

Welcome to the Webinar! Please note that we have moved to the ZOOM platform. Please join ZOOM audio (Voice over Internet) if you are able to connect. Otherwise, please see the webinar invitation for dial-in phone lines

# INCOSE Webinar Series

Wednesday 17<sup>th</sup> August 2022 – Webinar 160

**Impact of INCOSE Systems Engineering  
Handbook update on Certification Process**



Mrunmayi Joshi Courtney Wright

# With thanks to our Sponsors for 2022



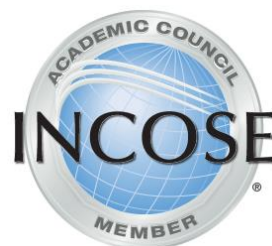
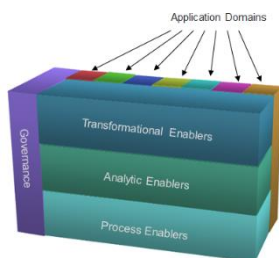
# INCOSE is offering Webinars...



**27<sup>th</sup>** annual **INCOSE**  
international symposium  
Adelaide, Australia  
July 15 - 20, 2017



Vision25  
INCOSE



**INSIGHT**

**Systems Engineering**



**2017**  
annual **INCOSE**  
international workshop  
Los Angeles, CA, USA  
January 28 - 31, 2017

- To provide a forum for experts in the field of Systems Engineering to present information on the “State of the Art”
- To explain how INCOSE works, and how to make the most out of INCOSE membership



# INCOSE Systems Engineering Professional PDU Credit

For more information about INCOSE certification renewal, including PDU categories and limits:

<http://www.incose.org/certification/CertProcess/CertRenew>

You can claim 1 PDU credit towards your INCOSE Systems Engineering Professional (SEP) renewal by attending this entire webinar.

## Claim PDUs



## Eligible Sources To Claim PDU

- Live attendance at the webinar: "Attend non-peer-reviewed Professional Technical Society event."
- Watching a recording of the webinar: "Consume SE-related media, including journal article, book, video, or audio."

INCOSE webinars may also apply to the PDU requirements of other organizations, depending on the subject matter.

## Claim PDUs for Other certifications



# Choreography

1. Andy Pickard (your host) will introduce the Webinar and the speakers
2. Mrunmayi Joshi and Courtney Wright will speak for about 40 to 45 minutes
3. During their talk, participants can write questions using the Zoom Q&A window
4. After Joshi and Courtney complete their talk, they will spend 10 minutes answering questions that Andy selects from those submitted by the audience
5. Andy Pickard will provide information about upcoming Webinars and then end this session
6. This Webinar is being recorded and will be made available on the INCOSE website to members and employees of CAB organizations





# Impact of INCOSE Systems Engineering Handbook update on the Certification Process

By,

[Mrunmayi Joshi](#)

[Courtney Wright](#)

17-August-2022



# Agenda

- INCOSE Systems Engineering Handbook update
- Timeline for knowledge exam development and transition
- Timeline for Learning Objectives release and Academic Equivalency Transition
- Certification Stakeholders
- Impact on certification stakeholders
- Communication
- Q and A



# INCOSE Systems Engineering Handbook update

## Purpose of INCOSE Systems Engineering Handbook :

- Describes key process activities performed by systems engineers and other engineering professionals throughout the life cycle of a system
- Describes a wide range of fundamental systems concepts that broaden the thinking of the systems engineering practitioner

