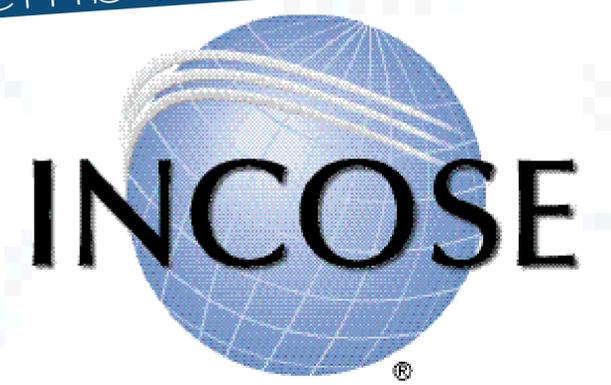


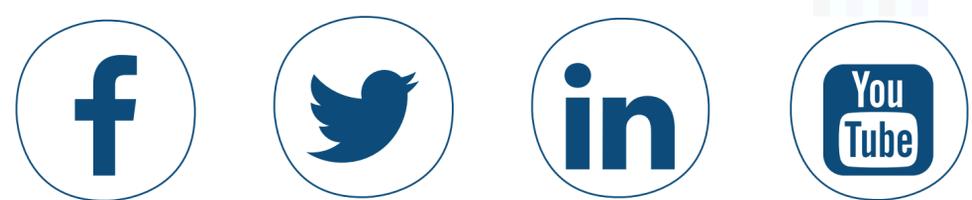
MEMBERS NEWSLETTER

September 2018 - Q3



President's Corner • President-Elect's Letter • Notes from the Board
Sector Updates • Working Group Updates • Academic Council Update
EWLSE Update • Foundation Awards • Socio-Technical Systems Engineering
DevSecOps • My INCOSE Story • Spotlight ON!
Note from *INSIGHT* Editor • Social Media Update • Note from the Editor

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President's Corner

Garry Roedler, garry.j.roedler@lmco.com



As a member of INCOSE since 1994, I have had the opportunity to attend the majority of the INCOSE symposia. The INCOSE International Symposium (IS) has always been the highlight of the year for me with respect to not only INCOSE events, but all engineering events. This year, the IS was exceptionally engaging and impactful, really hitting a high mark that set the gold standard for future events.

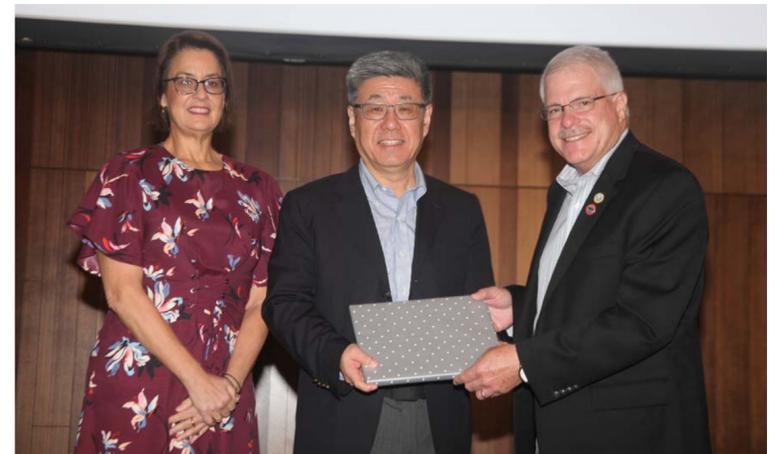
The IS attracted a record number of attendees. With nearly 1,100 attendees, a new record attendance was set, surpassing the previous record of 875 attendees at the IS in Seattle in 2015. We are grateful to the Events Committee, Technical Operations, KMD Partners Events Management, other INCOSE staff, and the large number of volunteers, who worked together in what looked to us as a seamless effort to provide an extraordinary event. Additionally, we are grateful to all the professionals who submitted papers and those who had the opportunity to present in a paper session or panel or who were engaged in one of the other sessions, such as the Practitioner's Challenge. Thank you to all who had any role in IS 2018 – you truly made it a success.



As INCOSE continues to focus on the evolution of the systems engineering discipline for the future, the IS program was designed to have a significant amount of forward-looking technical content. This included panels, innovative content sessions, great paper presentations, a thought-provoking practitioner's challenge, and keynote speakers that had messages to make us think. There was also a Model-Based Systems Engineering Lightning Round. Many of these sessions have videos that are in the process of being posted. Look for these over the next month as they get posted on the INCOSE website.

IS 2018 had a diverse set of dynamic keynote speakers. These included:

- Dr. Xin Guo Zhang, EVP and CIO of the Aviation Industry Corporation of China, discussed the co-evolution of complex systems and complex systems engineering. He showed that there is a need to evolve how we perform systems engineering as the systems we engineer continue to grow in complexity, now fielding systems that are highly interconnected and part of one or more systems of systems.
- Langdon Morris, Senior Partner of InnovationLabs, addressed the role of systems engineering for dealing with the systems of the future that are increasingly more complex and interconnected. His talk painted a picture of the future economy and showed that there is a need to evolve how we perform systems engineering as the systems we engineer continue to grow in complexity and interconnectedness. The audience resonated with the need for systems engineering to help deal with the challenges of humanity.
- Kristen Baldwin, Acting Deputy Assistant Secretary of Defense for Systems Engineering, provided a presentation on the use of systems engineering to ensure national security. She clearly showed that systems engineering is essential for the future of defense missions and programs. Systems engineering is becoming an even more important element for ensuring the right systems and systems of systems are in place, the systems continue to become more complex, interconnected and driven by new technology. So there is a need to evolve our practices, tools, methods, competencies, and workforce development to be effective.
- Dr. Barbara Kellerman, Lecturer in Leadership at the Harvard Kennedy School, spoke about the challenges and evolution of leadership. She showed that the challenges are seen across all types and size organizations in all sectors and the impact of changes in culture and technology are seen in our daily experiences. Her presentation included ideas on how to be an effective leader.



There were a significant number of panels that explored the future direction of systems engineering. The following are some of the forward-looking panels that were featured at the IS. The first four of these were recorded, so the videos will be posted.

- The Impact on Systems Engineering from Future Technology Advances
- Future Directions of Systems Engineering Research

President's Corner

- Systems Engineering: Taming the Inevitable Controller of Capabilities
- Systems Approaches to Governance and Policy
- Government Interagency Panel on Systems Engineering of the Future
- Is Systems Engineering Well-Equipped for the Fourth Industrial Revolution?
- Complex – Agile – Open: The Shape of Future System Realization
- System of Systems Engineering – An Approach to Agile Systems Engineering?
- Exploding the Boundaries of Systems Engineering
- Accelerating Innovation Effectiveness

This year was the 5th year we had a Practitioner's Challenge. This year it focused on "Applying Systems Thinking and System of Systems Engineering to Innovation Systems." It provided a chance for symposium participants to work together in a collaborative manner to demonstrate how systems engineering can address and support global solutions. There was very positive feedback on this challenge from the participants.

We were fortunate to be able to release two superior new products – the INCOSE System Engineering Competency Framework (ISECF) and the INCOSE System of Systems (SoS) Primer.

- The ISECF was developed through a multi-year industry collaboration. It is aligned with the current knowledge base for SE, including ISO/IEC/IEEE 15288, System life cycle processes, as well as the INCOSE SE Handbook. It also leverages the previous work from several models used across the industry. More information on the INCOSE SE Competency Framework can be found at: <https://www.incose.org/products-and-publications/competency-framework>. It is also available for free to all in the [INCOSE Store](#).
- The SoS Primer is an 8-page foldout that was developed to provide an introduction to systems engineers and others regarding SoS. It is also available on the [INCOSE Store](#).

Additionally, there were great opportunities to engage

some of the various initiatives the INCOSE supports, including a strategy workshop for the Future of Systems



Engineering (FuSE) initiative; the Empowering Women Leadership Forum: Embracing Systems Engineering Leadership Diversity; and a special session on Science, Technology,

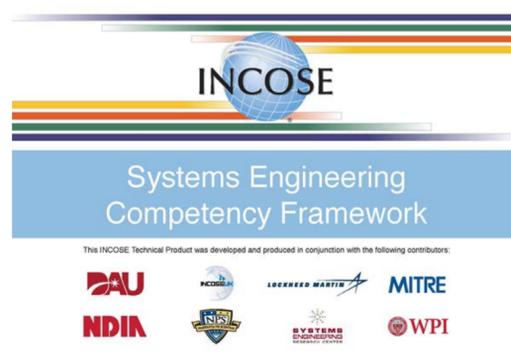
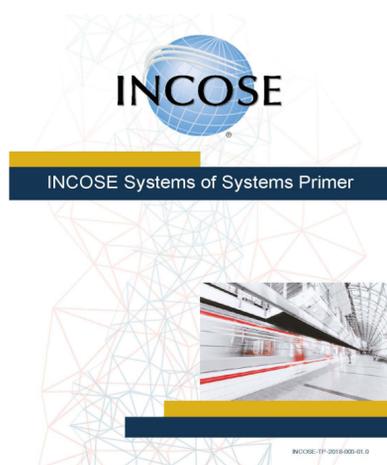
Engineering, and Mathematics (STEM), among others.

And it was my honor to provide awards to a number of very deserving individuals and teams, including two Pioneer Award winners for their significant accomplishments and contributions to systems engineering. These included Dr. B N Suresh, recognized for his pioneer work in Space Systems Engineering as the backbone of some successful launches by ISRO (Indian Space Research Organization), and a posthumous recognition of James Long, one of the founders of INCOSE, for his substantial and relevant pioneering contributions in model-based systems engineering (MBSE). Congratulations to all of our INCOSE Award winners.



Finally, IS 2018 was absolutely great for networking, not only due to the record number of attendees, but also from the evolution of the event to enable meeting people and getting engaged. There were top-notch social events and the banquet was held at the National Portrait Gallery.

If you were fortunate enough to have been at the INCOSE IS, I truly hope you enjoyed it as much as I did. If you were not able to attend, there is a wealth of resulting artifacts from the IS for you to explore. Please take some time to look at a few of the papers in the proceedings, view the recorded content, or review the outcomes of the various other activities. And most of all, get engaged in the many opportunities in INCOSE – make a difference!



Launched at 28th Annual International Symposium in July! Now Available



INCOSE

INCOSE Systems of Systems Primer



INCOSE-TP-2018-003-01.0

Systems of Systems Primer

The SoS Primer is intended to reach a broader audience. The primer will serve as an effective introduction to the SoS area, while also providing a roadmap for the reader on where to find additional information.

[Learn more and download your copy!](#)

Competency Framework

The INCOSE Competency Framework provides a set of 36 competencies for Systems Engineering within a tailorable framework that provides guidance for practitioners and stakeholders to identify knowledge, skills, abilities and behaviors crucial to Systems Engineering effectiveness.

[Learn more and download your copy!](#)



INCOSE

Systems Engineering Competency Framework

This INCOSE Technical Product was developed and produced in conjunction with the following contributors:



INCOSE Technical Product Reference: INCOSE-TP-2018-002-01.0

President-Elect's Letter

Kerry Lunney, kjlunney@tpg.com.au

What's In A Name – You Will Be Surprised!

Hello All,
I hope that those who were fortunate to attend and participate at IS2018 in Washington DC found the symposium informative, perhaps thought-provoking, interactive, and of course fun to be part of. I thank everyone for making this a successful event.

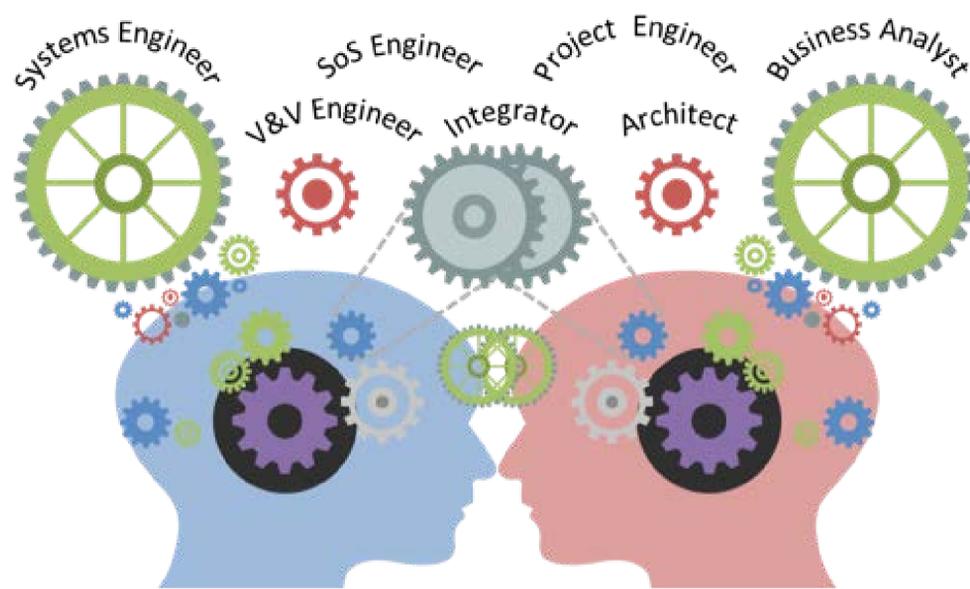
I was wondering what to write about in this edition and I thought I would share with you my experience with the challenge of recognisable terminology across different industry/domains and between various disciplines. It appears as “people of systems” (whether called engineers, architects or some other title), it has become part of our skillset to interpret the technical language employed in delivering solutions for different domains and/or disciplines. I would never have thought I could “speak another language” but it appears that I do so, more and more every day.

