B.2. Future of Systems Engineering

Shaping the Future of Systems Engineering: Pathways to SE Vision 2035. This session invites contributions that empower Systems Engineering through merging collaboration, standardisation, and educational initiatives to build the competencies and knowledge base essential for current and future engineers; encourage innovation and adaptation by integrating advanced tools, technologies, and methodologies to prepare for a digital future, and; emphasise value and evolution, highlighting the significance of systems engineering across various sectors and promoting its maturity to meet emerging challenges effectively.

Lead: Ren King, Erika Palmer
Domains: Education, Certification & Training, Human Systems Integration, Research Capabilities

Submissions Summary:

1. Collaborating in the Systems Engineering Ecosystem for Realizing the Systems Engineering Vision 2035 (Panels and Workshops)
2. INCOSE's Product Development Process (Paperless Presentations)
3. INCOSE Product Spotlight: A Deep Dive into Recent Releases and Upcoming Content (Paperless Presentations)
4. From I to We, From Vee to Us: A Model for Engineering Systems (Paperless Presentations)
5. The Importance of Open Standards and Architectures for Integrated Digital Engineering Capabilities (Paperless Presentations)
6. T&E for Model Validation to Support Synthetic V&V Outcomes (Paperless Presentations)
7. Embracing AI in Digital Engineering: A Holistic Approach to Managing Work, Workforce, and Workplace (Paperless Presentations)

21298 Collaborating in the Systems Engineering Ecosystem for Realizing the Systems Engineering Vision 2035

William D Miller 1, Stephen Cook 2, Kerry J Lunney 3, Paul Pearce 4, INCOSE, BERKELEY HEIGHTS, NEW JERSEY, United States, SHOAL Group Pty Ltd, Adelaide, Thales Australia, Greater Sydney Area, ASC Pty Ltd, Greater Adelaide Area

Keywords: Education,Certification & Training,Human Systems Integration,Research Capabilities

Type: Panels and Workshops
Stream submitted: B.2. Future of Systems Engineering

The panel moderator will describe the context for the Future of Systems Engineering (FuSE) initiative to realize the Systems Engineering Vision 2035 followed by the panelists presenting their position statements identifying challenges, opportunities, development needs, and opportunities for collaboration. The exponentially increasing aspects of scale, interactions, complexity, uncertainties, and emerging technologies challenges our engineering of systems and systems of systems. Together with stakeholders in the systems engineering ecosystem, we must foster collaboration to innovate and build quality professional practice of system engineering, which continues to evolve in response to technical opportunities and political, economic, social, technological, environmental, and legal (PESTEL) challenges. Anticipating what systems engineering will and should be in the future has significant implications for research, education, training, certification, and resources. The panel is 90 minutes with the intent to allocate 50 percent of the time for participants to then engage with the panel and each other.

20971 INCOSE's Product Development Process

Christian Sprague 1, Erika Palmer 1, INCOSE

Keywords:

Type: Paperless Presentations
Stream submitted: B.2. Future of Systems Engineering

Overview: This session will provide an in-depth overview of INCOSE's product development process where we examine its evolution and adaptation to the digital era. Attendees will gain a thorough understanding of the various stages and best practices employed in creating new and innovative systems engineering products. Context: In an era marked by rapid digital transformation, INCOSE is strategically refining its product development process to make better use of technology and foster collaborative endeavors. Each stage, from ideation, to team formation, to distribution, contributes an important part in shaping the final product and its wider impact on the systems engineering community. Purpose: This session seeks to equip attendees with a broad understanding of INCOSE's product development pipeline by providing them with the information and tools necessary to actively contribute to the future of systems engineering products. By highlighting the process and calling out opportunities for engagement, we will cultivate greater innovation and inclusion within the INCOSE community. Approach: This session combines expert insights, case studies, and interactive discussions to guide attendees through the stages of INCOSE's product development process. We will examine each part, from the sketching out a Technical Product Plan (TPP) and participating in technical reviews, to the style guideline for designing visually compelling and user-centric products. Attendees are encouraged to engage in discussion, share insights, and gain practical tips for navigating the project pipeline. Insights: Attendees will leave with a clear understanding and actionable steps to further their participation in INCOSE's product development. They will gain appreciation for the collaborative nature of product creation, recognizing the interactions between technical expertise, design, and effective distribution. By learning about INCOSE's stance in leveraging digital platforms, targeted marketing, and community engagement, attendees will be well-positioned to drive the success and impact of future systems engineering products.

