

CIMdata PLM Leadership Systems Modeling & Simulation Certificate Program

Leveraging Systems Modeling & Simulation to Improve Business

For more than thirty-five years, CIMdata has been working in the Product Lifecycle Management (PLM) industry. Our consulting services and research expertise are known around the world for best practice-based content and insight. CIMdata has combined its knowledge and experience with that of SMS_ThinkTank, a leader in Systems Modeling and Simulation (SMS), to create the Systems Modeling & Simulation Certificate Programs as an integral part of CIMdata PLM Leadership—the PLM industry’s most comprehensive non-biased education and training offering. The SMS Certificate Program adds premier education for today’s simulation and analysis professionals.

CIMdata PLM Leadership is comprised of a set of well-defined, assessment-based education and training certificate programs, short courses, and webinars. The SMS certificate program offerings, as described herein, are delivered through a series of education and training sessions and are intended to ensure that those who participate in a systems modeling and simulation project all have a strong understanding of systems modeling and simulation concepts and industry leading best-practices.

These SMS certificate programs are available to industrial companies who are considering, evaluating, implementing, and/or enhancing their systems modeling and simulation capabilities as part of their digital transformation efforts, as well as to software and service providers in the systems modeling and simulation domain. These programs are offered in three different configurations designed to address the specific needs of various communities. See CIMdata.com¹ for additional information.

SMS Certificate Program

The education sessions described herein leverage a common systems engineering and product data model that encompasses simulation, analysis, benefits, requirements, platform, program, project, system definition, product structure, lifecycle, and configuration-management capabilities. These are key enablers to achieve higher systems modeling and simulation maturity levels and, in turn, help a company reach and maintain a highly competitive position within the industries it serves. Innovation leaders realize that accurate and accessible data is the foundation for insight and inspiration. They also realize that it is critical to recognize that the surrounding ecosystem with its

culture and behaviors must be brought into play. This is foundational to defining and achieving sustainable innovation.

CIMdata’s Systems Modeling & Simulation Certificate Program, offered together with SMS_ThinkTank, leverages CIMdata’s assessment-based educational framework and satisfies the systems modeling and simulation education requirements of small to large enterprises. The Public version of the program provides primary systems modeling and simulation education to industrial companies, as well as PLM solution providers and their employees who are responsible for marketing, developing, selling, and delivering systems modeling and simulation solutions and associated implementation services. The Private version of the program provides organizations with an exclusively presented series of educational seminars that may be tailored to their specific industry and/or topical needs.

The SMS Certificate Program is delivered through a series of education and training sessions comprised of lectures, industry case studies, exercises, and tests. The delivery of the program’s content is tailored, within the given time restrictions, to address any industry-specific issues of interest to the participants. Finally, participants are expected to take part in exercises that require additional time following each day’s formal education sessions.

SMS Certificate Program Modules

The SMS Certificate Program offering is comprised of seven delivery modules that have been configured into three certificate programs—one for executives, one for managers, and one for practitioners.

A full description of each of the sessions that comprise the modules is found in Appendix A.

Module Descriptions

Module 1: Systems Modeling & Simulation for Executives—this module is comprised of following three sessions:

- Overview—An Introduction to SMS
- The Value of SMS
- Challenges & Essentials to deploy SMS—A Business Perspective

¹ <https://www.cimdata.com/en/education/sms-certificate-program>

Module 2: *Systems Modeling & Simulation for Managers*—this module is comprised of following four sessions:

- Overview—An Introduction to SMS
- The Value of SMS
- Challenges & Essentials to deploy SMS—A Business Perspective
- Essentials to deploy SMS—An Operations Perspective

Module 3: *Systems Modeling & Simulation for Practitioners*—this module is comprised of following six sessions:

- Overview—An Introduction to SMS
- The Value of SMS
- Challenges & Essentials to deploy SMS—A Business Perspective
- Essentials to deploy SMS—An Operations Perspective
- The Architecture of SMS
- The Usage of SMS—How to apply SMS

Module 4: *Digital Twin—Its Fundamentals*—this module is comprised of following three sessions:

- Digital Twin—Its Role & Structure within a Modern Systems Engineering Approach
- Challenges Implementing Digital Twin Capabilities & Methodologies
- Roadmap towards the Digital Twin & its Maturity Levels

Module 5: *Model-Based Systems Engineering—A Business Perspective*—this module is comprised of following four sessions:

