

5th Annual INCOSE Great Lakes Regional Conference Systems Engineering: Leveraging Adaptability to Tame Uncertainty

November 4-6, 2011 at The Dearborn Inn, Dearborn, MI

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industrial & systems engineering
WAYNE STATE UNIVERSITY COLLEGE OF ENGINEERING



Welcome to the 5th Annual Great Lakes Regional Conference! This year's theme is Systems Engineering: Leveraging Adaptability to Tame Uncertainty. We are hosting this event in the metropolitan Detroit area for the first time and are glad you have joined us at the historic Dearborn Inn as we share techniques, case studies, and insights into our profession.

I would like to acknowledge our sponsors, Booz Allen Hamilton, BAE Systems, Wayne State University, and Dassault Systems. We also thank our partners, the Engineering Society of Detroit, the Detroit Chapter of the National Defense Industry Association, Project Performance International, Oakland University, and the University of Detroit Mercy. We also wish to recognize 3SL and Atego for their participation in our MBSE Tool Vendor Challenge and Booz Allen Hamilton, BAE Systems, and the Chicagoland and Michigan Chapters of INCOSE for sponsoring our welcome banquet.

Finally, I extend our thanks to the speakers and attendees, without whom this conference would not be possible.

We look forward to seeing all of you at next year's regional in Chicago!

Sincerely,

Michael J. Vinarcik, ESEP-Acq
Vice-President, INCOSE Michigan Chapter
Organizing Committee Chair

Organizing Committee Members:

Troy Peterson, Bob Reed, George Walley, Jitu Shah, and
Jack Stein (Michigan Chapter);
Bob Parro and Russ Kubychek (Chicagoland Chapter).

PROGRAM SCHEDULE

FRIDAY 11/4/2011

6:00pm to 8:30pm

Systems Engineering Professional / Welcome Banquet

SATURDAY 11/5/2011

8:00am	BREAKFAST
8:45am	MBSE Tool Vendor Challenge: Briefing
9:00am	Samantha Robitaille Keynote Speaker (BAE Systems, INCOSE President)
9:30am	Robert Ellinger Systems Engineering and System Architecture in an Agile and Short-cycle Transformation Process
10:00am	Chris Unger, et al. Hierarchical, Statistical Approach to Model Based Development for Medical Imaging Device Development
10:30am	Philip Lopez Process Development via SysML
11:00am	Charles Wasson Model-Based System Engineering (MBSE): Organizational Panacea or Mirage
11:30am	Michael J. Vinarcik The M1911 Centennial: Architecting Lessons From John Browning
12:00pm	LUNCH
1:00pm	Sponsor Presentations
1:30pm	Jason Dick SWAP-CC, The Product Structure & Everything
2:00pm	Chris Unger A Systematic Approach to Technical Design Reviews for Distributed Development Teams
2:30pm	Daniel Zielinski Adapting Knowledge Management to Manage Changing Experience and Varying Requirements in an Automotive Test Center
3:00pm	BREAK
3:30pm	Jerome Tzau Lessons Learned in Performing Technology Readiness Assessment For A Major Milestone B Acquisition Program
4:00pm	Richard Staiert Systems of Systems Capability Engineering (SoSCE) Capability Development at BAE Systems
4:30pm	Kenneth Harden, et al. A System Analysis of Government Rules for Industrial Transformer Efficiency
5:00pm	William Schindel The Impact of "Dark Patterns" On Uncertainty: Enhancing Adaptability In the Systems World
5:30pm	Troy Peterson, et al. Extending System Life Cycles Under Uncertainty
6:00pm	Matthew Hause "Are We There Yet" Assessing Quality in Model-Based Systems Engineering
6:30pm	BREAK
7:00pm	John Thomas Dinner Speaker (Booz Allen Hamilton, INCOSE President-Elect)

SUNDAY 11/6/2011

8:00am	BREAKFAST
8:30am	Steven Walter An SE Certification Overview
9:00am	Jonathan Weaver Innovation Workshop
11:00am	MBSE Tool Vendor Challenge: Results Showcase
12:00pm	LUNCH
1:00pm	ADJOURN



Keynote Speaker

Samantha Robitaille
BAE Systems
President of INCOSE

BIOGRAPHY

Samantha Robitaille is the President of INCOSE. She has been an INCOSE member since 1999, serving initially as Corporate Advisory Board member for BAE Systems. In 2004 she was appointed as Technical Director, a position she retained until she was elected to the presidency at the end of 2007.

