These Are Our Needs, Make It Happen!

PMI Clear Lake-Galveston Chapter

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INCOSE RWG Overview

RWG Charter

1 **Purpose**

The purpose of the Requirements Working Group (RWG) is to advance the practices, education, and theory of needs and requirements development and management and the relationship of needs and requirements to other systems engineering activities.

2 **Goal**

Expand and promote the body of knowledge of needs and requirements and its benefits within the systems engineering community

3 **Scope**

Activities relating to best practices for needs and requirements development and management throughout the product lifecycle including:

Elicitation	Analysis	Allocation
Traceability		
Elaboration	Management	Change
Management		
Expression	Verification	Validation

RWG is About…

- Understanding how to improve the practice of systems engineering through excellence in needs and requirements development and management across the lifecycle
- Learning from experiences and sharing with the SE community
- Questioning approaches that yield poor outcomes
- Publishing guidance and continuing research into requirements development and management, including the understanding of Needs, Requirements, Verification, and Validation

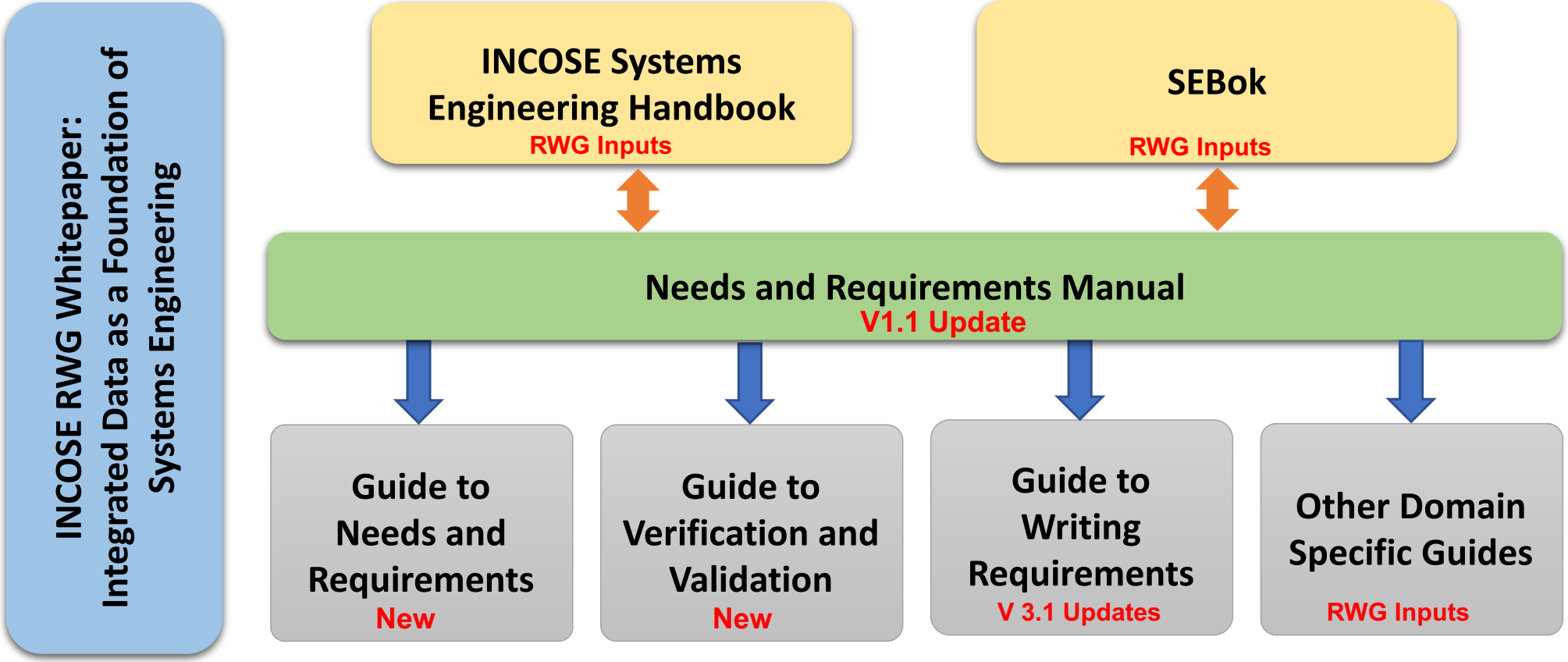
RWG Leadership

- **Chair**: Tami Katz; Ball Aerospace, USA
- **Co-Chair**: Lou Wheatcraft; Wheatland Consulting, USA
- **Co-Chair**: Mike Ryan; Capability Associates Pty Ltd, AU
- **Co-Chair**: Raymond Wolfgang; Sandia National Lab, USA
- **INCOSE Websites:**
  - https://www.incose.org/incose-member-resources/working-groups/process/requirements
  - https://connect.incose.org/WorkingGroups/Requirements/Pages/Home.aspx
  - https://www.youtube.com/channel/UCadgYaqKWDckenP2SU8-cPw
- **Number of Members:** 408, one of INCOSE's largest WG

The RWG is comprised of members from industry and academia with a common purpose of improving the practice of systems engineering through improvement of **Needs and Requirements** development and management across the system lifecycle.