- MBSE—Challenges for Management
- MBSE—Deployment Challenges
- The Role of Taxonomy
- MBSE—The Roles of Existing & Emerging Standards

Module 6: *Model-Based Systems Engineering—Its Fundamentals*—this module is comprised of following three sessions:

- MBSE—A High-Level Review for Newcomers
- Explaining MBSE without using the Traditional “V Model”
- Model-Based Definitions & their Role within Engineering

Module 7: *Model-Based Systems Engineering—A Deeper Dive*—this module is comprised of following five sessions:

- The Systems Engineering “V”
- The Role of Requirements
- Writing Good Requirements
- The Role of Taxonomy
- MBSE—The Roles of Existing & Emerging Standards

SMS Certificates Offered

Currently, the following certificates are available:

- *SMS Basic Certificate for Executives*—includes Module 1
- *SMS Basic Certificate for Managers*—includes Module 2
- *SMS Basic Certificate for Practitioners*—includes Module 3
- *SMS Core Certificate*—with the SMS Basic Certificate as a prerequisite, this certificate requires the completion of Modules 5, 6 & 7
- *SMS Standard Certificate*—with the SMS Core Certificate as a prerequisite, this certificate requires the completion of Module 4

Each of these certificates are combinable into a set of role-specific certificate programs, as described below.

Role-Specific SMS Certificate Programs

SMS Certificate for Executives

For executives of organizations in which the understanding of engineering analysis and virtual modeling approaches are of importance to meet market demands and help to deliver competitive products and services. This executive-focused program is achieved by successfully completing the following two programs:

- SMS Basic Certificate for Executives
- SMS Standard Certificate

SMS Certificate for Managers

This certificate has been designed for managers of teams who utilize simulation at various lifecycle stages and teams supporting simulation in various functions. This manager-focused program is achieved by successfully completing the following three certificate programs:

- SMS Basic Certificate for Managers
- SMS Core Certificate
- SMS Standard Certificate

SMS Certificate for Practitioners

This certificate has been designed for Practitioners (i.e., general users and application engineers), Systems Engineers, Simulation Engineers, Development Engineers, SMEs, and IT Analysts. This practitioners-focused program is achieved by successfully completing the following three certificate programs:

- SMS Basic Certificate for Practitioners
- SMS Core Certificate
- SMS Standard Certificate

Target Audience

The target audience for the SMS Certificate Program includes, but is not limited to:

- Program Champions and Sponsors
- Business Managers
- SMS Practitioners
- Business Subject Matter Experts
- Project Leaders
- SMS Project Team Members
- IT Professionals
- IT Managers

Target Industries

The SMS Certificate Program has been designed to be industry independent. However, industry-specific content (e.g., process discussions, examples, and cases studies) can be easily added if the program is being delivered to a specific company or industry group.

Course Delivery

A team of internationally experienced, senior-level CIMdata and SMS_ThinkTank consultants will deliver all course material in English. The courses can be delivered as on-site sessions, as well as in a virtual-live format.

For on-site sessions, all presentation materials are provided to each participant in a printed notebook, as well as in a fully searchable set of PDF files provided on a USB thumb drive. For virtual-live sessions, the material will be provided electronically.

Pricing

The Public SMS Certificate Program cost is calculated per student per company represented. Pricing is as follows:

SMS Basic Certificate for Executives

- First student sent by a specific company—US\$1,150
- Students #2 through #5—US\$1,000 each
- Students #6+—US\$900 each

SMS Basic Certificate for Managers

- First student sent by a specific company—US\$1,550
- Students #2 through #5—US\$1,400 each
- Students #6+—US\$1,250 each

SMS Basic Certificate for Practitioners

- First student sent by a specific company—US\$2,250
- Students #2 through #5—US\$2,050 each
- Students #6+—US\$1,850 each

SMS Core Certificate

- First student sent by a specific company—US\$3,150

- Students #2 through #5—US\$2,875 each
- Students #6+—US\$2,530 each

SMS Standard Certificate

- First student sent by a specific company—US\$1,550
- Students #2 through #5—US\$1,400 each
- Students #6+—US\$1,250 each

Notes

- CIMdata Community Members are eligible for a discount; please contact CIMdata for additional information.
- A maximum of 25 students can attend a Public Certificate Program session.
- Any travel expenses incurred by participants are the responsibility of the attendee and are not handled by CIMdata.
- Private certificate courses are available for companies that would like the courses to be customized for their employees. Pricing can be provided on request.

