Celebrating the Sound of Systems Engineering

Book of Abstracts

Status as of August 26, 2020

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Keynote - Plenary

Keynote - Plenary#K2

Engineering America's Most Ambitious Regional Transit Expansion.

Mr. Peter Brown (Director, Systems Engineering and Integration, Sound Transit) - peter.brown@soundtransit.org

Presented on: Friday, 09:15-10:15

Biography

Mr. Peter Brown (Director, Systems Engineering and Integration, Sound Transit) - peter.brown@soundtransit.org
Peter Brown is the Director of Systems Engineering and Integration at Sound Transit. After joining the agency in 2011, Peter played an instrumental role in the delivery of the University Link and Angle Lake light rail extension projects in addition to other significant projects including the implementation of Positive Train Control. In his current role Peter is responsible for the design, construction and testing of signaling, power and communications infrastructure and light rail vehicles worth over a billion dollars in support of Sound Transit's system expansion plan. Since graduating from the University of Sydney with a bachelor's degree in civil engineering, Peter has held various engineering, construction and operational roles in critical road and rail infrastructure in Sydney, London and Washington, D.C. Peter's international experience in the public and private sector covering all life-cycle phases of critical infrastructure has resulted in a deep appreciation of the value of diverse perspectives and the importance of systems thinking in effective project delivery.

Keynote - Plenary#K1

Migrating to MBSE on Legacy and New Programs.

Ms. Christi Gau Pagnanelli (Director, Systems Engineering, Boeing Defense, Space and Security) - christi.a.gaupagnanelli@boeing.com

Presented on: Thursday, 09:15-10:15

Biography

Ms. Christi Gau Pagnanelli (Director, Systems Engineering, Boeing Defense, Space and Security) - christi.a.gaupagnanelli@boeing.com
In her current role, Christi is responsible for defining and implementing Systems Engineering and Model Based Systems Engineering best practices, processes and tools to be used across Boeing programs. She has over 31 years of experience in the Aerospace Industry primarily in Program/Project Management, Systems Engineering and Global Engineering Management. Her experiences include Deputy Program Manager of Vigilare for Boeing Australia Limited where she was responsible for program execution. Gau Pagnanelli joined Vigilaire from various satellite and proprietary programs where her last position was the Director of Systems Engineering. Prior she held leadership positions responsible for systems integration and test laboratory, mission software, hardware/software integration, and program tools and processes. Christi began her career at McDonnell Douglas Corporation working on the International Space Station program as a member of the technical staff where she worked on designing a number of integrated systems. She continued to hold a variety of leadership positions. Her last position on the ISS program was as Segment Integrated Product Team Leader. She held this position throughout the final design and assembly, integration, test, sell-off to the NASA customer and on-orbit mission support. Christi received her Bachelor of Science degree in aerospace engineering from Iowa State University.

Keynote - Plenary#K3

Never Let a Good Crisis Go to Waste: The significant opportunities for healthcare improvement through the wake of the COVID-19 pandemic.

Mr. Geoff Austin (Chief Operating Officer at University of Washington Medical Center / Northwest Hospital & Medical Center) - graustin@uw.edu

Presented on: Friday, 12:15-13:15

Biography

Mr. Geoff Austin (Chief Operating Officer at University of Washington Medical Center / Northwest Hospital & Medical Center) - graustin@uw.edu
Geoff Austin, MBA, MHA is the Chief Operating Officer for the newly integrated University of Washington Medical Center, in Seattle, which across several campuses consists of over 1,500 medical staff, 7,000 employees, and 500 residents. Previously, he was the Executive Director for the University of Washington Medical Center, ranked as the number one hospital in the state of Washington and the number five cancer hospital in the country. He has over 25 years of experience in health care and has worked for UW Medicine since 2005. Prior to his executive roles in UW Medicine, he led strategic service lines including Oncology, Organ Transplantation, and Neurosciences. Before UW Medicine, Geoff was a consultant with ECG Management Consultants and led strategic, financial and operational planning engagements for academic medical centers and schools of medicine across the country. He began his career as a management engineer with Kaiser Permanente in Southern California. Geoff is a clinical instructor with the Master of Health Administration program at the University of Washington. He is the current board treasurer and past board president with Community House Mental Health Agency, and is an advisory board member of LifeCenter Northwest (the northwest region’s organ procurement organization).

Keynote - Plenary#K4

Nuclear Technology Development with Systems Engineering

Mr. Eric Williams (Vice-President of Engineering, TerraPower) - ewilliams@terrapower.com

Presented on: Thursday, 12:15-13:15

Biography

Mr. Eric Williams (Vice-President of Engineering, TerraPower) - ewilliams@terrapower.com
Eric Williams is the Vice President of Engineering at TerraPower. In this role, he oversees the engineering associated with TerraPower's advanced reactors and medical isotope programs. He works closely with the senior program managers to provide design, analysis, and testing to meet project objectives. Williams has 22 years of experience in engineering and has spent the last 15 years developing nuclear power plant designs, with an emphasis on safety. Before coming to TerraPower, Williams spent four years at B&W mPower developing a new small modular reactor design and worked to develop the safety of the plant and take the design through pre-licensing with the U.S. Nuclear Regulatory Commission. He also led the development of an Integrated Systems Test facility, which was a small-scale, electrically powered version of the nuclear power plant used to demonstrate the safety characteristics of the plant during simulated accident scenarios. Earlier in his career, Williams worked on another new reactor design where he led a team that analyzed severe accidents. He developed the analysis and documentation needed to license the design and took the severe accident analysis through the licensing process. Prior to working on new nuclear reactor designs, Williams worked on making the current fleet of nuclear power plants in the U.S. more efficient by upgrading their equipment and modernizing their systems. He worked directly with electric power utilities and visited operating nuclear power plants to understand the issues they faced and helped develop solutions. Williams holds a Bachelor of Science in Mechanical Engineering from the University of Florida, a Master of Business Administration from Lynchburg College and a Professional Engineer license.

Welcome Plenary - Introduction

Presented on: Friday, 09:00-09:15

Presentation

Presentation#9

A Proposed Model-Based Approach for Product Verification

Raymond Wolfgang - rwolfga@sandia.gov

Presented on: Friday, 14:15-15:00

Keywords. MBSE;Verification & Validation;Qualification;Using MBSE for V&V

Topics. SE Processes and Methods;

Abstract. For many systems in highly regulated industries, Verification and Validation is very formal - this type of V&V is sometimes called product or system qualification. This presentation will present an MBSE approach to product verification. This approach was considered, because even for simple products sold to the government, qualification engineers must create, organize and then deliver a large data package as part of the formal submission to the government. Much has been written about using MBSE to improve and accelerate design; this presentation suggests that such a tool may also be used to curate the final qualification package for customer acceptance. A simplified coffee maker example is used to illustrate the idea. The end result can be a more credible, organized, and readable V&V package, as well as reduced labor hours spent by the V&V engineer on package preparation. This is of particular interest to the author, who performs such engineering as part of his normal work.

Biography

Raymond Wolfgang - rwolfga@sandia.gov
Raymond currently works as a Systems Engineer on several programs at Sandia National Laboratories. He has experience on many types of projects - from software development work to multi-year defense programs. Currently he performs system engineering, requirements development and qualification engineering for several development products. He has also performed requirements engineering and management, safety engineering, and verification strategy implementation. Before joining Sandia he worked at the Naval Information Warfare Systems Command (NAVWAR) San Diego (formerly SPAWAR). There, he matured requirements for several programs, performed R&D, and supported acquisition for several ship-board technology upgrades. His interests include using MBSE to improve requirements analysis, and overall SE process improvement. He has presented at several INCOSE conferences. A graduate of both Purdue and Penn State Universities in the United States, he is originally from the Philadelphia, USA area.

Presentation#35

Comparison of FDA Quality System Regulation and INCOSE Systems Engineering Handbook

Daniel Piraino - dan.piraino@stryker.com

Presented on: Thursday, 10:30-11:15

Keywords. Medical Devices;Quality System Regulation;Design Controls

Topics. Education and Workforce Development;Healthcare and Medical Devices;SE Processes and Methods;

Abstract. The United States Food and Drug Administration (FDA) has the primary regulatory responsibility for the safety and effectiveness of medical devices in the United States. The primary regulation is promulgated in the Quality System Regulation (21 CFR 820) (QSR). The section of the regulation of most concern to System Engineers is Subpart C of the regulation, Design Controls (820.30)

Comparison of Design Controls to the corresponding sections of the INCOSE Systems Engineering Handbook raises many questions about what is meant by the Quality System Regulation. Since many engineers are trained on concepts similar to those in the Systems Engineering Handbook and since most FDA officials have no experience in either formal Systems Engineering or industry, this causes considerable confusion.

This paper will examine details of the differences of such concepts as Stakeholder Requirements (Design Input in the QSR), System Requirements (also termed Design Input in the QRS), Verification and Validation. It will explore some of the consequences on the differences in concepts. Finally the strengths and weaknesses in the authors view of the two systems is examined.

Biography

Daniel Piraino - dan.piraino@stryker.com
Dan Piraino has been in the medical device field for 44 years, with experience in noninvasive devices, including transcutaneous oximetry, laser Doppler blood flow, diagnostic ultrasound, electrocardiography, cardiopulmonary feedback devices and defibrillation. He earned a PhD in Electrical Engineering from the University of Washington in 1981, and is currently on the research staff at Stryker Emergency Medical Division in Redmond, Washington, formerly Physio-Control Corporation.

