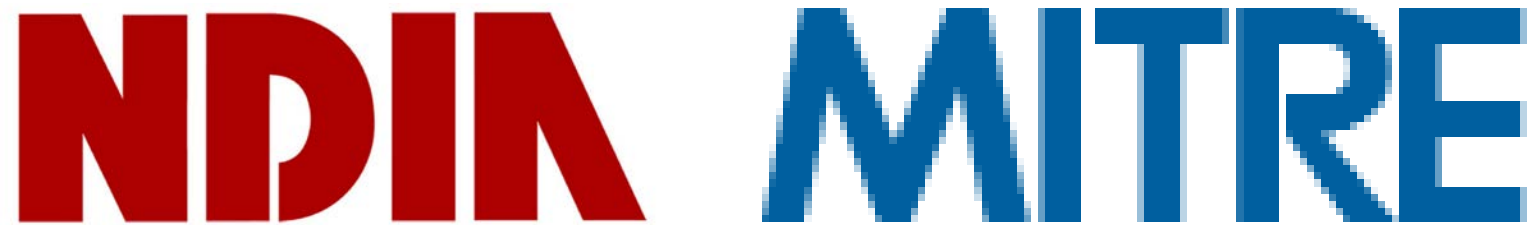


SoSECIE Webinar

Welcome to the
2019 System of Systems Engineering Collaborators
Information Exchange (SoSECIE)



We will start at 11AM Eastern Time

Skype Meeting +1 (703) 983-2020, 46013573#

You can download today's presentation from the OUSD(R&E) Website:

<https://www.acq.osd.mil/se/outreach/sosecollab.html>

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NDIA System of Systems SE Committee

- **Mission**

- To provide a forum where government, industry, and academia can share lessons learned, promote best practices, address issues, and advocate systems engineering for Systems of Systems (SoS)
- To identify successful strategies for applying systems engineering principles to systems engineering of SoS

- **Operating Practices**

- Face to face and virtual SoS Committee meetings are held in conjunction with NDIA SE Division meetings that occur in February, April, June, and August
- SoS Track at NDIA 22nd Annual Systems Engineering Conference, Grand Hilton Tampa Downtown, Tampa, FL, October 21-24, 2019
 - Conference Info:
<http://www.ndia.org/events/2019/10/21/22nd-annual-systems-and-mission-engineering-conference>

NDIA SE Division SoS Committee Industry Chairs:

Mr. Rick Poel, Boeing

Ms. Jennie Horne, Raytheon

OSD Liaison:

Dr. Judith Dahmann, MITRE

Simple Rules of Engagement

- I have muted all participant lines for this introduction and the briefing.
- If you need to contact me during the briefing, send me an e-mail at knharrington@mitre.org.
- Download the presentation so you can follow along on your own
- We will hold all questions until the end:
 - I will start with questions submitted online via the CHAT window in Skype.
 - I will then take questions via telephone; State your name, organization, and question clearly.
- If a question requires more discussion, the speaker(s) contact info is in the brief.

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2019 System of Systems Engineering Collaborators Information Exchange Webinars *Sponsored by OUSD(R&E) and NDIA SE Division*

February 5, 2019

Development of New Standards for Systems of Systems Engineering

Dr. Mike Yokell, Lockheed Martin Fellow and Deputy Director, Systems Engineering

February 19, 2019

Systems of Systems Engineering Managerial and Operational Affinity

Dr. Mike Yokell, Lockheed Martin Fellow and Deputy Director, Systems Engineering

March 12, 2019

Mission Engineering Competency Model

Dr. Nicole A. Hutchison, Stevens Institute of Technology

March 26, 2019

Practical Modeling Concepts for Engineering Emergence in Systems of Systems

Dr. Judith Dahmann, The MITRE Corporation

Ms. Philomena Zimmerman, OUSD(R&E)

April 16, 2019

Mission Analysis and Operational Architectures

Mr. Zane Scott, Vitech Corporation

2019 System of Systems Engineering Collaborators Information Exchange Webinars *Sponsored by OUSD(R&E) and NDIA SE Division*