After starting her career in Royal Ordnance as a student engineer, Samantha developed a broad understanding of UK defence industry and specifically military vehicles business through a wide range of roles spanning business winning, research, development, manufacturing, facilities management and engineering process development before formally moving into systems engineering on the Terrier armoured engineering vehicle programme.

In 1999 she was appointed Deputy Chairman of the BAE Systems 'Systems Engineering Council', a role in which she was responsible for the coordination of global Systems Engineering capability development across BAE Systems and its joint venture companies. She received a BAE Systems SPIRE award for her service to Systems Engineering education & training within the company in 2004.

Samantha holds a Bachelors degree in Mechanical Engineering from the University of Bath, UK; Masters degrees in Gun Systems Design from the Royal Military College of Science, Shrivenham, UK and in Engineering Management from the University of Bristol, UK, and an Engineering Doctorate in Systems Engineering from Loughborough University, UK. She is a Chartered Engineer and Fellow of the Institution of Mechanical Engineers.

In 2010 Samantha transferred to BAE Systems Land and Armaments business in Sterling Heights, Michigan, USA, where she is a Systems Engineering Fellow.



Systems Engineering and System Architecture in an Agile and Short-cycle Transformation Process

Robert S. Ellinger, Ph.D.

ABSTRACT

For a Systems Engineering and Architecture process to tame uncertainty in a continuous change organizational and technology environment requires that the transformation process be agile. Agility is "the ability to successfully respond to unexpected challenges and opportunities." Fundamental to the agile philosophy is the assumption that "not all requirements are known up front." This means that the development process must allow the customer to add requirements throughout the transformation process.

First, a short-cycle CMMI Level 3 software development process, based on Extreme Programming, and anecdotal results from over 100 efforts using the process will be presented. Second, a generalized process that includes systems engineering and system architecture procedures and functions for many types of agile and short-cycle development and transformation efforts will be shown. Third, the implications of this process on the roles of the program manager, systems engineer, and system architect will be presented.

BIOGRAPHY

Robert S. (Bob) Ellinger Ph.D., holds his Ph.D. from the University of Iowa. After teaching and working for a short time in the office furniture industry, in 1986 he began his work in the aerospace and IT defense industry. He was internal National Lead Systems Engineer, Enterprise Architect, and Chief Software Architect for the Northrop Grumman Corporation. He has served on many international standards committees including the OASIS SOA Reference Model and SOA Reference Architecture Framework Technical Committee.



Hierarchical, Statistical Approach to Model Based Development for Medical Imaging Device Development

Chris Unger, Ph.D.
Technical Design Review Technology Manager
GE Healthcare

ABSTRACT

GE Healthcare designs complex medical imaging devices, which can be considered systems of systems. These are often million dollar machines, and the image quality depends on hundreds of detailed process and design parameters. This paper describes a systematic approach to development which minimizes development time and cost through specification flowdown and system modeling.

A comprehensive approach of CTQ (critical to quality parameter) flowdown is proposed:

- Three levels of Subsystem performance, Component performance, and Device/Process are defined
- Models are developed, beginning with basic research (>10 years in advance of shipment)
- Disciplined process of technology development (mapped to the standard Technology and Manufacturing Readiness Levels)
- Simulations are developed and validated with a limited number of prototypes
- Appropriate use of Design for Six Sigma helps prioritize design work
- Statistical modeling then allows rapid optimization of performance
- Optimized parameters cover cost, reliability, and clinical performance
- Advanced visualization toolkits allow rapid analysis and selection of robust designs

This comprehensive, hierarchical, statistical approach to MBSE has saved years of development and millions of development cost on typical platform development programs.

BIOGRAPHY

Chris Unger graduated with a B.S. in Mathematics and B.S. in Philosophy from M.I.T. and a Ph.D. in Physics from Boston University. He has worked as a systems engineer in the defense and medical fields for 28 years, and is an expert in systems engineering and medical imaging. He is a certified Master Black Belt and has eight issued patents and seven patents applied for.



