2024
Annual INCOSE
international workshop
HYBRID EVENT
Torrance, CA, USA
January 27 - 30, 2024

RWG IW2024

www.incose.org/IW2024

IW2024 RWG Agenda

Day	Time (PST USA)	Details
Sat 1/27/24	15:30 - 18:00	15:30-16:00 RWG Introductions, RWG Overview, and Overview of 2023 accomplishments 16:00-17:00 Plans for 2024, New Products, Areas for Engagement 17:00-18:00 Ask the Experts - Open discussion on Needs, Requirements, Verfification, & Validation.
Sun 1/28/24	9:30 - 12:00	09:30-10:30 RWG Introductions, RWG Overview, Ask the Experts 10:30 -12:00 Assessing Poorly Formed Requirements
	12:00 - 13:00	Lunch
	13:30 - 17:00	13:30-15:00 Assessing Poorly Formed Requirements 15:00-15:30 Break 15:30-17:00 Assessing Poorly Formed Requirements

INCOSE RWG Overview

RWG Charter

1 **Purpose**

Advance:

- Practices, education, and theory of needs and requirements development and management
- Relationship of needs and requirements to other systems engineering activities.

2 **Goal**

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

3 **Scope**

Activities relating to best practices throughout the product lifecycle including:

- Elicitation, Analysis, Allocation, Traceability
- Elaboration, Management, Integration
- Change Assessment and Management
- Expression, Verification, Validation

RWG is About…

- Improving the practice of systems engineering through excellence in needs and requirements definition 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 needs and requirements definition and management, including understanding the role of Needs, Requirements, Verification, and Validation across the lifecycle.

RWG Leadership

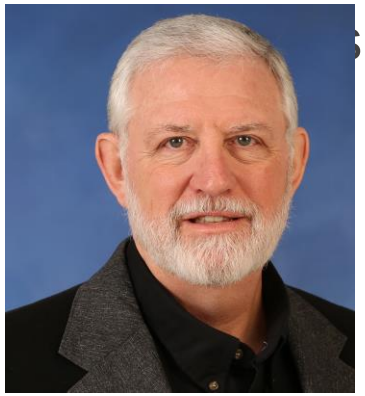
- **Chair**: Lou Wheatcraft; Wheatland Consulting, LLC, USA
- **Co-Chair**: Tami Katz; Ball Aerospace, USA
- **Co-Chair**: Mike Ryan; Capability Associates Pty Ltd, AU
- **Co-Chair**: Kevin Orr, Eaton, USA
- **Co-Chair**: Jeffery Williams, University of Alabama, Huntsville, USA
- **Co-Chair**: Katarzyna Kot, BA Coach, NL

- **INCOSE Websites:**
  - https://www.incose.org/incose-member-resources/working-groups/process/requirements
  - https://www.incose.org/inet/working-groups/requirements
  - https://www.youtube.com/channel/UCadgYaqKWDckenP2SU8-cPw

- 1144 followers on Viva Engage, 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** definition and management across the system lifecycle.

Jeffery L. Williams, Ph.D.



Dr. Williams is an Adjunct Professor of Systems Engineering at the University of Alabama in Huntsville.

He retired from industry after almost 49 years with experience that spans Aerospace & Defense, Rail, and Commercial Aircraft Systems Development. Dr. Williams has stood up SE organizations from scratch while maintaining ongoing development programs.

Dr. Williams has experience in program management, functional (SE) management, engineering leadership rolls on major development programs and smaller supplier development programs.

Dr. Williams has BA and MA degrees in Mathematics from the University of West Florida and Ph.D. in Applied Science from Lyle School of Engineering at Southern Methodist University.

Dr. Williams has been an INCOSE member since 2002 and continues to be engaged.

Katarzyna Kot

Katarzyna is an independent consultant in requirements engineering and business analysis from Poland currently living and working in the Netherlands.

Katarzyna studied Computer Science at the University of Technology in Gdansk, in Northern Poland. She started her career 25 years ago as an embedded software designer at Philips Semiconductors.

Early in her career she quickly discovered her true calling – defining and managing requirements. She has worked for high-tech companies in the Netherlands as a software designer, quality assurance engineer, software architect, and requirements engineer.

Later, she worked for consulting companies, where she helped organizations enhance their requirements definition and management practices and delivered courses on requirements. She also worked on implementing requirements definition and management solutions and aligning them with the companies' software engineering practices.

In 2015, she became an independent consultant in requirements and business analysis. In her current role, she educates organizations on the importance of requirements and helps them define well-formed requirements based on industry best practices.

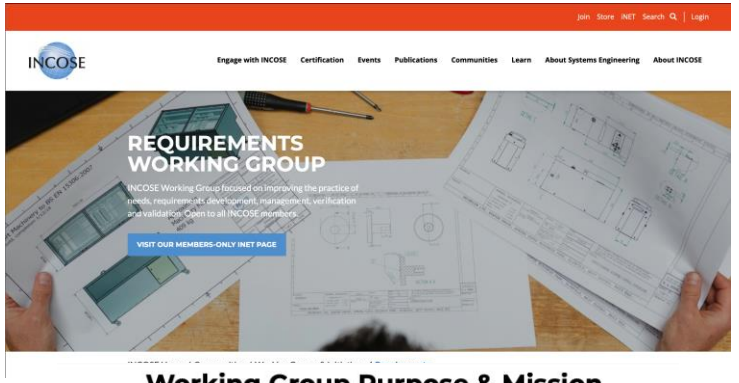
Katarzyna is passionate about sharing knowledge and inspiring others to excel in requirements. Together with like-minded colleagues, in 2010, she help set up a Dutch chapter of the International Institute of Business Analysis (IIBA), where she was a Chapter Board Member till 2022.

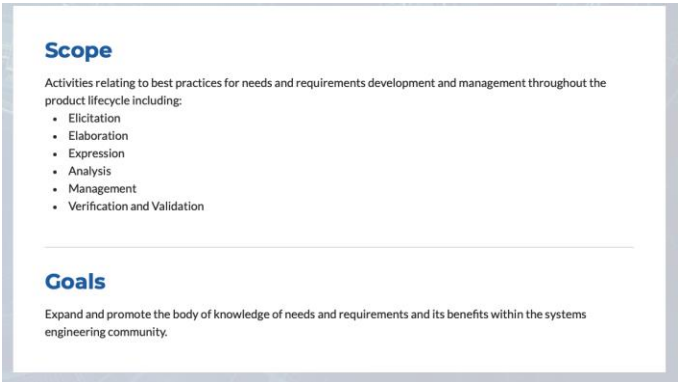
She has been part of the INCOSE community over the last several years, joining the INCOSE community in 2021 to be able to participate in the Requirements Working Group activities.

Katarzyna is very honored to be selected as a co-chair to be able to contribute to the purpose and goals of the RWG.

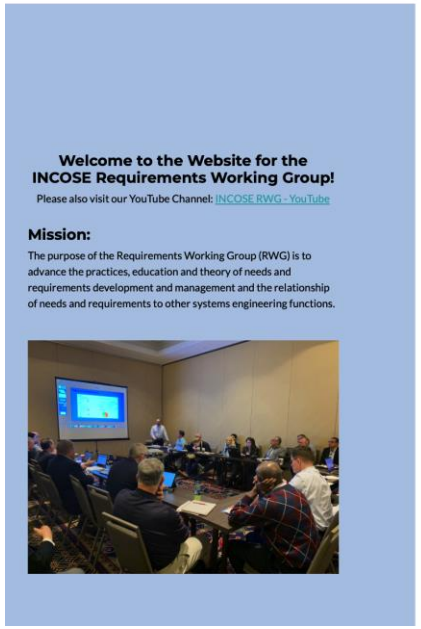
INCOSE RWG External Website

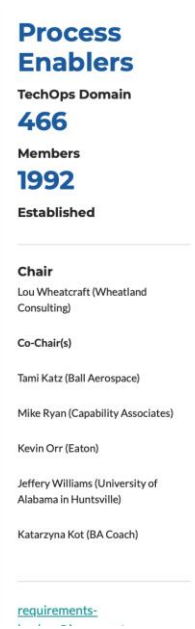
- The RWG maintains an external website (no INCOSE membership needed to view)
- Information on upcoming meetings and in work activities is provided.
- Anyone interested in participating in requirement working group activities is welcome to view this site to stay informed and obtain links to content.

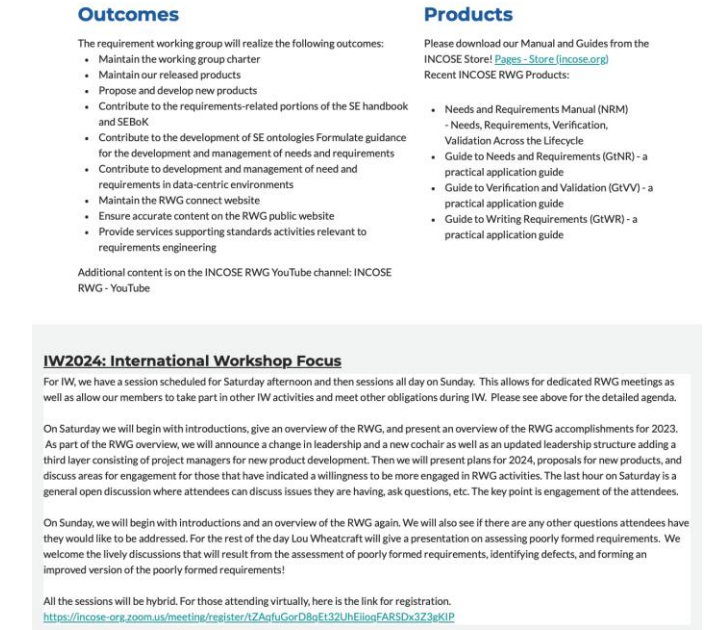




Working Group Purpose & Mission



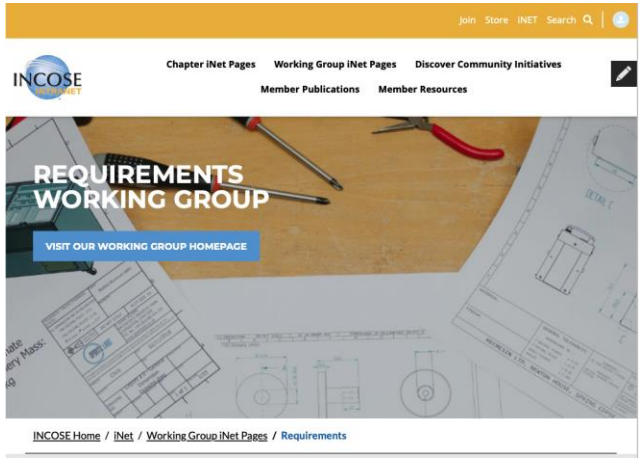


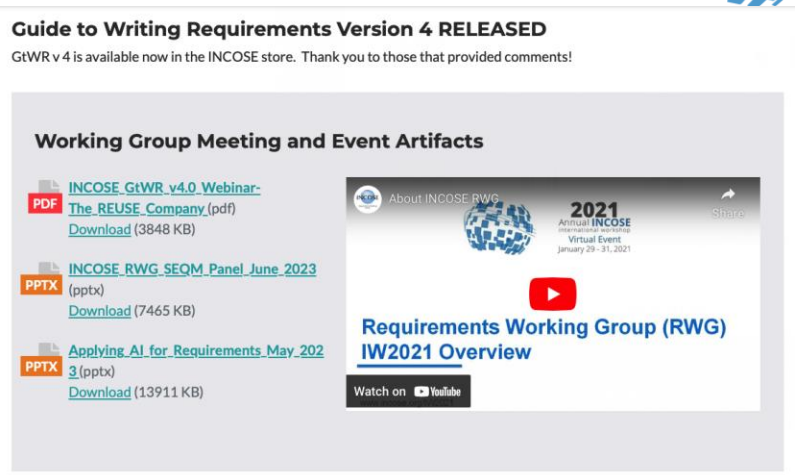


https://www.incose.org/communities/working-groups-initiatives/requirements

INCOSE RWG Internal Website (iNet)

- The RWG is using the “iNet” intranet sites for member only resources.
- Information on upcoming meetings and current activities are provided as well as additional, member-only content.
- IW2023 material and presentations will be provided on this platform.