Presentation#20

Complexity of Dynamic Systems in Mining Operations

Michael Do - michael.do@comcast.net
Raymond Yost - ray.yost@teck.com

Presented on: Thursday, 13:30-14:15

Keywords. Complexity;Normal Accident Theory;Mining Operations;Haulage Operations;Systems Approach

Topics. Transportation;

Abstract. The mining industry experiences significant incidents involving haulage operations up to and including severe injuries and fatalities. Normal Accident Theory (NAT) posits that accidents occur due to a combination of the interactive degree of system elements (complexity) and the degree to which elements are bound together in space or time (coupling). This paper evaluates the applicability of Normal Accident Theory (NAT) to haulage operations in the mining industry. Given that the theory was developed for somewhat static systems, one of the initial challenges in applying NAT to haulage operations was the need to develop an appropriate index for quantifying complexity in dynamic environments, where elements that contribute to the spatial complexity could enter and exit a workspace freely. By viewing haulage operations as a system composed of elements and nodes, a quantitative complexity index is proposed, calculated for a conceptual operation and compared to Mine Safety and Health Administration statistics for baseline validation. Initial results indicate that there appears to be a correlation between the computed complexity of subcomponents of the haulage cycle and the incidence of haulage accidents.

Presentation#26

Customer Analytics for Service Excellence in Systems Engineering

Dr. Kenneth Preston - alphapreston@yahoo.com

Presented on: Thursday, 14:15-15:00

Keywords. systems engineering;big data;customer analytics;service of excellence;communication;Mitigation;technical data

Topics. Education and Workforce Development;

Abstract. Customer Analytics is an important element in meeting service excellence for customers. Technical and business efficiencies resulting from affordability, predictive forecasting, strong decision-making and strategic growth are influential events when focusing on customer service. Customer Analytics is the result from customer behavior patterns can effectively dissect, evaluate, analyze, and respond to large amounts of analyses, evaluations, modeling, and assumptions made in procuring a design by engineering. This information in systems engineering, have grown so large and complex that it is difficult to manage and determine its value while meeting conditions required for customer's service excellence. This justifies the need behind the importance of Customer Analytics within systems engineering. Analytics is the process used by customers to make key technical, marketing, and business decisions as well as enhance relationships. Building a supportive environment that inspires excellence in everything done is key to having these successful and productive relationships (Service Excellence Team, www.montana.edu). Much of this technical data obtained from systems engineering analyses and databases are highly specialized in nature and can be redundant at times. It makes it difficult for the customer to understand the results and make effective decisions. A model will be presented focusing on Customer Analytics demonstrate the relationship between systems engineering and customers. Customer Analytics is critical to the success of the overall growth of any systems engineering organization with respect to service of excellence and enhance competitiveness. This analytics helps businesses "to win clients" in an extremely competitive environment and facilitate cost savings (Dive the Customer Service Improvement Company, www.dive-group.com). Possessing an effective model can be used to satisfy a consumer's service of excellence and enhance those relationships required to have a positive influence upon the vision and value of all parties.

Biography

Dr. Kenneth Preston - alphapreston@yahoo.com
Kenneth L. Preston, DBA - Systems Engineering and Integration/Parts Management. Ken has 33 years of aerospace and defense industry experience (over 25 years in Project Management). He is a Sr. Project Engineer and Technical Lead Engineer on the C-17 Program. He leads the technical oversight of the parts management obsolescence. He worked on the Space Shuttle program in various technical and management positions as well as a project lead for the Return-to-Flight Safety and Engineering team's computational foam fracture mechanics assessment. Dr. Preston serves as an Instructor at California Institute of Technology's Center for Technology and Management Education (CTME). He is Vice-Chair of the Cal State LA Industry Advisory Board (IAB) for Mechanical Engineering and Ambassador for the California State University (CSU) system/Faith-Based partnerships. He presented and had published a paper in 2016 to the INCOSE Regional Mini-Conference entitled "Big Data Analytics/Role of Analytics in Systems Engineering". Dr. Preston received his Doctor of Business Administration (DBA) and MBA in Project Management from Columbia Southern University, and M.S. and B.A. from Hampton University/Institute in Physics. . Ken has been married for over 34 years and resides in Southern California with his family.

Presentation#30

Distributed, Data-centric Collaborative Information Management (DDCIM) for Project Management and SE&I

Kristina Rojdev - kristina.rojdev-1@nasa.gov
Tony Williams - antony.g.williams@nasa.gov
Jennifer Devolites - jennifer.devolites@nasa.gov

Presented on: Thursday, 13:30-14:15

Keywords. Data-centric;Information management;Collaboration;Project management

Topics. SE Processes and Methods;

Abstract. Over the past decade, a team at NASA's Johnson Space Center has been developing and testing innovative approaches to streamline project processes across the full life cycle, applied to two successful in-house flight projects. Both projects made use of an approach called Distributed, Data-centric Collaborative Information Management (DDCIM). DDCIM is a data-centric approach to managing project information, with a primary goal of greatly reducing the inefficiencies of document-centric information management approaches. DDCIM relies upon the use of a data-centric collaborative environment with linked data relationships. DDCIM is scalable and can be used standalone or to augment traditional document management or MBSE approaches to development. This paper describes the application of DDCIM to project management and systems engineering approaches over the project life cycle, from conceptual development through flight operations.

Biography

Jennifer Devolites - jennifer.devolites@nasa.gov
Jenny Devolites received a B.S. in Aerospace Engineering from Texas A&M University. She has been with NASA Johnson Space Center for over 25 years, starting out in guidance, navigation and control, and moving into increasingly complex responsibilities for project management and systems engineering. From 2015-2019, she served as the Orion Ascent Abort-2 flight test's Crew Module and Separation Ring (CSR) Flight Test Conductor, SE&I Lead, and Deputy Project Manager. For the final nine months of the project and through the successful flight test in July 2019, she served as Project Manager. She is currently serving as SE&I Lead for NASA's Gateway Production Office.

Presentation#8

Early System V&V Using SysML Simulation

Saulius Pavalkis - saulius.pavalkis@nomagic.com

Presented on: Friday, 13:30-14:15

Keywords. SySML;Simulation;Validation and Verification

Topics. Aviation and Space Systems;SE Processes and Methods;

Abstract. Presentation will demonstrate recent trends in system model execution with SysML to perform early validation and latter architecture and design verification. We will demonstrate system simulation, automated requirements verification, test cases specification and automated execution. We will use Cameo Simulation Toolkit which is integrates pluggable evaluation engines and standards to enable out of the box system model execution and analysis.

NASA perspective on recent trends in executable models:
"This is an important development since it requires minimal configuration, can be used earlier in the lifecycle and can evolve as the design matures."

Presentation will be done in context of satellite model.

Biography

Saulius Pavalkis - saulius.pavalkis@nomagic.com
18 years at Dassault Systems (No Magic) in model based solutions and R&D Expert in systems modeling, simulation, MBSE ecosystem, interfaces / integrations, traceability, queries INCOSE CSEP, OMG OCSMP, No Magic lifetime modeling and simulation excellence award Community author for simulation (youtube.com/c/MBSEExecution) and MBSE success cases (blog.nomagic.com) Author of multiple papers on MBSE. In 2020 got NAVAIR $20M budget for V&V paper implementation Representative at INCOSE CAB Supporting MBSE adoption in A&D, T&M and other domains. Major clients: P&W , Boeing, NASA, BAE Systems, Raytheon Technologies, NGC, FORD

Presentation#27

Flight Test: The Ill-regarded Tail-End-Charlie of a Project

Jorg Largent - jorg.largent@incose.org

Presented on: Thursday, 11:15-12:00

Keywords. Test;Flight Test;Requirement;Test Requirement;Systems Engineering;Design;Divide between design and test;Types of data;Traceability;Requirement owner

Topics. Aviation and Space Systems;SE Processes and Methods;Transportation;

Abstract. Testing has often been the ill-regarded tail-end-Charlie of a project. This presentation uses an overview of the history of flight test to illustrate its utility and to further illustrate the importance of testing in general. Testing and systems engineering are complementary in their maturation and execution, intertwined in the successful execution of a project.
Enthusiasm, schedule, and money are often lavished upon the beginnings, with only the dregs of enthusiasm and money left as the end of development as an immovable milestone, such as production and a promised initial operating capability, looms large on the Gantt Chart. The ever-quickening pace of changes in technology has increased the pressure. The history of the changes is littered with failures, such as the Tacoma Narrows Bridge (also known as "Gallopin' Gertie") failure in 1940 to the recent recall by Volvo of all 2019 and 2020 model year vehicles sold in the United States. While the bridge failure was an aeroelastic phenomenon and the Volvo problem is a software problem, the common thread throughout the history of technology is the penchant for inadequate testing. This fertile field of disasters and disappoints spawned systems engineering as a science and a discipline, but there is evidence to suggest that the practitioners are being intellectually seduced by the novel, at the expense of the fundamentals.
This presentation illustrates the importance of the fundamentals and the role of tools to facilitate them by examining some of the challenges facing flight test before the organization of the National Council on Systems Engineering. This examination is interspersed with advances in the discipline of systems engineering to illustrate the utility of the discipline as a tool. And while this presentation uses historical flight test as a sounding board, the principles are applicable to all the testing that need be done as a part of any project and transcend the passage of time.

