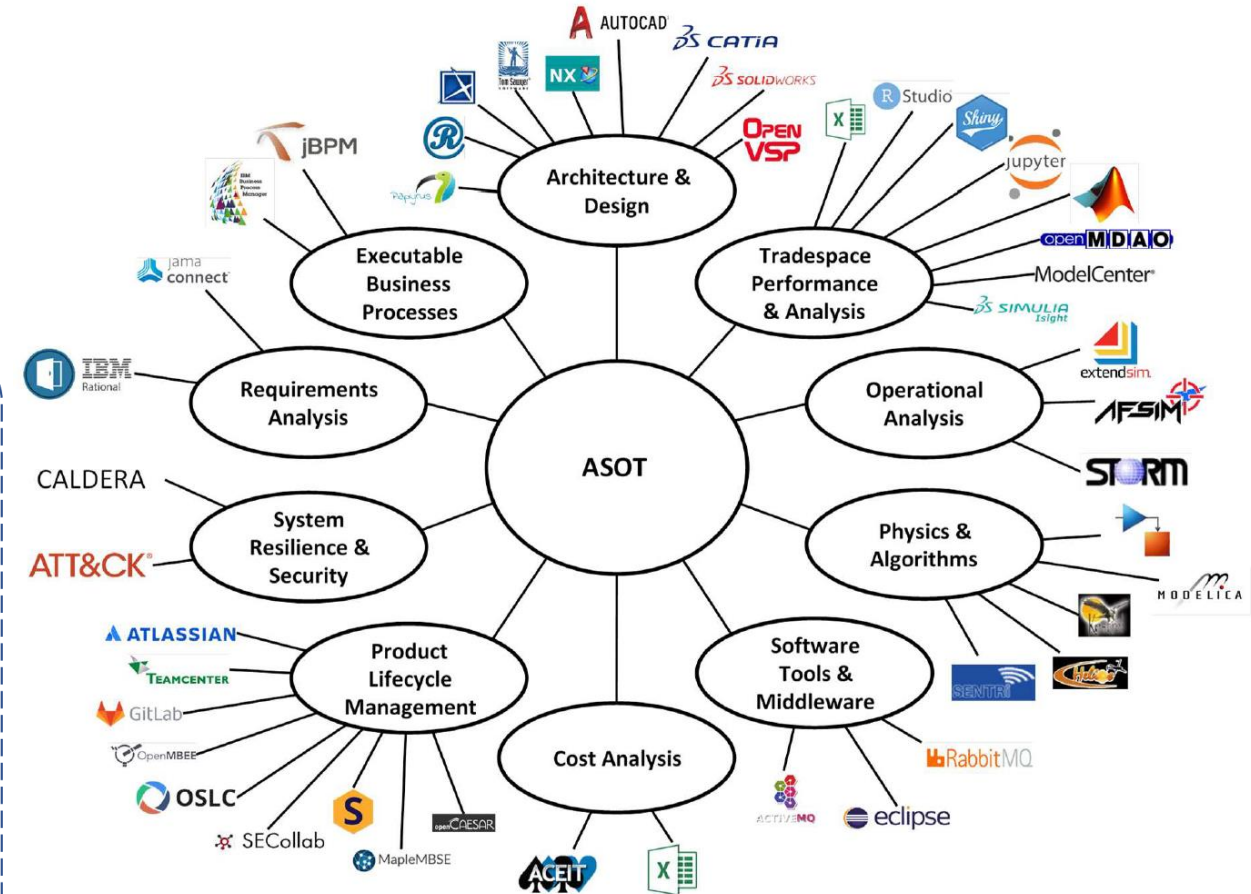
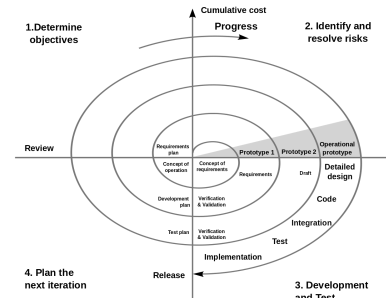
Credit: Sumit Awinash, Creative Commons 4.0