Process Development via SysML

Philip Lopez
Senior Staff Systems Engineer
BAE Systems

ABSTRACT

The objective of the project was to take a systems engineering approach to documenting the structure and flow of the engineering processes. SysML was selected because of its readability and flexibility.

The notion of using systems engineering ideologies and methods to develop and document the engineering processes was logical and afforded several benefits. It allowed the team to see the structure of the processes at varying levels of abstraction. This allowed individuals to focus on a given area quickly and filter out items that were not pertinent. It was used to follow the inputs and outputs of the processes in the sense of documentation used and created by the processes. This provided visibility into the process cause and effect and clearly showed roles and responsibilities associated with the flow of the processes. SysML is currently being used to develop work break down structures and other planning elements within the engineering environment. In the future the team intends to apply parametric diagrams to run planning simulations.

The entire exercise presented a more flexible and focused view of our organization's processes. Developing the model in this way allowed the engineering community to see the benefits of using the modeling language and allowed the team to learn how to use it effectively in varying circumstances.

BIOGRAPHY

Phil Lopez has a Bachelor's Degree in Electrical Engineering Technology and is currently working on his Master's Degree in Engineering Management. Phil has worked as a Quality Engineer in the semiconductor and automotive industries and is currently working as a Systems Engineer at BAE Systems supporting SysML and process standardization.



Model-Based System Engineering (MBSE): Organizational Panacea or Mirage

Charles S. Wasson
Wasson Strategics, LLC

ABSTRACT

With the introduction of Model-Based System Engineering (MBSE), organizations sometimes view MBSE as a panacea that will overcome poor System Engineering practices and performance. The panacea resides in the belief that if: 1) you acquire a tool that complies with the Unified Modeling Language™ (UML™) and its System Engineering subset, System Modeling Language™ (SysML™) and 2) create graphical models of a system, you are by inference performing System Engineering and will be successful in developing systems, products, and services.

Many people often have the belief that MBSE is a recent innovation. The reality is the underlying concepts of employing graphical tools to model system / component entity relationships, interactions, and performance have been in existence for decades. Through standardization of UML™ / SysML™ as modeling languages coupled with software tools that comply with the standards and faster computers, the concept of MBSE provides a new level of capability. MBSE, in combination with supporting tools, can and does provide a better approach for capturing user / stakeholder needs via use cases, modeling system operations, derivation of system and capabilities and performance requirements, developing system architectures, defining system interfaces, modeling behavioral performance and system interactions externally and internally, etc. However, IF the organization: 1) does not fully understand how to properly apply system engineering concepts, principles, and practices and 2) employs a tool to create graphics under the guise of SE, the chances of success are minimal.

This presentation explores key considerations an organization should consider when deciding to employ MBSE and provides insights for making "informed decisions" to ensure success. The discussion includes a brief, historical perspective of applying graphical modeling tools to system engineering, explores why MBSE should be considered, examines organizational factors required for a successful MBSE deployment, addresses Measures of Effectiveness (MOEs), and assess the organizational state of readiness implementing MBSE. Based on information provided in this presentation, organizations should be better prepared to determine if MBSE is an organizational panacea for success or simply a mirage.

BIOGRAPHY

Mr. Wasson is a member of the International Council on Systems Engineering (INCOSE) and the Program Management Institute (PMI) and President of Wasson Strategics, LLC. His professional career experience includes over 38 years of proven leadership in program/project management; system, hardware, and software design, development, integration, and test; and organizational development with Lockheed Martin Corporation, Loral Corporation, Teledyne Brown Engineering, U.S. Army Missile Research & Development Center, et al. As an internationally recognized author and instructor in systems engineering and its organizational application, Charles is an invited guest speaker and panelist at professional meetings, conferences, and symposia.



As the author of numerous technical papers and papers, Mr. Wasson is the author of System Analysis, Design, and Development, a Systems Engineering textbook published by John Wiley & Sons, Inc. as part of its highly acclaimed Systems Engineering and Management Series. The textbook was selected by the International Academy of Astronautics (IAA) in Paris for its most prestigious of four book awards, the 2006 Engineering Sciences Book of the Year Award. The text was written for general application to any domain such as aerospace and defense, medical, financial, transportation, education, et al systems..

