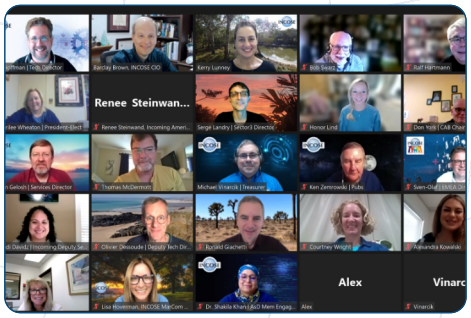
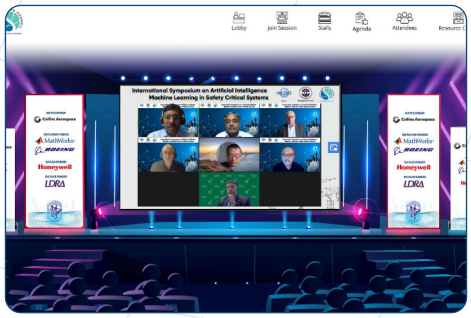
MEMBERS NEWSLETTER

DECEMBER 2021





President's Corner • Updates from the Board • Director Updates • New Member Experience • Chapter Updates • Working Group Updates • Journey to ABET Approval • Academic Council Updates • EWLSE Updates • Volunteers Month • AI Mini Event • INSIGHT Preview • Note from the Editor

Follow us

President's Corner

Kerry Lunney, INCOSE President
Kerry.lunney@thalesgroup.com.au

Greetings members.

Another year has rushed by. I find it hard to believe this will be my last editorial to you as INCOSE's President.

I started the year by labelling it as the "Year of Solidarity," representing togetherness: teamwork while recognizing our differences. Our expectations assumed a faster recovery from the pandemic. Although this did not quite happen as envisioned, the sentiment was and still is highly relevant. You may ask why? Quite simply, our success depends on collaboration and co-operation. Achieving this requires recognition and interplay of both the individual and the group—sounds like a system, right?

Highlighted below are example outputs of our collaborations and co-operations for 2021. Although we may have been physically distant, we still had many options and opportunities for connecting to people worldwide. What I show here is only a small sample of our achievements. The enduring and adaptable qualities of INCOSE and its members shone through 2021, our second year living under a pandemic.

Alliances
- PMI Conference
- NAFEMS Conference
- Cybernetics Premier Series
- CSDM Asia 2021 Conference
- AI-ML for Safety Critical Systems
- SAE-INCOSE Joint Membership
- Joint Certification Discounts

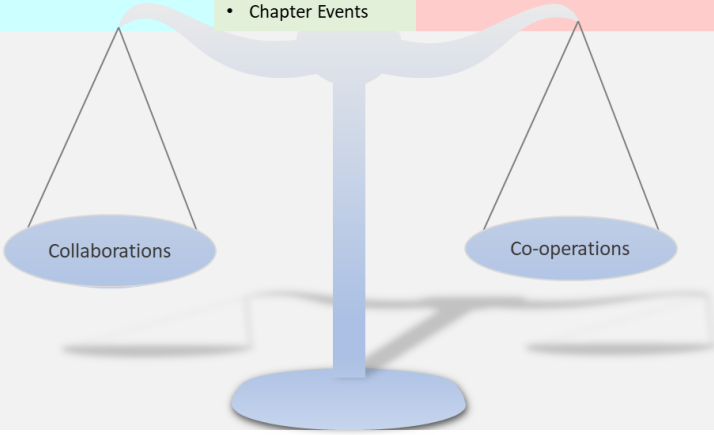
INCOSE Operations
- Membership
- Finances
- IT
- MarCom
- Technical Operations
- Services Operations
- Outreach
- Legal & Commercial
- Policies & Procedures
- Internal Comms

Communities
- Webinars
- System Exchange Cafes
- Yammer Groups

Publications
- SETDB
- INSIGHT Magazine
- SE Journal
- SEBoK
- IS2021 Proceedings

Events
- IW 2021
- IS 2021
- HSI 2021
- AI Mini Event
- Regional Events
- Chapter Events

Education & Training
- ABET SE Program Criteria
- SE Foundations Tutorial
- Technical Leadership Institute
- xSE Professional Certification
- STEM Working Group



Collaborations
- International Standards
- SE Vision 2035
- Future of SE (FuSE)
- MBSE Initiative
- Smart Cities Initiative
- EMEA Workshop
- ASEW Workshop
- Engineering X Research Project
- INCOSE Working Groups

And Almost Ready…
- SE Vision 2035 Publication
- SE Competency Assessment Guide
- SE Education Ecosystem Application
- Professional Development Portal
- SE Principles & Heuristics
- "Letters to my Younger Self" Publication
- Artificial Intelligence Primer
- Complexity Primer Rev1

As you may know, we had a dedicated team working with numerous other technical organizations worldwide over the last two years, identifying the current trends and technology advances to determine what systems engineering may resemble in 2035. To quote our upcoming Systems Engineering Vision 2035, "it is to inspire and guide the strategic direction of systems engineering across diverse stakeholder communities."

President's Corner

Kerry Lunney, INCOSE President
Kerry.lunney@thalesgroup.com.au

Taking a leaf from this document, INCOSE can look for inspiration to create our future state:

- Address future INCOSE challenges through dedicated team members and support services, sharing knowledge and expanding networks, operating over collaboration platforms sustained by INCOSE.
- Broaden the INCOSE membership by offering a diverse but targeted portfolio of benefits valued by current and future members.
- Align INCOSE initiatives to expedite realizing the Systems Engineering Vision 2035 for diverse stakeholder communities.
- Promote INCOSE exploration to adopt and adapt INCOSE policies and practices in our digital transformation to better serve our members, our community, and prospective systems engineering needs.

From our current position, and despite the challenges thrown at us, we have achieved much this year. You should all be proud of our achievements as a technical community and showcase these when opportunities arise.

At the end of January, I hope to connect with you at our International Workshop (IW) 2022 in Torrance, US-CA. Enjoy the remainder of 2021 and welcome 2022—make it an excellent year for you and INCOSE.

Keep well, keep safe.

Cheers,

Kerry Lunney

INCOSE President 2020-2021

2022 Annual INCOSE international workshop

Torrance, CA, USA
Jan 29 - Feb 1, 2022

HYBRID EVENT

A hybrid event combines in-person and virtual elements in a way that unlocks a live dialogue between and among presenters and attendees—whether they join in person or online.

In person participation
In-person experience at the Torrance Marriott Redondo Beach hotel

Remote participation
Online experience hosted on our virtual event platform

Highlights on the program

- **Opening Plenary and Town Hall Meetings:** Get updated on INCOSE Projects and Initiatives.
- **SE Vision 2035:** Be inspired about the strategic direction of systems engineering and guided to collectively address systems engineering challenges, broaden the base of practitioners, align initiatives, and promote research!
- **Working Group Meetings:** Join us for working sessions and outreach sessions throughout the IW.
- **Model-Based Systems Engineering Initiative:** This year the MBSE Workshop will again be a cross-cutting activity at the IW.
- **Closing Plenary and Market Place:** Join this session to hear short reports on the key outcomes from IW2022 as well as important announcements about IS2022.

Registration

Registration is open. Book your seat now!

Sponsors

Sponsorship packages are available & registration is open

Thanks to our sponsors
(as of November, 30)

PROJECT PERFORMANCE INTERNATIONAL

SPEC INNOVATIONS

Torrance Marriott Redondo Beach
3635 Fashion Way
Torrance, California 90503 - USA

Contact us workshop@incose.net
More information on www.incose.org/IW2022

Notes from the Board

Lisa Hoverman, Marketing and Communications Director
marcom@incose.net

The INCOSE Board of Directors (BoD) held their fourth quarter meetings (3) to date remotely via Zoom, continuing the on-going global quarantine status. While the in-person meetings are very much missed, the bond and productivity of this Board is strong. This BoD meeting welcomed newly appointed, elected, and non-contested members, and focused on:

2022 Required Items:

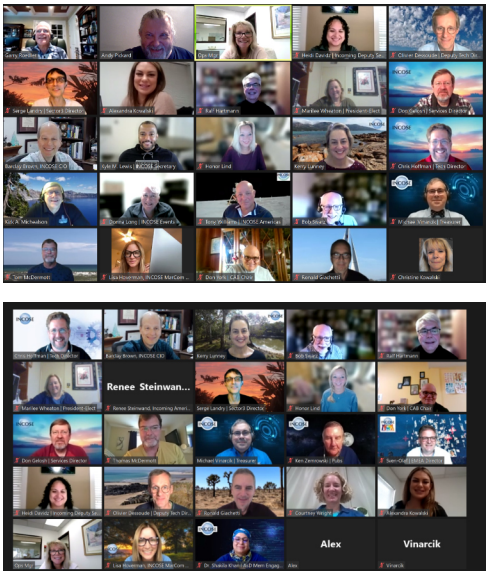
- Annual Operating Plan (AOP) for 2022 – AOPs live on Connect. Download Here.
- Budget for 2022 consideration, review, and approval, with a review of the 2021 budget prior
- Transitions for 2022 BOD Members
- Board Top 20 Priorities of 2021 Progress

Updates from the following committees (C), initiatives (I), operations (Ops), shared services (SS), special projects (SP), and task teams (TT:

- Diversity, Equity, and Inclusion Plans for 2022 (SP)
- Information Technology (SS)
  - Infrastructure & Initiatives
- Marketing and Communications (SS)
- Nominations and Elections (C)
- Operations Contract Renewals (Ops)
- Outreach/Alliances (SS)
  - Alliance Resource Management System
- Service Operations (Ops)
- Technical Operations (Ops)
  - Working Group Awards
  - Sector Updates (Ops)
- Emerging Chapters: Latin America and New Zealand
- Strategic Integration (SS)
  - Strategy Session Planning and Determination
  - Systems Engineering Education Ecosystem (SP)
  - Vision 2035 (SP)

The Board shared 2021 progress and upcoming work on from our Value Streams:

- Certification Plans for 2022
- Education and Training as a minimal viable service (MVS) with the Professional Development Portal (PDP) in 2022
- Events (specifically the upcoming 2022 International Symposium and Workshop events)
- Membership (Individual and CAB)
- Products
  - Pipeline Review for 2022 and Future
  - Recorded Offerings Model