## Motivation behind handbook update:

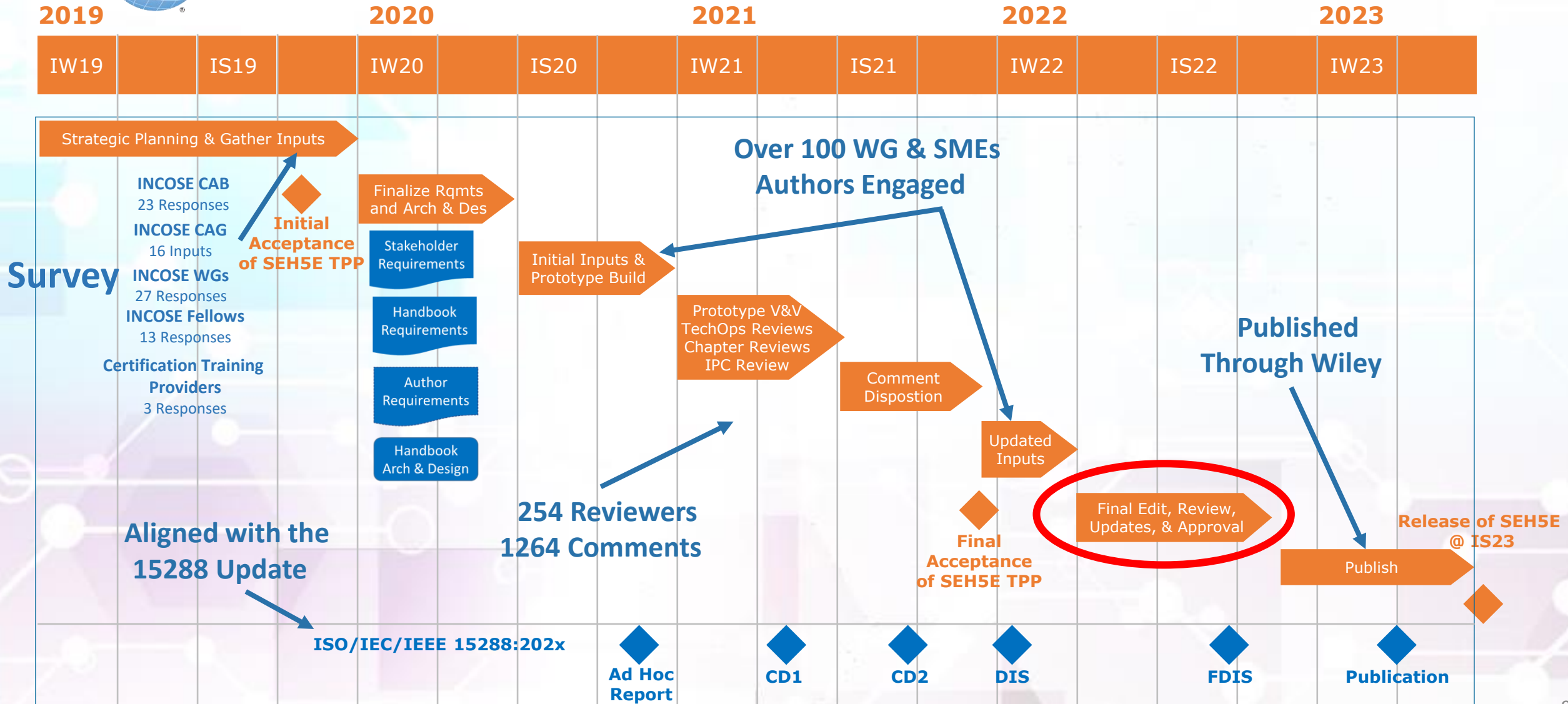
Since INCOSE Systems Engineering Handbook reflects the state-of-the-good-practice of Systems Engineering, it generally is updated every 5-8 years to capture/incorporate:

- Changes in Systems Engineering due to improved principles, processes, methods and tools.
- New information like Digital Engineering.
- Updated versions of systems engineering standards (ISO/IEC/IEEE 15288).
- New challenges and Vision in Systems Engineering