The M1911 Centennial: Architecting Lessons From John Browning

Michael J. Vinarcik, ESEP-Acq, P.E.
Associate
Booz Allen Hamilton

ABSTRACT

The ubiquitous .45 automatic (the M1911) was adopted by the United States Army on March 29, 1911. It subsequently became one of the most successful firearms in history; over 2.7 million were made for the government and countless others have been produced for the civilian market.

In addition designing to this pistol, John Moses Browning developed many other firearms that have been in production for nearly a century, including the Auto-5 shotgun, the M2 (.50 caliber) and M1919 (.30 caliber) machine guns, and the Browning Hi-Power. He held 128 patents and created many innovative architectural features that are still in use today. Browning is one of

the most-imitated architects and innovators in firearms history.

This presentation will discuss the principles Browning followed when designing his systems and how they may be applied to diverse architectures today.

BIOGRAPHY

Michael J. Vinarcik is an Associate at Booz Allen Hamilton; he is currently working as a Systems Engineer. He has over twenty years of automotive and defense engineering experience. He received a Bachelor of Science (Metallurgical Engineering) from the Ohio State University, an MBA from the University of Michigan, and a Master of Science (Product Development) from the University of Detroit Mercy. He holds a number of certifications, including a ESEP-Acq, and is a Fellow of the Engineering Society of Detroit.



SWAP-CC, The Product Structure & Everything

Jason Dick
Staff Systems Engineer
BAE Systems

ABSTRACT

Managing and controlling mass properties (Weight, Center of Gravity (CG), Moment of Inertia (MOI), etc.) and other system level parameters such as size, power, cooling, and cost during development, production and in service is critical to modern product lifecycle management. Each of these parameters manifests itself at the system level through the aggregated contribution of each individual lower level subsystem and component. The parameters are often managed using allocations once the initial concept and architecture for a system is established. Maintaining accurate and useful measures of these quantities is essential from the earliest phase of product development through the retirement of a system. Aligning the tracking, management, and control of these product parameters to a configuration-controlled physical architecture is critical to meaningful and timely input to the system development and support processes. This presentation provides an overview of Size, Weight, Power, Cooling and Cost (SWAP-CC) management and control and identifies the challenges typically encountered in tracking and managing these parameters during system development and operation. It then identifies demonstrated and proposed methods for optimizing the timeliness and value of SWAP-CC data to the system development and support lifecycles.

BIOGRAPHY

Jason Dick graduated with a Bachelor's of Science in Aerospace Engineering and Mechanics from the University Of Minnesota and after several years of engineering work experience earned a Master's of Business Administration from the Carlson School of Management. Jason is a Staff Systems Engineer at BAE Systems, Land & Armaments, in Troy, Michigan. His work experience spans the product lifecycle spectrum from technology research and development, through product verification, production, and in-service support. In addition to his work with BAE Systems, Jason began his career at the Boeing Company working on Transport Category aircraft and has also worked at Cirrus Aircraft on development of general aviation aircraft and product improvements. Jason is a certified private pilot.



A Systematic Approach to Technical Design Reviews for Distributed Development Teams

Chris Unger, Ph.D.
Technical Design Review Technology Manager
GE Healthcare

ABSTRACT

GE Healthcare designs complex medical imaging devices. Its development teams are spread out in over forty locations across the world, with vastly different levels of product and engineering experience. This drove the need to create a structured but flexible approach to design. The approach selected has been to deploy internal design standards and best practices, along with statistical engineering tools, through the use of senior engineers and more rigorous Technical Design Reviews (TDRs). While the GE approach is based on senior engineers overseeing the work of more junior engineers, the high level of turnover in developing countries leads to special challenges.

(cont.)

Specific topics covered are:

- The criteria used to evaluate deployment maturity
- The template used to improve TDR planning, and facilitate the review of the TDR plan itself
- The use of internal and independent reviewers
- The approach to developing TDR reviewers' skill sets, and some standard work goals
- The incorporation of statistical techniques in the subject matter expertise profile
- The use of checklists in review
- The appropriate level of customization to site specific cultures
- Approaches to sustaining systems and operating mechanisms
- Proposed metrics for evaluating business impact at varying time scales

GEHC has developed an efficient and effective way of utilizing senior engineering talent to improve the predictability of our programs and the quality of the products offered to customers.