Members of the INCOSE BoD on a Zoom Call during the INCOSE Q4 Board Meetings

Director Updates

Kerry Lunney, INCOSE President
president@incose.net

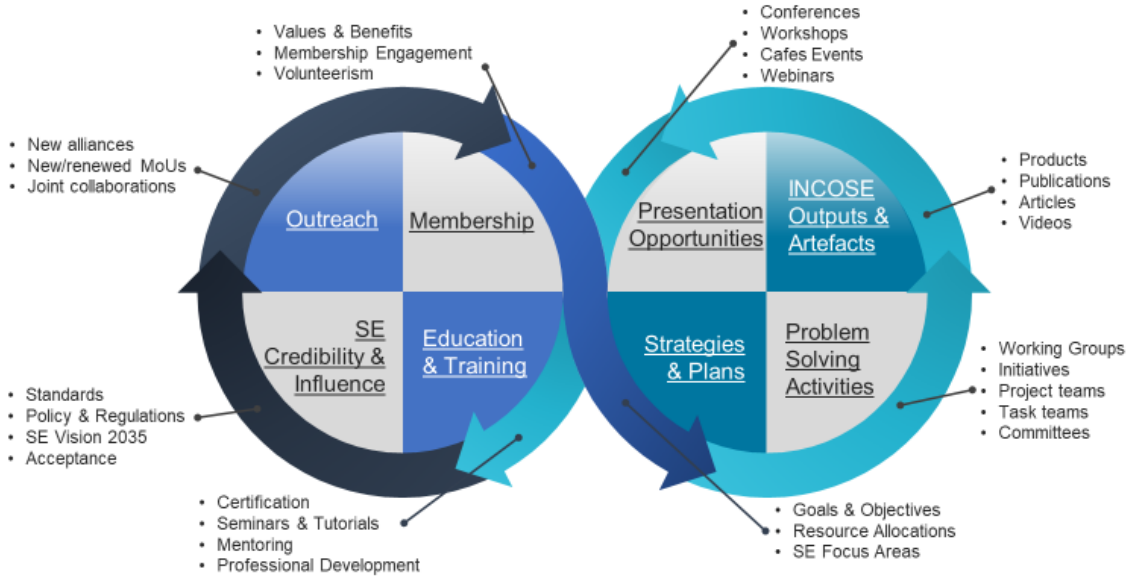
Updates from the President

As you may be aware, I am nearing the end of my 2-year term as INCOSE President, and this will be my final column. I cannot believe how fast my term has come and "almost" gone, all completely under the constraints of a pandemic. Who would have thought this would be the case when I ran as a candidate in 2017! I can honestly say INCOSE is indeed a very international organization, having led it from my home in Sydney, Australia.

The presidential role has been amazing. Although we have operated in unprecedented times, the trajectory has been "onwards and upwards." The experience of holding a position on the INCOSE Board can be valuable to your professional development. To be the head of this great group is just phenomenal.

As systems engineers, we are very familiar with working with patterns, looking for interactions and dependencies, addressing cause and effects, and so forth. These skills can apply anywhere. Thus, from the INCOSE association perspective, I have depicted one particular pattern of our primary activities in the figure below.

Starting with Outreach, INCOSE endeavors to disseminate systems engineering knowledge, bring together and support thought leaders in our discipline, promote our discipline, and offer our services. This, in turn, attracts individuals and organizations to join our community. Through Membership, many opportunities to network, gain new experiences and skills, and participate in realising the INCOSE vision to "build a better world through a systems approach" become available. This leads to defining and



communicating Strategies and Plans that underpin the needs of the membership, systems engineering, global challenges and needs, and INCOSE as an organization.

However, there is no point in having strategies and plans if we do not execute them. Different groups and individuals within INCOSE work towards implementing these strategies and plans through the many Problem-Solving Activities. These undertakings produce products, publications, papers, models, training aids, videos, and all INCOSE Outputs and Artefacts. With such material, INCOSE can share and inform others through numerous Presentation Opportunities such as conferences, workshops, system exchange cafes, and webinars. We can also provide many services to members, alliances, and the general public.

We gain credence as a valued Education and Training resource provider on related systems topics through these exposures. This is extremely important to recognize systems engineering professionals and grow our future workforce. With such talent, we can give Systems Engineering Credibility and Influence to decision-makers and shape our future. In doing so, we extend our Outreach.

The foundational elements of INCOSE's IT, Operations, and Marketing and Communications (MarCom) enable this pattern.

At an abstract level, it is no coincidence the pattern is the symbol of infinity. Considering our organization's trajectory, and in the words of Buzz Lightyear, INCOSE will aspire to "infinity and beyond"—a great concept I like, reinforced by our progress and achievements over the recent years, and noting these are primarily from a volunteer workforce. I will walk through some of these accomplishments during my presidency at the International Workshop (IW) 2022 in January 2022.

Lastly, a few people have asked me, "what will be in store for me after my presidency?" Well, of course, I will need to re-engage with work, family, and friends, and I will continue to contribute to systems engineering and INCOSE. In addition to going boating, going to the beach, camping, and reading, I feel it may be time for a new phase in my life—I have always felt there is a short novel in me. Think of the material I can imagine with design thinking and system thinking techniques!

I would like to sincerely thank you for your support to INCOSE, our discipline, and myself personally. It has been my honor to serve on the INCOSE Board for the last seven years. The INCOSE community is one I am very proud to be part of.

Enjoy the end-of-year festivities. See you in 2022.

A fond look back on Kerry's tremendous service to INCOSE as President and President-Elect:

Director Updates

Valkand Jhaveri, Outreach Ambassador
valkand.jhaveri@incose.net

INCOSE Outreach Overview - The Director and Assistant Directors

INCOSE Outreach's objective is to identify other organizations, industries, and entities that either complement INCOSE or have strong synergies with INCOSE and systems engineering. Once identified, the INCOSE Outreach team allies with these identified entities using established policies and procedures. INCOSE Outreach also assigns ambassadors to industry domain areas and relationship managers to professional organizations or societies.

INCOSE Outreach is led by Director Dr. Julia Taylor. Early in her career, Julia worked in technical roles in numerous technology companies, including Intel, Acurex, and Buckman Laboratories. She then grew interested in helping companies adapt to changing technologies and improving their business approach. Her background includes degrees in chemistry and electronics, plus an MBA in business and a doctorate in strategic management.

VJ and Julia with potential future outreach members Saulius (center between VJ and Julia) and Alex (far right)

From IWCE, and with a suggestion from Julia. We had a spinning wheel/dart wheel.

An active member in the systems engineering community, she not only serves as Outreach Director for INCOSE, but she also represents the local INCOSE chapter on the San Diego County Engineering Council. She participates in the Institute of Electrical and Electronics Engineers (IEEE) and the American Chemical Society. She has written and presented several technical papers, as well as three business books.

She currently works as a management consultant, helping companies diagnose problems and implement innovative new solutions. Her current emphasis is on systems approaches and using systems thinking to achieve long-term business success.

Other Outreach Team members include Joe Marvin (Assistant Director for Professional Societies), Valkand Jhaveri (VJ) (Assistant Director for Industries/Domain), and Dr. Alice Squires (Assistant Director for Empowering Women Leaders in Systems Engineering). All are available at incose.net email addresses.

Outreach data is available in the Alliance Relationships Management System (ARMS) in the INCOSE Teams area. It has outreach activities, memoranda of understanding (MOUs), and ambassador information. We also

document Outreach data in INCOSE Connect. At present, we have developed and currently maintain relationships (MOUs) with professional societies, including Project Management Institute (PMI), SAE International, IEEE, and American Institute of Aeronautics and Astronautics (AIAA), among others. We assign ambassadors in different industry domains and different geographical locations.

Announcing the INCOSE and ASEE Systems Engineering Division 2021 Outstanding Systems Engineering Educator Award Recipients

Alice Squires, alice.squires@incose.net

As another example of the many Outreach activities that have taken place in 2021, INCOSE has a Memorandum of Understanding (MOU) with the American Society of Engineering Education Systems Engineering Division (ASEE-SED). As part of this MOU, the ASEE-SED and INCOSE jointly offer an Outstanding Systems Engineering Educator Award. This award recognizes outstanding contributions to systems engineering education, as evidenced by one or more of the following:

- Creating/developing a systems engineering program of outstanding value
- Developing/promoting innovative instructional approaches that have long sustained effective learning and others have potentially widely adopted
- Infusing systems engineering education in non-traditional settings such as K-12 or as a common major for undergrads
- Systems engineering education research widely adopted by others with effective results
- Long-term sustained training of effective systems engineers.
- Providing outstanding service promoting research in systems engineering education and systems engineering education outreach and adoption

The 2021 Outstanding Systems Engineering Educator awards went to:

Dr. Azad Madni: Astronautical Engineering Professor at the University of Southern California

Dr. Gregory Parnell: Professor practicing in the Industrial Engineering Department at the University of Arkansas

Please note 2021 marks the inaugural year for this award, and therefore Dr. Madni and Dr. Parnell are the first recipients of this award and special recognition. Please join me in extending your congratulations to Dr. Parnell and Dr. Madni and thanking them for their passion for systems engineering and their continuing service to furthering lifelong systems engineering learning throughout the global community.

Ms. Susan Ronning and VJ at IWCE—Las Vegas

Some of our recent in-person activities from September 2021 include the Western States Regional Conference (WSRC) in San Diego and the International Wireless Communication Expo (IWCE) in Las Vegas. Both events were successful. We also virtually managed an INCOSE booth at NAFEMS—World Congress Conference (Austria).

We had some leads on future ambassadors and some future members for INCOSE at WSRC.

Director Updates

Dr. Don York, CAB Director

don.york@incose.net

Neither Snow, Nor Rain, Nor Heat, Nor Gloom of Night

I serve as INCOSE's Corporate Advisory Board's (CAB) chair/co-chair, filling these roles for almost four years. I will finish my term at the International Workshop 2022 in Torrance. One of my duties is reviewing and approving new applications from industry and academic organizations interested in becoming an INCOSE CAB member. Before an organization applies, they often want to learn more about the role of the CAB in INCOSE, the benefits being a CAB member brings to their organization, and what their role in the CAB would entail. I have had numerous exchanges with organizations ranging from emails to telephone conversations to Zoom meetings. Introducing them to the CAB and telling them how they can become an active CAB member is my most enjoyable activity as the CAB chair. As INCOSE is an international society, our CAB members are worldwide and in different time zones. Thus, my CAB introductions and discussions have occurred during all hours of the day, ranging from 4:00 AM to midnight.

Perhaps the most memorable CAB introductions occurred this past summer during an early evening virtual meeting. We live in Maryland near the Atlantic coast and the Chesapeake Bay, so we are no strangers to weather events such as tropical storms and hurricanes. I was preparing to engage with the perspective CAB member when my cell phone started to blast an obnoxiously loud alert. I grabbed my phone to see we were under a warning and someone had seen a tornado nearby. "Oh, great," I exclaimed out loud. I had just established the virtual connection and had three of the organization's senior leaders on the phone. Momentarily turning off the video, I quickly grabbed my laptop and headed for the basement with our golden retriever Zulu. My wife and son were out running some errands. "What were they going to do?" I thought.

