June 2016 Newsletter

INCOSE San Diego CHAPTER

Newsletter Highlights:

- ✓ Our INCOSE heritage
- ✓ Two upcoming San Diego tutorials
- ✓ Highlights from Western Regional Mini Conference
- ✓ Resisting the Urge to "Optimize" Healthcare Delivery

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From the President:

Our INCOSE Heritage.

In our first 2016 newsletter I wrote that we would highlight some enduring concepts of systems engineering embodied in our INCOSE heritage in this series. Our organization started nationally in 1990 due to the shortage of qualified engineers who were able to think in terms of the total system rather than just their specific disciplines. I'd like to recognize a few of its key early people and their enduring ideas. See the picture below of the 1994 inaugural issue of our Systems Engineering Journal.
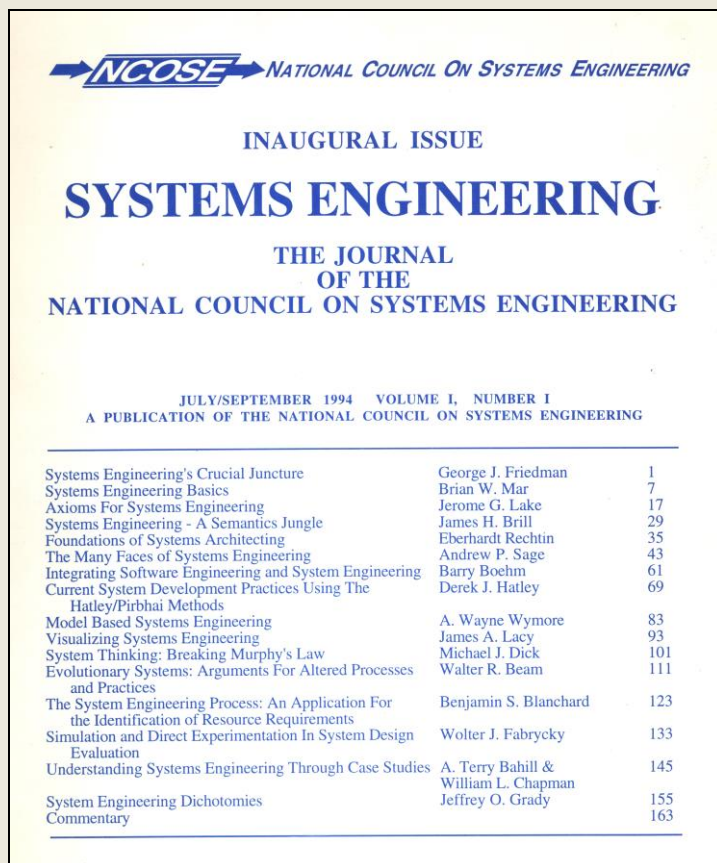
During my systems engineering academic upbringing, I was most fortunate and honored to have been taught systems engineering principles by INCOSE founders and pioneers at this very time. Two of my Ph.D. committee members, Eb Rechtin and Barry Boehm, contributed to this inaugural issue.

Our own local member and INCOSE pioneer Jeff Grady also contributed to this first issue. Furthermore, he was in charge of the journal and chosen as its first editor.

The late Eb Rechtin defined the field of systems architecting. One of his ideas was that successful systems engineers must employ art with science. His accomplishments and honors were enormous. Previously he was architect of the Deep Space Network at JPL, then served as President and CEO of the Aerospace Corporation. He then came to USC and founded the systems architecting program and co-founded INCOSE. He was writing his book *The Art of Systems Architecting* during the time I took his classes, which helped teach me how to think about complex systems.

It would seem that once system requirements and architecture are defined, powerful analysis tools (e.g. MBSE today) can be used to complete the building of a system. In the article "Foundations of Systems Architecting", Rechtin explains this mechanistic approach doesn't work out for large, unprecedented complex systems. There are too many "to be determined (TBDs)", placeholders, uncertainties and stakeholders early on.

Analysis alone can't solve complex engineering problems, so we can also use heuristics to ease the solution. They comprise descriptive lessons learned, prescriptive problem solving guidelines, warnings and tricks of the trade. Heuristics are thus informal, rules-of-thumb determined by experience. They embody common sense, intuition and are applicable across system types. Good heuristics will be resilient across different scenarios but must be interpreted in context.

Science and art historically overlap in architecture to achieve pleasing solutions, but a practical part of the systems engineering art comes from past experience codified into heuristics. Here are some time-tested examples from *The Art of Systems Architecting*:

- Don't assume that the original statement of the problem is necessarily the best, or even the right one.
- Build in and maintain options as long as possible in the design and implementation of complex systems. You will need them.
- In partitioning, choose the elements so that they are as independent as possible; that is, elements with low external complexity and high internal complexity.
- Simplify. Simplify. Simplify.

Space constrains us from providing full detailed examples, and I encourage you to read Dr. Rechtin's classic book. You probably have personal experiences that validate these as useful heuristics to keep in mind.

Fortunately our co-founders had good foresight, hard knocks of experience, and heuristic thinking to define our professional niche and some enduring principles. From these recent beginnings we now have over 10,000 international members. Each should keep in mind that not everything is computable in the big picture.