Over the last 10 years I have found the diversity in terminology quite interesting, but nothing more. It has not been a road block for me nor altered the execution path of a project, tailored appropriately to meet the needs. However for some it can be significant and even lead to heated discussions. Countless times I have had members of technical teams state “we don't follow a systems approach” or “that only works for engineering projects, and I'm in ICT.” Likewise, “we don't have Systems Engineers, we have Architects” is often a subject of debate. Same can apply in the world of Civil and Construction with Business Analysts and Project Engineers.

OK – this is fair enough. But then ask the question, what is the responsibility of each role and how are these responsibilities executed? When the practices are described they will sound very familiar and with the right translation can be illuminating for the “Architects,” “Business Analysts,” and others in various non-traditional systems Engineering domains. The different titles and terminology are masking similar/same activities as commonly described by systems engineering.

Likewise, across diversified domains, ask what the contractual obligations are for a specific project, including the deliverables. Some mistake a “heavy engineering approach” as evident by the number of deliverables. This is often not the case, just a direct result of contractual commitments in a complex delivery framework, largely influenced by the client itself. It may be considered a “tailoring up” of a standard systems engineering approach.

So why is the diversity in terminology a problem or even considered a “big deal”? Do we wear our titles and roles as a measure of our expertise and speciality? The answer I would say is “yes.” If we recognise this we can better understand the importance some people place on the technical language of various domains and/or disciplines.



You may ask “what's in a name?” Well, for some it is of low importance and for others it is not. Either way, as members of INCOSE we need to be conscious of this, and facilitate and support the diversity of domains and disciplines in the world of systems and systems engineering. Our own paths into “all things systems” was varied, so why not help others on this journey?

Cheers,

Notes from the Board

Rachel LeBlanc, marcom@incose.org

The 2018 INCOSE International Symposium (IS) was a big success! We welcomed over 1,000 attendees in Washington, D.C. for nearly a week's worth of meaningful knowledge transfer, technical discussions, and networking. If you were unable to attend the event, please see our YouTube channel to watch the Keynotes and Leadership Plenary (www.youtube.com/incoseyoutube). A huge thank you to the Events Team and all of the volunteers who helped to make the IS so successful!

The Board is diligently undertaking an effort to update our policies. Many new policies were recently approved and can be found on our new website: <https://www.incose.org/about-incose/policies-and-bylaws>. Stay tuned – more policies are in the process of updating. Additionally, there will be a focus on improving our written procedures to allow for more transparency, ease of transitions, and increased consistency.

Budget planning began for 2019. Directors started reaching out to their organizations to build plans and proposed budgets in preparation for the Quarter 4 BOD meeting. Additional Quarter 4 BOD meetings are also underway as the Board prepares for long days in Cape Town, South Africa.

Notes from the Board

New INCOSE appointments:

- Paul Schreinemakers – EMEA Sector Director
- Marilyn Pineda – Associate Director for Professional Development
- Cliff Whitcomb – Editor in Chief for the *Systems Engineering Journal*
- Rob Cloutier – Editor in Chief for the Systems Engineering Body of Knowledge

Sector Updates Americas

Huntsville Alabama Chapter

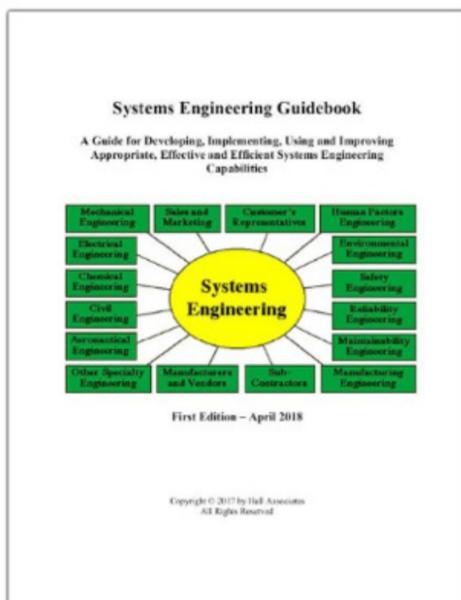
New Systems Engineering Book

Huntsville, Alabama Chapter member David C. Hall, ESEP, has published a new systems engineering book.

Systems Engineering Guidebook: A Guide for Developing, Implementing, Using and Improving Appropriate, Effective and Efficient Systems Engineering Capabilities

(ISBN-13: 978-0-692-09180-7)

Systems engineering, when done optimally for your product(s), can significantly enhance your capabilities and enable your programs or projects to be completed on time and on budget with all required functions, however we note that this is not happening in most cases. To correct this, the Huntsville, Alabama Chapter has designed the Systems Engineering



Sector Updates

Americas

San Diego Chapter

STEM-exPLOSION! A Night of Celebration for our Teachers and Kids

The INCOSE San Diego Chapter invites you to please join us for our 2018 SD INCOSE Science-Technology-Engineering-Math (STEM) celebration event in honor of our San Diego county teachers and students and their STEM projects, sponsored by the generous STEM donations of San Diego corporations, individuals, and INCOSE members!

This year's event will be held at the San Diego Children's Discovery Museum in Escondido, CA. This museum provides hands-on educational exhibits and programs focusing on science, art, and world cultures for over 100,000 visitors including children, families and school groups annually. Come check it out!



Date: Saturday, 13 October 2018

Time: 5-9 PM

Venue & Address: San Diego Children's Discovery Museum, 320 N Broadway, Escondido, CA 92025

Tickets: \$20 Adult/ \$10 children/ \$50 Family Pack (Includes 2 adults and up to 4 kids)/ Kids under 5 free!

Dress Code: Semi-Formal is encouraged (tie optional).

This event includes:

LIVE STAGE SHOWS by the Fleet Science Center, Rigamajig, and Lego Robotics, with hands on activities!

Children's Discovery Museum kids exhibits

Guidebook as a template describing what to do to successfully employ the systems engineering process to implement and apply appropriate (effective and efficient) systems engineering processes and activities.

For a free copy of the e-book, send a request to info@hallassociateshval.com.

Huntsville Chapter Member Inducted as 2018 INCOSE Fellow



The Huntsville, Alabama Chapter selected member Charles Wasson, ESEP, as one of the 2018 class of INCOSE Fellows! Charles is a long time

systems engineering practitioner and educator, and founder and principal consultant for Wasson Strategics, LLC. Among Charles' many impactful contributions to the systems engineering profession is his acclaimed 2nd edition text, System Engineering Analysis, Design and Development: Concepts, Principles, and Practices, published by John Wiley & Sons, Inc. Charles was inducted as an INCOSE Fellow at the 28th INCOSE International Symposium (IS) in Washington, US-DC, in July. Congratulations, Charles!

Editor's Note: You'll see Charles called out in other ways in this issue, and they highlight further how deserving this honor is!



Sector Updates

Americas

Dinner by Kennedy's Karne (veggie and meat options)

50-50 Raffle

Professional Networking with other Systems Engineers

Affordable prices

SPONSORSHIPS: In addition, INCOSE is accepting event sponsorships for STEM grant teachers and students. Please help support STEM recipient school teams – the teacher and 2 students – to attend this event free. You can sponsor a student or teacher for \$20 in addition to your own ticket, or sponsor them alone in the event you can't make the event. Your help is appreciated – thank you!!

You can [RSVP](#) on the SD INCOSE website.

WSRC or to register, please visit: [https://www.incose.org/events-and-news/incose-event/2018/09/20/default-calendar/western-states-regional-conference-\(wsrc\)](https://www.incose.org/events-and-news/incose-event/2018/09/20/default-calendar/western-states-regional-conference-(wsrc)).



Colorado Front Range Chapter

Michael Tadros, Michaeltadros@me.com

INCOSE members from the Colorado Front Range (CFR) Chapter Executive Committee (ExCOM) attended the strategy session at the International Symposium (IS) 2018 in Washington, DC, along with leaders and staff from each INCOSE sector. Important highlights of the meeting included importance of membership participation and retention, chapter communications, and involvement of members in shaping chapter activities. Other activities included participation in IS 2018 plenary sessions, technical meetings, and working group sessions.

On the 9th of July, CFR Denver area director and lead ambassador, Mr. Valkand Jhaveri (VJ), held a meeting for INCOSE ambassadors. The goal of this meeting was to re-establish the INCOSE Ambassador Group and discuss future activities.

The CFR ExCOM has been engaged in various activities in preparation for the Western States Regional Conference (WSRC), which will take place on 20-22 September 2018, in Ogden, US-UT. The CFR Chapter is a co-sponsor for the event and several members from the ExCOM will be representing their chapter. For more information about

Florida Chapter

Reamonn Soto – an INCOSE Member, and founder of Sensatek – Propulsion Technology, Inc. – was recently featured in The Corridor's magazine, *florida.HIGH.TECH.* 2018, as one of our Faces of Technology – an initiative that highlights individuals developing innovative technologies in The Corridor region. We would appreciate your help in sharing this exciting news with members of your local chapter or working group and via social media, member newsletters or otherwise!

A personal note to Reamonn might be great way to congratulate this member!

Reamonn's feature can be found online at <http://bit.ly/FacesOfTech2018>, and his video interview can be viewed on YouTube: <http://bit.ly/fHT18Sensatek>.

Thanks, Reamonn for all you do to further systems engineering and INCOSE!

Great Lakes Region Chapters

Call for Participation

The chapters of the INCOSE Great Lakes Region invite you to participate in the 12th annual INCOSE Great Lakes Regional Conference (GLRC2018) at the nation's crossroads, Indianapolis US-IN.

The 12th annual INCOSE Systems Engineering Conference of the Great Lakes region, GLRC2018 will feature presentations from systems engineering thought leaders and papers from systems engineering practitioners and academia on important systems engineering topics around the theme "Systems at the Crossroads." Those delivering content will cover a breadth of information around key decisions, or "crossroads," that are common in multiple product domains, applications, and critical sectors such as aerospace agriculture, biomedical and healthcare, defense, education, energy, environmental sciences, government,

Sector Updates

Americas



2018 Annual INCOSE Great Lakes Regional Conference **SYSTEMS AT THE CROSSROADS** 17 - 20 October 2018 | Indianapolis, Indiana

information, infrastructure, safety and security, cybersecurity, space, and transportation.

INCOSE Vision 2025 describes a landscape of opportunities and challenges an evolving approach to engineering the world of the future—a world of “systems.” Many of these issues represent “crossroads” requiring conscious choices and action leading in new directions. The INCOSE Great Lakes Region organized “GLRC2018–Systems at the Crossroads” around a series of these crossroad issues and will provide opportunities for attendees to compare and advance their understanding and approaches to these important issues.

We live in evolving times with ever-increasing access to knowledge and data. New and emerging technologies expand and enhance engineering and scientific capabilities. Many challenges exist in security, increasing speed to market, increasing reliability, better safety, greater sensitivity to environmental needs, and optimizing system costs. A wide range of industries face these challenges from aerospace, to manufacturing, to healthcare and are at various stages of utilizing a systems approach. We are at an exciting time with many “Systems at the Crossroads.”

GLRC2018 is for the entire Great Lakes Community—not just INCOSE members and not just systems engineers. Our shared interest in the successful advancements of systems vital to our regional and global prosperity connects our community.

GLRC2018 will again feature an INCOSE Systems Engineering Professional Development Day (SE PDD). The SE PDD will be a virtual extension of the conference with the featured sessions broadcast from Indianapolis to several satellite sites on Friday, the 19th of October.

This Year's Program Features:

- Keynote and featured speakers
- Technical presentations
- Panel sessions
- Tutorials
- An opportunity to take the INCOSE CSEP/ASEP exam (free for GLRC2018 attendees)
- Region-wide Systems Engineering Professional Development Day
- Science, technology, engineering, and math (STEM) demonstrations

Confirmed Speakers Include:

- Laurent Borne, global vice president of Product Design Excellence, Whirlpool Corporation
- Phillip Burkholder, president of Defense Programs, Rolls-Royce
- Matthew Clemente, chief technology officer of Delivery, Devices, and Connected Solutions, Eli Lilly and Company
- Art Hyde, former chief engineer, Ford Global Product Development System
- Mark Petrotta, 2018 Sigma Theta Mu Lecture speaker, System Strategies Inc

For More Information

https://www.incose.org/glrc2018/attendees_2018/registration

Registration Now Open for GLRC2018!

