Agile Systems Engineering

A Presentation to INCOSE LA Chapter

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Getting to Know You

- Fellow at Northrop Grumman

- Advocate for Women in Engineering and STEM

- Mentor

- Podcaster
  - Keys to the Future

- INCOSE ESEP

- Veteran

- B.S. Industrial Engineering, University of Miami

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Definitions

- "Systems Engineering is a branch of engineering that concentrates on the design of the whole as distinct from its parts looking at a problem in its entirety, taking into account all the facets and all the variables, and relating the social to the technical aspects." – Simon Ramo

- "An interdisciplinary collaborative approach to derive, evolve, and verify a life cycle balanced system solution that satisfies customer expectations and meets public acceptability" - IEEE 1220 (1994)

- "Systems engineering is a disciplined, iterative process by which engineers transform customer needs into a validated system solution, evolving and maturing the system to achieve a system solution that balances cost, schedule, and technical performance objectives of the customer." – Systems Engineering, NGC CO E100
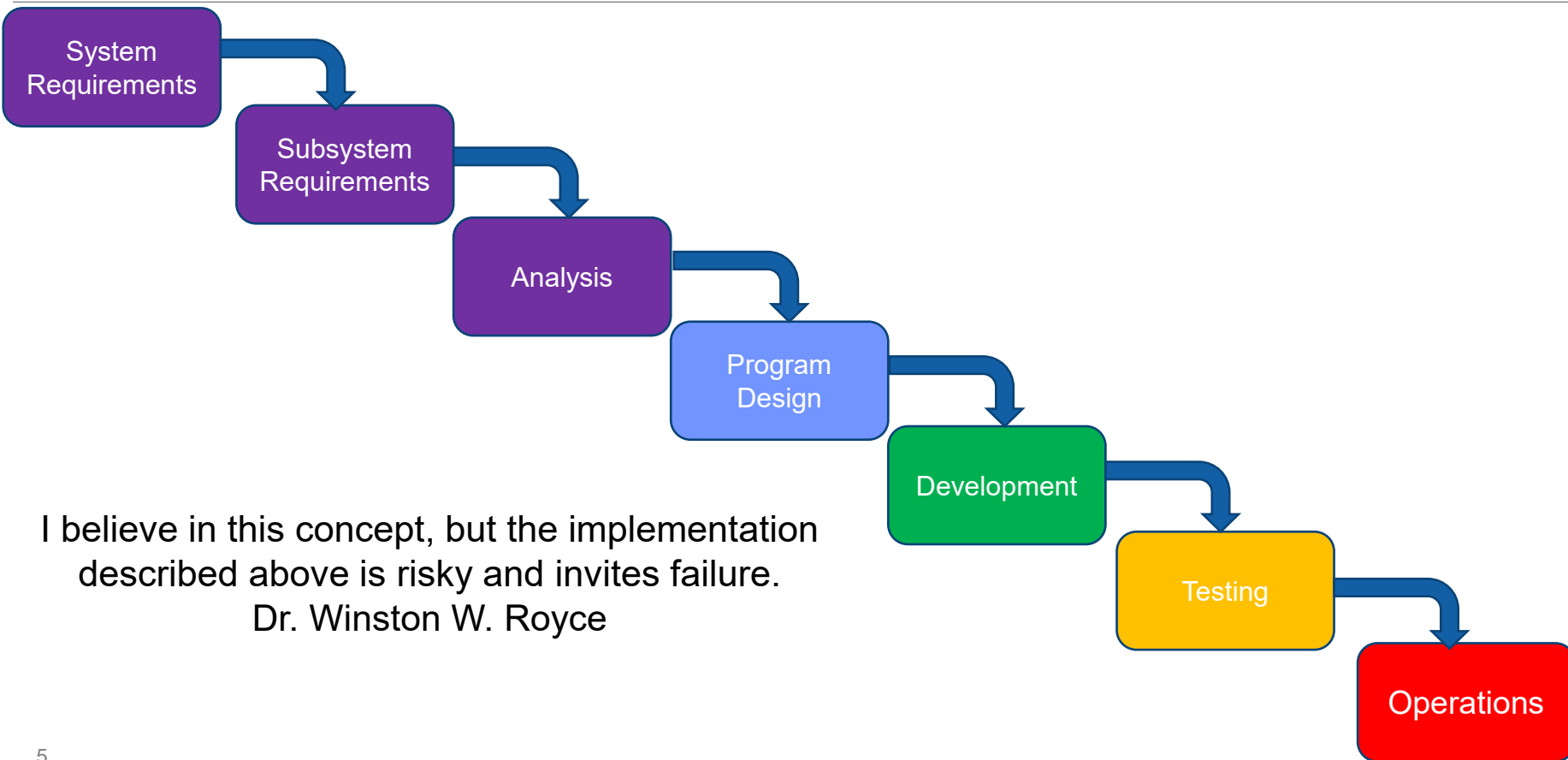
The Big Picture

- Systems Engineers have the responsibility to tell the story of the system, ensuring that there is a common consistent understanding of the system intent, context, and implementation shared between all stakeholders at all levels of system development and operations.