# INCOSE SE Handbook 5E Schedule



## Structure of 4<sup>th</sup> Edition

## Front Matter

Chapter I - Systems  
Engineering  
Handbook Scope

Chapter II - Systems  
Engineering  
Overview

Chapter III – Generic  
Lifecycle Stages

Chapter IV –  
Technical Processes

Chapter V – Technical  
Management  
processes

Chapter VI –  
Agreement  
Processes

Chapter VII –  
Organization Project-  
Enabling Processes

Chapter VIII –  
Tailoring process and  
Application of  
Systems Engineering

Chapter IX – Cross-  
cutting Systems  
Engineering  
Processes

Chapter X – Specialty  
Engineering Activities

## Appendices

## Structure of 5<sup>th</sup> Edition

## Front Matter

Part I - Systems  
Engineering  
introduction

Part II - System Life  
Cycle Concepts,  
Models and  
Processes

Part III - Life Cycle  
Analyses and  
Methods

Part IV - Tailoring and  
Application  
Considerations

Part V - Systems  
Engineering in  
Practice

Part VI - Case Studies

## Appendices

## Part I - Systems Engineering introduction

- 1.1 What is Systems Engineering?
- 1.2 Why is Systems Engineering Important?
- 1.3 Systems Concepts
  - 1.3.1 System Boundary and the System of Interest (Sol)
  - 1.3.2 Emergence
  - 1.3.3 Enabling Systems, Interoperating Systems, and Interfacing Systems
  - 1.3.4 System Innovation Ecosystem
  - 1.3.5 The Hierarchy within A System
  - 1.3.6 Systems States and Modes**
  - 1.3.7 Complexity
- 1.4 Systems Engineering Foundations
  - 1.4.1 Uncertainty**
  - 1.4.2 Cognitive Bias**
  - 1.4.3 Systems Engineering Principles**
  - 1.4.4 Systems Engineering Heuristics**
- 1.5 System Science and Systems Thinking

## Part II - System Life Cycle Concepts, Models and Processes

- 2.1 Life Cycle Terms and Concepts
  - 2.1.1 Life Cycle Characteristics
  - 2.1.2 Typical Life Cycle Stages
  - 2.1.3 Decision Gates

- 2.2 Life Cycle Models
  - 2.2.1 Sequential Methods
  - 2.2.2 Incremental and Iterative Methods
  - 2.2.3 Technical Reviews and Audits**

- 2.3 System Life Cycle Processes
  - 2.3.1 Introduction to the System Life Cycle Processes
    - 2.3.1.1 Format and Conventions
    - 2.3.1.2 Concurrency, Iteration, and Recursion
  - 2.3.2 Agreement Processes
  - 2.3.3 Organizational Project Enabling Processes
  - 2.3.4 Technical Management Processes
  - 2.3.5 Technical Processes

## Part III - Life Cycle Analyses and Methods

- 3.1 Quality Characteristics
  - 3.1.1 Introduction to Quality Characteristics
  - 3.1.2 Affordability
  - 3.1.3 Agility
  - 3.1.4 Human Systems Integration
  - 3.1.5 Interoperability
  - 3.1.6 Logistics/Supportability
  - 3.1.7 Manufacturability/ Producibility
  - 3.1.8 Reliability, Availability, Maintainability
  - 3.1.9 Resilience
  - 3.1.10 Sustainability /Disposability
  - 3.1.11 System Safety
  - 3.1.12 System Security
  - 3.1.13 Other Quality Characteristics**

- 3.2 Systems Engineering Analysis and Methods
  - 3.2.1 Modeling, Analysis, and Simulation
  - 3.2.2 Prototyping
  - 3.2.3 Traceability**
  - 3.2.4 Interface Management
  - 3.2.5 Architecture Frameworks**
  - 3.2.6 Patterns
  - 3.2.7 Design Thinking**

## Part IV - Tailoring and Application Considerations

## 4.1 Tailoring Considerations

- 4.2 SE Methodology / Approach Considerations
  - 4.2.1 Model-Based SE
  - 4.2.2 Digital Engineering**
  - 4.2.3 Agile Systems Engineering
  - 4.2.4 Lean Systems Engineering
  - 4.2.5 Product Line Engineering (PLE)

- 4.3 System Types Considerations
  - 4.3.1 Greenfield/Clean Sheet Systems
  - 4.3.2 Brownfield/Legacy Systems
  - 4.3.3 Commercial-off-the-Shelf (COTS)-Based Systems
  - 4.3.4 Software-Intensive Systems
  - 4.3.5 Cyber-Physical Systems (CPS)
  - 4.3.6 System of Systems (SoS)
  - 4.3.7 Internet of Things (IoT)/Big Data-Driven Systems
  - 4.3.8 Natural Systems and Biomimicry
  - 4.3.9 Service Systems
  - 4.3.10 Systems Engineering for Enterprises

