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

Mark Sampson & Troy Peterson – MBSE Initative

MBSE Workshop Round Robin

Quick 5 minute presentations providing highlights from INCOSE WG Activities with MBSE content

www.incose.org/IW2024

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Juan P. Amenabar, Chief Systems Engineer, Leidos, INCOSE ESEP
Member Competency Working Group –SysML Model Developer

Competency Guide Model Description

Purpose of Brief

- The INCOSE Systems Engineering Competency Framework (SECF) and INCOSE Systems Engineering Competency Assessment Guide (SECAG), published in 2018 and 2023 respectively, provide a definition for 37 systems engineering competencies and the evaluation criteria against these.
- This briefing describes the current state of a Systems Modeling Language (SysML) Model Based Systems Engi-neering (MBSE) model of the SECF and SECAG.
- A description of the metamodel and data structure is presented as well as a series of evolving use cases for this model.
- Paper describing SysML model submitted for IW2024

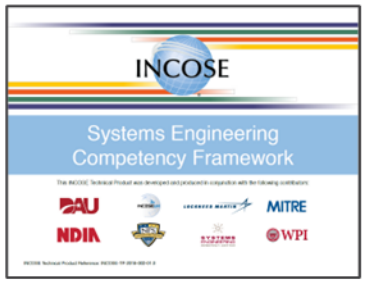
Competency Framework Timeline

2011

- CWG started work on SECF
- Earlier INCOSE UK Frameworks served as reference

2018

- **INCOSE SECF published** as collaboration between 2 professional societies, 12 corporations, 4 academic institutions, and 1 research center
- INCOSE-TP-2018-002.01.0



2019

- Work starts on follow on Competency Assessment Framework
- Vision starts for planning digital version of SECF

2021

- Work starts on coordination with PDP
- Work continues on follow on Competency Assessment Framework

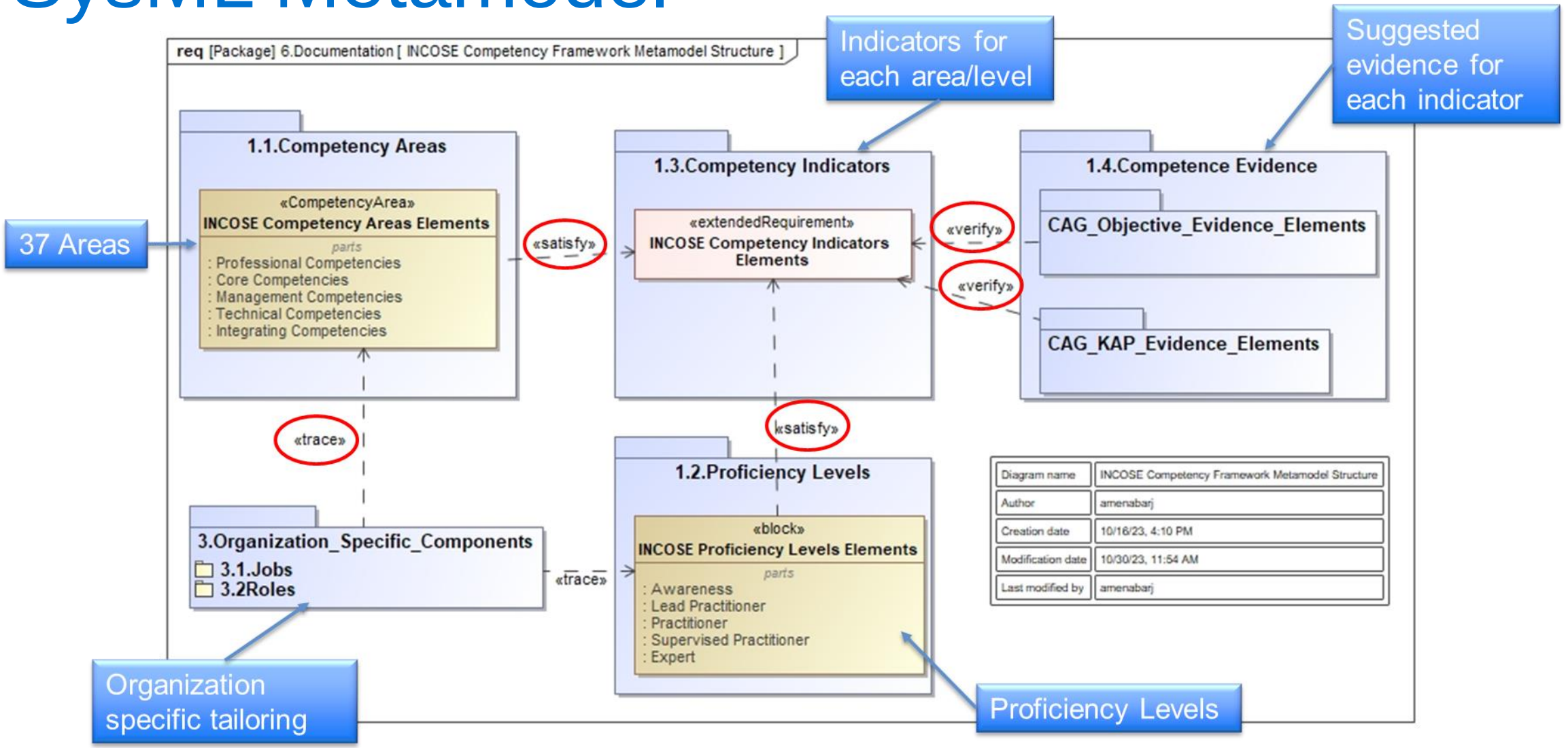
2023

- **INCOSE Competency Assessment Guide published through Wiley**
- **SysML Cameo Systems Modeler model developed**
- **INCOSE IS24 SysML Model Paper submitted (Oct)**
- Plan for implementation within INCOSE SE Lab (fall)

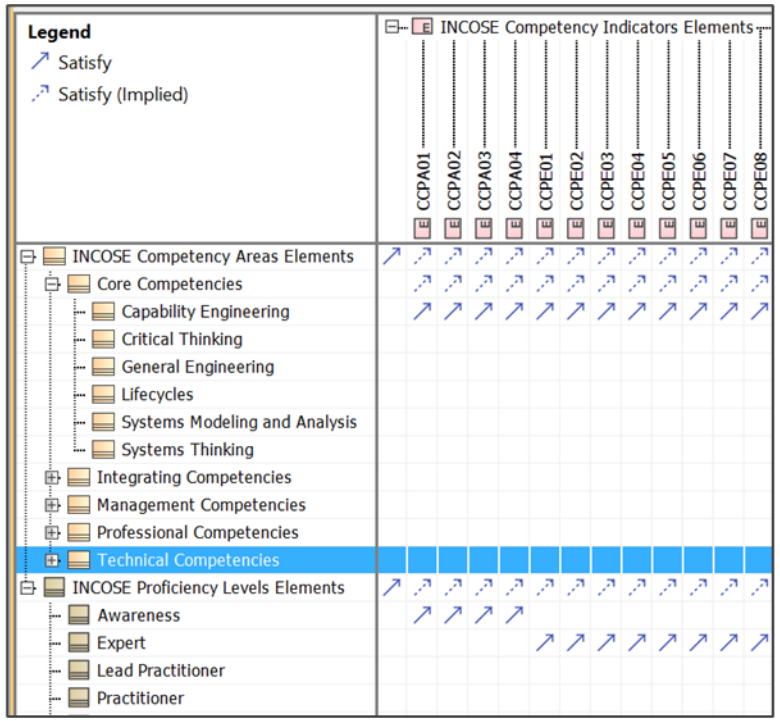
Future

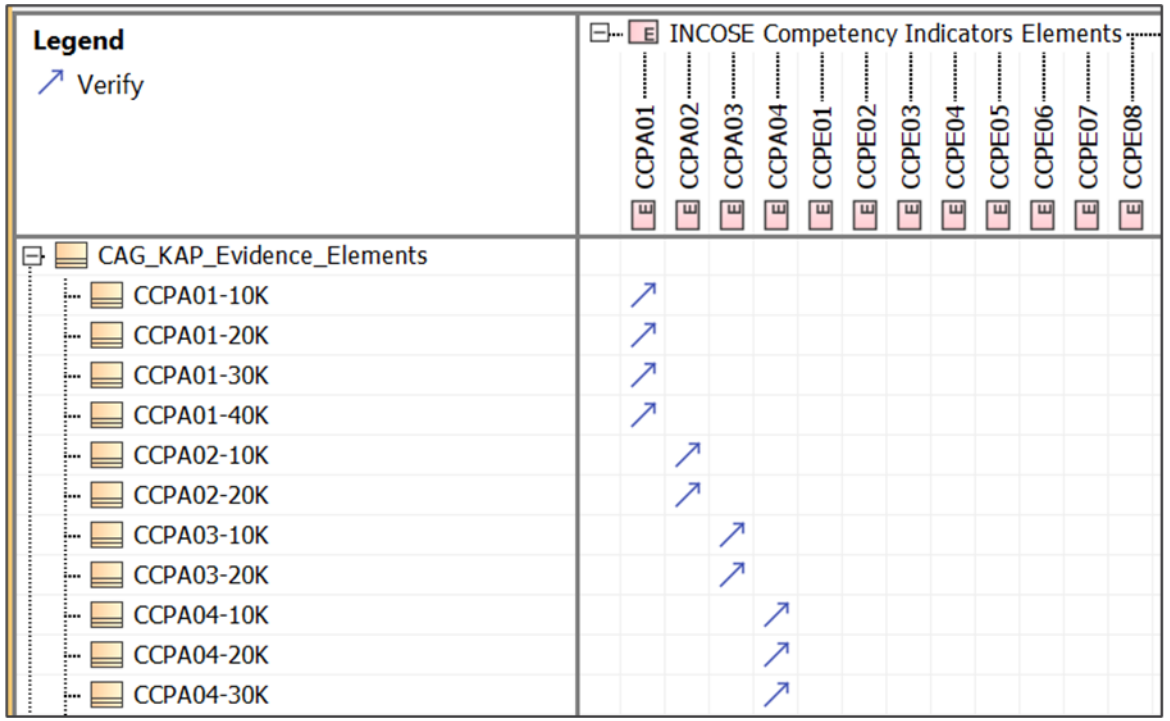
- Plans for additional competencies, model use cases, user interfaces

SysML Metamodel



Framework Structure





- Competency areas (**37 model elements**) vs proficiency levels (**5 model elements**) = 185 cross entries
  - Each cross entry contains multiple indicators (“requirements”) = **1541 model elements**
- Each requirement model element has an associated evidence element(s)
  - **4751 KAP evidence model elements**
  - **3081 Objective evidence model elements**
- Almost 10,000 model elements

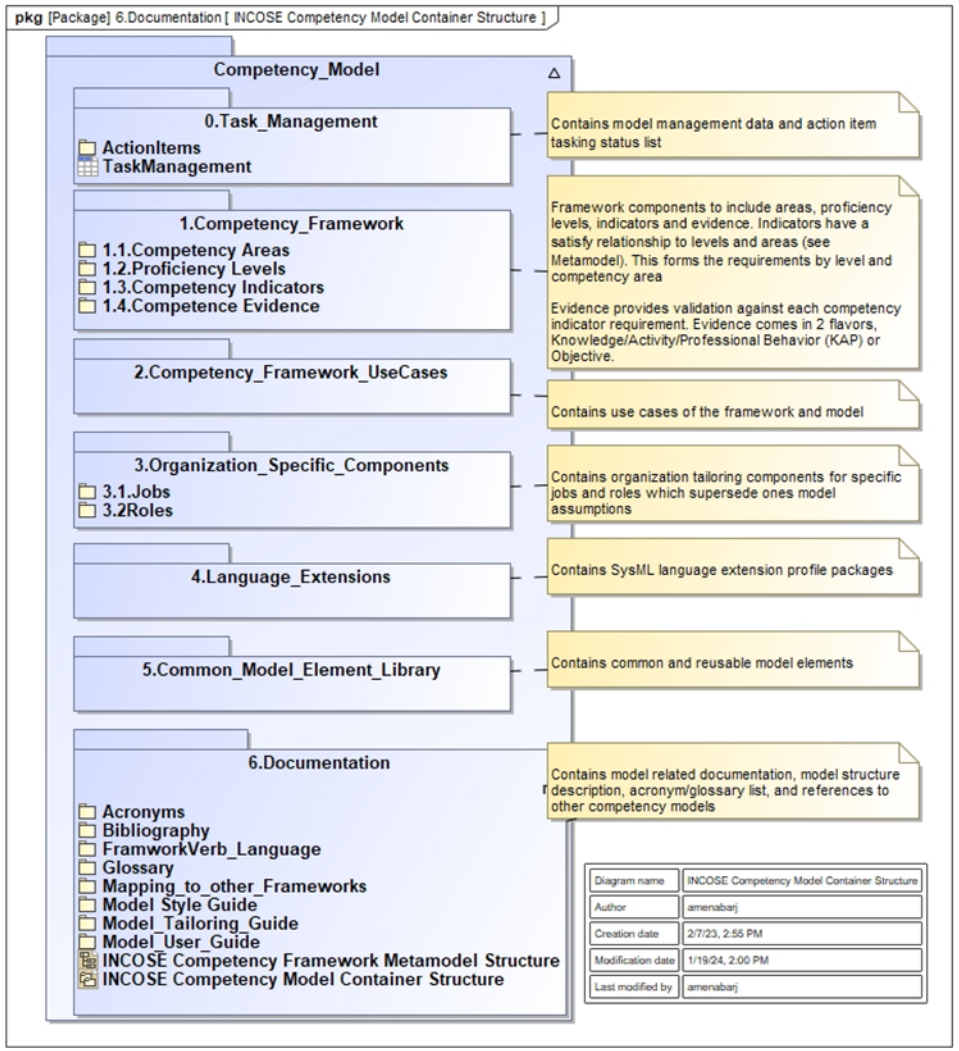
Organization Specific Model Elements

#	Name	Documentation	Job_ Description	Job_ Role	Job_ Role_ Level	Job_ Competency_ Area
1	Sample_Organization_Job	Organizations can have many job openings depending on need. Jobs can contain one or more role and each role can contain one or more competency at different required levels.	Jr Systems Engineer in support of requirements management, configuration management, and risk management tasking	Requirements Manager Risk / Opportunity Manager Configuration Manager	Responsible	Requirements Definition Risk and Opportunity Management Configuration Management