The Crossroads of America Chapter of INCOSE welcomes you to Indianapolis, US-IN. GLRC2018 Conference will be at the Indianapolis Marriott East on the east side of Indianapolis, approximately six miles from downtown.

Sector Updates

Americas

Individual registration is now open for the main conference site at the Indianapolis Marriott East. To register, please click on the link below for the conference registration link.

<https://events.r20.constantcontact.com/register/eventReg?oeidk=a07efki6n7u263293ce&oseq=&c=&ch=>

If you plan to stay in the Indianapolis area, special discounted room rates are available for GLRC2018 attendees. Visit [Indianapolis Marriott East](#) for reservations, which are applicable for the conference dates of 17-19 October.

If you would like to stay up to three days before or after the GLRC Conference, you must call the Indianapolis Marriott East at 317-352-1231 to book at the same special discounted rate. Mention INCOSE Great Lakes Regional Conference for the special rates.

SE-PDD Registration Now Open for GLRC2018!

For the third year, the GLRC conference will feature an INCOSE Systems Engineering Professional Development Day (SE PDD). The SE PDD is a virtual extension of the conference, with featured sessions broadcast from the host site in Indianapolis exclusively to several satellite sites on Friday, the 19th of October. The objective is to create mini-satellite conferences that give a portion of the GLRC experience without having to travel, thus expanding the impact and value of the conference to the entire region.

Participants will see live feed presentations following one of the tracks from GLRC 2018 and have interactive discussions on these topics. The SE PDD sites are set up with AV equipment for the live feed from Indianapolis.

For More Information click on the site in your area to register:

<https://www.incose.org/glrc2018/programs/call-for-se-pdd-site-participation>

Be a Sponsor or Exhibitor at GLRC2018!

The GLRC on Systems Engineering for 2018 is shaping up as one of the best ever. We have a record number of outstanding submissions of state-of-the-art technical sessions, panels, in depth tutorials, and exciting keynotes--all in the great state of Indiana!

For More Information

https://www.incose.org/glrc2018/sponsors_and_exhibitors/become-a-sponsor-and-or-exhibitor

The conference planning team is now asking for volunteers willing to help either during the conference days (October 17-20) or with preparations of materials before the conference. Help with the registration desk, session chairs, literature packaging, set up, photography, and other tasks have been identified for assignment to

volunteers. Will you help us put on this outstanding event? If you'd like to volunteer, or have related questions, please respond by email to Stephen Lewis, Operations Planning Co-Chair: lewis@icctt.com. Many thanks for your interest in and support for INCOSE, and GLRC 2018—***Systems at the Crossroads!***

Western Region Chapters

Paul White, Paul.White@kihomac.com;
Charlie Vono, charlesvono@gmail.com; and
Jorg Largent, Palmdalejorg@aol.com

INCOSE western region chapters teamed up to have a Western States Regional Conference (WSRC) each year. This inaugural year, the chapters will hold the conference on 20-22 September 2018 at the Northrop Grumman Conference Center in the scenic Ogden Canyon, US-UT—just a few miles from Hill Air Force Base.

To get more information and to register, visit <https://incose-wsrc.eventbrite.com>.

The program includes presentations, panel discussions, workshops, tutorials, networking events, and a banquet.

A plenary on 20 September (Thursday) at 11 a.m. will open the proceedings. This will be followed by lunch and a choice of two tracks of tutorials or workshops. Thursday also will include an opportunity to take the Systems Engineering Professional (SEP) Beta Exam.

Friday will include plenary speakers, presentations, panel discussions, tutorials, and workshops. Tracks include Systems Engineering Program/Project Management, Agile Systems Engineering, Model-Based Systems Engineering, Resilience and Sustainability, Systems Engineering across the Enterprise, and Specialty Topics.

Friday will feature a "Systems Engineering Professional Development Day" (SE PDD) with a keynote address from Garry Roedler, INCOSE President. Friday evening, there will be a dinner at the conference venue with keynote speaker, Dr. Ben Goldberg, Director of Technology at Northrop Grumman Innovation Systems (formerly Orbital ATK). Between the presentations and dinner, there will be hors d'oeuvres and an opportunity for networking.

Saturday will conclude the conference with more presentations, tutorials, and workshops. Justin McMurray (Northrop Grumman Program Director), Paul White (INCOSE Wasatch Chapter president), and Phyllis Marbach (INCOSE Los Angeles Chapter Past President) will also give a keynote address.

For the benefits of members who are interested but cannot make the trip to Ogden, some of the chapters in the region are planning for the broadcast of the SE PDD to a site in their respective region. The link above has details.

Sector Updates

Americas

This is a great opportunity to keep your systems engineering practices current and learn about leading-edge practices and solutions to challenges the technical community is facing. We hope you can attend in person, but if that is not possible, consider attending at a remote location.

For more information, please contact Paul White, conference chair, at paul.white@kihomac.com.

Hampton Roads Area Chapter

John Clark, john.clark@incose.org

The INCOSE Hampton Roads Area Chapter and the INCOSE Training Working Group (TWG) are providing free INCOSE Systems Engineering Handbook V4.0 training and other free systems engineering training for all INCOSE members, employees of INCOSE Corporate Advisory Board organizations, employees and students of INCOSE Academic Council organizations, and INCOSE student members.

The Systems Engineering Handbook V4.0 weekly series began on 8 October 2015 and completed on 21 April 2016. Members recorded all sessions for later download. To access the materials, do one of the following:

1. Log into Connect then click on Library, Tutorials, and TWG Tutorials. Scroll down to Systems Engineering Handbook V4.0 Tutorial, click on Tutorial ID: 01_October 2015, click on the Tutorial Session you want, right click on the file you want, click on Save target as, and save the file on your drive.
2. Click on <https://connect.incose.org/Library/Tutorials/training/SitePages/Home.aspx>, log in to Connect, scroll down to Systems Engineering Handbook V4.0 Tutorial, and follow the instructions above.

Tutorial Session: 00_Shared Documents contains the schedule and reference documents. Other past recorded tutorial sessions include: Systems Engineering Fundamentals (Tutorial ID: 02_October 2014), Systems Engineering Handbook V3.2.2 (Tutorial ID: 02_October 2014), and Leadership Skills (Tutorial ID: 01 thru 04).

The Systems Engineering Handbook V4.0 tutorial also provides tips and personal help in systems engineering. INCOSE will provide a certificate of completion on request. The tutorial consists of weekly sixty-minute sessions. There is no need to register; just join in. We strongly recommend reading the applicable sections of the INCOSE Systems Engineering Handbook V4.0 before each session. Course materials include the shared documents, tutorial slides, questions, and audio and video recordings for download and use at your convenience. Most slides contain speaker

notes in the PowerPoint notes view.

Please contact john.clark@incose.org with any questions.

Asia-Oceania

Australia Chapter

Bill Parkins, bill.parkins@bigpond.com

Australia-Systems Engineering Society of Australia (SESA) Report



G'day from Australia!

It has been an active quarter for SESA, with the changeover and settling-in period for me as the incoming president of the INCOSE Australia Chapter. As we have pointed out previously, we have two "parent organisations,"

INCOSE and Engineers Australia (EA). We are an INCOSE chapter and an EA technical society (one of many, like INCOSE's Transportation Working Groups). This leads to some excellent synergies, but brings with it some challenges, especially in the diversity of interest groups in both organisations. There are so many different initiatives that our members are pursuing globally, regionally, and in-country that it takes a significant amount of time trying to figure out what is important to our membership and their sponsors. Fun, but challenging!

From my observations so far, I believe our members are willing to engage and contribute in areas of value to both their current occupation and to those broader initiatives which contribute to their professional careers. This is a worthy cause for our leaders to pursue.

On behalf of those twenty or so Australians who travelled to Washington, US-DC for IS 2018, I would like to congratulate the organisers and activity leaders for their great efforts. Not only did we enjoy the technical content of the symposium, keynote speaker addresses, paper sessions, panels, technical working groups, and special interests, but also the chance to network with leading practitioners in the social events and break-out sessions. On one morning in the lift to the foyer, I shared my ride with Eric Honour and Walt Fabrycky. It was such a rare sample and treasured moment for me!

At IS 2018 on behalf of SESA, I was presented with a Gold Circle Award and a Good Neighbour Award. The Singapore Chapter nominated us for this award,

Sector Updates

Back home in Australia, we have an outreach activity aiming to involve our corporate sponsors in industry, government, and academia with the SESA management to set the direction for technical leadership. We are setting up a Corporate Engagement Group of Australian organisations recognising the contribution of systems engineers to their operations.

We structure our national events around the “SESA Cycle” harmonised with INCOSE events as shown in the figure.

- Australian Systems Engineering Workshop (ASEW): conducted annually in October/November. Next ASEW is in Adelaide, AU on 1-2 November 2018. If you look up the program, you will see some relationship to the International Workshop (IW) and we are looking for local ideas for contributions to the global systems engineering activities of several of INCOSE’s Technical Working Groups.
- Systems Engineering Test & Evaluation (SETE) Conference: held Annually in late April/early May. This conference, held in conjunction with the International Test & Evaluation Association, has refereed papers, industry presentations, tutorials, and panel sessions. We will be holding SETE 2019 in Canberra, AU, our national capital, and we are currently setting our theme, preparing our program, and getting it organised. We will be asking for contributions from home and abroad, so keep a lookout for SETE 2019. org.au if you are interested in getting involved.
- National Speaker Program: approximately quarterly and connecting our major metropolitan areas by an audio visual conference. We hope to extend the coverage of this event to other countries in Asia-Oceania.

We have a particularly active SESA Branch in Melbourne, Victoria, AU. A Transportation Working Group conducted technical meetings on a monthly basis for most of this year and the attendance has been very high, typically over 100 people! This reflects the number of rail and road projects in progress in Victoria and also the contribution that systems engineering is making to the planning and execution of these projects. In Sydney, AU, there is also a strong interest in transportation due to several major rail and road projects in progress. We experienced a significant contribution from systems engineers in the transportation sector to our recent SETE 2018 Conference in April in Sydney.

I expect this interest to continue and yield further exciting work products in the coming year from our technical teams. The recurring themes of resilience, affordability, critical infrastructure, cyber security, digitisation of systems engineering products and model-based conceptual design, systems engineering, and product support applications are all attracting quality contributions.

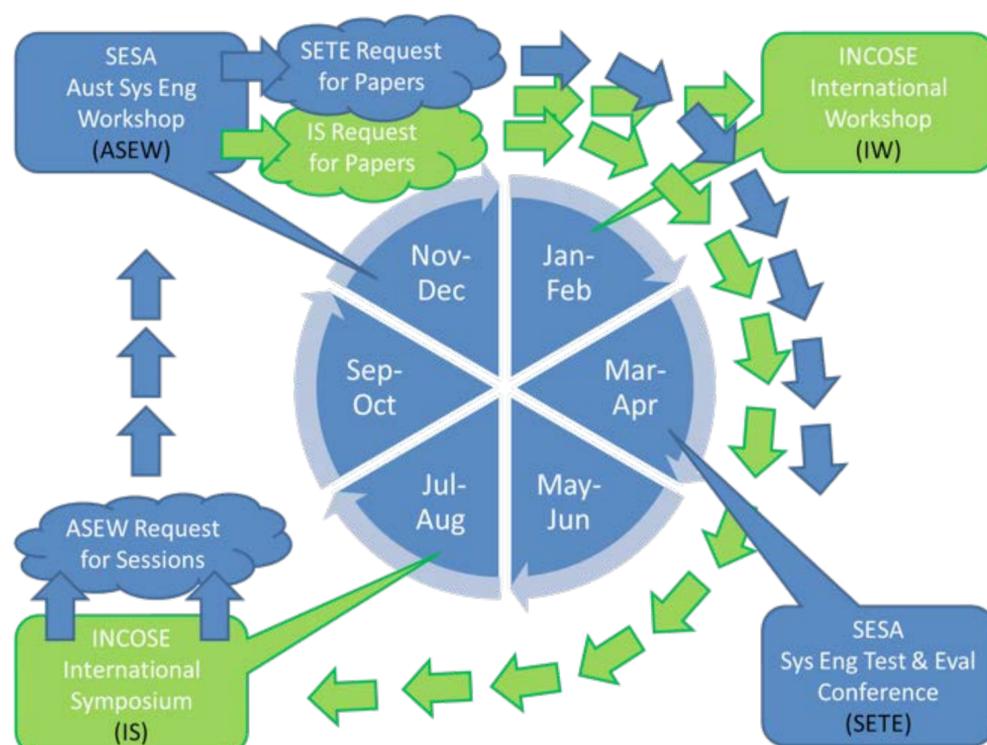


Figure 1. SESA cycle of events

India Chapter

Sewalkar Swarupanand,
SewalkarSwarupanand@JohnDeere.com

On behalf of the systems engineering community in India, INCOSE India Chapter congratulates Dr B N Suresh for receiving the prestigious INCOSE Pioneer Award 2018, for his lifetime of significant achievements and pioneering work in space systems, as the backbone of various successful launches of ISRO (Indian Space Research Organization). The award was given on 9th July 2018 during the INCOSE International Symposium (IS2018) in front of an audience of 900+ delegates from all over the world. Dr Suresh is an outstanding practitioner and researcher in systems engineering of complex space systems such Control Systems, Actuation systems, Simulation & Test systems, and Launch Vehicle systems. A thought leader, he has made significant contributions to Design, Mission planning, and R&D Management for the Indian space program. He is the first recipient from India to have received this prestigious recognition.