- 4.4 Application of Systems Engineering for Specific Product Sector or Domain Application
  - 4.4.1 Automotive Systems
  - 4.4.2 Biomedical and Healthcare Systems
  - 4.4.3 Commercial Aerospace Systems
  - 4.4.4 Defense Systems
  - 4.4.5 Infrastructure Systems
  - 4.4.6 Oil & Gas Systems
  - 4.4.7 Power & Energy Systems
  - 4.4.8 Space Systems
  - 4.4.9 Telecommunication Systems**
  - 4.4.10 Transportation Systems

## Part V - Systems Engineering in Practice

- 5.1 Systems Engineering Competencies
  - 5.1.1 Systems Engineering Professional Competencies
  - 5.1.2 Technical Leadership
  - 5.1.3 Ethics
  - 5.1.4 Other Professional Competencies and Soft Skills**
- 5.2 Diversity, Equity, and Inclusion
- 5.3 Systems Engineering Relationships to other Disciplines
  - 5.3.1 SE and Software Engineering (SWE)
  - 5.3.2 SE and Hardware Engineering (HWE)
  - 5.3.3 SE and Project Management (PM)
  - 5.3.4 SE and Industrial Engineering (IE)
  - 5.3.5 SE and Operations Research (OR)
- 5.4 Systems Engineering Transformation
- 5.5 Future of SE

## Part VI - Case Studies

- 6.1 Case 1: Radiation Therapy—The Therac-25
- 6.2 Case 2: Joining Two Countries—The Øresund Bridge
- 6.3 Case 3: Cybersecurity Considerations in Systems Engineering—The Stuxnet Attack on a Cyber-Physical System
- 6.4 Case 4: Design for Maintainability—Incubators
- 6.5 Case 5: Artificial Intelligence in Systems Engineering - Autonomous Vehicles**
- 6.6 Other case studies**

**THE HIGHLIGHTED TOPICS ARE ADDITIONS TO THE 5<sup>TH</sup> EDITION (NOT PRESENT IN THE 4<sup>TH</sup> EDITION)**



# INCOSE Systems Engineering Handbook update

Differences between 5<sup>th</sup> (5E) and 4<sup>th</sup> (4E) Edition:

- The 5<sup>th</sup> edition is a “Core handbook” compared to the 4<sup>th</sup> edition being a “Process-centric handbook”
- Change in structure between 4<sup>th</sup> Edition and 5<sup>th</sup> Edition
- Additional information on Systems Engineering Concepts provided in the 5<sup>th</sup> edition