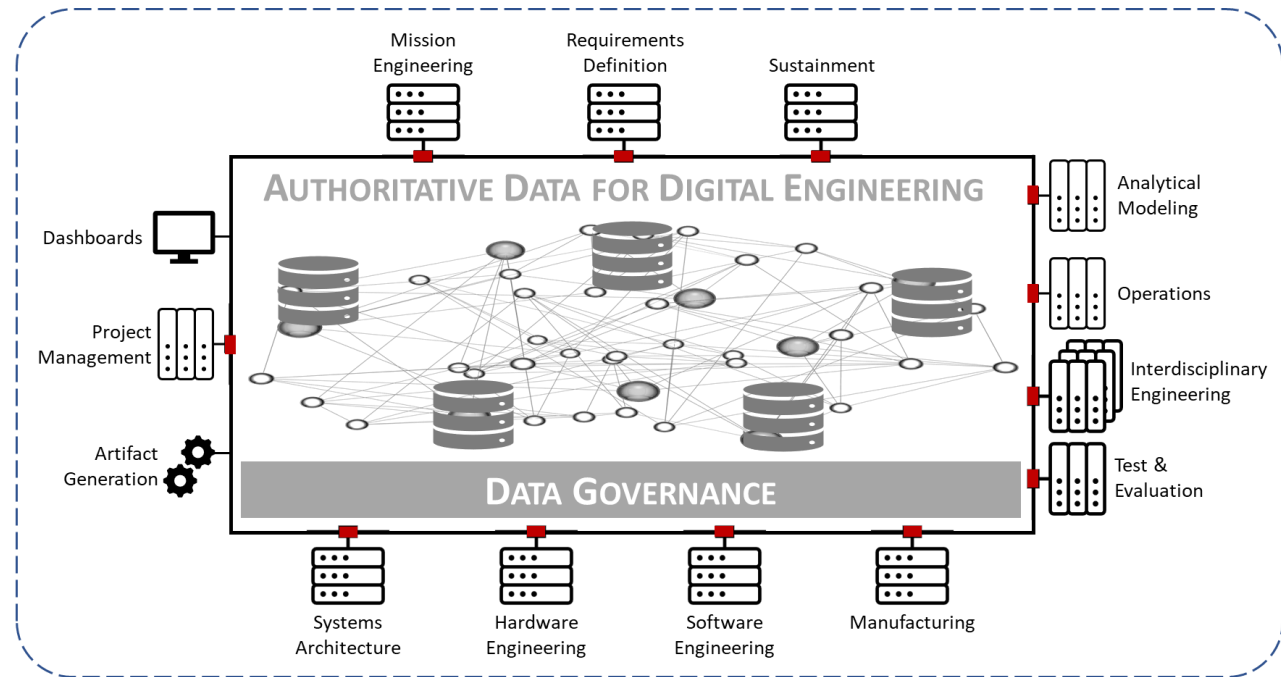
Credit: SE Vision 2035. Copyright © 2021 by INCOSE.