During the INCOSE IS2018, the INCOSE India Chapter was presented the Silver Circle award. On behalf of the chapter, Dr. Anand Kumar accepted the award.

The INCOSE India chapter conducted AGM for FY18 on 4 August at Pune, IN. We discussed chapter plans related to activities for the current year and also for FY19, including plans for the Asia Oceania Systems Engineering Conference - AOSEC 2019. The sector conference is in Bangalore, IN during Q4 – 2019.

Sector Updates

Asia-Oceania

Indonesia Chapter?

Serge Landry,
serge.landry@asia.thesgroup.com

On the invitation of one of our INCOSE members from Indonesia, I presented at the Trisakti University of Jakarta, ID on 23 July 2018.

This presentation was part of a seminar on “Enterprise Architecture for Digital Transformation in Industry and Government” with an audience from academia, industry, and government. I presented information on INCOSE overall, the Asia-Oceania Sector, and why systems engineering is an asset to help Indonesia overcome upcoming challenges. The presentation ended with a very interactive question-answer session.

INCOSE members organized this event to draw interest before the opening of a “System Modelling Training Week” run by the company No Magic in Jakarta. They sent invitations to current Indonesian members for the seminar as well as for two additional evening meetings.

During these additional meetings, attended by members and non-members of INCOSE, we had engaging discussions about the possible creation of an Indonesian Chapter, which drew a lot of interest. We discussed people’s interest to become involved as well as the steps required in the journey to achieve a full-fledged chapter status.

Editor’s note: I personally think an INCOSE Indonesia Chapter logo would add nicely to our growing connection!

Interested in becoming a Chapter, truly? Check out the steps to take under [Chapter Resources](#) on the INCOSE Website!





29th Annual **INCOSE**
international symposium

Orlando, FL, USA
July 20 - 25, 2019

Engage with your colleagues from
the Systems Engineering community!

Learn about state-of-the-art
methods and essential skills for
Systems Engineers.

Find out how people are making a
difference with Systems Engineering.

Mark your calendar now!

July 20 – 25, 2019



Sector Updates

Asia-Oceania Singapore Chapter

Diego Abas, diegoabas@yahoo.com

On the evening of 26 August 2018, Robert Halligan from Project Performance International shared some tips and methodology for efficient and effective requirement elicitation, capture, and validation, in an interesting one-hour talk on “A Journey Through Requirement Analysis.” Around fifteen-chapter members and non-members attended the networking and talk event which was held at Singapore Institute of Technology (SIT).

Robert, based in Australia, has been a regular guest speaker for the INCOSE Singapore Chapter. At the end of the event, Singapore Chapter president, Yip Yew Seng, presented a special token of appreciation to Robert for his many contributions to Singapore Chapter talk events.

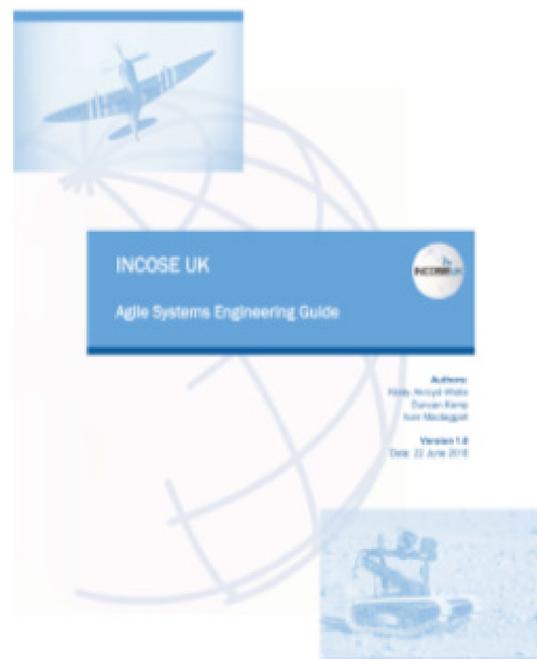
Some highlights from the presentation are captured in the photos.



EMEA

UK Chapter

Molly Stone, Richard Tingley,
publications@incoseonline.org.uk



INCOSE UK supports our working groups who publish community-produced publications. We recently added Agile Systems Engineering Guide to our collection. Businesses and governments are always looking for efficient approaches and the adoption of agile approaches offers potential for radical improvements. Based on practice from a range of sectors, this new guide, from the Agile Systems Engineering Working Group, takes the “true agile” world view and provides high-level guidance in what is meant by agile systems engineering and how systems engineers should approach and apply it. It is available on the INCOSE UK online store now as a hard copy and is also in PDF format.

INCOSE UK is also preparing for our Annual Systems Engineering Conference (ASEC) 2018. One of the biggest events in the UK system engineering calendar, we bring a

Sector Updates

EMEA

UK Chapter

professional, informative, and enjoyable event to our delegates. The ASEC 2018 booking system will be going live on the ASEC 2018 website in early September. Until then, to follow information and programme updates as they develop, along with the date, location, and this year's conference theme, head to our dedicated Annual Systems Engineering Conference website: ASEC2018.org.uk.

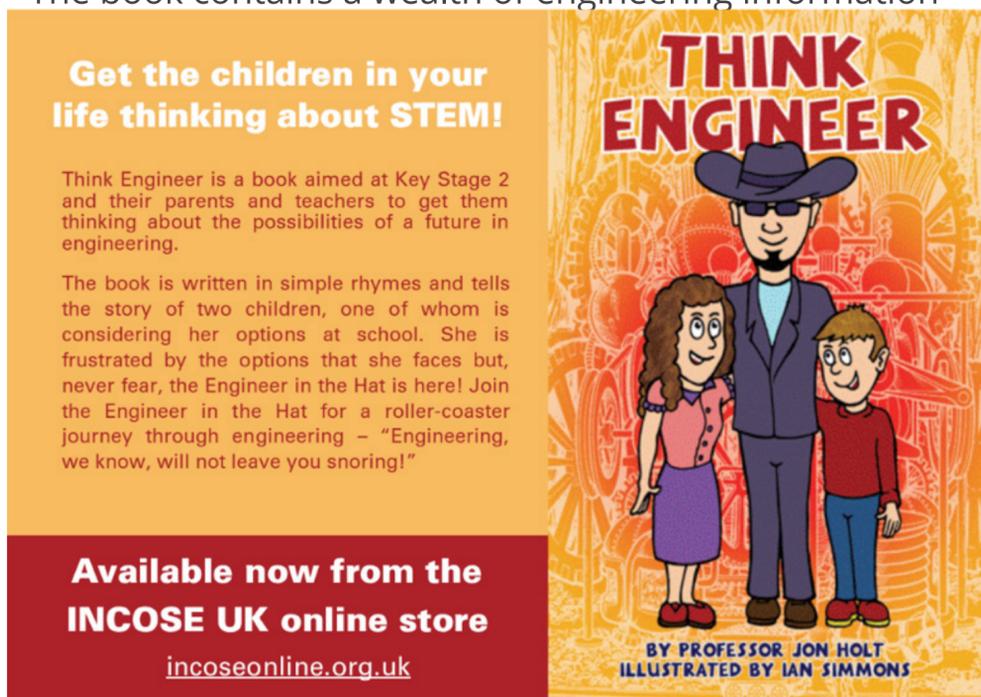
Our latest edition of ePreview was released earlier this



month. Head to our website to read it and find out about the upcoming council elections and Outstanding Service Awards nominations.

INCOSE UK, in collaboration with 8 corporate UKAB partners, are delighted to announce the publication of a special 'Year of Engineering' edition of the children's book 'Think Engineer', a publication aimed at Key Stage 2 pupils (ages 7-11) and their parents and educators to raise the awareness of STEM (Science, Technology, Engineering and Mathematics) and in particular engineering.

The book contains a wealth of engineering information



hidden within the rhymes whilst each image in the book has been carefully crafted to be as child friendly as possible yet have a solid link back to engineering.

By publishing this bespoke edition, INCOSE UK engages with and supports the 2018 'Year of Engineering', a government-led year-long campaign aimed at tackling the engineering skills gap and widening the pool of young people who join the profession, by increasing awareness and understanding of the sector.

Working Group Updates

Systems Science Working Group

James Martin, martinqzx@gmail.com; Kent Palmer, kent.d.palmer@gmail.com; Robert Edson, rwedson@mitre.org; Swami N, swami.n@tcs.com; Duane W. Hybertson, dhyberts@mitre.org; Regina Griego, drgriego@comcast.net

One of the workshops at the ISSS Conference in July 2018 explored the scientific and philosophical foundations for systems engineering and a possible basis for the unification of systems science. INCOSE has a joint venture with the International Society of Systems Sciences through the Systems Science Working Group to advance and better understand the science behind the systems engineering that we practice.

This workshop presented a theory on "schemas" which are the different ways we see things in the world, followed by a presentation on the theory of "categories" which is a mathematical basis for characterizing things in the world. Category theory is put into the context of four different "worlds" based on Popper, Penrose, and others. We explored how schemas theory reveals the various kinds of things upon which category theory can be applied. These two theories have the potential of providing a new foundation for systems science and systems engineering, paving the way for greater insights into each of these disciplines. Kent Palmer presented the discussion on schemas theory and Ken Lloyd discussed category theory.

Overview - This workshop featured a tutorial on schemas theory originally presented at INCOSE and ISSS events in 2014. In addition, it included a presentation by Kenneth Lloyd on his book about the foundations of systems science based on mathematical category theory.

Schemas Theory - The schemas discussed were: facet, monad, pattern, form, system, meta-system, domain, world, kosmos, and pluriverse. The system schema is most familiar to those who practice systems engineering while the pattern schema is becoming popularized in our discipline. All engineering disciplines deal with form most directly, while monad and facet tend to be "hidden" in the engineering methods that we employ.

The concept of facet is straightforward since it means any of the definable aspects that make up a subject or an object. Leibniz used the concept of monad when he referred to things that are considered to be elementary particles. According to Diogenes, "from the monad evolved the dyad; from it numbers; from numbers, points; then lines, two-dimensional entities, three-dimensional entities, bodies, culminating in the four elements earth, water, fire, and air, from which the rest of our world is built up." ([en.wikipedia.org/wiki/Monad_\(philosophy\)](http://en.wikipedia.org/wiki/Monad_(philosophy)))

Meta-system is accounting for the concept of "holon" as described by Arthur Koestler in his book, *The Ghost*

Working Group Updates

in the Machine (1967). A holon is something that is simultaneously a whole and a part. There is no good English word that exactly captures the notion of meta-system but words using -scape, such as landscape and seascape, hint at it. One can think of this as the “surroundings” of the system, like, but not the same as, our notion of the environment or context that surrounds our system of interest. Members can find the full tutorial on schemas theory online at <http://schematheory.net>, including audio for each slide and a transcript of each session, along with other supporting and related papers on schemas theory.

Category Theory - A category (in mathematics) is a generalized notion of an object. A category is an object that adds or imposes structure on its aggregation of objects. The form of that structure is a pattern that is identifiable even when the component objects differ. We can think of categories as abstract templates for creating fewer abstract objects. We realize and recognize objects by the form of their properties. Lloyd discussed several key concepts fundamental to category theory: object, functions, morphism, structure, context, world, domain, and paradigm.

He also examined the three worlds of Popper: physical world, mental world, and conceptual world. These are primarily based on schemata, cognates, and percepts. In addition, Lloyd talked about the Platonic world of forms, which Penrose had incorporated into the other worlds. Each world is a meta-world to the others and is at a different level of abstraction. These worlds are complex-coupled and operate at various distances from equilibrium, as Prigogine described. One can use category theory to explore the relationships between these four worlds.