April 30, 2019

Digital Engineering Transformation

Mr. Thomas McDermott, Georgie Tech Research Institute, SERC

May 14, 2019

Toward Scaling Model-based Engineering for Systems of Systems

Dr. Ryan B. Jacobs, The MITRE Corporation

May 28, 2019

TBD

TBD

June 11, 2019

Mission Engineering and Prototype Warfare

Mr. Matthew Horning, US ARMY FUTURES COMMAND

June 25, 2019

A Tool for Architecting Socio-Technical Problems: SoS Explorer

Dr. Cihan Dagli

July 16, 2019

Modular Online Open SoS Education (MOOSE)

Mr. Kyle Hastings, The MITRE Corporation

DEVELOPMENT OF NEW STANDARDS FOR SYSTEMS OF SYSTEMS (SOS)

System of Systems Engineering
Collaborators Information Exchange (SoSECIE)

February 5th, 2019
11:00 a.m. to Noon Eastern Time

Dr. Mike Yokell, ESEP
Lockheed Martin Fellow and
Deputy Director, Systems Engineering
Mike.R.Yokell@LMCO.com

OVERVIEW

- Background
- Status
 - ISO/IEC/IEEE 21839 – *System of Systems (SoS) Considerations in Life Cycle Stages of a System*
 - ISO/IEC/IEEE 21840 – *Guidelines for the utilization of ISO/IEC/IEEE 15288 in the context of System of Systems (SoS) Engineering*
 - ISO/IEC/IEEE 21841 – *Taxonomy of Systems of Systems*
- Summary

NEW INTERNATIONAL
STANDARDS FOR SYSTEMS
OF SYSTEMS (SOS)

BACKGROUND

ISO/IEC JTC1/SC7



International
Organization for
Standardization



International
Electrotechnical
Commission



Institute of Electrical and
Electronics Engineers

ISO/IEC JTC 1/SC 7/WG 7

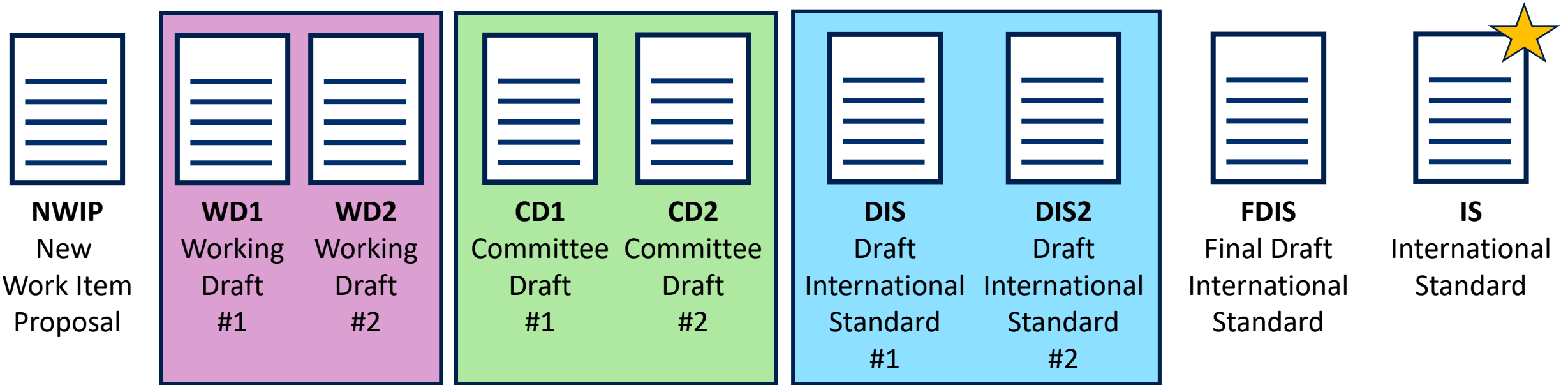
JTC 1 – Joint Technical Committee 1: Information Technology