Appreciate and Honor Your Scope

Neither Benefit nor Difficulty Increase Linearly

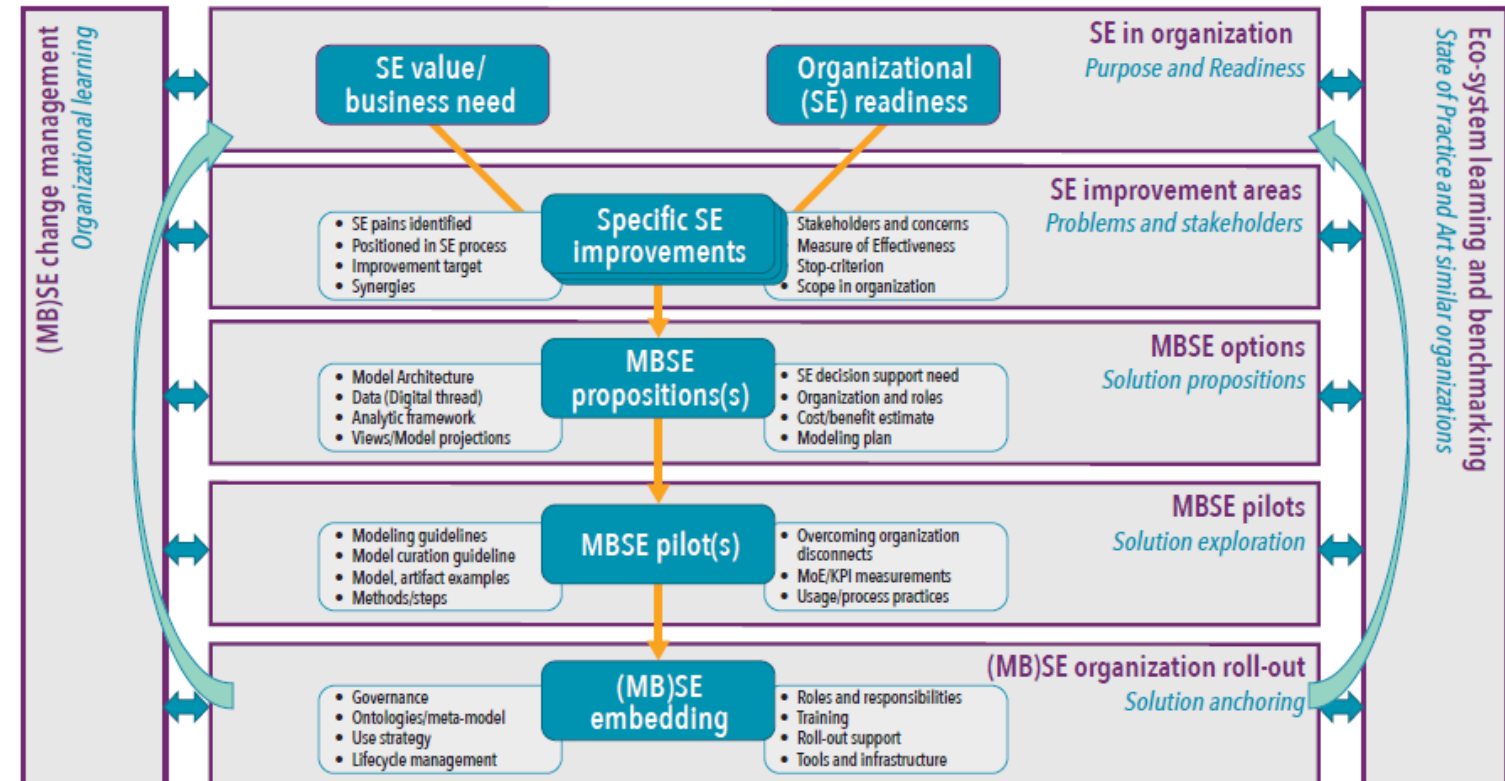