Follow-on Work - The Systems Science Working Group will continue to work with schemas theory and category theory at upcoming INCOSE events. Please join us at the International Workshop (IW) in January to advance our understanding of how these two theories can improve the practice of systems engineering.

Training Working Group

John Clark, john.clark@incose.org

The INCOSE Training Working Group (TWG) is looking for volunteers who can provide training in any systems engineering functional area such as members training members. Please complete the survey at <https://www.surveymonkey.com/r/GGDFDSP> by 30 September 2018 to help us determine gaps as well as establish a regular cadence for training.

Academic Council Updates

Dr. Devanandham Henry, dhenry@regent.edu

The INCOSE Academic Council sponsored a panel titled “Investigating Approaches to Advance Knowledge and Maturity in Systems Engineering” at the 2018 American Society for Engineering Education (ASEE) Annual Conference & Exposition, in collaboration with the ASEE Systems Engineering Division. Traditionally, engineers developed systems engineering competencies over several years, starting with a decade or two of experience, as they transitioned from a specialty domain of engineering into higher-technical and management roles. Today, there is a growing need to advance and mature systems engineering knowledge, skills, and abilities early in the systems engineers’ education and career. Further, systems engineering is becoming a stand-alone domain with its unique set of competencies, tools, and methods. The objective of this panel was to explore how the systems engineering academic community was responding and the approaches it was taking.

The council conducted the panel in two ninety-minute sessions over two days. Dr. Alice Squires (Washington State University) moderated on the first day and Dr. Federica Robinson-Bryant (Embry-Riddle Aeronautical University) on the second, with the same set of panelists. The audience was comprised primarily of academics associated with systems engineering programs at various US universities including George Mason University, Michigan Tech, Regent University, The University of Alabama in Huntsville, US Air Force Academy, and Western Michigan University (in addition to the universities that the moderators and panelists represented).

During the first session, the panelists presented their individual perspectives:

- Dr. Jon Wade (Stevens Institute of Technology) talked about educational approaches that embraced complexity. Research is needed to advance the state of the art in complex systems, differentiated from complicated systems. While technology can provide educational and training opportunities, curriculum and pedagogy need to evolve from where they currently are. Ways to effectively incorporate mentoring need to be developed as well.
- Dr. Radu Babiceanu (Embry-Riddle Aeronautical University-ERAU) talked about systems engineering education and mentoring in high-tech domains like aviation/aerospace. ERAU’s graduate systems engineering program, modeled after the Graduate Reference Curriculum for Systems Engineering (GRCSE), is specific to aviation/aerospace but places special emphasis on system safety, security, and assurance in the overall systems engineering process. ERAU’s Cybersecurity and Assured Systems Engineering (CyBASE) Center focuses on critical systems and infrastructures.
- Dr. Alejandro Salado (Virginia Tech) emphasized two

Academic Council Updates

specific aspects related to systems engineering education. The first is the need to expose students to (real-world) suffering! Scar tissue is almost essential for the development of a systems engineer and, traditionally, engineers obtained this over years of experience. Now, there is a need to provide some scar tissue to students as well, by exposing them to unknown expectations, changing expectations, and incomplete information in the classroom. The second aspect was on his current attempt to replicate an art studio approach in a systems engineering course. In art, students initially learn about and how to draw form and objects; then they practice by drawing a real person; they then draw persons out of their imagination; and finally draw not a just an imagined person, but convey a story through their art. Taking a similar approach to systems engineering would mean initially teaching students about building blocks—elements and objects; then exploring existing solutions that deploy those building blocks; then applying patterns and heuristics on hypothetical problems; and finally attempting to apply all their learning on an unprecedented solution to a real-world problem.

- Prof. William Miller (Stevens Institute of Technology) shared his thoughts on “Systems Engineering of the Future,” an ongoing systems engineering community initiative led by INCOSE. The debate on whether systems engineering is a discipline or not, and its level of maturity, is still ongoing. When we look at systems and services of the future, the scale continues to increase exponentially with intricate and often hidden interfaces and interrelationships. The systems, the environments, and defects are all non-deterministic. What then does systems engineering look like in the future? Bluntly, it will become irrelevant if it does not adapt! Systems engineering needs to quickly learn and adapt to

emerging behavior; cybersecurity and assurance need to be integral and not an afterthought; and new approaches to verification and validation and testing are needed across the lifecycle.

During the rest of the first session and the second session of the panel, there was active interaction between the panelists and the audience, facilitated by the moderators. Here are some highlights:

- Despite many efforts in the past, there are no clear theoretical underpinnings to the systems engineering discipline yet. Consequently, systems engineering is not yet a stable discipline, while trends and buzzwords keep cropping up and influencing it. Buzzwords will always be there, but we must be able to differentiate them and clarify how they relate to systems engineering.
- Those who built the pyramids did not possess a formal engineering degree—it was a craft at that time. Today’s builders require formal qualifications, credentials, and licenses. Systems engineering is transitioning from a craft to a formal discipline. While many practicing systems engineers today may not possess a formal degree in systems engineering, it is very likely that employers will require the systems engineer of the future to possess a formal degree or certification in systems engineering. There is also likely to be a stronger analytical component in systems engineering education.
- There are few undergraduate programs in systems engineering today, and the landscape has been fairly flat for many decades, but that might be changing now. New undergraduate programs in systems engineering are beginning to emerge, even as some industrial engineering programs are adding systems engineering in the title, though they may not be making many changes to the curriculum as

such. There are different systems engineering activities at different levels that will require different systems engineers. A systems engineer with an undergraduate degree in systems engineering could be a junior systems engineer.

- We tend to think that engineering (and systems engineering) is similar to math and physics but perhaps, it is more like medicine where the life of the patient is of utmost importance. Similarly, (engineered) systems being fit for purpose and doing no unintentional harm to the people it is meant to serve, is of utmost importance.
- The output of a systems engineer is not always tangible, and this gives rise to misconceptions and confusions. At the workplace, the systems engineer is viewed as a manager by other engineers and as an engineer by managers. Further, one can lose the inherent value of systems engineering in terminology, concepts, and principles. When computer science was growing as a discipline, computer scientists were better off since they typically did not depend on any other discipline. But that is not the case with systems engineering, since systems engineers depend on and interact with other disciplines and experts.
- Exposing students to authentic real-world situations is a challenge, particularly from the assessment point of view. Grading is critical for undergraduate education, and it is not easy to grade open-ended questions or to train teaching assistants to do so. At the same time, students strongly desire immersive hands-on experiential learning in all engineering disciplines. Systems engineering must adapt to this environment.
- There is a need to rapidly update the systems engineering curriculum in universities. Yet, it is not easy to cover everything a systems engineer needs to know

Academic Council Updates

during the limited time in an academic program. In this regard, it might be possible to cover more of systems engineering in a four-year undergraduate program than in a two-year graduate program. But perhaps systems engineering education and systems thinking should start even earlier! Could it be that the way we learn and teach math and the current path to engineering is actually filtering out children with impressive systems thinking ability and preventing them from becoming (systems) engineers?

Overall, it was an interactive and informative panel session that reflected the current state of systems engineering education, with valuable takeaways for systems engineering educators and practitioners. The increasing movement to non-deterministic systems is driving us to realize the importance of a broader systems engineering practice that is driven less by reacting to the systems of today and more by proactively embracing systems thinking and approaches across the engineering disciplines. It was evident that systems engineering is moving into mainstream engineering within universities, and that their presence is gaining prominence with stand-alone programs, minors, and curricular additions to other engineering programs.

The council is considering ideas for a follow-on panel to carry forward these discussions and explore topics such as systems engineering across boundaries and domains, thinking like a systems engineer, and success stories of systems-based approaches.

For more details about the ASEE Systems Engineering Division and to offer your comments and suggestions, please contact the Division Chair (Dr. Federica Robinson-Bryant, robinsof@erau.edu) or the Program Chair (Dr. Alejandro Salado, asalado@vt.edu).

Special Note: The Call For Papers for the 2019 ASEE Conference is open, inviting the systems engineering community to submit a paper.

The INCOSE Academic Council discusses and explores issues related to systems engineering in academia. Please consider joining if academic programs in systems engineering is an area of your work or interest. If you have questions or comments, please contact the Director for Academic Matters (Dr. Ariela Sofer, asofer@gmu.edu).



EWLSE Update

Tracee Gilbert, Alice Squires, and Dinesh Verma
ewlse@incose.org

Empowering Women Leadership Forum: Embracing Systems Engineering Leadership Diversity

On July 7, 2018, over 40 engineers gathered at the International Council on Systems Engineering (INCOSE) International Symposium (IS) for a transformative leadership forum. Empowering Women as Leaders in Systems Engineering (EWLSE) and the Systems Engineering Research Center (SERC) co-sponsored the event to inspire and empower women as leaders in the engineering field. Featured were two keynote speakers, a panel, an interactive workshop, followed by a networking reception. Attendees gained insights into overcoming leadership obstacles, strategies for pursuing leadership, and how to create inclusive work environments.

Ms. Kristen Baldwin, Acting Deputy Assistant Secretary of Defense for Systems Engineering, kicked off the event with the “Department of Defense (DoD): Research & Engineering Leadership” keynote address. As the principal systems engineering advisor to the Secretary of Defense, Ms. Baldwin leads more than 50,000 acquisition professionals in the DoD Engineering and Production, Quality, and Manufacturing workforce. She gave an overview of the DoD Research and Engineering enterprise, which provides the technological foundation to ensure our military remains the most capable in the world. Ms. Baldwin also chronicled her journey, highlighted the demographics of women in defense, and provided key tenets that she followed to navigate her career.

Ms. Victoria Fox provided a second keynote address: “Flying High and Fast Towards the Next Generation of Leaders.” As the Federal Aviation Administration’s former Assistant Administrator, Ms. Cox led the transformation of the national airspace system with responsibility for the multi-billion-dollar NextGen portfolio. She opened with candid experiences, discussed in the context of what leadership is not. After an engaging discussion with attendees, she shared successes that stemmed from effective leadership practices.

After a networking break, Dr. Alice Squires, the Chair of EWLSE, moderated the Leadership Journey panel that included Ms. Baldwin, Ms. Cox, Mr. David Long, and Mr. Bill Parkins.



EWLSE Update

Mr. Long is currently the founder and president of ViTech, a leading systems engineering software environment. Mr. Parkins recently retired as the principal engineering manager of Rockwell Collins Australia, and is the current president of the Systems Engineering Society of Australia. The panel was transparent in sharing their leadership journey - the successes, failures, sacrifices, challenges with work-life balance and gender specific experiences. There was also a discussion on how to increase the percentage of women in leadership roles.

The forum concluded with an interactive workshop: “Embracing Systems Engineering Leadership Diversity: Ally Skills Outcomes.” Facilitated by Dr. Sherry Smarts, CEO of S*Marts Consulting LLC., the first half of the workshop began by providing the attendees an understanding of diversity and inclusion and its importance to organizations. The group defined diversity beyond the traditional view (e.g., gender, race, and age), and characterized it as a broad set of experiences, backgrounds, and ideas, which ultimately provide different ways of seeing the world. Inclusion was defined as having one’s voice heard, being treated fairly and equitably with equal access to opportunity and resources, and welcoming differences. The primary need for increasing diversity and inclusion in the organization was to have greater diversity of thought, and to make better decisions for the organization as a whole.

In the second half of the workshop, small group discussions were used to openly discuss personal issues, identify ally skills that are needed to support colleagues in the workplace, and apply the lessons learned from the workshop. The focus of the scenarios was on recognizing a situation when someone was being mistreated (both consciously and unconsciously), and how allies can respond to behavior, ask clarifying questions, and become active bystanders.

Participants shared their top takeaways from the workshop, including the examples below:

- Celia Tseng: “Raising the number of women in engineering may require sacrifice and courage, like speaking up and advocating for each other.” “Real innovation requires diversity.”
- Ellie Gianni: “The messages conveyed are useful for ALL professionals - empowering professionals as leaders in systems engineering.”
- Dorothy McKinney: “Those who have risen in their professions have done so by facing and overcoming their own and others’ limiting beliefs and prejudicial actions - to develop and strengthen skills which were useful in many other ways in their careers.” “There is huge power in example — successful women often have used the success of other women before them to support their own convictions that they can rise high in their career.”
- Renee Steinwand: “My key takeaway was a definite excitement and enthusiasm from the panel discussion regarding the systems engineering profession and how government and industry are embracing the need for systems engineering throughout acquisition and product lifecycle.”
- Jennifer Nelson: “One of the most valuable things I heard for professional and personal life is ‘unspoken expectations are premeditated resentment,’ and to consider the impact of microaggression.”

What Can You Learn About Systems Engineering by Building a Lego™ Car?