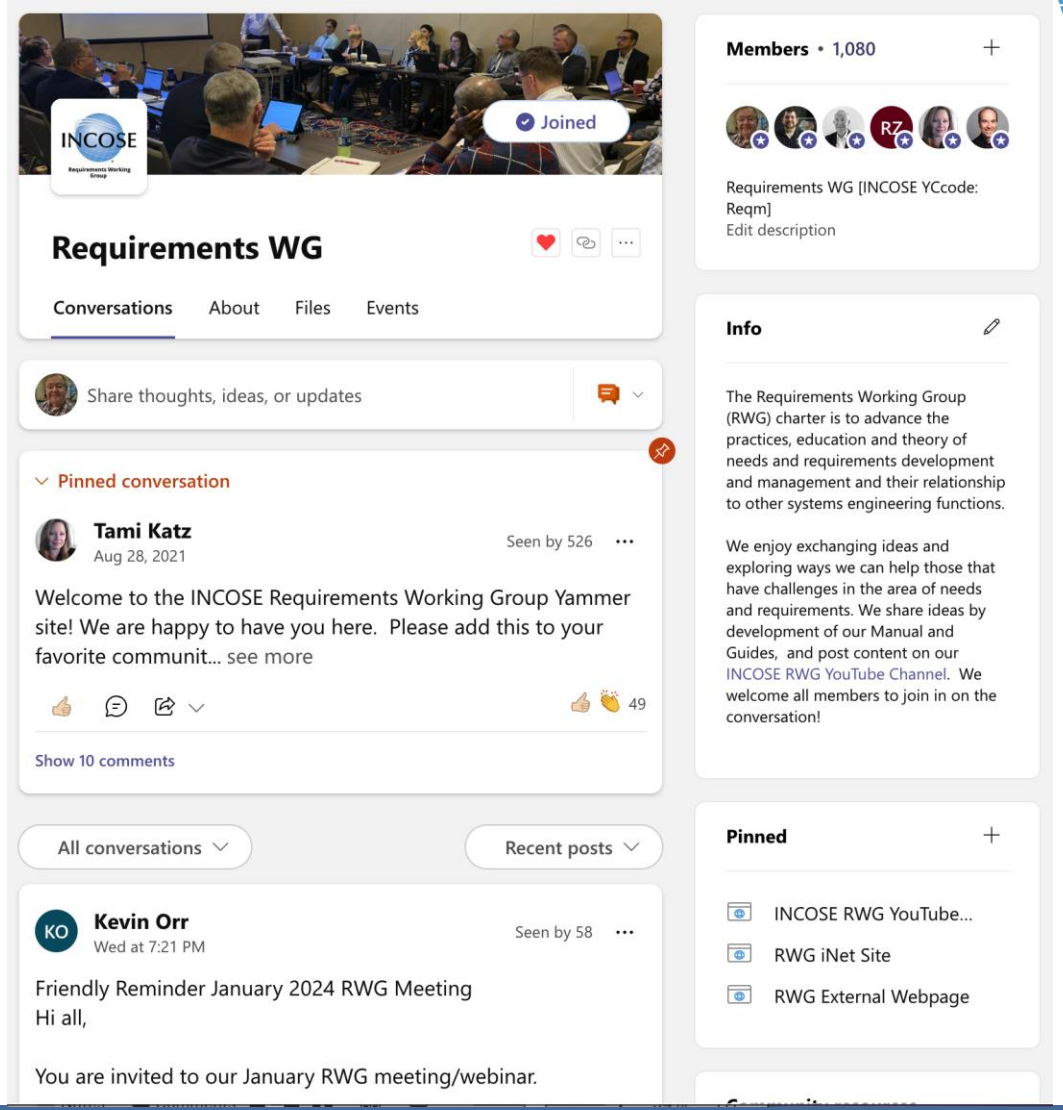




https://www.incose.org/inet/working-groups/requirements

RWG Viva Engage (Yammer) Community

- The INCOSE organization has established Microsoft platforms for INCOSE member engagement.
- Upon obtaining the member login from the INCOSE CIO Barclay Brown, navigate to Viva Engage and join the Requirements WG Community.
- This platform enables more interactive announcements, questions, and discussions throughout the year!



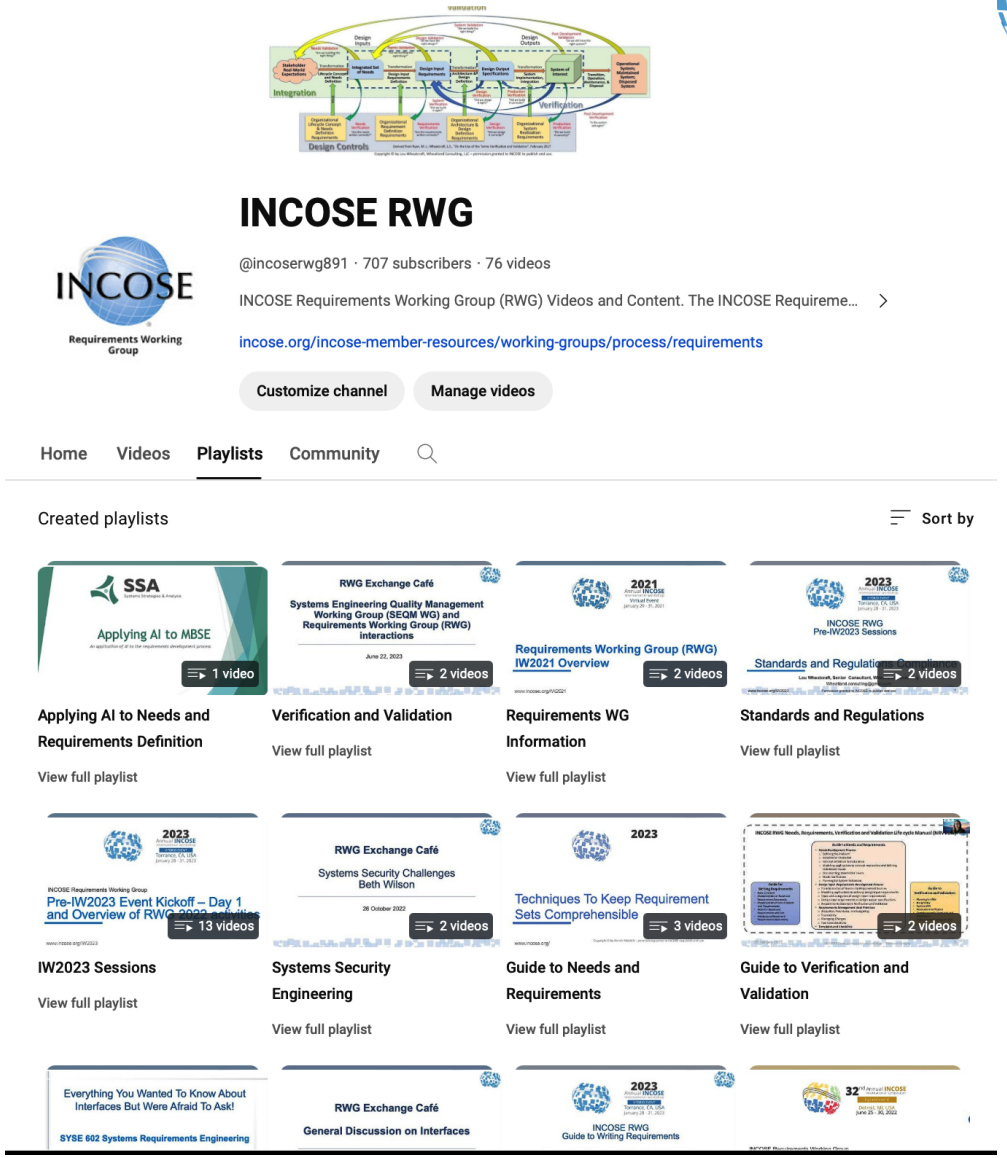
Access to Communities is through the Microsoft Teams App, Viva Engage App (iOS), or the online Microsoft Teams site.

RWG Outreach Events

- RWG engages with the INCOSE community as well as the larger SE community through regular events centered around the topic of Needs and Requirements.
  - Guest speakers on Requirements Topics
  - RWG Exchange Cafés
- Open to INCOSE members and non-members.
- RWG members contribute ideas towards topics discussed.
- Attendees are encouraged to share their experiences and questions with the broader working group community.
- Recordings of these events are available on the INCOSE RWG YouTube Channel.

INCOSE RWG YouTube Channel

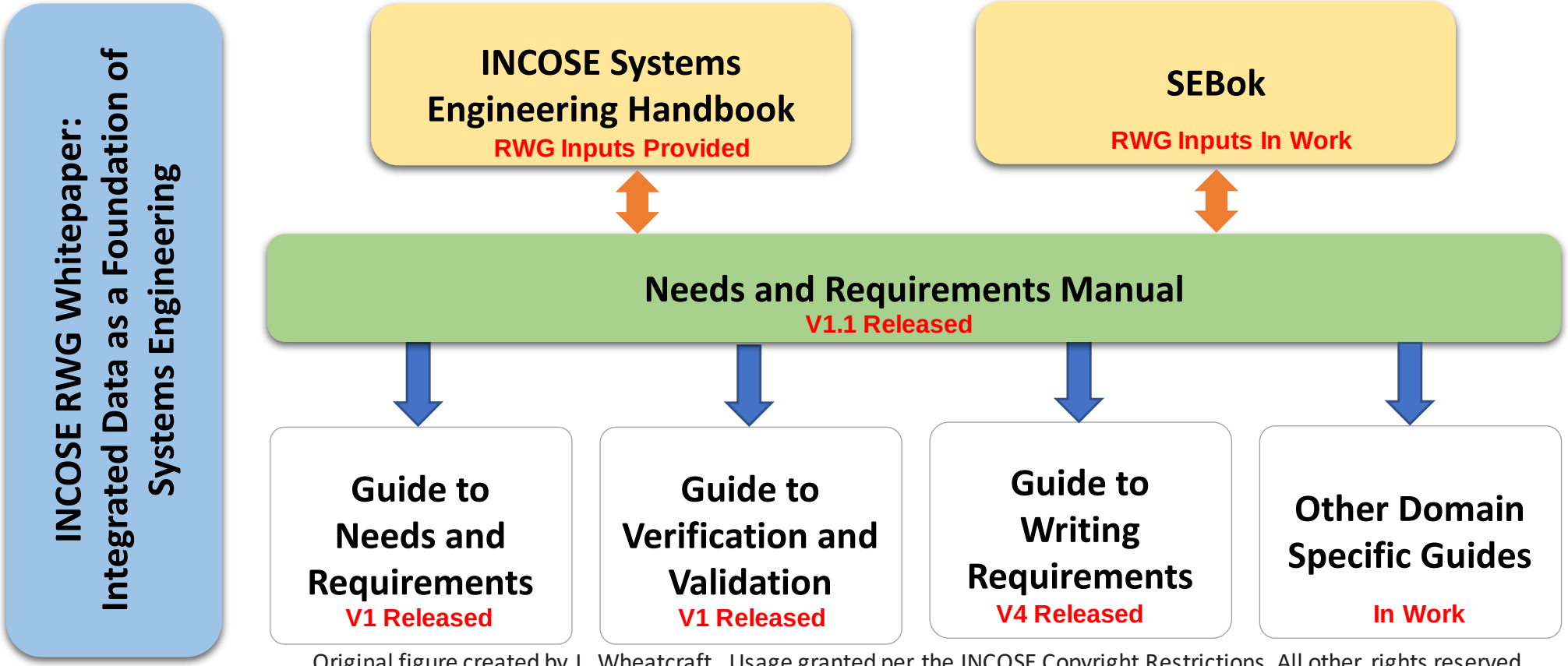
- INCOSE RWG YouTube channel has recordings of meetings and presentations to the broader SE community.
- Available to everyone to catch up on events and learn more about the RWG activities and products.
- Also exists to attract interest in joining INCOSE and the RWG and share experiences, lessons learned, best practices, wisdom, and ideas with all that engage in needs, requirements, verification, and validation activities.