#	Name	Organization_ Role_ Purpose	Organization_ Role_ Activity	Organization_ Role_ Level	Organization_ Role_ Constraint	Required Competencies
1	Sample_Organization_Role	Configuration Manager	Perform configuration management and maintain configuration items. Provide reports on configuration control and conduct audits.	Responsible	Conforms to program requirements and organization standards	Configuration Management Communications Team Dynamics Systems Thinking

- Jobs and roles particular to an organization can be created and mapped to existing model elements
- Allows for model tailoring to a particular organization

Model Organization



- Model organized into containers for ease of configuration management, maintenance, and development
- Task Management contains information about model management and prioritized dynamic development task list
- Language Extensions contains model specific SysML extensions
- Common Element Library contains model elements common across the model organization
- Documentation contains model dynamic documentation and PowerPoint presentation templates for auto generation

Evidence Tables for KAP and Objective

#	Name	CAG Area Name	CAG Area Category	CAG Area Description	CAG Area Why it Matters	CAG Types of Evidence	CAG Learning and Development	CAG Indicator	CAG_Evidence_Text	CAG_Evidence_Satisfied
1	CSTS01-E10	Systems Thinking	Core Competencies	The application of the fundamental concepts of systems thinking to Systems Engineering. These concepts include understanding what a system is, its context within its environment, its boundaries and interfaces, and that it has a lifecycle. System thinking applies to the definition, development and production of systems within an enterprise and technological environment and is a framework for curiosity about any system of interest.	Systems thinking is a way of dealing with increasing complexity. The fundamental concepts of systems thinking involve understanding how actions and decisions in one area affect another, and that the optimization of a system within its environment does not necessarily come from optimizing the individual system components. Systems Thinking is conducted within an enterprise and technological context. These contexts impact the lifecycle of the system and place requirements and constraints on the systems thinking being conducted. Failing to meet such constraints can have a serious effect on the enterprise and the value of	Any combination of the types of evidence may be acceptable (depending on how the Framework is tailored and used).	The INCOSE Professional Development Portal provides example guidance on how to gain an initial awareness of a competency area and options for developing further competence thereafter.	CSTS01	Concept map or other model of a system. (CSTS01-E10)	false
2	CSTS01-E20	Systems Thinking	Core Competencies	The application of the fundamental concepts of systems thinking to Systems Engineering. These concepts include understanding what a system is, its context within its environment, its boundaries and interfaces, and that it has a lifecycle. System thinking applies to the definition, development and production of systems within an enterprise and technological environment and is a framework for curiosity about any system of interest.	Systems thinking is a way of dealing with increasing complexity. The fundamental concepts of systems thinking involve understanding how actions and decisions in one area affect another, and that the optimization of a system within its environment does not necessarily come from optimizing the individual system components. Systems Thinking is conducted within an enterprise and technological context. These contexts impact the lifecycle of the system and place requirements and constraints on the systems thinking being conducted. Failing to meet such constraints can have a serious effect on the enterprise and the value of	Any combination of the types of evidence may be acceptable (depending on how the Framework is tailored and used).	The INCOSE Professional Development Portal provides example guidance on how to gain an initial awareness of a competency area and options for developing further competence thereafter.	CSTS01	System concept document defining system lifecycle, context, hierarchy, sum of parts, purpose, boundary and key interactions. (CSTS01-E20)	false

Evidence Element ID

Area Information

Satisfied requirement ID
Evidence text
Boolean check on satisfaction

INCOSE Competency Framework SysML Model

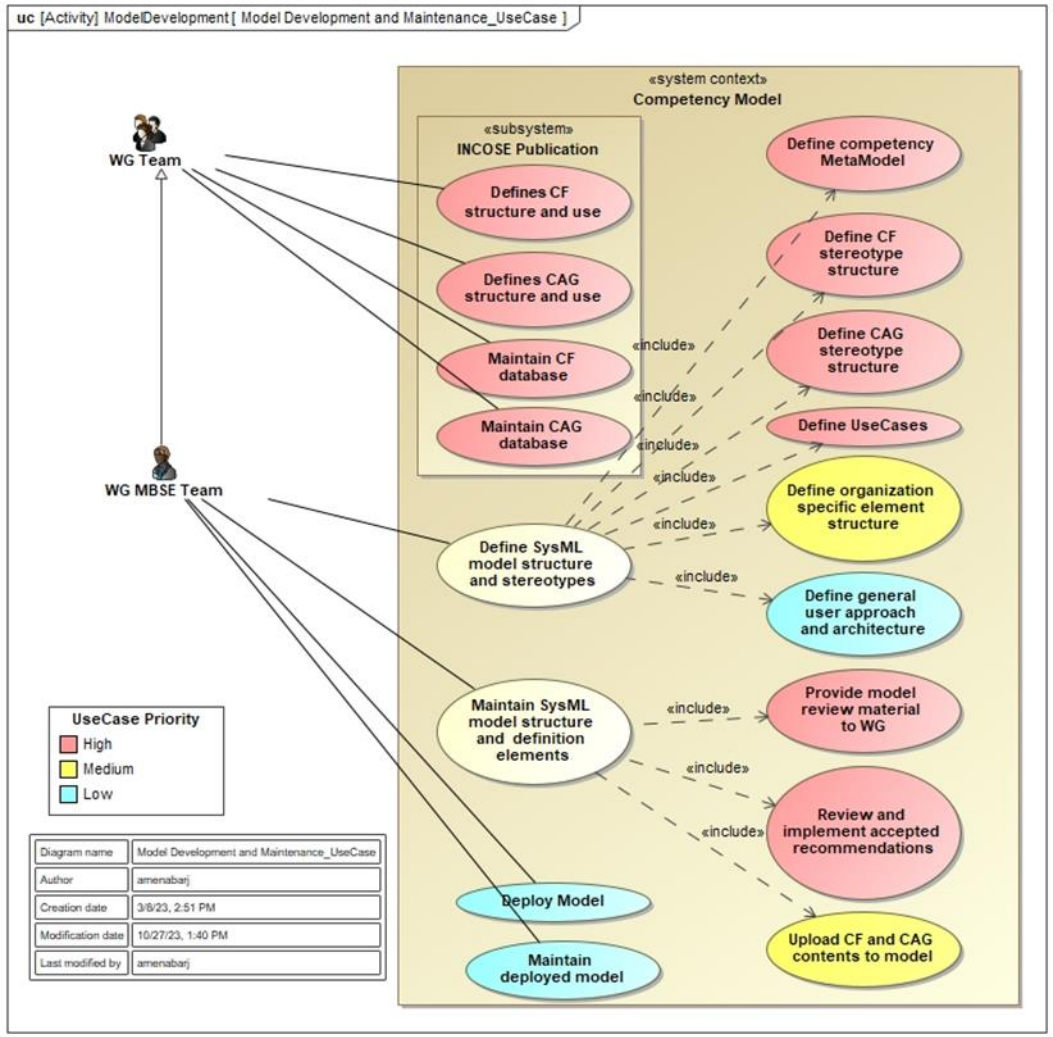
Current Model Use Cases

#	Name	Documentation
1	CandidateRecruitment	Having defined the requirements for a role in terms of competencies, an employer can assess candidate competence against the required competencies using the Competency Framework assessment guide. This helps to provide an objective (and repeatable) assessment of candidates at interview
2	CareerPath	An employer can link career paths within the organization to differing expected combinations of competencies and associated minimum competence levels. This can be used to provide insight to employees as to the competence needs for differing career development paths. This indicates the competencies and levels necessary to progress a selected career path – informing employee career development choices along the way.
3	CourseCurricula	An educational curriculum provider interacts with curriculum sponsors and/or accreditation agencies to assess the effectiveness of an educational course/module in delivering stated outcomes against pre-defined accreditation objectives. This might be through assessment of learning objectives against competency needs, and outcomes against competence acquired or those attending the course
4	DevelopmentPlanning	An employee can "self-assess" their skills against the competency framework, using the assessment guidance provided. This helps inform their career development choices – whether as part of a job application or more generally as part of a personal career path development.
5	EducationalCourses	A company recruiter or capability manager interacts with a representative of an educational institution to define the competencies expected from those leaving the educational institution. This helps align program content to better prepare graduates for company employment.
6	EducationalVerification	A company recruiter or capability manager interacts with a representative of an educational institution to assess and recruit pre-qualified students against a set of competency needs for a company pipeline programs.
7	JobDescription	An employer publishes the requirements for an organizational role in terms of competencies and their minimum required levels – as defined above. Candidates and recruiting agencies can compare this against their own (or their candidates') competences to determine their suitability for the position. It also supports candidate preparation as it provides an insight into the evidence they may be asked to provide during their application and/or interview.
8	ModelDevelopment	SysML digital representation of INCOSE framework database and structure development and maintenance
9	ModelUsage	SysML digital representation of INCOSE framework utilization by INCOSE Competency Work Group members and/or other users
10	PerformaceAssessment	An employer sets targets for individual competence attainment in one or more competencies, and provides opportunities for competency development to occur. The competence assessment activity can be used to formally gauge competence level attainment against the targets set, as an input to their overall performance rating.
11	RoleDescription	An employer defines the needs for an organizational role in terms of competencies and their minimum required levels. This use case is elaborated further in the section on role definitions elsewhere in this document. A competency-driven job definition can also help ensure that the requirements for a role are based upon ability rather than age and thus aligns with age-discrimination legislation in areas such as the European Union (GOV. UK 2017).
12	TrainingInvestment	An organization gathers enterprise-wide data through individual employee competence assessment against the framework and uses this to assess organizational-level strengths and weaknesses. This enables training investment to be focused on areas deemed organizationally (and individually) in areas where it is needed most.
13	WorkForceRiskAnalysis	An organization can use information gathered through individual employee competency assessment against the framework to analyze organizational capability within a specific domain of Systems Engineering, or more generally. This could be driven by current or future business aspirations. Acquirers (i.e. organizations placing contracts) could mandate minimum organizational capability requirements for those supporting a contract/task as a risk reduction strategy – requesting capability data based upon competency assessments using the framework rather than traditional more generalized experiential statements from a business.

INCOSE Competency Framework SysML Model

- 13 use cases included in the model
- Current and near future work looks to expand and solidify current set

Sample Model Use Case – Model Development



- Model development use case covers the Comp WG team usage as well as the MBSE development sub team (members of the WG)
- Primary utilization is to have a digital copy of the INCOSE publication which aids in the development and advancement of future frameworks

Future Plans

- Model structure (metamodel) has been implemented and 2023 CAG data imported
- Use case scenario development and growth will be a 2024 activity
- Mapping to other framework and INCOSE areas is another possible growth area
- Development of a user interface to allow an engineer to self assess with the model is another longer-term project of interest
- Expansion of current framework into other areas such as digital engineering, security, etc is also of interest

Competency WG Points of Contact

- Clifford Whitcomb, WG Chair
- Lori Zipes, WG Co-Chair
- Ian Presland, Framework Editor
- Juan Amenabar, SysML developer

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INCOSE Tool Integration and Model Lifecycle Management Working Group and Alliance Partners

A Presentation for IW 2024 MBSE Initiative WG

TIMLM WG Profile

Chair, Co-chairs, Project Leaders

John Nallon: Chair

Co-Chair: Mark Williams

Co-Chair: Juan Mendo

Misak Zetilyn: MPMG Project Leader

INCOSE Web Pages

Tool Integration and Model Lifecycle Management (incose.org)

INCOSE SE Tools Database (SETDB)

144 Members in the TIMLM WG
49 Members MBSE for PDES and LOTAR
346 Members of the SETDB WG

Yammer Communities
www.yammer.com/incose.net

TIMLM WG

MBSE for PDES and LOTAR

SETDB WG

MOU Alliances: PDES Inc., LOTAR, NAFEMS, and PPI

The Tool Integration and Model Lifecyle Management WG

- **The TIMLM WG Objectives:**
  - Advance the ***integration and interoperability of tools, data, models and processes*** as they relate to Systems Engineering processes and throughout acquisition and product life cycles.
  - **Collaborate with** PDES Inc., ISO and STEP **standards organizations, the INCOSE Standards Development Department** and other INCOSE Working Groups to **improve the *exchange, archival and retrieval of digital artifacts produced by our systems engineering processes.***

The HOW to do, not the What to do (processes)

PDES/LOTAR/INCOSE Historical Highlights

- ***ISO 10303-AP233****: Systems Engineering Data Exchange Standard*
  - *Championed the initial requirements document for the development of the standard and worked with PDES Inc. to develop the standard*

- ***System Architecture Virtual Integration (SAVI)*****:** *An AVSI initiative for model data interchange using standards-based definitions for interchange formats for interoperability and consistency.*
  - *See Virtual Systems Integration – AVSI*
  - *The SAVI Program was a collaborative, industry-led project developing the processes and technologies necessary to **enable virtual integration of complex systems**.*
  - *2013-2014 Proof of concept using:*
    - *AADL- Architecture Definition Language*
    - *SysML – Systems Modeling Language*
    - *VIP – Vertical Integration Process*
  - *AVSI – Aerospace Vehicle Systems Institute is currently at Texas A&M University*

TIMLM WG Collaboration

- **Regular Joint Sessions**
  - ***Every Wednesday 09:30 am to 11:00 am EST USA – PDES/LOTAR/INCOSE***
  - ***Annual INCOSE International Workshops***
  - ***Quarterly PDES-LOTAR Workshops*** *(2 Virtual; 2 Virtual and in person)*

- **Frequent Collaboration Participants:** (Example Listing)
  - INCOSE ***DEIX Working Group***,
  - INCOSE ***MBSE Initiative Teams***,
  - INCOSE ***NAFEMS-SMS Working Group*****,**
  - **INCOSE *Standards Department*** *(ISO 10303-AP243 and ISO/IEC_CD_24641)*
  - ***CIMdata*** *(A&D PLM), OSLC, and the OMG*
  - Tool Vendors, Tool Users and Standards Developers

PDES/LOTAR/INCOSE Collaboration

- **LOTAR for MBSE Standards in Work: (European Norm/National Aerospace Standards)**
  - **EN/NAS 9300-500 Series**: Common concepts for Long term archiving and retrieval of Model Based Systems Engineering information (digital data, models, etc.)