About CIMdata

CIMdata, an independent worldwide firm, provides strategic management consulting to maximize an enterprise's ability to design and deliver innovative products and services through the application of Product Lifecycle Management (PLM) solutions. Since its founding over thirty-five years ago, CIMdata has delivered world-class knowledge, expertise, and best-practice methods on PLM solutions. These solutions incorporate both business processes and a wide-ranging set of PLM-enabling technologies.

CIMdata works with both industrial organizations and solution providers of technologies and services seeking competitive advantage in the global economy. CIMdata helps industrial organizations establish effective PLM strategies, assists in the identification of requirements and selection of PLM technologies, helps organizations optimize their operational structure and processes to implement solutions, and assists in the deployment of these solutions.

For PLM solution providers, CIMdata helps define business and market strategies, delivers worldwide market information and analyses, provides education and support for internal sales and marketing teams, as well as overall support at all stages of business and product programs to make them optimally effective in their markets.

In addition to consulting, CIMdata conducts research, provides PLM-focused subscription services, and produces several commercial publications. The company also provides industry education through PLM certificate programs, seminars, and conferences worldwide. CIMdata serves clients around the world from offices in North America, Europe, and Asia-Pacific.

To learn more about CIMdata's services, visit our website at www.CIMdata.com or contact CIMdata at: 3909 Research Park Drive, Ann Arbor, MI 48108, USA. Tel: +1 734.668.9922. Fax:

+1 734.668.1957; or at Oogststraat 20, 6004 CV Weert, The Netherlands. Tel: +31 (0) 495.533.666.

About SMS_ThinkTank

SMS_ThinkTank is a global resource and leader in systems modeling and simulation, bringing the worlds of systems engineering and computer aided engineering together. SMS_ThinkTank was founded to provide systems modeling and simulation business solutions to help OEMs, suppliers, academia, and government organizations navigate through the difficult tasks associated with the adoption of systems engineering methods and best practices in their own business environment. SMS_ThinkTank's goal is to enable organizations, across all industries, to achieve sustainable innovation and become leaders in their fields.

SMS_ThinkTank helps companies improve their engineering maturity to successfully address market challenges that are characterized by faster than ever changing and evolving technologies. This becomes evident by the drastically increased complexity of consumer products and their systems and the environments in which they operate. This evolution is supported by the digitalization of science and engineering, as well as the need for upfront predictive capabilities to deliver on

improved product quality, robustness guarantees and certification. To support those efforts, SMS_ThinkTank developed industry-based maturity and engagement models. This also includes recommendations for organizational and operational optimization.

SMS_ThinkTank works with both end-user organizations and solution providers. The work with solution providers is driven by the end-user organization's requirements. SMS_ThinkTank works with established businesses, as well as with startup companies.

In addition to consulting, SMS_ThinkTank conducts research, publishes articles and commentaries on related topics, as well as provides education through certificate programs, seminars, and conferences worldwide. SMS_ThinkTank also plays a leading role in non-for-profit organization, such as NAFEMS, INCOSE, and the Community of Experts (COE). SMS_ThinkTank serves clients globally.

To learn more about SMS_ThinkTank and its services, visit our website at www.smsthinktank.com, follow us on Twitter (https://twitter.com/sms_thinktank) or LinkedIn (<https://www.linkedin.com/company/sms-thinktank>) or contact us at info@smsthinktank.com.

Appendix A: SMS Certificate Program Session Descriptions

Session 1: Overview—An Introduction to SMS

Duration: 1.5 hour

Prerequisites:

- None

Intent: The scope of this 1.5-hour session is to introduce the participants to the current market trends and business challenges associated with simulation. In addition, digital transformation and its needs are described to support making the case to adopt systems modeling and simulation and realize its benefits.

Session Outline:

- Introduction
- Setting the Stage—Engineering Landscape (References to Automotive Industry)
 - a. Business Challenges
 - b. Market Trends
- Digital Transformation
 - a. The Case for System Modeling and Simulation
 - b. The Systems Engineering Approach
 - c. The Value of Systems Engineering
 - d. Achieving Sustainable Innovation
- Interactive Discussion

Session 2: The Value of SMS

Duration: 1 hour

Prerequisites:

- Session 1: Overview—An Introduction to SMS

Intent: The scope of this one-hour session is to clearly define the current vision and landscape of systems engineering, and to describe the value and benefits that can be realized by adopting appropriate best practices. Additionally, the case for organizational change, which is a necessity, coupled with the role of management in introducing these disciplines within the enterprise is discussed.