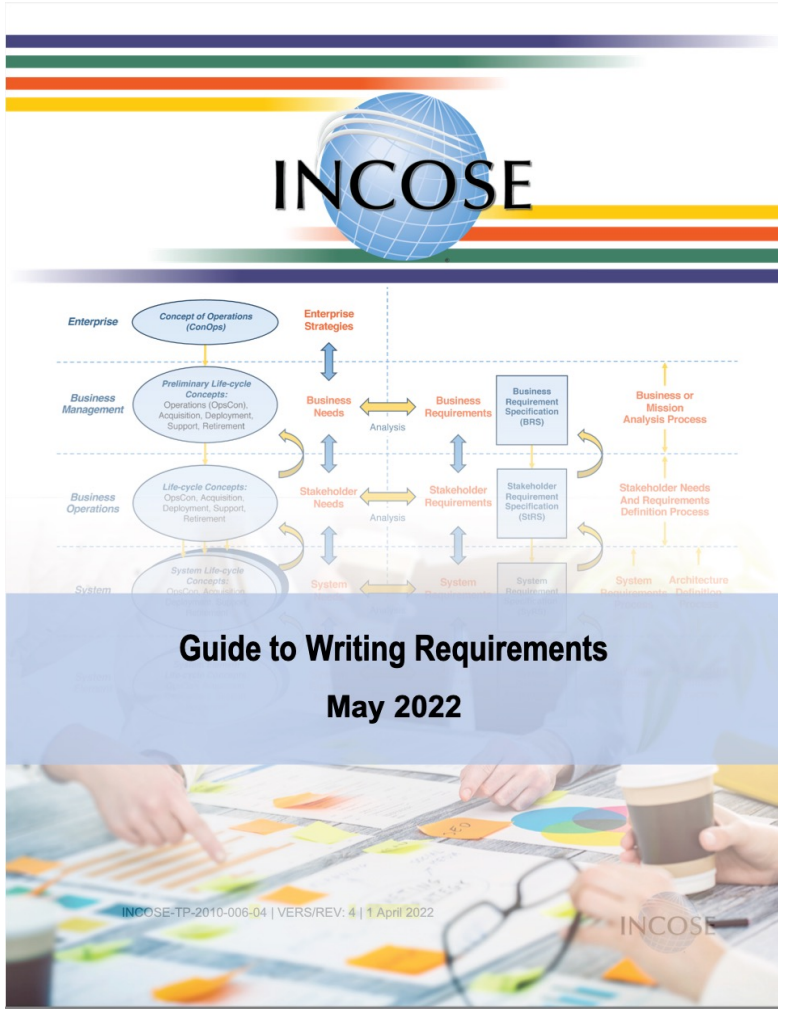
RWG Products

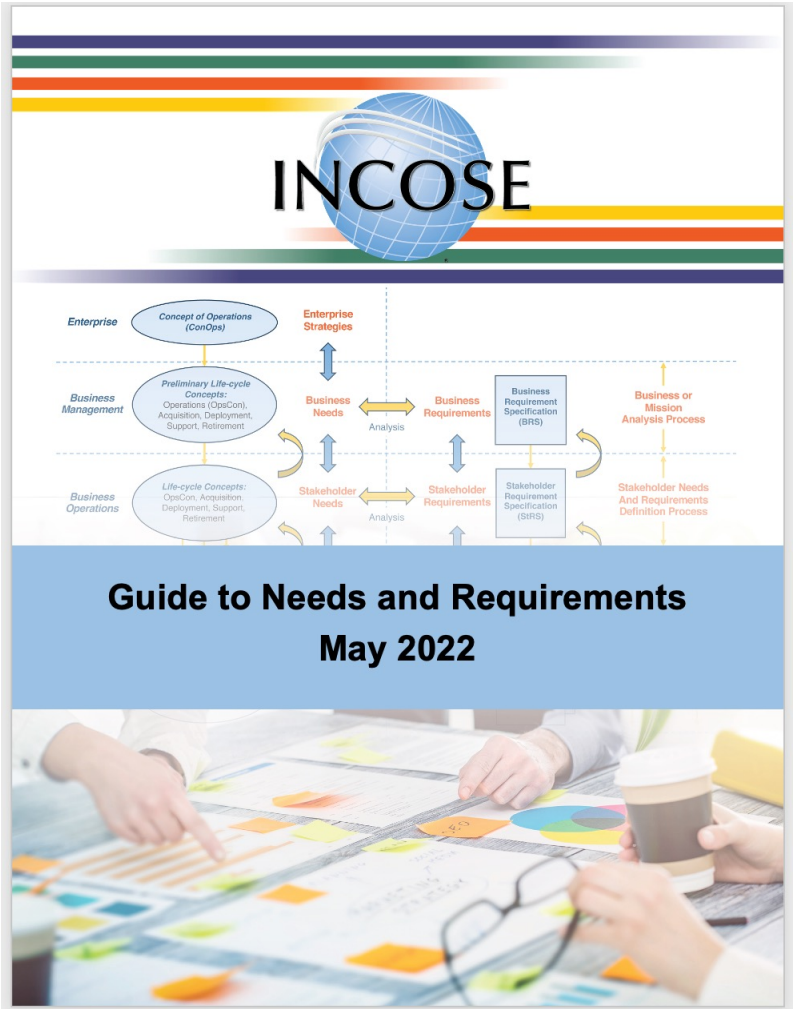
- The RWG has been working on new products and supporting development of other INCOSE publications