- **INCOSE IW MoSSEC Workshops and Forums**: (supporting PDES Inc./LOTAR)
  - **MoSSEC Implementor Forum :** (initiated at IW 2023)
    - Supporting: prototypes, vendor implementations, knowledge dissemination to the user and business communities, relationships with other standards, etc.
  - ***MBSE Interoperability Forum*** (held at 2023 PDES/GPDIS Workshop and INCOSE IW 2024)
    - Featuring multiple data exchange standards, new approaches, real experiences and open discussions – Sunday January 28th 13:00 to 17:00

IW 2024 Interoperability Sessions

- **INCOSE IW 2024: MBSE Interoperability Forum (see the schedule of events fort Sunday and Monday)**

- **Presentations Include:**
  - **MoSSEC Activity Update** (PDES)
  - **Paper**: "**Methods to embed and manage links in MBSE Models**" (Modelon)
  - **LOTAR NAS 9300 Overview** – the MBSE model archival and retrieval standard (PDES Inc.)
  - **MBSE Interoperability Enabled by SpecIF** and the prostep ivip **Digital Data Package** (GfSE)
  - **Model Based Supply Chain Collaboration** (CIMdata)
  - **Federated PLM using OSLC Integration** (Saab Aerospace)
  - **Web-based approach to traceability using Web-apps** (Koneksys)

TIMLM WG – MPMG Released Dec. 2023

- **The INCOSE Model Portfolio Management Guide**
  - A reference document for pre-award acquisition, final contract award and execution processes

  - The guide presents the following topics:
    - Model Portfolio Management Initiation
    - Model Portfolio Management Planning
    - Model Portfolio Management Execution
    - MPM Monitoring and Control

Available now in the INCOSE Store

Thank You

Come join us Sunday or Monday and you are welcome to attend our regular weekly meetings

We welcome: Reviewers, authors, open discussion, presenters, all interested personnel, new ideas, use cases, lessons learned…..

TIMLM WG Standards Activities

- **LOTAR for MBSE Standards in Work: (European Norm/National Aerospace Standards)**
  - **EN/NAS9300-500**: Common concepts for Long term archiving and retrieval of Model Based Systems Engineering information
  - **EN/NAS9300-510**: Requirement management of 'text, graphics, tables and parameter-based information
  - **EN/NAS9300-515**: Model Verification and Validation
  - **EN/NAS9300-520**: How to Archive System Behavior and Simulation Models
  - **Others:** Architecture Descriptions (530), Logical Bill of Materials (540), Links relating elements across numerous tools (550)

- **Interoperability Standards**:
  - **ISO 10303 - AP243 Mo**deling and **S**imulation information in a collaborative **S**ystems **E**ngineering **C**ontext **(MoSSEC)**
    - **Activities**: prototypes, vendor implementations, knowledge dissemination to the engineering community, relationships with other standards and leading the formation of ***Implementor and Interoperability Forums***

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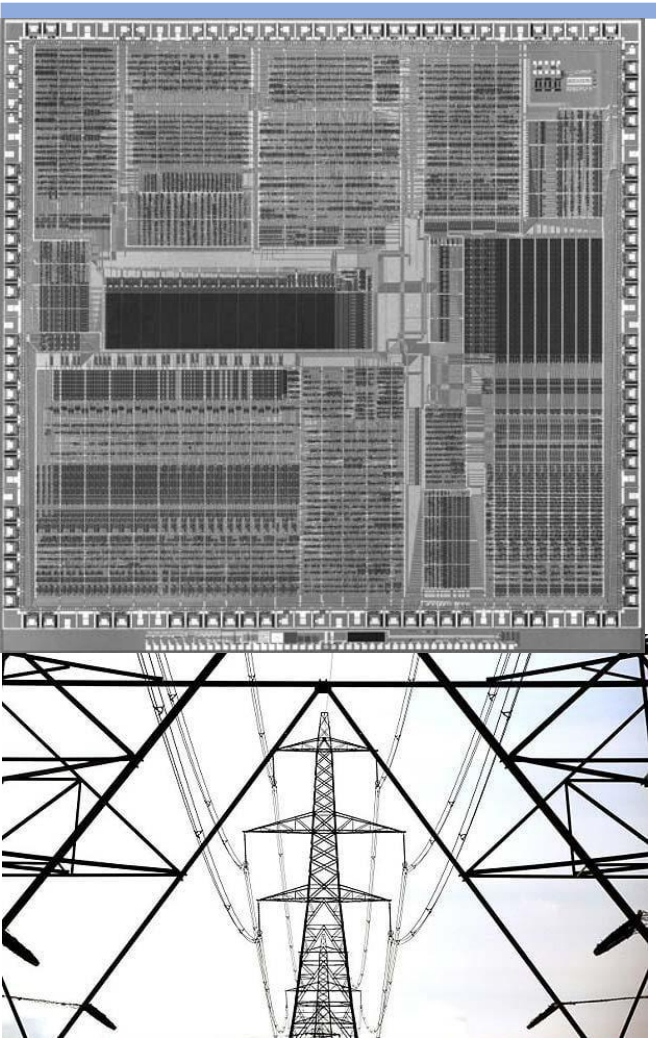
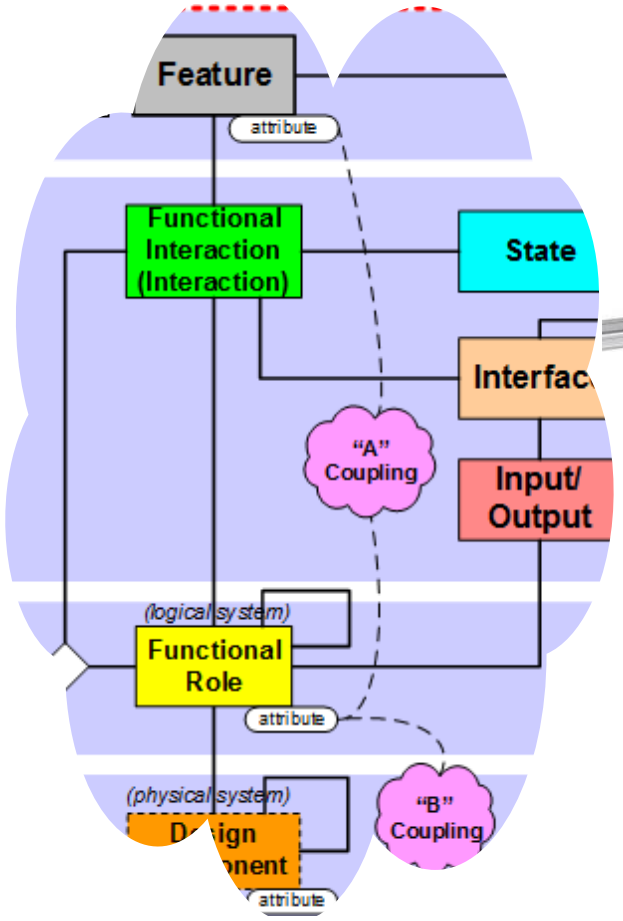
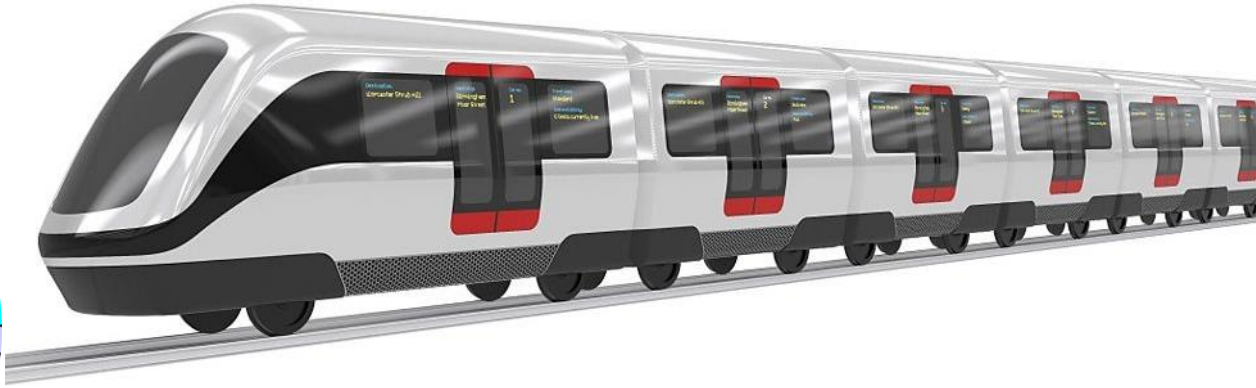
V1.2.1

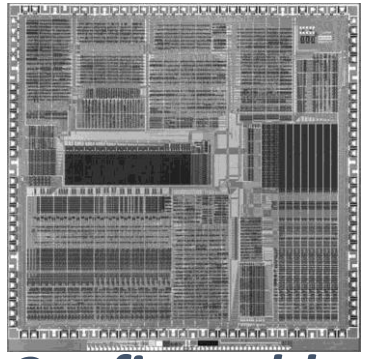
Round Robin: MBSE Patterns Working Group







Invitation to Patterns WG Meeting at IW2024: Sunday, Jan 28, 1:30 – 3:30 Pacific Time, Salon H

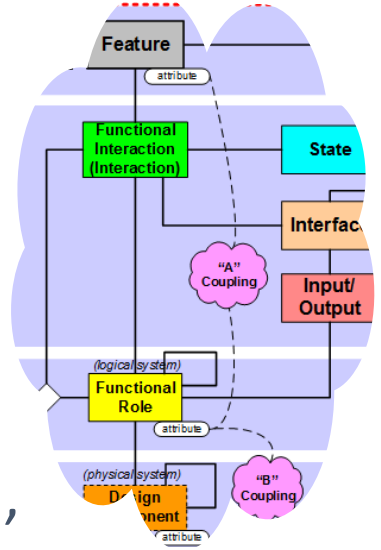


Focus of MBSE Patterns Working Group: S*Patterns

FOR MORE

***Configurable, re-usable system models*:**

1. Models containing a certain minimal set of elements are called S*Models (S* is short for “Systematica”).
2. Those underlying elements are called the S*Metamodel, which was inspired by the unmatched success of the physical sciences and impact of STEM.
3. S*Models using those elements may be expressed in any modeling language via formal mapping (e.g., in OMG SysML, or in other languages).
4. S*Models can be (have been) created and managed in many different COTS modeling tools using such diverse languages.
5. Re-usable, configurable S*Models are called S*Patterns.
6. By “Pattern-Based Systems Engineering” (PBSE) we mean MBSE enhanced by these generalized assets to enable model configuration from trusted patterns.
7. These are typically system-level patterns (models of whole managed platforms), not just smaller-scale component design patterns.