Session Outline:

- Introduction
- Setting the Stage—A brief Introduction of Systems Modeling and Simulation:
 - a. Market Challenges and Trends
 - b. Vision
 - c. The Current Landscape
- Systems Engineering Approach
 - a. The Challenge
 - b. The Engineering “V” and the Lifecycle
 - c. Pros and Cons
- Value and Benefits of Systems Engineering and Systems Modeling and Simulation
 - a. System Engineering Studies

- b. The Value of Data
- c. “Innovation at the Speed of Thought”
- d. Business Model Transformation
- e. The Impact of Systems Engineering
- f. Cultural Transformation
- Interactive Discussion

Session 3: Challenges & Essentials to deploy SMS—A Business Perspective

Duration: 1.5 hour

Prerequisites:

- Session 1: Overview—An Introduction to SMS
- Session 2: The Value of SMS

Intent: The scope of this 1.5-hour session is to provide the participants with the challenges associated with deploying systems modeling and simulation. Additionally, the essential items to consider in addressing these challenges will be identified and at the conclusion of this session an open discussion to field specific questions related to each attendee’s enterprise will take place.

Session Outline:

- Introduction
- Setting the Stage
 - a. Business Pressure and Challenges Companies are Facing
 - b. The Value of Systems Engineering
- Overcoming the Challenges
 - a. Reflections from End User Organizations of Various Industries
 - b. Cultural Challenges
 - c. Introduction to Essentials in Addressing Adoption Challenges
- Interactive Discussion

Session 4: Essentials to deploy SMS—An Operations Perspective

Duration: 2 hours

Prerequisites:

- Session 1: Overview—An Introduction to SMS
- Session 2: The Value of SMS
- Session 3: Challenges & Essentials to deploy SMS—A Business Perspective

Intent: The intent of this two-hour session is to define what is needed to establish the simulation roadmap and subsequently improve the organization’s SMS maturity. Additionally, the session will identify the hurdles that need to be overcome when deploying state-of-the-art virtual capabilities. Furthermore, this session establishes the “As-Is,” “To-Be,” and “gaps” that need to be filled to effect change. The task of establishing the governance structure to ensure a healthy adoption of best practices is presented in detail.

Session Outline:

- Introduction
- Setting the Stage
 - a. The Value of Data
 - b. Engineering Landscape
- General: Defining the Strategic Approach
 - a. Elements

- b. Organization
- c. Execution—Process to Achieve the Goal
- d. Introduction to Essentials in Addressing Adoption Challenges
- Essentials to Successfully Deploy System Modeling and Simulation
 - a. The Case for System Modeling and Simulation (SMS)
 - b. The Role of Assessments
 - i. Categories, Domains, Elements
 - ii. CMMI Maturity
 - iii. Types of Assessments
 - iv. Outcomes
 - c. The Case for Cultural Transformation
 - d. Governance
 - i. Structure
 - ii. Core Team
 - iii. Responsibilities
- Wrapping up
 - a. The Role of Roadmaps
 - b. Surveys as Part of Assessments and Accountability
 - c. The Central Role of Education / Training
 - d. The Importance of an Outside Perspective (Consulting)
- Interactive Discussion

Session 5: The Architecture of SMS

Duration: 1.5 hours

Prerequisites:

- Session 1: Overview—An Introduction to SMS
- Session 2: The Value of SMS
- Session 3: Challenges and Essentials to Deploy SMS—A Business Perspective
- Session 4: Essentials to Deploy SMS—An Operations Perspective

Intent: The intent of this 1.5-hour session is to define the architectural elements required to establish a healthy SMS ecosystem.

Session Outline:

- Introduction
- Setting the Stage
 - a. Market Challenges and Industry Trends
 - b. The Case for SMS
 - c. The Role and Value of Data
- The Architecture of SMS
 - a. The SMS Environment
 - b. The Role of the Digital Thread
 - c. The Role of Standards
- Interactive Discussion

Session 6: MBSE—A High-Level Review for Newcomers

Duration: 1.5 hours

Prerequisites:

- None

Intent: The intent of this 1.5-hour session is to introduce the participants to model-based systems engineering (MBSE), which is a subset of systems modeling and simulation. The discussions will center on how and why MBSE is being hyped by many software vendors. The building blocks to ensure the correct MBSE implementation rely upon a solid foundation, mainly requirements, which is often overlooked. The various entities that together form the MBSE strategy will be discussed, as well as how this digital thread relies upon the transfer of good quality data from one discipline to another.