Biography

Jorg Largent - jorg.largent@incose.org
Jorg Largent's career spans 55 years and ranges from the enlisted ranks of the United States military to Lead Systems Engineer on the B-2. In between he matriculated at the Georgia Institute of Technology. After completing his formal training, he worked in orbital mechanics on the Apollo Program. At the close of the Apollo program Jorg became a Flight Test Engineer, primarily on the CH-46E, the B-1A, and the B-2. After he left Flight Test he moved on to liaison engineering and then to system engineering on the B-2 program and special projects. Jorg has studied transportation for over 50 years and has worked as a conductor on the Sierra Railroad. He has mentored high school and college level engineering students, has been a judge for the California State Science Fair, and has a passion for STEM. Jorg has been active in INCOSE working groups, including Transportation, Very Small Entity, and Systems Engineering Quality Management. Jorg is a writer and the Editor of the INCOSE Los Angeles Newsletter.

Presentation#5

Hardware-Inclusive DevOps: Applying DevOps Principles & Practices to Cyber-Physical System Engineering

Bryan Smith - bryan@321gang.com

Presented on: Thursday, 10:30-11:15

Keywords. Agile Systems Engineering;Lean Product Development;DevOps;Scaled Agile Framework;SAFe

Topics. Artificial Intelligence;Autonomous Systems and Resilience;Aviation and Space Systems;Communications;E-Commerce, Cloud Services, and System Security;Education and Workforce Development;Energy;Healthcare and Medical Devices;SE Processes and Methods;Transportation;

Abstract. Much like the Agile Manifesto itself, DevOps surfaced and was developed with a strong software-centric focus. As software becomes more pervasive within the systems engineering context, our more recent frontier is the application, and scaling, of DevOps practices to the development of large, complex, 'cyber-physical' systems composed of software AND non-software components.

In this presentation, we'll examine how agile development (Dev) exposed a bottleneck in operations (Ops) and pushed these formally distinct (and siloed!) organizations to work together in concert to help ensure the consistent delivery of high-quality functionality to the market.

After reviewing the well-known issues with waterfall/phased-gate process environments we'll discuss the necessity of creating synchronized value-streams, working on a common cadence, in order to reduce costly delays, rework and quality issues. Non-software engineers need to recognize that delivering 'value' on a 2-4 week cadence need not be a physical widget... but shared learning across disciplines that helps avoid mistakes from propagating and/or inform better decision making.

While those with a lean/agile mindset will recognize that the basic DevOps principles can be applied with minimal adaptation for hardware-inclusive systems, we'll discuss how other practices and emerging technologies can address the challenges of applying these principles in the development of cyber-physical systems- resulting in better engineering and business outcomes.

Biography

Bryan Smith - bryan@321gang.com
Bryan has been helping software and systems engineering organizations improve how they develop their products for over 20 years. Beginning with companies like Rational Software and IBM, Bryan moved into the world of lean and agile in 2007 at Rally Software (now part of Broadcom). He joined 321 Gang in 2011 and helped launch its engineering-centric lean/agile consultancy in 2014. As a reseller for IBM, Polarion and Atlassian, 321 Gang provides both the services and tooling to help its clients successfully implement agility at scale.

Presentation#22

How to Realign Engineering Teams for Remote Work with Minimal Disruption

Aaron Perillat - aperillat@jamasoftware.com
Deric Merino - ffcmerino@hotmail.com

Presented on: Friday, 11:15-12:00

Keywords. requirements management;test management;risk management;system engineering;remote;cloud

Topics. Aviation and Space Systems;E-Commerce, Cloud Services, and System Security;Energy;Healthcare and Medical Devices;SE Processes and Methods;Transportation;

Abstract. Throughout 2020, due to COVID, many businesses and engineering teams have been forced to make a transition to remote work and distanced collaboration.

This session will focus on better practices for remote work and collaboration. Jama would like to share our experiences and expertise so you can align your engineering teams to a new remote work reality without jeopardizing quality, efficiency, or timelines.

A client example will also be reviewed. This client relies on those same collaborative features to communicate critical changes to remote teams as part of their daily operations. They develop features at a fast pace, often enhancing the functionalities of their electric freight vehicles after they're deployed. Teams need to react fast and change tracks if necessary — and collaborate with each other early in the process.

- Learn how you can use a single platform to introduce remote collaboration and conversations into complex workflows with minimum disruption to your business.
- Learn how traceability can help you identify the impact of changes that occur in your supply chain.
- Get helpful tips you can implement right away to help your remote teams maintain momentum in the product development process.
- Participate in a Q & A.

Biography

Aaron Perillat - aperillat@jamasoftware.com
Aaron Perillat is a Sr. Solutions Architect with Jama Software. Aaron has 10+ years of experience in the software engineering world with a focus around requirements in industrial and automotive technology. In addition, Aaron has a deep understanding of regulated and risk sensitive industries, working with Jama prospects and customers to recommend process improvements to achieve traceability across their product development process and help ease the burden of increasingly complex and competitive ecosystems.

Presentation#24

INCOSE's Guide to Verification and Validation: Context, Progress, and Content

Raymond Wolfgang - rwolfga@sandia.gov

Presented on: Thursday, 10:30-11:15

Keywords. Verification and Validation;Requirements Working Group;Guide to V&V;INCOSE publications

Topics. SE Processes and Methods;

Abstract. This brief will introduce to the community the INCOSE Guide to Verification and Validation, a work-in-progress of the INCOSE Requirements Working Group (RWG). The context of the Guide with respect to the other RWG documents under development will be shared. These other documents are the forthcoming Guide to Managing Requirements (GMR), and the Needs and Requirements Lifecycle Manual (NRLM). A very top-level table of contents of the Guide to V&V will be presented, along with a timeframe for completion and release. The attendee will leave with an understanding of what documents are in-process from the RWG, how they will eventually all fit together, and an approximate timeline for their release to the INCOSE community.

Biography

Raymond Wolfgang - rwolfga@sandia.gov
Raymond currently works as a Systems Engineer on several programs at Sandia National Laboratories. He has experience on many types of projects - from software development work to multi-year defense programs. Currently he performs system engineering, requirements development and qualification engineering for several development products. He has also performed requirements engineering and management, safety engineering, and verification strategy implementation. Before joining Sandia he worked at the Naval Information Warfare Systems Command (NAVWAR) San Diego (formerly SPAWAR). There, he matured requirements for several programs, performed R&D, and supported acquisition for several ship-board technology upgrades. His interests include using MBSE to improve requirements analysis, and overall SE process improvement. He has presented at several INCOSE conferences. A graduate of both Purdue and Penn State Universities in the United States, he is originally from the Philadelphia, USA area.

Presentation#10

Introduction to Uncertainty Quantification and Industrial Challenges

Gavin Jones - gavin.jones@smartuq.com
Ray McConnell - raymond.mcconnell@smartuq.com

Presented on: Thursday, 11:15-12:00

Keywords. Analytics;Decision analysis;Digital Engineering;Digital Twin;UQ;Stochastic methods;Probabilistic methods

Topics. Artificial Intelligence;SE Processes and Methods;

Abstract. Uncertainty is an inescapable reality that can be found in nearly all types of system analyses. It arises from sources like measurement inaccuracies, material properties, boundary and initial conditions, and modeling approximations. With the increasing use of simulation models throughout industry, it has become vital to include Uncertainty Quantification (UQ) in engineering analysis. Moreover, in systems engineering UQ becomes a crucial tool for identifying the probability and severity of adverse interactions between components, particularly as their number and complexity increases. This presentation will introduce stochastic methods and Uncertainty Quantification (UQ) tools and show how they form the backbone of digital engineering technologies such as digital twins.

The competitive benefits of UQ include reduced development time and cost, improved designs, better understanding of risk, and quantifiable confidence in analysis results and engineering decisions. This presentation will demonstrate how stochastic methods and UQ can be used to enhance engineering processes with fewer resources and in more situations. These methods will be shown to be inherently data/application agnostic and thus applicable to the engineering challenges faced by most if not all industries.

Multiple examples and methodologies will be presented to demonstrate the UQ techniques invaluable to meeting industry challenges. Advanced design of experiments, methods to handle epistemic uncertainty, and analysis of input sensitivities will all be covered. These examples will demonstrate the need for a paradigm shift toward probabilistic thinking and UQ analyses.

The attendees for this presentation would be engineers, program managers, and data scientists who want to gain an understanding of how UQ can maximize insight, improve design robustness, and increase time and resource efficiency.

Biography

Gavin Jones - gavin.jones@smartuq.com
Gavin Jones, SmartUQ Sr. Application Engineer, is responsible for performing simulation and statistical work for clients in aerospace, defense, automotive, medical device, gas turbine, and other industries. He is also a key contributor in SmartUQ's Digital Twin/Digital Thread initiative. Mr. Jones received a B.S. in Engineering Mechanics and a B.S. in Mathematics from the University of Wisconsin-Madison.