WG projects, discussed now, plus others

The others

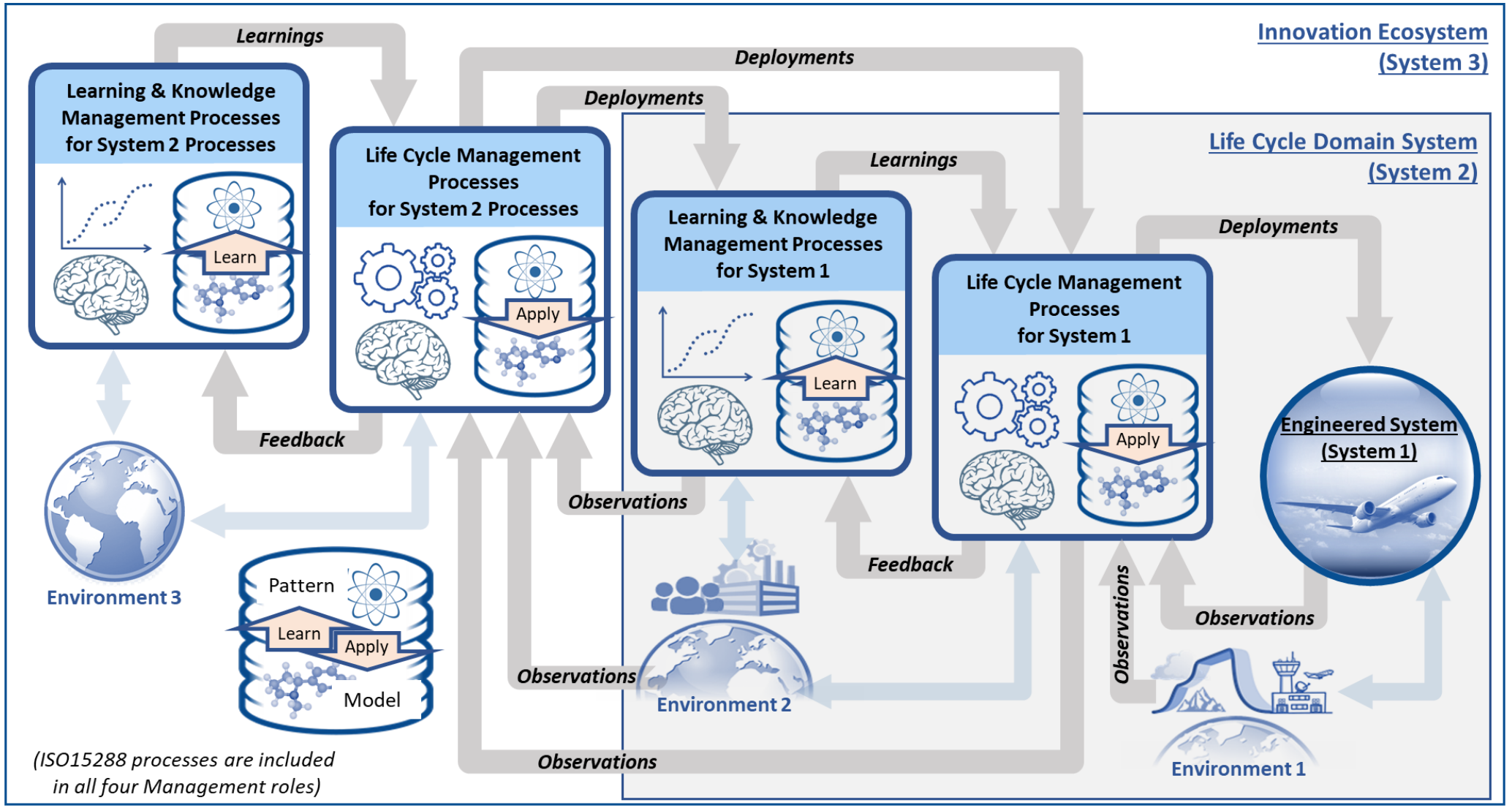
Patterns & Technologies:

1. Semantic Technologies for Systems Engineering (ST4SE) Project.
2. Adaptive Learning Ecosystem Pattern—the INCOSE ASELCM Reference Framework.
3. Universal Model Metadata Wrapper: Model Characterization Pattern (MCP), w/ASME VV Stds Cmte & V4 Inst.
4. S*Pattern Configuration Wizard.

Publications:

1. Minimal S*Models—A Primer (including S*Metamodel and its formal mappings to OMG SysML and tools)
2. S*Patterns Primer (second ed)
3. ASME Guideline for Managing Credibility of Models for Adv. Manufacturing, w/ASME VV50 Stds Working Grp.
4. AIAA Aerospace Digital Twins Case Studies Pub; Digital Twin Analysis and Planning Reference Pattern, w/AIAA.
5. AIAA Aerospace Digital Threads Position Pub; Digital Thread Analysis & Planning Reference Pattern, w/AIAA.
6. *Handbook of System Sciences*, for ISSS via Springer: Chapter: “Patterns in Science and Engineering”, w/ISSS.
7. *Handbook of Model-Based Systems Engineering*, Madni & Augustine, eds, Springer, Chapter: “MBSE Patterns”.
8. *INCOSE SE Handbook*, 5th Ed., for INCOSE, D. Walden et al, eds, material on S*Metamodel and ASELCM Pattern
9. Support for Vision 2035 Implementation Streams: Innovation Applications, SE Foundations.
10. *INCOSE INSIGHT,* Dig. Engg. Issue, 2022, F. Salvatore, ed, Realizing the Promise of Digital Engineering: The Innovation Ecosystem Reference Pattern for Analysis, Planning, and Implementation.

Adaptive Learning Ecosystem Pattern—the Learning Ecosystem (ASELCM) Reference Framework

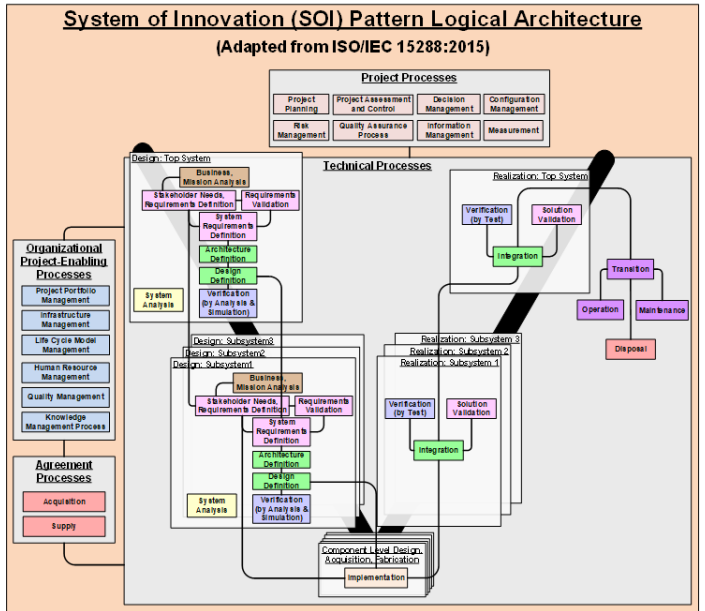


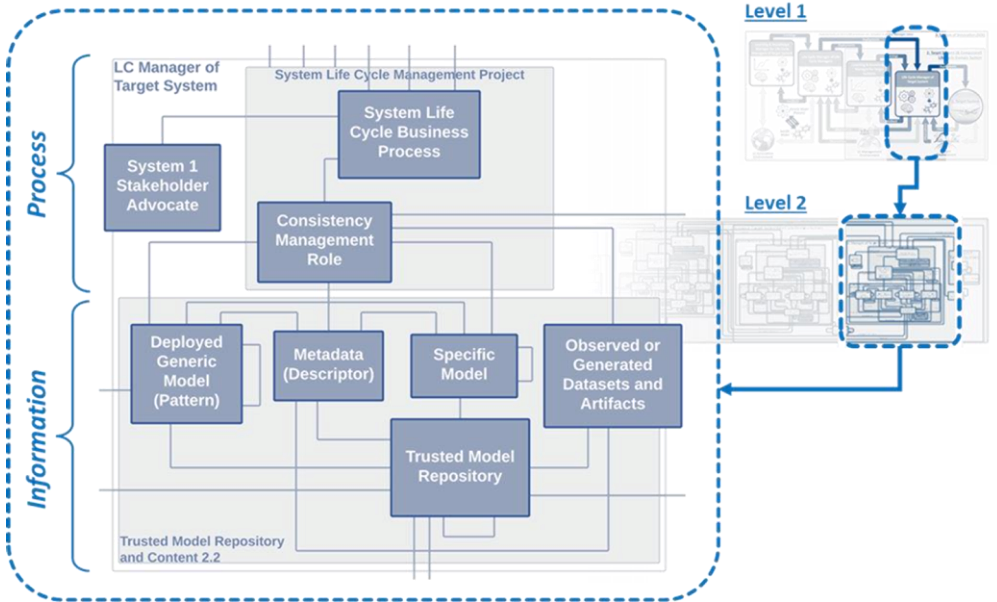
ASELCM Pattern Description

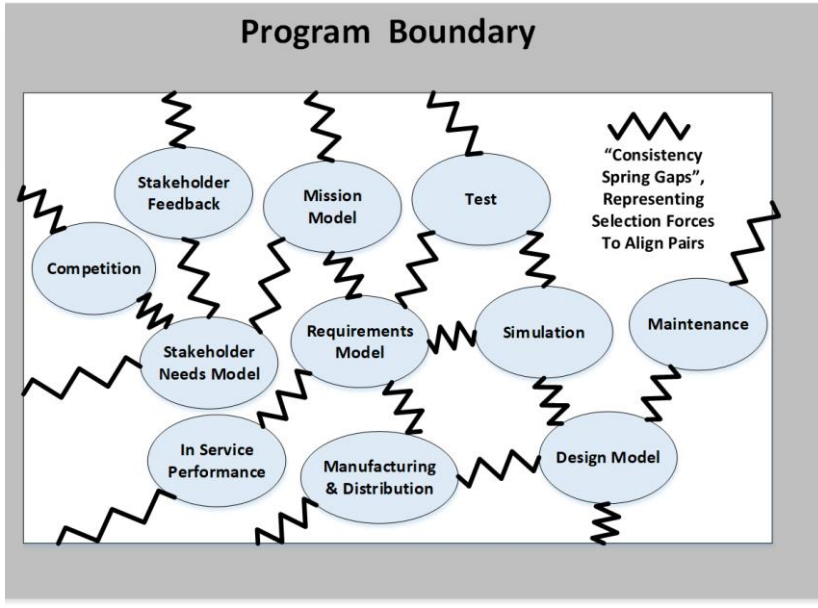
AIAA's Related Application (Digital Threads)

Consistency gap management paradigm for innovation ecosystems

- The consistency management paradigm is the central information thread running through the ASELCM pattern's representation of any engineering/life cycle management / supply chain system's primary activities.
- Including the digital thread and its many precursors.







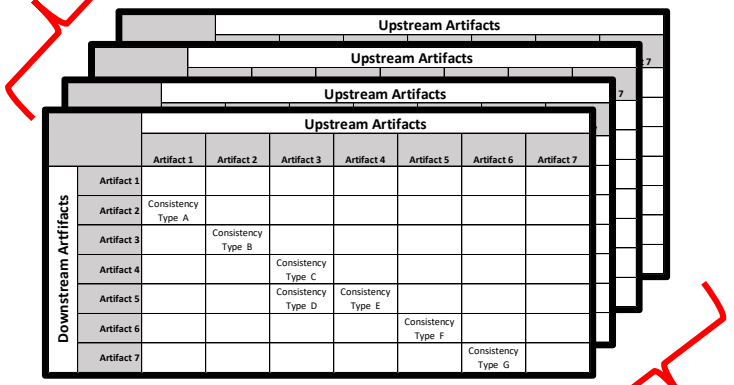
Related collaboration project across four societies:

- Different discipline communities (e.g., ISO 15288 SE *versus* ASME VVUQ-1 computational modeling communities) have different consistency confirmation frameworks, nomenclatures, standards.
- This can present challenges to engineering rigor, when performed "together" for trust-critical integrated systems.
- Working groups of INCOSE, ASME, AIAA, and NAFEMS are collaborating on a comparative "Rosetta Stone" mapping of different consistency confirmation frameworks of different communities:

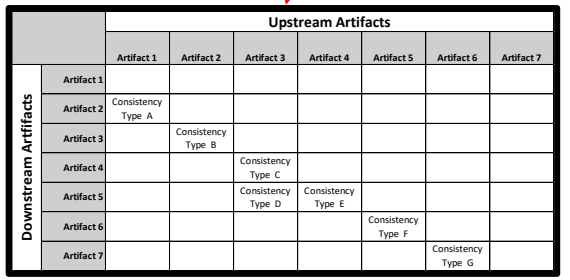
		Upstream Artifacts						
		Artifact 1	**Artifact 2**	**Artifact 3**	**Artifact 4**	**Artifact 5**	**Artifact 6**	**Artifact 7**
Downstream Artifacts	**Artifact 1**							
	Artifact 2	Consistency Type A						
	Artifact 3		Consistency Type B					
	Artifact 4			Consistency Type C				
	Artifact 5			Consistency Type D	Consistency Type E			
	Artifact 6					Consistency Type F		
	Artifact 7						Consistency Type G	

For one discipline

Multiple disciplines



Merge



Merged multiple discipline mapping

Related application of Hamiltonians for IT and socio-technical systems

- Adopting W R Hamilton's "characteristic function" perspective enriches interpretation of the nature of momentum and energy, in additional settings:
  - *By reasoning in the right order, Hamiltonians can be defined for IT (i.e., digital) and socio-technical systems, using observational data.*
  - *Managed consistency gaps provide the potential energy part of the ASELCM System 2 Hamiltonian, characterizing the ecosystem.*
- A partial discussion during the Patterns WG meeting Sunday in Salon H.
- This summer in Dublin (Hamilton's home), we'll detail it further during IS2024.

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RWG MBSE Roundtable

Jeff Williams, RWG Co-Chair

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2024 RWG Leadership Team

- Louis Wheatcraft – Chair (New)
- Tami Katz – Co-Chair (Outgoing Chair)
- Michael Ryan – Co-Chair
- Kevin Orr – Co-Chair
- Jeffery Williams – Co-Chair (New)
- Katarzyna Kot – Co-Chair (New)

Major Activities

- Version 2 of the Needs and Requirements Manual (NRM) is ready to be published by Wylie.
- Plan for additional Guides to elaborate on key concepts and activities of the NRM
  - "Guide to Security Needs and Requirements" (SSWG – Beth Wilson)
  - Proposed "Guide to Model-based Needs and Requirements"
    - Stresses practical guidance on the application of the concepts and activities in the NRM to the needs and requirements definition in a Model-based Environment.
  - Other guides based on member interests and needs.