Session Outline:

- Introduction
- Setting the Stage—A Brief Introduction to Systems Modeling and Simulation:
 - a. Market Challenges and Trends
 - b. Vision
 - c. The Current Landscape
- Model-Based Systems Engineering—Basics
 - a. MBSE Defined
 - b. Why the Hype?
 - c. MBSE Drivers
 - d. The Infamous “V” Model
- Model-Based Systems Engineering—Innovation Environment
 - a. Innovation
 - b. Need for Good Requirements
 - c. Digital Thread Defined
 - d. The Role of the Digital Thread
 - e. Traditional SE Practice
- Potential “To-Be” MBSE Practice

Session 7: Explaining MBSE without using the Traditional “V Model”

Duration: 1.5 hours

Prerequisites:

- None

Intent: The intent of this 1.5-hour session is to educate middle- and upper-level managers regarding model-based systems engineering (MBSE), which is a subset of systems modeling and simulation. This session addresses MBSE without utilizing the conventional engineering “V” model which is often confusing to upper management. The discussions will center on how and why MBSE is being hyped by many software vendors. The building blocks to ensure the correct MBSE implementation rely upon a solid foundation, mainly requirements, which is often overlooked. The various entities that together form the MBSE strategy will be discussed, as well as how this digital thread relies upon the transfer of good quality data from one discipline to another.

Session Outline:

- Introduction
- Setting the Stage—A Brief Introduction to Systems Modeling and Simulation:
 - a. Market Challenges and Trends
 - b. Vision
 - c. The Current Landscape

- Model-Based Systems Engineering—Explained Without the Engineering “V”
 - a. The Role of the Digital Thread
 - b. MBSE Motivation
 - c. MBSE Terminology and Definitions
 - d. Traditional SE Practice
 - e. Potential “To-Be” MBSE Practice
- Model-Based Systems Engineering—Challenges
 - a. The Hype of MBSE—Where are you with MBSE?
 - b. Barriers to Industry Implementation
 - c. Cultural Transformation
 - d. Challenge: Tool Integration, Data Interoperability
 - e. Who is Driving Whom?
- Final Stretch
 - a. Enabling the Digital Thread Vision for MBSE
 - b. In Parting...

Session 8: Model-Based Definitions & their Role within Engineering

Duration: 1.5 hours

Prerequisites:

- Session 6: MBSE—High-Level Review for Newcomers

Or

- Session 7: Explaining MBSE without using the Traditional “V Model”

Intent: The intent of this 1.5-hour session is to help the participants establish a solid foundation for the meanings of the commonly used model-based terms and definitions.

Session Outline:

- Introduction
- Setting the Stage
 - a. Introduction of Complexity
 - b. Communication and Buzz Words
 - c. Simple Driving Forces
- The Approach to Common Model-Based Definitions
 - a. Glossary
 - b. Approach
 - c. Where Does One Find the NAFEMS Terms & Definitions
 - d. Taxonomies
- Model-Based Definitions
 - a. Model-Based X Definitions Overview
 - b. Model-Based Enterprise
 - c. Model-Based Engineering
 - d. Model-Based Systems Engineering
 - e. Model-Based Design
 - f. Model-Based Definition
 - g. Model-Based Safety Analysis
- Wrapping up—Value of Model-Based Approaches

Session 9: The Systems Engineering “V”

Duration: 2 hours

Prerequisites:

- Session 1: Overview—An Introduction to SMS
- Session 2: The Value of SMS
- Session 3: Challenges & Essentials to Deploy SMS—A Business Perspective
- Session 4: Essentials to Deploy SMS—An Operations Perspective
- Session 5: The Architecture of SMS
- Session 14: MBSE—Challenges for Management
- Session 15: MBSE—Deployment Challenges

Intent: The intent of this two-hour session is to provide a detailed view of the key elements in developing a comprehensive SMS implementation utilizing the systems engineering “V.” The session identifies the inputs and outputs for each block that constitutes the stages required for the complete holistic view of the overall system and its validation.