Heidi Ann Hahn, hahn@lanl.gov

Los Alamos National Laboratory’s (LANL’s) Future Female Leaders in Engineering (FFLIE) Program brings female engineering undergraduate students to the Laboratory for summer internships, which include a technical work assignment and a specialized eight-week long professional development program. During their first year in the program, FFLIE students receive training on LANL’s Mission Assurance (MA) Program, which involves the integrated application of systems engineering (SE), project management (PM), and engineering quality and rigor (QA) to ensure mission success. The instruction is organized around the system development project life cycle and emphasizes activities and artifacts associated with the various life cycle phases. A home improvement project (adapted from Braakhuis, Janssen, Koudenburg, de Liefde, Malotau, Rens, and Stevenson, 2010) is used in a series of table-top exercises throughout to illustrate various points. The training culminates with a project – building a car for a Lego™ Derby race – on which the students exercise the skills they have just learned in the classroom instruction.

In her presentation on this topic at IS2018, Heidi briefly reviewed the instructional content, with an emphasis on the activities and artifacts exercised in the Derby project; provided lessons learned; and concluded that there’s a lot one can learn about systems engineering by building a Lego™ Derby car if the experience is properly structured! As there was a great deal of interest among audience members, the instructional materials have now been reviewed by LANL management and approved for public release. Send Heidi an email (hahn@lanl.gov) if you would like to receive a copy.

Following the successful events at the INCOSE IS 2018, EWLSE continues their mission by inviting abstracts for a dedicated *Diversity in Systems Engineering* themed *INSIGHT* volume in 2019. Also, EWLSE invites systems engineers to consider submitting a letter written to their younger self for an upcoming INCOSE EWLSE book entitled: “Letters To My Younger Self: How Systems Engineering Changed My Life.” For more information about EWLSE and up and coming news and events, please visit: <https://www.incose.org/incose-member-resources/ewlse/about-ewlse>

INCOSE San Diego

STEM EXPLOSION!

*A Night of Celebration for STEM-based Family Education,
Including Honoring Teachers*

- * Saturday, October 13th, 2018, 5-9 pm
- * Live stage show by Fleet Science Center, Rigamajig, and Robotics hands-on activities
- * San Diego Children's Discovery Museum 320 N Broadway, Escondido, CA 92025



* Tickets: \$20 Adult / \$10 children
\$50 Family Pack (Includes 2 adults and up to 4 kids)
Kids under 5 free!

* Dress code: Semi-formal encouraged

* RSVP (by 10/5) at www.sdincose.org

INCOSE Foundation News

James E. Long Awardee

Hanumanthrao Kannan, hkannan@vt.edu

Hanumanthrao “Rao” Kannan, Assistant Professor at Virginia Tech in Blacksburg, US-VA is the 2018 **James Long Fellowship Awardee**. Below he provides us with an overview of this award winning research.

My research focuses on improving the present systems engineering processes used for developing large-scale complex engineered systems (LSCES) by bringing together and exploiting the complimentary nature of multiple disciplines including engineering, decision analysis, economics, statistics, psychology, and philosophy. I plan to achieve this through three primary research thrust areas as described below.

Preference Formulation

Organizations designing LSCES like satellites and aircraft, to name a few, involve hundreds to thousands of decision makers across the hierarchy who vary vastly in their preferences on outcomes, especially when uncertainties are present. Current processes rely on requirements, which only state what is not desired of the system, to communicate preferences. My work involves investigating how engineers can capture and reformulate existing requirements in the design of LSCES using a mathematical preference function, by tracking the attribute relationships between subsystems and across the hierarchy using visualization techniques. In addition to capturing the value preferences in a deterministic scenario, my work also uses utility theory to capture risk preferences when uncertainties are present. My future work in this area will delve into the principles of behavioral economics to understand why people make decisions the way they do. This will help to factor in aspects of bounded rationality.

Theory of Verification and Validation (V&V)

Verification in systems engineering refers to the question “Did we build the system right?” and validation refers to the question “Did we build the right system?” Traditionally, engineers achieve verification when they meet the requirements, whereas they achieve validation when they meet stakeholder preferences, which they represent using system requirements. My research in this area will particularly focus towards a mathematical theory of verification and validation that is founded on epistemic logic and will aim at answering the following fundamental questions:

- How do we know if we have the right stakeholder preferences?
- How do we know if we met the stakeholder preferences?
- How do we know if we verified the subsystems/ components?

- How are verification and validation related?

Systems Design Methodology

With a number of individuals spread across the hierarchy of an organization and usually across multiple organizations in the design of LSCES making so many decisions, it is crucial to have consistency in design decision-making. The current requirements-based systems engineering processes cannot adequately scale to these complex systems. My research focuses on creating a mathematically rigorous framework that uses principles from multidisciplinary design optimization, value-driven design, and decision analysis to aid in optimal decision-making that is more aligned with the stakeholders’ preferences. My background in these areas has enabled me to create a value-based systems engineering (VBSE) framework that supports system optimization in a hierarchically decomposed satellite system by representing the true preferences of the stakeholder using a value function, while also mathematically capturing the couplings of the system thereby ensuring consistency in system physics. My research involving decision analysis facilitates decision making under uncertainty by examining the value and risk preferences of individuals using expected utility theory. My future work will expand on the existing VBSE framework. This will include investigating the effect of varying beliefs, that exist in decision makers across the hierarchy, on the system value and incorporating belief updating in the iterative decision-making processes.

Stevens Doctoral Awardee

Edwin Ordoukhanian, ordoukha@usc.edu



Edwin Ordoukhanian is the 2018 **Stevens Doctoral Award** recipient. He is a Ph.D. Candidate in University of Southern California’s Department of Astronautics specializing in Systems Architecting and Engineering (SAE). He is doing his doctoral research under Professor Azad

M. Madni, his dissertation adviser. His dissertation focuses on formalization of resilience methods/mechanisms for multi-UAV System-of-System Control.

Edwin has been a teaching assistant in the SAE Program in the Viterbi School of Engineering for various introductory and advanced systems engineering courses. Edwin has also been a research assistant at USC working on research efforts focused on model-based approaches for resilient autonomous systems and system-of-systems with applications to driverless cars funded by General Motors and UAV swarms funded by DoD-SERC UARC. Prior to these research projects, he was a research assistant on projects focused on experiential design and distributed

INCOSE Foundation News

cognition sponsored by The Boeing Company. In summer of 2018, Edwin was an intern at General Motors Research and Development working on modeling and simulation of Autonomous Vehicles.

Edwin served on planning and technical committees of the Conference on Systems Engineering Research (CSER), co-sponsored by USC, in 2014 and 2017. He is a member of AIAA, INCOSE, and IEEE-SMC societies. In July 2017, Edwin became a full member of INCOSE Institute for Technical Leadership where he represents INCOSE-LA Chapter and USC. He is also a member of IEEE-SMC Model-Based Systems Engineering Technical Committee. Edwin also served as the President of the INCOSE Student Division at USC for AY 2015-2016. He is the recipient of 2017 Outstanding Engineering Student Award from Orange County Engineering Council and recipient of 2018 Stevens Doctoral Award for promising research in systems engineering and integration.

Edwin received his Masters of Science in Aerospace Engineering from University of Southern California and his Bachelor of Engineering in Automation and Control from National Polytechnic University of Armenia. Edwin's research interests include Model-Based Systems Engineering, Resilient System-of-Systems, Trade-off Analysis, Complex Systems, and Human-Systems Integration.

Research Summary

The mission execution capability of multi-UAV swarms today is limited to the plans loaded before the mission without adequate flexibility to respond to known and unknown disruptions. These disruptions include system failures (within UAV, within UAV network) and environmental disruptions (jamming, loss of communication, loss of sensor, or loss of observability due to extreme weather).

Resilience is a key requirement for multi-UAV swarms to successfully cope with disruptions. What is missing in current resilient system design approaches, and specifically in the management and control of resilient multi-UAV swarms is a structured framework and methodology for evaluating the impact of resilience methods and mechanisms. Methods specify the key variables and operations on those variables. Mechanisms comprise the sequence of action to be executed to successfully recover from a disruption.

The impact of these methods/mechanisms can potentially be evaluated by a dynamic utility function. This recognition provided the motivation for my doctoral research. I employ two different levels for utility functions in my research: swarm (multi-UAV) level, and system (UAV) level. My specific research objectives are to: Investigate the most appropriate formulation of multi-UAV problem to parametrize the operational space to measure effectiveness of resilience mechanisms; and develop a dynamic utility function to evaluate impact of candidate

resilience mechanisms for individual UAV and multi-UAV control in the face of disruptions.

The research hypothesis is that by formulating multi-UAV problem as a system-of-systems problem and reducing problem complexity by parametrizing operational space, a dynamic utility function can be defined to systematically evaluate the impact of resilience mechanism.

To this end, my research aims to develop a dynamic utility function where weightings change as a function of context to identify and explore impact of resilience mechanisms at both the system and system-of-systems levels to deal with different classes of disruptions. To scope the problem, I assume that systems (UAVs) have full observability on their internal states and surrounding environment.

Multi-UAV operations have high priority for DoD and the Armed Services. Developing resilient multi-UAV swarms will enable uninterrupted operation in the face of disruptions, thereby reducing the risk of mission failure. Multi-UAV teams are currently being used in variety of applications such as payload transportation, science data collection, traffic surveillance, agriculture, and search and rescue. I expect my research results to positively impact these application areas.

The expected outcome from my research is a methodological framework for system/SoS modeling and model-based resilience analysis. My research contribution is formalization of resilience methods/mechanisms for multi-UAV swarm control. This capability will fill a current gap in resilient system design, specifically for resilient multi-UAV system-of-systems. The framework will be extensible to other related domains such as autonomous ground vehicles, infrastructures, and energy grids.

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Socio-Technical Systems Engineering

David Quimby, dhquimby@virtualcoast.com;
Bill Farmer, farmerbill@alum.mit.edu

Abstract

The tension/fracture between product design and systems engineering imposes a significant load on the overall product/service development system and results in a significant loss of value from a financial analysis perspective. This fracture is a systems issue and systems engineering could address it in an objective, effective, and systematic way. Systems engineering, as a discipline and a community, failed to address this issue. We call upon the discipline and the community to re-evaluate its posture toward optimizing the super-system (eco-system) in which it operates.

Systems engineering is unique among the engineering

Socio-Technical Systems Engineering

disciplines in its capacity to integrate other engineering disciplines. It can integrate electrical engineering, mechanical engineering, chemical engineering, aeronautical engineering, structural engineering, and other technical disciplines to produce a cohesive whole. The other disciplines can handle their various specializations in the context of a complex, inter-disciplinary project; they cannot transcend their boundaries to produce a cohesive whole. This integrative capability of systems engineering is the essence of its value proposition.

Beyond this integrative capability, systems engineering can inform organizational design and design of socio-technical systems. We know that all systems are composed of sub-systems and operate in the context of a super-system. While systems engineering is an interface to product design, it can also inform the super-system that combines product design and systems engineering. That super-system is a socio-technical system—it includes both technical and social elements.

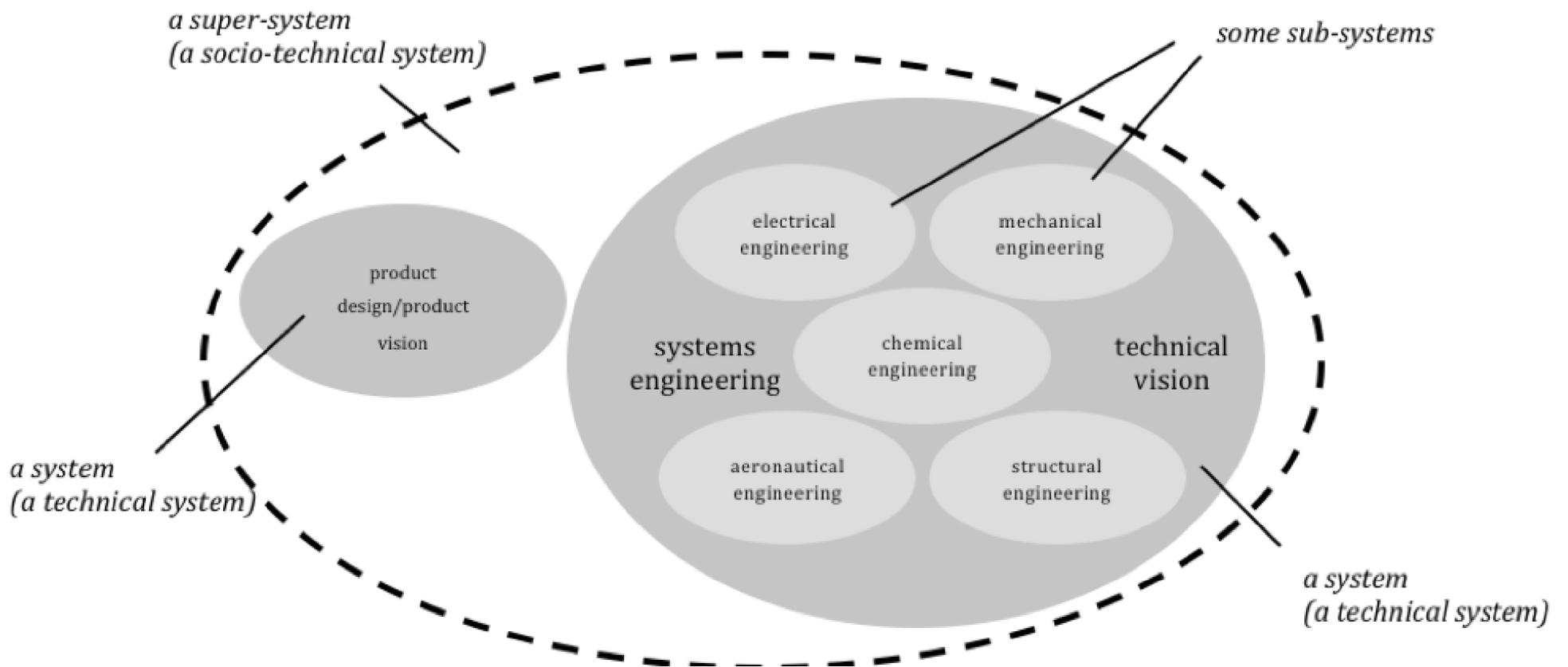


Figure 1. The super-system of product design and systems engineering

Integration of those elements is engineering; engineering of the social elements and the interfaces between the social elements and the technical elements is social engineering. No other engineering discipline is equipped to conduct social engineering. Figure 1 portrays this super-system and its corresponding systems and sub-systems.

