INCOSE Orlando
International Council on Systems Engineering

Chapter Meeting Highlights

A Revolution in Media Affairs

We were visited by a former Chapter officer in August. Mark Biddle, who is Past President and has held other offices, shared his insight on the impact media is having on systems engineering—touching on everything from music and art to training and education, and of course socializing. One example he sited was the use of Second Life for Air Force training. Given that Orlando has a technology corridor along with a wealth of artistic environments it's a hot spot for seeing this revolution in action.

With technology being more accessible Mark pointed out that so-called "amateurs" are getting involved in media-based business more and more often and frankly experiencing great success with it. Understanding the appeal that media has, especially with those of Generations Y and Z it started us all thinking a little harder about how we as systems engineers can take advantage of opportunities that media presents and some us started pondering creative endeavors…

Systems Engineering Documentation

The September meeting brought another rousing evening of discussion as Dave Krigelman took us through an in-depth discussion on systems engineering documentation.

The presentation provided a very good overview of SE documents and their content, especially helpful for those individuals new to the discipline. Yet it also sparked some discussion and questions from several seasoned systems engineers in the audience who wanted to share their experience and seek additional insight.

If you're looking for a comprehensive list of SE documentation and outlines of the contents you'll want to review Mr. Krigelman's materials.

To view these and other presentations visit the INCOSE Orlando website and look for the LINK on each chapter meeting notice.

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President's Corner
New Technical Discussion Sections

INCOSE Orlando is starting a new area in the Newsletter and on LinkedIn. All will be sent an invitation to join, if interested. Topics will include items of interest that have come up during monthly meetings, technical discussions between members and open questions posted to the LinkedIn site. Suggestions will be appreciated. Richard Biehl's systems engineering analysis of then (1960's) and now (2009) SE books is the start of this technical endeavor . Check out page 3 for more!

— Ed Smith, President

Upcoming Chapter Events

October 15: Chapter Meeting
Caroline Lazar
Project Engineering Responsibility & Applications

November 19: Chapter Meeting
Dr. Jen Narkevicius
Humans Systems Integration

November 20: Tutorial
Dr. Jen Narkevicius
Tools to Ensure the System includes the Human

December 17: Chapter Meeting
Holiday Celebration

January 21: Chapter Meeting
Dr. William Limm
Applicability of Knowledge Management to Systems Engineering

February 18: Chapter Meeting
Eric Honour
Measuring Systems Engineering ROI

Check the INCOSE Orlando web site often for the latest news on upcoming events.

Inside this issue:

Member News

Current active membership in the Orlando Chapter stands at 110 as of month-end September 2009. If you haven't renewed your membership yet or you're interested in becoming a member, visit the INCOSE Membership page or contact Jerry Gordon.

New Members (August)

Kurt Hamby, FSCX Inc.

Ken Cogan, DSCI

Mike Robel, Defense Industry

New Members (September)

Michael Mullins, United Space Alliance

Frank Travassos, United Space Alliance

Andrew Adams, Invivo Corporation

Member Profiles

With each edition of the newsletter we'll take an opportunity to introduce you to some of our new members, as well as those who've been part of INCOSE for awhile. If you'd like to share some info about yourself, please send your write-up to Penny Beierschmitt.

**** Andrew Adams.*** Thanks for welcoming me to your chapter! I'm a reliability and quality systems engineer for Invivo Corporation, a medical device engineering and manufacturing firm that specializes in MRI diagnostic imaging and accessories. In this role, I am primarily responsible for identifying process improvement opportunities and improving the quality management system to yield better quality, lower cost, and higher rates of on-time-delivery. In order to achieve these results, I lean heavily on the systems engineering body of knowledge, which has greatly supplemented my formal education in engineering, statistics, and manufacturing management. To further my competence in the SE field, I intend to pursue the MSSE at Johns Hopkins University next year and, until then, I look forward to enjoying the many educational benefits offered by the INCOSE-Orlando chapter.