Adapting Knowledge Management to Manage Changing Experience and Varying Requirements in an Automotive Test Center

Daniel Zielinski
Systems Engineer
BMW

ABSTRACT

The complex environment of an agile company is increasingly affecting its test centers. In order to provide appropriate support and verification activities, new test centers are designed for more and more functionalities, test scenarios, and objects. The traditional way of operating such facilities with isolated expert knowledge no longer fits their enhanced complexity. Thus, stakeholders experience an unacceptable amount of uncertainty concerning the facility's efficiency and effectiveness.

In the case of a wind tunnel, the main uncertainties to be analyzed and reduced were (1) the operator knowledge of facility characteristics (technical aspects and processes), (2) user/customer knowledge of facility capabilities, and (3) operator knowledge of user knowledge and interests. Causes and effects of these uncertainties were assessed with metrics evaluating the quality of information and its management.

Information Science theories were rendered to unitarily describe performance indicators for creating, distributing, using, and saving information. The situation on site was captured by surveys and workshops. Systems Engineering methods of change and knowledge management were applied to structure and analyze the relations between present independent yet interacting entities. System-of-Systems principles were deployed to model a communications architecture. To ensure information objects' usability their relations were organized in a fitted infrastructure. To ensure valuable interaction between entities their communication was based on these sound information objects.

BIOGRAPHY

Daniel Zielinski graduated from Technische Universität München obtaining a Diploma Degree in Engineering. He was awarded the GfSE prize 2010 for Diploma or Master's Theses. Daniel Zielinski is a PhD-Student at the Institute of Astronautics at Technische Universität München. He is working as a Systems Engineer for an automotive OEM and is an expert for metric based system evaluation.



Lessons Learned in Performing Technology Readiness Assessment For A Major Milestone B Acquisition Program

Jerome Tzau
Systems Engineer

Tank Automotive Research Development Engineering Center

ABSTRACT

One of the biggest challenges in developing Technology Readiness Assessments (TRA) is the determination of the critical technology elements (CTEs). This paper outlines a systematic process used to identify all potential technologies developed by contractors during the Technology Development (TD) phase as well as how to apply criteria for the selection of CTEs. To reduce the subjectivity in the assessment, the relevant technical requirements which are important to the customer are established for each CTE. These technical requirements must then be demonstrated satisfactorily to the requisite level of maturity before entering the Engineering & Manufacturing Development (EMD) phase.. The paper also includes other system requirements that CTEs must satisfy before the overall system can be evaluated given that the maturity of a CTE cannot be evaluated in isolation.

This TRA process was used in preparation for the MSB Review with the Assistant Secretary of the Army for Acquisition, Logistics, and Technology (ASA(ALT)) and the Assistant Secretary of Defense for Research & Engineering (ASD(R&E)) for the Joint Light Tactical Vehicle (JLTV), a major defense acquisition program. .

Systems of Systems Capability Engineering (SoSCE) Capability Development at BAE Systems

Richard Staiert, ESEP
SSEI PRP Implementation Manager
BAE Systems Land & Armaments

ABSTRACT

BAE Systems is a multi-national defense and aerospace company that regularly is the prime contractor on DoD, MoD, and other national-state programs. Often these programs are for the development of new or upgraded equipment for an enhancement of an existing "capability." Frequently the "customer" has an incomplete understanding of his needs, or of the complex relationships and dynamics between the procured item and the existing operational context and capability into which it is to be introduced. This has led to program delays and cost-over runs that deplete already scarce resources.

To better "help" our customers and ultimately to help ourselves, BAE Systems has initiated an effort to define and deploy a Systems of Systems Capability Engineering Framework that would enable a better understanding of our customer's challenges and needs in order to provide him with a better solution. Efforts to date have produced a capabilities engineering framework with a number of supporting tools enabling an effective SoSCE capability. While the framework was developed with defense/aerospace in mind, it was developed to be applicable to other government and commercial spheres such as DOE, Homeland Security, and FAA as well as state and local agencies needing to deploy capability. It should also be applicable to commercial enterprises seeking to introduce new capability or to re-invent themselves.

This paper will discuss the approach, its goals, the various tools that were developed as well as on-going plans/efforts to conduct pilot applications of the approach in various BAE Systems business areas and markets in order to "vet"/enhance the robustness of the approach before universal deployment across BAE Systems.