20973 INCOSE Product Spotlight: A Deep Dive into Recent Releases and Upcoming Content

Christian Sprague 1, Erika Palmer 1, INCOSE

Keywords:

Type: Paperless Presentations
Stream submitted: B.2. Future of Systems Engineering

Overview: This session will cover INCOSE's recent and upcoming product releases. It will also discuss the collaborations between volunteers, working groups, and staff in providing valuable content to the systems engineering community. Context: INCOSE contains a broad and ever-growing product portfolio, encompassing magazines, guides, primers, and data tools, all developed through the efforts of the systems engineering community. These products are designed to push the boundaries of systems engineering practices and tackle the most pressing challenges facing society. Purpose: This session will provide attendees a deep dive into new INCOSE products, discuss the development behind them, and give a glimpse into the products on the horizon. By highlighting these innovative resources, we seek to inspire attendees to contribute to INCOSE product development. Approach: The session will kick off with a deep dive into the core articles of the April 2024 INSIGHT magazine, which tackles the challenge of advancing systems engineering in an increasingly complex world. From there, we will showcase a carefully curated selection of other significant recent releases, such as the Guide to Security Needs and Requirements, Agile Systems Engineering Primer, and Guide to ISO/IEC/IEEE 42020. Attendees will have an exclusive look at the roadmaps and timelines for highly anticipated upcoming releases, including the next version of our systems engineering competency framework, updates to the development of standards, and work towards a modular ontology for systems engineering. Insights: Attendees will leave this session with a comprehensive understanding of INCOSE's latest offerings, a detailed preview of new developments, and actionable insights into how they can leverage and shape these resources to elevate their practice and drive the profession forward. The session will underscore the role our volunteer community has in driving product development and how they can make their mark on INCOSE's mission of advancing systems engineering.

21214 From I to We, From Vee to Us: A Model for Engineering Systems

David Long 1, Blue Holon, Blacksburg, VIRGINIA, United States

Keywords: Digital transformation,interfaces,lifecycle

Type: Paperless Presentations
Stream submitted: B.2. Future of Systems Engineering

Overview The power of digital represents an opportunity to fundamentally accelerate and transform the engineering lifecycle, but we must do so correctly. Digitization done poorly will enhance practices but silo practitioners. Embracing a holistic systems perspective enables us to digitalize engineering, empower radical collaboration, and adopt a new model for engineering systems. Context The various engineering disciplines have largely digitized their practices including the advancement and adoption of MBSE for systems engineering. However, many organizations and their supporting practices remain siloed. Integrations between teams and lifecycle phases remain largely constrained by old practices and organizational constraints slowing engineering progress and losing knowledge. Purpose Transformation requires more than simply digitizing existing practices. We must reconceptualize what is possible given the unprecedented computing power and data storage capacity of today. This includes ways of working within given disciplines and processes. More importantly, it requires that we look across the engineering lifecycle addressing workflows and interfaces to transform the engineering system rather than its constituent components. Approach For over 30 years, I have worked with government and commercial organizations as they assess, adopt, and deploy new methods and tools to enhance their engineering enterprise first MBSE and now digital thread, digital twin, and digital engineering. I have observed common patterns across organizations and disciplines. Looking to fundamental system concepts allows one to transform from the traditional Vee lifecycle model to a series of Us through concurrency, modularity, and integration powered by digital flows. Insights By changing our perspectives from digitization to digitalization, from serial to parallel, from part to whole, from siloed to collaborative we embrace a new lifecycle model, meet the promise of digital engineering, and deliver transformative results as we engineer the future.

21235 The Importance of Open Standards and Architectures for Integrated Digital Engineering Capabilities

JORDAN MARSHALL 1, QINETIQ AUSTRALIA, Mt Duneed, VICTORIA, Australia

Keywords: Digital Engineering,Open Standards,Integrated,Data,Systems Engineering

Type: Paperless Presentations
Stream submitted: B.2. Future of Systems Engineering