As the meeting started and I introduced myself, I received a text from my wife saying they had sought shelter in the basement of a local church. "Thank you, Lord!" I said. The meeting continued as the company leaders introduced themselves and talked about their organization and interest in systems and systems engineering. "Systems?" I thought to myself. "There is a weather system out there right now!" I could see the chaos the system was causing right now through the small basement window. The sky had turned pitch black as though it were the middle of the night, although it was only late afternoon. The winds kicked up and howled ferociously. I could see leaves and debris swirling and twisting around. I informed our perspective CAB organization that our conversation might end abruptly. Undaunted, they continued to share their company's interest in becoming a CAB member and peppered me with questions about the benefits as the storm continued to rage outside.

Eventually, the storm ended, as did my virtual meeting with the potential CAB member organization. My family and I were all safe and returned to our daily routine, the storm now only a memory filed in the catalog of weather systems we experienced in our 25 years in Maryland. Several weeks later, I received an email from INCOSE Operations stating the organization submitted their application to join the CAB, asking for my approval. As my mind flashed back to the images and events of that evening during my virtual meeting with the company, I heartily responded "I approve!" to my most memorable CAB addition. Neither snow, nor rain, nor heat, nor tornado warnings stay the CAB chair from swiftly completing his appointed rounds!

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Enhancing the New Member Experience

Dr. Shakila Khan, shakila.khan@incose.net

A New Member's initial experience is a critical period that shapes their perspective of the INCOSE professional community. Having come to INCOSE seeking value for a wide range of reasons, one may ask:

What happens next?
Where do I go?
How would I connect and engage?

One New Membership Engagement Team goal is reducing the ambiguity members may face when taking their early steps in their INCOSE journey. Who would not want to know how to obtain value after joining our lively global village of systems engineering professionals.

The New Membership Engagement Team (NMET) has defined the "New Member Guide" and "Welcome Center" café programs held at the start of December 2021.

In the "Guide" program, experienced INCOSE members will support and shape a positive new member experience.

The "Welcome Center" cafés will enable guides and new members to connect and engage on various INCOSE topics through virtual events. Guides will host breakout sessions, interact with new members, answer questions, and help new members engage with INCOSE based on their interests.

NMET looks forward to enrolling guides and new members in these programs. Be on the lookout for additional communication seeking new member guides and the "Welcome Center" café program launch.

For additional information or inquiries, contact nme@incose.net.

Welcome Center Cafés January 2022

The New Member Engagement Team (NMET) is delighted to invite you to register and attend one of the January Welcome Center Café events. In this second Welcome Center Café series you will gain in-depth knowledge about the INCOSE International Workshop, the annual INCOSE technical exchange gathering happening in Los Angeles and online January 29 to February 1, 2022. Find out more here: https://www.incose.org/IW2022

Mark Your Calendar	Monday 10th January 2022 at 4:00pm (Japan Time)	Register here
	Tuesday 11th January 2022 at 8:00am (US Pacific Time)	Register here
	Wednesday 12th Janaury 2022 at 6:00pm (London Time)	Register here

If you have any questions about these programs, please contact the NMET at nme@incose.net.

Chapter Updates
Americas

Los Angeles Chapter

D. Benveniste,
djbenven@outlook.com

Education 2021

The INCOSE-LA Chapter is one of the largest globally, with nearly 450 members from over 40 organizations. INCOSE-LA is proud to attract systems engineering professionals in industry and government from around the world to our events. We pride ourselves on hosting engineering experts to teach tutorials and present current technical topics at our monthly speaker meetings. Presentation materials for all LA Chapter meetings are available in Connect, LA Chapter folder.

Major highlights of our 2021 events include:

March Tutorial: Solving Real-World Problems with MBSE

Students installed Cameo System Modeler to gain practical model-building experience and fully utilize model-based systems engineering (MBSE) to explore SysML capabilities.

Speaker: Casey Medina is the Studio SE, Ltd. President, an MBSE consultant, and an instructor for the Caltech Center for Technology and Management Education

The presentation is available here.

May: Systems Engineering Professional (SEP) Cohort

Hosted and supported a pair of 14-week joint SEP Cohorts with the San Diego Chapter to prepare prospective students to take the SEP exam by the Western States Regional Conference (WSRC) 2021.

October Speaker Meeting: Approach to Verify SEP Exam Sample Questions

Participants learned how INCOSE Certification teams prepare questions for the certification exam and how the INCOSE Certification program verifies exam and practice questions for accuracy.

Speaker: Courtney Wright, a Certified Systems Engineering Professional (CSEP) and the INCOSE Certification program manager

The presentation is available here.

November Speaker Meeting: Systems Engineering Approach to Technology Maturation

Students gained valuable insight into how current technology readiness level (TRL), manufacturing readiness level (MRL), and integration readiness level (IRL) quality standards help mature aerospace technology.

Speaker: Andrew Murrell, a CSEP and Northrop Grumman Principal Systems Engineer

The presentation is available here.

New Video/Audio Equipment Telecommunication and Hybrid event Initiative
We conducted several trade studies to improve video and audio communication for future INCOSE-LA events. One initiative included evaluating, designing, and deploying a low-cost, portable audiovisual stage equipment system that fits into a single 20-gallon container.

This system allows real-time 4K video capture, speaker amplification, online recording, and web conference connectivity through Zoom, allowing simultaneous bi-directional

communication between virtual and live attendees. INCOSE-LA not only successfully deployed this system for the six-hour INCOSE-LA November special program meetings, but the system exceeded our expectations.

We packaged the system trade studies, cost analyses, architecture diagrams, assembly instructions, and operations manuals for any chapter or organization interested in considering similar systems.

Please contact secretary@incose-la.org for further details.

San Diego Chapter

Valkand Jhaveri (VJ),
valkand.jhaveri@incose.net

Central Front Range (CFR) activities—Western States Regional Conference (WSRC)

The 2021 INCOSE WSRC conference took place in San Diego, US-CA, allowing CFR members to participate in person. The CFR board of directors took an active role in planning, coordinating, and implementing the 2021 WSRC. It was lots of fun meeting everyone in person, and the success of this event will help as we plan our 2022 WSRC.

CFR board of directors took on different roles for the 2021 WSRC. We were technical program leaders, paper reviewers, session chairs, logistics committee members, and more. We, as systems engineers and systems thinkers, had contingency plans - accounting for countless "what-if scenarios." These contingencies paid off as the hotel internet stopped working. No internet would have been disastrous as 2021 WSRC was a hybrid (in-person and virtual) conference. However, we implemented our pre-planned solution should this be the case, leading to complete success. Here are some fun photos from this year, and we look forward to the Front Range Chapter (FRC) sponsoring the WSRC in 2022.

Help Needed! WSRC 2022

The INCOSE Western States Regional Conference (WSRC) is a three-day event including presentations and keynotes on systems engineering topics.

One chapter from among the western United States INCOSE chapters hosts the WSRC with support and expertise from the other western state chapters. WSRC provides a high-quality education and networking source among systems engineers, including program managers, educators, and technology professionals who may benefit from the systems approach to solving challenging problems and optimizing processes.

The WSRC 2022 will take place in the Denver, US-CO, area. We are now forming the Steering Committee, and we need your support to develop the theme, plenary speakers, and technical program.

Please email the conference chair, Renee Steinwand, to volunteer at steinwand_renee@bah.com. Please join us!

32nd Annual INCOSE international symposium

Detroit, MI, USA
June 25 - 30, 2022

HYBRID EVENT

A hybrid event combines in-person and virtual elements in a way that unlocks a live dialogue between and among presenters and attendees—whether they join in person or online.

In person participation
In-person experience at the Torrance Marriott Redondo Beach hotel

Remote participation
Online experience hosted on our virtual event platform

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Deadline to submit your presentation: February 20, 2022

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- Participate in high level Systems Engineering tutorials
- Be informed on the latest practices in Systems Engineering

ENLARGE

- Be part of the largest worldwide community in Systems Engineering
- Meet and network other Systems Engineers (professionals at all levels, and practitioners in government and industry, as well as educators and researchers from all over the world.
- Share your experience, points of view, approaches and best practices with other participants

MAXIMIZE

- Take the INCOSE knowledge exam & get certified as an Associate Systems Engineering Professional (ASEP) or Certified Systems Engineering Professional (CSEP).
- Gain PDUs credit towards your INCOSE Systems Engineering Professional (SEP) certification
- Visit the sponsors virtual showcase & on site booths and see their latest products & services

Detroit TCF Center
1 Washington Blvd.
Detroit, MI 48226, USA

Contact us symposium@incose.net
More information on www.incose.org/symp2022

Chapter Updates
Asia/Oceania

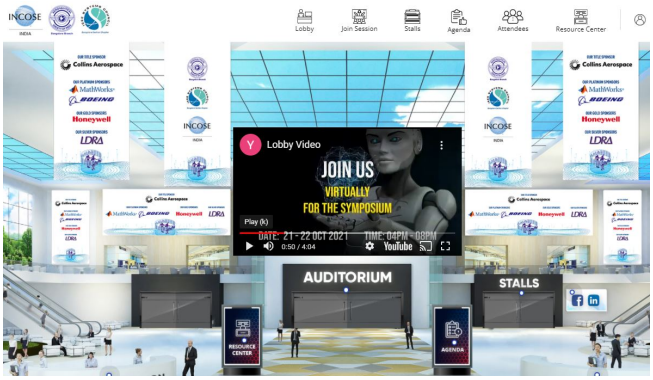
India Chapter

Aparna Kansal,
aparna.kansal@boeing.com

International Symposium on Artificial Intelligence-Machine Learning for Safety-Critical Systems

The INCOSE India Chapter organized its second big event this year, the virtual International Symposium on Artificial Intelligence-Machine Learning in Safety-Critical Systems, held on the 21st and 22nd of October 2021. Organized in collaboration with IEEE Systems Council Bangalore Section Chapter and The Aeronautical Society of India's Bangalore Branch, it was a grand event with over 600 participants and eight hours of packed sessions spread across two days.

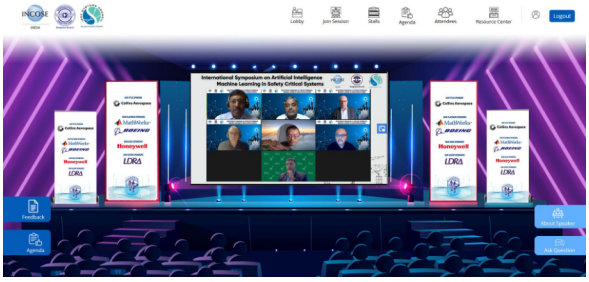
Although virtual, industry-leading event sponsors (Title Sponsors: Collins Aerospace, Platinum Sponsors: MathWorks and Boeing, Gold Sponsors: Honeywell, and Silver Sponsors: LDRA) and The Aeronautical Society of India treated the audience to an in-person conference like experience. The event platform allowed the audience to enter the symposium venue through a main lobby containing a help desk, details about the symposium, and an introductory video. Attendees could enter an Auditorium to listen to the speakers, learn more about the speakers, ask questions, and give feedback. There was also a virtual exhibition space to visit the sponsors' exhibits (stalls), to interact with people at the exhibit booths, and learn more about the sponsoring companies. A critical aspect of an in-person conference is networking, and this virtual platform provided people an opportunity to do so through the chat feature.