SC 7 – Subcommittee 7: Software and Systems Engineering

WG 7 – Working Group 7: Life Cycle Management

Liaison

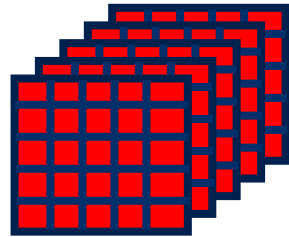
DEVELOPMENT LIFE CYCLE



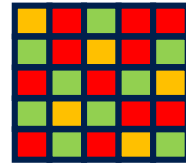
DISPOSITIONING COMMENTS



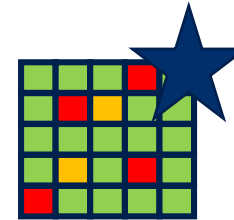
Convener
Releases for
Comment



**National Bodies
Liaison Organizations**
Provide Comments



Editor
Proposes
Dispositions



**National Bodies
Liaison Organizations**
Approve Dispositions

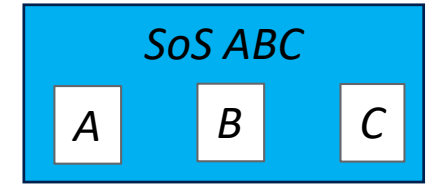


Editor
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Next Version

SE AND SOSE STANDARDS

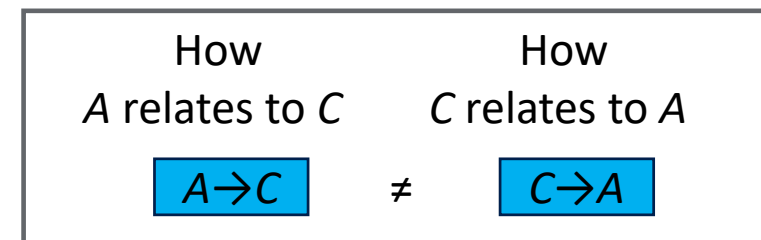
Number	Title
ISO/IEC/IEEE 15288:2015	<i>System life cycle processes</i>
IEEE 15288.1: 2014	<i>Application of Systems Engineering on Defense Programs</i>
IEEE 15288.2: 2014	<i>Technical Reviews and Audits on Defense Programs</i>
ISO/IEC/IEEE 21839	<i>System of Systems (SoS) Considerations in Life Cycle Stages of a System</i>
ISO/IEC/IEEE 21840	<i>Guidelines for the utilization of ISO/IEC/IEEE 15288 in the context of System of Systems (SoS) Engineering</i>
ISO/IEC/IEEE 21841	<i>Taxonomy of Systems of Systems</i>

RELATIONSHIP BETWEEN THE STANDARDS



SoS Considerations	21841	Taxonomy of Systems of Systems	ABC		
	21840	Guidelines for the utilization of ISO/IEC/IEEE 15288 in the context of System of Systems (SoS) Engineering	A→B A→C	B→A B→C	C→A C→B
SoS Considerations For Systems	21839	System of Systems (SoS) Considerations in Life Cycle Stages of a System	A	B	C
System Considerations	15288	System life cycle processes	A	B	C
	15288.1	Application of Systems Engineering on Defense Programs			C
	15288.2	Technical Reviews and Audits on Defense Programs			C

