Systems Modeling & Simulation (SMS) Working Group
Update for MBSE workshop – 30 Jan 2021

Peter Coleman, Airbus

**MBSE:**
The formalized application of modeling to support system requirements, design, analysis, verification and validation activities beginning in the conceptual design phase and continuing throughout development and later life cycle phases.

**Systems Modeling and Simulation:**
The use of interdisciplinary functional, architectural, and behavioral models (with physical, mathematical, and logical representations) in performing MBSE to specify, conceptualize, design, analyze, verify and validate an organized set of components, subsystems, systems, and processes.

**Engineering Simulation:**
The use of physics-based mathematical (numerical) models and/or logical models, including relevant data derived from their physical model counterparts, as representations of a conceptual or real-world system, phenomenon, or process in studying its technical requirements and operational behaviour.

SMSWG – Terms & Definitions: [https://www.nafems.org/about/technical-working-groups/systems_modeling/smstermsdefinitions/s-u/](https://www.nafems.org/about/technical-working-groups/systems_modeling/smstermsdefinitions/s-u/)
SMSWG supporting INCOSE – NAFEMS collaboration

2011: INCOSE and NAFEMS agree to develop a collaborative relationship that benefits both organizations and their members

2012: Joint MoU signed at INCOSE International Symposium with announcement to form the INCOSE/NAFEMS SMSWG

2013: Founding steering committee to establish SMSWG and promote membership

2019: Renewed MoU signed at NAFEMS World Congress alongside special “Systems Engineering meets Engineering Simulation” session

2020: Common INCOSE Charter & NAFEMS Terms of Reference refreshed for SMSWG

Broader level collaboration between INCOSE and NAFEMS

- Mutual recognition of the certifications offered by each organisation
  - NAFEMS Professional Simulation Engineer (PSE)
  - INCOSE Systems Engineering Professional (ASEP, CSEP, ESEP)

- Ongoing discussions on membership and training opportunities

- Supporting flagship events e.g. INCOSE IS and NAFEMS World Congress
SMSWG Purpose, Mission & Goal (ref Charter / ToR)

**Purpose**

- **Systems Engineering** has recognized the importance of models in a wide range of roles. Early in the development of a system, models may be used to understand the user domain, to define functions and concepts, and to capture system requirements across the levels of a system architecture. Such models may specify functional, interface, performance, and physical requirements, as well as other non-functional requirements such as reliability, maintainability, safety, and security.

- **Engineering Simulation** has been an essential part of product development engineering across many industries and disciplines for decades. This work is typically performed by technical specialists with deep knowledge in their respective domains, and with expertise in specialized mathematical and analytical tools.

- Combining the Modeling and Simulation perspectives of both Systems Engineering and Engineering Simulation can improve communications and coordination across the product development life cycle.

**Mission & Goal**

- To develop a vendor-neutral, end-user driven consortium that not only promotes the advancement of the technology and practices associated with integration of engineering simulation and systems engineering, but also acts as the advisory body to drive strategic direction for technology development and international standards in the space of complex engineering.

- The SMSWG supports activities that bridge engineering simulation and systems engineering to optimize the integration of Systems Engineering and Engineering Simulation solutions for both OEM and supplier. This includes education, communication, promotion of international standards, and development of requirements that will have general benefits to the Engineering Simulation and Systems Engineering communities.
**SMSWG organisation**

**NAFEMS leadership + 17 Working Groups**

**Collaboration MoU** + SMSWG Charter / ToR

**INCOSE leadership + > 50 Working Groups**

### WG Members
- Roger Burkhart | INCOSE
- Peter Coleman | Airbus (Chair)
- Hans Peter de Koning | DEKonsult
- Rodney Dreisbach | Consultant (NAFEMS Americas)
- David Kaslow | DEKaslow Consulting
- Edward Ladzinski | SMS_Thinktank
- Eric Landel | IRT SystemX / ELC
- Phyllis Marbach | INCOSE (Assistant Director Transformational Enablers)
- Frank Popielas | SMS_Thinktank (Vice Chair)
- Ian Symington | NAFEMS (Technical Officer)
- Don Tolle | CIMData
- Hubertus Tummescheit | Modelon
- Mark Williams | The Boeing Company
- Trudy Hoye | NAFEMS (TWG manager)