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

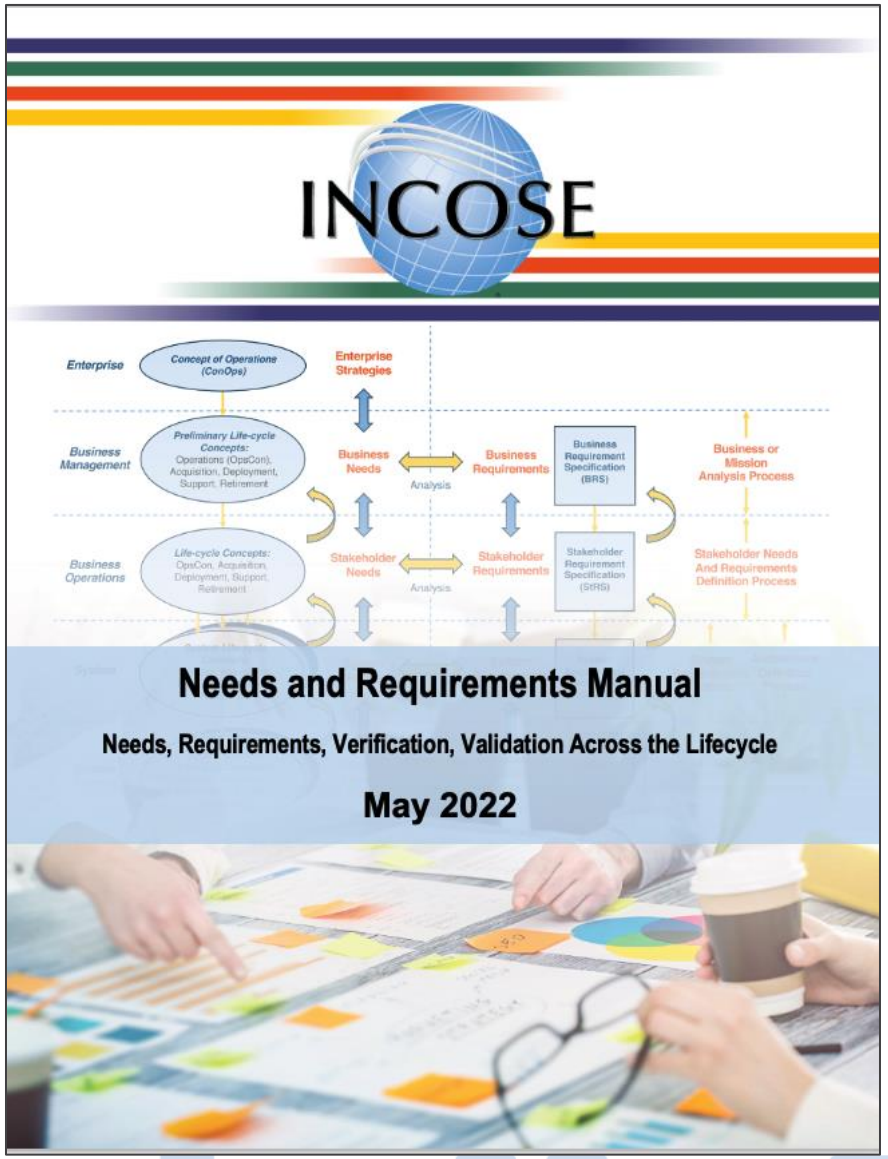
RWG Product Tree

The RWG has developed a family of products and supported development of other INCOSE publications.

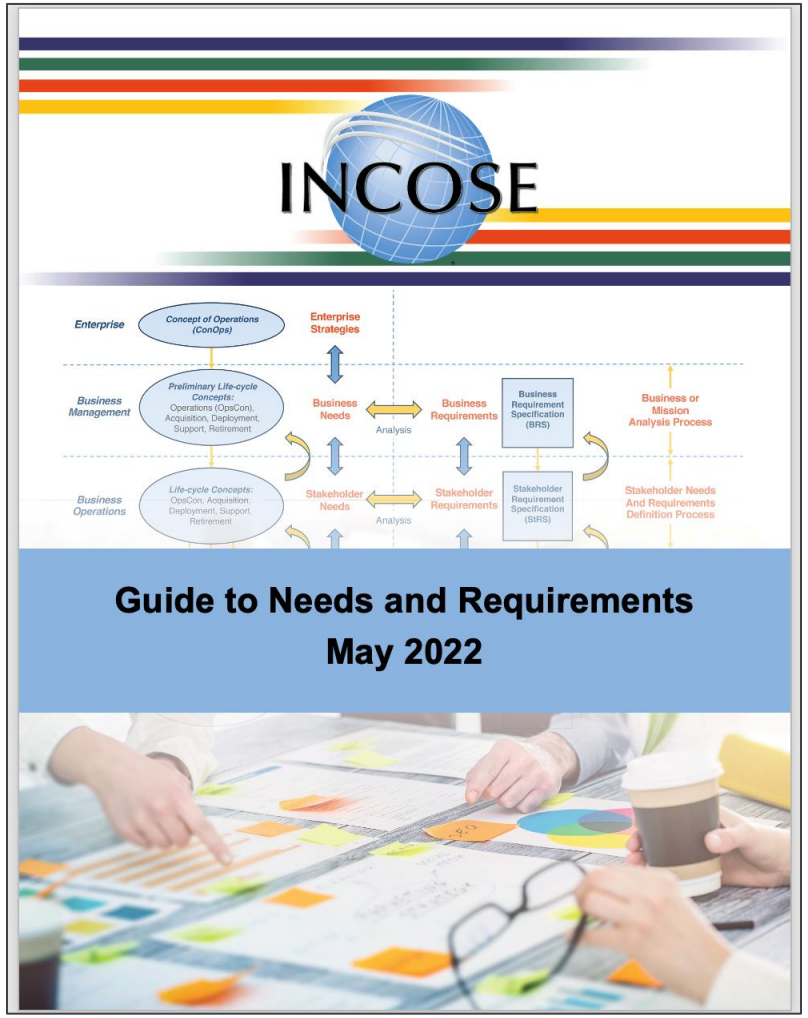


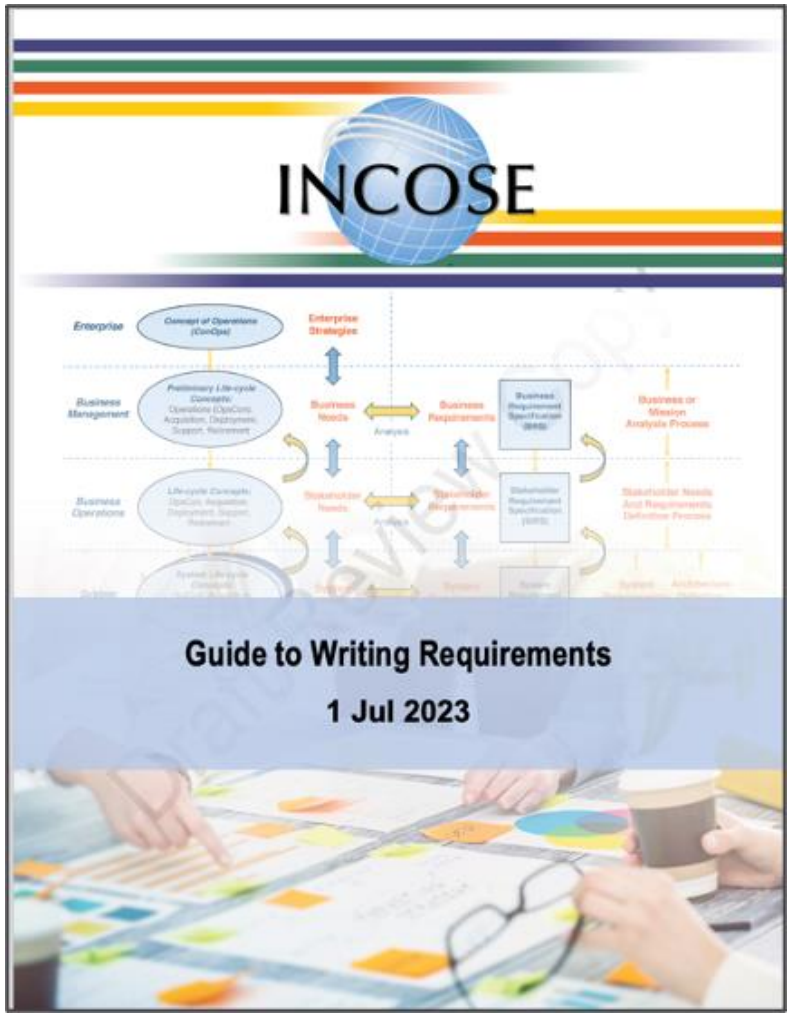
Needs and Requirements Manual (NRM)

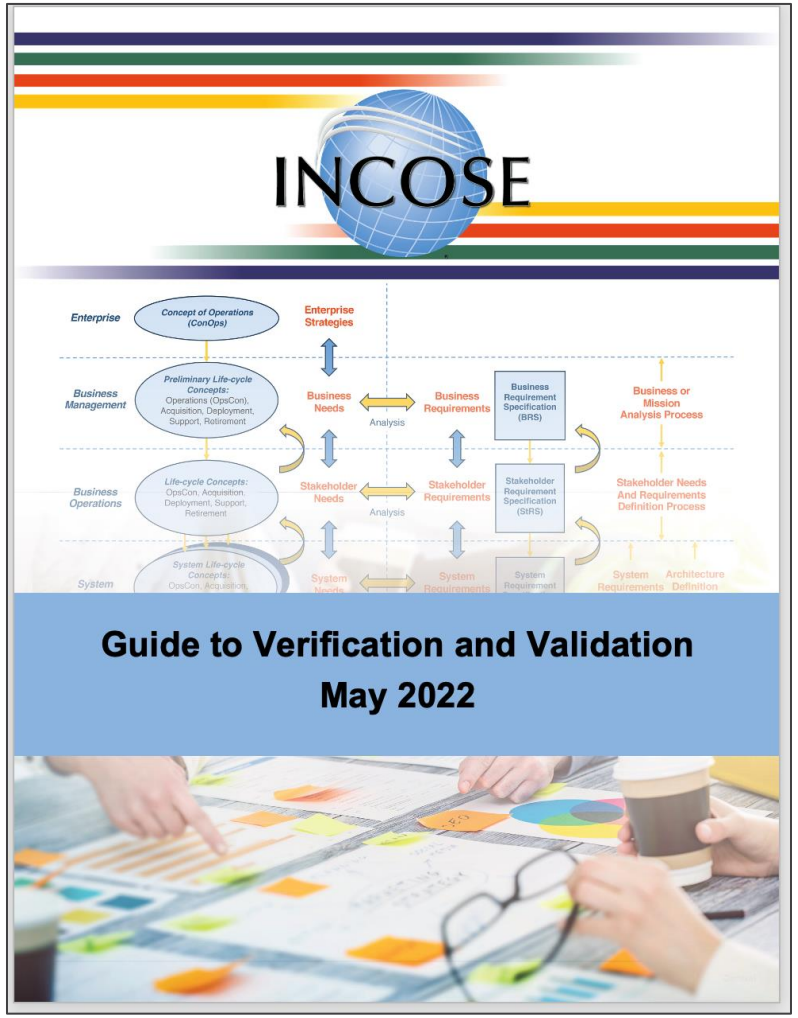
- The NRM (was NRVVLM) is the RWG flagship product, V1 released in January 2022
- V1.1 minor updates in May 2022 to shorten title, add subtitle, and align with other RWG products
- Content aligns with, and expands, the INCOSE SE Handbook version 5 material.



The RWG Guides Provide Practical Application of the NRM







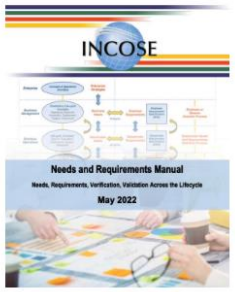
RWG Products are in the INCOSE Store!

- RWG Products are available in the INCOSE Store!
- Free to INCOSE members
- All are encouraged to download and start using, feedback is welcome!