Session Outline:

- Introduction
- Setting the Stage—The Engineering Landscape
 - a. Business Challenge and Engineering Trends
 - b. Typical Landscape and Vision
 - c. The Engineering Challenge, the Pros and Cons, and the Systems Engineering Effectiveness
- The Systems Engineering Approach
 - a. SMS is an Iterative Process Throughout the Product Lifecycle
 - b. 3 Key Foundational Elements to a Solid Systems Engineering Approach
- The Systems Engineering “V”
 - a. The Systems Engineering “V” Model and the Lifecycle
 - b. Embedded Systems Development—Example
 - c. Deep Dive into the Systems Engineering “V”
 - d. Going beyond the “V”
- Key Messages

Session 10: The Role of Requirements

Duration: 1.5 hours

Prerequisites:

- Session 1: Overview—An Introduction to SMS
- Session 2: The Value of SMS
- Session 3: Challenges & Essentials to Deploy SMS—A Business Perspective
- Session 4: Essentials to Deploy SMS—An Operations Perspective
- Session 5: The Architecture of SMS
- Session 9: The Systems Engineering “V”
- Session 14: MBSE—Challenges for Management
- Session 15: MBSE—Deployment Challenges

Intent: The intent of this 1.5-hour session is to introduce the most important component in any systems engineering approach, namely system requirements. The various types of requirements, their attributes, structure and traceability are covered. Additionally, the basic common traps in writing good requirements are presented.

Session Outline:

- Introduction
- Setting the Stage—How can the Current Landscape be Linked to Requirements?
 - a. Vision
 - b. Engineering Trends
 - c. The current Landscape
- Requirements—Fundamentals
 - a. Benefits of Systems Engineering—a Different Viewpoint
 - b. System Requirements
 - c. Concept of Operations
 - d. Types of Requirements
 - e. Attributes
 - f. Clarifications
 - g. Structure
 - h. Requirement Traps
 - i. Breaking Down Requirements
- Examples

Session 11: Writing Good Requirements

Duration: 2 hours

Prerequisites:

- Session 1: Overview—An Introduction to SMS
- Session 2: The Value of SMS
- Session 3: Challenges & Essentials to Deploy SMS—A Business Perspective
- Session 4: Essentials to Deploy SMS—An Operations Perspective
- Session 5: The Architecture of SMS
- Session 9: The Systems Engineering “V”
- Session 14: MBSE—Challenges for Management
- Session 15: MBSE—Deployment Challenges

Intent: The intent of this two-hour session is to further detail the need for good requirements and assist the participants in how to write good requirements and derive more detailed requirements with associated use cases. The various types of requirements are reviewed regarding their attributes, structure and traceability.

Session Outline:

- Introduction
- Setting the Stage—Requirements Basics
 - a. Overview
 - b. Concept of Operations
 - c. Types of Requirements
 - d. Clarification
- Writing Good Requirements
 - a. Attributes of Good Requirements
 - b. Requirements Structure
 - c. Requirement Traps
- Breaking Down Requirements
 - a. Traceability
 - b. The Engineering “V”, the Lifecycle, and Requirements
 - c. Good Requirements Flowchart
- Examples, Discussion and Exercise

Session 12: The Role of Taxonomy

Duration: 2 hours

Prerequisites:

- Session 1: Overview—An Introduction to SMS
- Session 2: The Value of SMS
- Session 3: Challenges & Essentials to Deploy SMS—A Business Perspective
- Session 4: Essentials to Deploy SMS—An Operations Perspective
- Session 5: The Architecture of SMS
- Session 9: The Systems Engineering “V”
- Session 10: The Role of Requirements
- Session 14: MBSE—Challenges for Management
- Session 15: MBSE—Deployment Challenges

Intent: The intent of this two-hour session is to introduce the participants to the role of taxonomies in a simulation, model-based, and systems environment. The session will look into the general definition and classification of taxonomy, as well as specifics required to understand how taxonomy helps address business and implementation challenges.