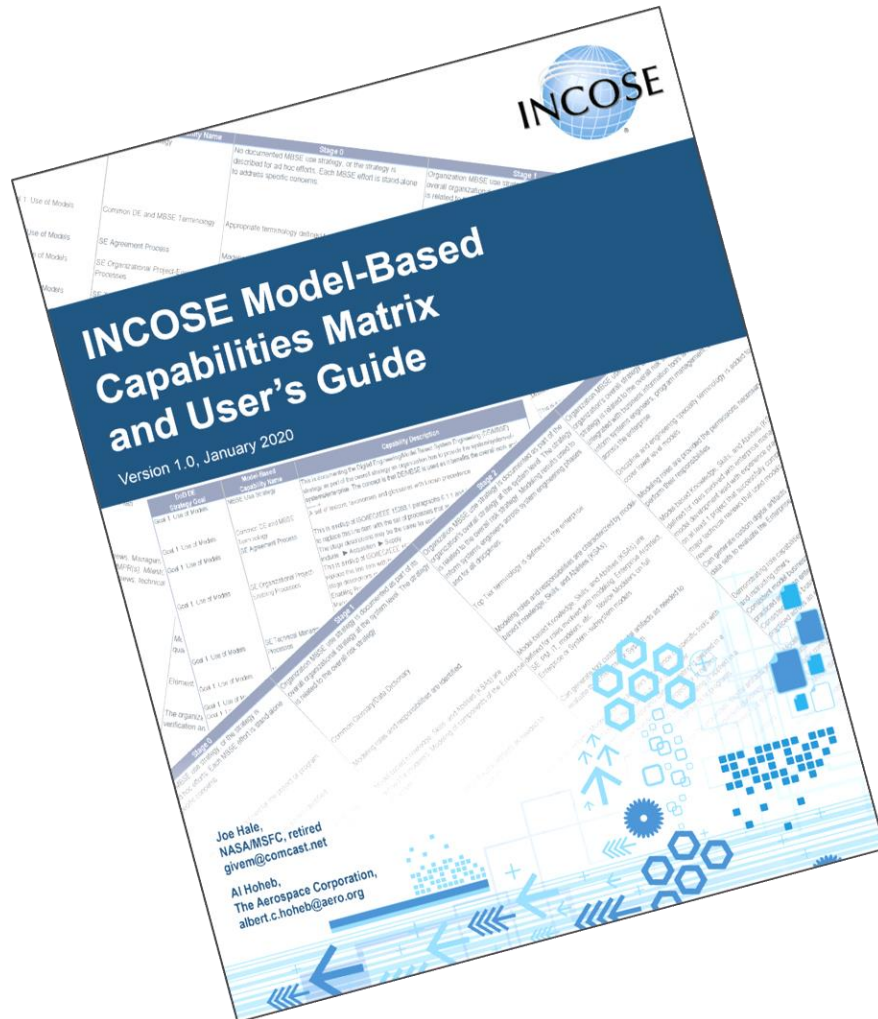
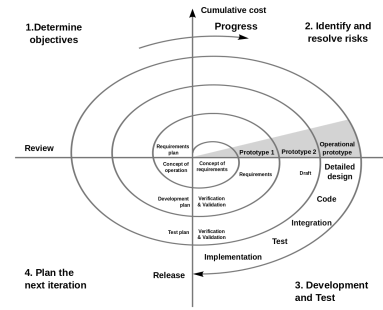