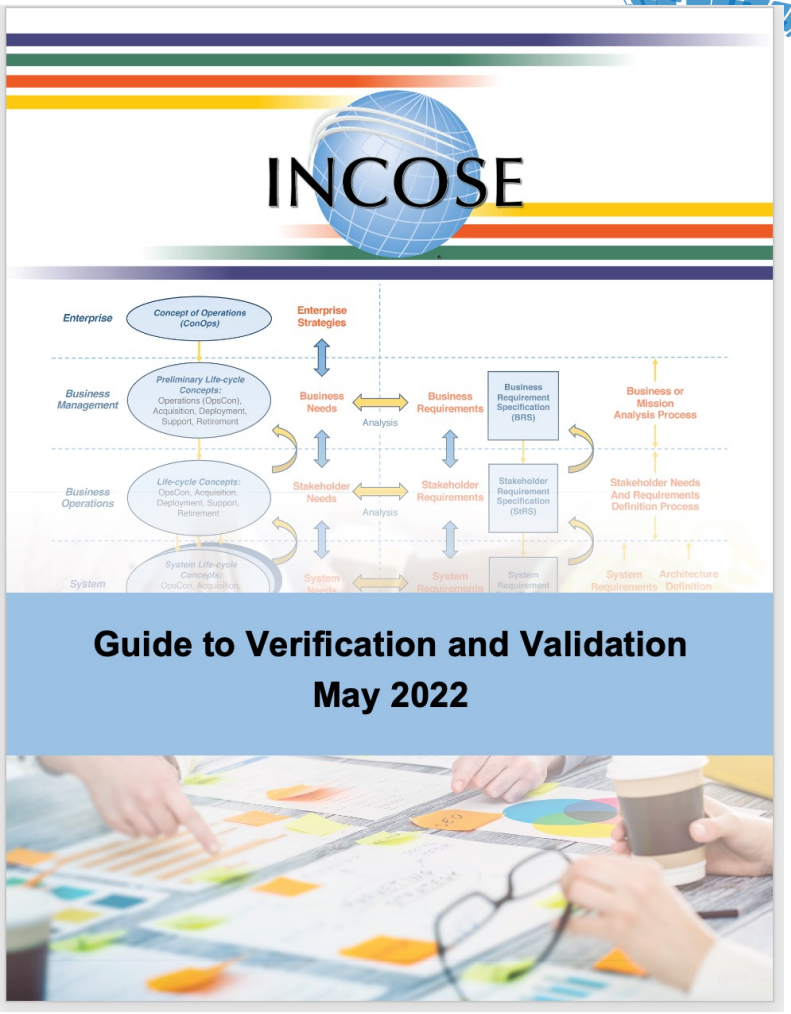


Needs and Requirements Manual

RWG Guides







Summary Sheet:
https://www.dropbox.com/s/rzznnhrkfxwf8cd/INCOSE_RWG_Guide_to_Writing_Requirements_v3.1_SummarySheet_041822_6pg.pdf?dl=0

RWG Events

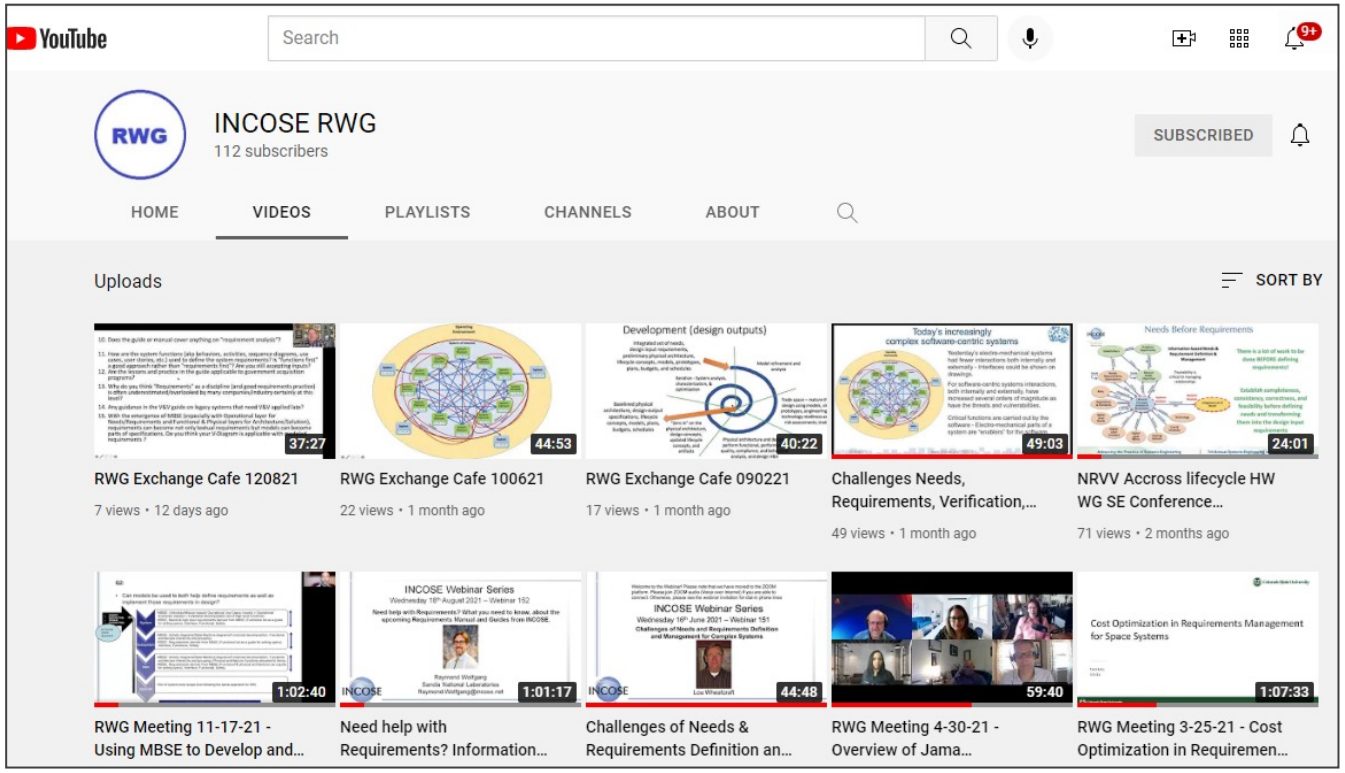
- The RWG engages the INCOSE community through regular events around the topic of Needs and Requirements
  - Guest speakers on Requirements Topics
  - RWG Exchange Cafés
- RWG members contribute ideas towards topics discussed and are encouraged to share their experiences and questions with the broad working group community.