If System C is a Defense Program IEEE 15288.1 and IEEE 15288.2 may apply



STATUS OF ISO/IEC/IEEE 21839

SYSTEM OF SYSTEMS (SOS) CONSIDERATIONS IN LIFE CYCLE STAGES OF A SYSTEM

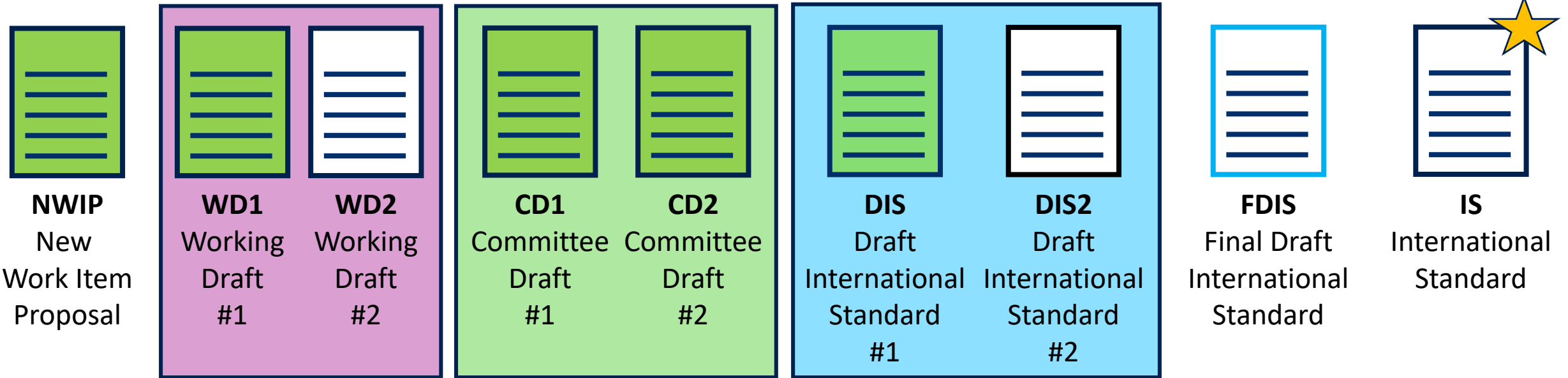
PURPOSE OF ISO/IEC/IEEE 21839

SYSTEM OF SYSTEMS (SOS) CONSIDERATIONS IN LIFE CYCLE STAGES OF A SYSTEM

- Provides a set of critical considerations to be addressed at key points in the life cycle of systems created by humans.
- Refers to a constituent system that will interact in a system of systems as the system of interest (SOI).
- Considerations are aligned with ISO/IEC/IEEE 15288 and the ISO/IEC/IEEE 24748 framework for system life cycle stages and associated terminology.
- Selected subsets of these considerations may be applied throughout the life of systems.

EDITOR: DR. JUDITH
DAHMAN (US)
CO-EDITOR: GARRY
ROEDLER (US)

ISO/IEC/IEEE 21839 DEVELOPMENT



ISO/IEC/IEEE FDIS 21839
Out for Ballot
Comments Being Collected

OUTLINE OF 21839

1. Scope
 2. Normative References
 3. Terms and Definitions
 4. Concepts
 5. SoS Considerations for Sol Life Cycle
- Annexes
- Bibliography

FINAL DRAFT INTERNATIONAL STANDARD

ISO/IEC/IEEE 21839:201x

ISO/IEC/IEEE FDIS 21839:201x(E)

ISO/IEC JTC 1/SC 7 N XXXX

Date: 2018-12-14

ISO/IEC JTC 1/SC 7/WG 7 N2446

Secretariat: BIS

**Systems and software engineering -- System of systems
(SoS) considerations in life cycle stages of a system**

Warning

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STATUS OF ISO/IEC/IEEE 21841