Credit: WRT-1051, Program Managers Guide to Digital and Agile Systems Engineering Process Transformation, August 2022



Know Where You Are Today

Undertaking a Journey Requires Both an As-Is and To-Be

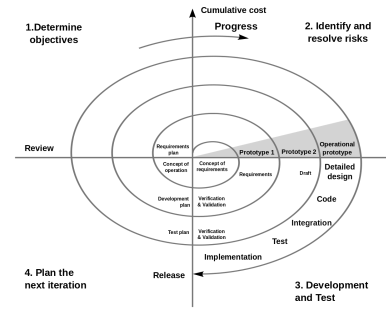


Credit: Creating Value with MBSE in the High-Tech Equipment Industry, Hendriks et al., INCOSE Insight Volume 25 Issue 4, December 2022.

Identify Critical Stakeholders

Separating Who You Serve and Who You Engage

- Project team members
 - Test & verification
 - Design teams
 - Subject matter experts
 - Project management
 - ...
- Corporate
 - Business champion
 - Management
 - Operations and maintenance
 - IT
 - Process owners
 - ...
- Others
 - Customer
 - Partners
 - Users
 - Additional project stakeholders



Thinking about Problem and Solution



Semantic Science

Design Thinking and UX

Computational Augmentation

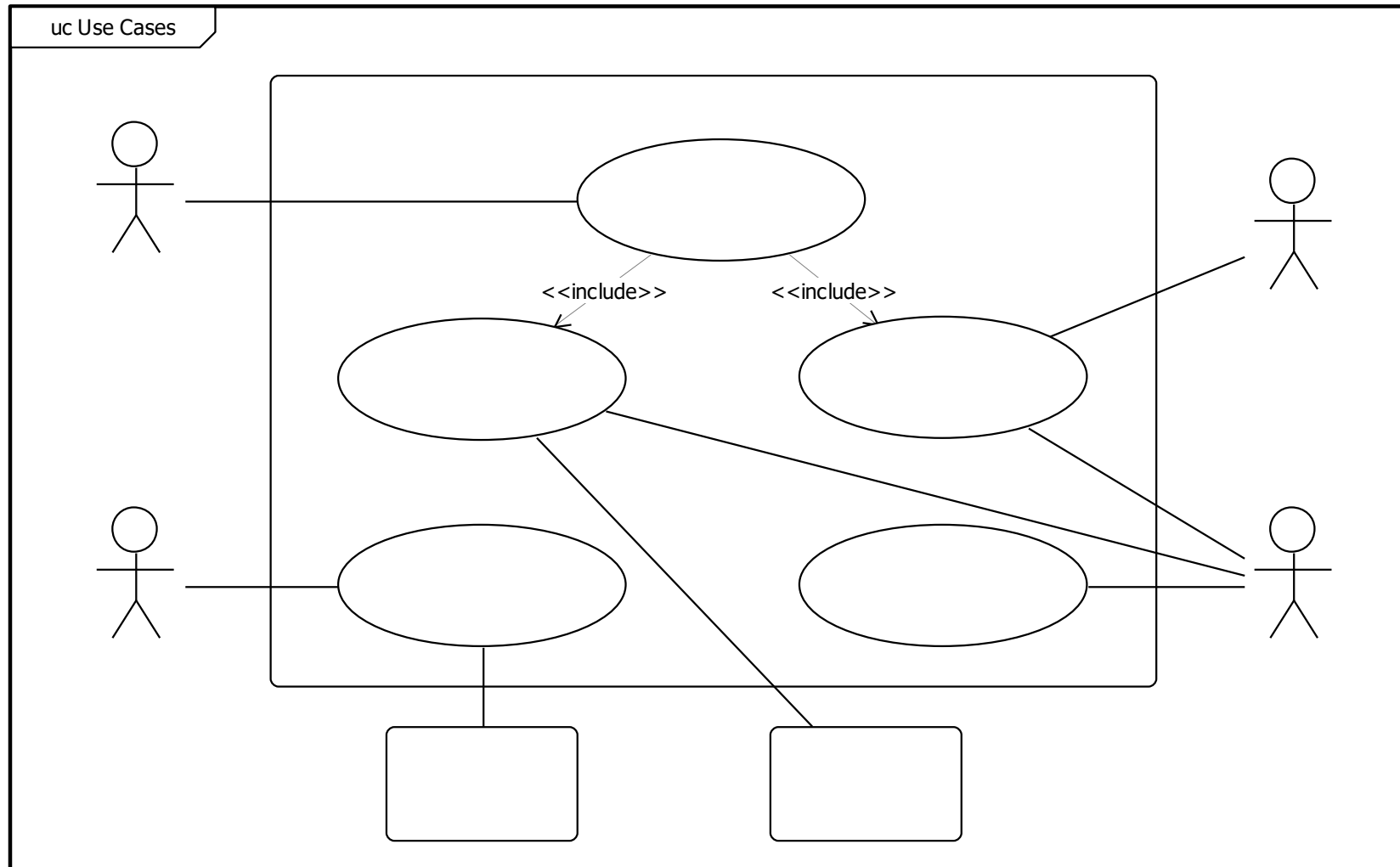
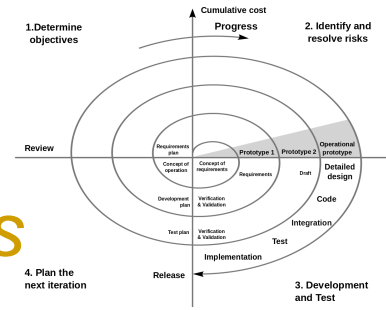
IT Experts