### Focus Team
- Roadmap & Best Practices
  - Frank Popielas ++
- SMS Standards Ecosystem
  - Don Tolle ++
- Terms & Definitions
  - Ed Ladzinski ++
- SE Handbook-E5 4.2 M&S
  - HP de Koning ++

### Focus Team
- SMSWG organisation

**SMS Community**
Open to all INCOSE or NAFEMS
322 members at end 2020
- Americas = 47.5%
- Europe = 42.5%
- Asia = 9%
- Rest of the world = 1%

**AFIS-NAFEMS**
SMSWG
Eric Landel ++

**Industry Sector**

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2020 retrospective

January – incose.org/iw2020
IW MBSE wshop + SMS#35
- Recap NWC’19
- Focus Teams updates
- Standards session

March - SMS#36
- SMSWG ToR / Charter update
- Model Characterization Pattern (MCP) - Bill Schindel (ICTT)

June – SMS#37
- CAASE20 overview
- Digital Twin Maturity & Impact – Frank Popielas (SMS_ThinkTank)

June – nafems.org/caase20
Advancing Analysis & Simulation in Engineering
- SMSWG – Frank Popielas
- Inc. tracks on SMS & MBE

July – SMS#38
- Coherent Digital Thread as enabler for Systems Thinking - M.Panthaki (Aras) + R.Mottola (Toyota)

October – SMS#40
- LOTAR for MBSE Data + How MoSSEC (STEP AP243) supports model-based collaboration - Adrian Murton (Airbus)

November – SMS#41
- Progress on SysML v2 – HP de Koning (DEKonsult)

September – SMS#39
- SE driven M&S method – Pascal Paper (Airbus)

December – SMS#42
- Model Identity Card (MIC) – Eric Landel (IRT SystemX / ELC)
SMSWG Web Pages + Repository of SMS Community shared material


TO BE UPDATED

https://www.incose.org/incose-member-resources/working-groups/transformational/incose-nafems-collaboration

https://www.nafems.org/community/working-groups/systems-modeling-simulation/
SMSWG “What is FMI?” publication 2018

- Short guide promoting awareness on the Modelica FMI standard for Model Exchange and Co-simulation
- NAFEMS branded product freely available via: [https://www.nafems.org/publications/resource_center/wt06/](https://www.nafems.org/publications/resource_center/wt06/)
• Short guide promoting awareness of both MBSE and Engineering Simulation for successful product development and Model-based integration across multiple disciplines
• First co-branded product available for INCOSE or NAFEMS members via:
  - https://connect.incose.org/Pages/Product-Details.aspx?ProductCode=what_is_sms
SMSWG identify and promote SMS related standards

- SMSWG aim to identify and promote the maturity and industry adoption of relevant international standards that enable Systems M&S and the integration of MBSE with engineering simulation
- “Unknown or no standards” identified as major gap in survey from MBSE workshop at 2018 GPDIS
- Need for improved model/data interoperability and cross-domain engineering collaboration
- Connect with industry groups working on developing or promoting adoption of standards for MBSE and Engineering Simulation
- Ongoing liaison with NAFEMS Standards Initiative
- Examples:
  - Modelica Assoc. standards e.g. FMI/FMU, SSP …
  - ISO STEP standards e.g. AP209ed2, AP243 DIS (MoSSEC), link with LOTAR
  - Web standards e.g. OSLC, RDF, XML/XMI, UML
  - OMG standards e.g. ReqIF, SysML v2, UAF

https://www.nafems.org/publications/standards/
SMSWG maintain and evolve the SMS Terms & Definitions