Presentation#15

Model of Models Methodology

Aleczander Jackson - alec.jackson@mtsi-va.com

Presented on: Thursday, 15:15-16:00

Keywords. MBSE;Model Based Systems Engineering;Digital Engineering;DE;Modularity;Traceability;Reuse;MOSA;Modular Open Systems Architecture;SysML;Systems Modeling Language

Topics. SE Processes and Methods;

Abstract. A current underutilized benefit of MBSE is reuse of artifacts.
Most processes allow for reuse of some, but the more reuse one can get out of their systems engineering data, the more time and cost savings they can observe.
The Model of Models Methodology provides a tool-agnostic, SysML-pure, methodology that achieves just this. Through breaking models into a vast, modular, library system, components-to-full-blown systems can be shared and reused as necessary. In addition, through inheritance full-traceability is enabled.
Finally, as this scales across an entire organization, the benefits are able to compound, truly providing a significant "bang-for-your-buck".

Biography

Aleczander Jackson - alec.jackson@mtsi-va.com
MTSI, Chief Engineer of Digital Engineering, bachelors in Electrical Engineering and Computer Science OCSMP Model User Certified. Starting in the software development world I started in development of features for the tool vendor No Magic, creator of MagicDraw. In this position I primarily developed plugins, scripts, and reports for many of No Magic's major corporations including Boeing, Ford, and CACI to name a few. Here, I was instrumental in helping these organizations develop methods to enable import/export of data in a standard format utilizing SysML, UPDM, and UML. I was then promoted to the role of solution architect, in which I still performed the same work as the software engineer, but also became a UML, SysML, and UPDM training developer and instructor teaching alongside individuals like Sandford Friedenthal and being trained by those like Lenny Delligatti. While performing the role of solution architect at No Magic, I also became skilled at selling MBSE to organizations that primarily operate in the domains, explaining how the logical architectures helps them better guarantee success instead of diving straight into physics, and filled the role of consultant where I either helped launch initial architectures with our clients or fix their broken models. Now, as Chief Engineer of Digital Engineering at MTSI, I focus on development of strategy, acquisition of talent, internal training, and kicking off major programs using modeling i.e. Army Long Ranged Hypersonic Weapon and NASA's Advanced Air Mobility before back-filling myself with staff I've trained. My personal goal is to bring in a change in culture where the government begins to reuse existing data they acquired in previous contracts across multiple programs to reduce new work for acquisition programs and hopefully reduce the amount of time such programs take to put a product out of the door.

Presentation#14

ModelCenter MBSE: The Bridge Between Systems Engineering and Multi-Fidelity Analytical Models

Henrique Correa - hcorrea@phoenix-int.com
Karsten Lies - klies@phoenix-int.com

Presented on: Friday, 10:30-11:15

Keywords. Requirements Validation;Requirements Verification;Behavioral Simulation;Executable Analysis;Executable Model;Workflow;Cloud;Distributed Computing;Host;Server;Automation;Integration;High-Fidelity Model;High-Fidelity Analysis;MBSE;MBE;MDAO;Optimization;Trade Studies;ModelCenter;COTS;MagicDraw;Cameo;Windchill Modeler;GENESYS;Rhapsody;Aerospace;Defense;Automotive;ADAS;Autonomous Driving

Topics. Autonomous Systems and Resilience;Aviation and Space Systems;E-Commerce, Cloud Services, and System Security;SE Processes and Methods;

Abstract. This session will describe and demonstrate ModelCenter MBSE, an analysis integration framework for CAMEO Systems Modeler, Rhapsody, GENESYS, and PTC Windchill Modeler. ModelCenter MBSE allows engineers to integrate analysis tools with any SysML model element to validate system behavior, verify requirements satisfaction, and perform trade studies to optimize the system design, resulting in reduced cost, shortened development times, and higher quality product roll outs .
We will demonstrate how engineers can use ModelCenter to automate any engineering analysis tool (COTS tools such as EXCEL, MATLAB, Creo, ANSYS, HyperMesh, Windchill, and TeamCenter, as well as in-house FORTRAN and Python codes, etc.), and connect these tools together to create automated and repeatable engineering process workflows. The individual analysis tools can reside on different operating systems and in different geographical locations. When a workflow is executed, the integrated analysis tools are executed in the order specified by the workflow, and data is automatically linked from tool to tool as needed.
Finally, we will show how engineers can use ModelCenter MBSE to connect the automated workflows to SysML models for requirements validation, behavioral analysis, and optimization. We will conclude by presenting aerospace industry case studies from Northrop Grumman and a driveshaft example illustrating the use and benefits of the Phoenix Integration simulation automation technology.

Biography

Henrique Correa - hcorrea@phoenix-int.com
Education: Bachelor's in Mechanical Engineering, University of Kentucky, Spring 2018. Experience: Two years of experience with Phoenix Integration working in pre-sales, post-sales and support. Undergrad experience from multiple co-ops at Akebono Brake Corporation, a tier 1 automotive OEM and as the Energy Engineer Intern to the University of Kentucky's utilities division. Henrique joined Phoenix Integration shortly after finishing his bachelor's degree. He's worked on multiple product demonstrations, including integration of a variety of Commercial Off The Shelf (COTS) tools such as CAD, CAE and SysML. He also helps with technical support and with providing ModelCenter training. He has assisted with or lead over several MBSE training sessions. He was a key resource in developing the new ModelCenter MBSE training course.

Presentation#7

Perspectives on the Boeing 737MAX MCAS

Ronald Carson - ronald.s.carson@gmail.com

Presented on: Thursday, 15:15-16:00

Keywords. Boeing 737MAX MCAS;Human factors;Aviation regulation;Hazards;Severity;ARP4761;Failures

Topics. Autonomous Systems and Resilience;Aviation and Space Systems;SE Processes and Methods;

Abstract. Using publicly available news articles and reports we examine the system design and characteristics of the Boeing 737MAX MCAS (Maneuvering Characteristics Augmentation System) in the context of two fatal crashes in 2018 and 2019. The rationale for the system is explained. The system architecture and operational characteristics are described. Hazard severity classification is examined, along with the required reliability per the regulations. The role of the pilots in compensating for failure is highlighted. The regulatory and business environments are also discussed as contributors.

We describe how assumptions regarding pilot responses were apparently not validated, and contributed to the fatal crashes of the two airplanes. The human factors implications for automation, training, simulators and manuals are described. Ongoing modifications to the 737MAX, organizational design, and regulations are described.

The attendees will receive an overview of the MCAS including rationale, architecture, and operations during normal and failure conditions, and understand some consequences of the program and system design assumptions and implementation. Specific implications for the role of systems engineering are discussed.

Biography

Ronald Carson - ronald.s.carson@gmail.com
Dr. Ron Carson is an Adjunct Professor of Engineering at Seattle Pacific University, an Affiliate Assistant Professor in Industrial and Systems Engineering at the University of Washington, a Fellow of the International Council on Systems Engineering and a certified Expert Systems Engineering Professional. He retired in 2015 as a Technical Fellow in Systems Engineering after 27 years at The Boeing Company. He is the author of numerous articles regarding requirements analysis, failure modes and effects analysis, and systems engineering measurement. His current interests are in quantitatively incorporating sustainability considerations in systems engineering methodologies and education. Dr. Carson has a PhD from the University of Washington in Experimental Plasma Physics, and a BS from the California Institute of Technology in Applied Physics.

Presentation#23

Sensitivity Classification of Information Assets Using Machine Learning

Andrew Carson - andrew.r.carson@outlook.com

Presented on: Thursday, 11:15-12:00

Keywords. security;cloud architecture;machine learning;classification

Topics. Artificial Intelligence;E-Commerce, Cloud Services, and System Security;

Abstract. Sensitivity classification is crucial for maintaining the privacy of a company's customers and the security of its organization. Classifying data and documents into categories such as Non-Business, Public, General, Confidential, and Highly Confidential enables employees to know how best to handle the labeled data from a privacy and security standpoint, what permissions are required for access, and what controls are needed for handling the data appropriately.

However, data and documents do not classify themselves. Most documents and company sharing sites are manually given a privacy classification by the owners. Sometimes system admins can create policies that automatically assign a privacy classification, but these must trade off privacy/security with usability and tend to err on the side of usability. Still, some products try to infer the appropriate classification of documents based on content or pattern matching.

Consequently, there is not an automatic or consistent way to identify important intellectual property (IP) or other sorts of important information (e.g., sales leads, other customer information) that does not match these kinds of patterns. This means that important assets can be unclassified or misclassified by users. This problem is especially problematic at large companies and organizations. Focusing on the specific case of SharePoint sites, with thousands of sites and millions of documents, how does one coherently and consistently classify documents and sites across teams and organizations?

In this presentation I will discuss this problem in more detail and present a solution, namely, the use of machine learning supported by a cloud-based architecture. I will begin with the current state of solutions to this problem, present a brief conceptual introduction to machine learning, and then discuss how machine learning can be applied to solve the problem.
In presenting my solution to the problem, I will be discussing the supporting cloud-based architecture design in more detail, the data and related variables used in the models, the kinds of machine learning models and data transformation techniques used, and the appropriate evaluation metrics. I will then discuss the results considering the various evaluation metrics, system performance, complexity, and other factors that impact the choice of an optimal solution.

Finally, I conclude with the main challenges that were encountered as well as learnings from the development and implementation process. I also discuss intended future enhancements and the desired end state for the solution (i.e., put the best model into production using the architecture described, and use the results to identify misclassified sites, assign classification to unclassified sites, and rank sites based on their level of predicted sensitivity).