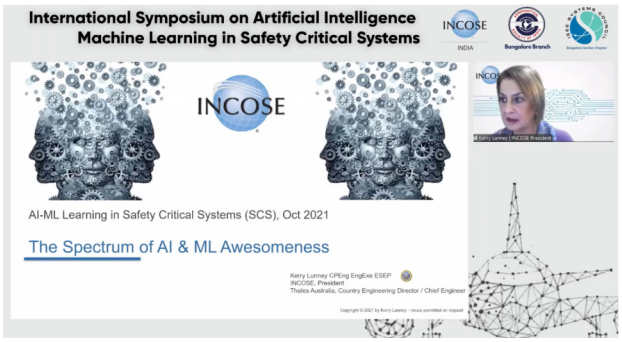
As systems complexity increases rapidly, there is an increasing demand for systems to include humanlike-intelligence and autonomy through Artificial Intelligence (AI) models, including data-driven decision-making capabilities based on Machine-Learning (ML) algorithms and techniques. Adopting AI and ML, in turn, would exponentially increase the complexity in the design, verification, and validation of such intelligent systems. This symposium brought together experts from various sectors, including aerospace, automotive, industrial automation, and healthcare, to share their research findings and experiences and discuss the various challenges of adopting AI and ML in safety-critical systems. Each day of the symposium had a specific theme. The first day focused on modeling and simulation AI and ML aspects and applications, and day two discussed systems engineering, certification, and regulation of AI and ML aspects.

Dr. Ramakrishnan Raman (Principal Systems Engineer at Honeywell, Assistant Director for INCOSE Asia Oceania, and IEEE Systems Council Bangalore Section Chapter Chair) commenced day one of the symposium. As a part of the Inaugural session, Dr. Raman

introduced the key dignitaries for the event: Chief Guest Dr. Satheesh Reddy (DRDO chairman), Ms. Kerry Lunney (INCOSE president and Thales Country Engineering Director), Dr. Vincenzo Piuri (IEEE Systems Council President), and Mr. Savyasachi Srinivas (Collis Aerospace Engineering Executive Director). All dignitaries comprehensively introduced the symposium topic. They addressed AI-ML application aspects and advantages in various areas and situations, the systems engineering role, challenges associated with adopting and accepting AI-ML, current AI-ML applications in safety-critical Aerospace domains, and the importance of applying AI to the human-system environment. Dr. Satheesh Reddy, in his Chief Guest address, spoke about the labs set up in Bangalore to promote AI research and encouraged young entrepreneurs to use the opportunities available to take this domain forward.



With this great kick-start to the symposium, day one continued with talks focusing primarily on the theme for the day. Through engaging illustrations, Dr. Ravindra D. Gudi, IIT Bombay AI and ML chair professor, spoke about using AI in monitoring safety-critical systems. Professor Gudi's idea of calling AI Augmented Intelligence rather than Artificial Intelligence was appropriate, as AI aims to augment human intelligence, not replace it. Dr. Ramesh Bharadwaj, a senior researcher at the US Navy's Center of Excellence in High Assurance Systems, highlighted some challenges with implementing AI and safety aspects requiring consideration during ML application. Mr. Satish Thokala, Mathworks Aerospace and Defense Industry manager, highlighted how Mathworks can support AI implementation, primarily in the Aerospace and Defense sector.



Day one sessions concluded with a fascinating panel discussion, moderated by Dr. Darren Cofer, a Collins Aerospace Fellow. The panel was privileged to have Mr. A.S. Kiran Kumar (an ISRO Bangalore Vikram Sarabhai Professor and ISRO President-AeSI Past Chairman), who is well known for his contributions to ISRO's Chandrayaan-1 Mission and Mars Orbiter Mission. The panel also included General Atomics' Dr. Stacy MacAllister (AI/ML solutions architect) and Mr. Rey Nicolas (Director Of Software, Autonomy, and AI Solutions), Merlin Labs' Mr. Robert Voros (System Safety Lead and SAE International Chairperson), and Mathworks' Mr. Prashant Rao (Application Engineering Head). The panelists highlighted numerous challenges to look out for in AI and ML implementation and safety from different perspectives—Space, UAVs, aircraft, safety assessment, and tool applications. Finally, Dr. Cofer concluded the panel agrees there is much enthusiasm towards using AI and ML. However, we should have realistic expectations on how much and what we can implement, how soon, and what to expect in the future. Dr. Yogananda Jeppu (Honeywell principal systems engineer and IEEE Bangalore Section Systems Council Chapter Secretary) summarized the day's proceedings and showed what to expect on day two. In line with the theme of day two, and after Mr. Mudit

Mittal (Bluekei Solutions director and INCOSE India Chapter President) set the context, Mr. George Romanski (FAA Chief Scientist and Technical Advisor) gave the Keynote Address. He addressed the ongoing progress, however acquiring Regulatory Certification for AI-ML based intelligent systems is still a long way off and requires answering some pertinent questions. There were some great talks on day two covering opposing AI and ML aspects. Dr. Barclay Brown (Raytheon Technologies Fellow and INCOSE AI Working Group Co-chair) spoke about ML challenges and findings using an interesting green school bus problem. He also highlighted how systems engineers must identify the variety of data needed to "teach" the AI. Mr. Ritesh Ghimire from FAA brought out some recommendations on the certification aspects. Opposing the cautionary views, Dr. Seema Chopra (Boeing Data Analytics Global Technical Leader/Principal Data Scientist) spoke about how ML and big data applications are already beneficial and necessary for some applications in the aerospace industry. The panel on day two, moderated by Mr. George Koilpillai (Honeywell Chief Engineer), also discussed AI safety aspects. The panelists, spanning industry and academia, included Dr. Huafeng Yu (Boeing Senior Researcher), Mr. Tom Ferrell (Joby Aero Digital Development Assurance Group Lead), Prof. Tom Melham (University of Oxford), Dr. Ali Raz (George Mason University Assistant Professor), Mr. Paul La Pietra (Honeywell Senior Engineering Director), and Mr. Adishesha Sivaramasastry (Collins Aerospace Technology Director).

The discussion reiterated the points highlighted throughout the symposium on how it will still take time for confidence in full-scale AI applications, brought out some interesting ongoing research in academia and industry, and looked into the future. Mr. Shashi Kumar (Honeywell Principal Engineer) summarized day two. Mr. Raj Pai (NASA Aeronautics Division Senior Technologist) followed Mr. Kumar with the final keynote address, highlighting work done at NASA and future AI and ML trends. Finally, the event came to a memorable end with a "Vote of Thanks" from AeSI.

artificial intelligence and machine learning are the future. There is still a long way to go and lots to consider, especially regarding AI-based system safety, regulation, and certification. However, several small areas exist where applying these technologies proves to be extremely beneficial and effective. Events like this symposium help get people thinking, raise awareness, and encourage people to pursue this field and work for its betterment in the times ahead.

Singapore Chapter

Meng Seng Toh,
MengSeng.Toh@incose.net

Webinar Presentation: Introduction to Model-Based Systems Engineering (MBSE) and its Adoption Roadmap

The 20th of October 2021 marked the local Singapore chapter's first event since a new committee assumed the chapter leadership in March 2021. Mr. Robert Ong, an industry process consultant, passionately rose to the occasion, delighting us with his Model-Based Systems Engineering (MBSE) perspectives. Robert shared insights explaining how MBSE offers various but interconnected perspectives to achieve consistent and meaningful cross-collaborations.

Industry Process Consultant Robert Ong on Presenting on MBSE

Robert Ong, Robert.Ong@incose.net

"This also marked the INCOSE Singapore chapter's first initiative to reboot its activities after the crisis caused by the COVID-19 pandemic. With a new phase in the pandemic upon us, we must radically change everything we do and learn to live with it. Many companies realized the importance of being responsive and ready to adapt to a new way of living. The world has changed many times, and it is changing again. As Albert Einstein said, "In the midst of every crisis lies a great opportunity." These challenging times present an opportunity for organizations to do more than survive by changing the way they work, migrating to digital technologies, implementing new technologies, and making faster decisions amid uncertainty. Transforming systems engineering and adopting MBSE are the next steps for many companies to emerge stronger.

It has been a great pleasure to receive the chance to participate in the October INCOSE Singapore webinar and discuss MBSE and its adoption path with our engineer community from Singapore and other countries. This was our first talk introducing and promoting MBSE and its adoption roadmap. I strongly believe systems engineering practices can help organizations grow, transform, and take advantage of digital engineering. I sincerely hope those who attended the webinar enjoyed it as much as I did.

I also had the opportunity to organize workshops for some INCOSE members, the Land Transport Authority of Singapore, and Continental AG Singapore. We discussed safety and reliability with Failure Mode and Effects Analysis (FMEA). We also learned about Systems Modeling Language (SysML) and how it could apply to different contexts. It was such a rewarding experience for me as an INCOSE Ambassador for the Asia region to contribute during these challenging times and keep our engineering community moving forward.

We will hold a Christmas special event and discuss either "Introduction to Systems of Systems Architecture with UAF" or "Systems Model vs. Analysis Model—A Case Study on How to Support Early Validation and Trade Study." If you are interested in the other MBSE-related topics, please let us know. Stay safe and keep your systems engineering engine running!"

INCOSE Singapore Chapter President

Ming Wah Tham,
MingWah.Tham@incose.net

The local chapter President, Ming Wah Tham, took over the leadership in March 2021. He looks forward to revitalizing systems engineering appreciation and further fostering systems engineering awareness, processes, and current best practices.

This term (2021-2022), we aim to do many things. We will organize regular webinars discussing interesting systems engineering topics to help our members further their knowledge in systems engineering. We will also organize sharing sessions to help people understand our Systems Engineering Professional (SEP) certification and re-certification process.

We want to recruit more members to our chapter and discover promising individuals keen on contributing their efforts to running the chapter.

If you would like to connect with the systems engineering community (both locally and internationally), I encourage you to take the first step and contact us.

We also embrace diversity and inclusion to try to recruit more female members into the engineering community and our committee.

Through our activities, I hope to see you more as you discover and appreciate the wonderful world of systems engineering!

