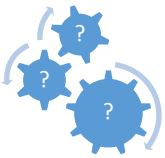
INCOSE ENCHANTMENT CHAPTER

The Enchanted View

Thinking about Systems

2019 Quarter #4



President's Message:

Back to School with NM Tech

Heidi Hahn
Chapter President

As many of you are aware, the Chapter has had a collaborative relationship with New Mexico Tech (NMT) for several years. That relationship created the opportunity for the first Socorro Systems Summit, which was held on the NMT campus in 2016, hosted by Dr. Aly El-Osery, Chair of the Electrical Engineering Department. At that first Summit, several of the Chapter Board of Directors members also met Dr. Frank Reinow, Chair of the Engineering Management Department, and became engaged in conversations about how the Chapter could increase our engagement with NMT consistent with the Chapter's strategic goal to increase regional interactions.

One idea was to start a Student Division at NMT – and there appeared to be interest in that among the graduate students that Aly enlisted to help with the 2019 Summit. The other was to have Chapter members serve as adjunct faculty members. Now that I have retired from Los Alamos (and only infrequently have to go "Up to the Hill" for service on a committee there), I have accepted a position as an Adjunct Professor of Engineering Management and am currently teaching a graduate-level course in project management – with a little systems engineering thrown in, of course, consistent with my philosophy about the systems engineering and project management lifecycles existing in parallel for the life of a project. I am pleased to be ably assisted in teaching this course by Ann Hodges, Chapter Secretary.

Next semester, I will be teaching a graduate-level systems engineering overview course – this time with a little project management thrown in. This will truly be an overview – best suited to early career systems engineers or more seasoned discipline engineers who are just starting out in SE. In this course, we will take an integrated view of activities performed and artifacts produced throughout the project and systems engineering lifecycles. A simple team project will enable students to gain experience producing relevant artifacts from the systems engineering, project management, and quality management perspectives. Specifically, students will produce a project plan, Work Breakdown Structure, mission and needs analysis, requirements matrix with measures of performance and verification and validation plans, and a trade study. A formal course announcement will be posted on the Sandia and Los Alamos web sites and on the NMT web site when the course becomes available for registration. Students will need to register directly with NMT. Questions? Contact me at drsquirt@outlook.com or Dr. Reinow at frank.reinow@nmt.edu.

I am sure that Dr. Reinow would welcome additional engagement from Chapter members, so please contact me or Chapter Vice President, Robin Reynolds, who chairs the Regional Interaction goal for the chapter, if you have ideas for improving our interactions with NMT (or anyone else in the region!).

And Meanwhile at UTEP

The Society of Industrial and Systems Engineers (SISE) joint student chapter of INCOSE at UTEP reports that they took a Tech Tour earlier this year to Seattle, visiting several sites including the Boeing and Microsoft Headquarters. Beside plant tours and networking, they took in the Space Needle and a Seattle Sounders FC soccer game.

Back home and back to work, SISE collaborated with the Texas Manufacturing Assistance Center and the UTEP College of Engineering on Lean Six Sigma Green Belt Certification. More than twenty students learned the use of statistical tools and project management concepts.

Security and the Future of Systems Engineering (FuSE)

by Rick Dove,
Paradigm Shift International

Note: The following is a recap of one of two topics presented at the recent 2nd Annual SE Challenge Event. The entire event is posted on the Chapter Library page.

Security Challenge: Profiling the Operating Environments: What are the nascent evolutionary trends in the systems security environment that will shape necessary response capabilities in the Future of Systems Engineering? This is a question about the dawning problem space, not about solution strategies and tactics.

Topic Context: The Future of Systems Engineering (FuSE) is an INCOSE led multi-organization collaborative project with a key concern about the nature of systems security in that future. The futures of SE and of systems security are determined by the nature of the environments in which they will operate. Those environments are the fitness functions that will naturally select compatible approaches, and select out those which aren't compatible, with prejudice.

