



EMEA Workshop 2019
Utrecht, the Netherlands
10-11 October 2019

INCOSE EMEA 2019 Workshop

Rijkswaterstaat - LEF Future Center
Workshop: Competency

Chair: Ian Presland, Charterhouse Systems Ltd.

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Workshop Purpose

- **Purpose:**
 - Provide an opportunity for attendees to become aware of INCOSE SE Competency Framework content but more importantly to contribute actively to the review of the evaluation guide which is currently in work.
- **Expected Session Deliverables / Outcomes**
 - A series of comments on the “in progress” Evaluation Guide which will be taken up by the International Competency Working Group and addressed as part of their ongoing work



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Workshop Agenda

- Overview of the new framework
- Relationship to other INCOSE initiatives
- Introduction to the draft evaluation guide
- Discussion on “rules” for commenting
- Activity (individuals, small groups) to review selected draft content of the evaluation guide
 - Identification of section(s)
 - Review
 - Feedback



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Room setup and preparation (1/2)

- Projector/screen for Laptop connection (HDMI/VGA)
 - Internet access for Laptops
 - We do not know of anyone “dialling-in” to the workshop
- Flipchart at front of room for communal discussions
- Delegate set-up depends on number of participants...
 - Expect groups to split into groups of 1-3 to work
 - Suggest small tables for up to four delegates is best
- 1-2 Additional white boards or flip charts might be useful for discussions (depending on attendee numbers)
- To perform the review, each group of 1-3 delegates will require one of the following:
 - Use of their own laptop
 - Use of a laptop provided by others
 - A paper printout of part of the framework (next page)

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Room setup and preparation (2/2)

- Laptops – Highly desirable to facilitate work on spreadsheets
 - Ideally some attendees will be able to use own laptops or these can be provided. One per group of 2-3 people ideal
 - Laptop users will be emailed a softcopy of part of the draft framework to work on directly during the workshop
 - To ensure “latest” version
 - Requires Excel 2016 and Word 2016
 - Wi-fi link highly desirable to enable document research during workshop
- Paper copy
 - As the document under review is approx. 200 pages long recommend subsections only are printed “on request” on site during the workshop!
 - Based upon what competency area people select to work on
 - Paper copies will need to be printed ideally in **colour A3** size
 - Ideally one copy for each person in a group
 - Each competency area is typically 8-12 pages long.
 - Sample PDF files will be provided for areas to be worked on.

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Workshop Content

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History of the SE Framework

for newcomers

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Framework Evolution

- Framework is the first published product from the INCOSE International Competency Working Group
- Comprises two parts:
 - The Framework Definition
 - The Evaluation (or “Assessment”) guide
 - The Framework Definition was published in July 2018
- It took approximately seven years to complete and involved many people from many countries and organisations
- We are currently working to complete the Assessment guide
 - That is the background for this workshop. You can help!!



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Why did INCOSE want a “new” international framework?

- Creates an internationally-agreed standard for Systems Engineering competencies and organizational benchmarking.
- Capitalizes on existing Work Products
 - e.g. UK Chapter framework was produced in 2010. We have feedback from usage
 - Other work done (e.g. by NDIA in US)
- Aligns and integrates with other INCOSE initiatives
 - e.g. INCOSE SE Handbook, SEP Programme
- Helps facilitate deployment of SE outside its “traditional” defence and aerospace markets
- Framework issued in draft (INCOSE-TP-2018-002-01.0)
 - **Downloadable to anyone** from INCOSE website

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Why did INCOSE want an international framework?

- Lack of wider awareness of “competence” concepts
 - Concept of “competence” is new to some countries
 - Legal perspective different in some countries
 - Some organisations struggled with competence vs. role definitions
- Desire for alignment with other INCOSE initiatives
 - INCOSE SE Handbook Fourth Edition
 - SEP programme Technical areas
 - Other initiatives such as MBSE

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Framework Overview

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Systems Engineering Competency Framework

- International and Diverse Collaboration:
 - 7 Years
 - 6 Countries
 - 2 Professional Societies
 - 12 Companies
 - 4 Schools
 - 1 Research Center
 - 1 National Lab
 - 5 Primary Authors
 - 23 Secondary Authors/Reviewers



Download for free at

<https://www.incose.org/CompetencyFramework>

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Systems Engineering Competency Framework

- Comprises 36 competencies spanning 5 “themes”:
 - Core engineering
 - SE Technical Lifecycle
 - SE Management
 - Professional (aka “behaviours”) and Ethics
 - Understanding of other disciplines

Aligns with major ongoing INCOSE initiatives.