Session Outline:

- Introduction
- Setting the Stage
 - a. Market Challenges, Engineering Trends and Current Landscape
 - b. The importance of Taxonomy
- Taxonomy—Fundamentals
 - a. Taxonomy Definitions
 - b. Character Taxonomy View
 - c. Taxonomy Development Steps
 - d. Systems-of-Systems Types of Taxonomy
 - e. Product Taxonomy
 - f. Engineering Taxonomy
 - g. Breaking Down Requirements
 - h. Risk Taxonomies
 - i. Taxonomy Dependencies
 - j. Error Taxonomy
- Taxonomy—Execution
 - a. Development Methodology
 - b. Enterprise Technology Governance
 - c. Holistic Thinking with Taxonomies
 - d. Taxonomy Execution
 - e. The Approach to Common Definitions
- Benefits of Developing Strong Taxonomies
- Interactive Discussion
- Exercises

Session 13: MBSE—The Roles of Existing & Emerging Standards

Duration: 2 hours

Prerequisites:

- Session 1: Overview—An Introduction to SMS
- Session 2: The Value of SMS
- Session 3: Challenges & Essentials to Deploy SMS—A Business Perspective
- Session 4: Essentials to Deploy SMS—An Operations Perspective
- Session 5: The Architecture of SMS
- Session 9: The Systems Engineering “V”
- Session 10: The Role of Requirements
- Session 12: The Role of Taxonomy
- Session 14: MBSE—Challenges for Management
- Session 15: MBSE—Deployment Challenges

Intent: The intent of this two-hour session is to help the participants establish the baseline for communication across all groups within the enterprise and their suppliers. To have a successful systems engineering implementation the appropriate inputs and outputs must allow for the unobstructed transfer of data. This session will help to identify existing and emerging standards to ensure the proper flow of data.

Session Outline:

- Introduction
- Setting the Stage
 - a. Market Challenges, Engineering Trends, and Current Landscape
 - b. MBSE Drivers
 - c. Systems Complexity and its Challenges
 - d. The Importance of Standards
- The Role of the Digital Thread
- The Role of Emerging and Existing Standards
 - a. Why we Need MBx Interoperability Standards
 - b. Many Groups Involved with Many Standards
 - c. The Hype of Standards
 - d. Systems Engineering Existing and Emerging Standards (examples detailed)
- Final Stretch
 - a. Not-for-Profit Organizations Supporting Both Existing and Emerging Standards
 - b. Business Opportunity—Key Factors for Success
 - c. Barriers to Industry Implementation
 - d. Summary
 - e. Who’s Driving Whom?
- Interactive Discussion

Session 14: MBSE—Challenges for Management

Duration: 1.5 hours

Prerequisites:

- Session 1: Overview—An Introduction to SMS
- Session 2: The Value of SMS
- Session 3: Challenges & Essentials to Deploy SMS—A Business Perspective
- Session 4: Essentials to Deploy SMS—An Operations Perspective
- Session 5: The Architecture of SMS

Intent: The intent of this 1.5-hour session is to introduce the role of MBSE in an organization and related challenges for management. This includes the roles of governance, leadership, and mentorship. Additionally, interactive discussion for and among the participants will help them understand this topic.

Session Outline:

- Introduction
- Setting the Stage
 - a. MBSE Defined
 - b. Market Challenges and Engineering Trends
- The Role of Model-Based Systems Engineering
 - a. The Complexity Issue
 - b. Technology
 - c. Business
- The Role of Management—The Case for Cultural Transformation
 - a. The Hype of MBSE—Is Management Up To the Challenge?
 - b. Governance
 - c. Leadership
 - d. Mentorship
- Wrapping Up
- Interactive Discussion

Session 15: MBSE—Deployment Challenges

Duration: 1.5 hours

Prerequisites:

- Session 1: Overview—An Introduction to SMS
- Session 2: The Value of SMS
- Session 3: Challenges & Essentials to Deploy SMS—A Business Perspective
- Session 4: Essentials to Deploy SMS—An Operations Perspective
- Session 5: The Architecture of SMS
- Session 14: MBSE—Challenges for Management

Intent: The intent of this 1.5-hour session is to introduce all participants to the deployment of MBSE adoption. This includes the roles of education, approach, perception, reality, and how to measure success. Additionally, interactive discussion for and among the participants will help in the understanding of this topic and develop ideas for their businesses.