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The Need for Agility

System Requirements → Subsystem Requirements → Analysis → Program Design → Development → Testing → Operations

I believe in this concept, but the implementation described above is risky and invites failure.
Dr. Winston W. Royce

Systems Engineering Process Realities

Myth	Reality
Well-defined, stable, and consistent requirements at project onset.	SE must deal with instability and discovery and help the customer evolve requirements.
Customer resources consistent with requirements.	SE must work with customer to perform cost trades if desired functionality exceeds budget.
Design begins with a clean sheet of paper.	SE must recognize and incorporate constraints imposed by history, politics, or current state of technology.
Systems Engineering can be driven "top down" through product development.	SE must leverage heritage designs and supplier expertise; mate top-down and bottom-up approaches; create handshake between customers, implementers, and suppliers.

Sustainable Value with Quality and Speed
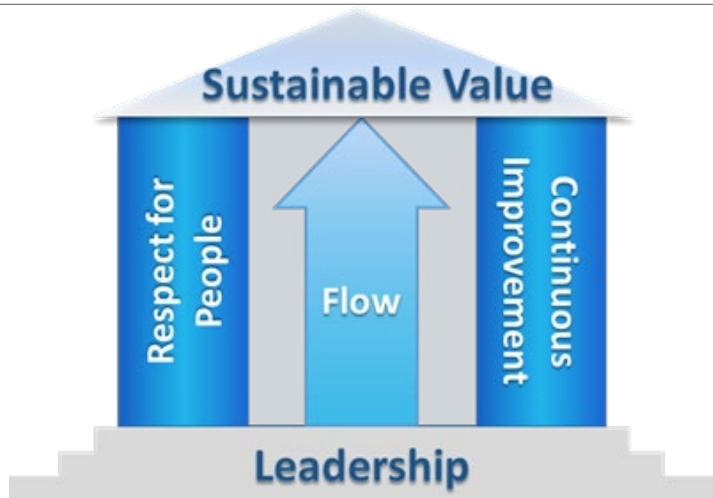
- Deliver what we promise

- Ensure best quality and value to people and society

- Maximize customer satisfaction, team morale, safety

- Minimize waste

The Lean-Agile Goal

- Build the right product
- Build the product right
- Build a productive environment for the right team
- Build better

Systems Thinking

#1 Take an economic view

#2 Apply systems thinking

#3 Assume variability; preserve options

#4 Build incrementally with fast, integrated learning cycles

#5 Base milestones on objective evaluation of working systems

#6 Visualize and limit WIP, reduce batch sizes, and manage queue lengths

#7 Apply cadence, synchronize with cross-domain planning

#8 Unlock the intrinsic motivation of knowledge workers

#9 Decentralize decision-making

#10 Organize around value

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- A holistic approach

- Incorporates all aspects of a system and its environment into the design, development, deployment, and operations and maintenance
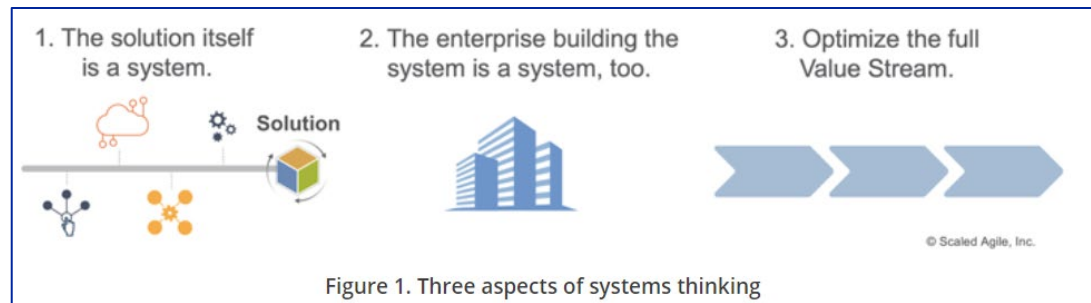
1. The solution itself is a system.

2. The enterprise building the system is a system, too.

3. Optimize the full Value Stream.

Solution

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Figure 1. Three aspects of systems thinking

Principle #2 - Apply systems thinking - Scaled Agile Framework

Design Thinking

- Discover – understand the problem

- Define – focus solution on what customers views as desirable (Epics, Features)