Designed to be tailored to support a wide variety of individual and organizational usage scenarios

Enables organizations to tailor and derive their own competency models that address their unique challenges.

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Summary

- Competence definitions capitalize on recognized best practice – not re-inventing ideas established in other disciplines (e.g. HR)
 - Part of this was to facilitate integration into existing HR systems
- Enables any role or course which includes an SE element can have the SE element defined and assessed in an objective and verifiable manner. And thus the framework supports
 - role definition, career development frameworks, individual competency evaluation, organizational capability evaluation, training need definition and course evaluation
- To help traction, there was a significant expansion on competence vs roles

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36 Competencies: 5 Competency “Themes”

- 6 “Core” competencies
 - Core competencies believed to underpin engineering as well as systems engineering.
- 8 “Professional” (or “behavioural”) competencies
 - Behavioural competencies well-established within the Human Resources (HR) domain.
 - Internationally-recognized definitions rather than partial or complete re-invention by INCOSE.
- 9 “Management” competencies
 - Controlling and managing Systems Engineering activities identified in the INCOSE SE Handbook.
- 9 “Technical” competencies
 - Tasks associated primarily with Technical Processes identified in the INCOSE SE Handbook.
- 4 “Integrating” competencies
 - Recognizes Systems Engineering as an integrating discipline, joining activities and thinking from specialists in other disciplines to create a coherent whole.

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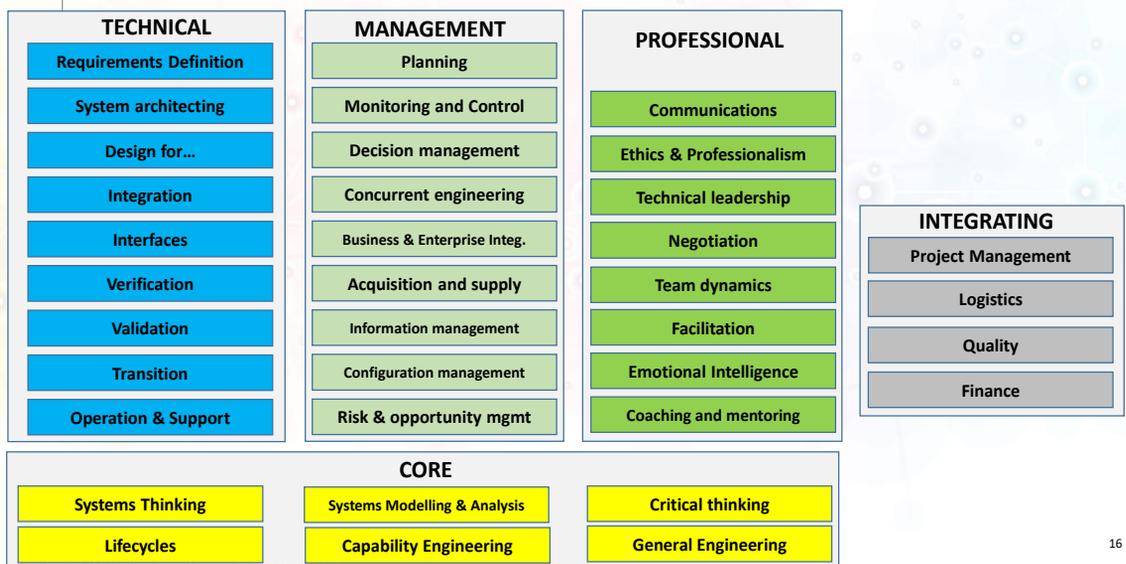
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SE Competency Framework Summary