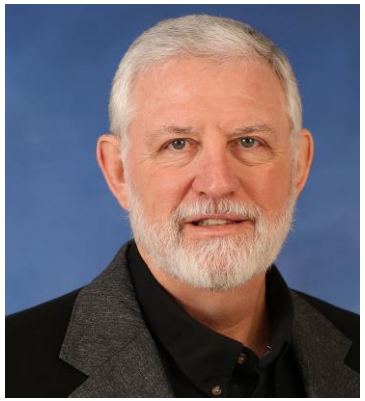
Why create a *Guide to Model-based Needs and Requirements?*

- 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".**

Bio of Jeffery L. Williams, Ph.D.



Adjunct Professor of Systems Engineering at the University of Alabama in Huntsville.

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 on going 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.

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INCOSE Digital Engineering Information Exchange Working Group (DEIXWG)

Chair: Terri Chan: terri.chan@incose.net

Deputy Chair: Celia Tseng: Celia.Tseng@3ds.com

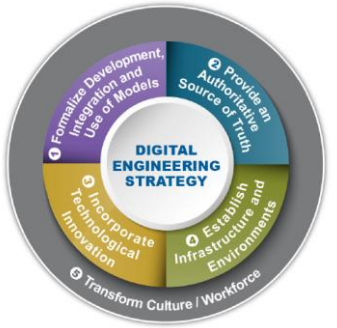
Co-Chair (OSD Liaison): Frank Salvatore: Frank.J.Salvatore@SAIC.com

Co-Chair (NDIA Liaison): Chris Schreiber: Chris.Schreiber@LMCO.com

Tech Lead (DVM): Ken Zhang: LeqiKen.Zhang@l3harris.com

What is the DEIXWG?

- Formed as INCOSE Working Group in 2018
- Collaboration between the International Council of Systems Engineers (INCOSE), National Defense Industrial Association (NDIA), and the Office of the Under Secretary of Defense for Research and Engineering (DoD OUSD(R&E))
- The DEIXWG supports the strategic objective of accelerating digital engineering transformation by characterizing the content and relationships involved in the exchange of digital artifacts between stakeholders of various disciplines throughout the engineering lifecycle

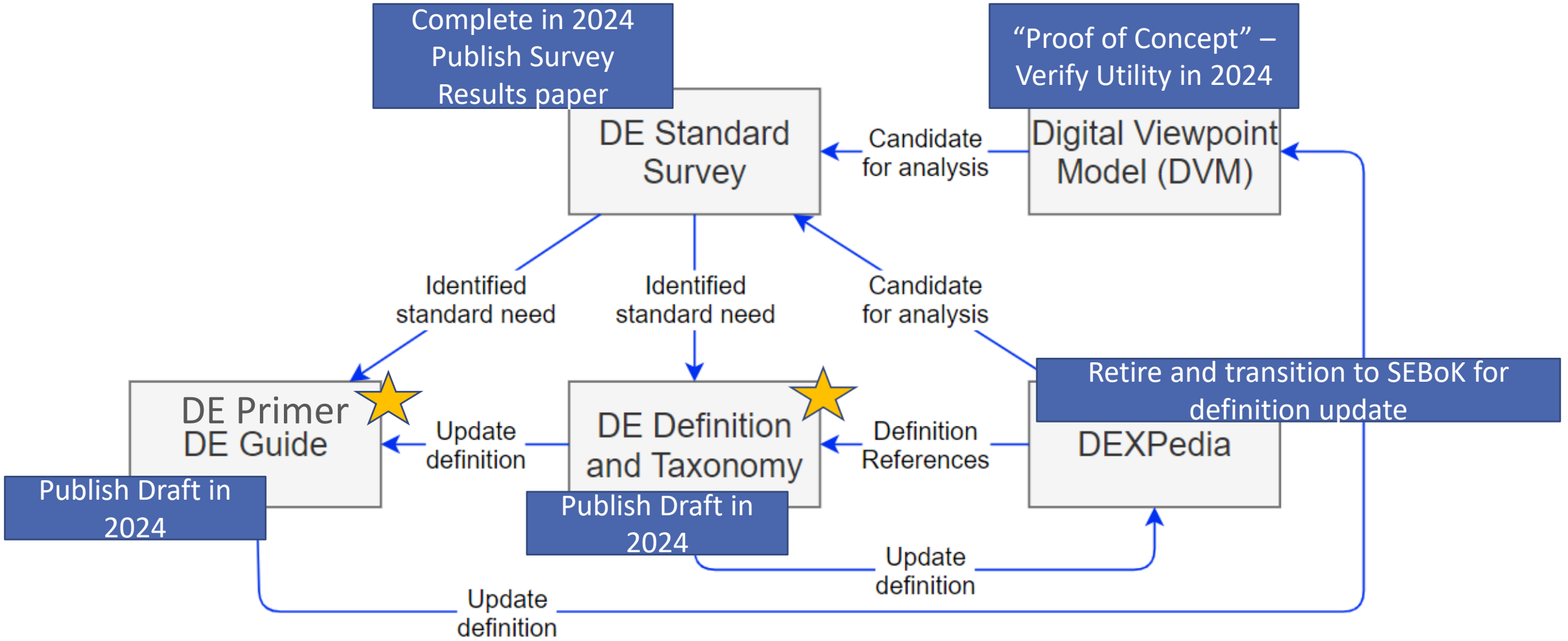


Use the authoritative source of truth to produce digital artifacts, support reviews, and inform decisions

As the technical baseline matures, preserving the knowledge across programs and lifecycle phases is essential. Technical reviews can be conducted from the authoritative source of truth on a continuous basis. Stakeholders will generate digital artifacts, representing multiple views and various perspectives from the authoritative source of truth. Digital artifacts provide visibility of appropriate information across functional domains, disciplines, and organizations.

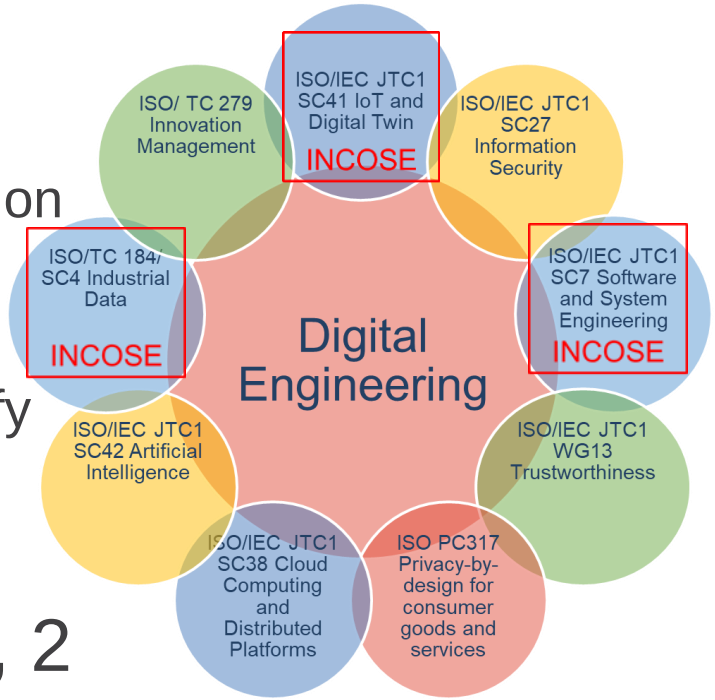
--- DoD Digital Engineering Strategy, 2018

DEIX Product 2024 Status and Relationship



DE Standard Survey

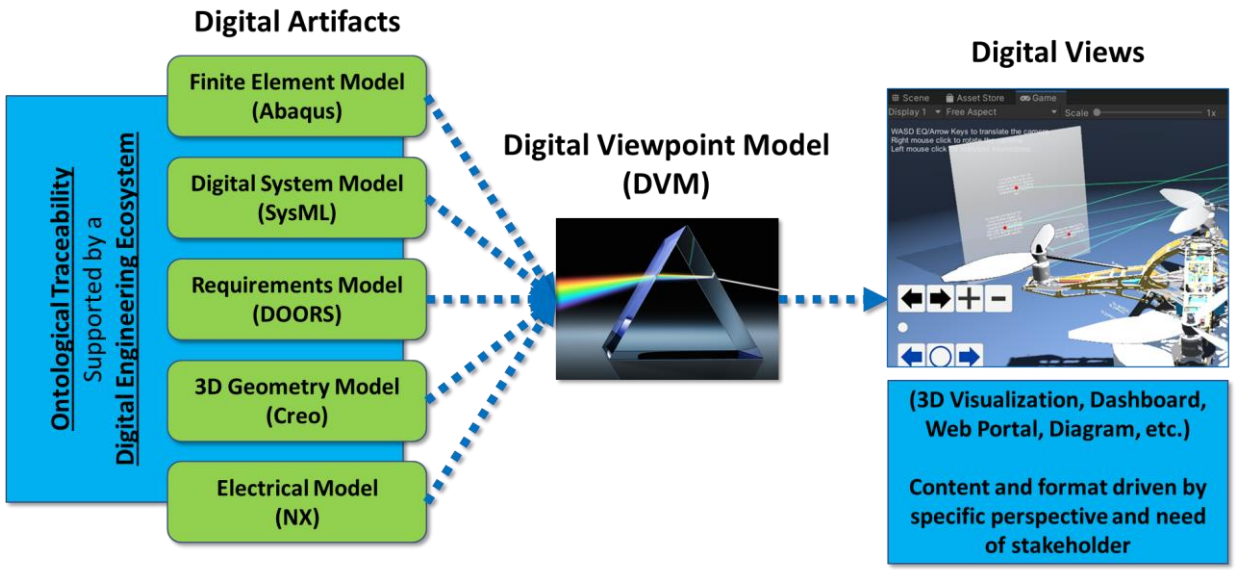
- Scope: Collaboration with ISO/IEC JTC1 SC7 AHG 6 to provide analysis of the requirements of the market for DE standard development
  - Alignment of standardization needs identified in INCOSE SE Vision 2035
    - Presented in 2023 INCOSE IS
  - Alignment of ongoing standard development activities and identify standard gaps
  - Collect SE community input via DE survey
- Outcome: Analysis report completed in Dec 2023, 2 standards proposal accepted for draft development

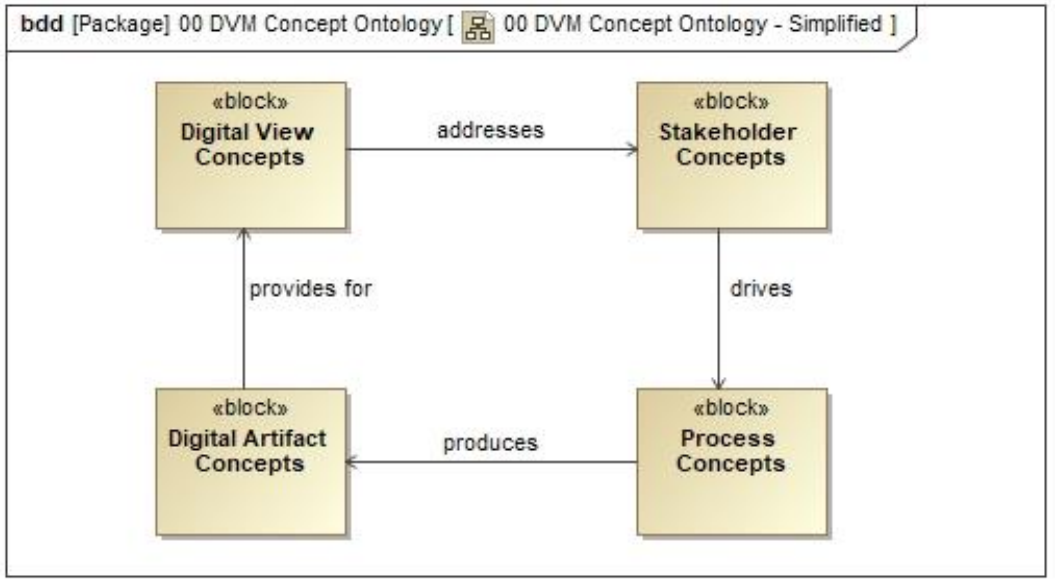


DE Standard Recommendations (2023)

- Ongoing with ISO/IEC JTC 1 SC 7 WG 7
  - Digital Engineering Measurement Framework “DE measurement”
    - Version 1.1: https://www.psmsc.com/DEMeasurement.asp
    - Version 2 update currently in development
  - Guidance for the utilization of ISO/IEC/IEEE 15288 with Digital Engineering “DE Guide”
    - “DE primer” draft publication in Jan 2024 as early draft of key lifecycle considerations
- Potential New Standard Investigation
  - Digital Viewpoint Model (DVM)
    - Need to demonstrate utility in 2024 for standard considerations
    - Incorporate DVM into DE guide, as representative digital views for each identified DE considerations
  - Digital Engineering Definitions
    - Use survey findings and literature research to inform definition updates in ISO vocabulary and INCOSE SEBok
    - Incorporate definition updates to DE measurement and DE guide
    - Develop into Taxonomy for new standard, or as annex for DE Measurement and DE Guide
  - Digital Engineering Ontology
    - To support MBSSE information and knowledge layer (24641 Annex A) to support lifecycle activities
    - Potential long term project with WG 7 and WG 4

Digital Viewpoint Model (Lead: Ken Zhang)





While the DVM is modeled using SysML, the concepts are agnostic of any particular language, tool, or infrastructure

- The Digital Viewpoint Model (DVM) is an **implementation-agnostic (platform independent), reference framework** developed from DEIXWG
- The DVM provides a high-level framework for describing sources of digital information in a digital engineering ecosystem (DEE)
- The DVM also conceptualizes how that information can be transferred, translated, transformed, and related for the purpose of exchanging digital information between stakeholders… who might not have the same DEE infrastructure or standards

DE Guide

Key areas of focus

- Tailors ISO/IEC/IEEE 15288 process to the unique challenges presented by digital engineering
- Clearly describes digital considerations across all system lifecycle stages
- Follows format of ISO/IEC/IEEE 21840

Objectives in terms of ISO alignment and industry impact

- Sets a foundation for cross-industry collaboration
- Provides general guidance for each ISO/IEC/IEEE 15288 process and process outcome in the context of DE
- Follows similar standards alignment to ISO/IEC/IEEE 21840

How the DE Guide aims to address current challenges and gaps in digital engineering

- Bridge gap between traditional systems engineering and digital engineering practices
- Provides adaptable guidelines that evolve with digital engineering practices

Questions…?