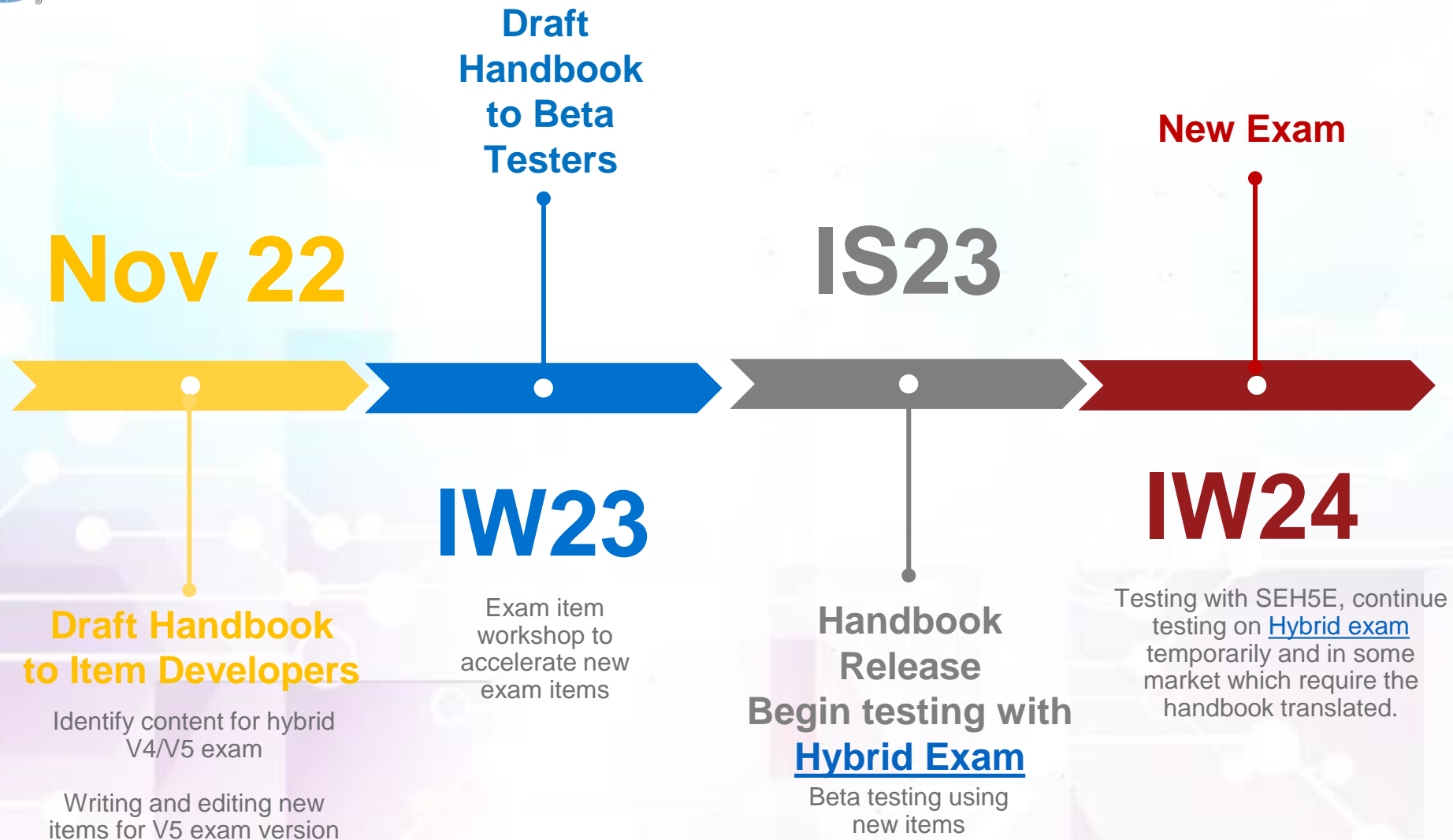
Pros of studying the 5<sup>th</sup> Edition (5E) of the handbook

- Refreshed and additional content reflecting the evolution of “state-of-the-good-practice” in SE
- It includes references to new INCOSE products related to domains of application