TAXONOMY OF SYSTEMS OF SYSTEMS

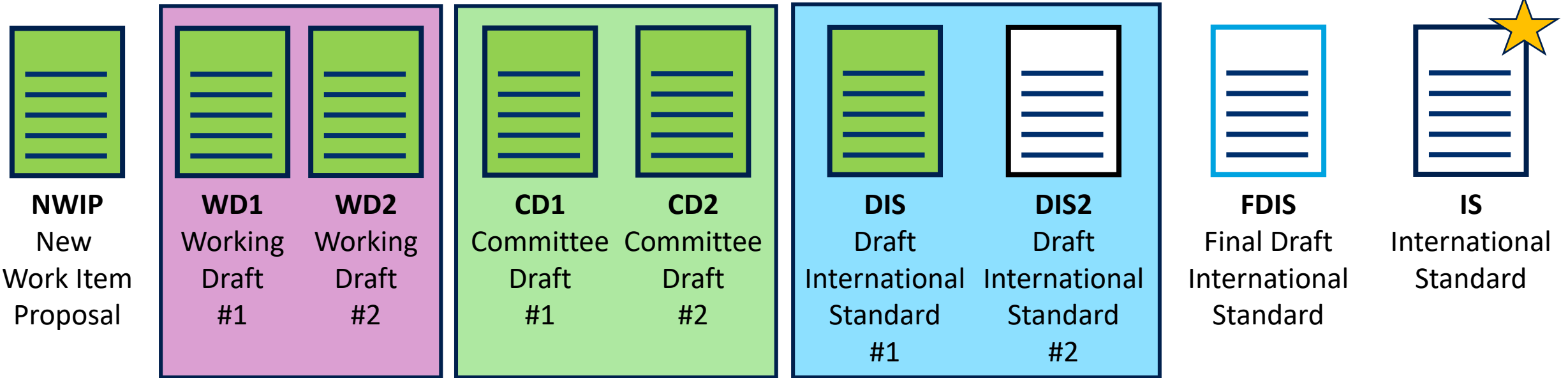
PURPOSE OF ISO/IEC/IEEE 21841

TAXONOMY OF SYSTEMS OF SYSTEMS

- The purpose of this standard is to define normalized taxonomies for systems of systems (SoS) to facilitate communications among stakeholders.
- It also briefly explains what a taxonomy is and how it applies to the SoS to aid in understanding and communication.

EDITOR:
DR. MIKE YOKELL (US)
CO-EDITOR:
DR. FRANÇOIS COALLIER
(CANADA)

ISO/IEC/IEEE 21841 DEVELOPMENT



ISO/IEC/IEEE DIS 21841
Ballot Passed
Comments Being Dispositioned

OUTLINE OF 21841

1. Scope
2. Normative References
3. Terms and Definitions
4. Concepts and Application
5. Taxonomies for Systems of Systems

Annex

Annex contains a summary of taxonomies that are less mature but potentially still useful

Bibliography

DRAFT INTERNATIONAL STANDARD
ISO/IEC/IEEE/DIS 21841

ISO/IEC JTC 1/SC 7

Secretariat: BIS

Voting begins on:
2018-10-30

Voting terminates on:
2019-01-22

Systems and software engineering — Taxonomy of systems of systems

Ingénierie système et logiciel — Taxonomie des systèmes de systèmes

ICS: 35.080

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Reference number
ISO/IEC/IEEE/DIS 21841:2018(E)

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3. TERMS AND DEFINITIONS

4. CONCEPTS AND APPLICATION

3. Terms and Definitions

3.1 General Terms and Definitions

3.2 SoS Types

4. Concepts and Application

4.1 Overview

4.2 Importance of Taxonomies to SoS

4.3 Use of the SoS Taxonomies

5. TAXONOMIES FOR SYSTEMS OF SYSTEMS

- 5 Taxonomies for systems of systems
 - 5.1 Introduction
 - 5.2 Directed, Acknowledged, Collaborative, Virtual
 - 5.2.1 Overview
 - 5.2.2 Description of the taxa
 - 5.2.3 Examples of potential application of the taxa
 - 5.2.4 When to use
 - 5.2.5 How to use
 - 5.2.6 Why to use
 - 5.2.7 Limitations
 - 5.2.8 Benefits of use



Common outline

Currently, Clause 5 contains only 1 mature taxonomy

STATUS OF ISO/IEC/IEEE 21840

*GUIDELINES FOR THE UTILIZATION OF ISO/IEC/IEEE 15288
IN THE CONTEXT OF SYSTEM OF SYSTEMS (SOS) ENGINEERING*

PURPOSE OF ISO/IEC/IEEE 21840

GUIDELINES FOR THE UTILIZATION OF ISO/IEC/IEEE 15288

IN THE CONTEXT OF SYSTEM OF SYSTEMS (SOS) ENGINEERING

- Provides guidance for the utilization of ISO/IEC/IEEE 15288 in the context of SoS.
- While ISO/IEC/IEEE 15288 applies to systems (including constituent systems), this document provides guidance on application of these processes to SoS.
- However, ISO/IEC/IEEE 21840 is not a self-contained SoS replacement for ISO/IEC/IEEE 15288.
- This document is intended to be used in conjunction with ISO/IEC/IEEE 15288, ISO/IEC/IEEE 21839 and ISO/IEC/IEEE 21841 and is not intended to be used without them.