Integrated Data as a Foundation of SE (Soft Copy)

Member Price: 0.00 USD

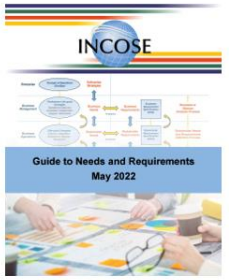
Non-Member Price: 0.00 USD



Needs and Requirements Manual (Soft Copy)

Member Price: 0.00 USD

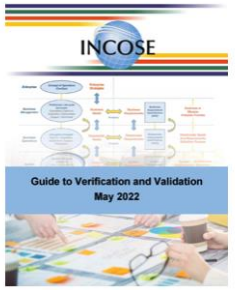
Non-Member Price: 35.00 USD



Guide to Needs and Requirements (Soft Copy)

Member Price: 0.00 USD

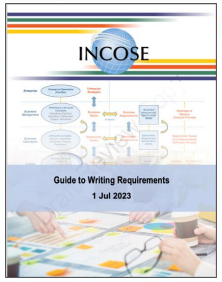
Non-Member Price: 25.00 USD



Guide to Verification and Validation (Soft Copy)

Member Price: 0.00 USD

Non-Member Price: 25.00 USD



Guide to Writing Requirements (Soft Copy)

Member Price: 0.00 USD

Non-Member Price: 25.00 USD

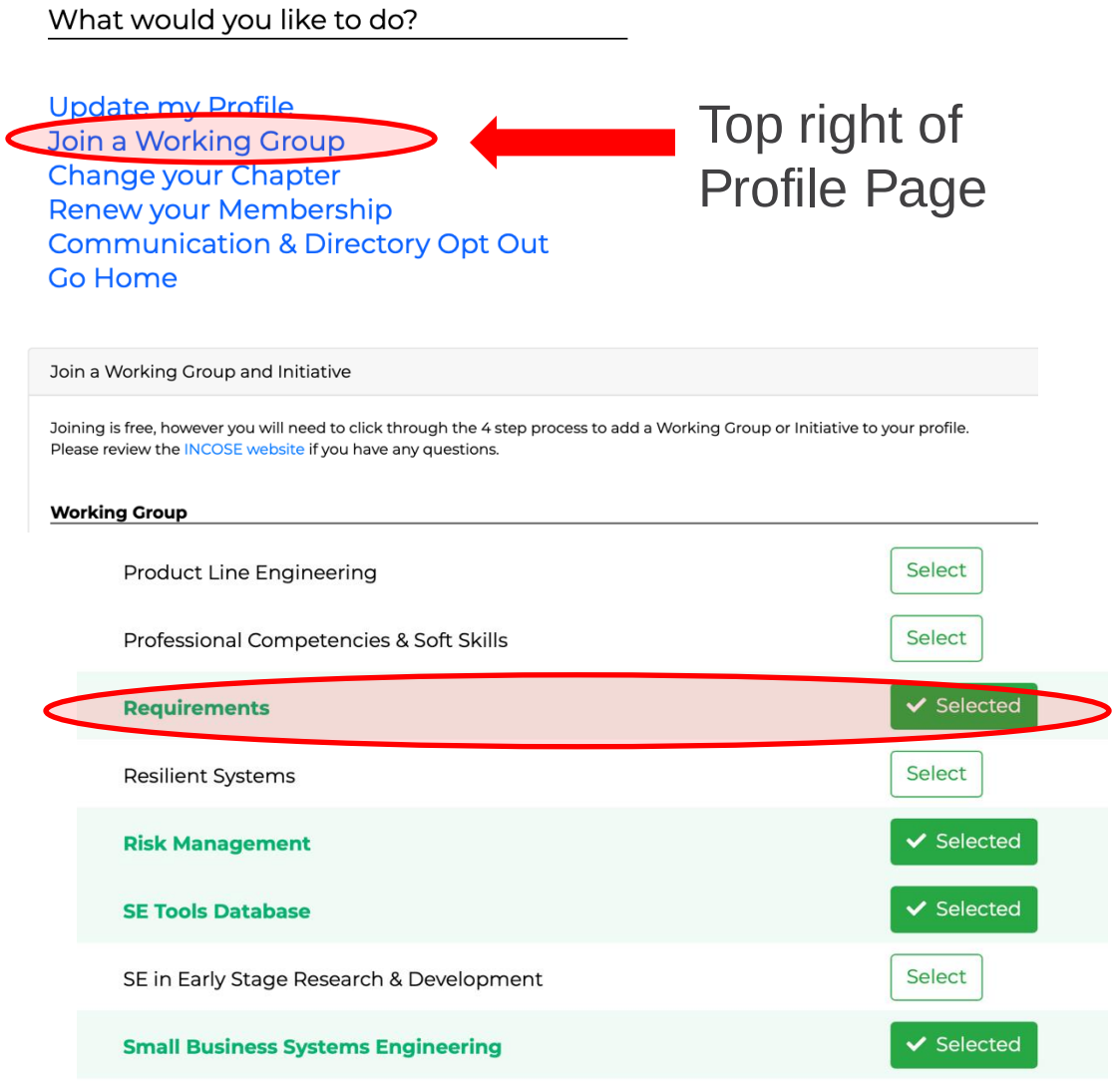
Guide to Writing Requirements Summary Sheet (Soft Copy)

Member Price: 0.00 USD

Non-Member Price: 0.00 USD

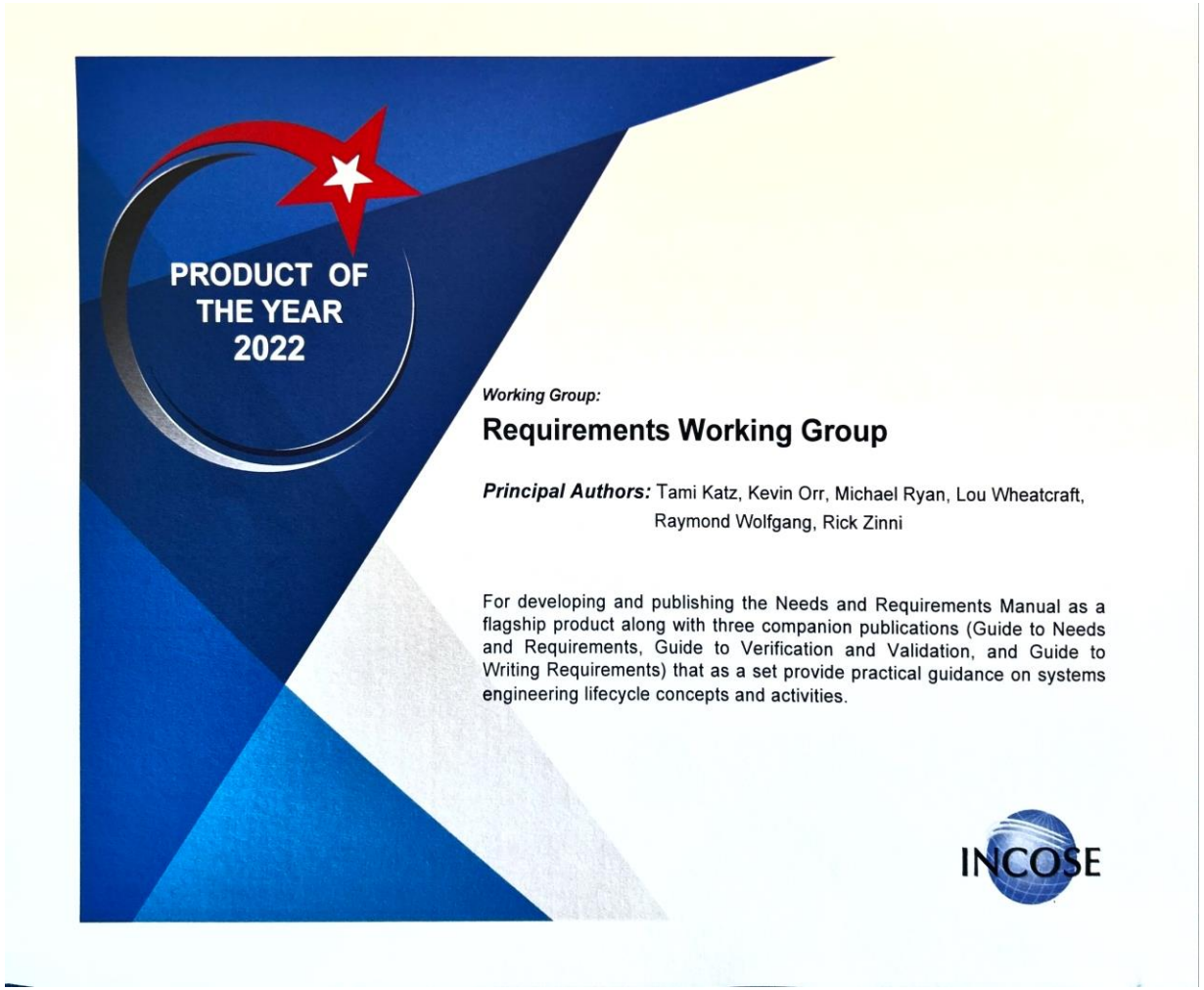
How to Become Involved in RWG

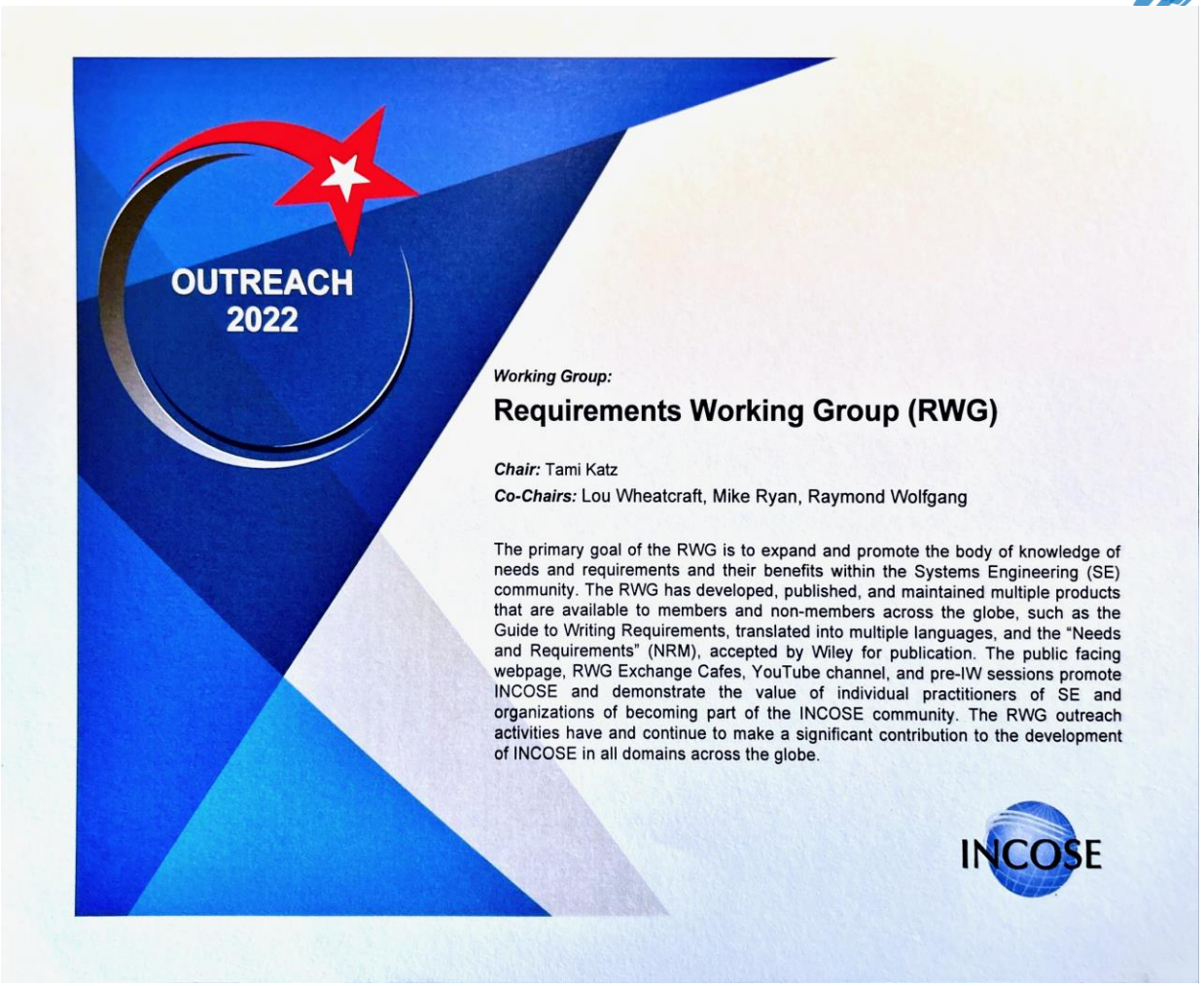
- As a large working group, the RWG has been very active in virtual events as well as smaller product team efforts.
- Joining the RWG enables the members to learn about the products, provide an opportunity to contribute to product development, and participate in the RWG virtual events with other practitioners.
- Members can be very involved (product support), involved in our monthly meetings, or minimally involved (view Viva Engage conversations or watch meeting recordings) - the intention is to enable all levels of participation and interaction.