Organizational Change Experts

Systems Literacy for All

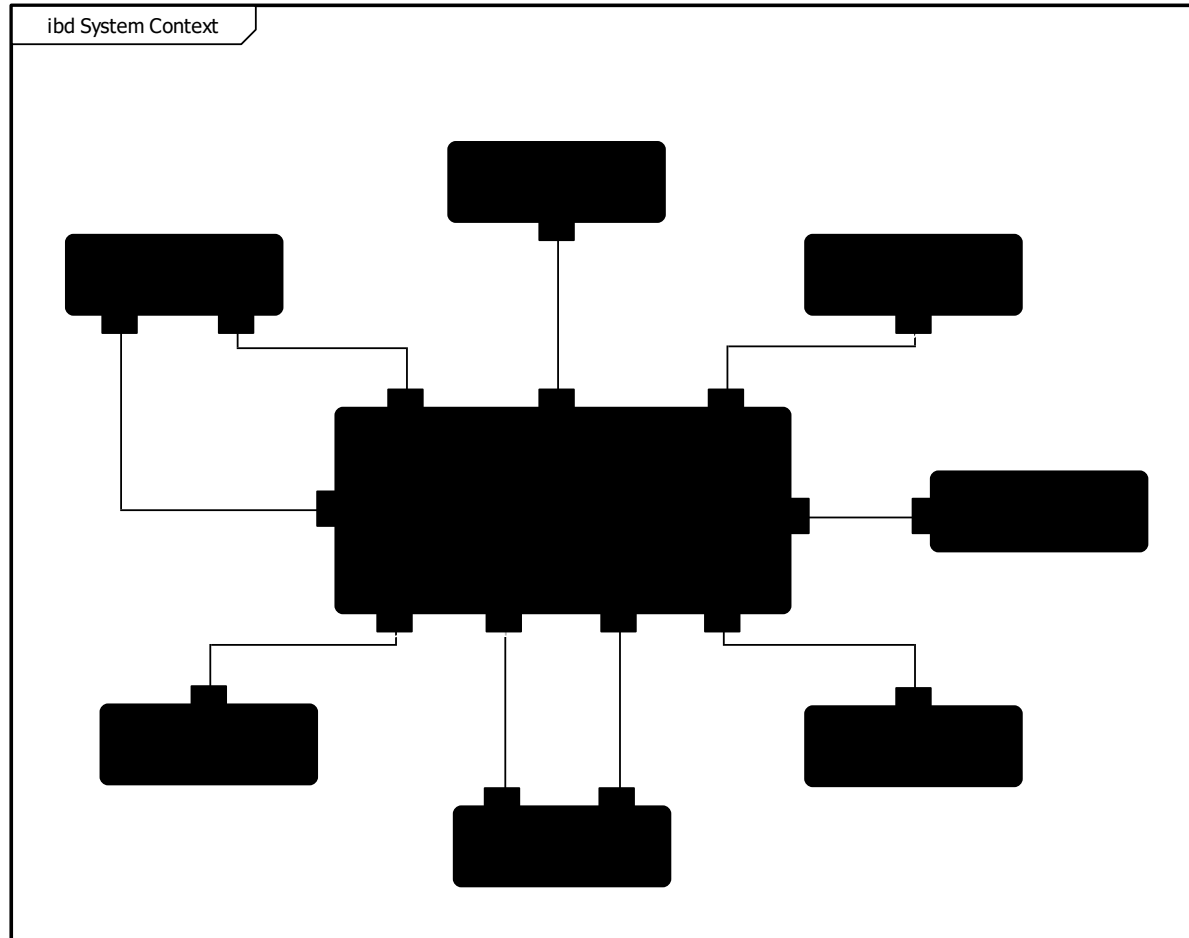
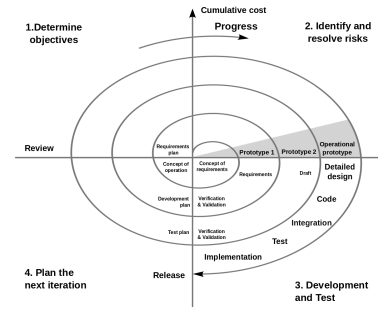
Elicit Requirements