Engineering of the social elements and the interfaces between the social elements and the technical elements is social engineering—it is not “social science” in the traditional sense of sociology, psychology, or anthropology. Sociology/psychology/anthropology may be involved in the overall architecture; systems engineering may integrate sociology/psychology/anthropology and the various technical disciplines into a cohesive whole—just as it integrates the various technical disciplines into a cohesive whole. None of the “social sciences” are inherently equipped with this integrative capability—just as none of the other technical disciplines are equipped with this integrative capability. Systems engineering is uniquely positioned in this regard.

Unfortunately, the systems engineering discipline/community seems reluctant to adopt its rightful position as the “integrator of record.” It seems to self-limit itself to integration of the technical disciplines; integration of socio-technical systems is apparently “without scope.” Admittedly, integration of socio-technical systems is a higher call—it is a higher-order function than “mere” integration of technical disciplines (a considerably complex function in itself). Admittedly, it is a more intensively inter-disciplinary activity than the “conventional” role of systems engineering; it may require a higher order of systems engineering expertise and experience. Nonetheless, systems engineering, by its very nature as an integrative capability, is uniquely equal to the challenge. As we have indicated, no other discipline—technical or social—is equipped to perform that integration.

While the interface between product design (product vision) and systems engineering (technical vision) remains relatively dis-integrated and under-served, it represents a significant source of noise and friction in the overall product/service development system. We assert that the loss in value over this interface is the most significant source of loss in the overall product/service development system; we further assert that the associated impact on revenue, profitability, and enterprise value is material from a financial analysis perspective. The development and operations functions have become more seamlessly integrated as a result of the so-called “DevOps” movement—through systems engineering of the interface and component functionality. Admittedly, the design/development interface is more complex than the

Socio-Technical Systems Engineering

development/operations interface. Nonetheless, we assert that the corresponding “design pattern” is a reasonable representation.

We therefore call upon the systems engineering community to declare the defect in this socio-technical interface “within scope;” pursue quantification of the defect; and investigate application of its considerable capabilities to mitigate/resolve the defect. We invite our esteemed colleagues in this most noble and capable of disciplines to join us in this worthy and value-creating endeavor.

David Quimby is a mathematical economist and systems analyst. He has rotated through various cycles at the extremes of large enterprise and small enterprise as a technology executive and a software entrepreneur. His expertise includes knowledge management, technological forecasting, and systematic innovation; he is also a thought leader in the application of systems engineering to organizational design. David has conducted business process re-engineering (BPR) in the large-enterprise domain and he has led large-scale technical integration in the context of mergers and acquisitions. He is a co-founder of Minnesota Change Management Network (MNCMN). He has presented to professional communities on various topics around data science, product management, and business architecture; he has presented on systematic innovation at the Great Lakes Regional Conference (GLRC) of INCOSE. He is a patented inventor in the user experience and web middleware domain; his work on next-generation information architecture was published in XML Journal; and he collaborated with Doug Engelbart, the inventor of the graphical user interface (GUI), at Stanford Research Institute. David earned a bachelor’s degree in mathematical economics and developmental economics at UCLA and a master’s degree in organizational behavior and socio-technical systems at UC, Berkeley.

Bill Farmer is an independent consultant and an adjunct professor in business problem-solving at Augsburg University. He has consulted on lean development, agile development, and related disciplines. He has held leadership positions in product development and general management in a variety of technology-based enterprises. He worked as a research engineer at Sharp Electronics in Japan, where he became proficient in “Japanese-style management” based on the Deming management system. Bill earned a bachelor’s degree in electrical engineering at the University of Minnesota and a master’s degree in optical engineering and computer-based holography at Massachusetts Institute of Technology, where he conducted original research at the MIT Media Lab.



DevSecOps

Gabriela Coe, gabriela.coe@ngc.com

By using a systems thinking approach in business acquisition efforts, Northrop Grumman demonstrates a superior ability to provide quality and value to our customers. A systems thinking approach using DevSecOps allows us to provide needed vision to our customers, guide transformations of their organizations, and ease their anxieties about meeting the increasing pressures of mission critical functions.

Systems thinking starts with the end in mind. It requires cross discipline evaluation and collaboration to consider every aspect of a problem. Through a common language, framework, and thought process, systems thinking facilitates problem solving and promotes communication and collaboration. “Systems thinking means that each team should be aware of the actions of every team in the pipeline and ultimately the customer¹.” DevSecOps (a clipped compound of “development,” “security,” and “operations”) used within a systems thinking approach, is a comprehensive framework governing the automated promotion of validated software from development to operations, with embedded security and monitoring. It emphasizes synergy between the development, security, and operations engineers; it promotes a holistic approach to software development; and uses automation at every step to improve quality, delivery, and monitoring. Through DevSecOps, we deliver our products as soon as they are deployable, rather than an arbitrary pre-planned release schedule. Our development and operations teams have a common understanding of the business/product vision and collaborate to determine the technical feasibility of solutions. Working together, each team can influence the aspects of their discipline in the development and delivery of the solutions. Our development teams understand not only the functional requirements, but also the non-functional requirements, platform specific inputs, and business continuity inputs. The security teams understand the security requirements and can anticipate vulnerable areas. The operations teams understand the functionality required such that they can anticipate infrastructure and deployment and sustainment needs. That end-to-end synergy of communication and cross-functional collaboration leads to tangible results and satisfied customers.

The DevSecOps framework ensures software quality and security validation, from the initial build through production. DevSecOps encourages team work, self-organization, accountability, and best practices that facilitate rapid delivery of high-quality products that align with customer needs. The benefits include reduced time to market; improved productivity, quality, and transparency; increased response to change and regular delivery of value.

DevSecOps advocates automating every aspect of the development and operational pipeline to the maximum extent possible, facilitating the collection of metrics that will drive business outcomes and create a culture

of continuous assessment and improvement at every stage of the lifecycle.

The 2017 Federal CIO Survey² reports that the four main reasons why most federal agencies struggle to transform to DevSecOps are: (1) slow release management because of the of lack test automation, (2) unavailability of tools to employ continuous delivery, (3) inability to perform continuous improvement, and (4) inability to execute upgrades and patches without taking systems offline. As their budgets get tighter, our customers need to find efficient ways to obtain the solutions they need in a timely manner to meet the increasing demands of mission critical functions.

Northrop Grumman has an opportunity to partner with federal agencies to address these concerns by demonstrating that we, as a global leader in IT development and sustainment, embrace a systems thinking approach to providing customers with the quality mission solutions they desire. To demonstrate our prominence as thought leaders, Northrop Grumman embraces change within to continually transform our culture toward one of systems thinking applying DevSecOps. In the business acquisition process, we confidently provide the guidance, direction (and in some cases comfort) our federal customers are lacking and desiring.

But not only do we need transformation with the teams developing and delivering products; we must embrace transformation throughout the organization from the business management perspective as well as the development and delivery perspective.

A Northrop Grumman's systems thinking approach using DevSecOps allows us to provide the holistic vision needed to help our customers transform their organizations, develop high quality products, and improve cost performance.

1. <https://www.infoworld.com/>

[article/3090137/devops/the-three-ways-core-principles-of-devops.html](https://www.infoworld.com/article/3090137/devops/the-three-ways-core-principles-of-devops.html)

2. https://www.pscouncil.org/Downloads/documents/CIO%20Survey/2017_FEDCIO_survey_Final.pdf

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My INCOSE Story

Lori Zipes, lorizipes@gmail.com

I was lucky enough to be introduced to the discipline of Systems Engineering (SE) by Eric Honour, who taught a Fundamentals class at my organization around 2004. He spoke of INCOSE in the class but it seemed expensive and not too useful to me at the time. As my work shifted and I learned more, I realized systems engineering was something that really resonated with me, so I joined in 2006.

My local chapter was 85 miles west, so I was not able to engage with them very much and decided to engage through the Working Groups. The Standards Review group seemed like something I could manage via e-mail. Dick Kitterman ran that group

and we provided feedback on ISO 15288, 12207, and 27478, working to harmonize them. Despite my very limited knowledge, the group treated me as an equal and appreciated my comments. My newbie/outsider perspective allowed me to notice some inconsistencies across the set that others had not.

In 2008 there was a call for beta testers for the exam for the INCOSE Handbook revision. I figured I had nothing to lose, so I bit and took the 7 hour exam, plus the 2 hour DoD extension. At the exam in VA, I got to meet in person some of the members of the WGs I had joined, and that was pretty nice. There was great camaraderie. To my slight surprise, I passed, filled out the rest of the paperwork and became a CSEP in 2008.

I continued to engage with various WGs, shifting my focus as my work responsibilities changed, and groups formed and dissolved. In 2012 I got to attend my first IW and I was hooked. I was stunned to be in the same room as leaders in the field. One of my most memorable moments was later in 2012 when I was researching a course on MBSE to bring to my organization. On a bit of a whim I pulled up Sandy Friedenthal's contact information from the INCOSE directory and e-mailed him my request. I thought I had a 50-50 chance of getting a response. He called me. I almost dropped the phone. We had a great conversation and he gave me a recommendation. I remember taking Sandy's book into my boss's office and telling him, "This guy (point to book) says we should bring this class." We did, and it's a great class we continue to host.

I had graduated from the Naval Postgraduate School in 2011 with a Master's in Systems Engineering and got involved with their effort to support the Systems Engineering Competency Framework development; which then led me to the INCOSE Competency Working Group. It was a good fit for me as I had been selected in 2013 as the Systems Engineering Competency

My INCOSE Story

Lead at my organization, charged with raising the bar on how we performed systems engineering. The challenge was that most of the engineers had a very different concept of what systems engineering was, and management was largely unengaged with the effort. Boy did I have an uphill battle. I got a lot of push back and blank stares, and began to think I was crazy. But then I would come to an INCOSE event and realize I was not crazy at all, everyone at those events “spoke my language.” I even found people fighting the same kinds of battles in their organizations, so that was heartening. I would go back re-energized and try again. I struck up a conversation with then-President John Thomas at an IW. He ended up visiting my organization (only 15 people came to hear him speak. SIGH.) He then became a mentor to me when things got really rough. I will always treasure the time and advice he gave to me. During that time when things were very bad, almost on a whim I decided to apply for my ESEP. I thought that maybe if INCOSE felt I was a leader and expert in the field, that maybe that would give me the confidence to keep trying. I applied and lo and behold, got my ESEP. Almost no one in my organization understood or cared, but I knew what it meant, and it meant a LOT to me.

I made a lot of progress in the job, but after almost 5 years it was time for me to move on. I’m still working to shift the culture and “raise” great systems engineers, just from a different, but possibly more impactful position. I do it now for our profession, more so than for my organization.

Several things about INCOSE have really struck me over the years. One thing that may seem trivial but is not, is the presence of women. As a female in engineering who has been to many conferences over the years, there is almost always a 10 second moment where you look around and notice how few women there are in the room. I’d estimate I was used to seeing maybe 10%. Right from the start with INCOSE that number was noticeably higher, probably 20-30%. There is just something about that that makes you feel more like you belong.