**** Mike Robel*** is a retired Army officer with service in the 11th Armored Cavalry Regiment and the 1st Infantry Division (Mech) including Desert Storm. He graduated from the University of Florida in 1976 with a BA in History. He is currently a Senior System Engineer with Raytheon working on JLCCTC on the logistics area. Prior to that, he worked for Northrop-Grumman on WARSIM as a SME, System Engineer, Test Engineer, and Data Modeler. The last two years he worked for Northop, he invented and helped produce the Civil Effects Leaders Training Simulation (CELTS) a non-kinetic effects simulation. Prior to moving to Orlando he worked as a database manager for the 87th Exercise Division in Birmingham, as the Simulation Center Manager in Fort Polk for the 2nd Armored Cavalry Regiment, and as the VP for Wargaming Development for a now bankrupt commercial company named 360 Intracorp/Three-Sixty Pacific and produced one of the versions of the wargame Harpoon. At the same time, he wrote a wargaming column, did reviews and how-to's for the commercial magazine Computer Games Stratgey Plus. His hobbies are model building (mostly of spacecraft and boosters, but also of aircraft and armored fighting vehicles, wargaming (from about 3rd grade), and military history. These hobbies led him into the modeling and simulation business and explain a little about how he came to be a system engineer. He lives on Merritt Island which offers him a first hand view of space shuttle launches and the beach, with his wife of over 30 years.

Penny Beierschmitt is a Systems Engineering Manager with the Enterprise Operations business area of Lockheed Martin. She graduated from Purdue University with BS degrees in Retail Management (1987) and Computer Technology (1998) and from Florida Institute of Technology with an MS degree in Systems Management (2002). After moving to Florida in 1998 she met Tim, who is her husband of 4 years. They have two sons, Tim (21) and Patrick (19), who live with them and attend college locally. When she's not busy performing her duties as the INCOSE Orlando chapter secretary, Penny likes to spend her time listening to live local jazz, trying to learn the art of vegetable gardening in the Florida climate, and watching Planet Green (Ed Begley, Jr. is her idol). If you see her at work or out and about, be sure to say hello. Boiler up!

* denotes new member

Book Reviews

Reviewed by Rick Biehl

Systems of Systems Engineering: Principles and Applications

Edited by Mo Jamshidi

CRC Press, 2009. 480 pages.

Handbook of Systems Engineering and Management

Edited by Andrew P. Sage and William B. Rouse

Second Edition. Wiley, 2009. 1,476 pages.

Systems Philosophy

By David O. Ellis and Fred J. Ludwig

Prentice-Hall, 1962. 386 pages.

There's a lot of talk of complexity in the systems engineering world today, and recently much of that talk has centered on the idea of Systems of Systems (SoS).

In *Systems of Systems Engineering* (SoSE), Jamshidi and his contributors explore the issues and peculiarities of SoSE by specifically focusing attention on the aspects of SoS most notably different from traditional systems and systems engineering. There are no lifecycles, stages, or decomposing architectures; theirs is a story centered on *emergence* and *autonomy*.

As systems get larger and more complex, distinct features become apparent or available that were often not the direct target of the design effort. Such emergence includes "any characteristic or property of a SoS that is not observed in any proper subset of the systems comprising the SoS, and *only* such characteristics." (p. 101, author's italics)

Additionally, large-scale systems increasingly combine systemic parts that are more autonomous, increasingly complex, and environmentally or technically diverse. The distinction has its root in the fact that SoSE is an *aggregating* discipline. Where traditional systems engineering can result in decentralized function and control as an intentional part of the design process, the decentralization of a SoS is an accident – "decentralized by default as a *fait accompli*." (p. 96) The systems components of a SoS exist autonomously in their environment, making the decentralization of a SoS a natural by-product of the SoSE process.

Jamshidi (through contributor George Rebovich) takes on the issue of whether or not a SoS is fundamentally different than what we would simply refer to as a System. "Some are different in degree … while others are different in kind." (p. 165) Engineering of systems is described as being able to control for, and account for, all relevant factors. An engineer facing a SoS challenge is faced with an absence of control over the participation, involvement, and requirements of the component systems. With this lack of control, and with the high-value attributes being emergent properties of the entire SoS, the SoSE process becomes fundamentally different. It focuses "more on shaping the environment, incentives, and rules of success in which classical engineering takes place." (p. 179) In seeking emergent properties in a SoS, validation shifts from an emphasis on testing to a significant role for modeling and simulation.

It seems that throughout Jamshidi's *SoSE* the distinction between systems with components and systems of systems made up of systems requires active energy to be maintained. Remove that energy and one could easily substitute System-to-Component in place of every SoS-to-System reference without invalidating the points being made.

Clearly the level of autonomy and emergence at the SoS level is greater than one expects at the System level, but the distinction might be more of a difference of degree than of any fundamental shift. We've all worked on systems where an unexpected level of component autonomy or attribute emergence resulted in engineering challenges. Not all of those occasions could be described as SoS situations.