Chapter Updates
EMEA

UK Chapter

INCOSE UK Secretariat,
publications@incoseuk.org

INCOSE UK Council Changes

It is our pleasure to announce Stuart Jobbins as the new INCOSE UK Outreach Director.

Stuart is a seasoned systems engineer, previously holding positions on the Institute of Engineering and Technology (IET) council and is an IET Fellow, a Senior Institute of Electrical Engineers Member, an INCOSE member, and a Chartered Engineer. In his statement, available in full on page three of issue 86 of ePreview, he states, "I am interested in this position in being able to further the understanding and need for more rigorous approaches to systems engineering, with emphasis on greater smaller organisation adoption, better recognition as a competency and profession in industrial groups, greater industrial application in academia, and better recognition and standing in other professional organisations."

We wish him every success in the role.

More information regarding the Council positions and structure is available in the INCOSE UK website.

ASEC 2021 Proceedings Now Available

The Annual Systems Engineering Conference 2021 took place on the 23rd and 24th of November 2021 at the Royal Armouries Museum in Leeds, West Yorkshire. This was our first live event to take place since the pandemic started.

The ASEC 2021 Proceedings compiles published papers from the event, giving those who could not attend the event a taste of the topics discussed and hopefully inspiring them to attend a future event. We trust the proceedings will provide a lasting benefit and fitting record of INCOSE UK's ASEC 2021 "Creating Stability in Uncertain Times."

The proceedings are available to purchase from the INCOSE UK Online Store.

Endorsed Training Provider Event

As part of our commitment to members, we recently developed our official INCOSE UK Endorsed Training Provider scheme. This was in direct response to many members who needed quality training recommended by INCOSE UK. The Endorsed Training Provider scheme is open to any training providers who, once they apply, undergo assessment regarding their: position in systems engineering, their organisational ability to run training courses, the course content and structure, the trainer competence; and the support material provided as part of the courses.

If the applicants are successful, they receive Endorsed Training Provider status and may use the Endorsed Training Provider logo to promote their courses. As part of the scheme, INCOSE UK facilitates several courses in a face-to-face format in the UK, Europe, and remotely across the rest of the world.

We would like to offer other INCOSE chapters the opportunity to collaborate with us in providing these courses to their members. These courses are professional services and, as such, INCOSE UK generates income from them. Of course, any INCOSE chapter who would like to collaborate with us would receive

a share of any income generated.

More information about the Endorsed Training Provider Scheme is available on the INCOSE UK website.

Don't Panic! Meet the Author Sessions

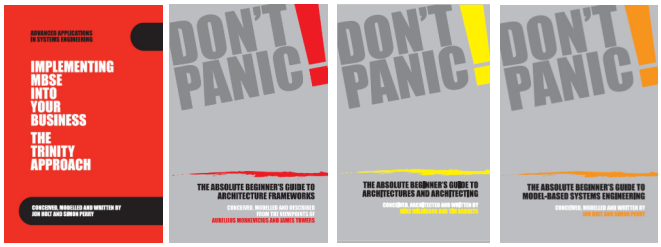
During the past twelve months, we introduced the Meet the Author Sessions. These gave the chance for members and non-members to meet and talk with the authors of our Don't Panic! and Advanced Application book series.

For those unable to attend, we recorded the sessions. These are now available to stream on the INCOSE UK YouTube channel.

The sessions available are:

- Advanced Applications in Systems Engineering Implementing MBSE Into Your Business—The Trinity Approach with Jon Holt and Simon Perry
- Don't Panic! The Absolute Beginners Guide to Architectures and Architecting with Mike Wilkinson and Tim Rabbets
- Don't Panic! The Absolute Beginners Guide to Architecture Frameworks with Aurelijus Morkevicius and James Towers
- Don't Panic! The Absolute Beginners Guide to Model-Based Systems Engineering with Jon Holt and Simon Perry

The publications are available to purchase from the INCOSE UK Online Store.



INCOSE UK Contribution to New UK Government Project Support Tool

INCOSE UK has contributed to the UK Government's Infrastructure and Projects Authority (IPA) new Project Routemap for guidance on systems integration.

The Project Routemap is the IPA's support tool for major novel or complex projects. It helps sponsors and clients understand the capabilities needed to successfully deliver projects, incorporating learning from other major projects and programmes. It provides practical advice, and the UK government developed it in collaboration with industry and academia.

You can find more information about the project here.

INCOSE UK Is an Industry Partner of the HS2 Learning Legacy

As an HS2 Learning Legacy industry partner, INCOSE UK shares knowledge and insights contributing to an overall body of knowledge on major projects. Supported by the Major Projects Association and the Infrastructure and Projects Authority, the HS2 Learning Legacy has started sharing insights across the infrastructure sector. Topics include design, engineering, and architecture.

HS2 is a state-of-the-art, high-speed line critical for the UK's low-carbon transport future. It will provide much-needed rail capacity across the UK, and is integral to rail projects in the North and Midlands, helping rebalance the UK economy.

To find out more visit the HS2 website.

Working Group Updates

Project/Program Management - Systems Engineering (PM-SE) Integration Working Group Update

Tina P. Srivastava
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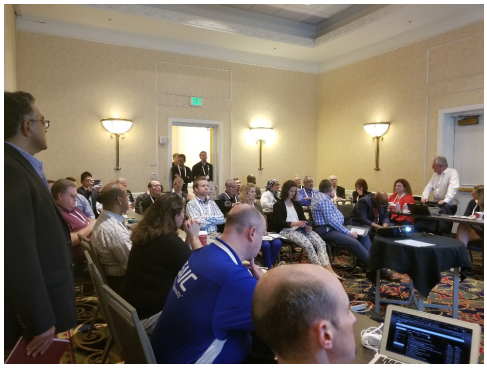
About the Working Group

The PM-SE Integration Working Group (WG) aims to identify and promote opportunities to effectively integrate project/program management and systems engineering (PM-SE). The WG encompasses defining, capturing, evolving, and communicating PM-SE integration best practices. This includes developing training material, guideline material, recommendations for industry best practices and standards, and shared output with industry WGs from other organizations.



PM-SE WG meeting IW19

Achievements

In 2017, the PM-SE WG collaborated with the Project Management Institute (PMI) and the Massachusetts Institute of Technology (MIT) to publish Integrating Program Management and Systems Engineering: Methods, Tools, and Organizational Systems for Improving Performance. This book shows how organizations can become more effective, more efficient, more responsive, and enjoy better performance outcomes. The book can be purchased here.

How to Get Involved

We are looking for systems engineers with solid knowledge and experience in engineering management or project management applications. We welcome hands-on experience in industries.
We are currently working on Version 5 of the Program Management and Systems Engineering Handbook.

If you would like to contribute or assist as a reviewer, please contact Tina at tinaps@sbcglobal.net.

Healthcare Working Group

Christopher Unger
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Robert J. Malins
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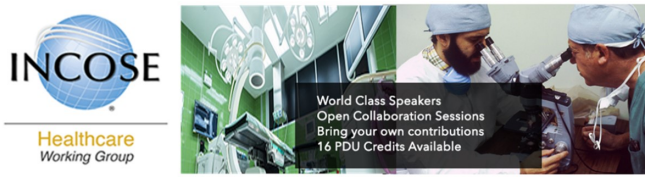

SAVE THE DATE: Eighth Annual Systems Engineering in Healthcare Conference

26-28 April 2022 Minneapolis, MN

The Annual INCOSE Systems Engineering in Healthcare Conference enables participants to share the best practices in the latest systems engineering topics applied to medical devices and healthcare delivery. The theme for the conference is "Advancing the Practice of Systems Engineering in the Healthcare Industry." The intended audience is systems engineers, product developers and testers, and organization leaders developing complex

healthcare products and services from large healthcare IT systems to medical devices to healthcare delivery organizations. We welcome attendees from other domains interested in learning about systems methods in healthcare as well.

Please visit our conference website for information about previous conferences. We will also publish additional information about the 2022 conference on the conference website and our LinkedIn group as it becomes available.

Human Systems Integration A Contemporary Discipline

Guy André Boy & Grace Kennedy,
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The engineering community often asks to clarify what Human Systems Integration (HSI) entails. HSI often suffers from an identity crisis. Common opinions say it is synonymous with human factors and ergonomics, designing user interfaces, integrating the human with computer systems, a checklist of human-centered evaluations for a partially or fully developed engineering system, and more. In truth, HSI includes these areas or activities, but the scope is far more comprehensive. Despite originating four decades ago, these misconceptions around HSI persist.

What is HSI today, and what should we be doing? This article addresses these questions and emphasizes the evolution of HSI, why it is crucial to systems engineering, and how it is becoming a contemporary discipline.

The most recent INCOSE HSI Working Group definition reads:

Human Systems Integration (HSI) is a transdisciplinary sociotechnical and management approach of systems engineering, ensuring the whole system life cycle, service, or enterprise system appropriately addresses a system's technical, organizational, and human elements. HSI considers systems in their operational context with the necessary interactions between and among their human and technological elements to make them work in harmony and cost-effectively, from the early design to disposal.

Since HSI's inception in the 1980s (Booher 2003), the definition essentially has not changed. Put simply, HSI ensures addressing human concerns throughout the system's life cycle and guarantees these concerns are explicitly part of the planned systems engineering efforts. So why do misconceptions persist, and where do they originate? Understanding these questions requires understanding the context of HSI's origins and how it evolved from and alongside more commonly understood disciplines.

From User Interfaces to Human-Centered Design

For a long time, mechanical engineering dominated the engineering field. Mathematics, physics, and other "hardcore" technical disciplines were the primary support for correctly making engineering systems. Human Factors and Ergonomics (HF&E) developed after World War II to adapt people to machines, even if it was often the opposite. Dominant issues were physical, and HF&E mostly focused on physiology and biomechanics. Practitioners developed methods and tools to improve human-machine adaptation physically.

Around 1980, human-centered engineering design approaches started to appear, especially with the development of microcomputers and the universal dissemination of office automation. Human-Computer Interaction (HCI) became a major focus for the development of software-based user interfaces. Interaction design then became a significant focus. Computer graphics developed and progressively supported HCI, and more specifically, user-friendly human-machine interfaces. However, user interfaces were still add-on components of machines, developed after fully developing the core machine technology.