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Competencies Outline

Figure 1 in New Competency Framework

Core Competencies		Professional Competencies	Management Competencies	Technical Competencies
Core competencies underpin engineering as well as Systems Engineering.		Behavioral competencies well-established within the Human Resources (HR) domain. To facilitate alignment with existing HR frameworks, where practicable, competency definitions have been taken from well-established, internationally-recognized definitions rather than partial or complete re-invention by INCOSE.	The ability to perform tasks associated with controlling and managing Systems Engineering activities. This includes tasks associated with the Management Processes identified in the INCOSE SE Handbook.	The ability to perform tasks associated primarily with the suite of Technical Processes identified in the INCOSE SE Handbook.
Systems Thinking	The application of the fundamental concepts of systems thinking to Systems Engineering.	Communications The dynamic process of transmitting or exchanging information.	Planning Producing, coordinating and maintaining effective and workable plans across multiple disciplines.	Requirements Definition To analyze the stakeholder needs and expectations to establish the requirements for a system.
Lifecycles	Selection of the appropriate lifecycles in the realization of a system.	Ethics and Professionalism The personal, organizational, and corporate standards of behavior expected of systems engineers.	Monitoring and Control Assessment of an ongoing project to see if the current plans are aligned and feasible.	System Architecting The definition of the system structure, interfaces and associated derived requirements to produce a solution that can be implemented.
Capability Engineering	An appreciation of the role the system of which it is a part.	Technical Leadership The application of technical knowledge and experience in Systems Engineering together with appropriate professional competencies.	Decision Management The structured, analytical framework for objectively identifying, characterizing and evaluating a set of alternatives.	Design for... Ensuring that the requirements of all lifecycle stages are addressed at the correct point in the system design.
General Engineering	Foundational concepts in mathematics, science and engineering and their application.	Negotiation Dialogue between two or more parties intended to reach a beneficial outcome where difference exist between them.	Concurrent Engineering A work methodology based on the parallelization of tasks.	Integration The logical process for identifying a set of system elements and aggregating into the realized system product of design.
Critical Thinking	The objective analysis and evaluation of a topic in order to form judgement.	Team Dynamics The unconscious, psychological forces that influence the direction of a team's behavior and performance.	Business and Enterprise Integration The consideration of needs and requirements of other internal stakeholders as part of the system development.	Interfaces The identification, definition and control of interactions across system system/element boundaries.
Systems Modeling and Analysis	Presentation of system data and information including the use of modeling to support technical understanding and decision making.	Facilitation The act of helping others to deal with a process, solve a problem, or reach a goal without getting directly getting involved.	Acquisition and Supply Obtaining or providing a product or service in accordance with requirements.	Verification A formal process of obtaining objective evidence that a system fulfils its specified requirements and expectations.
		Emotional Intelligence The ability to monitor one's own and other feelings and use this information to guide thinking and action.	Configuration management Ensuring the overall coherence of system functional, performance and physical characteristics throughout its lifecycle.	Transition Integration of a verified system into its operational environment including the wider system of which it forms a part.
		Coaching and Mentoring Development approaches based on the use of one-to-one conversations to enhance an individual's skills, knowledge or work performance.	Configuration management Ensuring the overall coherence of system functional, performance and physical characteristics throughout its lifecycle.	Transition Integration of a verified system into its operational environment including the wider system of which it forms a part.
			Risk and Opportunity Management The identification and reduction in the probability of occasion events, or maximizing the potential of opportunities provided for them.	Operation and Support When the system is used to deliver its capabilities, and is supported over its lifetime.
Integrating Competencies		Project Management Identification, planning and coordinating activities to deliver a satisfactory system, product, service or appropriate quality.	Logistics The support and sustenance of a product once it is introduced to the end user.	
		Finance Estimating and tracking costs associated with the project.	Quality Achieving customer satisfaction through the control of key product characteristics.	