Upcoming RWG Meetings for 2022

- **July 20**: Presentation by Beth Wilson on Systems of Systems (SoS) challenges.
- **August 24**: RWG Exchange Café – Beth Wilson lead on SoS vs the NRM, GtNR, GtVV
- **September 28**: RWG Exchange Café – General discission focusing on interfaces
- **October 26**: Presentation by Beth Wilson – System Security Challenges
- **November 16**: RWG Exchange Café – Beth Wilson lead on System Security vs NRM, GtNR, GtVV
- **December 14**: Presentation by Henrik Mattfolk – “Configuration Management Across the Digital Thread”
- **January 2023**: IW 2023 RWG prevent sessions - TBD

INCOSE RWG YouTube Channel

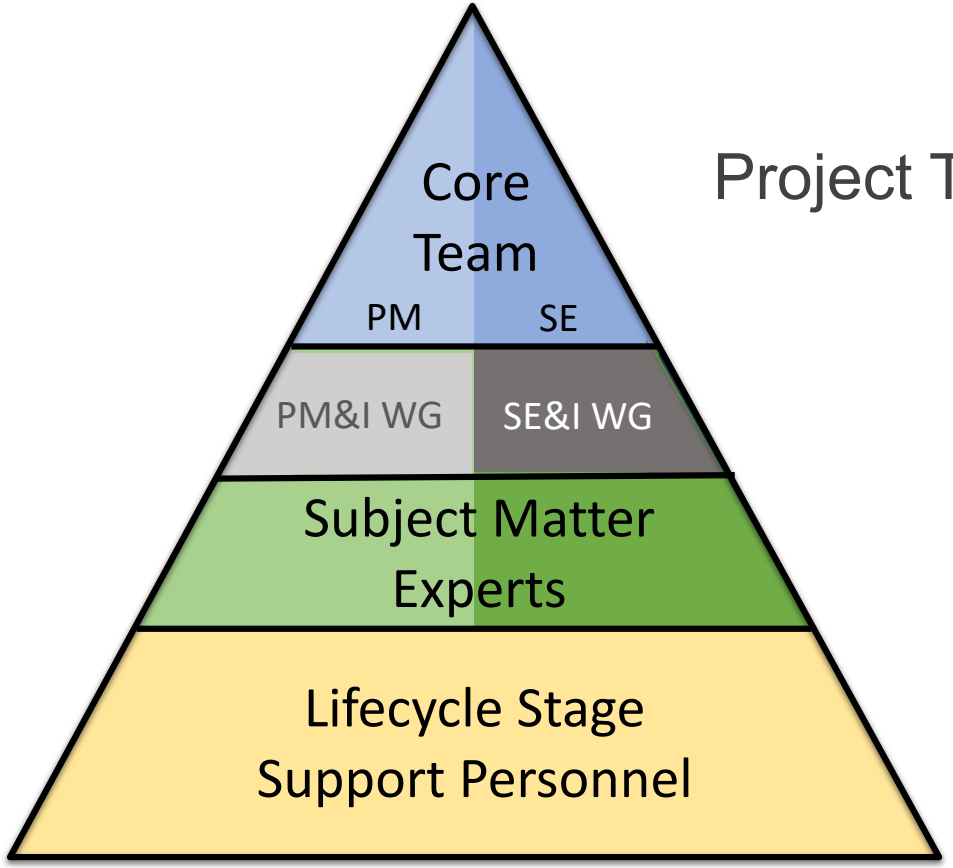
- The INCOSE RWG chairs have created a YouTube channel to post recordings of meetings and presentations to the broader community.
- This is available to everyone that would like to catch up on events and learn more about the RWG efforts and products.
- This is also available to non-INCOSE members as a method to attract interest in potentially joining INCOSE and the RWG and share good options to all that engage in needs and requirements efforts.



https://www.youtube.com/channel/UCadgYaqKWDckenP2SU8-cPw/playlists

Some Basics

Integrated, collaborative, multidisciplined project team – minimize silos!