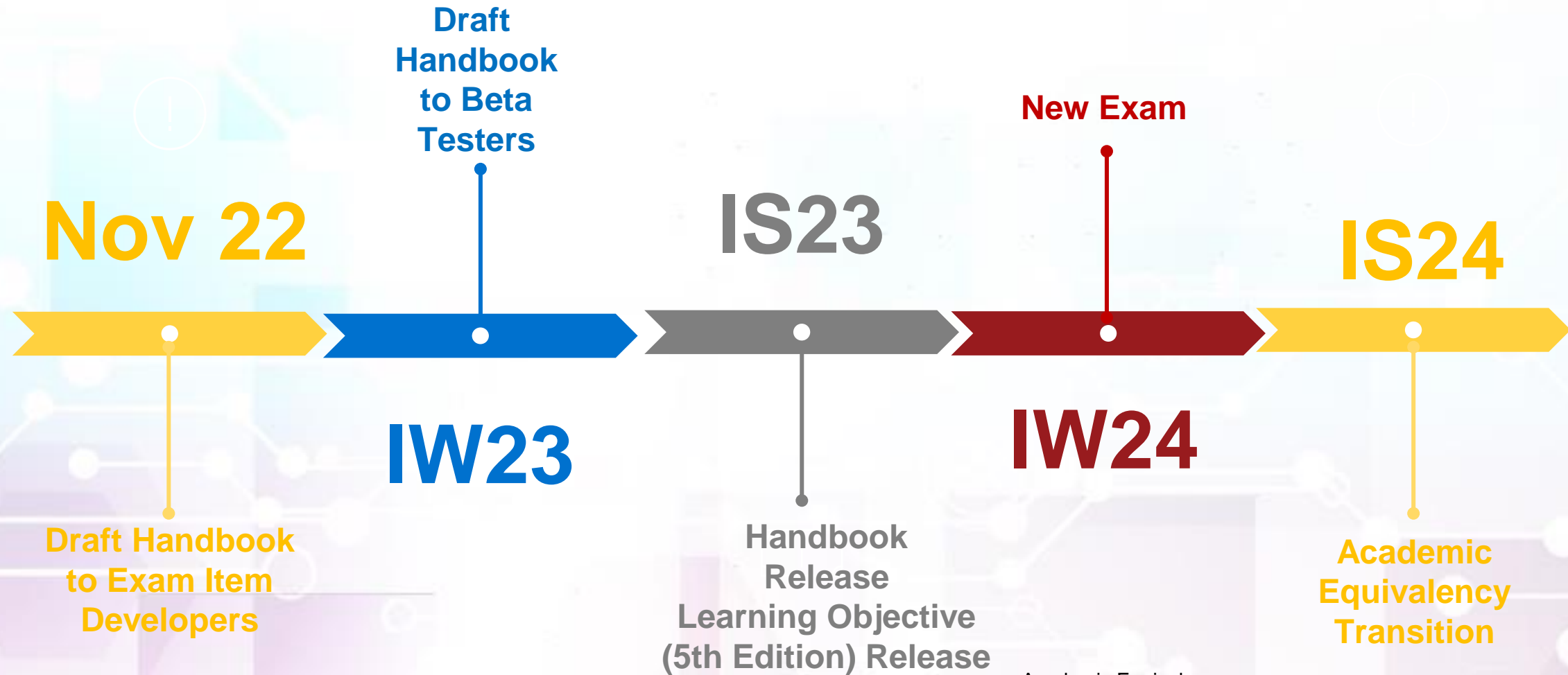


# Timeline for knowledge exam development and transition





# Timeline for Learning Objectives release and Academic Equivalency Transition



Academic Equivalency programs can start mapping to new objectives and have new handbook as a text book

# Certification Stakeholders





# As a Certification Applicant

## **Who will be impacted?**

ASEP, CSEP applicants, and Academic equivalency students.

ESEP applicants will not be affected by the update in the handbook.

## **How will the applicants taking the knowledge exam be impacted?**

Applicants can/will have to take exam on 5<sup>th</sup> Edition (after 5<sup>th</sup> Edition release)

## **How will the applicants the students from Academic Equivalency impacted?**

They will not see a direct transition like candidates taking the exam. They will be tested against the Learning Objectives based on the 5<sup>th</sup> Edition.



# As a Certification Applicant

## When can an applicant take test on 5<sup>th</sup> Edition?

Applicants can take an exam based on the 5<sup>th</sup> Edition immediately after its release.

## Until when can an applicant take a test on 4<sup>th</sup> Edition?

Applicant can take the exam based on the 4<sup>th</sup> Edition till 6 months after the release of 5<sup>th</sup> Edition (except for some regions where translation of handbook is needed)

## Will the validity of my certification be affected if I take the exam on 4<sup>th</sup> Edition?

No, the validity or renewal of certification will not be affected

## How do the applicants know which handbook edition based exam will they be taking?

From when the 5<sup>th</sup> Edition is released till 6 months after, applicants will be taking **Hybrid exam** which is based on the overlapping learning objectives of the 4<sup>th</sup> and the 5<sup>th</sup> Edition. After 6 months of the 5<sup>th</sup> Edition release applicants will take the exam based on the 5<sup>th</sup> edition.

## Will there be a change in the pattern of the question paper ?

No, there still will be 100 scored questions in the exam with 1 minute per question.