RWG IW2023 Activities

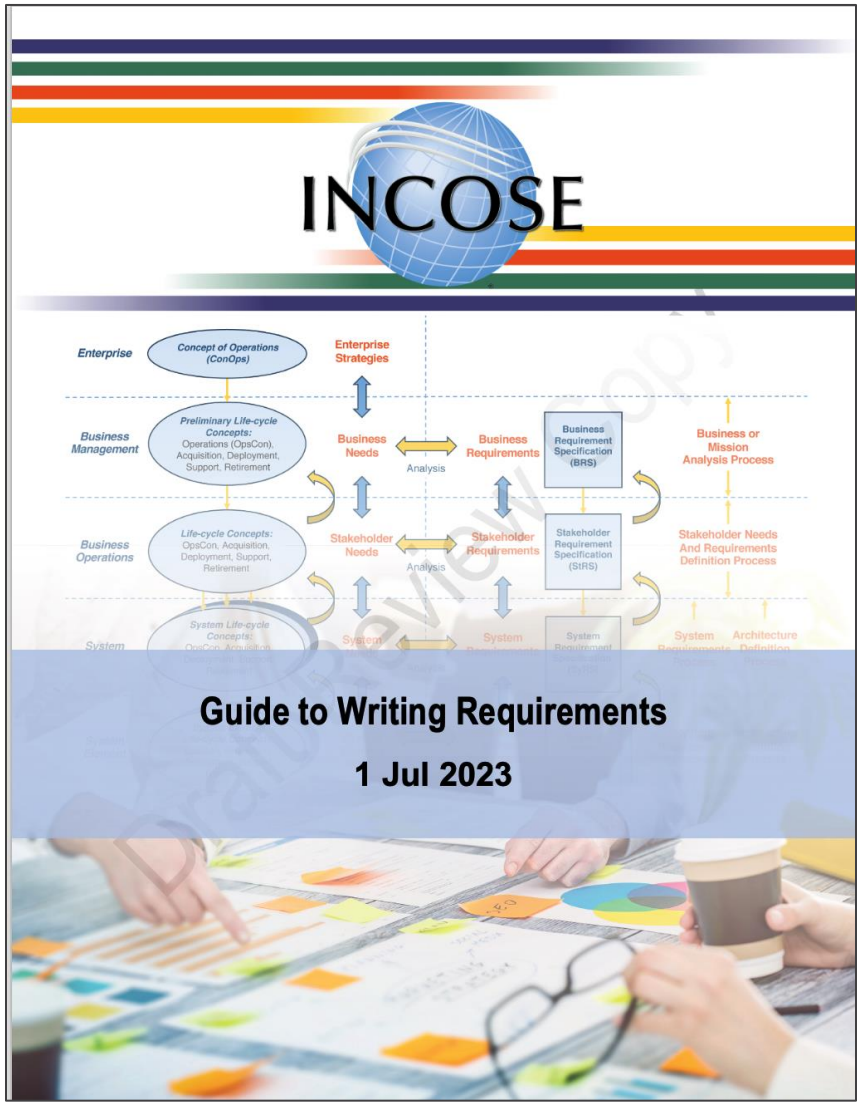
RWG Awards Presented at IW2023





RWG Award Presented at IW2024

Guide to Writing Requirements

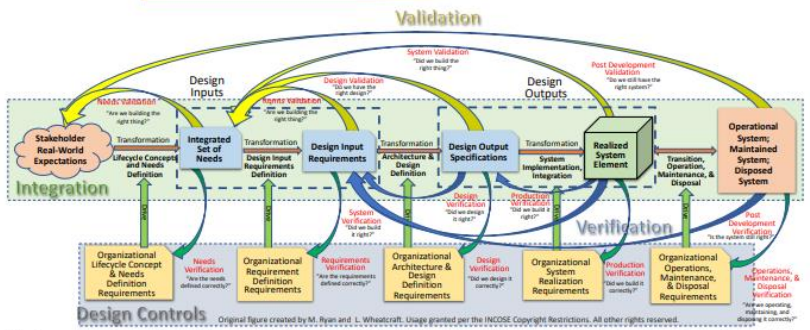


- The Guide to Writing Requirements (GtWR) has been a popular product from the RWG for many years.
- The **Gold Standard** for writing quality need and requirement statements.
- The RWG released V3.1 in May 2022 update to align the GtWR with the NRM, GtNR, & GtVV.
- **V4 was released in June 2023.**

"The INCOSE Guide To Writing requirements is referenced in the SYS.2 System Requirements Analysis process in Automotive SPICE 4.0. This is a major step forward for the automotive industry and will drive significant interest to INCOSE and especially the Requirements Working Group." LinkedIn post 12/18/23

GtWR
7-page Summary Sheet

INCOSE Guide to Writing Requirements V4 – Summary Sheet



Needs and Requirements are the common threads that tie all lifecycle activities and artifacts together. Once the needs are verified and validated, all subsequent artifacts are validated against the needs and once the resulting design input requirements are verified and validated, all subsequent artifacts are verified against those design input requirements.

Definitions

An ***entity*** is a single item to which a concept, need, or requirement applies: an organization, business unit, project, supplier, service, procedure, SOI (system, subsystem, system element), product, process, or stakeholder class (user, operator, tester, maintainer, etc.).

*A **concept** is a textual or graphic representation that concisely expresses how an entity can fulfill the problem, threat, or opportunity it was defined to address within specified constraints with acceptable risk that provides a business in terms of people, process, and products.*

*A set of **lifecycle concepts** includes multiple concepts across the lifecycle for how the organization (and stakeholders within an organization) expects to manage, acquire, define, develop, build/code, integrate, verify, validate, transition, install, operate, support, maintain, and retire an entity.*

*A **need statement** is the result of a formal transformation of one or more sources or lifecycle concepts into an agreed-to expectation for an entity to perform some function or possess some quality within specified constraints with acceptable risk.*

A ***requirement statement*** is the result of a formal transformation of one or more sources, needs, or higher-level requirements into an agreed-to obligation for an entity to perform some function or possess some quality within specified constraints with acceptable risk.

Characteristics

When defining needs and requirements, it is important that they have the characteristics of well-formed needs and requirements. These characteristics are a result of following the rules defined in the Guide to Writing Requirements (GtWR) as well as performing the activities associated with the definition of the needs and requirements as discussed in the Needs and Requirements Manual (NRM) and Guide to Needs and Requirements (GtNR). The underlying analysis from which a need or requirement was derived is as important as how well the need or requirement statement is formed.

Formal Transformation. Given the need and requirement is a result of a formal transformation, the following characteristics of a well-formed need or requirement have been derived:

C1 - Necessary: The need requirement statement defines capability, characteristic, constraint, or quality factor *needed or required* to satisfy a lifecycle concept, need, source, or higher-level requirement.

C2 - Appropriate: The specific intent and amount of detail of the need or requirement statement is appropriate to the level (the level of abstraction, organization, or system architecture) of the entity to which it refers.

C5 - Singular: The need or requirement statement should state a single capability, characteristic, constraint, or quality factor.

C8 - Correct: The need statement must be an accurate representation of the lifecycle concept or source from which it was transformed. The requirement statement must be an accurate representation of the need, source, or higher-level requirement from which it was transformed.

C9 - Conforming: Statements and expressions of individual needs and requirements should conform to an approved standard pattern and style guide or standard for writing and managing needs and requirements.

Agreed-to Obligation. Since the need and requirement is to be a part of a fair agreement to meet an obligation, the following characteristics of a need or requirement have been derived:

C3 - Unambiguous: Need and requirement statements must be stated such that their intent is clear and can be interpreted in only one way by all intended audiences.

C4 - Complete: *The need statement sufficiently describes the necessary capability, characteristic, constraint, conditions, or quality factor to meet the lifecycle concept or source from which it was transformed.* The requirement statement sufficiently describes the necessary capability, characteristic, constraint, conditions, or quality factor to meet the need, source, or higher-level requirement from which it was transformed.

C6 - Feasible: The need or requirement can be realized within entity constraints (for example: cost, schedule, technical, legal, ethical, safety) with acceptable risk.

C7 - Verifiable: The need statement is structured and worded such that its realization can be validated to the approving authority's satisfaction. The requirement statement is structured and worded such that its realization can be verified to the approving authority's satisfaction.

Characteristics of well-formed needs and requirements.

Rules for Need and Requirement Statements and Sets of Needs and Requirements

Accuracy

R1 - Structured Statements: Need and requirement statements must conform to one of the agreed patterns, thus resulting in a well-structured complete statement.

R2 – Active Voice: Use the active voice in the need or requirement statement with the responsible entity clearly identified as the subject of the sentence.

R3 - Appropriate Subject-Verb: Ensure the subject and verb of the need or requirement statement are appropriate to the entity to which the statement refers.

R4 - Defined Terms: Define all terms used within the need statement and requirement statement within an associated glossary and/or data dictionary.

R5 - Definite Articles: Use the definite article "the" rather than the indefinite article "a".

R6 - Common Units of Measure: When stating quantities, all numbers should have appropriate and consistent units of measure explicitly stated using a common measurement system in terms of the thing the number refers.

R7 - Vague Terms: Avoid the use of vague terms that provide vague quantification, such as "some", "any", "allowable", "several", "many", "a lot of", "a few", "almost always", "very nearly", "nearly", "about", "close to", "almost", and "approximate". Avoid vague adjectives such as "ancillary", "relevant", "routine", "common", "generic", "significant", "flexible", "expandable", "typical", "sufficient", "adequate", "appropriate", "efficient", "effective", "proficient", "reasonable" and "customary."

R8 - Escape Clauses: Avoid the inclusion of escape clauses that state vague conditions or possibilities, such as "so far as is possible", "as little as possible", "where possible", "as much as possible", "if it should prove necessary", "if necessary", "to the extent necessary", "as appropriate", "as required", "to the extent practical", and "if practicable".

R9- Open-Ended Clauses: Avoid open-ended, non-specific clauses such as "including but not limited to", "etc." and "and so on".

Concision

R10 - Superfluous Infinitives: Avoid the use of superfluous infinitives such as "to be designed to", "to be able to", "to be capable of", "to enable", "to allow".

R11 - Separate Clauses: Use a separate clause for each condition or qualification.

Non-ambiguity

R12 - Correct Grammar, 13 - Correct Spelling, 14 - Correct Punctuation - Use correct grammar, spelling, punctuation.

R15 - Logical Expressions: Use a defined convention to express logical expressions such as "[X AND Y]", "[X OR Y]", [X XOR Y]", "NOT [X OR Y]".

R16 - Use of "Not": Avoid the use of "not."

R17 - Use of Oblique Symbol: Avoid the use of the oblique ("/") symbol except in units, i.e., Km/hr, or fractions.

Singularity

R18 - Single Thought Sentence: Write a single sentence that contains a single thought conditioned and qualified by relevant sub-clauses.

R19 – Combinators: Avoid words that join or combine clauses, such as "and", "or", "then", "unless", "but", "as well as" "but also", "however", "whether", "meanwhile", "whereas", "on the other hand", or "otherwise".

R20 - Purpose Phrases: Avoid phrases that indicate the "purpose of ", "intent of", or "reason for" the need statement or requirement statement.

R21 – Parentheses: Avoid parentheses and brackets containing subordinate text.

R22 – Enumeration: Enumerate sets explicitly instead of using a group noun to name the set.

R23 - Supporting Diagram, Model, or ICD: When a need or requirement is related to complex behavior, refer to a supporting diagram, model, or ICD.

Completeness

R24 – Pronouns; Avoid the use of personal and indefinite pronouns.

R25 – Headings: Avoid relying on headings to support explanation or understanding of the need or requirement.

Realism

R26 – Absolutes: Avoid using unachievable absolutes such as 100% reliability, 100% availability, all, every, always, never, etc.

Conditions

R27 - Explicit Conditions: State conditions' applicability explicitly instead of leaving applicability to be inferred from the context.

R28 - Multiple Conditions: Express the propositional nature of a condition explicitly for a single action instead of giving lists of actions for a specific condition.

Uniqueness

R29 – Classification: Classify needs and requirements according to the aspects of the problem or system it addresses.

R30 - Unique Expression: Express each need and requirement once and only once.

Abstraction

R31 – Solution Free: Avoid stating implementation in a need statement or requirement statement unless there is rationale for constraining the design.

Quantifiers

R32 - Universal Qualification: Use "each" instead of "all", "any", or "both" when universal quantification is intended.