Human-Centered Design (HCD) was born within the HCI community (Norman 1990 and Boy 2013). This occurred thanks to interaction design's naturally participative nature and digital media enabling human factor consideration in computing systems design. However, since its inception during the 1980s, the HCI community focused on personal computing and consumer electronics. The massive introduction of software-based automation in aircraft cockpits, for example, incrementally led to considering a more systemic approach to HCD. We started discussing onboard embedded systems and today's cyber-physical systems. HCI in the cockpit began to reveal new research concerns, such as cognitive engineering, advanced interaction media for complex life-critical systems control and management, complexity analysis, organization design and management, and finally, virtual modeling, prototyping, and simulation. We needed to wait until the beginning of the 21st century to have real HCD approaches. We could finally consider machines and stakeholders from the beginning of the design process throughout the entire life cycle of a technological system. Why? The reason is simple: modeling and simulation started to support user experience from the beginning realistically. It became possible to run human-in-the-loop simulations at design time and incrementally use experience feedback to improve engineering design.

Concretely, the HCI-Aero Conference Series, born within the HCI community, led to the inauguration of the INCOSE HSI biennial conference in 2019. Of course, virtual HCD is not exclusive to the aeronautics domain but is involved in numerous domains where life criticality is at stake. HCD nurtured from human-in-the-loop simulation became possible thanks to virtual prototypes and formative evaluation techniques whose evolution also became compatible with agile approaches. For these reasons, HCD expanded into the systems engineering world. HCD is no longer a user interface design adapting people to machines. Instead, it enables the co-adaptation of people and machines from the beginning of design to the dismantling phase of complex systems. Modeling and Simulation (M&S) enables design flexibility, improves resource commitment management, and capitalizes on systems knowledge. Today's digital twin approaches are this evolution's result. Indeed, developing the design process and its solution(s) through shifting from document-based to model-centric efforts lead to model-based HSI (Boy 2020).

Figure 1. Current HIS WG Activities

The Systemic Evolution of Human-Centered Design Toward HSI

INCOSE, formed in the 1990s, framed systems engineering as heavily technology-centered. Until recently, systems engineers counted on HF&E and HCI specialists to adapt people to the machines they developed. The user interface, based on usability engineering, was the solution. At the same time, our world became more digital and complex in the interconnectivity sense. We now needed to deal with new complexities requiring new tools and methods.

During the past decade, HSI evolved and cross-fertilized from HCD to systems engineering, subsequently extending as the combination of HCD and systems engineering (Boy and Narkevicius 2013). HSI became necessary as we started to understand that co-adapting people and machines is a deeper enterprise to consider during a sociotechnical system's whole life cycle. Today, we no longer focus solely on a user facing a machine through a user interface. We need to investigate an entire organization of people and smarter systems functioning cooperatively. We are no longer interested in a single-agent approach but in understanding how several human and machine agents can work together and how to define and organize such agents.

In addition to physical and cognitive factors, the social element of HSI became essential. Engineering design is not only technology and people using technology in isolation, but a matter of organizational design and management. This is why HCD could not stay based on single-agent premises. It needed multi-agent representations. The very notion of a "system" needed updating; a system is not only a concept representing artificial things. Systems can represent people, products, services, information, processes, and natural elements. Furthermore, the multi-agent socio-cognitive shift is now consistent with the system of systems notion.

INCOSE HSI Working Group Mission

The INCOSE HSI working group's current mission is to share experiences, learnings, and understandings around the emergence of HSI as a contemporary discipline. As with all emerging disciplines, we seek to formalize and disseminate this new knowledge for both existing professionals and students. The HSI working group's role is also to offer a forum for practitioners and researchers to exchange ideas and current practices in HSI. We need working group members with different perspectives and learnings to ensure the discipline's progression. We organize regular events, such as conferences and workshops, as well as monthly meetings. During the COVID period, these events and meetings were, and still are, virtual. We cannot wait to organize them in person soon, hopefully. We also produce materials for the systems engineering and HSI community. Figure 1 provides a snapshot of our current activities.

Over the last five years, the INCOSE HSI working group has continuously grown and continues to produce materials supporting its definition and development of associated methods and tools. For example, the "HSI Working Group Workshop" organized in October 2020 gathered 350 participants from 24 countries. We devoted a significant effort writing the HSI chapter for the INCOSE Systems Engineering Handbook Fifth Edition and a contemporary HSI Primer. We held the first INCOSE HSI conference in September 2019 in Biarritz, France, and the second as a virtual event in November 2021. The HSI conferences take place every two years and alternate with the HSI workshops.

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Launching at the INCOSE International Workshop 2022

Systems Engineering

Vision 2035

This Vision is intended to inspire and guide the strategic direction of systems engineering across diverse stakeholder communities.

INCOSE | Vision35 Systems Engineering

Journey to ABET Approval of Systems Engineering Program Criteria

Phil Brown, phil.brown@incose.net

What is ABET?

Originally founded in 1932 as the Engineers' Council for Professional Development (ECPD), in 1980, they became the Accreditation Board for Engineering and Technology to more accurately describe the emphasis on accreditation. In 2005, to reflect expanded scope, the Board began using the acronym ABET only.

Why is ABET Important?

The very professionals ABET serves drive their actions. The 35 member societies (of which INCOSE is one) provide the Experts who develop their criteria, setting the standards for our accreditation process.

Outcomes Based Education

In 1997, following nearly a decade of development, we adopted Engineering Criteria 2000 (EC2000), considered at the time a revolutionary approach to accreditation criteria. EC2000 focused on learning outcomes (what students learn) rather than what is taught. By implementing such fundamental changes, ABET moved away from a rigid process orientation toward a set of attributes professionals must possess to excel in fields of critical importance to society.

The Quest Begins

John Clouet, INCOSE president, meets Wolt Fabrycky and Phil Brown in a hall at the 2001 ABET symposium in Melbourne, Australia to announce the Board of Directors approved applying for ABET membership. Later that year Dennis Buede and Phil Brown met with the ABET CEO, a retired military officer who knew about systems engineering, to discuss the application process.

Buede and Fabrycky informed ABET's executive staff of INCOSE's interest in ABET membership in October 2002. A draft application for Participating Body Status was submitted for ABET review in May 2004. Andy Sage submitted INCOSE'S final application for ABET member society status in February 2006. ABET formed an Ad Hoc Committee of Systems Engineering Accreditation in March 2006. INCOSE representatives on the committee were Brown, Buede, Fabrycky, Sage, and Dinesh Verma. The "Final Report and Recommendations on Systems Engineering Accreditation" was published on February 1, 2008. Pat Hale, INCOSE President (2008-2009) received letter in August announcing INCOSE's admittance to ABET as a participating society. Hale responds with a September 2008 letter to Dr. Peterson, ABET CEO, appointing Fabrycky, Brown and Stan Settles to ABET positions and duties.

Fabrycky takes seat on ABET Engineering Delegation in 2009 and Brown assumes role as ABET liaison. Fabrycky and settles, past president of the Institute of Industrial Engineers and Chair of the Department Of Industrial and Systems Engineering at the University of Southern California, collaborate on developing systems engineering program criteria. Resistance from multiple sources terminates the initiative in 2010. Program evaluators trained for accreditation visits were Rashmi Jain, Dave Olwell, and John Farr.

Wolt Fabrycky's six-year term on the ABET Board of Delegates ended in the fall of 2014. Art Pyster, then INCOSE Director for Academic Matters, appointed Phil Brown to assume the

delegate position and Steve Sutton to become ABET liaison for INCOSE. Sutton and Brown collaborated on an effort to raise the profile of INCOSE and systems engineering. The first step was a brochure for distribution at ABET functions on the origins of system engineering and the role of INCOSE in expanding systems engineering's body of knowledge. INCOSE sponsored panels at ABET's annual Symposiums further spread the word about systems engineering's benefits. Members who aided in these endeavors were Larry Strawser, Nicole Hutchison, Richard Turner, Mike Pennotti, Peggy Brouse, and Dennis Buede. Sutton's active participation in ABET's annual meeting for liaisons produced needed attention to the challenges small societies faced in serving the educational community. The members who aided in these endeavors were Larry Strawser, Nicole Hutchison, Richard Turner, Mike Pennotti, Peggy Brouse, and Dennis Buede. Other INCOSE members participating at a workshop defining the fundamental elements of Systems Engineering were Chris Davey, Cory Cooper, John MacCarthy, Eileen Arnold, and Jim Armstrong.

The Final Phase

The final phase leading to ABET approval on October 29, 2021, of a Systems Engineering Program Criteria adds yet more names to the list of involved members. Ariela Sofer provided a critical communication channel to the IISE community and forwarded a suggested criterion to ABET's accreditation community that facilitated further discussion on what a workable criterion should contain. Still more names that helped along the journey were John Colombi, Garry Roedler, Young Moon, Dick Fairley, Cliff Whitcomb, Bob Swarz, Don York, and Avigdor Zonnenshain.

"This is a real milestone in the maturation of the discipline," said Art Pyster, who went on to add that "ABET has previously approved special criteria for more than two dozen other engineering disciplines such as biomedical, electrical, mechanical, and civil engineering. Systems engineering now takes its place beside them as a fully recognized academic discipline."

Academic Council Update

Alice Squires, Assistant Director for Education (Sector I)

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In multiple roles as the INCOSE Academic Council representative to the American Society of Engineering Education (ASEE), a board member of both the Corporate Member Council and the Systems Engineering Division (SED) of ASEE, and the Relationship Manager of the Memorandum of Understanding (MOU) between INCOSE and the ASEE-SED, it is my pleasure to announce the outcome of the inaugural **Outstanding Systems Engineering Educator Award** sponsored jointly by INCOSE and the ASEE-SED. This award recognizes outstanding contributions to the field of systems engineering education, as evidenced by one or more of the following:

- Creation/development of a systems engineering program of outstanding value.
- Development/promotion of innovative instructional approaches that have long sustained effective learning and have been potentially adopted widely by others.
- Infusion of systems engineering education in non-traditional settings (K12, common major for undergrads).
- Systems engineering education research that has been widely adopted by others with effective results.
- Long-term sustained training of effective systems engineers.
- Provided outstanding service to promote research in systems engineering education and the outreach and adoption of systems engineering education.

INCOSE's role in the MOU includes featuring the award recipient(s) in the INCOSE newsletter. To this end, the recipients of the 2021 Outstanding Systems Engineering Educator award are as follows:

Dr. Azad Madni, Professor, Astronautical Engineering at University of Southern California

Dr. Gregory Parnell, Professor Practice, Department of Industrial Engineering at University of Arkansas

Since 2021 marks the inaugural year for this award, Dr. Madni and Dr. Parnell are the first recipients of this award and this in itself is a special recognition. Please join me in extending your congratulations to Dr. Parnell and Dr. Madni and thanking them for their passion for systems engineering and their continuing service to furthering lifelong learning of systems engineering throughout the global community.