Biography

Andrew Carson - andrew.r.carson@outlook.com
Andy Carson is a Senior Data and Applied Scientist for the Insider Threat Program in Microsoft's Digital Security & Risk Engineering organization. The Insider Threat Program team is responsible for preventing, detecting, and mitigating insider threats and risk internally at Microsoft. In his role, Andy is responsible for providing and analyzing data to support team initiatives, building and maintaining models along with supporting architecture, and defining technical requirements for partners. Prior to his current role, Andy was a senior consultant in the Seattle area providing data analytic capabilities and solutions to area technology companies. He has a Master's degree in Philosophy from Northern Illinois University and a Master's degree in Data Science from City University New York.

Presentation#36

Systems Engineering for Small and Medium Nuclear Projects

Jared Harper - jharper@terrapower.com

Presented on: Thursday, 14:15-15:00

Keywords. Nuclear;Project;Methodology;Process;Small Business;VSE;R&D

Topics. Energy;SE Processes and Methods;

Abstract. This presentation indicates the need for and alignment between systems engineering and the nuclear project domain. Areas of alignment, application principles, and project examples will be demonstrated.

Refer to the .pdf abstract for more information.

Biography

Jared Harper - jharper@terrapower.com
The presenter of “Systems Engineering for Small and Medium Nuclear Projects” is Jared Harper, a professional engineer with a Bachelor of Science degree in Mechanical Engineering from Louisiana Tech University. He has worked in multiple industries throughout his career, including; 1. Pulp and Paper – 4 months 2. Oil & Gas: Upstream, Midstream, and Downstream – 2.5 years 3. Government Nuclear Waste Management – 2.5 years 4. Commercial Nuclear Power R&D – 2.5 years The presenter is responsible for the development and practice of systems engineering processes at TerraPower in Bellevue, WA. He is responsible for the development of the technical planning, assessment, and technical measurement processes at TerraPower. He managed the company-wide efforts in 2019 to restructure procedures to integrate systems engineering into the company’s core engineering practices. He serves in multiple roles at TerraPower, one of which as the systems engineer for the Molten Chloride Reactor Experiment project. His previous experiences include: • mechanical fluid systems design, • field engineering, • nuclear procurement engineering, and • project engineering.

Presentation#4

Systems Engineering Problem Solving for Undergraduates

Ronald Carson - ronald.s.carson@gmail.com

Presented on: Thursday, 13:30-14:15

Keywords. Undergraduate SE Education;Quantitative methods;SE tools;System life cycle

Topics. Education and Workforce Development;SE Processes and Methods;

Abstract. Much systems engineering formal education revolves around systems engineering process definition based on ISO/IEC/IEEE 15288 and related materials. One means to gain more respectability in undergraduate engineering education is to enable students to acquire quantitative tools in systems engineering, similar in utility and effectiveness to those acquired in more traditional engineering disciplines.

This presentation will describe the curriculum, methods, and tools used in the Seattle Pacific University upper-division ""System Design"" course and how it helps enable undergraduate majors in various engineering disciplines to become aware of the scope, processes, tools, and relevance of systems engineering to their current and future careers. The considerations can also apply to experienced engineers seeking to transition into an SE role from another engineering discipline.

Specific topics include problem definition with associated measures of effectiveness as means to evaluate solutions, multi-criteria decision making, anomaly handling and hazard severity in system behavior, redundancy analysis and effectiveness, use of system design methods like ""N2"" diagrams, interface analysis, system effectiveness measures, reliability analysis, and human-factors considerations. A course goal is to not only expose undergraduate engineers to systems engineering concepts, but to also give them quantitative tools and methods applicable to contextual thinking in their various engineering disciplines.

Attendees will receive an overview of the undergraduate course and identification of specific methods and quantitative tools used to introduce undergraduates to systems engineering as more than a set of processes.

Biography

Ronald Carson - ronald.s.carson@gmail.com
Dr. Ron Carson is an Adjunct Professor of Engineering at Seattle Pacific University, an Affiliate Assistant Professor in Industrial and Systems Engineering at the University of Washington, a Fellow of the International Council on Systems Engineering and a certified Expert Systems Engineering Professional. He retired in 2015 as a Technical Fellow in Systems Engineering after 27 years at The Boeing Company. He is the author of numerous articles regarding requirements analysis and systems engineering measurement, and is the developer of numerous industry systems engineering training courses. His current interests are in quantitatively incorporating sustainability considerations in systems engineering methodologies and education. Dr. Carson has a PhD from the University of Washington in Experimental Plasma Physics, and a BS from the California Institute of Technology in Applied Physics.

Presentation#19

The Future of Performance Design with MBSE: Electric Powertrain Example

Saulius Pavalkis - saulius.pavalkis@3ds.com
Gauthier Fanmuy - Gauthier.FANMUY@3ds.com
Thomas Reimer - Thomas.REIMER@3ds.com
Paul Lalor - Paul.LALOR@3ds.com

Presented on: Friday, 15:15-16:00

Keywords. MBSE;Design Of Experiment;Trade Studies;SysML;Modelica

Topics. SE Processes and Methods;Transportation;

Abstract. Model-based systems engineering (MBSE) is a burgeoning approach for the development of complex systems. MBSE is the use of models to support systems engineering to both understand the problem and define an optimal solution to solve it while greatly minimizing costly and time consuming engineering changes late in the development cycle. The promise of MBSE is to progressively model and simulate systems behavior in accordance with the needs & scenarios of usage, at any time. This promise avoids the discipline-specific tunnel effect, giving all project stakeholders the ability to continuously monitor the evolution of system development. If in Aerospace & Defense MBSE is a standard practice, in other Industries it is only now emerging. One of the key success factors of MBSE is to apply best practices based on a sound systems engineering methodology.

Using an electric vehicle powertrain example, we will illustrate how to achieve performance design in the context of a system architecture utilizing a MBSE methodology called Cyber MagicGrid©. Through this framework, we will cover all phases from analysis of the problem in SysML, definition of a solution utilizing trade studies in Modelica, implementation and assessment of component performance through design of experiment in Process Composer, verification of system performance, and validation of the system against stakeholder requirements in 3DS Experience platform. This will demonstrate how this framework helps to manage the complexity of a development program and thus reduce the risk of cost overruns due to late phase re-designs or, worse yet, recalls due to low quality products.

Biography

Saulius Pavalkis - saulius.pavalkis@3ds.com
18 years at Dassault Systems (No Magic) in model based solutions and R&D Expert in systems modeling, simulation, MBSE ecosystem, interfaces / integrations, traceability, queries INCOSE CSEP, OMG OCSMP, No Magic lifetime modeling and simulation excellence award Community author for simulation (youtube.com/c/MBSEExecution) and MBSE success cases (blog.nomagic.com) Author of multiple papers on MBSE. In 2020 got NAVAIR $20M budget for V&V paper implementation Representative at INCOSE CAB Supporting MBSE adoption in A&D, T&M and other domains. Major clients: P&W , Boeing, NASA, BAE Systems, Raytheon Technologies, NGC, FORD

Presentation#32

The Powerful Advantages of Developing a "Failure Resume"

Tim Boyd - timttp@gmail.com

Presented on: Thursday, 14:15-15:00

Keywords. Failure;Resume;Engineering;Systems;Leadership;Mistake;Fired;Different;Perspective;Planning;Sharing;Mentor;Mer

Topics. Artificial Intelligence;Autonomous Systems and Resilience;Aviation and Space Systems;Education and Workforce Development;SE Processes and Methods;

Abstract. Today's fast paced and results driven engineering environment, forces us to search for quick win solutions that result in immediate impact, while maintaining the trifecta of cost/schedule/quality. This extremely risk adverse environment breeds a deep fear of failure as employees are held accountable for the smallest of failures, which can limit their career potential and minimize years of positive contributions. This environment of fear and doubt inherently limits our ability to leverage the power innovation and failure to drive change.

To pivot our culture from avoiding risk to embracing calculated risk, our people need to be comfortable with the possibility of failure. Just as failures of past engineering designs are necessary to develop improved designs, the experience of failing provides engineers and leaders with the lessons they need to improve their approach and hone their craft. Experienced professionals know that failure is a necessary learning experience.

This presentation will gather real world experiences of leaders from various disciplines, backgrounds and experience levels, share their ""failure resumes"" and walk us through their favorite ""failure"". Each interviewed leader will also highlight the risks they failed to take when they exercised restraint due to the fear of failure. Finally, this topic will also share ways to maximize one's own failures, leverage historical best practices, and re-frame one's perspective to view failure positively.

Biography

Tim Boyd - timttp@gmail.com
Tim Boyd specializes in systems engineering, project management and organizational leadership development. He has technical experience in a wide variety of mission areas including space, air and ground systems as well as the systems engineering life cycle. Mr. Boyd currently is the system engineering lead for the ground segment for a new satellite program, which brings enhanced capability to the overhead persistent infrared domain. In this early program phase, Tim is leading the design and development of core data processing and command and control capabilities. He has a diverse background and has previous experience in a multitude of roles: regional ops manager, systems engineer, system performance, project manager, cyber strategy analyst, business development, technical team lead and cost account manager. Mr. Boyd has been a professional coach, instructor and facilitator with the American Society of Engineering Education, B/E Aerospace, Boeing, Cal Poly San Luis Obispo, Cal Poly Pomona, California Institute of Technology, IJK Controls, UCLA and Northrop Grumman. Tim holds multiple certifications in various technical and non-technical domains and is credited with over 50 technical publications, trade secrets and technology awards in the areas of space, air, cyber, radiometric calibration, systems engineering, software engineering and human capital development.