# As a Certification Applicant

## Pros and Cons of taking the exam before the release of 5<sup>th</sup> Edition

### Pros:

- Since the exam will be based on the 4<sup>th</sup> Edition, a lot of training providers and study materials available to support the preparation
- If you have started the preparation already, it would be good to keep the momentum and write the current exam instead of waiting for the hybrid test or test based on 5<sup>th</sup> edition

### Cons:

- Preparing for the current exam may take longer than the hybrid exam
- You would learn more studying from the 5<sup>th</sup> edition
- Some companies/ employers might prefer candidates certified with knowledge of the 5<sup>th</sup> Edition

## Pros and Cons of taking the exam after the release of 5<sup>th</sup> Edition till 6 months after

### Pros:

- You have an option to study from the 4<sup>th</sup> Edition or the 5<sup>th</sup> Edition
- Since the exam is based on overlapping learning objectives of the 4<sup>th</sup> and the 5<sup>th</sup> Edition, preparation would take lesser time when compared to taking the test on the 5<sup>th</sup> Edition or the 4<sup>th</sup> Edition

### Cons:

- If you decide to prepare by studying the 5<sup>th</sup> Edition, you might not be able to find many trainings/ materials to support your preparation.
- If you decide to prepare by studying the 4<sup>th</sup> Edition, some companies/ employers might prefer candidates certified with knowledge of the 5<sup>th</sup> Edition

## Pros and Cons of taking the exam after 6 months of the release of 5<sup>th</sup> Edition (exception: applicants from regions requiring handbook translation):

### Pros:

- Exam will be based on the 5<sup>th</sup> edition
- You will learn more by studying the 5<sup>th</sup> Edition
- Students certified with knowledge of the 5<sup>th</sup> Edition might be preferred by some employers/companies

### Cons:

- Preparing for the exam based on the 5<sup>th</sup> Edition may take longer than the hybrid exam



# As Universities with Academic Equivalency

## What will the impact be?

Students of Academic Equivalency have to be evaluated against the learning objectives based on the SE Handbook. Change in the handbook leads to change in the learning objectives and hence how the students are evaluated.

## What changes do we have to do ?

Universities with Academic Equivalency Program will have to provide information on how their students will be evaluated against the new learning objectives by providing a mapping to the learning objectives based on the 5<sup>th</sup> Edition.

## When will the new learning objectives be released ? Until when do we have to make the above changes?

The learning objectives based on the 5<sup>th</sup> Edition will be released after the 5<sup>th</sup> Edition release. There are following 3 cases for complying to the learning objectives of the 5<sup>th</sup> edition:

- 1. University requesting new academic equivalency:** starting 12 months after handbook release, the application must show a mapping to v5 learning objectives and use of v5 handbook in order to qualify for academic equivalency
- 2. University with current academic equivalency up for renewal:** starting 12 months after handbook release, a renewing university must show mapping to v5 learning objectives and use of v5 handbook to renew
- 3. University with current academic equivalency updating their course(s):** when a university transitions to the v5 handbook and v5 learning objectives, they need to send us the revised mapping. We can restart the renewal period.



# As Universities with Academic Equivalency

**Do we have to comply to the learning outcomes corresponding to the hybrid exam?**

No, you can comply to the learning objectives of the 4<sup>th</sup> edition until the transition based on the 3 cases described earlier.

**Will they have to resubmit academic equivalency application for the curriculum complying to the learning objectives of the 5<sup>th</sup> Edition?**

Yes, you have to submit the mapping to the learning objectives based on the 5<sup>th</sup> Edition which will demonstrate how the students will be evaluated against them. This submission could count towards the renewal of the academic equivalency.



# As a training provider

## **What will the impact be?**

Students will probably be looking for trainings/study materials based on the 5<sup>th</sup> Edition of the handbook.

## **How do the applicants know which handbook edition based exam will they be taking?**

From when the 5<sup>th</sup> Edition is released till 6 months after, applicants will be taking Hybrid exam which is based on the overlapping learning objectives of the 4<sup>th</sup> and the 5<sup>th</sup> Edition. After 6 months of the 5<sup>th</sup> Edition release applicants will take the exam based on the 5<sup>th</sup> edition.

## **When can an applicant take test on 5<sup>th</sup> Edition?**

Applicants can take an exam based on the 5<sup>th</sup> Edition immediately after its release.