An example of a concept that seems most justified only if the distinction needs to be maintained is Jashmidi's (and contributors Bjelkemyr, Semere, and Lindberg) depiction of two kinds of emergence: weak and strong. Weak emergence "can be predicted by extensive modeling and simulation" (p. 194), while strong emergence includes "high level behaviors [that] are autonomous from the systems and ele-

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ments on lower levels." (p. 194)

The contributors seem to suggest that strong emergence belongs up in the realm of SoS, while weak emergence can be allowed to occur down in the realm of individual systems or components. Without weak emergence, the SoS distinction couldn't explain fundamental emergent properties like the lift on a wing, or the thrust of an engine – properties that occur every day in the realm of traditional systems.

In *Handbook of Systems Engineering and Management*, Sage and Rouse take on that realm of traditional systems. Professionals looking for a comprehensive work describing all aspects of systems engineering will want this *Handbook*. There is no reference to a system of systems in the book's index, yet the *Handbook* includes all of the necessary topics to match the issues raised in *SoSE*. To read the *Handbook* from a SoS perspective, one almost has to read it backwards.

While the vast bulk of systems engineering materials in the *Handbook* follow a predictable methodological path through the 34 different chapters, the reader has to wait until near the end to run into the SoS issues raised as distinctions by Jamshidi. Emergence, although not explicitly discussed in the *Handbook*, is a characteristic of complex adaptive systems discussed in a chapter late in the *Handbook* starting on page 1,283. The role for sociocognitive system aspects raised by Jamshidi and resulting in unpredictable and autonomous behaviors at the SoS level are best explored in the *Handbook* starting back at page 1,319 in the chapter on human systems integration.

After having read Jamshidi's *SoSE*, one might wonder how the *Handbook* would be different if those very late chapters on complexity and human interaction had been very early in the text. Presented early, each remaining methodological chapter would have had to include allowances for emergence and autonomy throughout the elicitation of systems engineering practices. If this revised baseline for systems engineering included those concepts throughout, would the separate distinction of SoS have been needed or evolved in the literature?

Clearly there is a continuum of system complexity that includes a high-end complexity of mostly autonomous previously implemented components demonstrating emergent properties. There's no question about that. The question is whether or not the current paradigm of SoS would have been as needed or useful if such complexity had been integrated into traditional systems engineering practice throughout its history. The *Handbook* doesn't address the question, so the answer remains for further discussion.

To know where a discussion might go in the future, it can sometimes be helpful to look back to the beginning. Ellis and Ludwig's *Systems Philosophy* is a story of systems engineering in its infancy. It is the oldest book in the UCF library that is cataloged under the systems engineering subject heading.

Systems Philosophy defines *system* hierarchically, with systems containing subsystems containing components, and systems themselves grouped into every larger systems. Ellis and Ludwig emphasize that the relativity of these terms "may cause much confusion if not clearly understood." (p. 11) They give the National Defense System as an example of a system, the subsystems of which include the Strategic Air Command, each Bomber Wing, their bombers, the computers on those bombers, the logic circuits in those computers, and finally each diode in those logic circuits as components. The level of this hierarchy designated as a system is exclusively one of selected viewpoint.

To Ellis and Ludwig, systems seem to be things of wonder and excitement. Unlike the *Handbook*, they deal with *complexity* and *human subsystems* very early in chapter three. There is no systems scale beyond which they seem afraid to go as systems engineers. Times have certainly changed.

In the intervening decades, systems engineers have concentrated on building the physical. We've gotten very good at computers and bombers, and we've forgotten our early willingness to attack the organizational and human systems that take advantage of such physical things. More recently, with those physical engineering challenges largely solved, we've turned our attention to the bigger things. But in forgetting our past, we've invented the SoS concept to handle the unique difficulties that reappear at those levels of engineering. If challenged to call the Strategic Air Command a system of systems, Ellis and Ludwig would have viewed the distinction as unnecessary, and might have dismissed it as a by-product of the confusion over differing viewpoints.

Ellis and Ludwig's work seems dated today with the plainness of their presentation, and with their heavily academic tone. They close with predictions of space exploration and scientifically-based improvements to our environment and lifestyles to come in the 1960s and 1970s. But theirs was a philosophy centrally based on systems thinking, and their work is an informative read even today. *Systems Philosophy* should be recommended reading for any systems engineer hoping to reestablish a working knowledge of the fundamental perspectives of our profession.