- First published 2016 with regular updates on dedicated pages via NAFEMS website:
  - [https://www.nafems.org/community/working-groups/systems-modeling-simulation/smstermsdefinitions/](https://www.nafems.org/community/working-groups/systems-modeling-simulation/smstermsdefinitions/)

- 12 additions in 2020:
  - Democratization of Simulation
  - Digital Twin
  - Engineering Simulation
  - Generative Design
  - Model-Based Definition (MBD)/(MBDef)
  - Model-Based Design (MBD)
  - Model Based Development (MBDev)
  - Model-Based Engineering (MBE)
  - Model-Based Enterprise (MBE)
  - Model-Based Safety Analysis (MBSA)
  - Model-Based Systems Engineering (MBSE)
  - Simulation Governance
SMSWG update of 4.2 Modeling and Simulation content for INCOSE SE Handbook E5

- SMS WG & Community team started revision from Dec’20
  - Hans Peter de Koning + Peter Coleman, Alexander Karl, Maurice Theobald, Hubertus Tummescheit, Rod Dreisbach
- Target: reduction from 7.5 pages to 4
  - Currently ~6 pages text (excluding figures) – challenge to reduce further more without compromising content!
- Proposed adapted title: Modeling, Analysis and Simulation
- Initial R1 draft submitted on 4 Jan 2021 + improved R2 draft submitted on 22 Jan 2021
  - Major re-write – streamlining content & narrative
  - Reference to "What is SMS" flyer –
  - Proposed additional terms & definitions (table)
- First review & feedback with Editorial team done 28 Jan.
- Next steps - coordination and cross-check with other author teams & next round of revision from Feb to March
SMSWG outlook for 2021

- Plan SMS Community webinars approx 2nd Tuesday each month 17.00 CET / 11.00 ET
  - Proposals for topics & speakers are welcome
- Maintain & streamline availability of SMSWG content across INCOSE and NAFEMS platforms
- SE Handbook-E5 focus team to improve 4.2 M&S for next draft in March
- Terms & Definitions focus team to refine & evolve content of SMS T&D’s
- SMS related standards focus team to monitor & promote standardisation efforts
- Launch new focus team on SMS modelling metadata in collaboration with related initiatives
- Potential publication to help clarify “What is MBx”
- Opportunities to connect & collaborate with other working groups and initiatives
  - INCOSE TIMLM, SETDB, MBSE patterns MCP, Standards Dev, …
  - NAFEMS Business Impact, SDM, SG&M, …
  - ASSESS
- Propose and further develop Engagement Strategy
  - Support NAFEMS to develop a strategy that improves their visibility, awareness, engagement and participation in relevant INCOSE activities and deliverables
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Want to hear more?
SMS Community meeting at IW 2021 on Monday 01 Feb : 17:00-20:00 CET

Outline Agenda:

- Welcome & SMSWG overview 2020-2021 : Peter Coleman (Airbus Operations)
- Status of SMSWG input to SE Handbook Edition 5 – Section 4.2 M&S : Hans Peter de Koning (DEKonsult)
- SMSWG highlights from 2020 and preview SMSWG roadmap for 2021 : Frank Popielas (SMS_ThinkTank)
- Proposed focus team on “SMS Meta Data” : Peter Coleman (Airbus Operations)
- Setup & activities of affiliated AFIS-NAFEMS SMSWG in France : Eric Landel (IRT SystemX)
- BREAK!
- SMS related Standards – Overview : Hans Peter de Koning (DEKonsult)
- SMS related Standards - MoSSEC, PDES + LOTAR MBSE : Mark Williams (The Boeing Company)
- SMS related Standards - Modelica, FMI 3.0 & e-FMI developments : Hubertus Tummescheit (Modelon)
- Evolution in SMS Terms & Definitions : Ed Ladzinski (SMS_ThinkTank)
- Q&A
Interested to join the SMSWG or SMS Community?

[Insert images of forms for joining SMS WG or SMS Community]

www.nafems.org/community/working-groups/systems-modeling-simulation/get_involved/

www.nafems.org/community/working-groups/systems-modeling-simulation/get_involved_sms_community/