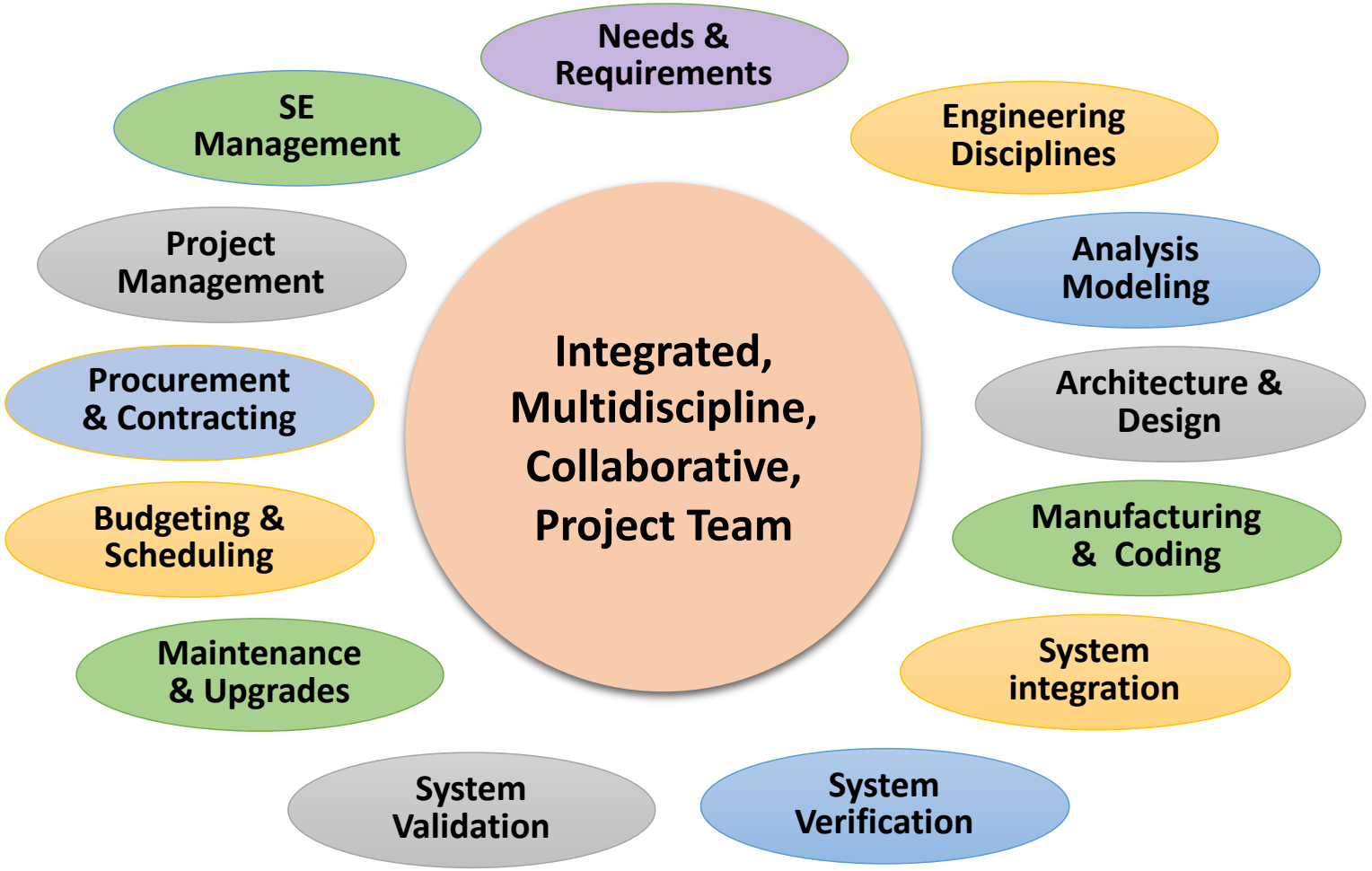
Project Team Organization

Project Management (PM) and Systems Engineering (SE) are two sides of the same coin

Integrated, Multidisciplined, Collaborative, Project team – minimize silos!

The team is made up of both PM and SE personnel as both activities are tightly dependent

This can be challenging when outsourcing development to a supplier



These Are Our Needs, Make It Happen!