No need to guess at what those environments will look like. William Gibson's famous statement makes it clear: "The future is already here, it's just not evenly distributed"… yet.

A system interfaces with, and interacts with, its operating environment; and remains viable (capable of working successfully) and relevant (appropriate to current desires) only to the extent to which it is operationally compatible with the current order (its operating environment).

Cyber-Physical-Social systems: The social dimension will play a major role in the future of systems engineering, with key implications for system security. The social dimension deals with symbiotic collaborative relationships among components in a System of Interest (SoI) as well as among the SoI and its encompassing SoSs (components include software, hardware, and people).

Strawman profile of SE and Security Operational Environments, presented for discussion

Need: A short general list that encompass key necessary considerations.

Intent: Irrefutable considerations that can achieve broad consensus.

FuSE General SE CURVE	FuSE System Security CURVE
Caprice	
• Survivability (i.e., current order compatibility) • Occurrence and nature of emergent behavior • Game-changing technologies • Availability of symbiotic social relationships	• Innovative attack method • Dependency cascade • AI employment, quantum computing • Collaborative symbiosis (failed and new)
Uncertainty	
• Relevance (i.e., fits current desires) • Cohesion in the greater SoSs (multiple) • Integrity & symbiosis of social relationships.	• Cost vs perceived value (both sides) • Broken physical relationships • Broken/weakened social relationships
Risk	
• Viability (i.e capable of working successfully) • Cohesion among constituent parts	• Inadequate design consideration & execution • Addressing adversity effectively
Variation	
• Operational environments • Social compatibility	• Peer behavior, breech criticality • Social priority conflicts
Evolution	
• Toward more op environment complexity • Toward more SoI complexity • Toward shorter SoI static viability • Toward new technology options • Toward new malevolent threats to viability • Toward greater social involvement.	• IoT in general, external SoS • Component technical scope, internal SoS • Growing attack community (skills and scope) • Increasing technical innovation • Increasing perceived attack value • DevSecOps, increasing connectivity

Discussion notes follow, with some elucidation

- Note taken: "*Variation aspect – social compatibility with systems and components – SE perspective?"* This discussion began with the traditional "human" social interpretation, and was broadened to reflect the profile's intent of recognizing that systems components of all types (software, hardware, people) have collaborative and teaming social relationships. The strength and integrity of these "component" social relationships varies with system operational context and varies across time within a given context. In security there is a particular concern about the sharing of information among knowledgeable humans, and there is the collaboration between human and system about the meaning of anomalous behavior detection.
- Note taken: "*Health – components/nodes comparing notes of "community", common in ad hoc networks. More common, more necessary."* This discussion dealt with some examples of component social relationships and recognized that the FuSE environment will make greater use of such relationships. Ad Hoc network nodes already collaborate on the health of neighboring nodes. Autonomous systems are beginning to collaborate with each other about the nature of their collective operational environment and behavior of their "teammates" (driverless vehicles, drone swarms, robot teams).
- Note taken: "*How critical is a breach? Behavior monitoring – local vs. global perspectives on criticality. Security systems monitor for threats (components or human). Timing – how critical now? Is it a breach or a denial of service?" Consequence evaluation – known vs. unknown.* Discussion centered on the security profile variation elements. The "social priority conflicts" recognizes that the consistency of a social relationship collaboration varies with competing individual priorities of the moment.

Not For Women Only:

The Manhattan Project and the Names We Don't Know

by Heidi Hahn

Here's an interesting article from the Smithsonian Magazine about female scientists who got little recognition for their accomplishments during their time:

https://www.smithsonianmag.com/science-nature/unheralded-women-scientists-finally-getting-their-due-180973082/

Add to that some ladies from the Manhattan Project to give this a New Mexico twist. From the LANL external web page: In 1943 Manhattan Project leaders J. Robert Oppenheimer and General Leslie R. Groves scoured the country looking for anyone that would help achieve their goal: to end World War II by building a "gadget" that exploited the newly discovered phenomenon of nuclear fission. They did not discriminate; women or men, young or old, Ph.D. or technical experience—all were considered if they had something to contribute.