Tolerance

R33 - Range of Values: Define each quantity with a range of values appropriate to the entity to which the quantity applies and against which the entity will be verified or validated.

Quantification

R34 - Measurable Performance: Provide specific measurable performance targets appropriate to the entity to which the need or requirement is stated and against which the entity will be verified to meet.

R35 - Temporal Dependencies: Define temporal dependencies explicitly instead of using indefinite temporal keywords such as "eventually", "until", "before", "after", "as", "once", "earliest", "latest", "instantaneous", "simultaneous", and "at last".

Uniformity of Language

R36 - Consistent Terms and Units: Ensure each term and unit of measure used throughout need and requirement sets as well as associated models and other SE artefacts developed across the lifecycle are consistent with the project's defined ontology.

R37 – Acronyms: If acronyms are used, they must be consistent throughout need and requirement sets as well as associated models and other SE artefacts developed across the lifecycle.

R38 – Abbreviations: Avoid the use of abbreviations in needs and requirement statements as well as associated models and other SE lifecycle artefacts.

R39 - Style Guide: Use a project-wide style guide for individual need statements and requirement statements.

R40 - Decimal Format: Use a consistent format and number of signification digits for the specification of decimal numbers.

Modularity

R41 - Related Needs and Requirements: Group related needs and requirements together.

R42 – Structured Sets; Conform to a defined structure or template for organizing sets of needs and requirements.

Attributes of Need and Requirement Statements (defined in the NRM)

A minimum set of attributes that should be defined for each requirement are annotated with an asterisk ("*")

Attributes to Help Define Needs & Requirement and Their Intent

A1 - Rationale*
A2 - Trace to Parent*
A3 - Trace to Source*
A4 - States and Modes
A5 - Allocation/Budgeting*

Attributes Associated with System Verification & System Validation

A6 - System Verification or System Validation Success Criteria*
A7 - System Verification or System Validation Strategy*
A8 - System Verification or System Validation Method*
A9 - System Verification or System Validation Responsible Organization*
A10 - System Verification or System Validation Level
A11 - System Verification or System Validation Phase
A12 - Condition of Use
A13 -System Verification or System Validation Results
A14 -System Verification or System Validation Status

Attributes to Help Maintain the Requirements

A15 - Unique Identifier*
A16- Unique Name
A17 - Originator/Author*
A18 - Date Requirement Entered
A19- Owner*
A20 – Stakeholders
A21 - Change Board
A22 - Change Proposed
A23 - Version Number
A24 - Approval Date
A25 - Date of Last Change
A26 - Stability/Volatility
A27 - Responsible Person
A28 - Need or Requirement Verification Status*
A29 - Need or Requirement Validation Status*
A30 - Status of the Need or Requirement
A31 - Status (of Implementation)
A32 - Trace to Interface Definition
A33 - Trace to Dependent Peer Requirements
A34 - Priority*
A35 - Criticality or Essentiality*
A36 - Risk (of Implementation) *
A37 - Risk (Mitigation)
A38 - Key Driving Need or Requirement (KDN/KDR)
A39 - Additional Comments
A40 - Type/Category

Attributes to Show Applicability and Allow Reuse

A41- Applicability
A42 - Region
A43 - Country
A44 - State/Province
A45 - Market Segment
A46 - Business Unit

Attributes to Aid in Product Line Management

A47 – Product Line
A48 - Product Line Common Needs and Requirements
A49 - Product Line Variant Needs and Requirements

			Characteristics for Individual needs and requirements									Characteristics for Sets of needs requirements				
			Necessary	Appropriate	Unambiguous	Complete	Singular	Feasible	Verifiable	Correct	Conforming	Complete	Consistent	Feasible	Comprehendible	Able to be validated	Correct
Quality Focus	Rule	Subject	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15
Accuracy	R1	Structured Statements			X	X			X	X	X						
	R2	Active Voice		X	X	X			X								
	R3	Appropriate Subject-Verb		X	X				X		X				X		
	R4	Defined Terms			X				X				X		X	X	X
	R5	Definite Articles			X				X								
	R6	Common Units of Measure			X	X			X	X							
	R7	Vague Terms			X	X			X								
	R8	Escape Clauses			X				X								
	R9	Open-ended Clauses			X	X	X		X								
Concision	R10	Superfluous infinitives			X				X								
	R11	Separate Clauses			X	X			X	X							
Non-ambiguity	R12	Correct Grammar			X				X	X	X						
	R13	Correct Spelling			X				X								
	R14	Correct Condition			X					X							
	R15	Logical Expressions			X				X								
	R16	Use of "Not"			X				X	X							
	R17	Use of Oblique Symbol			X				X								
Singularity	R18	Single-thought Sentence			X		X		X		X				X		
	R19	Combinators			X		X										
	R20	Purpose Phrases	X				X										
	R21	Parentheses					X										

(includes the matrices)

RWG 2023 Completed Events and Activities

- **December:** Reviewed papers for IS2024
- **December**: Exchange Café: “Ultimate Requirements Assessment Part 3”
- **December:** INCOSE Turkey Chapter mini event on requirements: “Guide to Writing Requirements V4.”
- **November:** Exchange Café: “Ultimate Requirements Assessment Part 2”
- **October:** Presentation to the INCOSE Finger Lakes Chapter: “Guide to Writing Requirements V4.”
- **October:** Exchange Café: “Ultimate Requirements Assessment Part 1”
- **October:** INCOSE Webinar 168: “Guide to Writing Requirements V4”.
- **September:** Exchange Café: Implementing the latest concepts of the latest version 4.0 of the INCOSE Guide to Writing Requirements (GtWR) v4.0
- **August:** Exchange Cafe: Applying AI to MBSE
- **August:** Lecture to SE graduate class at CSU: “Ultimate Requirements Assessment”.
- **August:** Presentation to Boeing INCOSE CAB Lunch and Learn: “Overview of the RWG and GtWR V4”
- **August**: Presentation to the Texas Gulf Coast Chapter – “Guide to Writing Requirements V4”.

RWG 2023 Completed Events and Activities

- **July:** Presentation to the ChicagoLand Chapter – "Defining Needs and Requirements for Sustainable Systems".
- **July:** INCOSE NTX Chapter Presentation: "Overview of the RWG".
- **July:** RWG monthly meeting held at IS 2023
- **July:** Released the GtWR V4
- **June:** Exchange Cafe: "SE Quality Management WG and Requirements WG Interactions"
- **May:** Presentation to the ChicagoLand Chapter – "GtWR Rules for Writing Well-formed Needs and Requirements".
- **May:** Exchange Cafe: "Applying AI for Requirements Development".
- **April:** Presentation to the ChicagoLand Chapter – "NRM Section 6 & 7 Design Input Requirements Definition".
- **April:** "Techniques to Keep Requirements Sets Comprehensible".
- **April:** EMEA 2023 Presentation – "Defining Needs and Requirements for Sustainable Systems"
- **March:** RWG monthly meeting Model-Based Structured Requirements in SysML
- **February:** "RWG Exchange Cafe - Insights from IW2023".
- **January:** RWG Meetings at IW2023 (see next slide)

Recordings of monthly meetings and presentations are available on the INCOSE RWG YouTube Channel

Presentations given at IW 2023

Pre_IW2023 Event

- "Collaboration in Needs/Requirements Development" by Raymond Wolfgang
- "Configuration Management of Variants Across the Digital Thread", by Henrik Mattfolk
- "Project Data Dictionaries: A choice piece to comply with the INCOSE Guide to Writing Requirements", by Ilyes Yousfi
- "Standards and Regulations Compliance" by Lou Wheatcraft
- "Capabilities for Libraries of Requirements, Standards, and Regulations" by Cary Bryczek
- "Quantitative Aspects and Considerations with Requirements", by Carlo Leardi

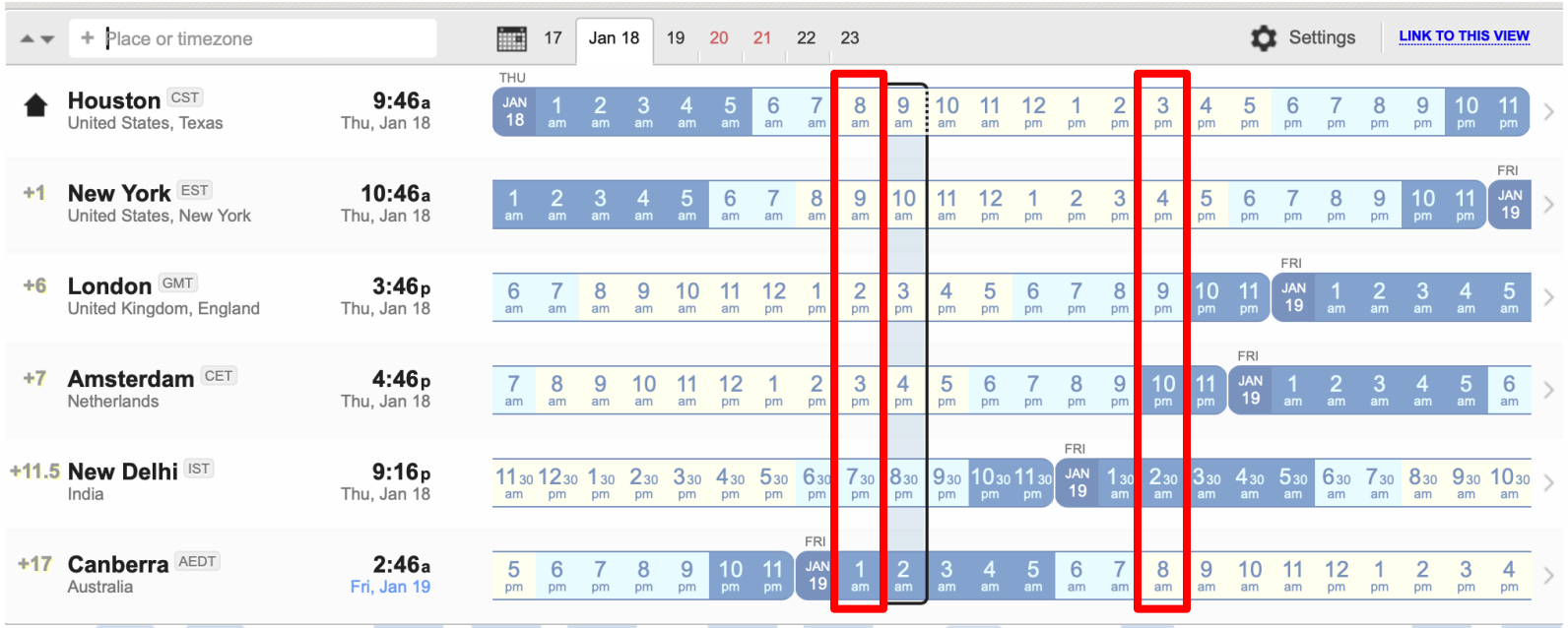
During RWG IW2023 Sessions

- "GtWR Introduction and Key Underlying Concepts" by Lou Wheatcraft
- GtWR Section 2 "Characteristics of Individual Need & Requirement Statements" by Lou Wheatcraft
- GtWR Section 3 "Characteristics of Sets of Needs and Sets of Requirements" by Lou Wheatcraft

RWG 2024 Plans

Planning for 2024

- New RWG organization – to expand opportunities of engagement.
  - Chair and co-chairs
  - Third level of project managers
    - Members can propose projects (writing a paper and/or developing a new Guide).
- Addressing time zone issues with a worldwide membership.
  - Will try having our monthly meetings scheduled twice.
    - 8 am CT US and 3 pm CT US