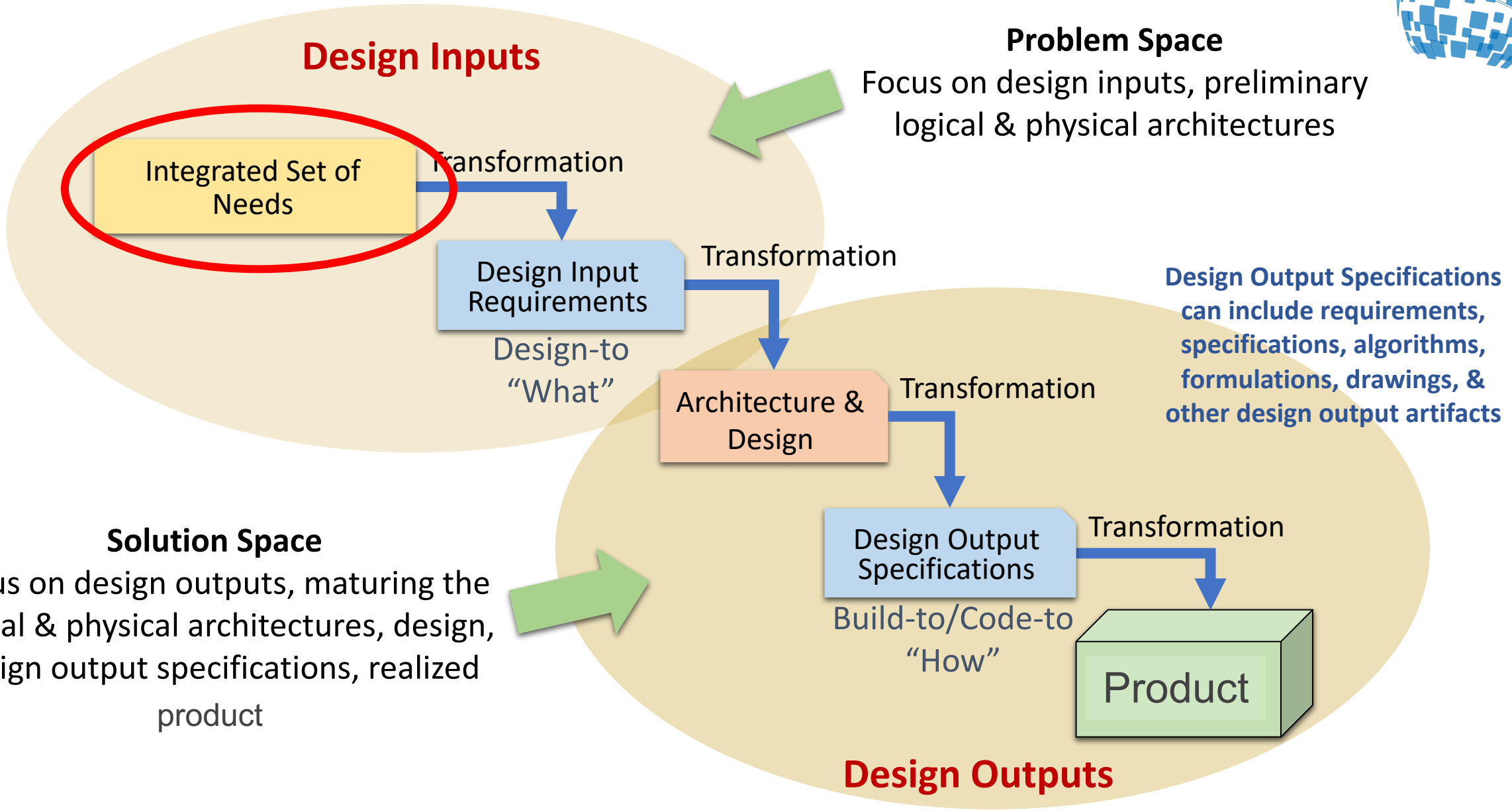
Needs AND Requirements

At the beginning of a Project rather than asking "What are the Requirements?" we should first ask "What are the Needs?

Before defining a set of requirements, we must first define and understand what the stakeholder's need!!

Both needs and requirements must be defined – not just the requirements!.

Needs and Requirements are the common treads that tie all product development lifecycle activities and artifacts together.


Design Inputs
Problem Space
Focus on design inputs, preliminary logical & physical architectures
Integrated Set of Needs
Transformation
Design Input Requirements
Transformation
Design-to
"What"
Architecture & Design
Transformation
Design Output Specifications
Transformation
Build-to/Code-to
"How"
Product
Design Output Specifications can include requirements, specifications, algorithms, formulations, drawings, & other design output artifacts
Solution Space
Focus on design outputs, maturing the logical & physical architectures, design, design output specifications, realized product
Design Outputs

Needs vs Requirements

- Needs represent the stakeholder, customer/acquirer view of the product to be developed.
  - What do the stakeholders need the product to do that will result in their problem to be solved or opportunity to be realized within defined constraints?
  - Needs communicate the stakeholder expectations for the end-state once the product is delivered – in the end **what will make the customer happy**?
  - The product will be validated against its integrated set of needs.

Needs vs Requirements

- Needs statements are not requirement statements
- Need statements do **not** include the word “shall”
- Examples:
  - “The stakeholders need the system to ……..” or
  - “The stakeholders would like the system to …….” for a goal
  - Rather than “The users shall be able to ……” say
    “The users need to be able to ……” or
    “The stakeholders need the system to allow users to ……”
  - Rather than ““The system shall meet applicable government safety standards and regulations.” say
    “The stakeholders need the system to meet applicable government safety standards and regulations.”

Using these distinct formats helps make a clear distinction between needs and design input requirements.

Needs vs Requirements

- Requirements represent the technical, developer view of the product
  - What must the product do in order to meet the needs?
  - Needs are transformed into design input requirements that will result in a design that will implement the needs
  - The product will be verified against its design input requirements

The quality of the requirements is dependent on the quality of the needs from which they are transformed.