I’ve also been so happy that I have always felt nothing but 100% valued and appreciated for my thoughts and perspectives. There have been some IW meetings that got a bit intense, but everyone was respected. No one was criticized, no matter how different their thoughts were. In fact, critical but constructive conversations were often encouraged, to help us work through the difficult aspects of our efforts. At that time, I was facing some pretty significant disrespect at my own organization; I knew that was not a “norm.” INCOSE showed me that teams with incredible amounts of diversity of thought and perspective and personality can work together in a positive manner to accomplish amazing things.

The final thing that impresses and inspires me is that I continue to have “nerdy rock star” moments like I did with Sandy Friedenthal. I’ve now met three INCOSE members (Stephen Dam, Charles Wasson, Dennis Buede) who are

the authors of some of my favorite systems engineering books on my shelf. I’m not much of an extrovert, but I have compelled myself to say hello, and they are without exception humble and genuine. I’ve also had great conversations with David Long, Zane Scott, and other very public faces of our practice. The list of great people I meet through INCOSE grows longer every year.

So now my goal is to give back to the society that has given so much to me over the years. I am so honored to be a primary author on the new Competency Framework. Our team feels like extended family – what could be more fun than working with those crazy Brits? I’ve found some work colleagues who are helping to re-energize our local chapter which has been dormant for many years. I’m on the chapter board and excited we’ve just established a relationship with our local college campus that is starting a Master’s degree in systems engineering. I’m trying to stay engaged with other INCOSE working groups like Systems Security Engineering and Model Based Concept Development so I can continue to improve my knowledge and skills, and hopefully help us all keep pushing the discipline forward.

My story is not over. If you have read this far, I hope I get to meet you and make you part of that story.

Spotlight ON!

Interviewed by Sandy Young, info@incose.org



Name: Terry Kuykendall, Ph.D.

Title/Organizations: Vice President and Co-Owner at Evolve Engineering & Analysis, LLC

Place of Birth: Atlanta, US-GA

Current Residence: Okaloosa Island, US-FL

Domains: Diverse systems engineering industries and applications

Studied in college: Engineering – nuclear (BS), environmental (MS), and systems (PhD)

Year joined INCOSE: 1997

Role(s) in INCOSE: Vice president, Huntsville Regional Chapter, 2002-03; first chapter president, Atlanta Chapter, 2004-06; author for “INCOSE *INSIGHT*,” 2002-04; represents INCOSE as industry board member for Kennesaw State University’s graduate systems engineering program, 2006-present; president, Emerald Coast Chapter, 2017-present.

Years in systems engineering and program management: 35

When did you first hear about systems engineering?

In 1983 I was working at nuclear power plant and was assigned as the systems integration engineer for process renovations.

Spotlight ON!

You've had an impressive career, working on systems engineering projects and programs for nuclear, space and defense industries, and international organizations. What advice would you give to systems engineers beginning their careers?

Young systems engineers should seek opportunities to work across discipline lines and build bridges among diverse project groups. Additionally, they should learn as many problem-solving systems engineering techniques and analytical methods as possible, and develop a personal toolset that can create opportunities beyond the traditional domain of the project systems engineer.

What are you working on at Evolve Engineering & Analysis?

My most interesting recent work is supporting the Center for International Trade and Security at the University of Georgia. I address issues associated with the integration of nuclear security and safety requirements for worldwide nuclear facilities and materials protection, and for anti-terrorism planning.

As the president of the restarted Emerald Coast Chapter of INCOSE, what are your goals for the chapter?

Our immediate goals are to engage our prospective chapter members and build interactive participation in activities, including programs and speaker presentations. We have a strong board of experienced systems engineers who have the skills and abilities necessary to make our chapter exceptional.

What do you consider to be the biggest advancement in systems engineering to-date?

I'd say the computerization and automation of complex processes and operations. Whether or not responsible discipline engineers realize it, they all have been utilizing tools and aspects of systems engineering to integrate computer controls into electromechanical and chemical systems, and to optimize operations.

Complete the sentence: *The biggest development in systems engineering in the near future will be ...* "integration of artificial intelligence and cybernetics in biomedical engineering." Medical science has taken strides to increase the engineering content of research and education programs in ways that encompass the discipline of systems engineering.

How has INCOSE shaped your systems engineering career?

INCOSE has provided a forum to exchange ideas, keep up with new developments and maintain professional networks of associates, which otherwise would have been challenging. The ability to stay abreast of ideas and practices as the discipline grows has been invaluable.

What systems engineering topics would you like to be remembered for?

Probably (1) for promoting safety and security as primary-level requirements that drive design, and (2) my ongoing crusade to ensure that the "engineering" aspect of systems engineering isn't lost or subjugated as the body of systems engineering knowledge expands.

What do you like to do outside of work?

My favorite personal indulgence is playing guitar. Also, my wife and I support animal rights (we have three rescue dogs), and I'd like to encourage my INCOSE associates to adopt a pet and to contribute to organizations such as the US Humane Society.

Want to know more about Terry Kuykendall? Read his full interview on www.incose.org.

INCOSE *INSIGHT*

William Miller, insight@incose.org

We hope you are looking forward to the September 2018 issue of *INSIGHT* published in cooperation with John Wiley & Sons as a magazine for systems engineering practitioners. *INSIGHT's* mission is to provide informative articles on advancing the state of the practice of systems engineering. The intent is to accelerate the dissemination of knowledge to close the gap between the state of practice and the state of the art as captured in *Systems Engineering*, the Journal of INCOSE, also published by Wiley.

The current mold for systems engineering has its roots in engineering the systems of increased complexity in the 1930s through the 1960s. We are now transforming from document centric to model-based artifacts. The recent March 2018 *INSIGHT* focused on the origins, alternatives, evolutions, and challenges in model-based systems engineering (MBSE). Previous issues focused on MBSE in December 2009 (Volume 12, Issue 4) and August 2015 (Volume 18, Issue 2), and model-based conceptual design (MBCD) in December 2014 (Volume 18, Issue 4).

Your *INSIGHT* editor asserts that our legacy methods and tools, and perhaps the emerging model-based approaches, are not fit for purpose to engineer the systems now demanded of us. Systems engineering is increasingly challenged by the exponentially rising complexity of systems that have hidden interactions and are much more non-deterministic and volatile in their behaviors, with negative unintended consequences. We must underpin systems engineering with principles from both the physical and soft sciences. The focus of this September issue of *INSIGHT* are the challenges to the engineering of systems driven by technology advances that impact their contextual ecosystems and our social constructs. Technology advances in materials, energy, and electronics enable advances in computing, communications, and software that further advance the development of much more complicated and complex networked, cyber-physical systems at scale, that leverage artificial intelligence, deep/machine learning, and autonomy. These systems self adapt in operation, which begets the question of how to verify and validate them.

Many great articles (from the IS 2018!) from leaders in systems engineering investigate these challenges. We're excited to share it with you next month!

Feedback from readers is critical to the quality of *INSIGHT*. We encourage Letters to the Editor at insight@incose.org. Please include **Letter to the Editor** in the subject line. We hope you continue to find *INSIGHT*, the practitioners' magazine for systems engineers, informative and relevant.





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#SocialMediaUpdate

Alan D. Harding, alandharding@gmail.com

The #incoseIS seems a long while ago now, even though it was only five weeks ago! Our global events are a wonderful opportunity for networking with old and new friends and the record attendance in Washington, US-DC of over 1,000 #systemsengineers gave us plenty of opportunities. However, this is the

#socialmedia column and I wanted to talk about how we extended the conversation outside the walls of the #GrandHyatt hotel.

For the third year now, we have actively encouraged delegates to use #socialmedia to share highlights and talking points, to take and share photos of our technical content and more social moments, and to involve

the wider systems community in our conversations.

We also used Twitter, Facebook, and LinkedIn before #incoseIS to let people know about when they could register, the technical programme, our sponsors, and the main social highlights. During the symposium we also focussed on our four fabulous keynote speakers, the new technical products we launched, and many of the planned and unexpected highlights we enjoyed.

INCOSE President
@incosepres

Did you hear! Great news for #systemsengineering The @incose_org #Competency Framework and #SoS Primer are both now available from the #incoseSTORE at incose.org



INCOSE @incose_org

.@incosepres Garry Roedler gives his closing remarks at #incoseIS - thanks to Garry, @KerryL888 the whole Board, all our volunteers and professional staff



So what effect did it have? Amazingly we reached over 50,000 people with tweets from the @incose_org twitter account along with 3,537 people visiting the profile and hopefully finding out more about INCOSE in doing so. In fact, we were mentioned 304 times in other tweets and we gained 45 new followers-in fact, during 2018 our twitter following has grown by almost 300! In the same time the following for our president's account

@incosepres has grown by 25% up to 455.

Our Facebook page is doing well too - reaching thousands of people in the run up to #incoseIS with hundreds of engagements with our postings. We have over 1,300 Facebook users who like our page, another great audience who we can engage about our vision, mission, and activities.

So, let's keep the social media conversation about @incose_org, #systemsengineering, and #systemsthinking alive, take opportunities to highlight the many great things that are going on, and have #fun with it!

July 2018	July 2017
41 tweets	69 tweets
55.2k tweet impressions	40.9k tweet impressions
3537 profile visits	1612 profile visits
304 mentions	163 mentions
45 new followers	49 new followers

INCOSE @incose_org

Thanks to all our #incoseIS sponsors without whom the premier #systemsengineering event would not be possible: @LockheedMartin @SAICinc @AerospaceCorp @IBM @BoozAllen @jamasoftware @JHUAPL @DeptofDefense @MITxonedX phoenix-int.com @WPICPE



INCOSE @incose_org

#incoseIS #2018 electronic proceedings are available to download until 30th Sept 2018. Attendees have received an email with the details. A wonderful #systemsengineering opportunity for #insight and #learning



Note from the Editor

Lisa Hoverman, newsletter@incose.org



Welcome to the 3rd Newsletter of 2018, and our largest ever! We set out 3 years ago to grow this publication into something of value, and under 2 wonderful MarCom Directors (or similar titles - we're an evolving council!) we are doing that!

For the very first time ever, and a long-term goal of INCOSE Communications, especially their

Assistant Director, there are 2 great practitioner pieces in the Newsletter! These speak to the grand challenges of our time, and a call to action to deal with them, and a practical approach to one way a large US government contractor is approaching some of them. We also for the first time, have someone's exciting INCOSE story! What is your's? I really hope you enjoy these unique additions to this Newsletter.

With the exciting [28th International Workshop \(IS\)](#) just past, and [great events just before us](#), like the WSRC, INCOSE China Beijing Summit, the South Africa Systems Engineering Conference, the Board Meetings in South Africa, GLRC, EnergyTech, ASEW, EMEASEC, ASEC, and the [new INCOSE product launches](#), 2018 continues to highlight how INCOSE leads for the Future of Systems Engineering.

The Newsletter continues to grow and improve in content to inform our readership on all things INCOSE - both current, upcoming, but also historically. There are some interesting updates on the IS2018, chapters, working groups, and our Foundation initiatives of INCOSE in this 3rd Newsletter of 2018. As stated already, new and important to this Newsletter are some great articles from practitioners - practitioners tackling both the real and grand challenges of our times that apply to systems engineering - a nice prelude to the coming *INSIGHT*. We have several great INCOSE members highlighted in this issue - one of whom is representing INCOSE in Florida High Tech in a big way! We are growing with your stellar submissions - so Thank You!

Please keep sharing your publications with us as we continuously work to improve. I hope that you see some of your suggestions and contributions in this issue. As always, we welcome feedback and contributors.

We look forward to seeing you participating, networking at, and presenting at one of the many terrific upcoming INCOSE events. I end with a sincere note of appreciation to all who contributed to this Newsletter and the wonderful IS2018! I look forward to your upcoming contributions (submission dates follow in the next column).

Have a wonderful September, I hope to see you soon!

INCOSE Member Newsletter

Publication of the International Council on Systems Engineering

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Publication Schedule. The INCOSE Member e-Newsletter is published four times per year. Issue and article/advertisement submission deadlines are as follows:

Q1 Newsletter, General Content (GC): 15 Feb, Late Breaking News (LBN): 25 Mar; Q2 Newsletter, GC: 15 May, LBN: 25 May; Q3 Newsletter, GC: 15 Aug, LBN: 25 Aug; Q4 Newsletter, GC: 15 Nov; LBN: 25 Nov. For further information on submissions and issue themes, visit the INCOSE website as listed above.

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Who are we? INCOSE is a 10,000+ member organization of systems engineers and others interested in systems engineering. Its mission is to share, promote, and advance the best of systems engineering from across the globe for the benefit of humanity and the planet. INCOSE charters chapters worldwide, includes a corporate advisory board, and is led by [elected officers and directors](#).



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