In the next newsletter I will continue by highlighting the contributions of Barry Boehm for integrating the systems engineering and software engineering disciplines.

- Ray Madachy

Upcoming Events

Membership meetings are open to all. They are held from 6:00-7:00pm at Giovanni's Restaurant in Kearny Mesa. The address is 9353 Clairemont Mesa Blvd, San Diego 92123.

There is an optional buffet between 5:00 and 6:00 ($5 for members, $10 for non-members). Reminder emails shall be sent.

➢ **June 15th** – "UAV Cybersecurity", Andy Von Stauffenberg, VSTAR Systems. The UAV industry is lifting off. While many technology companies are designing the next exciting products, Cybersecurity is not well understood or is even overlooked during the design phase. This presentation will go over some of the types of attacks we see now, and might see in the future, in order to raise cybersecurity awareness. By designing security into the system from the beginning, we as Systems Engineering professionals can prevent such attacks from happening when the system is fielded.

➢ **No July or August general membership meetings**. Enjoy your summer.

Upcoming Tutorials in San Diego

➢ **July 23rd – Systems of System (SoS) Development Lifecycle Process.** This $3^{1/2}$ hour tutorial will be given by Dr. Jo Ann Lane at the UCSD extension. Details are forthcoming and will be sent via email.

➢ **October (exact date forthcoming)** – **Data Science for Systems Engineering.** Have you heard of Big Data? You will soon. The planet is virtually swimming in data – **estimates are that the world's information is more than doubling every two years** – and the race is on to design and implement data analytic systems to capture and computationally analyze this data, to reveal patterns, trends, and associations, especially relating to human behavior and interactions. As systems engineers, we need to understand the software options, engineering challenges and driving factors behind this relatively new domain.

To this end, we are currently working on a tutorial on Big Data, to be given by Dr. James Short of the UCSD San Diego Supercomputer Center. This tutorial may eventually become part of an international course, titled *Data Science for Systems Engineering*, on *edx.org*. The tutorial will be an accelerated version of the course.

Fall INCOSE San Diego Mini Conference

This year's INCOSE San Diego mini-conference will be held on November 5th, 2016. Calls for papers will be announced in early July – watch your email. The mini-conference's location, speakers and cost will also be announced via email and in the upcoming September newsletter.

Coming Soon – A New INCOSE San Diego Website

Our new webmaster and board member Andrew Bonica has been working diligently to revamp our local website. This was necessary to take advantage of the latest web page software tools, including WordPress. The new site is expected to go live over the summer – stay tuned!

Upcoming USS Midway Event

The INCOSE San Diego board is hopeful to will have our USS Midway event in late September or early October. However, some of the organizations who partnered with us last year for the event may not do so this time – we are therefore currently looking for alternative partners. Please stay tuned while we carry on our efforts to continue this annual fun and exciting event.

Upcoming 26th INCOSE International Symposium

This year's Annual **INCOSE International Symposium** will be held in Edinburgh, Scotland, from July 18 to 21, 2016. This conference attracts an international mix of professionals at all levels, including government, industry, educators and researchers. The conference will be held at the Edinburgh International Convention Centre (EIEE). Please see their website at http://www.incose.org/symp2016/home.

New Members

INCOSE San Diego is pleased to announce the addition of five new members to our chapter since March. Please welcome the following individuals:

▪ Sudha Kundathil Mohanan – *HCL Technologies*
▪ Philip Parlin – *Department of Navy Civilian*
▪ Kathy Tran – *Booz Allen Hamilton Inc.*
▪ Duncan Palmer – *Booz Allen Hamilton Inc.*
▪ Saurav Suman – *Parker Aerospace*

We hope to meet each of you at the many upcoming INCOSE events!

Postcards from the Western Regional Mini-Conference

The western RMC was held in LA at Loyola Marymount University, April 9-10. **Below are excerpts from the LA Chapter's newsletter**:

The 2016 Regional Mini-Conference was an impressive success and provided value for those who attended. "Value" came in many forms, starting with the presentations, and was quickly buttressed by the tutorials, formal presentations, and panel discussions. The contributions and efforts of the sponsors and exhibitors, combined with the hours of tireless effort on the part of the volunteers and the graciousness of our host – Loyola Marymount University – all resulted in the success of and satisfaction with the conference.

Keynote presentation by USC's Professor Azad Madni

Co-chairman Dick Emerson

Mr. Dick Emerson stated "One of the tacit assumptions about systems engineers is that they are life-long learners. They take this position because, from the perspective of systems, all things are related, changing and evolving. They also take this position because the application of systems engineering is expanding into new industries and fields. Industries and fields that have now become complex and adaptive. "

"This conference is dedicated to the engagement, education and expansion of Systems Engineers and those who have the potential to become Systems Engineers."