EWLSE Updates

EWLSE Year End Update 2021

Alice Squires, alice.squires@incose.net

As we round out 2021, Empowering Women Leaders in Systems Engineering (EWLSE) would like to share two important resources related to women in the workplace with the systems engineering community:

The September 27, 2021, article from McKinsey & Company, in partnership with Leanin.org: Women in the Workplace 2021. Please see: https://www.mckinsey.com/featured-insights/diversity-and-inclusion/women-in-the-workplace. This is the seventh year of this report which provides an overview of various trends of women in the workplace. This year's report includes a data set from 423 organizations employing 12 million people, 65,000 workplace experiences surveys, and in-depth interviews with women of diverse identities. One main finding indicates that although women are significantly more burned out from the impact of the pandemic than men, they are also doing more to support their teams and advance diversity, equity, and inclusion efforts and are more likely to be allies to women of color. But this important work is critical work and it is going unrecognized and unrewarded by most companies. Please see the report for more research findings.

The October 14, 2021, article in the New York Times (link courtesy of Dr. Mike Pennotti of the INCOSE Technical Leadership Institute), *This Is How Everyday Sexism Could Stop You From Getting That Promotion*. Please see: https://www.nytimes.com/interactive/2021/10/14/opinion/gender-bias.html. This opinion piece article includes a system simulation over a ten-year period of what happens when women's work is undervalued by a mere three percent in the workplace. One such bias that has been repeatedly shown in research – that men are assumed to be competent whereas women have to repeatedly prove themselves – results in the systemic effect being shown in the system simulation. The resulting simulation shows how this creates what has been noted in research as the funnel that is created where women are hired into the organization at the entry level but are not advancing to higher levels of leadership and end up working in positions far below their level of qualification. Please see the article for more information. One implication is that your organization may have undervalued woman who are ready to take on higher level leadership roles; organizations committed to promoting women can more seamlessly achieve gender parity in all levels of leadership.

For the final year end activity report, EWLSE has been active in supporting several Q4events including the Society of Women Engineering (SWE) annual conference, and the Western States Regional Conference (WSRC) – please see the two following articles reporting on these EWLSE activities. EWLSE also continues to support the newly forming Diversity, Equity, and Inclusion Team, the Professional Development Portal mentor/mentee strategy, and the completion of two products targeted for 2022: a future INCOSE e-book publication "Letters to My Younger Self: How Systems Engineering Changed My Life", and a future Springer book publication sponsored by EWLSE members and advocates: "Emerging Trends in Systems Engineering Leadership: Practical Research from Women Leaders" as part of the Springer Women in Engineering and Science series.

As always, EWLSE is interested in hearing from you! Please send your greetings, queries, comments, stories to ewlse@incose.net.

Are you Willing to Take the "Level Up Your LinkedIn Challenge?"

Stueti Gupta, stueti.gupta@incose.net &
Alice Squires, alice.squires@incose.net

Following the INCOSE IW 2021 *Level Up your LinkedIn and Grow Your Network* Interactive Workshop, a second iteration of the workshop was requested, and an updated version of the workshop was delivered on September 17th for the Western States Regional (WSRC) Conference 2021, a hybrid conference with the face-to-face part held in San Diego, CA, USA.

The objective of the workshop is to assist participants from the science and engineering communities to share their expertise as systems engineers and thought leaders and build the right visibility in professional social media platforms such as LinkedIn while also virtually networking with like-minded professionals. LinkedIn is often misconstrued as only a job search platform; however, LinkedIn can also be leveraged to create and grow one's network and increase one's visibility in your network and beyond, by sharing your expertise, insights, and lessons learned with others who have an interest in these topics. In this workshop, the facilitators review how to level up your LinkedIn profile, the art and science of writing a post on LinkedIn, and hacks to keep in mind. Attendees complete and share, as time allows, a writing exercise as part of the workshop.

For the WSRC, the workshop session host Phyllis Marbach reminded participants to think of LinkedIn as our digital twin that represents our interests and passions through articles and posts. Attendee Tony Williams took on the workshop challenge and implemented his thought piece on LinkedIn as a small article on the initial stages of systems analysis rather than just creating an announcement or post. Tony reported: "I got a few responses and that was a lot of fun. I found many of the tips and ideas you shared both new and reminders were on target and thought provoking. I applaud you both for taking on the challenge and it was definitely well worth the time." If you would like to conduct a similar workshop for your chapter or event, please contact Alice Squires.

You may be aware that INCOSE as a professional society has a very strong social media presence. With systems engineering knowledge and experience comes a responsibility to spread the word to others so they too can benefit from a systems approach to make the world a better place. Are you willing to take on the LinkedIn challenge?

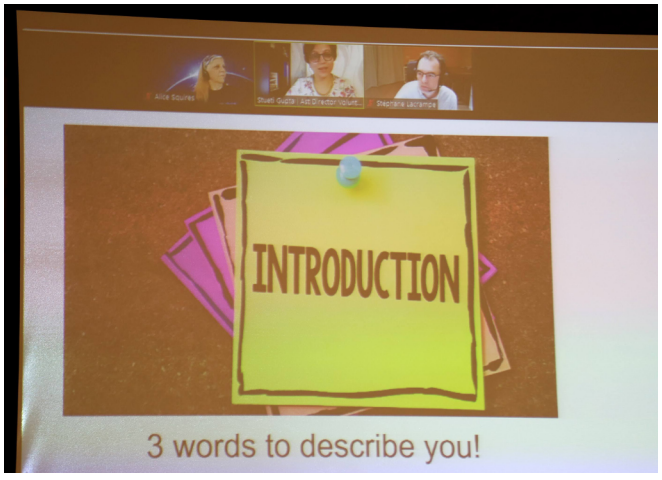


Figure 1. Screenshot from workshop

Society of Women Engineers (SWE) Conference Report 2021

Federica Robinson-Bryant,
robinsof@erau.edu

This marks the fourth consecutive year that EWLSE has sponsored an INCOSE EWLSE booth at the annual Society of Women Engineers (SWE) conference (WE21). Last year WE20 was all virtual with 12 INCOSE members supporting the booth. WE21 resumed in-person participation this year. As the largest and most prestigious conference for women in engineering and technology, the event fosters the assembly of men, women and others, students to professionals, small and large businesses, to government organizations for an array of aims including professional development, research dissemination, employment, and overall field transformation.

Figure 2. INCOSE EWLSE SWE 2021 Booth Ready to Go!

WE21 was designed around the theme "Aspire to Inspire" and hosted both in person at the Indianapolis Convention Center and online over nearly a two-week period. Despite the strains resulting from the ongoing COVID-19 pandemic, the International Council on Systems Engineering and its initiative Empowering Women Leaders in Systems Engineering (EWLSE) was among hundreds of exhibitors this year. Local INCOSE leaders Mr. Christopher Hoffman and Dr. Lisa Hoverman were joined by Dr. Federica Robinson-Bryant at the in-person booth during the two-day exhibition (see Figures 2 through 5). Students from as early as middle school stopped by the booth with their teachers to better understand the wonders of the systems engineering profession and the varied opportunities inherent. Past members were reminded why the organization exists and how they could re-establish their membership and take advantage of the resources available. Then some participants simply stopped by the booth out of curiosity, only to discover the parallels and intersection of systems engineering and what they already know and do, what they may have been wondering about and even what they never dreamed was possible.

Figure 3. Chris Hoffman Greets SWE 2021 Participants

Figure 4. Someone out there has a SWE21 water bottle WITH an INCOSE sticker!

This year's WE21 conference, like those before, served as an opportunity for INCOSE to engage among multidisciplinary individuals in optimal ways to plant and nurture seeds with unknown future impact to the field. The intimacy of one-on-one engagement with people from across the world is unmatched, especially in the current context of limited personal contact. Federica's personal experience at this event may shed light on what many have been experiencing lately:

"I have been isolated from my peers for almost two years. It's been difficult balancing kids, work, home, and life in general, when it's all taking place simultaneously and in the same environment. So, this year's participation in the conference was especially special. The peer-to-*peer contact with other facilitators was comforting and stimulating. Each person that visited the booth seemed to arouse my intellect in ways that I cannot explain. I just wanted to share more about the organization and its ongoing work and recent accomplishments. I wanted to learn more about what each person was doing, and thinking, and planning. What brought them out of their pandemic-ridden shells? Why are they at the systems engineering booth? Where will they end up…"*

Yet, the conference also ensured everyone wishing to participate had various options to do so. During the week following the in-person conference, INCOSE hosted a virtual booth with the same intent. INCOSE leaders Dr. Alice Squires, Dr. Marilee Wheaton and Courtney Wright were prepared to welcome those stopping by online with an abundance of information and insight catered to their personal interests. While some stopped to review the INCOSE EWLSE virtual booth (see Figure 6), the enthusiasm to engage in a video meeting was not as it was in 2020 when the conference was completely virtual. Charging forward to WE22 planning, it should be exciting to see how the event continues to evolve and how INCOSE can participate to continue to achieve its organizational goals.

Figure 5. Part of our fearless WE21 Crew: Dr. Robinson, interested INCOSE CAB Associate, and Mr. Hoffman

Figure 6. INCOSE EWLSE Booth at WE21

2022 CSER
conference on systems engineering research

March 24-26, 2022
Norwegian University
of Scienceand Technology

What is CSER?

Co-founded by the University of Southern California and Stevens Institute of Technology in 2003, CSER has become **the preeminent event for researchers in systems engineering across the globe.**
The 19th Conference on Systems Engineering Research (CSER) focuses on theoretical work in systems engineering and its translation to practical application. The conference will include: **research papers, plenary speakers, panels, and interactive sessions where attendees can engage in discussions and idea generation.**
Since its inception, CSER has become **the primary conference for disseminating systems engineering research and germinating new research ideas.**

About Trondheim and NTNU

Venue – The conference will be organized in the university facilities on the Gløshaugen campus,
south of the city center, and in walking distance of the city center. The campus is accessible to
persons with disabilities, and the university hospital is across the street in case of a medical emergency. Our web site will contain more information and maps of Trondheim and the campus.

Accommodation & travel

Trondheim is the third largest city in Norway with ample accommodations, restaurants, pubs and cafés. There are many webpages in English that cater to visitors, such as visittrondheim.no/en. The city of Trondheim offers a wide range of hotels. Special rates will be negotiated and listed on our web site. Trondheim Værnes Airport (TRD) has many daily international connections, and most travelers are most likely to arrive from a major hub airport, such as Copenhagen or Amsterdam. The main operators are SAS, KLM and Norwegian. The airport bus (Flybussen) brings you to the center of town in approx. 35 minutes. The city also has excellent public transportation and abundant taxi services.

Mark your calendar

December 20, 2021: Paper Submission Deadline
March 24-26, 2022 : Norwegian University of Science and Technology
Trondheim, Norway
March, 24: PhD colloquia Systems Engineering and Architecture Network (SEANET)
March, 25 – 26: Conference on Systems Engineering Research

INCOSE · USC Viterbi School of Engineering · Stevens Institute of Technology · NTNU

Contact us cser2022@kmdevents.net

More information on cser2022.cser.info

Volunteers Month!