Identifying Needs, Desires, and (Often Unstated) Constraints



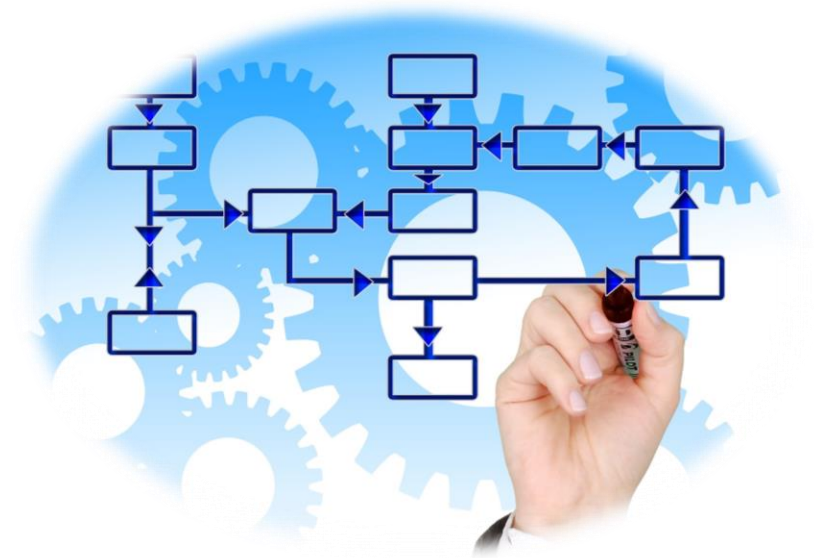
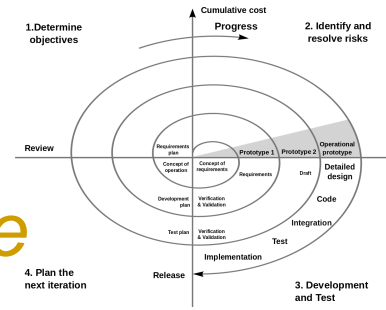
Define the System Boundary