EDITOR:

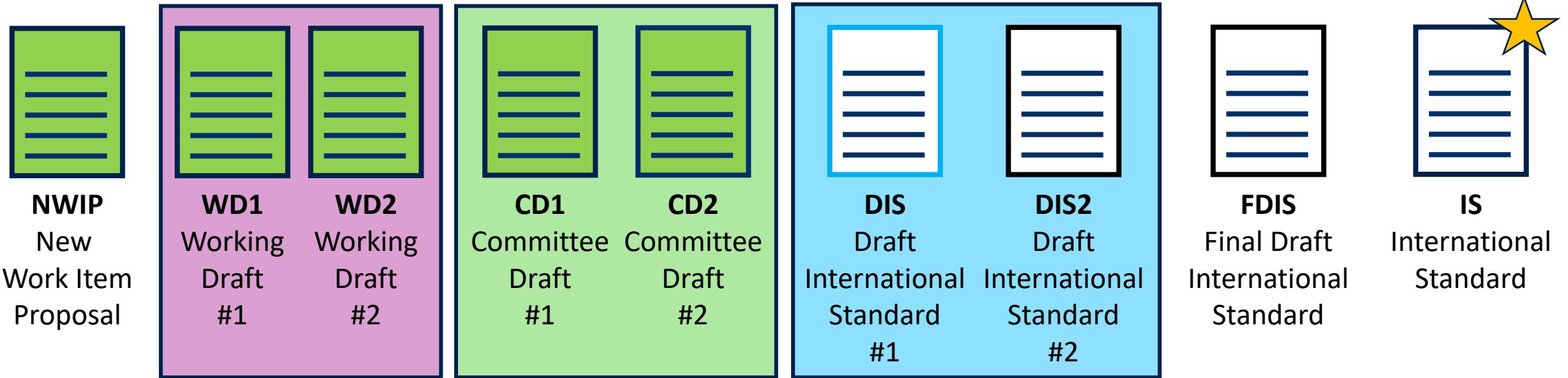
DR. MIKE YOKELL (US)

CO-EDITOR:

DR. ALEJANDRO SALADO

(INCOSE)

ISO/IEC/IEEE 21840 DEVELOPMENT



ISO/IEC/IEEE DIS 21840
Out for Review
Comments Due Mid-April

OUTLINE OF 21840

1. Scope
 2. Normative References
 3. Terms and Definitions
 4. Relationship to Other Standards
 5. Key Concepts and Application
 6. Application of System Life Cycle Processes to SoS
- Bibliography

DRAFT INTERNATIONAL STANDARD
ISO/IEC/IEEE/DIS 21840

ISO/IEC JTC 1/SC 7

Secretariat: BIS

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Systems and software engineering — Guidelines for the utilization of ISO/IEC/IEEE 15288 in the context of System of Systems (SoS) engineering

ICS: 35.080

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Reference number
ISO/IEC/IEEE/DIS 21840:2019(E)

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FOR EACH PROCESS GROUP IN 15288, CLAUSE 6

- Sentence to introduce the 15288, Annex G info, refer to box
- Box the 15288, Annex G info relevant to this process group
- Further elaborate the general guidance in the context of SoS

6 Application of system life cycle processes to SoS

6.1 Agreement processes

ISO/IEC/IEEE 15288 contains general information on the application of system life cycle agreement processes to a system as shown in the box.

This subclause specifies the requirements for the establishment of agreements with organizational entities external and internal to the organization.