Presentation#11

The Role of Analytics in the Digital Twin

Gavin Jones - gavin.jones@smartuq.com
Ray McConnell - raymond.mcconnell@smartuq.com

Presented on: Thursday, 16:00-16:45

Keywords. Predictive Analytics;Digital Engineering;Digital Twin;Statistical Calibration;UQ

Topics. Artificial Intelligence;SE Processes and Methods;

Abstract. In the era of Industry 4.0, the digital twin has emerged as a new technology that brings together physical and simulated information to deliver greater value. When paired with the latest in predictive analytics, digital twins can lead to better decision making at each step of the product lifecycle.

For a specific part, product, or system, an authoritative digital truth source can be created. This is a digital, interrogatable repository of all the accumulated data and knowledge concerning that part, product, or system. Using efficiently sampled data from the trade space of simulations of the system as well as physical test or sensor data, a surrogate model of the simulation may be created and tuned to match real world system performance. Statistical calibration is one technique that may be used in this process. Statistical calibration has the advantage over other techniques of accounting for the imperfect nature of all models by assuming discrepancy between the model being calibrated and the physical data set exists. Understanding the discrepancy between the simulation model and physical data can help identify model form errors and aid in verification and validation of the simulation.

Using statistical calibration and other UQ and analytics techniques, this presentation will introduce attendees to the digital twin process workflow. The techniques discussed will be shown to be the solution to building and running an efficient and accurate digital twin. Industrial challenges and benefits that come from digital twin implementation will be addressed.

The presentation will conclude by utilizing systems simulation data combined with UQ and analytics tools to demonstrate a digital twin example for an electric motor. The example will show how data from physical sensors along with statistical calibration can improve the accuracy of a digital twin while leading to new insights such as predictive maintenance or health monitoring.

Biography

Gavin Jones - gavin.jones@smartuq.com
Gavin Jones, SmartUQ Sr. Application Engineer, is responsible for performing simulation and statistical work for clients in aerospace, defense, automotive, medical device, gas turbine, and other industries. He is also a key contributor in SmartUQ's Digital Twin/Digital Thread initiative. Mr. Jones received a B.S. in Engineering Mechanics and a B.S. in Mathematics from the University of Wisconsin-Madison.

Presentation#33

The Surprising Benefits of Virtualizing Traditional In-Person Training for Complex Engineering Subjects

Rick Hefner - rhefner@caltech.edu
Tim Boyd - timttp@gmail.com

Presented on: Thursday, 15:15-16:00

Keywords. Virtual;Virtualization;Traditional;Training;In-Person;Cohort;Module;Systems;Engineering;Complex;Topics;Advantag

Topics. Autonomous Systems and Resilience;Aviation and Space Systems;Education and Workforce Development;SE Processes and Methods;

Abstract. As most companies begin to modify agreements to host in person cohort training to support the technical development of their employees, a variety of providers have transformed their traditional in person courses into virtual flipped classroom formats. This new format has revolutionized the way engineering organizations look at learning and development, especially for complex engineering subjects such as Systems Engineering.

Historically, the virtual world teaching has a variety of best practice formats ranging anywhere from pre-recorded lectures to live virtual sessions. For something simple such as learning excel, a self-guided online course seems to make sense. However, for deeper and more intricate topics, different teaching formats are required, each with its own unique engagement strategies. As more and more virtualized courses are offered, the better the formula becomes. While there are inherent disadvantages to remote learning complex topics, there are numerous advantages that for some organizations outweigh all the negatives. Not every course is suited for online execution but it is worth re-evaluation if slight modifications to the format could enhance its effectiveness in a virtual format, especially with an ever-evolving client base.

This paper will discuss in detail the advantages and disadvantages to the remote learning of complex topics, such as Systems Engineering. It will also discuss the benefits of tailoring not only your course content but one's delivery style and techniques that improve engagement and retention of course material when presented in a completely remote environment. Lastly, it will provide a general summary of proven industry best practices for virtual learning by leveraging input and experience from seasoned instructors from different organizations, backgrounds, and geographical diversity.

Biography

Rick Hefner - rhefner@caltech.edu
Dr. Rick Hefner serves as the Program Director for Caltech's Center for Technology and Management Education. He has over 40 years of experience in aerospace systems design and management. Dr. Hefner has also worked with companies in the communications, electronics, and health sciences industries. He is credited with over 100 publications, and is active in several professional societies.

Presentation#34

The Unforeseen Impacts of Cognitive Bias

Tim Boyd - timttp@gmail.com

Maria Grundmann - maria.grundmann@ngc.com

Presented on: Thursday, 16:00-16:45

Keywords. Geek;Engineer;Unconscious;Bias;Conscious;System;Mitigation;Benefit;Research;Mitigate;Techniques;Prejudice;Unf

Topics. Autonomous Systems and Resilience;Aviation and Space Systems;Education and Workforce Development;Healthcare and Medical Devices;SE Processes and Methods;

Abstract. Cognitive bias is often defined as a form of prejudice that results in an unfavorable, or unfair, outcome for a particular person, group or entity. It unfortunately remains a systemic issue throughout a multitude of industries and continues to affect employees around the globe.

The Problem: A legacy system has been used to do much more than its original design specification ever called for. The users have developed problematic workarounds for an otherwise intractable Big Data problem. The negative effects of workarounds impede optimal use of resources and cause organizational friction. Unfortunately, the legacy system cannot be replaced, and upgrades are unlikely in the near future. The system in question? The human brain.

In large engineering organizations, scientists and engineers work on extremely complex engineering projects, usually leveraging some form of Systems Engineering. These systems require team engagement, collaboration, trust, motivation, and empowerment to drive high performance. If unconscious bias was present in just a small subset of that team or organization, it could threaten the culture of the entire organization, one unconscious interaction at a time.

The Mitigation Approach: Use research-based processes and techniques shown to reduce cognitive biases in order to account for unconscious bias, trigger more conscious processing when we need it most, and reduce the data our conscious minds recognize as irrelevant, but our unconscious bias uses to make poor decisions.

The Benefit: Help our diverse teams mitigate the effects of unconscious bias to achieve their full potential. What can we do differently, once we know what everyone else does unconsciously?

This paper will discuss in detail how unconscious bias affects everyone, how it manifests itself in our daily lives, our complex engineering teams, and broader engineering organizations. It will also discuss the negative consequences it can have if left untouched and unmonitored for an extended period of time. More importantly, it will discuss specific research-based processes and steps that have been proven to mitigate the effects of unconscious bias in various forums within your organization including workforce development.

Biography

Tim Boyd - timttp@gmail.com
Tim Boyd specializes in systems engineering, project management and organizational leadership development. He has technical experience in a wide variety of mission areas including space, air and ground systems as well as the systems engineering life cycle. Mr. Boyd currently is the system engineering lead for the ground segment for a new satellite program, which brings enhanced capability to the overhead persistent infrared domain. In this early program phase, Tim is leading the design and development of core data processing and command and control capabilities. He has a diverse background and has previous experience in a multitude of roles: regional ops manager, systems engineer, system performance, project manager, cyber strategy analyst, business development, technical team lead and cost account manager. Mr. Boyd has been a professional coach, instructor and facilitator with the American Society of Engineering Education, B/E Aerospace, Boeing, Cal Poly San Luis Obispo, Cal Poly Pomona, California Institute of Technology, IJK Controls, UCLA and Northrop Grumman. Tim holds multiple certifications in various technical and non-technical domains and is credited with over 50 technical publications, trade secrets and technology awards in the areas of space, air, cyber, radiometric calibration, systems engineering, software engineering and human capital development.

Presentation#3

What to do about global warming: Examining problem and solution alternatives

Ronald Carson - ronald.s.carson@gmail.com

Presented on: Thursday, 16:00-16:45

Keywords. Global warming;Trade study alternatives;Climate change;Carbon dioxide sequestration

Topics. Natural systems;SE Processes and Methods;

Abstract. There continues to be global concern regarding whether and how much the earth might be heating and what is causing it. The dominant paradigm is that human activity is causing unacceptable and unprecedented heating of the atmosphere. This presentation will analyze the contributions of carbon dioxide and the sun itself to global warming, analyze the effects on global average temperatures, describe various mitigation methods include carbon dioxide sequestration and increasing earth's solar reflection coefficient (albedo), estimate the related costs of various alternatives, and analyze the risk of various solution scenarios.

We demonstrate quantitatively that limiting mitigation to controlling carbon-dioxide emissions is inadequate and how much carbon dioxide would need to be removed annually from the atmosphere to prevent exceeding a 2 degree C ""tipping point"" temperature increase. We examine and compare the effectiveness and costs of carbon dioxide sequestration to solar power reflection as means to avoid heating the atmosphere. Finally, we examine the apparent risks and costs of different response scenarios with respect to the uncertainties and characterizations of the ""global warming"" problem.