And thank you for your attention!

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INCOSE IW 2024
Critical Infrastructure Protection & recovery (CIPR) WG Future Projects Plan (Extensions of Department of Homeland Security (DHS) SysML Model)

Tony Adebonojo
CSEP/OCSMP L2/CISSP
Saturday January 27th 2023

www.incose.org/IW2024

US Critical Infrastructure (CI) SysML Model Project & Extensions

- What Is this project
  - Use Cameo Enterprise Architect to Model entire US CI in SysML
  - Support DHS Critical Infrastructure Security Agency (CISA) in their Update of the 2011 Infrastructure Data Taxonomy (IDT)
  - Modeled and Cross referenced the IDT to 55 US National Critical Functions (NCFs)
  - Submitted paper for presentation at IS 2024 in Dublin
- IW 2024 Current Effort
  - Meet Sunday Jan 28th with CISA to present IDT update suggestions
  - Telecomm WG/Smart Cities WG Leads will be in attendance with DHS/CISA to discuss our findings and ongoing effort
  - Headway CR at 9:30 AM (until 4:30 PM)

Summary of DHS IDT Effort

- Tony adopted the idea to model US CI in 2021
- Dassault donated 15 Cameo/TWC Licenses to this effort
- Presented initial effort at IW 2022 and garnered interest from DHS-CISA.
- In 2023, CISA asked INCOSE to assist them in update of their Infrastructure Data Taxonomy (IDT) using SMEs from a set of pilot working groups (WGs)
  - Telecommunications Sector (ICT WG)
  - Water Sector (Smart Cities WG)
- Present results tomorrow and design a year challenge at DHS-CIPR Workshop

Critical Infrastructure Protection & Recovery - DHS IDT Workshop

Chair:
Daniel Eisenberg

Add to my calendar

Working Group: 371

When: Sun 28, Jan 09:30-12:00 PST

Where: Hideaway

Related Working Group: Critical Infrastructure Protection and Recovery;;

Meeting listing: Hybrid session

Link: **web.yammer.com/main/org/incose...**

Details:

Join the CIPR WG and infrastructure system modeling experts to discuss MBSE methods and taxonomies!

Purpose: Discuss the US Department of Homeland Security (DHS) Infrastructure Data Taxonomy (IDT) and determine its use with MBSE methods developed by CIPR Working Group.
Objective: Learn, apply, and critique the DHS IDT and show its use for various applications in systems engineering. The overall goal of the session is to establish potential projects and studies that support IDT improvement and application by INCOSE members.
Structure: Workshop structure with invited presentations by DHS and CIPR WG members alongside group discussion
Timing: Tentative all day.

Illustration of Findings from Support to DHS Update of Their Taxonomy

bdd [Smart Package] Demonstration Views for IW 24 [Military Facility Taxonomy]

Draft Model
Military Facility Sub Segment Taxonomy

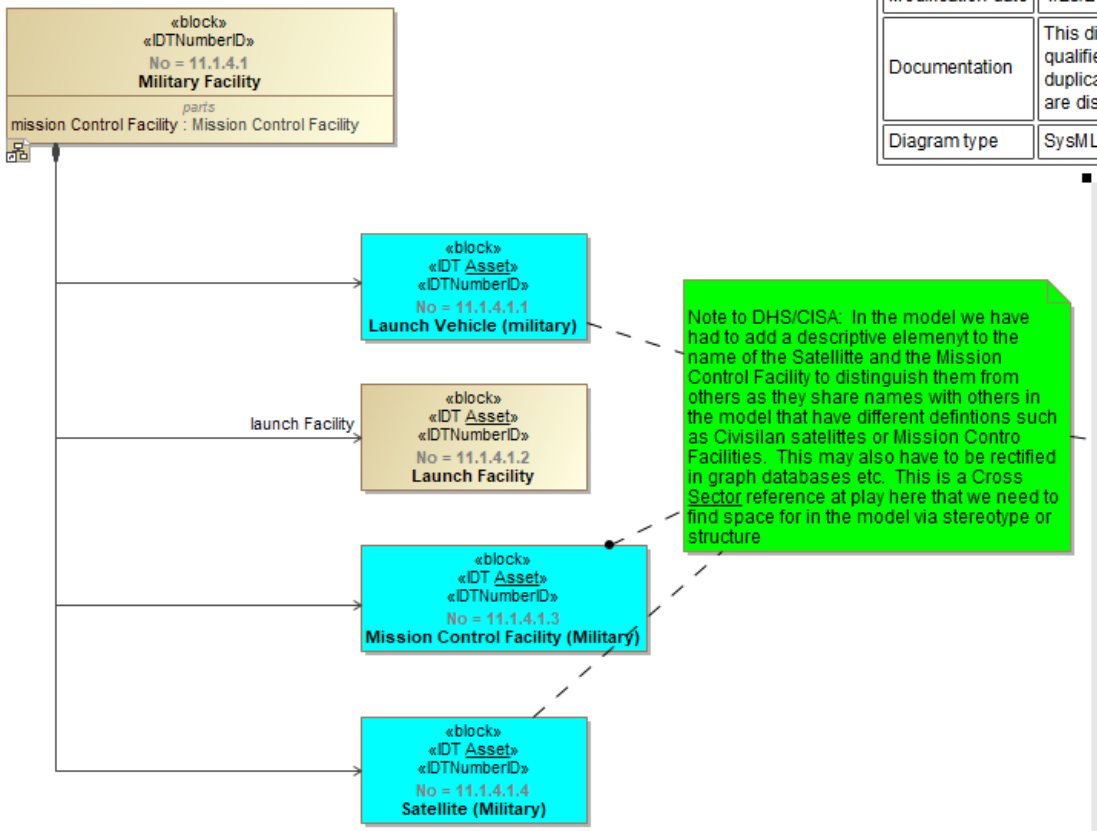

Diagram name	Military Facility Taxonomy
Author	Tony Adebonojo
Creation date	1/15/24, 7:32 AM
Modification date	1/23/24, 11:32 PM
Documentation	This diagram demonstrates the fact that the model reveals the need to add qualifiers or extra descriptive text to ensure that duplicates found in the base PDF IDT are distinguished from one another to assist in utilization of data within a model
Diagram type	SysML Block Definition Diagram

missing or overdue aircraft.

11.1.3.4 Other Air Traffic Control or Navigation Facility Air traffic control or navigation facilities and assets not elsewhere categorized.	808		488111
11.1.4 Space Transportation Facility	809		
11.1.4.1 Military Facility Facilities for the processing, integration, and assembly of military launch vehicles and payloads, launch and recovery operations, and range support for military launches.	810	15.6.1 Military Facility	
11.1.4.1.1 Launch Vehicle Military launch vehicles.	811	15.6.1.1 Launch Vehicle	927110
11.1.4.1.2 Launch Facility Facilities for launching military space vehicles.	812	15.6.1.2 Launch Facility	

IDT Path	IDT Description	IDT ID	Cross-sector Reference	NAICS Code
	11.1.4.1.3 Mission Control Facility Facilities for control of military space vehicles after launch.	813	15.6.1.3 Mission Control Facility	
	11.1.4.1.4 Satellite Military satellites.	814	15.6.1.4 Satellite	
	11.1.4.2 Commercial Facility	815		

Note: This Diagram is Provided for CIPR Community Review and is a DRAFT Version of this Model. It does not contain any Protected Critical Infrastructure Information (PCII) or disclose any vulnerabilities, or mitigation measures for any current or planned Critical Infrastructure capability, system or asset

Note that this is a generic model not intended for application in any specific project or instance

Draft Model

Future extensions to IDT effort

- ***CISA Interested in Yearly Challenge with INCOSE to extend these models***
  - ***Dependent on Success of the discussions Tomorrow***
  - ***You can get access to our TWC Environment in SE Lab***
  - ***Participate in the defined year Long challenge to extend the effort***
- ***Benefit to You:***
  - ***Recognition from DHS for winning the challenge***
  - ***Contribute to an effort that is significant to the USA***
  - ***Gain further experience in MBSE***
  - ***Learn Critical Infrastructure Field and apply MBSE in that domain***
  - ***Pull down models from INCOSE Website in 2024x Format and extend these models yourselves***

Future extensions to current IDT effort (Cont.)

- ***Arizona State University needs assistance with EPA Requirement for measuring parts per million in streams about this use case***
  - *Employ MBSE Techniques in this area*
- ***Convert SysML Model on TWC to UAF***
- ***Economic Analysis Use Cases:***
  - *Model is in SysML so leveraging the data there is all yours*
- ***Building Information Management (BIM) Taxonomy Collaboration***
  - *We have had initial collaboration meeting with National Institute of Building Sciences (Johhny Fortune) and IWG leadership to develop a collaboration on BIM Standards for Digital Transformation*
  - *Get with IWG to see how you can plug into that effort for digital transformation in Architecture, Engineers Contractors and Owners (AECO) Industry*

Other INCOSE CIPR WG Projects

- *Resilient Hospitals Project:*
  - *Summary: Development of decision support tool capability for a regional mid size hospital, to address preparing for and operating during Black Sky."*
  - *Contacts: (Howard Lykins at howard.lykins@verizon.net or John Juhasz at telepath.juhasz@yahoo.com*
  - *They require modelers to extend this effort (US citizenship required)*
- *COVID Last Mile Project:*
  - *Summary: Modeling of the effect of COVID era supply chain issues. Well received model looking to extend the effort into new areas*
  - *Contact: Steve Sutton at sjsutton.243@comcast.net*

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CubeSat System Reference Model™ (CSRM™) Quick Look

Space Systems Working Group (SSWG)

Co-Chairs

David Kaslow

david.kaslow@gmail.com

Alejandro Levi

alejandro.g.levi@ieee.org

CSRM Background

CSRM Project Objectives

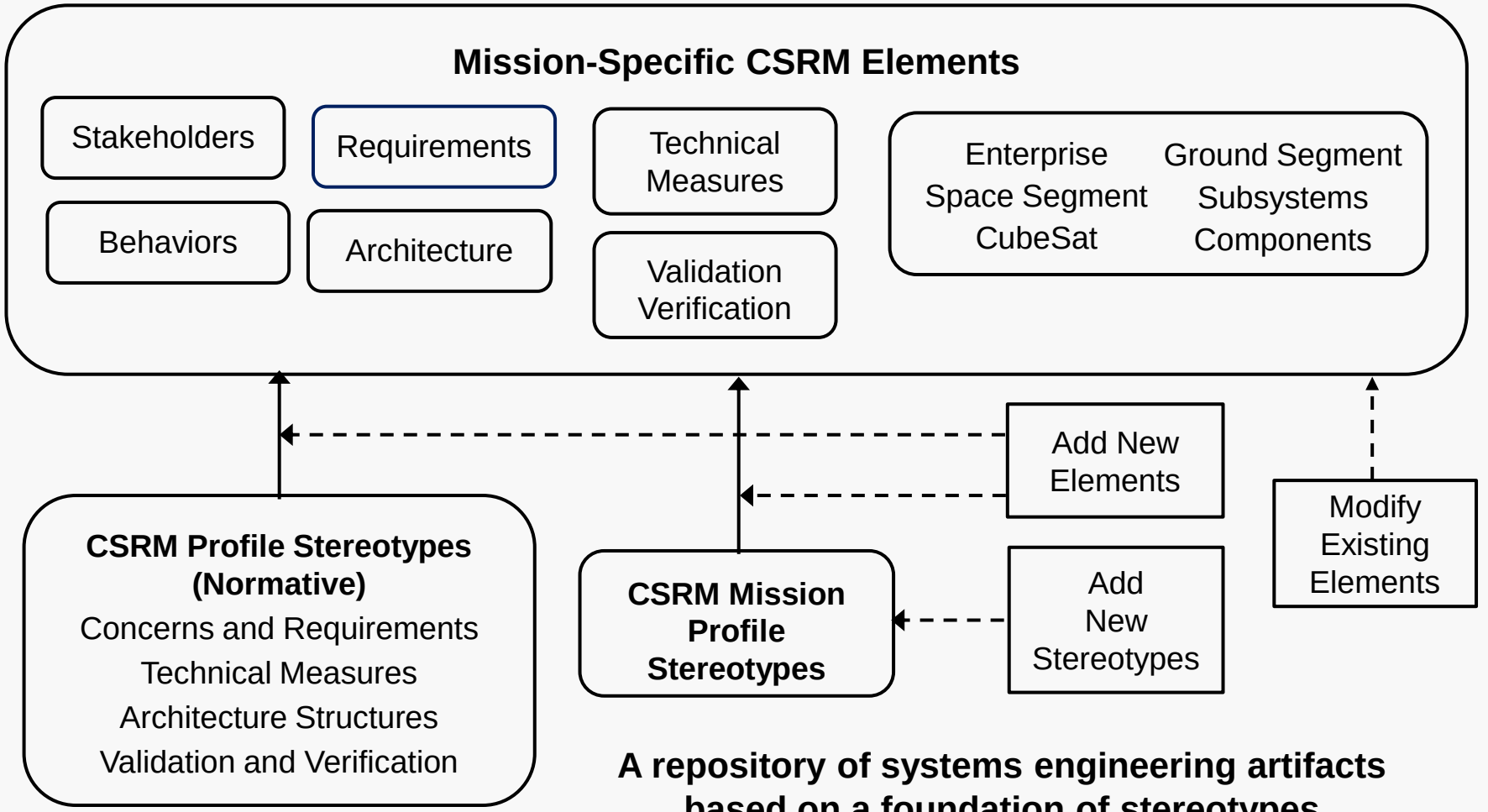
- International Council on Systems Engineering (INCOSE) Space Systems Working Group (SSWG) project
- Objectives of CSRM Project
  - Demonstrate Model-Based Systems Engineering (MBSE) as applied to a CubeSat Mission
  - Develop a CSRM that a university team can uses as starting point for their mission-specific model
  - Develop the CSRM as an Object Management Group (OMG) Specification