Sage and Rouse's *Handbook* is much more of a tome, and is unlikely to be read cover to cover, but the thoroughness of their coverage makes it an excellent resource that belongs on every systems engineer's personal or departmental bookshelf.

The SoS issues raised by Jamshidi are tougher to classify.

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The issue of emergence is not yet adequately handled by the traditional systems engineering literature, and so handling SoS as a separate sub-discipline makes sense for now. The examples from Jamshidi's contributors seem real and insightful, and fully justify a complete read by professionals calling themselves systems engineers.

After these two most recent works have been absorbed into our knowledge base, we might still look forward to a future work that will truly unify Systems Engineering with Complexity Theory, making SoS less a separate sub-discipline than an actual emergent property of systems engineering itself. Perhaps that work will come full circle and have to call itself a Systems Philosophy.

Education & Participation Opportunities

Need a Refresher on Requirements?

Download the Good Requirements Reference Card from Compliance Automation.

Rick Biehl, INCOSE Orlando member and Senior Consultant for Data-Oriented Quality Solutions offers a requirements reference card, which can be downloaded here.

Agile Development Practices Conference
November 9-13, 2009
Rosen Shingle Creek Resort, Orlando, FL

OOPSLA 2009
October 25-29, 2009
Disney's Contemporary Resort, Orlando, FL

Our chapter is well represented in the conference program: Rick Biehl will be presenting his "Ontology-based Dimensional Data Warehouse Design" at the *Ontology-Driven Software Engineering* workshop on Sunday, Oct. 25th; and Jeff Bryson will be presenting his "Polymorphic System Architecture Summary" in the *Innovation in Progress* session on Tuesday, Oct. 27th at 4:30. Both topics have been initially presented at our monthly meetings this year.

Board Approves Reimbursement of UCF Parking Fee

The Institute for Advanced Systems Engineering (IASE) located in the College of Engineering at UCF is home to cross disciplinary research and education in systems engineering. IASE provides the latest systems engineering tools to help industry leaders and university experts in conducting leading-edge research projects. Tools available include: IBM Rational Software Architect (RSA), EmbeddedPlus SysML toolkit for RSA, EmbeddedPlus Simulation toolkit for RSA, AnyLogic, Vensim, Telelogic DOORS, EmbeddedPlus Doorkeeper, Telelogic Systems Architect, Telelogic Logiscope, IBM Rational ClearCase, IBM Rational ClearQuest, Telelogic Tau, and Telelogic Rhapsody. To use the lab, contact Dr. Serge N. Sala-Diakanda, Engineering Building 2, Phone: (407) 823-3052, E-mail: serge@mail.ucf.edu.

Our Chapter representative will continue to work with Florida government officials to move IASE into the Partnership building in Research Park. In the meantime, INCOSE Orlando members using the lab are reimbursed the $5 UCF parking fee. Simply present parking receipts to the Chapter Treasurer.

Upcoming Tutorials

Don't miss out on this great opportunity for local training at a reasonable rate!

Tools to Ensure the System includes the Human
Presented by Jennifer McGovern Narkevicius
Friday, November 21st

Systems are developed to extend or enhance the capabilities of humans; therefore Systems Engineering (SE) must accurately represent humans in systems. Human Systems Integration (HSI) merges human considerations within and across all system elements and is an essential enabler to SE practice. To accurately define system requirements, the inherent capabilities and limitations of the user populations, the work environment, and the context in which the system will operate must be analyzed. Incorporating the data from analysis of humans in SE processes contributes to establishing accurate boundaries for the trade space and defining the successful system performance, ensuring that the complete system will perform as envisioned in the operational environment. This includes defining and incorporating requirements driven by people to be in and around the system as well as incorporating the body of knowledge about human contributions to performance into systems engineering practice.

One means of ensuring successful technical incorporation of HSI is to link its tools with the extant tools of SE, yielding richer tradeoffs and improved design and performance of the entire system. Primary HSI tools focus on modeling, requirements analysis and tradeoffs within the human domains. One of the current challenges is that many of the HSI tools do not directly feed or align with SE tools, resulting in data that must be massaged prior to use or integration into related SE tools. This tutorial will focus identifying the using HSI tools in SE process and practice, what data translations maybe required, and the expected utility of the products. The interactive lecture will conclude with a case study in which small groups will "walk through" the process of selecting the best fit tools needed at each phase and identifying the destination of the products throughout the development process.

Take Your Student to Work Day

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