Attendees will appreciate the historical context of the current situation and the costs and risks of various responses. This presentation is based on a series of articles published in LinkedIn: https://www.linkedin.com/pulse/what-do-global-warming-7-risk-management-ron-carson-phd-esep/

Biography

Ronald Carson - ronald.s.carson@gmail.com
Dr. Ron Carson is an Adjunct Professor of Engineering at Seattle Pacific University, an Affiliate Assistant Professor in Industrial and Systems Engineering at the University of Washington, a Fellow of the International Council on Systems Engineering and a certified Expert Systems Engineering Professional. He retired in 2015 as a Technical Fellow in Systems Engineering after 27 years at The Boeing Company. His current interests are in quantitatively incorporating sustainability considerations in systems engineering methodologies and education. Dr. Carson has a PhD from the University of Washington in Experimental Plasma Physics, and a BS from the California Institute of Technology in Applied Physics.

PDC Presentation

PDC Presentation#13

An Agile-Like Approach to Hardware Development: The Ejectable Data Recorder (EDR) for Orion's Ascent Abort 2 (AA-2) Test Flight

Kristina Rojdev - kristina.rojdev-1@nasa.gov
Antony Williams - antony.g.williams@nasa.gov
Jenny Devolites - jennifer.devolites@nasa.gov
Jon Olansen - jon.b.olansen@nasa.gov

Presented on: Friday, 10:30-11:15

Keywords. Ejectable Data Recorder;Agile;Hardware;Data-centric Project Management & Systems Engineering

Topics. Aviation and Space Systems;

Abstract. On July 2, 2019, the Ascent Abort 2 (AA-2) Flight Test Vehicle was launched from Cape Canaveral, with the goal of demonstrating the performance of Orion's Launch Abort System (LAS) and collecting data from hundreds of sensors throughout the vehicle. The data collected during this test flight is of paramount importance, as it will be used to certify the Orion vehicle for human spaceflight. Originally, the data was to be downlinked via a single string network of antennas on the LAS, with the associated risk of potential data dropouts, as well as loss of data once the LAS was jettisoned. Thus, additional antennas were added onto the crew module (CM) to support data downlink post-LAS jettison, a buffer rebroadcast capability was added to fill in any gaps in data downlink transmissions, and an ejectable data recorder (EDR) subsystem was added to the CM as a redundant measure to collect all the instrumentation data.

The EDR subsystem was added to the project about one year after the project commenced, which significantly reduced the available development time when compared with the other subsystems of the AA-2 Test Flight. The project was further accelerated by six months, around the critical design review gate. Due to the schedule compression challenge and the fact that the EDR subsystem was a backup system and not flight critical, the EDR subsystem was further challenged to find a new and more efficient way to develop hardware. Thus, the EDR subsystem experimented with different management and systems engineering processes, team sizes, communication methods, and tools. Some examples are novel uses of SharePoint as a Data-centric Project Management & Systems Engineering environment, a continuous testing approach through the lifecycle, and a Skunkworks approach to managing the team.

The EDR subsystem blended Commercial Off The Shelf (COTS) hardware with in-house developed hardware and software to create a novel data retrieval capability. The capability evolved rapidly through a hardware in the loop simulation environment that enabled incremental component updates for not only the EDR subsystem but across the entire Crew Module.

This paper will present an overview of how the EDR subsystem was managed and compare it to an Agile approach to managing projects. The paper will further provide a recommended approach to future Agile-like hardware development that incorporates lessons learned from the EDR experience.

Biography

Kristina Rojdev - kristina.rojdev-1@nasa.gov

Kristina Rojdev received a B.S. in Aerospace Engineering from the University of Michigan and a M.S. and Ph.D. in Astronautical Engineering from the University of Southern California. She has been with NASA Johnson Space Center for over 15 years working on deep space habitats, lunar landers, radiation effects of materials, and shielding of crew from deep space radiation. Her expertise lies in applied systems engineering and radiation research. On the Ascent Abort 2 Test Flight, she led the development and operations for EDR. She is currently leading systems engineering efforts associated with the Human Landing System.

PDC Presentation#31

Equipping Tomorrow's Systems Engineering Workforce

Rick Hefner - rhefner@caltech.edu

Presented on: Friday, 16:00-16:45

Keywords. training;workforce;mentoring;career;work environment

Topics. Education and Workforce Development;

Abstract. A recent report by the Aerospace Industries Association, entitled "The Defining Workforce Challenge in U.S. Aerospace & Defense", identified critical challenges in maintaining the highly skilled and robust defense and aerospace workforce essential to our nation's security and economic prosperity. This comment might also characterize the systems engineering workforce. Root causes for the shortage include our aging baby boomer-dominated workforce, a serious shortage of SE-ready college graduates, competition from other technology-driven sectors, and the changing technology needs of our industry.

This presentation will highlight some of the industry trends effecting the workforce gap and offer some potential solutions. New skill sets such as Model-Based Engineering, artificial intelligence, cybersecurity, and data analytics requires today's practicing systems engineers to learn new design principles and implementation practices associated with these technologies. In addition, today's systems engineering must personally help encourage and equip tomorrow's workforce, through publicizing career opportunities in SE and mentoring both those entering the workforce and those in the pipeline. Simultaneously, we must foster new work environments that appeal to the Millennials' career needs and the increasing numbers of minorities entering STEM – independence, flex time, and innovation in technology, processes, and business.

Biography

Rick Hefner - rhefner@caltech.edu
Dr. Rick Hefner serves as the Program Director for Caltech's Center for Technology and Management Education. He has over 40 years of experience in aerospace systems design and management. Dr. Hefner has also worked with companies in the communications, electronics, and health sciences industries. He is credited with over 100 publications, and is active in several professional societies.

PDC Presentation#6

On Track to Sounder Requirements - A Sound Transit Light Rail Vehicle case study?.

Matthew Scott - matthew.scott@soundtransit.org
Claire Rubin - Claire.Rubin@soundtransit.org

Presented on: Friday, 14:15-15:00

Keywords. Stakeholder Needs Transformation;Requirements Engineering;Enterprise Lifecycle;Model Based Systems Engineering (MBSE);Design for Excellence (DfX);Mass Transit;Light Rail Vehicles;Communications Systems

Topics. Transportation;

Abstract. Sound Transit (ST), the Puget Sound regional transit agency, is preparing to overhaul portions of the light rail vehicle (LRV) onboard electronic systems. Historical performance demonstrated a need for improved requirements that were transformed from business needs and aligned with overarching enterprise strategies. As a result, ST initiated an agency-wide effort to incorporate an enterprise lifecycle approach into the development and management of requirements. The LRV Electronic Suite Upgrade project is the first implementation of the new approach. The presentation will demonstrate how ST applied systems thinking to streamline RFP development, address known deficiencies, mitigate risk and validate the enterprise lifecycle approach. Attendees will be provided a model for their own use.

Biography

Matthew Scott - matthew.scott@soundtransit.org
Matt Scott is an engineering manager in Systems Engineering and Integration at Sound Transit. Matt leads a team of talented engineers providing design subject matter expertise across a wide array of networked communications and automation systems supporting Link light rail, Sounder commuter rail, and Regional Express buses. Since joining the agency in 2018, Matt has embraced the vision of Sound Transit leadership by collaborating with a wide array of stakeholders to develop a sounder approach to development of design requirements. Matt has provided technical leadership in systems integration and SCADA for public infrastructure and automated manufacturing throughout North America as a plant engineer, manufacturer and consultant. This wide-ranging experience has made Matt a strict adherent to systems thinking, road mapping, and reliability engineering. Matt holds a Bachelor of Science degree from Northern Arizona University.

Claire Rubin - Claire.Rubin@soundtransit.org
Claire is a senior systems engineer in the Operations Engineering and Technology group at Sound Transit focused on the support of the Link light rail vehicle fleet. Claire has a background in transportation engineering and has worked at the agency for the past four years in various engineering roles from quality management to safety. Prior to Sound Transit, Claire was a senior engineer on the Virgin Trains USA project in Florida. Her role supported both design and construction phases, led stakeholder management for over 50+ jurisdictions, and developed requirements for the 350 at-grade crossings within the corridor. Claire is a professional engineer in both Washington and Florida and has an MBA from University of Washington and a BE from Vanderbilt University.

PDC Presentation#25

Systems Engineering and the Insider Threat Problem

Andrew Carson - andrew.r.carson@outlook.com
Glenn Kaleta - Glenn.Kaleta@microsoft.com

Presented on: Friday, 15:15-16:00

Keywords. insider threat;cloud architecture;security;machine learning

Topics. E-Commerce, Cloud Services, and System Security;

Abstract. From a security threat perspective, one of the most significant emerging trends relates to the insider threat. The insider threat is the malicious or negligent staff member that through intentional or unintentional actions causes harm to an organization. Such insiders often have access to highly sensitive information and systems that can be used for theft, sabotage, fraud, and even espionage purposes.

What can organizations do to prevent and detect these insider attacks? In this presentation we discuss the insider threat in more detail and how the insider threat differs from traditional external attackers. Consequently, a different approach and response is required to effectively address the problem. We then proceed to outline the challenges and solutions to a system that can effectively address the issue using systems engineering concepts. That is, we apply the lens of systems engineering on the insider threat problem itself to highlight the key features of a successful insider threat solution system.