Leveraging the Power of the Black Box



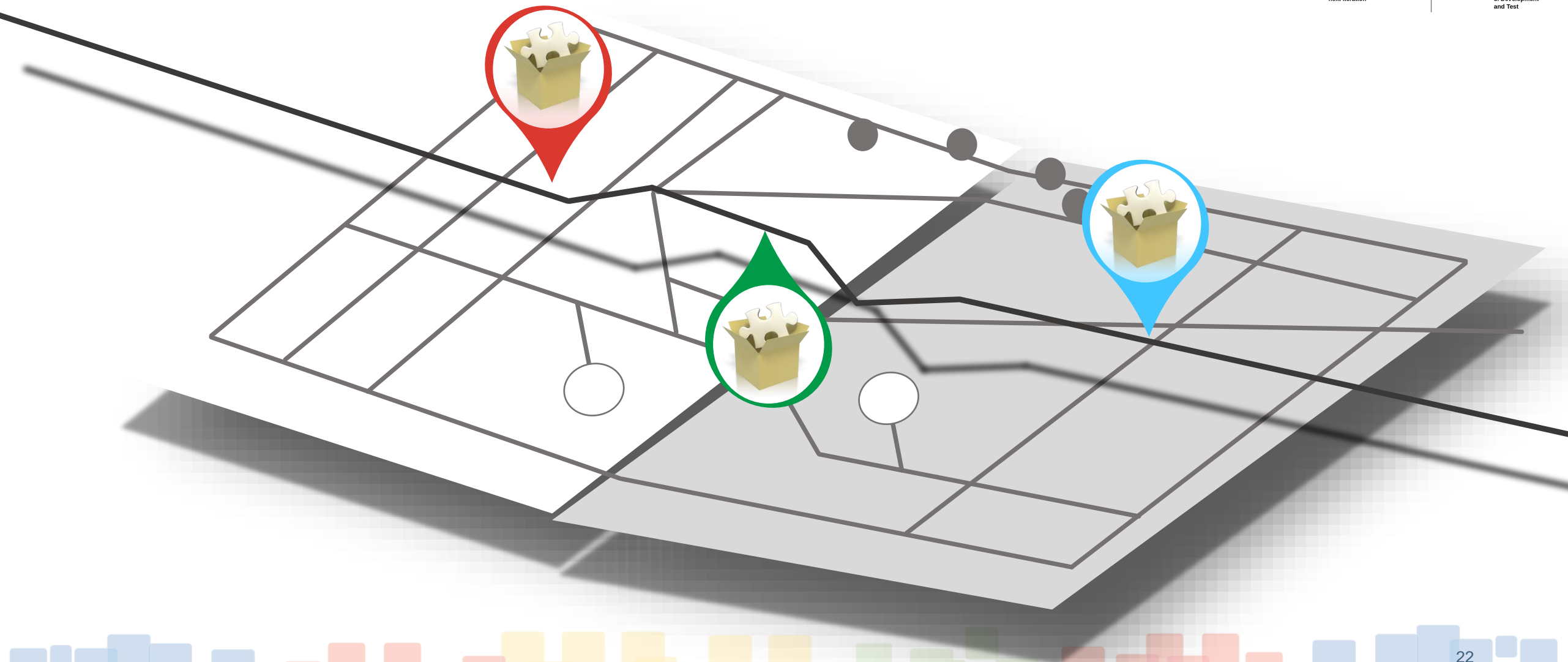
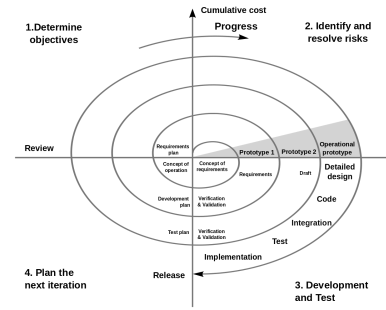
- ✓ Compartmentalize change
- ✓ Empower change agents
- ✓ Honor existing interfaces
- ✓ Honor interface formats
- ✓ Expand intentionally

Identify the Components and Allocate *Tools, Infrastructure, Processes, Workflows, Training, People*



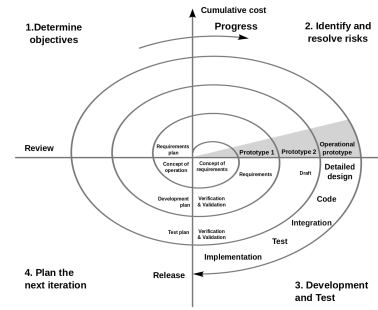
Plot and Adapt Your Journey Map

Engineering the Outcomes and the Change



Recognize Roadblocks and Risks

- Overestimating current state
- Following amateur experts
- Emphasizing tools and artifacts
- Chasing standards
- Reinventing the wheel
- Pursuing perfection
- Overlooking middle management
- Falling prey to Attention Deficit Disorder



Lead the Change

Transformation Must Live Outside the Silos



- Sell through attunement, buoyancy, clarity (“To Sell is Human”)
- Beware the Shangri-La of ROI
- Identify and guard your why
- Flow from problem to process to tools to procedures and standards
- Establish your scope with malice aforethought (avoid the organizational immune system)
- Leverage the power of the black box
- Honor existing interfaces
- Train and mentor teams on principles, process, methods, and tools
- Emphasize good engineering and good management support

Prioritize your letters – E then S before D and M then lastly B

A Final Thought

The Paradoxes of (MB)SE and (D)E

Though model-based systems engineering and digital engineering appear to be technology, they are not technical problems



The path to optimizing systems engineering lies in suboptimizing systems engineering

Questions and Discussion



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Fellow

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