BIOGRAPHY

Dick is the Systems and Software Engineering & Integration (SSEI) functional engineering manager for BAE Systems Land & Armaments. He is also the champion and lead architect for the overall L&A model based product development, "speed to market" approach that is being deployed across all of L&A.

He has over 40 years of experience in Project Management, Systems Development, Systems Design, Systems Engineering, and Systems Integration of large, complex hardware and software systems, with roles from mechanical design engineer through Chief Engineer and Program Manager in both commercial and defense systems.

Before joining BAE Systems in 2009, he was Chief Systems Engineering Manager for SAIC and served as SAIC's Chief Engineer on the Future Combat System (FCS) Manned Ground Vehicles (MGV) Program beginning in 2002. Prior to that, he worked for United Defense LP (now BAE Systems) as Project Manager for Advanced Systems Development from 1997-2002. From 1992 to 1997 he was the Concept Development Technical Lead for the Crusader Program and from 1989 to 1992 he was the Technical Manager for Armored Systems Modernization for United Defense LP Fire Support Systems Mission Module subcontract to AVTA (an UDPL/GDLS joint venture).

He is a graduate of Iowa State University (BSME – 1968), the holder of nine US Patents and is an INCOSE certified Expert System Engineering Professional (ESEP)..



A System Analysis of Government Rules for Industrial Transformer Efficiency

Kenneth Harden
Senior Electrical Engineer
Schneider Electric

Steven Walter
Distinguished Professor of Systems Engineering
Indiana University–Purdue University Fort Wayne

ABSTRACT

Government energy efficiency standards, customer requirements, and commercial design practices strongly influence the selection and design of low voltage, dry type, distribution transformers (LVDT). These transformers, which range from 15 kVA to 1500 kVA, are typically used to step down 480 VAC line voltage to the specific voltages required to power buildings and industrial equipment. The design of a transformer for a particular application is usually a trade between multiple designs that meet the requirements of the stakeholders (i.e., the government, customer, and facility architect and engineer). The final selection will weigh

factors that are important to the manufacturer such as cost, ease of production, and reliability.

Improvements in transformer efficiency are highly desirable because they can achieve significant energy savings without impacting the customer or their operations. However, while current federal energy efficiency rulemaking attempts to optimize energy savings, they may be hampered by both unsubstantiated assumptions underlying the government regulations and commercial design practices that recommend margins driven by fire hazards and assumptions about future scope creep.

The impact of government regulations specifying transformer efficiency as a function of transformer load is clearly illustrated by typical transformer efficiency-load curves. When coupled with architectural design practices that tend to favor adding large load margins, the unintended effect is to thwart the efficacy of the government efficiency standards. The details of this study will demonstrate the importance of a data-driven systems analysis when developing regulations to realize higher energy savings in commercial and industrial facilities.

BIOGRAPHY

Kenneth Harden graduated with a BSEE from Purdue University in 1984 and is currently pursuing a Master of Science in Engineering from Purdue University, Fort Wayne, with an emphasis in Systems Engineering. He is a Senior Electrical Engineer for Schneider Electric with direct involvement in the design and development of Square D brand low voltage, dry type, distribution transformers and is the local subject matter expert in the area of DOE energy efficiency legislation.



Steven J. Walter, Ph.D. CSEP, earned his Bachelors of Science degree in Physics at the University of Maryland and his Masters and Doctorate in Physics at the University of Colorado in Boulder. After graduating, he worked at NASA Jet Propulsion Laboratory where he developed new and innovative remote sensing systems. In 2000, he joined Northrop Grumman Electronic Systems and has served in a variety of systems engineering and program management roles. He is currently the Distinguished Professor of Systems Engineering at Indiana University-Purdue University Fort Wayne.

The Impact of "Dark Patterns" On Uncertainty: Enhancing Adaptability In the Systems World

Bill Schindel, CSEP
President
ICTT System Sciences

ABSTRACT

There are increasing examples of the formal use of System Patterns in the development, delivery, and life cycle of systems, including patterns of requirements, design architectures, failure modes and effects, verification processes, and other aspects. Nevertheless, today many systems engineering efforts (even when model-based) still occur without use of explicit Pattern-Based SE methods. In spite of this apparent lack of formal or explicitly visible patterns, most contemporary systems projects do in fact have pattern content--but in the form of "Dark Patterns".