We will cover the larger cybersecurity context and what has changed in recent years, the challenges of addressing the problem in a large organization (e.g., many stakeholders, dependencies on other departments, technological constraints, cultural expectations, leadership guidelines), the many components involved in any potential solution system (e.g., technology, data, departments), and an approach for relating the components together into a solution system that can effectively address the problem. We conclude that the extensive use of data engineering and machine learning in a cloud environment, coupled with strong organizational cross-collaboration can effectively address this growing threat.

We will also discuss how the solution system can be evaluated through KPIs, as well as the key considerations and lessons learned from our experience in developing and operating an insider threat solution system. We note that machine learning is not always the answer. Rules and signature-based detections are better suited for some insider threat use cases. Second, data and engineering effort is necessary to have a solution that scales to the enterprise. Third, people are still needed as this cannot and should not be a fully automated process. Finally, the joint use of security experts and data experts is valuable in addressing this problem.

Biography

Andrew Carson - andrew.r.carson@outlook.com
Andy Carson is a Senior Data and Applied Scientist for the Insider Threat Program in Microsoft's Digital Security & Risk Engineering organization. The Insider Threat Program team is responsible for preventing, detecting, and mitigating insider threats and risk internally at Microsoft. In his role, Andy is responsible for providing and analyzing data to support team initiatives, building and maintaining models along with supporting architecture, and defining technical requirements for partners. Prior to his current role, Andy was a senior consultant in the Seattle area providing data analytic capabilities and solutions to area technology companies. He has a Master's degree in Philosophy from Northern Illinois University and a Master's degree in Data Science from City University New York.

Glenn Kaleta - Glenn.Kaleta@microsoft.com
Glenn Kaleta leads Microsoft's enterprise-wide Insider Threat program. The program is driven by a terrific team of security subject matter experts, data scientists and engineering program managers who proactively collaborate with business, engineering, legal and HR representatives around the globe to identify and reduce insider threat risk. Glenn has led multiple security and investigative teams, including Cloud & Enterprise Security and the Xbox Live Policy & Enforcement teams. Prior to joining Microsoft, Glenn led the worldwide Corporate Investigations organization for The Boeing Company and held leadership roles at KPMG Forensics and IOActiveSecurity in Seattle, where he led multiple

worldwide forensic engagements and investigations involving internal misconduct. Prior to the private sector, Glenn had a successful career in law enforcement, including assignments leading multiple major crimes investigations and in computer forensics investigations. He holds multiple patents for the creative use of data to identify and interdict technical and behavioral misconduct across large-scale systems.

PDC Presentation#29

Transitioning Legacy Systems to Model-based Systems Engineering

Paul White - paulwhite849@gmail.com
Erick Swanson - erick.swanson@baesystems.com

Presented on: Friday, 13:30-14:15

Keywords. MBSE;Legacy systems;Sustainment

Topics. Aviation and Space Systems;

Abstract. How do we apply model-based systems engineering (MBSE) to a legacy system? This presentation describes how to transition a legacy system from a document-based systems engineering (DBSE) approach to an MBSE approach--based on project experience. Attendees will leave with a greater understanding of how to apply MBSE to legacy systems, particularly those in system sustainment.

Historically, the United States Air Force (USAF) Minuteman-III (MM-III) program has been highly successful, and systems engineering has played an important role in MM-III's success. Presently, sustaining the MM-III legacy system is presenting challenges to the U.S. Department of Defense (DoD)—specifically with knowledge management (KM), knowledge transfer (KT), incorporation of newer technologies, and maintenance of documentation.

Recognizing the benefits of MBSE, the DoD defined a Digital Engineering Strategy (DES), in 2018, to modernize its capability to meet current and future demands. This strategy included a challenge by the DoD to adopt industry best practices, such as MBSE and the use of models. Now, MBSE is the primary approach for all newer DoD programs.

For a legacy program, however, the transition to MBSE presents formidable challenges. How would a legacy program, that has used DBSE for years, make this transition? To explore how a transition would be done, the Intercontinental Ballistic Missile (ICBM) Systems Directorate (ICBMSD), in partnership with BAE Systems as the Integration Support Contractor (ISC), has been undertaking efforts to implement MBSE for the MM-III.

First, we will discuss an effort to translate the MM-III's documentation from an older Functional Flow Block Diagram (FFBD) format to the Systems Modeling Language (SysML) activity diagrams. We will present a translation guide that the team developed and used during this process. We will show how we tracked our work to completion and how we verified the correctness of the SysML diagrams—both syntactically and semantically.

Second, we will describe an effort to model the top-down physical architecture of the MM-III. We will discuss how we researched and collated information from disparate MM-III documents. We will present how we created the top-down structure using SysML Block Definition Diagrams (BDD). We will discuss how we are verifying and validating the top-down structure.

MBSE is benefitting the MM-III system in several ways including:
• Providing clear traceability of model elements within the software tool
• Creating tailored visualizations, based on the target audience, of the whole system and its parts
• Linking different parts of the model to show relationships
• Propagating changes automatically throughout the model
• Making it easier to review information, pinpoint inaccuracies, and identify missing information
• Streamlining the analysis of the impact of a proposed change
The success of the MBSE initiatives undertaken by ICBMSD and BAE Systems has led the ICBMSD to broaden their

scope and provide our industry team with additional MBSE tasking.

In conclusion, our target audience will leave with ideas about how to apply MBSE to a legacy system.

For more information and authors' professional biographies, please see the attached ""WSRC 2020 Abstract.pdf"" file.

Biography

Paul White - paulwhite849@gmail.com
Paul White is an ICBM GBSD Digital Engineering Branch Lead at BAE Systems at Hill Air Force Base, Utah. He previously worked at Kihomac, Astronautics Corporation of America, L-3 Harris, and Raytheon. He has nineteen years of experience in the aerospace industry. Paul has been an INCOSE member since 2007 serving in various top leadership roles in the North Texas (Dallas - Fort Worth) Chapter, Chicagoland Chapter, and Wasatch (Utah) Chapter. He is the current president of the Wasatch Chapter. Paul has been a leader in the annual Great Lakes Regional Conference (GLRC) since 2012 including conference chair for the 6th and 8th conferences. He served as the conference chair for the first annual Western States Regional Conference (WSRC) in Ogden in 2018; and he chairs the WSRC Steering Committee since 2019. He was awarded the INCOSE Outstanding Service Award in 2019. He serves as the Deputy Assistant Director of Technical Events in INCOSE's Technical Operations organization. He has a graduate certificate in Systems Engineering and Architecting from the Stevens Institute of Technology, a Master of Science degree in Computer Science from Texas A&M University-Commerce, and a Bachelor of Science degree in Computer Science from Texas A&M University. He is a Certified Systems Engineering Professional (CSEP) through INCOSE and has an Object Management Group (OMG) Certified Systems Modeling Professional (OCSMP): Model Builder – Fundamental certification.

Erick Swanson - erick.swanson@baesystems.com
Erick Swanson is a Senior Principal Systems Engineer with BAE Systems at Hill AFB, Utah. At BAE, Erick has worked in integration, systems-engineering processes, and re-entry physics. He has recently added work on Model-Based Systems Engineering. Prior to BAE, Erick worked as an aerospace engineer for TRW/ Northrop Grumman, where he specialized in aerothermodynamics and flight mechanics for re-entry vehicles and missiles and in aircraft aerodynamics, using both experimental and computational approaches. Erick received a Bachelor of Aerospace Engineering and Mechanics from the University of Minnesota (2000) and a Master of Science in Aeronautics and Astronautics (2002) and a Doctor of Philosophy (2008) from Purdue University, with a graduate-school research specialization in experimental hypersonic fluid mechanics.

PDC Presentation#2

Using Architecture and MBSE to Develop Validated Requirements

Ronald Carson - ronald.s.carson@gmail.com

Presented on: Friday, 11:15-12:00

Keywords. Requirements development;Architecture;MBSE;Requirements validation;Structured requirements

Topics. SE Processes and Methods;

Abstract. Requirements incompleteness and ambiguity continue to plague many organizations. The introduction of MBSE provides an opportunity to relate the structure of the architecture model to the structure of requirements, and synchronize the data between them.

In this presentation we demonstrate how to use model-based systems engineering and the related architecture to develop and validate requirements of all types. We first describe the structure of different types of requirements and map the requirements elements, e.g., function, to elements of the architecture in the MBSE model. We show how these requirements elements map to specific data elements in a particular MBSE tool for all possible types of requirements. Finally, we show how this method enables validation of the requirements from the architecture.

Attendees will gain an understanding of how to integrate their organizational requirements development and MBSE architecture activities by mapping the data elements between them and integrating these into their MBSE tools.

Biography

Ronald Carson - ronald.s.carson@gmail.com
Dr. Ron Carson is an Adjunct Professor of Engineering at Seattle Pacific University, an Affiliate Assistant Professor in Industrial and Systems Engineering at the University of Washington, a Fellow of the International Council on Systems Engineering and a certified Expert Systems Engineering Professional. He retired in 2015 as a Technical Fellow in Systems Engineering after 27 years at The Boeing Company. He is the author of numerous articles regarding requirements analysis and systems engineering measurement. He has been issued six US patents in satellite communications, and two patents regarding “Structured Requirements Generation and Assessment”.