Session Outline:

- Introduction
- Setting the Stage
 - a. The Market and its Challenges
 - b. MBSE—Model Based Systems Engineering
 - i. Definition
 - ii. Benefits
 - iii. Is that all?
- What are the Deployment Challenges?
 - a. The Hype of MBSE
 - b. Knowledge / Education
 - c. What is the Proper Approach?
 - d. Perception & Reality
 - e. Do We Know how to Measure Success?
- Interactive Discussion

Session 16: Digital Twin—Its Role & Structure within a Modern Systems Engineering Approach

Duration: 2 hours

Prerequisites:

- Session 1: Overview—An Introduction to SMS
- Session 2: The Value of SMS
- Session 3: Challenges & Essentials to deploy SMS—A Business Perspective

Intent: The intent of this two-hour session is to properly define and position the digital twin. Additionally, the evolution and various aspects in terms of applications will be addressed. Importantly, the positioning of the digital twin within an organization’s infrastructure and maturity will be discussed holistically.

Session Outline:

- Introduction
- Setting the Stage
 - a. The “Hype” of the Digital Twin
 - b. Digital Twin as Part of Engineering Trends
- Digital Twin
 - a. Definition and Architecture
 - b. The Digital Twin and the Engineering “V”
 - c. How Does a Digital Twin Evolve?
 - d. What are Various Aspects of the Digital Twin in Terms of Applications?
 - e. What is the Role of the Digital Twin?
 - i. In Terms of the Engineering Lifecycle
 - ii. In Terms of Business Maturity
 - f. Examples
- Final Stretch
 - a. Future Considerations
 - b. Next Modules
- Interactive Discussion

Session 17: Challenges Implementing Digital Twin Capabilities & Methodologies

Duration: 2 hours

Prerequisites:

- Session 1: Overview—An Introduction to SMS
- Session 2: The Value of SMS
- Session 3: Challenges & Essentials to deploy SMS—A Business Perspective
- Session 16: Digital Twin—Its Role & Structure within a Modern Systems Engineering Approach

Intent: The intent of this two-hour session is to highlight the challenges in implementing digital twin capabilities and methodologies. This is a deeper dive into topics required for successful implementation, which include the roles of standards, IIoT, AI, predictive analytics, and more.

Session Outline:

- Introduction
- Session Objective
- Setting the Stage—Brief Recap from Previous Session
 - a. The “Hype” of the Digital Twin
 - b. Digital Twin as Part of Engineering Trends
 - c. Digital Twin Basics
 - i. Digital Twin Definition and Basic Architecture
 - ii. Digital Twin—Its Lifecycle and Evolution
 - iii. The New Digital Twin Architecture
 - iv. The Role of Platforms and the Digital Thread
- Digital Twin—Implementation Challenges and Methodologies
 - a. IIoT / Industry 4.0 / IoT
 - b. The Hype of the Digital Twin
 - c. Business Maturity and the Digital Twin
 - d. Evolution of Systems
 - e. Cognitive Behavior and Maturity
 - f. The Role of Standards
 - g. Achieving Sustainable Innovation
 - h. How to Get the IoT Transformation Off the Ground
 - i. Approach
 - j. Examples
- Final Stretch
 - a. On the Light Side
 - b. Summary
- Interactive Discussion

Session 18: Roadmap towards the Digital Twin & Its Maturity Levels

Duration: 2 hours

Prerequisites:

- Session 1: Overview—An Introduction to SMS
- Session 2: The Value of SMS

- Session 3: Challenges & Essentials to deploy SMS—A Business Perspective
- Session 16: Digital Twin—Its Role & Structure within a Modern Systems Engineering Approach
- Session 17: Challenges Implementing Digital Twin Capabilities & Methodologies

Intent: The intent of this two-hour session is to provide a roadmap to create and improve digital twin capabilities based upon the level of engineering “maturity” that exist within the organization. This session will explain the dependencies between the various maturity elements that define digital twin capability. Additionally, recommendations to improve this maturity will be provided using a customized industry based CMMI approach.

Session Outline:

- What is Engineering “Maturity”?
- The CMMI Approach
- Categories and Key Elements Defining Digital Twin Maturity
- Developing a Roadmap to Create and Improve Digital Twin capabilities

Session 19: The Usage of SMS—How to Apply SMS

Duration: 6 hours

Prerequisites:

- Session 1: Overview—An Introduction to SMS
- Session 2: The Value of SMS
- Session 3: Challenges & Essentials to deploy SMS—A Business Perspective
- Session 4: Essentials to deploy SMS —An Operations Perspective
- Session 5: The Architecture of SMS

Intent: The intent of this six-hour exercise session is to provide participants with the opportunity to apply the learned material to some use cases. Participants will form teams, develop solutions, and present those to the group for discussion.

Session Outline:

- The architectural essentials for the successful deployment of SMS will be taught through exercises.