This presentation will examine the role of Dark Patterns in commonly-practiced contemporary systems engineering projects. Like the "dark matter" of physics, Dark Patterns (1) are not directly visible, (2) exert substantial forces that can make their presence known, and (3) are widespread throughout the SE universe. Understanding Dark Patterns and their explicitly visible counterparts can enhance the adaptability of systems and systems projects in a dynamic world of risks.

BIOGRAPHY

Bill Schindel is president of ICTT System Sciences, a systems engineering company, and developer of the Systematica™ Methodology for model and pattern-based systems engineering. His 40-year engineering career began in mil/aero systems with IBM Federal Systems, Owego, NY, included service as a faculty member of Rose-Hulman Institute of Technology, and founding of three commercial systems-based enterprises. He has consulted on improvement of engineering processes within automotive, medical/health care, manufacturing, telecommunications, aerospace, and consumer products businesses. Schindel earned the BS and MS in Mathematics, and was awarded the Hon. D.Eng by Rose-Hulman Institute of Technology for his systems engineering work. At the 2005 INCOSE International Symposium, he was recognized as the author of the outstanding paper on Modeling and Tools, and is an INCOSE CSEP.



Extending System Life Cycles Under Uncertainty

Troy Peterson
Senior Associate
Booz Allen Hamilton

Robert Bordley
Associate
Booz Allen Hamilton

Fred Samson
Associate
Booz Allen Hamilton

ABSTRACT

Future Department of Defense complex system requirements are highly uncertain due to the dynamics in the operational context, agile adversaries or competitors, decreased innovation cycles and unknown futures. As a result, time-consuming and costly redesigns are no longer effective, making alternative approaches to traditional development and acquisition essential.

This paper will propose an alternative approach which couples uncertainty management and architecture management methodologies to reduce the total life cycle cost of systems. More specifically, it will outline approaches to identify and manage component and architectural drivers of cost due to future uncertainties.

Specific techniques used in the approach include:

- Influence diagrams for decomposing a system into its components and modeling the relationships between components
- Sensitivity analysis, based on design of experiments, to identify the best opportunities for cost-reduction from improving system components
- Design Structure Matrix (DSM) to identify and manage key elements in the architecture and to aid with modularization and identification of areas for flexibility to accommodate uncertainties
- Creation of a consolidated Pareto chart identifying top component and architectural drivers of system cost.

The approach ultimately helps to identify and manage platforms to become more adaptable and flexible thereby reducing total life cycle cost.

BIOGRAPHY

Troy Peterson leads Booz Allen's Systems Engineering and Integration work within Michigan and supports the DoD to improve ground system capability. He has led several global programs and technical teams in delivery of large-scale systems and his consulting experience spans academic, commercial, and government sectors. Mr. Peterson is also INCOSE's Michigan Chapter President, an INCOSE CSEP, PMI PMP and a Certified Six Sigma Black Belt. He holds a BS in Mechanical Engineering from Michigan State University, an MS in Technology Management from Rensselaer Polytechnic Institute and an advanced graduate certificate in System Design and Management from Massachusetts Institute of Technology.



Robert Bordley, a Lead Associate at Booz Allen Hamilton, is a recognized thought leader in Decision Analysis. He has extensive experience both in theory development and in the development, application and management of statistical, decision analysis and operations research models. Robert is a former Technical Fellow at General Motors and current Fellow of the Institute for Operations Research & Management Sciences. He has published over 70 refereed papers and has taught at Wharton, Oakland, and the University of Michigan. Bob received BS, BA and MS degrees from Michigan State University and an MS, MBA and PhD in Industrial Engineering & Operations Research from the University of California at Berkeley.

Fred Samson, an Associate and Senior Systems Engineer at Booz Allen Hamilton, has supported Systems Engineering activities in both the US Army TARDEC and PEO Integration. Prior to joining Booz Allen in 2009, Fred was a Vehicle Engineering Supervisor and Senior Technical Specialist at Ford Motor Company. Fred led Ford's global team in the development of Ford's DNA for Powertrain Attributes and was the North American lead for developing Lincoln DNA. Fred has both BS and MS degrees in Mechanical Engineering from the University of Michigan and a MS degree in Systems Design and Management from Massachusetts Institute of Technology.