## **Until when can an applicant take a test on 4<sup>th</sup> Edition?**

Applicant can take the exam based on the 4<sup>th</sup> Edition till 6 months after the release of 5<sup>th</sup> Edition (except for some regions where translation of handbook is needed)

## **When will the 5<sup>th</sup> Edition of Handbook be available?**

The 5<sup>th</sup> Edition of Handbook is planned to be released in July of 2023. There is no early access to the 5<sup>th</sup> edition for the training providers.



# As a training provider

## **How long do I have to change/modify my trainings?**

This is not under the control of INCOSE Certification Program. Hybrid exams (overlap of the 4<sup>th</sup> and 5<sup>th</sup> Edition) will begin as soon as the 5<sup>th</sup> Edition is released, in this period students would seek out for trainings based on the 5<sup>th</sup> edition.

## **Will there be a change in the pattern of the question paper ?**

No, there still will be 100 marked questions in the exam with 1 minute per question.





## As Exam provider/ host

**Do I need to change anything because of the handbook update ?**

No, there is no impact on the exam hosts/providers due to change in the handbook.

**Do the proctors/invigilator be aware of the new handbook?**

No, there is no requirement for the proctors/invigilator to be knowledgeable of the handbook.



# As other equivalency programs

For other equivalency programs:

- For Germany (GfSE) : No impact on applicants with the handbook update
- For INCOSE UK, Australia (SESA), and USA (DoD Engineering / DAU): there will not be any impact with the handbook update.



## As other linked certification authorities

For other linked certification programs such as : OMG, and NAFEM there will not be any impact with the handbook update.



# INCOSE Certification Program

Following are the changes/ impacts on the Certification Program:

- Certification program will be working on preparing exam items for the hybrid exam, and the exam based on the 5<sup>th</sup> Edition.
  - INCOSE Certification Program is looking for volunteers for exam item writing, please reach out if interested. Please check the position CER-001 here: <https://www.incose.org/about-incose/volunteer-opportunities/vo-request>
- Certification program will be reviewing the learning objective mappings provided by the Academic Equivalency Programs before their transition.



# Communication

- For specific certification questions, reach out to [certification@incose.net](mailto:certification@incose.net)
- For more information on INCOSE certification: [www.incose.org/certification](http://www.incose.org/certification), <https://www.incose.org/systems-engineering-certification/taking-the-exam>
- Updates will also be part a of <https://www.incose.org/certblog>
- Here is a Certification blog post on Impact of Handbook Update on the Knowledge Exam: <https://www.incose.org/certblog/certification-blog/2022/04/08/when-will-incose-start-testing-based-on-the-incose-se-handbook-fifth-edition>



Thank you for your attention!

Q and A

# ***Upcoming Webinars (tentative schedule)***



Who	What	When
Rick Dove	Agile SE Processes 205: Agility in the Future of Systems Engineering (FuSE)	Wednesday 21 <sup>st</sup> September 2022 at 11am EDT
Saulius Pavalkis	Digital Engineering (Joint webinar with SAE)	Wednesday 19 <sup>th</sup> October 2022 at 11am EDT

Invitations will be emailed in advance and informational updates will be placed on [www.incose.org](http://www.incose.org)

Go to <http://www.incose.org/products-and-publications/webinars> for more info on the webinar series, including a way to view the last 156 Webinars and soon – this one!

Information on the webinars is now being posted in INCOSE Connect, in the INCOSE Library area, at

<https://connect.incose.org/Library/Webinars/Pages/INCOSE-Webinars.aspx> .

Joining instructions will added around two weeks before the webinar is scheduled to take place.



# INCOSE Systems Engineering Professional PDU Credit

For more information about INCOSE certification renewal, including PDU categories and limits:  
<http://www.incose.org/certification/CertProcess/CertRenew>

You can claim 1 PDU credit towards your INCOSE Systems Engineering Professional (SEP) renewal by attending this entire webinar.

## Claim PDUs



## Eligible Sources To Claim PDU

- Live attendance at the webinar: "Attend non-peer-reviewed Professional Technical Society event."
- Watching a recording of the webinar: "Consume SE-related media, including journal article, book, video, or audio."

INCOSE webinars may also apply to the PDU requirements of other organizations, depending on the subject matter.

## Claim PDUs for Other certifications



# With thanks to our Sponsors for 2022