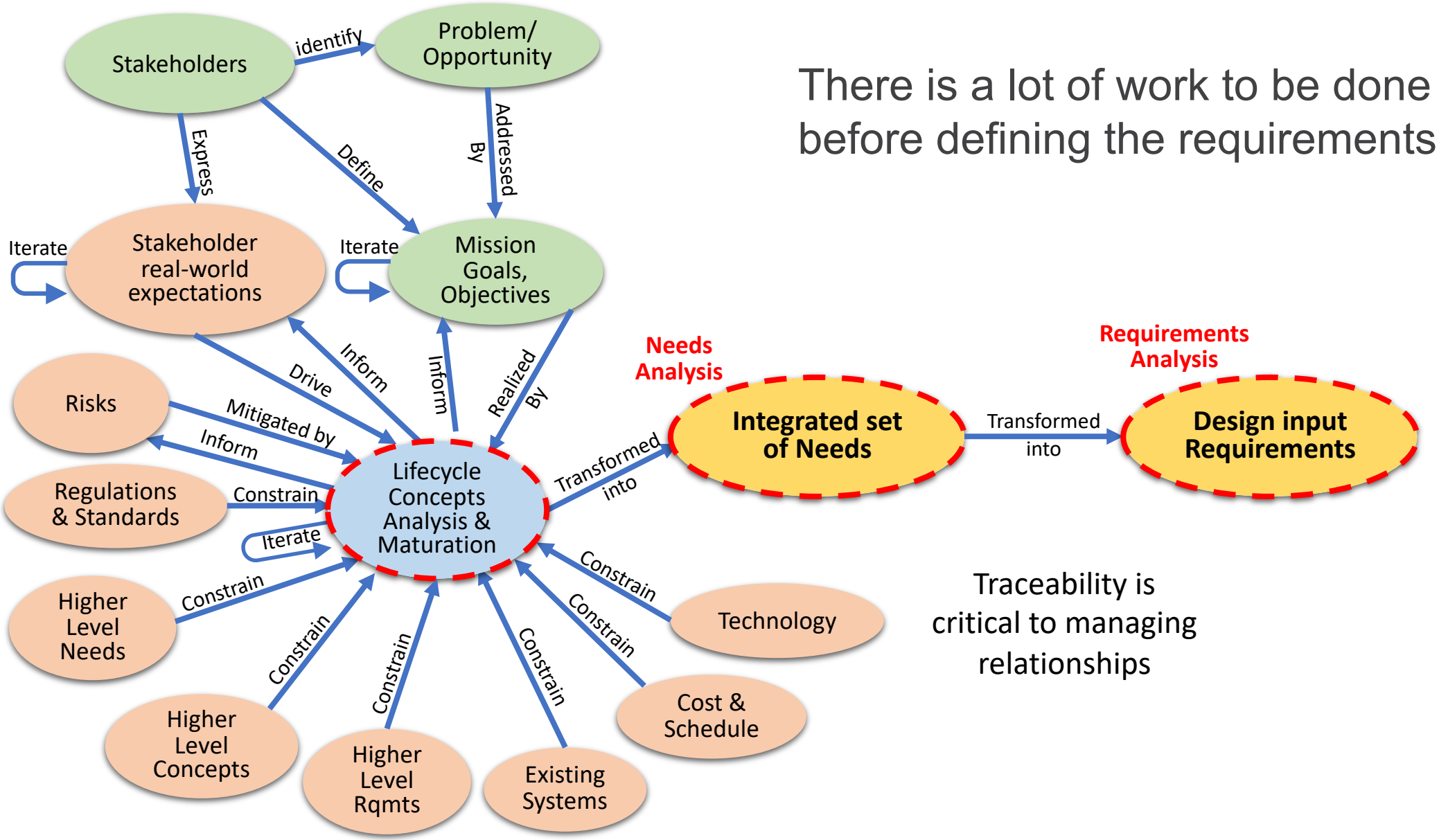
Needs vs Requirements

- Requirement statements include the word “shall”
- Example of transforming a need into design input requirements:
  - For “The users need to be able to [do something]” or “The stakeholder need the system to allow users to [do something]”
  - The project team would do an engineering analysis to determine what the system must to do such that users will have the capability to do that action.
  - Based on that analysis, the project team would then write one or more design input requirements (“shall” statements) that, when implemented by the design, would result in the user being able to do that action as stated in the need.

Project Success

- Depends on the project team understanding:
  - The source of concern, problem/opportunity,
  - The Mission, Goals, Objectives, and Measures (how well?),
  - What constitutes acceptability or desirability of a solution (what?),
    - What is “necessary for acceptance”?
  - Conditions in which the SOI must operate (in what operating environment?)
- This knowledge allows concepts to be defined, analyzed, and matured and a formal integrated set of needs defined, agree-to, and baselined.
  - Project Management Concepts
  - Product Development Concepts
  - Product Lifecycle Concepts
- There is a lot of work to be done before developing a set of design input requirements to which the system will be designed and built/coded.

A primary reason for project failure, is a failure to recognize the need for and doing this upfront work.



There is a lot of work to be done before defining the requirements.

Traceability is critical to managing relationships

Validation Across the Lifecycle

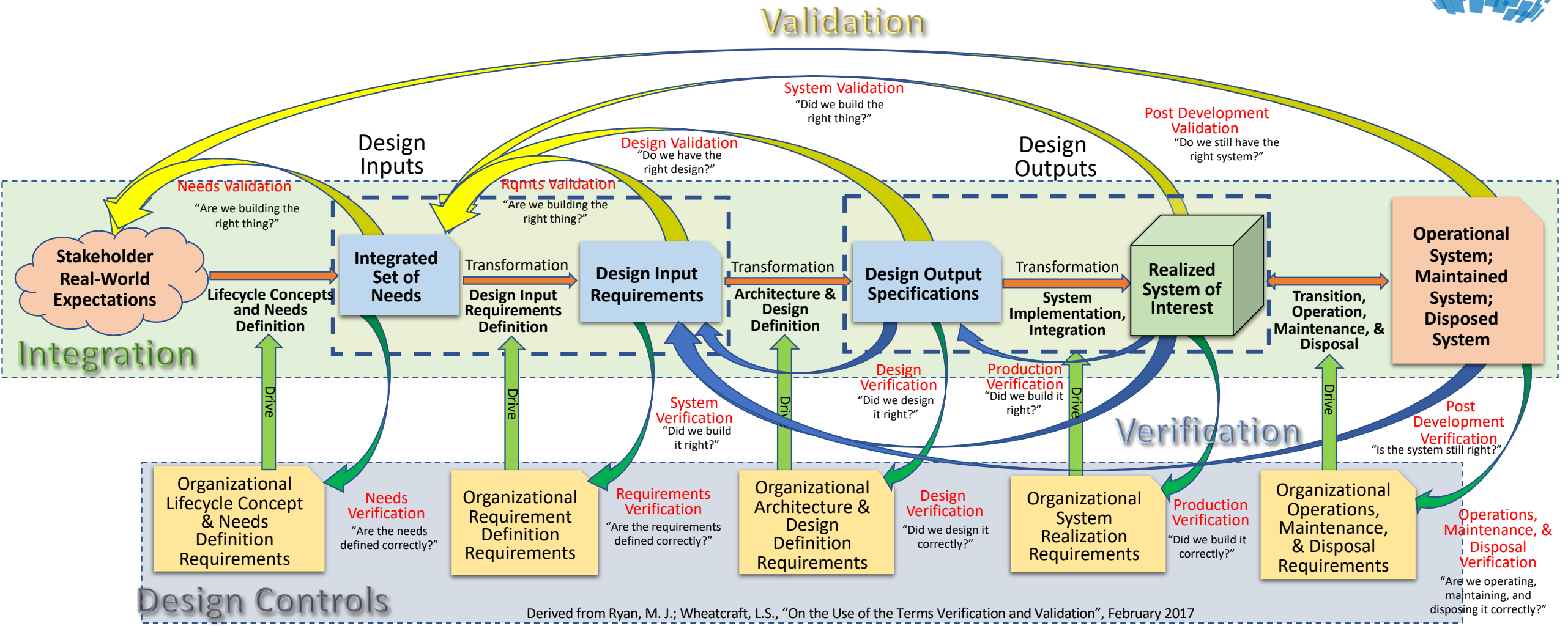
Validation Across the Lifecycle

Validation should not be thought of as something done at the end of a project.