Dr. Azad Madni's keynote address was title "Models, Stories, and Immersive Experiences, Systems Engineering in the 21st. Century." This is the subject of Dr. Madni's forthcoming book entitled, "Transdisciplinary Systems Engineering: Exploiting

Convergence in a Hyperconnected World." In his keynote, Dr. Madni suggested that systems engineering is in the midst of a much-needed transformation and argued for a new mindset that embraces holism, self organization, agility and resilience, and disciplinary convergence. He emphasizes ongoing disciplinary convergence as a movement that needs to be exploited to attack problems that are deemed intractable today. He concludes with projections of how convergence in systems engineering is likely to unfold in the future, centered around Model Based Storytelling.

"Integration of MBSE Tools" moderator Dr. Mark McKelvin

Activities on Sunday picked up where Saturday's activities left off. The morning started with a panel discussion, "Integration of MBSE Tools." The moderator was Dr. Mark

McKelvin, and the panel members were Dr. Curtis Iwata, James Horejsi, Steven Jenkins, and Dr. Barclay Brown. Dr. McKelvin's opening remarks set a lively and challenging basis for the discussion. Several insights with respect to the utility – and limitations – of tools were shared and discussed.

Recent INCOSE San Diego Presentations

We had two excellent presentations during the months of March and May:

Ms. Ellen Cheng presented *Design Thinking to Define Systems in a Constrained Environment*, an approach to understanding the needs of users and businesses and in setting design pace based on market and cost constraints. You can download can the presentation at www.sdincose.org/march-2016-chapter-meeting.

Jim Gottfried presentation, *Effective Risk Management And The Role of the System Engineer*, provided a very comprehensive overview of this important systems engineering topic. Download at www.sdincose.org/may-2016-chapter-meeting.

Resisting the Urge to "Optimize" Healthcare Delivery

By John Wood, PhD, GCorp Health Solutions

Driven by the passage of the **Patient Protection and Affordable Care Act in 2010**, several publications were released as a call to arms for applying systems engineering fundamentals within the healthcare industry. These included the 2013 Institute of Medicine and the 2014 National Academy of Engineering's *Systems Approaches for Improving Health Innovation Collaborative* and the President's Council of Advisors on Science and Technology report titled *Better Health Care and Lower Costs: Accelerating Improvement through Systems Engineering*. Systems Engineering is an interdisciplinary field that focuses on how to design and manage complex systems over their life-cycles. Systems engineers have proven their specialized tools and techniques with much success in several industries including manufacturing, education, and aeronautics. As such, leaders in these industries can now more effectively leverage their data to achieve improved reliability, quality, and efficiency.

The aforementioned publications suggest that systems engineers may be able to similarly benefit healthcare leaders. Indeed, as healthcare leaders become more aware of the success cases occurring in other industries, the more often they query, "What is systems engineering and what can it do for me?" In response, systems engineers have a tendency to dive into a discussion on how they would "optimize" the efficiency of healthcare delivery. But one must ask, "To what end?"

To fully understand the impact of "optimization" in the healthcare domain, one must first appreciate that efficiency in this industry is notoriously difficult to measure. In 2009, a Health Services Research systematic review of efficiency measures identified only six measures out of 265 that contained evidence of their reliability and validity. Further, effectivity within healthcare requires discerning what patients need and want—both of which pose significant challenges to the current healthcare system. These challenges are exacerbated as the near-constant barrage of new tests and treatments are fielded alongside older ones with scarcely any regard for their full benefits and harms to patients.

At the same time, patients often receive care they would not have selected had they been fully informed of the benefits and harms associated with each of the available treatment options. Facts such as these have led experts to estimate that as much as one-third of all medical care may be inefficiently allocated, with wide variation among resource inputs (e.g., hospital beds, diagnostic equipment, primary and specialty physicians per capita, etc.) and little to no consistent correlation between those inputs and the quality of patient outcomes.

In the face of these challenges, systems engineers would be irresponsible in attempting to "optimize" healthcare delivery under the (faulty) assumption that patient needs and wants are well-established signals. By doing so, systems engineers would increase the rate of wasteful spending occurring within the U.S. healthcare delivery system and simultaneously create ethical dilemmas for both patients and providers. Does that mean there is no place for systems engineering in healthcare? No, but prior to offering solutions, systems engineers must ensure they understand the unique aspects of the industry (e.g., general classes of treatment types, healthcare ethical values, reimbursement mechanisms, etc.). Only then will systems engineers be able to wield the tools of their trade judiciously and, as a result, maximize healthcare's benefits while minimizing its harms.

To learn more about healthcare's unique challenges and opportunities, please contact John via email at john.wood@gcorpconsulting.com or visit their website at www.gcorpconsulting.com/health.

Chapter Presentation Schedule for 2016

The following are our remaining chapter membership meetings for 2016:

Chapter Dinner Meeting Speakers			
Month	**Title**	**Author**	**Affiliation**
15-Jun	UAV Cybersecurity	Andy Von Stauffenberg	VSTAR Systems
July	*No Chapter meeting due to Tutorial*		
Aug	*No Chapter meeting - summer break*		
21-Sep	Beware the Cloud *Note: As a field trip to SDSC*	Dr. James Short	San Diego Supercomputer Center
19-Oct	Using SE for Transportation Research	Randy Woolley	
Nov	*No Chapter meeting due to Mini-Conference*		
Dec	*No Chapter meeting due to Chapter Social*		

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