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INCOSE SE Handbook coverage mapping

KEY
 ✓✓✓ The handbook process is broadly encompassed within the V4 competence area
 ✓✓ The handbook process has a limited overlap with the V4 competence area
 ✓ The handbook process has a limited overlap with the V4 competence area

INCOSE SE Handbook Processes	Technical Processes										Technical Management Processes					Agreement Processes		Organizational/Project-Enabling Processes											
	Business or mission analysis	Stakeholder needs and requirements definition	Architecture definition	Design definition	System analysis	Implementation	Integration	Verification	Validation	Deployment	Maintenance	Disposal	Project planning	Project execution and control	Decision management	Risk management	Configuration management	Information management	Measurement	Quality assurance	Acquisition	Supply	Risk cycle model management	Information management	Portfolio management	Human resources management	Quality management	Knowledge management	
Core SE principles	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓
Professional Competencies	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓
Technical Competencies	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓
SE Management Competencies	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓
Integrating Competencies	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓	✓✓✓

Figure 3 in New Competency Framework

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SEP technical areas mapping

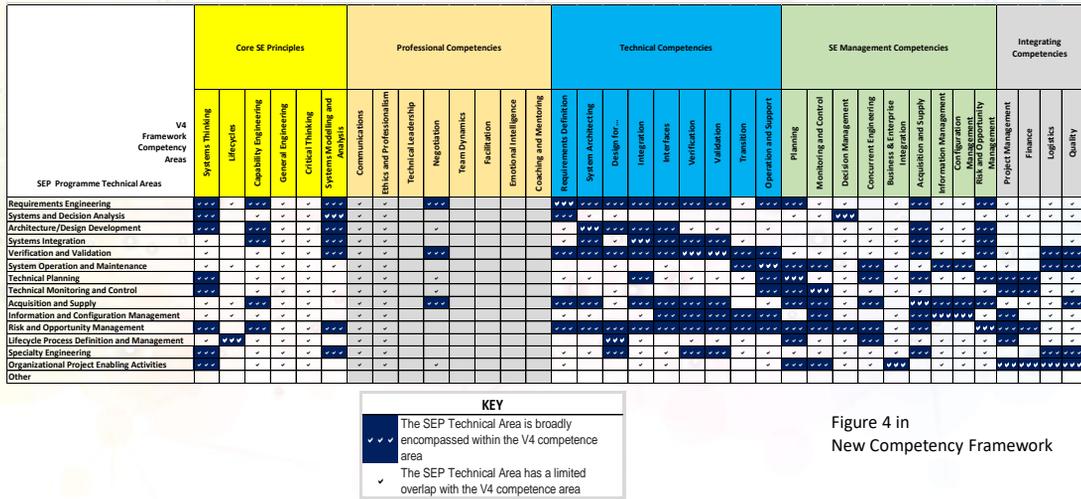


Figure 4 in New Competency Framework

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“Role” vs “Competence” for role

A role statement made up of

- Name
- Purpose
- Activities performed
 - The processes the role uses
- Competencies required
- Other preferences

A) To define competencies use process competency mapping to identify competencies needed in the role

B) Define level of involvement in process, and for each competency associated with process allocate competency level based on table below

	AWARE	SUPERVISED PRACTITIONER	PRACTITIONER	LEAD PRACTITIONER	EXPERT
ACCOUNTABLE (A)	○				
RESPONSIBLE (R)		○			
CONSULTED (C)	○				
INFORMED (I)	○				
FACILITATOR (F)		○			
EXPERT (E)					○

Figure 5 in new Competency framework

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Early feedback...

- Its too large!
 - We think it is “proportionate”
 - The document is designed to be tailored before use
- Don’t agree with the new document competency areas!
 - Its merely a view on systems engineering from a particular viewpoints.
 - Others are equally both are imperfect and incomplete, but in different ways!
- The new framework is still an initial release and will be changed if the need for updates is universally agreed.
 - We expect some changes as a result of completion of the assessment guide (which is the subject of todays session!)



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Our Primary Workshop Activity

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Workshop Activity

- Introduction
 - Guidelines for the review activity
 - Some background: “do’s” and “don’ts”
 - We will then do a “trial” review together
- Allocation of work
 - Since we cannot review the whole 200+ pages in <2hrs workshop attendees can pick a section of their choice to review individually, or in small groups
- Review and mark up, following the guidelines
- Feedback at end of session
- The competency working group will then review and incorporate in the coming months
- Its as simple as that!