Indeed, to maximize the productivity of the small Los Alamos population, couples that both had valuable skills were particularly prized.

One such valued couple included physicist Elizabeth "Diz" Riddle Graves - one of only a few scientists in the country who had experience with fast-neutron scattering and a device called a Cockcroft-Walton accelerator. She had received her doctorate in nuclear physics at the University of Chicago; however, she was working only as a volunteer researcher at the University of Texas in Austin because her husband Alvin's faculty position there precluded her from paid employment in the same department. Both Elizabeth and Alvin went on to play important roles in the development of the "gadget."

A significant effort was also made by the Project leadership to recruit locally. Agnes Naranjo (later Naranjo Stroud-Lee) was a member of the Santa Clara Pueblo who came to Los Alamos in 1945 when she finished her Bachelor of Science degree at the University of New Mexico.

As a research technician in hematology for the Manhattan Project, Naranjo gained valuable work experience studying the effects of radiation on blood—something that ultimately shaped her career after the war. She returned to school, earned a Ph.D. in zoology, and pursued a career in radiation biology and cytogenetics.

She went on to serve as director of the Department of Tissue Culture at the Pasadena Foundation for Medical Research and was a senior scientist at the Jet Propulsion Laboratory, also in Pasadena, California, before returning to Los Alamos to be a radiobiologist in the Lab's Mammalian Biology Group.

Physicist Elda Anderson was recruited to Los Alamos from Princeton University, where she worked in the Office of Scientific Research and Development. She is credited with preparing the first sample of nearly pure uranium-235 acquired by Los Alamos for experimentation.

Mathematician Naomi Livesay was working as a teaching assistant at the University of Illinois in 1943 when she received an invitation to join the Project. She supervised the use of the IBM computer used to calculate the predicted shock wave from an implosion-type bomb.

"One of our shock-wave calculations took us nearly three months, working six days a week, 24 hours a day, two operators per shift," describes Livesay in her unpublished memoir.

Beyond the scientific work, many other women played important roles as part of the Project, including Dorothy McKibben, who ran the office at 109 East Palace Avenue in Santa Fe that served as a gateway to the then-secret laboratory.

When President Truman made a statement revealing the Manhattan Project he said, "What has been done is the greatest achievement of organized science in history. It was done under high pressure and without failure."

This achievement is a tribute not just to the famous scientists whose names we all know, but also to the thousands of women and men – many of them from Northern New Mexico – whose stories are less well known, but no less necessary.

For more information on the women scientists of the Secret City, read the full story in 1663 – the Laboratory's science magazine or come to the March 12, 2020 presentation by Georgia Strickfaden (a local tour operator, who developed this presentation for the NM Historical Society) titled "Girls of Las Vegas (NM) in the Manhattan Project." Details to follow as the event gets closer.

Inspiration usually comes during work, rather than before it. – Madelaine L'Engle

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⌖ Thinking about Systems ⌖

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Recordings of past chapter meetings are stored in the chapter's website library at: https://www.incose.org/incose-member-resources/chapters-groups/ChapterSites/enchantment/library-and-resources

What You Missed…

Recent Chapter Meetings

by Ann Hodges,
Sandia National Labs

❖ **JULY 2019: Dr. Heidi Hahn**, ESEP and Senior Executive Advisor to the Associate Laboratory Director for Weapons Engineering at Los Alamos National Laboratory, and **Ann Hodges**, CSEP and Distinguished Member of Technical Staff at Sandia National Laboratories, presented ***Systems Engineering for Early Stage R&D Working Group Update***. An INCOSE Early Stage Research and Development Working Group (ESR&D WG) is in the process of being formed, and several Enchantment Chapter board members are in the thick of it! Heidi Hahn and Ann Hodges teamed with Nick Lombardo of Pacific Northwest National Laboratory and Dr. Mitchell Kerman of Idaho National Laboratory to host an information session at the 2019 International Workshop. Response was overwhelmingly positive, with over 40 people expressing interest. And, although we had thought that most of the interest would come from national laboratories and other Federally Funded Research and Development Centers, a wide spectrum of organizations, including academia and industry, were represented. The presentation discussed the Working Group, and presented some initial thoughts on questions that the Working Group will address.