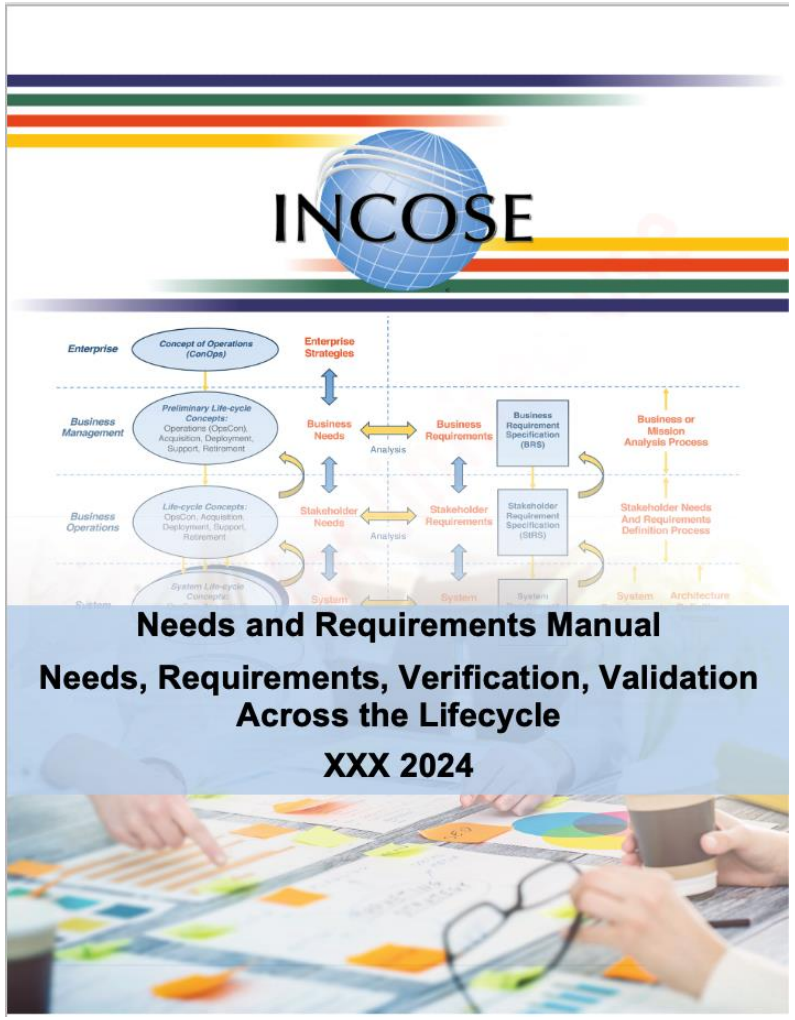
Planning for 2024

- Publication of NRM v2
- Update the SEBok
- Collaboration with other WGs
- Continue RWG Monthly meetings
- Continue to add presentations to our YouTube Channel
- Develop guidance on the use of our products - legally
- Develop guidance and a road map for using videos on our YouTube Channel for education and training.
- Develop new whitepapers and guides

The following slides elaborate on these topics

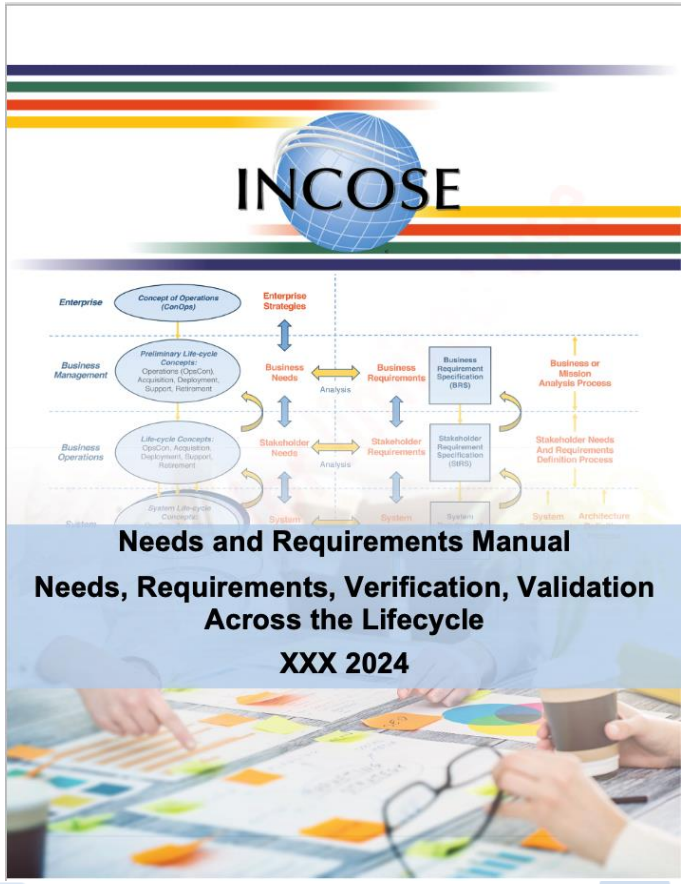
NRM V2

- INCOSE is under contract with Wiley to publish the NRM.
- Response has been very positive, e.g.,
  - *"The NRM has been a godsend for my organization!"*
  - *"The 2022 Needs and Requirements Manual is a must read! Awesome work!"*
- Incorporated changes/updates based on comments received.
  - Thanks to everyone that did a review and provided comments!
- Updates included:
  - Changes as a result of maturation of thinking.
  - Updates to the GtWR incorporated, to ensure consistency.
  - More concise wording.
  - Some reorganization.
  - Added additional figures.
  - Added case study (Lid Installation Robot)
  - 490 pages
- Version 2 of the Needs and Requirements Manual (NRM) has been submitted to Wylie for publication.



Update of the SEBoK

- With updates to RWG material, we plan to ensure alignment of the SEBoK with the concepts in the NRM.



SEBoK GUIDE TO THE SYSTEMS ENGINEERING BODY OF KNOWLEDGE

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Stewards

INCOSE | IEEE Systems Council | Stevens Institute of Technology

Quicklinks

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Outline

- Table of Contents
- Part 1: SEBoK Introduction
- Part 2: Foundations of Systems Engineering
- Part 3: SE and Management
  - Systems Engineering STEM Overview
  - Model-Based Systems Engineering (MBSE)
  - Systems Lifecycle Approaches
  - System Lifecycle Models
  - Systems Engineering Management
  - Business and Mission Analysis
  - Stakeholder Needs Definition

Stakeholder Needs Definition

Guide to the Systems Engineering Body of Knowledge (SEBoK) > Special:Search > Stakeholder Needs and Requirements > Stakeholder Needs Definition

Lead Authors: *Alan Faisandier, Garry Roedler,* ***Contributing Author:*** *Rick Adcock*

Stakeholder needs and requirements represent the views of those at the business or enterprise operations level—that is, of **users**, **acquirers**, **customers**, and other **stakeholders** as they relate to the problem (or opportunity), as a set of requirements for a solution that can provide the services needed by the stakeholders in a defined environment. Using enterprise-level life cycle concepts (see Business or Mission Analysis for details) as guidance, stakeholders are led through a structured process to elicit stakeholder needs (in the form of a refined set of system-level life-cycle concepts). Stakeholder needs are transformed into a defined set of Stakeholder Requirements, which may be documented in the form of a model, a document containing textual requirement statements or both.

Stakeholder requirements play major roles in systems engineering, as they:

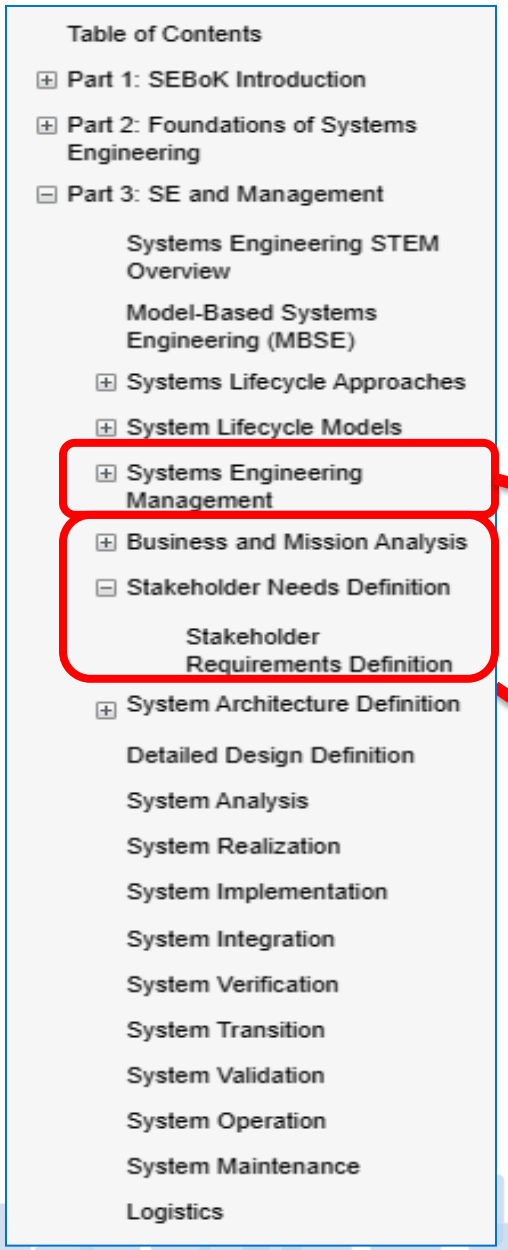
- Form the basis of **system requirements** activities.
- Form the basis of system **validation** and stakeholder acceptance .
- Act as a reference for **integration** and **verification** activities.
- Serve as means of communication between the technical staff, management, finance department, and the stakeholder community.

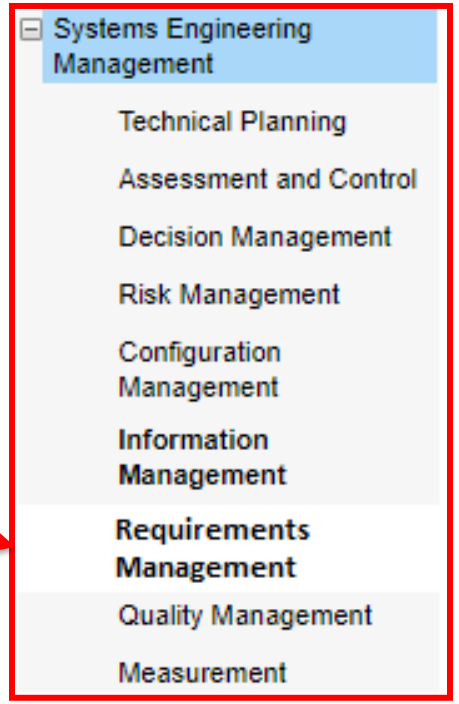
This topic describes the definition of stakeholder needs and requirements which involves the activities necessary to elicit and prioritize the needs of the stakeholder(s), and transform those needs into a set of defined stakeholder requirements. Defining the problem or the issue to be solved, identifying the opportunity for developing a new solution, or improving a **system-of-interest (SoI)** must begin prior to starting the activities necessary to define stakeholder needs and requirements. This means that an initial context of use of the new or modified mission, operation, or capability has already been characterized (see Business or Mission Analysis). System requirements are considered in detail during **system definition**. None of the above can be considered complete until consistency between the two has been achieved, as demonstrated by **traceability**, for which a number of iterations may be needed.

Contents [hide]

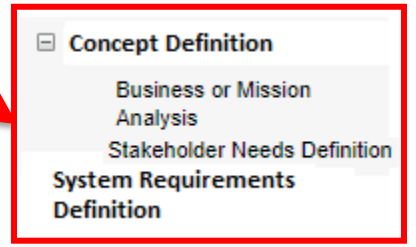
1 Purpose and Definition
2 Principles and Concepts
  2.1 Identifying Stakeholders
  2.2 Identifying Stakeholder Needs