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"Are We There Yet?" Assessing Quality In Model-Based Systems Engineering

Matthew Hause
Chief Consulting Engineer, Atego

ABSTRACT

"How do I know that my model is of good quality?" This question is frequently asked when developing models. This is true whether developing Yourdon, IDEF0, UML, SysML, UPDM, or Lego models. The purpose of the model is to fulfill a need or to answer questions. Consequently, before starting the modeling exercise, one has to determine the questions that need to be answered and assessment criteria. Possibilities include requirements traceability, performance modeling, simulation, behavioral modeling, human factors, etc. Other factors will also affect the scope of the model. Does the model need to capture the complete development lifecycle or product lifecycle? This paper will first examine the concept of quality in general and as applied to modeling. Next we will look at the different reasons for modeling, and some of the corresponding characteristics of quality that can be applied to ensure that the model is of "good quality".

BIOGRAPHY

Matthew Hause is Atego's Chief Consulting Engineer, the co-chair of the UPDM group and a member of the OMG SysML specification team. He has been developing multi-national complex systems for almost 35 years. He started out working in the power systems industry and has been involved in military command and control systems, process control, communications, SCADA, distributed control, and many other areas of technical and real-time systems. His roles have varied from project manager to developer. His role at Atego includes mentoring, sales presentations, standards development and training courses. He has been a regular presenter at INCOSE, the IEEE, BCS, the IET, the OMG, DoD Enterprise Architecture and many other conferences. Matthew studied Electrical Engineering at the University of New Mexico and Computer Science at the University of Houston, Texas. In his spare time he is a church organist, choir director, and composer.



Saturday Dinner Speaker

John Thomas
Booz Allen Hamilton
INCOSE President-Elect

BIOGRAPHY

John Thomas is a Senior Vice President at Booz Allen Hamilton and its Lead Systems Engineer. He leads teams that plan and execute multimillion dollar complex system programs. His clients include U.S. government and industries worldwide. John's current focus is supporting complex systems development activities for the U.S. federal government. With John's Systems Engineering and Integration (SE&I) stewardship, Booz Allen (a \$5 billion strategy and technology consulting firm) has invested in its Systems Engineers and SE methodologies for the purpose of enhancing the SE profession and its practitioners.



John's leadership assignments span program and engineering management, strategic planning, stakeholder communications, conflict management, business process analysis, activity-based costing, solutions concept development, systems synthesis (systems architecting, design, alternatives evaluation), systems integration, and systems verification/validation testing and operational test and evaluation.

John also is a business coach and mentor to a number of Booz Allen's senior technical and management professionals. He is a spokesperson for Booz Allen, speaking to groups and media to help raise the relevance and importance of Booz Allen's systems engineers and SE&I services. Systematic Innovation Workshop

Innovation Workshop

Jonathan Weaver, Ph.D.
Professor / Co-Curriculum Director
University of Detroit Mercy

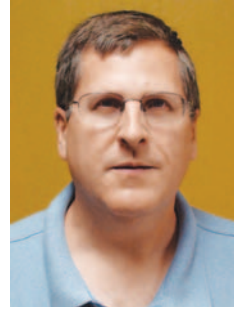
ABSTRACT

Innovation is often touted as essential to competitive advantage, yet most engineers receive very little training in systematic innovation techniques. As a result, lofty targets are often set for innovation, but little is done to develop and facilitate the innovative thinking about product and process to enable attainment of those goals. Systematic innovation techniques that are

teachable can be applied to help engineers routinely generate creative, innovative, high-value solutions. During this session, participants will engage in several exercises designed to help frame the need for and value of a structured approach to innovation and will be briefly introduced to approximately fifteen systematic innovation tools.

BIOGRAPHY

Jonathan Weaver, Professor of Mechanical Engineering at the University of Detroit Mercy, teaches a variety of courses – including courses on innovation/creativity, systems engineering, systems architecture, design of experiments, robotics, computer-aided engineering, and the product development process. He holds a BSME degree from Virginia Tech, and MS and Ph.D. degrees in mechanical engineering from Rensselaer Polytechnic Institute. He serves as the co-curriculum director for the Masters in Product Development Program and is a Kern Entrepreneurship Education Network Fellow.



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