CSRM Pedigree

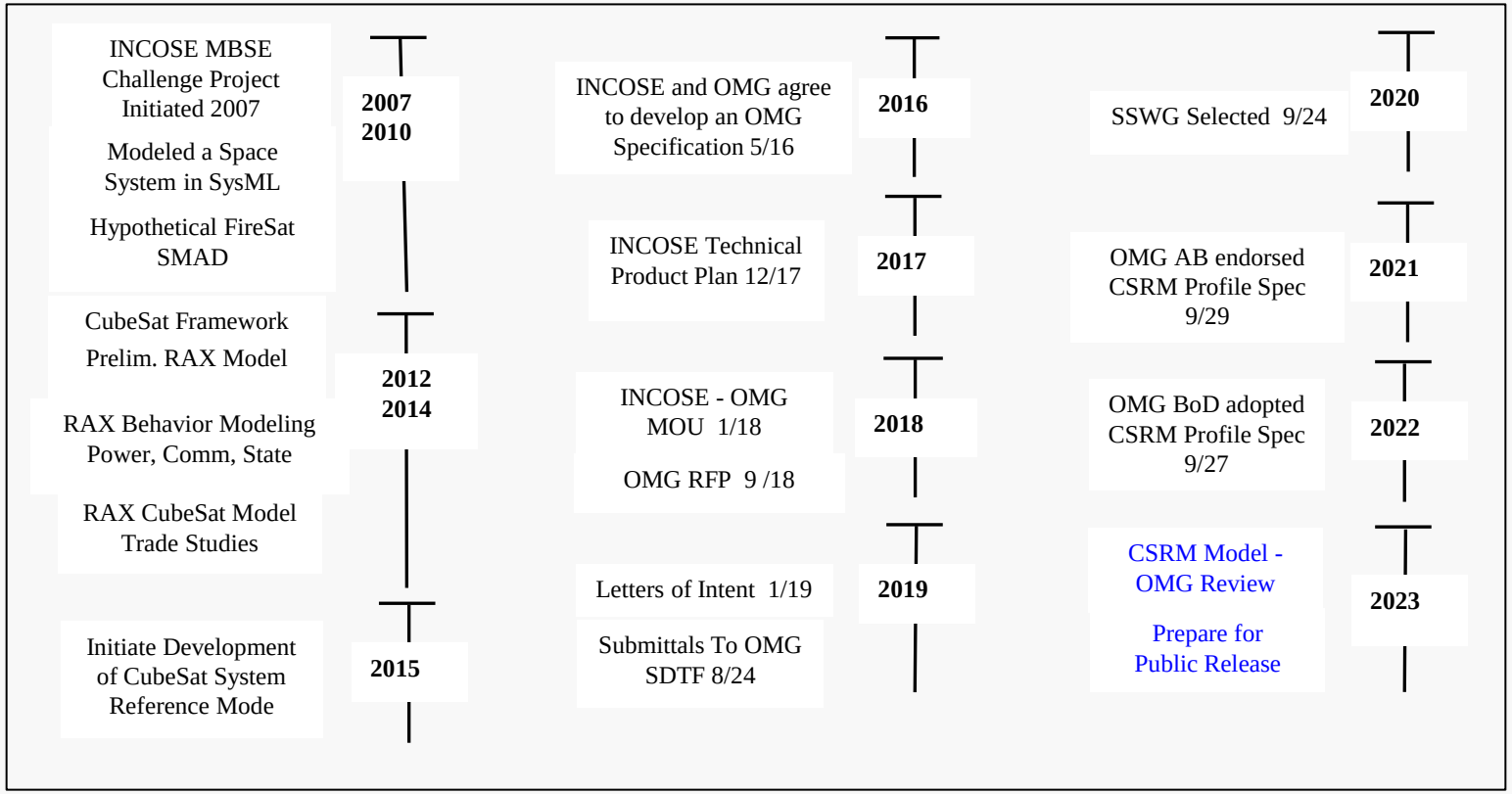
- Object Management Group (OMG) – An International Technical Standard Consortium - An International Voluntary Consensus Standards Body (VCSB)
  - The CSRM was developed in response to an OMG Request for Proposal (RFP)
  - In the past, OMG Specifications have been entirely document-based

- International Council on Systems Engineering™ (INCOSE™) – A Systems Engineering Organization and Professional Society
  - INCOSE and several others responded to the OMG RFP.
  - The INCOSE CSRM was selected to continue development

CSRM Elements



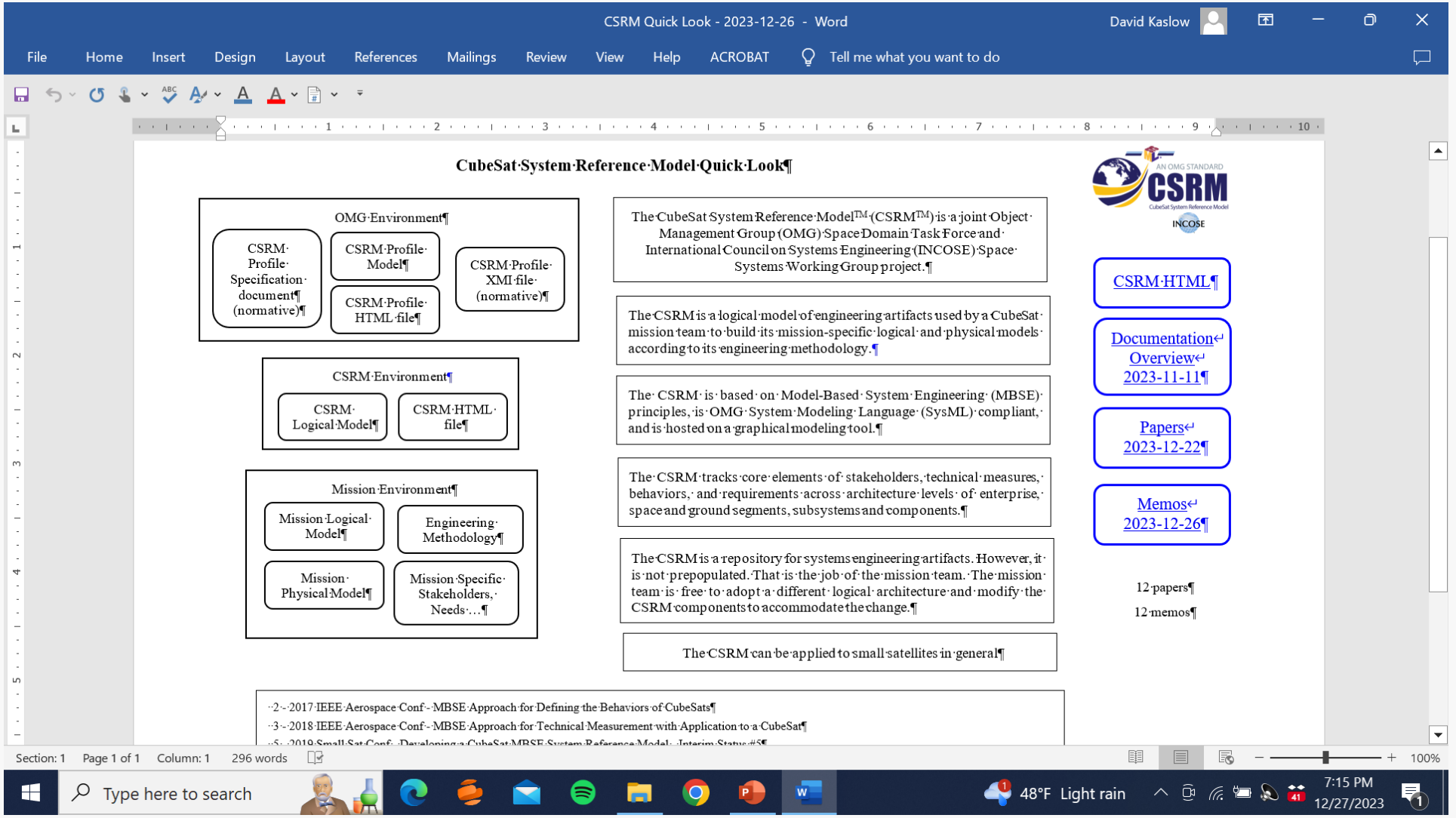
CSRM Development Timeline



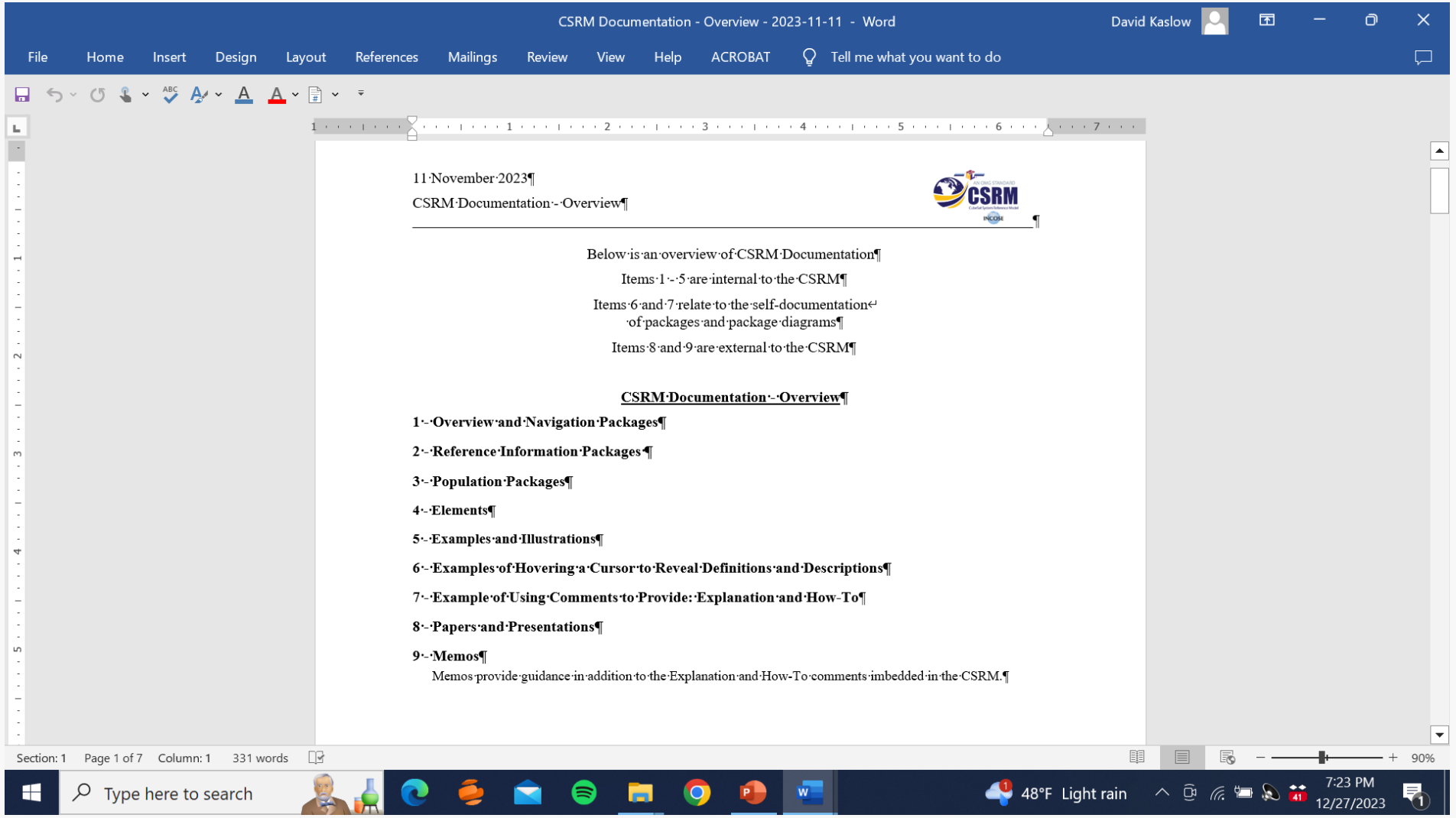
OMG Specification Processes Guided CSRM Development