Validation is done across the system lifecycle:
- Needs
- Design Input Requirements
- Architecture
- Design
- Design Output Specifications
- Realized Product

Early validation decreases issues when the product is delivered or put into the market

Verification and Validation in Context



Derived from Ryan, M. J.; Wheatcraft, L.S., "On the Use of the Terms Verification and Validation", February 2017

https://www.dropbox.com/s/eq6k9u0fiiqp4eg/Validation%20%26%20Verification%20in%20context%20Figure%20042922.pdf?dl=0

Product Validation

Validating that the realized physical, integrated product

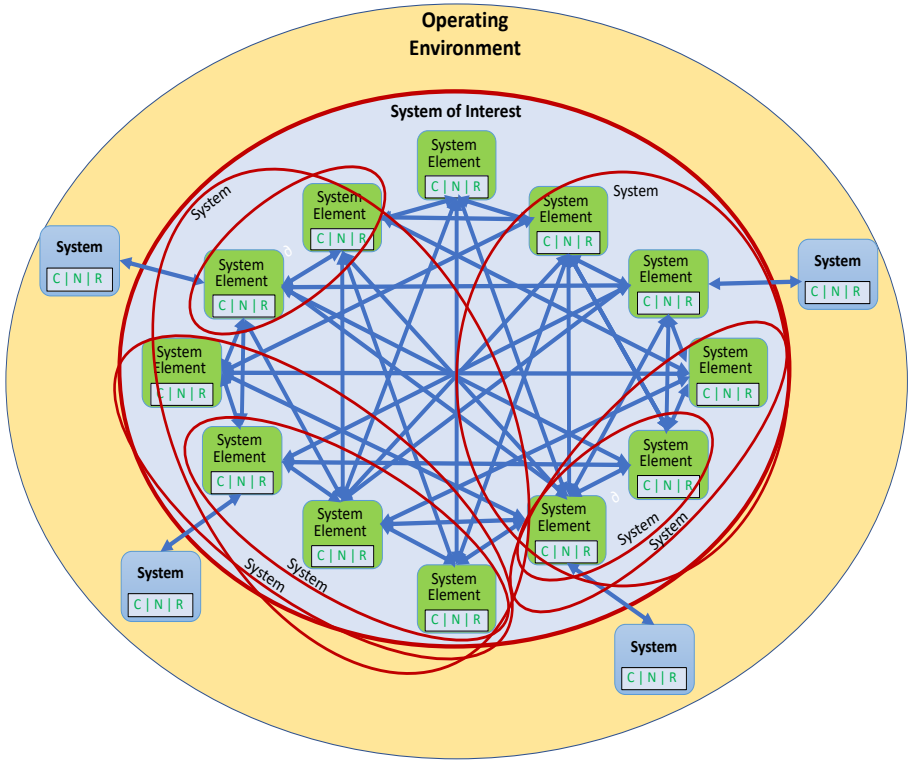
meets its intended purpose/use AND

identify and assess its behavior and emerging properties

in its actual operational environment

when operated by its actual intended users

and does not enable unintended users to negatively impact
the intended use of the system nor allow unintended users to use the system in an unintended way



Product Validation

What's more important?
Product Verification or Product Validation?????

Project success is based on the product passing product validation

Passing product verification but failing product validation results in a failed project…….

What do you validate the product against?

Where is it defined?

Who defines it?

Who is responsible?

What is "Necessary for Acceptance?

This must be made clear in all customer/supplier agreements

Questions and Discussion

Lou Wheatcraft

- **Lou Wheatcraft** is a senior consultant and managing member of Wheatland Consulting, LLC. Lou is an expert in systems engineering with a focus on needs and requirements development, management, verification, & validation. Lou provides consulting and mentoring services to clients on the importance of well-formed needs & requirements helping them implement needs & requirement development and management processes, reviewing and providing comments on their needs and requirements, and helping clients write well-formed needs & requirements.
- Specialties include: Understanding and documenting the problem; defining project and product scope; defining and maturing system concepts; assessing, mitigating, and managing risk; documenting stakeholder needs; transforming needs into well formed design input requirements; allocation, budgeting, and traceability; interface management, requirement management; and verification and validation.
- Lou's goal is to help clients practice better systems engineering from a needs and requirements perspective across all life cycle stages of system/product development. Getting the needs and requirements right upfront is key to a successful project. Poor needs & requirements can triple the chances of project failure.
- Lou has over 50 years' experience in systems engineering, including 22 years in the United States Air Force. Lou has taught over 200 requirement seminars over the last 21 years. Lou supports clients from all industries involved in developing and managing systems and products including aerospace, defense, medical devices, consumer goods, transportation, and energy.
- Lou has spoken at Project Management Institute (PMI) chapter meetings and INCOSE conferences and chapter meetings. Lou has published and presented many papers concerning needs and requirement for NASA's *PM Challenge*, INCOSE, INCOSE *INSIGHT Magazine*, and *Crosstalk Magazine*. Lou is a member of INCOSE, past Chair and current Co-Chair of the INCOSE Requirements Working Group (RWG), a member of the Project Management Institute (PMI), the Software Engineering Institute (SEI), the World Futures Society, and the National Honor Society of Pi Alpha Alpha.
- Lou has a BS degree in Electrical Engineering from Oklahoma State University; an MA degree in Computer Information Systems; an MS degree in Environmental Management; and has completed the course work for an MS degree in Studies of the Future from the University of Houston – Clear Lake.