❖ **AUGUST 2019:** ***Summer Social Event*** – INCOSE veterans and newcomers enjoyed locally brewed beer and barbeque from Kimo's Hawaiian BBQ in the loft of Bow and Arrow Brewing Company in Albuquerque. It was a small but lively crowd. The food, beer and company were all excellent.

❖ **SEPTEMBER 2019:** The ***2nd Annual Systems Engineering Challenge Event*** was held at the meeting room in the Nexus Brewery (do you perceive a pattern here) in Albuquerque. Fourteen SE professionals and guests (including 2 remote participants) explored two SE challenges submitted by chapter members, collaboratively discussing the nature of the challenge and brainstorming suggestions to overcome issues or amplify positive aspects. The topics were a) the Future of SE (FuSE, an INCOSE working group), and b) SE for early stage R&D. For a summary of the first topic, see the separate article on page 2 of this edition.

And If You Want More…

…How About an INCOSE Webinar?

The INCOSE Training Working Group (TWG) presents free SE training webinars for all INCOSE members. To access the latest schedule, slides, and past webinar recordings, log-in to INCOSE Connect, go to https://connect.incose.org/Library/Tutorials/training/SitePages/Home.aspx, scroll down to Systems Engineering Technical Processes, click on the Tutorial ID that you want, and download the files. Past TWG tutorials include: SE Fundamentals, SE Handbook v4.0, and Leadership Skills. (excerpted from INCOSE eNote Vol. 16 Issue 9)

Last Quarter's Found Object Puzzler:
Yes, the "found object" was an act of nature that "found" one of our board members on the road home south of Lubbock, TX. The official term for an intense dust storm comes from the Arabic, "haboob" which means "blasting / drifting" but in Texas, "sandstorm" will do.

photo courtesy of Gary Froehlich

You don't learn to walk by following rules. You learn by doing, and by falling over. – Richard Branson

Coming Up Next

Next Chapter Meetings / Events

by Ann Hodges,
Sandia National Labs

❖**OCTOBER 9, 2019: Randy Anway**, AIA, is a Registered Architect in New York and Connecticut specializing in interdisciplinary architectural design research inspired by natural patterns and systems. Randy will speak on ***Bioinspiration for Future Systems Engineering and Architecture***. "Bioinspired" refers to a range of novel approaches (biomimetics, bionics, biodesign, etc.) to design that make use of disciplined studies of natural systems. Recent and emerging developments in such design methods are enhancing the capacity of engineers and architects to move beyond conventional design set-points and identify effective strategies to address novel problem spaces. This program will provide an overview of the practice of bioinspired design as it may be applied toward future systems engineering and architecture project work. Additionally, practical approaches to near and long-term implementation will be discussed.

❖**NOVEMBER 13, 2019: David Long** is founder and president of Vitech, INCOSE Fellow and ESEP, and 2014-2015 President of INCOSE. David will speak on ***The Future of Model-based Systems Engineering (MBSE)***. MBSE is a term that has become "loaded" with meanings – many not intended in the original concept of MBSE, some of them even contradictory with it and with each other. As originally conceived, MBSE was the practice of basing the systems engineering (be that design, redesign or improvement) on a common, shared model of the system design. But the loading down of the term has resulted in confusion in engineering enterprises about what MBSE is and how it is practiced!