CSRM Quick Look

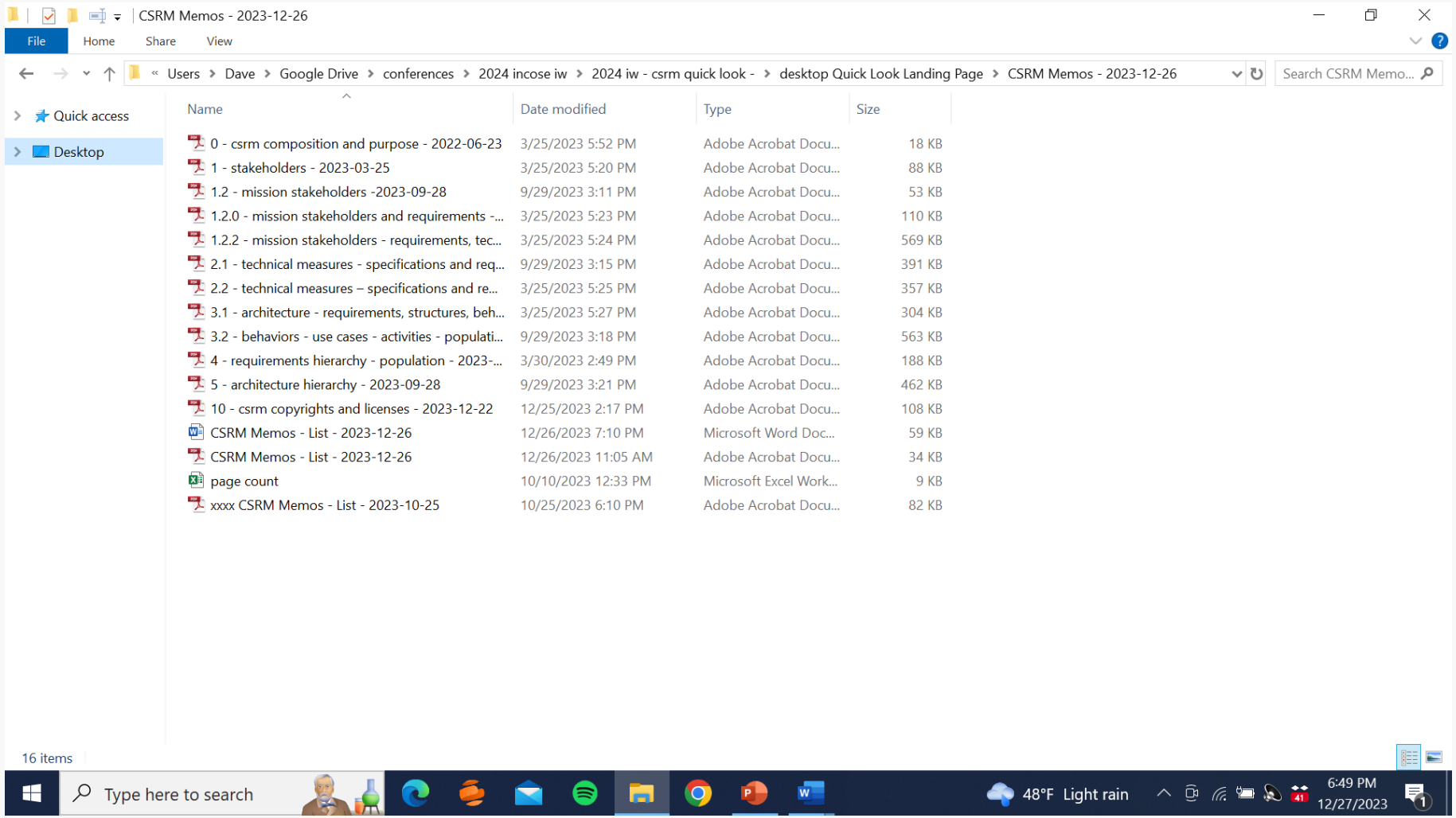
CSRM Quick Look



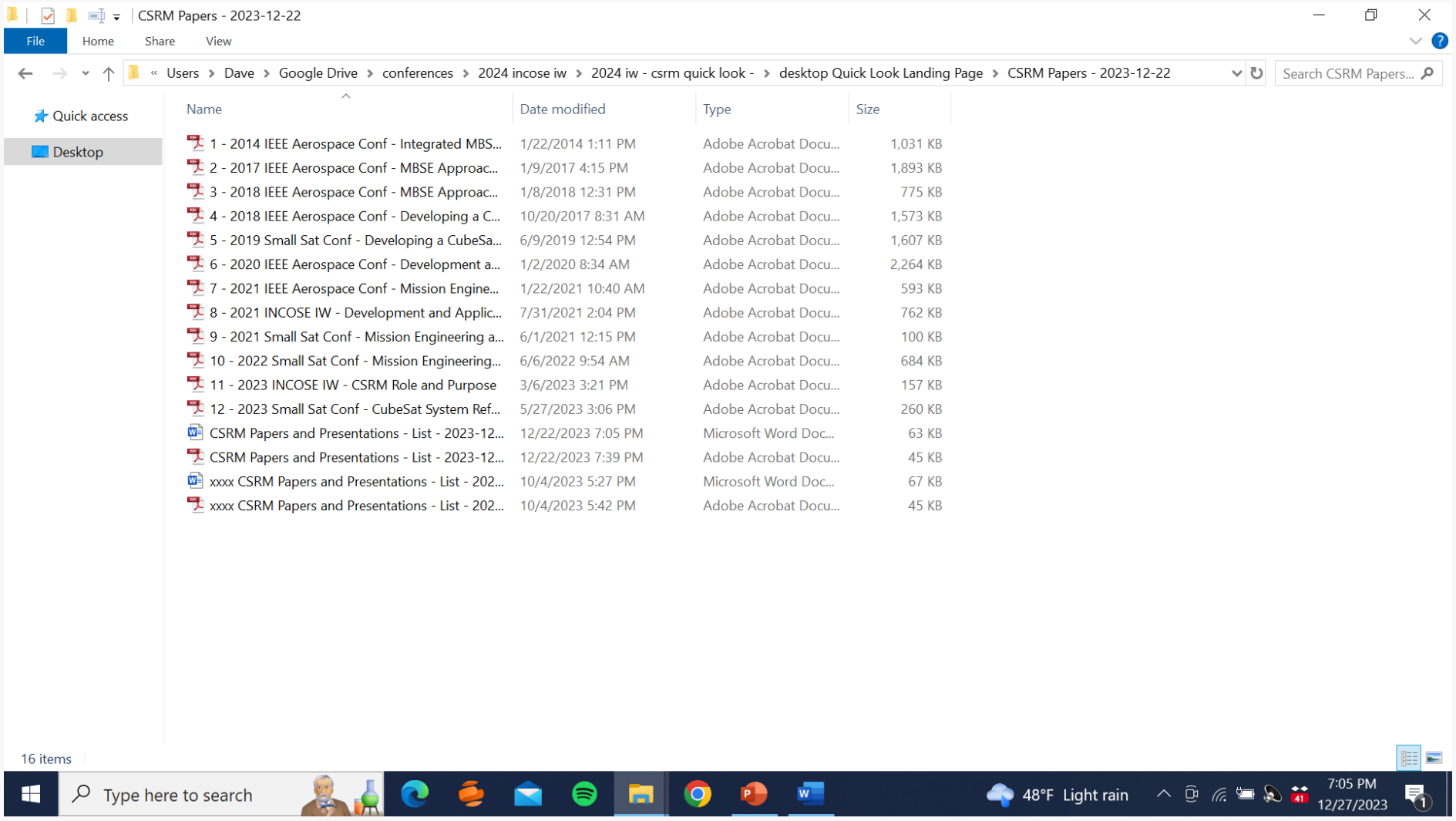
Documentation Screen Shot



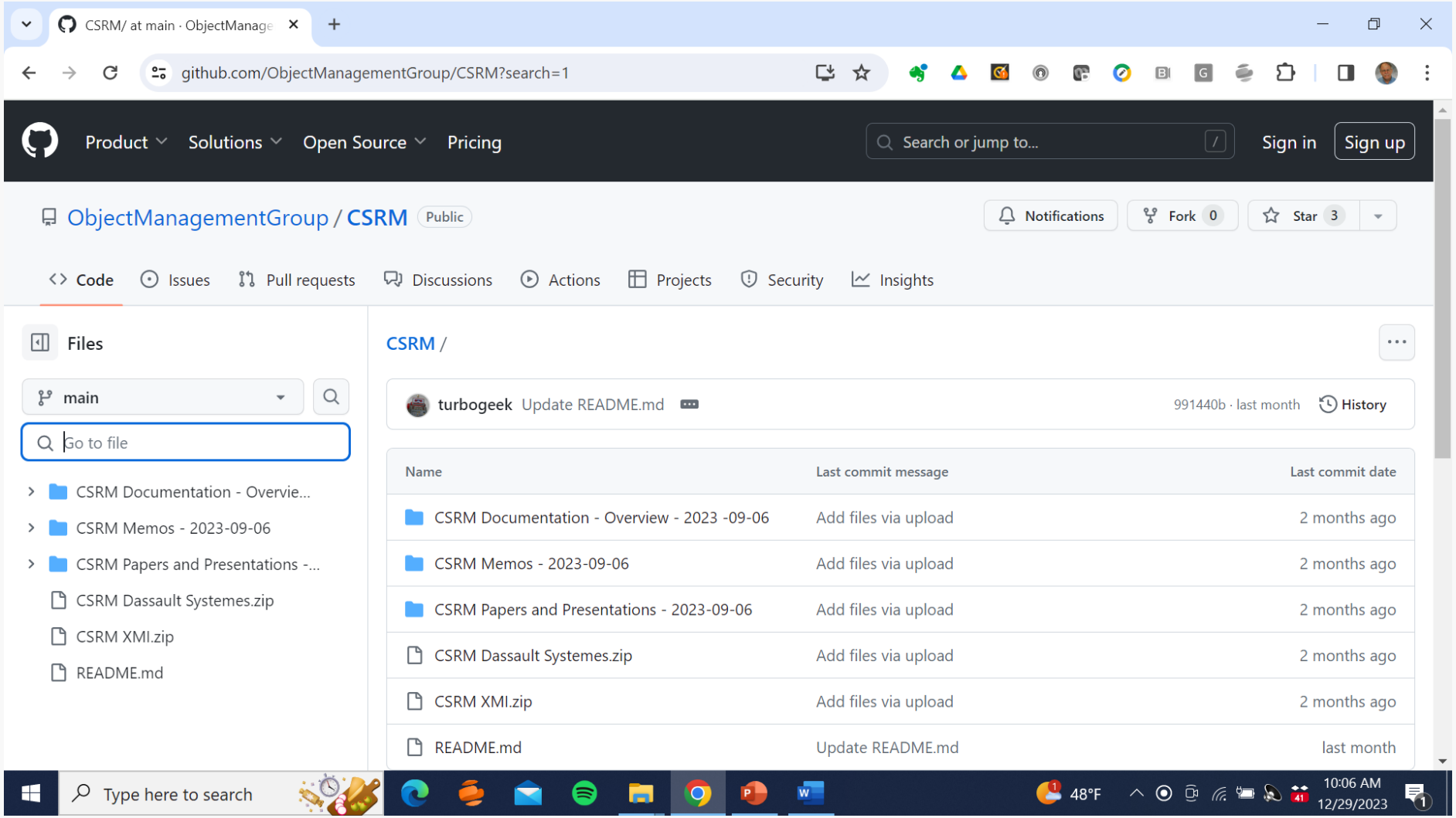
Memos Screen Shot



Papers Screen Shot



CSRM GitHub



Next Steps

- Establish a Creative Commons license and make available for release.

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A new working group

Implementing Systems Engineering into Organizations (ISEOWG)

Initiated by Richard Beasley, ESEP

www.incose.org/IW2024

Objective / Purpose

The goal is to fill gap in the guidance provided to members of INCOSE – rather than specifically looking at the practice of Systems Engineering as applied to individuals, it will look at organisations and how to ensure that how systems engineering is done in the most appropriate way

More information

- Meeting planned at IW 24 (in-person and Hybrid)
  - Sunday 28th Jan, 11.00-13.30
  - Pier 7
- Initial priorities
  - Complete a charter / set up group
  - Define problem and scope of WG and its first advice deliverable
  - Agree name of WG!
- See INCOSE Viva Engage
  - Search #ISEOWG or
  - Find Implementing Systems Engineering into Organisations WG discussion
- Contact Richard Beasley – in Teams, Viva Engage or richard.beasley@incose.net

Initial considerations

Nature of problem

- SE is not an island (in fact opposite)
- Strategy session (July 22 suggested following themes

- Initial WG activities
- Formalize WG
  - Leadership / Scope / WG name
  - Set up IT (Website, etc.)
- Initial activities
  - Review / define / describe the problem
  - Literature review (what exists)
  - Modelling of problem
  - Develop survey to examine practice in

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