- Develop – design solutions to problems quickly and cost-effectively

- Deliver – desirable solutions

Design Thinking - Scaled Agile Framework
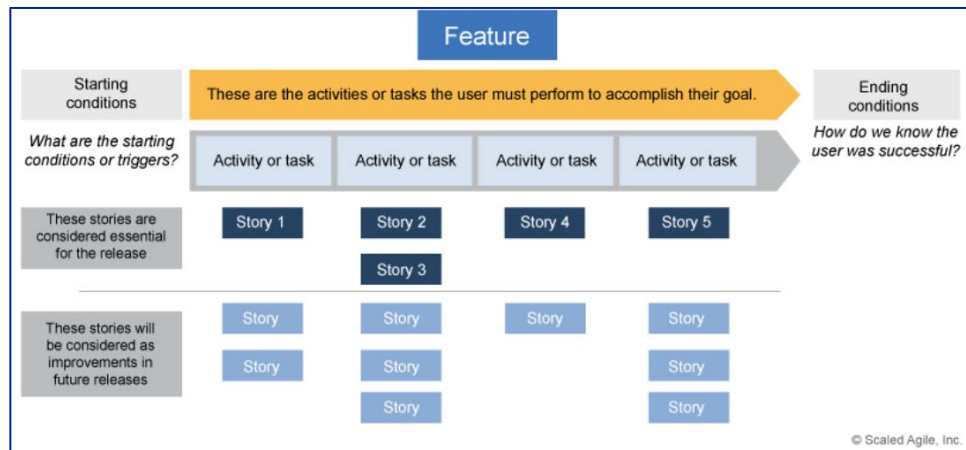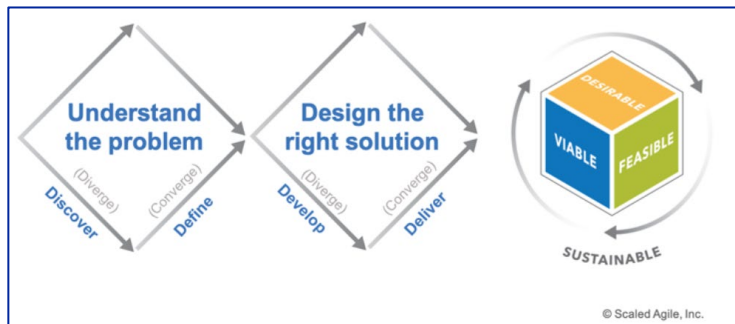
- Features are implemented through user stories

- User stories are part of the team Backlog and can be further broken down into tasks

Set-Based Design

- Keeps requirements and design options flexible

- Identifies and simultaneously explores multiple options, eliminating undesirable choices over time
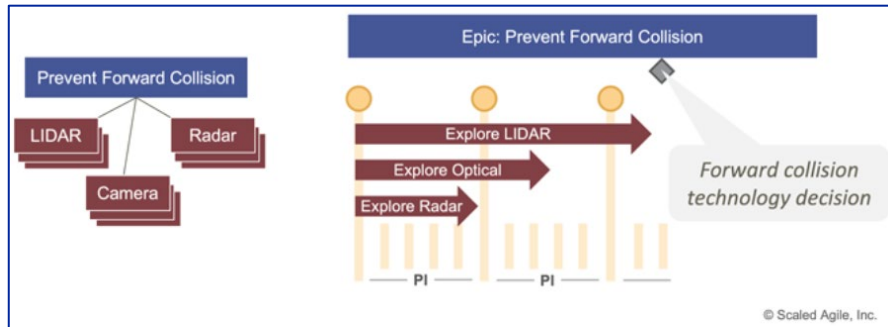
- Teams explore alternatives considering:
  - Cost trade-offs
  - Environmental conditions
  - Non-functional requirements
  - Etc.

- Teams filter design alternatives based on validated learning

Set-Based Design - Scaled Agile Framework

Continuous Exploration

- Drives innovation and fosters alignment to customer needs
- Hypothesize to capture ideas and measurements to validate them
- Collaborate and research to refine the understanding of potential customer and stakeholder needs
- Architect a technological approach to enable quick implementation, delivery, and support of operations
- Synthesize to organize ideas into a holistic vision, roadmap, and prioritized backlog of Features, user stories, and tasks
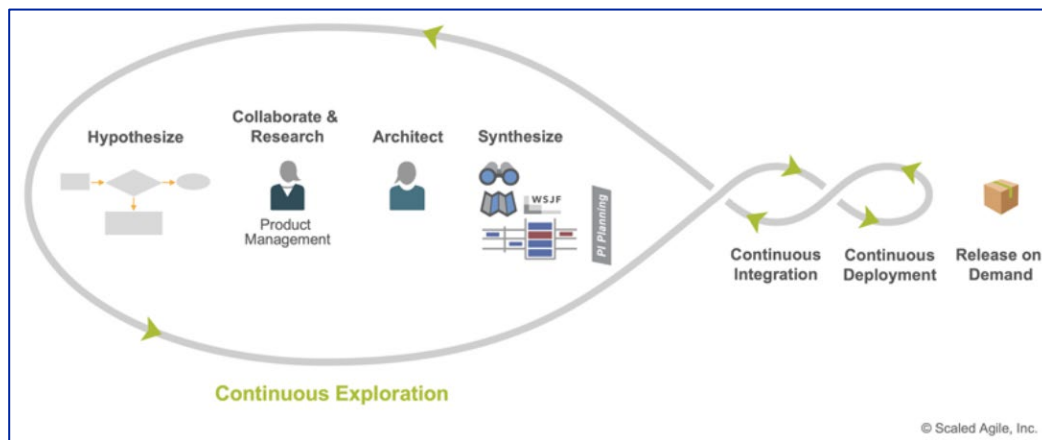
Continuous Exploration - Scaled Agile Framework

Questions?