RWG Planned Updates





Add Article on Requirements Management

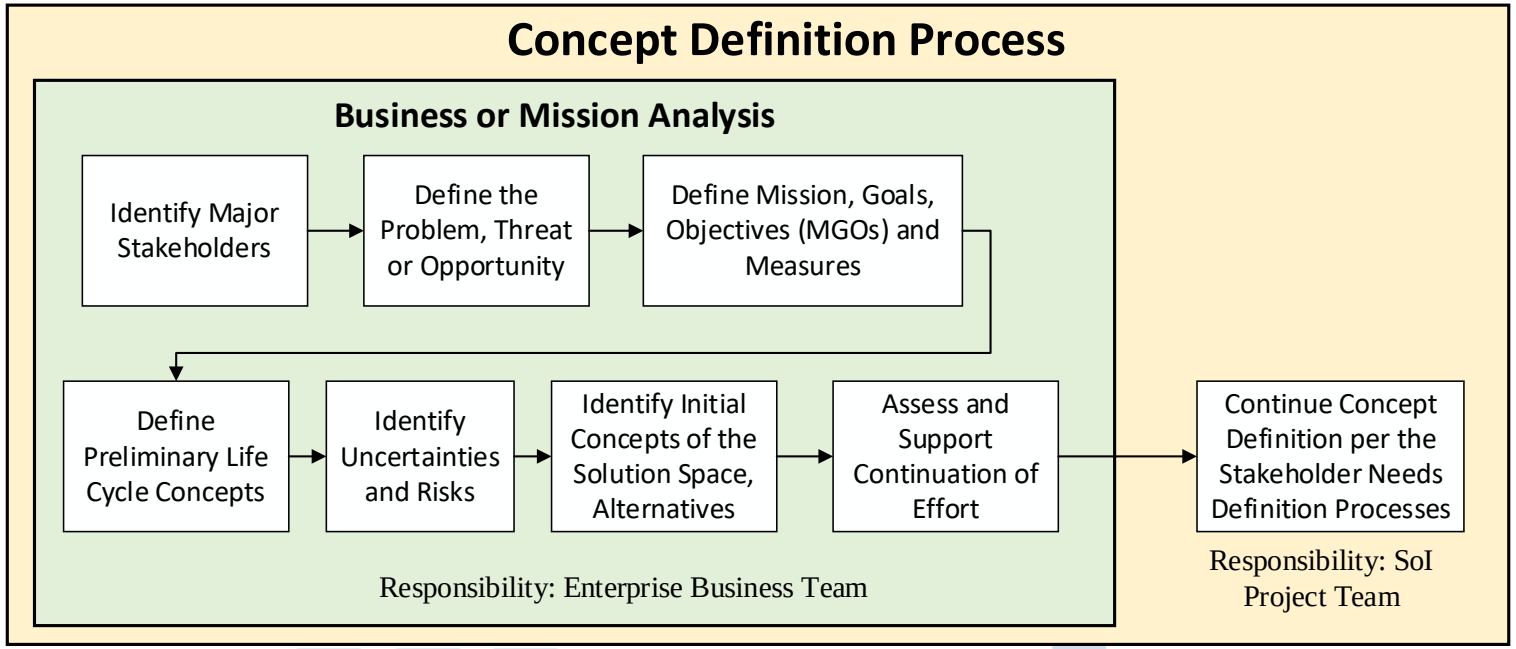


Revise Articles to Address:

- Problem/Opportunity/Threat, MGOs
- Lifecycle Concepts and Needs Definition
- Design-input Requirements Definition

Nomenclature Usage in Articles

- As the SEBoK is a joint product with INCOSE and other organizations, the expectation is that terminology aligns with ISO 15288 (2023) and current SE Handbook.
- The RWG approach taken is to use the concepts of the INCOSE NRM, while keeping the SE Handbook nomenclature, to ensure the multiple organizations concur with the narratives.



Example of RWG Updates

Stakeholder Needs Definition

Purpose and Definition

The purpose of the Stakeholder Needs and Requirements definition activities are to elicit a set of clear and concise needs related to a new or changed mission for an enterprise (see mission analysis (MA) for information relevant to identifying and defining the mission or operation), and to transform these stakeholder needs into verifiable stakeholder requirements.

Stakeholders may well begin with desires, and expectations that may contain vague, ambiguous statements that are difficult to use for SE activities. Care must be taken to ensure that those desires and expectations are coalesced into a set of clear and concise need statements that are useful as a start point for system definition. These need statements will then need to be further clarified and translated into more *engineering-oriented* language in a set of stakeholder requirements to enable proper architecture definition and requirement activities. As an example, a need or an expectation such as, *to easily* manoeuvre *a car in order to park*, will be transformed in a set of **stakeholder requirements** to a statement such as, *increase the driviability of the car, decrease the effort for handling, assist the piloting, protect the coachwork against shocks or scratches*, etc.

To allow a clear description of the activities of stakeholder needs and requirements to be described, a generic view of the business teams and roles involved in a typical enterprise has been used below., tThis includes teams such as business management and business operations;, and roles including requirements engineer and business analyst. For an overview of these roles and how they enable both stakeholder and business requirements across the layers of a typical enterprise see Life Cycle Processes and Enterprise Need.

Principles and Concepts

Identifying Stakeholders

Stakeholders of a SoI may vary throughout the **life cycle**. Thus, in order to get a complete set of needs and subsequent requirements, it is important to consider all stages of the **life cycle model** when identifying the stakeholders or classes of stakeholders.

Every system has its own stages of life, which typically include stages such as concept, development, production, operations, sustainment, and retirement (for more information, please see Life Cycle Models). For each stage, a list of all stakeholders having an interest in the future system must be identified. The goal is to get every stakeholder's point of view for every stage of the system life in order to consolidate a complete set of stakeholder needs that can be prioritized and transformed into the set of stakeholder requirements as exhaustively as possible. Examples of stakeholders are provided in Table 1.

Stakeholder Needs Definition

Purpose and Definition [edit | edit source]

The initial effort of SoI development is to establish the problem space, which is used as inputs into the design process. As shown in Figure 1, prior to the establishment of requirements there is an activity to gather *Needs*. These needs are assessed from multiple analysis activities, resulting in an Integrated Set of Needs that includes stakeholder needs, risks, drivers, constraints, and the results from life cycle concepts analysis and maturation effort.

[figure here]

Figure 1. Establishment of an Integrated Set of Needs ensures that all perspectives are analyzed during the Stakeholder Need Definition process, including risks, drivers, constraints, and life cycle concepts analysis and maturation. Figure from INCOSE Needs and Requirements Manual v1.1, Figure 1-2.

The establishment of needs forms the basis of a full understanding of the capabilities expected of the SoI, and these needs are ultimately transformed into a set of design-input requirements on the SoI as part of the System Requirements definition process.

Principles and Concepts [edit | edit source]

The results of the Business and Mission Analysis [link to page] is provided to the project team to complete the rest of the process of SoI concept definition using the Stakeholder Needs Definition process (shown in Figure 2). This includes the problem, threat or opportunity statement capturing why the project is worth doing, the mission, goals and objectives (MGOs) used as the criteria for project success, along with identification of major stakeholders, initial life cycle concepts, and identification of initial concepts of the solution space.

[insert figure here]

Figure 2. Stakeholder Needs Definition expands upon the Business or Mission Analysis results to refine the set of needs for the SoI. Original SEBoK figure.

The Stakeholder Needs Definition process continues the concept definition effort to ensure the **system-of-interest (SoI)** will provide the capabilities needed by users and other stakeholders in a defined environment. This process is much more than identification and elicitation of need statements from various stakeholders, it consists of a series of analysis steps done to ensure that all parameters are captured, including risks, drivers, constraints, as well as the SoI life cycle concepts analysis and maturation (shown in Figure 2); this effort results in an Integrated Set of Needs. [glossary term addition].

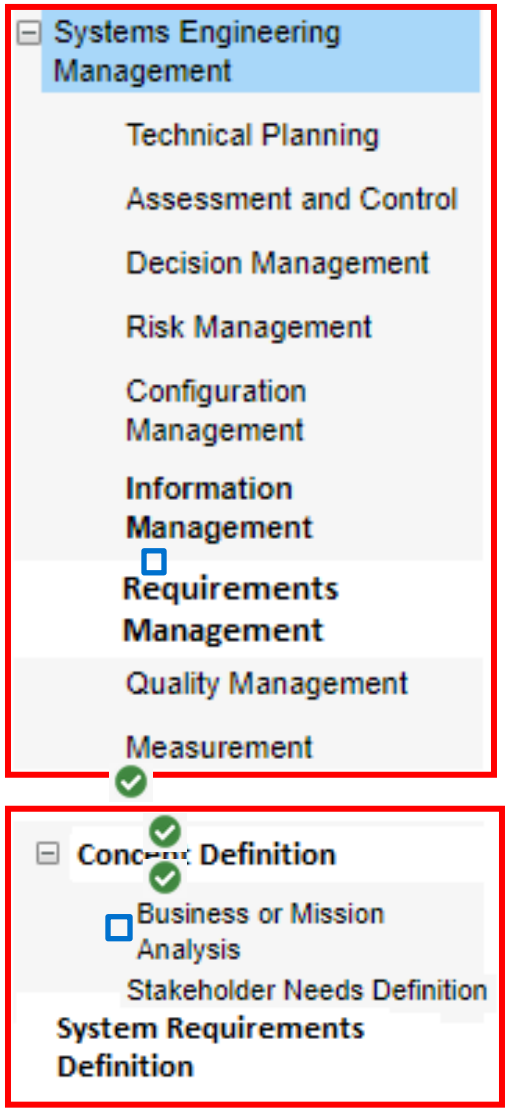
[insert Figure here]

Figure 3. Establishment of an Integrated Set of Needs ensures that all perspectives are analyzed during the Stakeholder Need Definition process, including risks, drivers, constraints, and life cycle concepts analysis and maturation. Figure from INCOSE Needs and Requirements Manual v1.1, Figure 4-5.

Each article addresses concepts to align with INCOSE NRM approaches.
(Note: all figures are inserted by Editors prior to publishing)

SEBoK Update Status

- Tami Katz received access and training to the draft SEBoK wiki late 2023.
- Initial draft updates have been made to three pages, two more planned.
- SEBoK work paused while NRM v2 updates occurred, this will ensure the SEBoK contains the most current material.
- RWG content will be ready for review by March, with plans to be published in the May 2024 SEBoK v2.10 release.



Continue Collaboration with Other Working Groups

- System Security Engineering (SSE) WG
  - Development of a new "Guide to Security Needs and Requirements" (Beth Wilson)
- System of Systems (SoS) WG
- Configuration Management (CM) WG
  - Coauthored a paper on Traceability submitted for IS2024
- Systems Engineering and Quality Management (SEQM) WG
- Others??

Continue our Monthly Meetings

- Will continue with the evaluation of poorly formed requirements series.
- We have several proposed presentations on various topics in work.
- If you have a topic you would like addressed or a presentation you would like to give, let us know.
- Meeting announcements will be via Viva Engage and email.

New Initiatives

- New Initiatives.
  - Develop guidelines on how to use INCOSE WG materials (Katarzyna lead)
    - How organizations can use RWG materials legally in their organizations - what is allowed and what is not (“do and don’ts”).
    - Expand on INCOSE boilerplate copyright information
      - Use of and distribution within organizations
      - Including text and figures in training and presentations
  - Education and Training (Katarzyna lead)
    - YouTube Channel contains many videos that could be used as educational material (e.g., lunch & learn meetings during which a team watches and discusses a video.
    - Need a roadmap with these videos to ensure people can find the videos quickly and watch them sequentially.
    - Need to identify topics in the Manual and other products that are not currently addressed. For missing topics, we’ll try to address them in the upcoming monthly meetings and post the videos on the YouTube channel to guarantee sufficient coverage.

New Products

- Additional Guides to elaborate on key concepts and activities of the NRM.
  - Proposed “Guide to Model-based Needs and Requirements” (Jeff)
    - Stress practical guidance on the application of the concepts and activities in the NRM to the needs and requirements definition in a Model-based Environment.
  - Proposed “Guide to Embedded Software Needs and Requirements” (Katarzyna)
  - Other guides based on member interests and needs.
  - We ask all members to identify the need:
    - for further elaboration or application guidance of any of the concepts and activities in the NRM or other products
    - the need to tailor the concepts and activities in the NRM to specific domains.
      - Often the intent is the same, but many domains use specific terminology that is different than that used in the RWG products.
      - Need a “decoder ring” to align terminology and activities.

Why create a *Guide to Model-based Needs and Requirements?*

- Model-based Systems Engineering has not diminished the importance of properly developed and well-formed needs and requirements.
- Systems Engineering activities associated with developing needs and requirements are important and still must be performed.
- Industry is moving towards a digital environment that will integrate tools, data, and products.
- Needs and requirements must be more closely tied to the processes of architecting, designing, integration, verification, and validation.

  "Needs and Requirements are the common threads that tie all SE process activities and artifacts together across the lifecycle."
- How industry develops an understanding of needs and requirements and integrates them across the system lifecycle will bring change to how products are developed, produced, maintained, and retired.
- **The intent of this Guide is to address the "how".**

Why create a *Guide to Embedded Software Needs and Requirements?*

- Today's systems are increasingly software-centric - both hardware and software are necessary to realize complex systems.
- How should these two domains work effectively together across the lifecycle – lifecycle concepts, needs, requirements, architecture, flow down of requirements (allocation and budgeting), design, testing, verification, and validation?
- What is the specific focus of each domain?
- How to identify and manage the interdependencies?
- How to manage the integrated system (avoiding siloes)?
- How do we prevent conflicts when during collaboration?
  - Systems Engineering Technical Processes vs Agile.

Questions and Discussion

2024

Annual INCOSE international workshop

HYBRID EVENT

Torrance, CA, USA

January 27 - 30, 2024

www.incose.org/IW2024