There is a path forward – to an MBSE 2.0 where the hurdles and missteps are behind us. In plotting this path, we don't reject the journey and the progress that has brought us to this point in time. Instead, we embrace them in all their richness – the strengths and successes to reinforce, the challenges to address and resolve. This involves understanding that a broad vocabulary consisting of representations that will communicate to a wide audience of customers and not just to a narrow segment accustomed to one way of representing systems. It requires connecting to a variety of analytical models (e.g. physics-based performance models) without thinking of them as the systems architecture model that makes systems engineering truly "model-based."

The path forward is a return to sound systems engineering principles and practices while incorporating and embracing the enrichment derived from the contributions of the sister disciplines of traditional engineering, software development and the advancing world of artificial intelligence. This is a practical reflection with pragmatic guidance to help us deliver against today's challenges while plotting a path to the greater digital engineering future. Moving towards MBSE 2.0 today allows us to mine the best of systems engineering's fundamentals and the learning of its future.

❖**DECEMBER 11, 2019: Becky Reed** and **Ian Pressland** will present a 2-hour tutorial on ***Why the SEMP (SE Management Plan) is not Shelfware***. Becky is President and CEO of Reed Integration, Inc. and an INCOSE ESEP. Ian Pressland, Charterhouse Systems, is a Fellow of the Institution of Engineering and Technology (FIET) and an INCOSE ESEP.

Yes, Your Very Own INCOSE Trench Coat

Come on, you know you want one... Just in time for the holidays, INCOSE announces the opening of their online store, where you can purchase various types of logo items from mugs to, yes, trench coats.

Unfortunately, there are currently no INCOSE Enchantment Chapter items! How could this be? Perhaps next year we'll brand our own chapter salsa. But for now, you'll have to be content with boldly proclaiming your identity as part of a stylin' global SE community.

To avoid the holiday rush, order now for all your loved ones at: https://stores.inksoft.com/incose_merchandise_store/shop/home

· ***The illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn.*** – Alvin Toffler

INSIDE THIS EDITION

Welcome New Members!

Please welcome the following new members to our Enchantment Chapter!

Valeria Alaniz - UTEP (student)
Jason Farley - UTEP (student)
Elsa Galloway - Sandia National Labs
Howard Morgenstern- *no affiliation listed*
Troy Pacheco - Los Alamos National Lab
Alan Herrera Rubio - UTEP (student)
Kyle Spisak - Sandia National Labs
JoAnna Trujillo - Sandia National Labs

Enchantment now has 128 members. That includes 111 regular members and 17 student members.

Bits & Pieces…

VIDEOS: The INCOSE North Star Chapter (our friends up in Minnesota) has created two new videos that highlight the value of SE and INCOSE. You may want to watch and share these:

- *"INCOSE - A Systems Engineering Community"* - https://youtu.be/u9CFrgVFMKI
- *"INCOSE Intro to Systems Engineering"* - https://www.youtube.com/watch?v=rsjyyI0VfiU

IW 2020: With the summer International Symposium behind us, it's not too early to start dreaming about this winter's International Workshop in Torrance CA. This is your chance to experience and contribute to the SE state of the art. Unlike the International Symposium and other conferences, there are no paper, panel or tutorial presentations. Instead, systems engineers at all levels and from all backgrounds are encouraged to engage in working sessions, and contribute their knowledge and experience to take the discipline forward. See you there?

2020 Annual INCOSE international workshop
Torrance, CA, USA
January 25 - 28, 2020

NEXT TUTORIAL: ***Systems Engineering Principles: Social Aspects*** 17 October 2019, noon EDT, presented by: Michael Watson (NASA MSFC Systems Engineering Office). Systems engineering deals not only with the system, but also the organizational system that develops or operates the system. The systems engineering principles provide guidance on the social aspects of integrating the different engineering and business disciplines in the development and operations of the system. Meeting link: https://incose.pgimeet.com/INCOSE_GMOne.

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Published material does not necessarily reflect the views or opinions of INCOSE, the Enchantment Chapter Board of Directors, or the Editor.

Call or email your news, reviews, announcements, or other contributions and suggestions to the chapter Secretary: Ann Hodges, alhodge@sandia.gov .