The Agreement Processes consist of the following:

- a) Acquisition process – used by organizations for acquiring products or services;
- b) Supply process – used by organizations for supplying products or services.

These processes define the activities necessary to establish an agreement between two organizations. If the Acquisition process is invoked, it provides the means for conducting business with a supplier. This may include products that are supplied for use as an operational system, services in support of operational activities, or elements of a system being provided by a supplier. If the Supply process is invoked, it provides the means for an agreement in which the result is a product or service that is provided to the acquirer.

NOTE Security is an increasing concern in systems engineering. See ISO/IEC 27036, Security techniques — Information security for supplier relationships, for requirements and guidance for suppliers and acquirers on how to secure information in supplier relationships. Specific aspects of information security supplier relationships are addressed in Parts 3 and Part 4.

[SOURCE: ISO/IEC/IEEE 15288, Clause 6.1 Agreement processes]

FOR EACH PROCESS IN 15288

- Introduce the purpose from 15288
 - Note that the purpose remains the same or with any additions as needed
- Introduce the outcomes with a slight modification to 15288's introduction
- For each outcome
 - Echo the outcome from 15288
 - Provide SoSE guidance
- Acknowledge that there may be additional outcomes needed for SoS
- Do not address 15288's "Activities and Tasks"

6.1.1 Acquisition process

6.1.1.1 Purpose

The purpose of the ISO/IEC/IEEE 15288 Clause 6.1.1 'Acquisition process' is shown in the box.

The purpose of the Acquisition process is to obtain a product or service in accordance with the acquirer's requirements.

NOTE As part of this process, the agreement is modified when a change request is agreed to by both the acquirer and supplier.

The purpose of the ISO/IEC/IEEE 15288 Clause 6.1.1 'Acquisition process' applies as stated with the following additions.

NOTE 1 In the context of SoS, an acquirer obtains the capabilities of CS, sometimes without explicit agreement, and without acquiring the CS that produced the capabilities. The acquirer may still need to obtain non-system system elements (i.e., system elements that are not CS).

NOTE 2 For SoS, terms such as participant or "partner" may be more applicable than acquirer and supplier.

6.1.1.2 Outcomes

The outcomes of the ISO/IEC/IEEE 15288 6.1.1 'Acquisition process' apply as stated in the boxes with the following additions:

a) A request for supply is prepared.

An SoS request for supply may not have the same formality as might be expected within a system. Instead of a formal request for supply for specific products or services, a search for specific capabilities or a request for information about existing and planned capabilities can be made. In an SoS governance sense,

SUMMARY

SUMMARY

- Status
 - ISO/IEC/IEEE 21839 – *System of Systems (SoS) Considerations in Life Cycle Stages of a System*
 - Final Draft International Standard released for review and comments (due in Mid-March)
 - Next Step: Address Comments and (pending approval) proceed to publication
 - ISO/IEC/IEEE 21840 – *Guidelines for the utilization of ISO/IEC/IEEE 15288 in the context of System of Systems (SoS) Engineering*
 - Draft International Standard released for review and comments (due in Mid-April)
 - Next Step: Address Comments and (pending approval) proceed to FDIS
 - ISO/IEC/IEEE 21841 – *Taxonomy of Systems of Systems*
 - Draft International Standard Approved, dispositions drafted for comments
 - Next Step: Address Comments and (pending approval) proceed to FDIS

QUESTIONS

BIOGRAPHY



Dr. Mike Yokell, ESEP
Deputy Director and Fellow
Systems Engineering
Aeronautics

Mike.R.Yokell@LMCO.com

817-935-3995

Dr. Mike Yokell is a Lockheed Martin Fellow and Deputy Director, Systems Engineering. He is the US representative to International Standards setting bodies for Systems and Software Engineering and is the project editor for two new international standards on Systems of Systems Engineering. Mike is certified as an expert systems engineering professional by the International Council on Systems Engineering (INCOSE). He holds multiple US and European Patents for Model Based Systems Engineering (MBSE) and large scale immersive virtual reality.