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Comments on Published framework

- **Do not change the published framework words, i.e.**
 - Competency area names, descriptions, “Why it matters” text boxes, or competence Indicator text
- However, if you would like to comment on these areas
 - Mark the cell(s) in question **ORANGE**
 - In the columns to the right of the table...
 - Add your initials
 - Add your comment in the “comments” column
 - **Don’t change the cells** in any other way

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Comments on Draft Evaluation Guide

- Do not change evaluation guide “look and feel”, i.e.
 - Column Colours, fonts, Column Widths etc.
- Where evaluation guide text is wrong or missing (RED or CLEAR CELLS)
 - Replace the red cell(s) with your text and recolour the cell YELLOW
- Where text EXISTS (CLEAR cells or BLUE cells), if you have a comment
 - In the columns to the right of the table...
 - Add your initials
 - Add your comment in the “comments” column

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Creating “new” Evaluation Guide entries. Rules...

- We are looking for circa five evidence indicators max per framework Competence indicator
 - Ideally just one or two
 - One sentence per worksheet cell
- Language
 - Use US English
 - Apply Bloom’s taxonomy at the appropriate level (next slide)
 - Use Present Active tense (“describes”, “analyzes”, “lists”, “reviews” ...)
 - Domain Agnostic-ism i.e. avoid domain-specific concepts, terms and ideas
- Indicator must written so as to be VERIFIABLE
 - Documentary verification evidence listed in “evidence indicators” column(s)

Sadly, we have not followed our own rules – this needs correction as well!

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What is BLOOMS Taxonomy?

Bloom's Level	Key Verbs (keywords)
Create	design, formulate, build, invent, create, compose, generate, derive, modify, develop.
Evaluate	choose, support, relate, determine, defend, judge, grade, compare, contrast, argue, justify, support, convince, select, evaluate.
Analyze	classify, break down, categorize, analyze, diagram, illustrate, criticize, simplify, associate.
Apply	calculate, predict, apply, solve, illustrate, use, demonstrate, determine, model, perform, present.
Understand	describe, explain, paraphrase, restate, give original examples of, summarize, contrast, interpret, discuss.
Remember	list, recite, outline, define, name, match, quote, recall, identify, label, recognize.

To cite Bloom...

- Before you can understand a concept, you must remember it.
- To apply a concept you must first understand it.
- In order to evaluate a process, you must have analyzed it.
- To create an accurate conclusion, you must have completed a thorough evaluation.

Level	Aware	Supervised practitioner	Practitioner	Lead practitioner	Expert
Know/Remember	"Knows..."	"Knows..."			
Understand	"Understands..."	"Understands..."	"Understands..."		
Apply		"Applies..."	"Applies..."	"Applies..."	"Applies..."
Analyze			"Analyzes..."	"Analyzes..."	"Analyzes..."
Evaluate			"Evaluates..."	"Evaluates..."	"Evaluates..."
Create				"Creates..."	"Creates..."

Darker colour = more important for the level (as a guideline)

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Example indicators from draft evaluation guide...

(link to separate PDF files taken from latest draft evaluation guide)

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Recommended areas for work at the Workshop

- Due to time constraints, a reduced set of competence areas has been identified to be reviewed this workshop
 - Some are BLANK, so need substantial new input
 - Some have data – requiring review or update
- Work can be performed by marking-up either
 - A soft copy of the Draft Evaluation Guide spreadsheet
 - Printed PDFs of a small number of the 36 competencies (for those without access to a laptop)

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Areas selected for the Workshop

- General Engineering – Blank
- Facilitation – Blank
- Finance – Blank
- Logistics – Blank
- Team Dynamics – Some text, some blanks
- Systems Thinking – First draft complete, but needs review
- Lifecycles – First draft complete, but needs review

If you have a strength in another competence area, we may be able to accommodate this, but the areas above, especially the “blank” areas are a priority

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After this workshop...

We WILL run out of time today... ☹️

...but if you are keen to continue your review after the workshop, whether tonight, tomorrow or in future...

- Submit your comments to me by email
 - ian@charterhouse-systems.com copy to Lori.Zipes@gmail.com
 - Ensure you provide your contact details!
- The Competency Working group will add you to the mailing list
- You will be most welcome in Torrance (IW2020) in Torrance, CA, USA

P.S. I will ensure you get feedback from the review process

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