Overview: One of the challenging concepts in shaping the future of Systems Engineering and preparation of a Digital future includes the complexity associated with Tools and Data integration. [SE Vision 2035] The complexity exists between many different types of tool sets and technologies used, and the effort required to exchange data between them. There is a Need to simplify this approach as much as possible. One such method, which we will explore to accomplish this, is through the use of Open Standards and Open Architectures. Context: Such approaches to this problem, may include the adoption of common interface standards, languages, schemas and modular based architectures. The presentation will provide a brief look into the relevant standards bodies; examples of existing open systems and languages, and how they may be utilised for developing Digital Engineering capabilities. Exploring the issues of stove piping, which typically inhibit the sharing of data openly across the system lifecycle. Purpose: This presentation will provide an outline of the challenges associated with closed systems, and a fresh look at the benefits of an open system in the context of implementing Digital Engineering capabilities. Outlining the key challenges associated with Tools and Data integration as described in the Systems Engineering vision for 2035. There is now a growing need and urgency to standardise our approach, in order to access, share, collaborate, and reuse data. Approach: By using Open Standards, the complexity of integration is reduced, resulting in a wide number of benefits, which this presentation will discuss in further detail. Insights: This is advantageous for the replacement of future Digital Engineering systems, which can then utilise those standardised interfaces and integrate easier. From this presentation, we will recognise the need for such open standards to enable us to implement Digital Engineering capabilities now, and in the future.

21249 T&E for Model Validation to Support Synthetic V&V Outcomes

Terence De Jong 1, Janice Wong 1, Jeet Shah 2, Digital Engineering, Nova Systems, Newstead, QLD, Australia, Digital Engineering, Nova Systems, Southbank, VIC, Australia

Keywords: Digital Mission Engineering,Verification & Validation,Modelling & Simulation,MBSE

Type: Paperless Presentations
Stream submitted: B.2. Future of Systems Engineering

In the emergent digital landscape, the evolution of Synthetic Test & Evaluation (ST&E) applications in systems engineering is essential, offering value in overcoming real-world testing constraints. This presentation explores the evolution of Synthetic Test & Evaluation applications in systems engineering, particularly for Uncrewed Aerial Vehicles (UAVs) and multi-UAV systems (swarms). We will present modelling and simulation of UAV power consumption to predict system performance, demonstrating how ST&E can complement traditional testing methodologies, addressing real-world constraints and enhancing efficiency. The operational adaptability and configurability of Commercial and Military off-the-shelf UAVs present significant challenges to conventional Test and Evaluation (T&E) methods, which are often costly, time-consuming, and logistically demanding. Existing methods struggle to keep up with the dynamic nature of UAV technology. The research aims to understand and demonstrate the effectiveness of a synthetic approach to Test and Evaluation for UAVs. The hypothesis is that validated Modelling & Simulation (M&S) can contribute to both ST&E and digital mission engineering throughout the life cycle, improving resource allocation, risk mitigation and overall mission performance assessment. Nova Systems hybrid Test and Evaluation framework combines Model-Based Systems Engineering (MBSE) and M&S with physical testing to verify and validate UAV performance. The study collected and analysed data on power consumption and battery utilization under various payloads and flight scenarios to validate the synthetic models presentation of real-world UAV behaviour. The benefits of synthetic testing extend beyond validation, with impacts across the system life cycle. By facilitating comprehensive system and mission analysis across the life cycle, ST&E can enhance operational efficiency, risk mitigation, and resource optimisation. Its integration into the broader framework of systems engineering not only augments traditional T&E practices but also drives the advancement of the digital mission.

21271 Embracing AI in Digital Engineering: A Holistic Approach to Managing Work, Workforce, and Workplace

Erika Palmer 1, Ren King 2 3, Christian Sprague 1, INCOSE, Certification Training International, Johannesburg, South Africa, Project Performance International, Sedgefield, South Africa

Keywords:

Type: Paperless Presentations
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Workshop SessionOverview: This workshop presents the Sociotechnical Function Allocation and Risk Analysis (SFARA) Framework, a conceptual schema for evaluating the relationships between humans and technology in the context of digital engineering for AI integration. The workshop addresses the opportunities and shifting risk profiles of utilizing AI in systems and offers a holistic approach to managing work, workforce, and workplace. Context: Managing the interplay of human and technological elements within socio-technical systems is crucial, especially in the context of rapid AI advancements. AI integration in digital engineering requires frameworks like SFARA to make strides towards advancement while managing new risks. Purpose: The workshop aims to explore the challenges and opportunities of AI within digital engineering and to present the SFARA Framework as a valuable resource for engineers and designers to assess function allocation and risk within a sociotechnical context. Approach: The session presents an array of global perspectives and best practices, followed by a hands-on activity that challenges participants to apply the SFARA Framework for AI implementation to an example in digital engineering. Participants will then engage in group discussions and presentations to share their findings and receive feedback. Insights: Attendees will gain knowledge about the SFARA Framework, which involves functional decomposition, subfunction assignment of automatability along the Human-Technology Spectrum (HTS), and analyzing the resulting functional distribution and risk profile across the system. They will learn how to apply the framework for AI integration in digital engineering and explore a holistic approach to managing work, workforce, and workplace.