Lisa Hoverman & Stueti Gupta, volunteer@incose.net

December is Volunteer Month, and our Assistant Director for Volunteerism, Stueti Gupta was actively engaging INCOSE volunteers to share their stories! With a social media post, we recognized International Volunteers Day. With a personal call to respond, Stueti reached out to the INCOSE Volunteer Network to share their stories as detailed in the 'Call for Volunteers.' If you volunteer for INCOSE in any way and have not received an email from Stueti, she, all of Membership Engagement and I, encourage you to share you volunteer journey with us!

Call for Volunteers

Volunteering is a rewarding endeavor benefitting the INCOSE community, INCOSE as a professional society, and also the individual INCOSE member(s). When you volunteer for INCOSE, you realize the value of contributing, of helping others. INCOSE members want to hear your volunteering stories!

We invite you to share with us "Stories From the Field," "Most Memorable Volunteering Moment(s)," "Volunteering in Action Photos," and your "Top Key Message to Encourage Members to Volunteer."

Please follow this link to submit your entry:

https://forms.office.com/Pages/ResponsePage.aspx?id=k6cjNVAORka4CyXYO9fylsBWwhvWoyxJpBghjqZC8G5UQzFUMjE0M0ZIOFJQTkkwNEY5TFNKUzlUUyQlQCN0PWcu

Why do we have this Volunteerism ask?

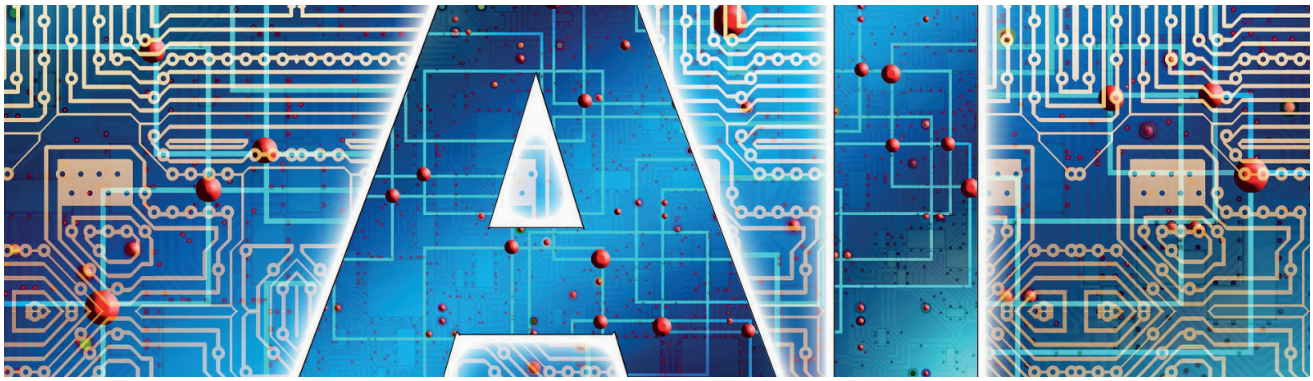
To celebrate your contributions with the INCOSE community

- To learn about the benefits of volunteering
- To encourage members to sign up for volunteering
- What will we do with your submissions?
- Share with the network in the most appropriate channel (social media, e-note, newsletter, yammer)
- Use testimonials, as is, for volunteerism campaigns

We look forward to hearing from you and are eager to share your story with the broader INCOSE network!

Artificial Intelligence (AI) Mini Event: Systems Engineering Pathways to AI Now!

Ricardo Reis, rjreis@embraer.fr



In November, Kerry Lunney (INCOSE President) hosted the AI Mini Event on the INCOSE AI Working Group (WG) Framework. This event addressed the need to increase discussion, awareness, and understanding on integrating AI in sociotechnical systems and systems of systems.

AI, enjoying a full spring after a long winter, is still an emerging technology. Like a teenager, it embodies the entire gamut of the "AI Spectrum of Awesomeness," all its promises and forewarnings, as well-illustrated by Kerry Lunney in her introduction speech.

AI Spectrum of Awesomeness by Kerry Lunney

There is an urge to increase our systems engineer situation awareness. Various operational systems already incorporate AI in a clear growing trend, affecting our lives one way or another. Systems engineers must specifically know AI idiosyncrasies. They must bring forward the right questions, ensuring robust, effective, and efficient sociotechnical systems developed with a life cycle perspective.

Four expert guides led the event audience through crucial aspects related to integrating AI into systems. Alejandro Salado (Associate Professor from the University of Arizona) opened with "Challenges to the Verification and Validation (V&V) of Intelligent Systems." He states, "current V&V approaches rely on the assumption that system behavior is the same during a system's lifetime." This assumption breaks down when deploying AI systems that can learn and adapt, when what the lab demonstrated can evolve into something quite different in the operating environment. Another challenge is that even when the AI learning capability is "frozen," small changes in the environment can still affect it. This brittleness will impact maintenance (a "dead pixel" in a camera sensor potentially changing the algorithm result). Alejandro posed several vital questions. "[Will] an intelligent system differentiate a test vector from the real environment and evolve different behaviors for each? To what extent do test models represent the system as the system operates? How differently will several systems of the same family become as they operate in different missions?" Or, more generally, "How must V&V transform to address these new challenges?"

Another AI aspect, present within neural networks and deep learning, is its black box aspect. eXplainable AI (XAI), the ability to understand the possible AI "reasoning," or opening the box, is a major research topic.

Terril N. Hurst (Senior Engineering Fellow at Raytheon) chose to guide us through another approach to the issue with his apt named talk "Causal Inference: Key for Opening the AI Black Box for Systems Engineering." Leveraging on the history of AI, Terril built upon Judea Pearl and Adnan Darwiche. The idea is to augment conventional AI methods with Bayesian analysis and build probabilistic models to capture the evolving understanding of the cause-effect relationships within the system. Based on simple mathematical tools, this approach is thus a methodological framework supporting the integration of black box AI into systems engineering or AI for systems engineering (AI4SE). Terril also showed how this approach supported his "3Ps" of systems engineering: People, Pipes, & Protocols. Judea Pearl summarized the talk. "Data do not understand causes and effects; humans do. I hope the new science of causal inference will enable us to better understand how we do it," which the author feels is a strong recommendation for her latest book, The Book of Why.

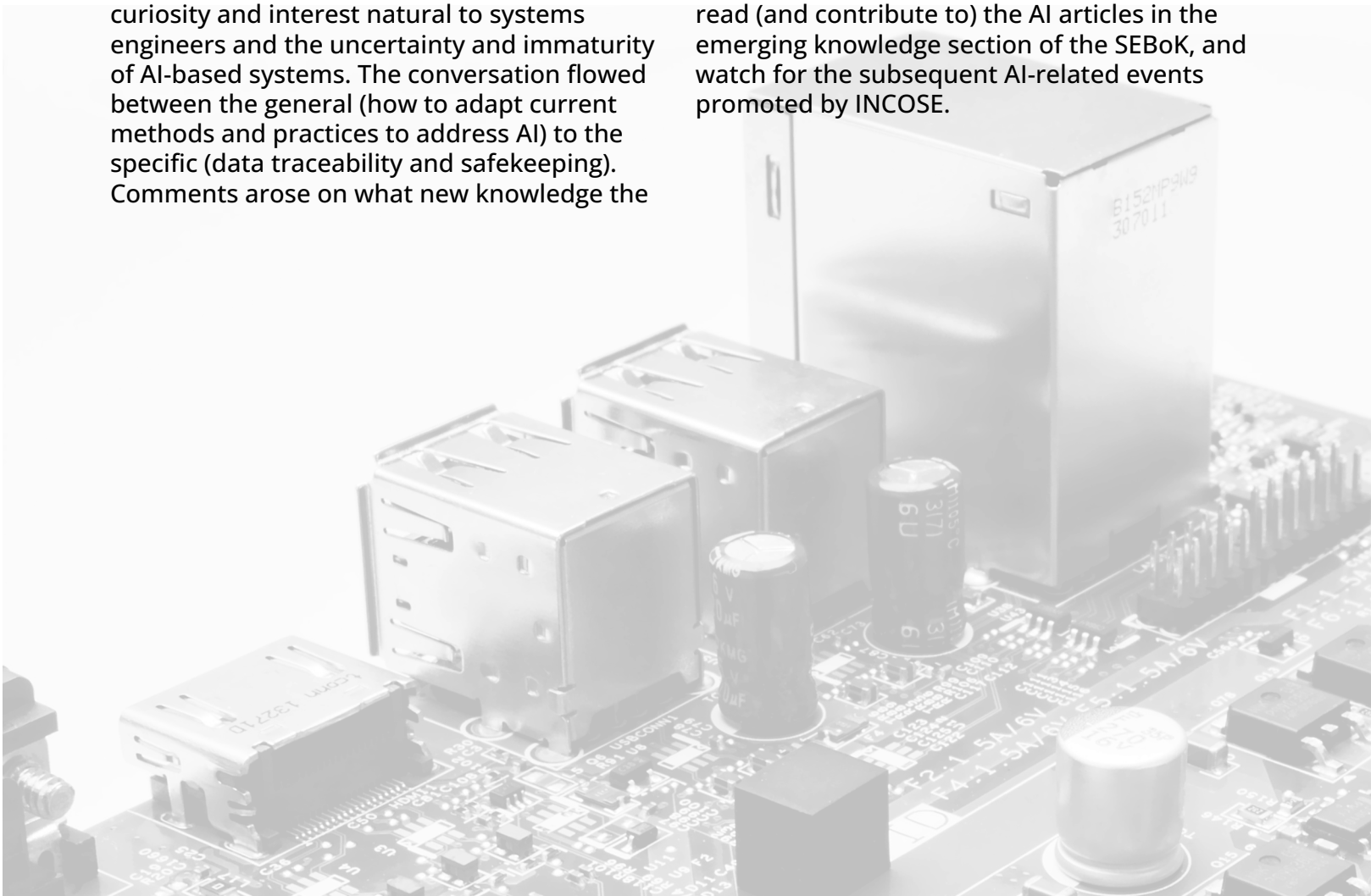
Right on cue, Barclay Brown (INCOSE CIO, ESEP, Engineering Fellow at Raytheon) and Ramakrishnan Raman (ESEP, Principal Systems Engineer at Honeywell) took off with a joint talk "Data Requirements and the Green School Bus Problem." They framed the issues surrounding data and the need to include data requirements as a new discipline for the systems engineer. "Data is code" was their thought-provoking kick-off on the role of data in machine learning, further illustrated by the "green bus problem." How would an AI trained with images of military vehicles and yellow school buses classify the sudden appearance of a green school bus? The uncertainty of the result illustrated the challenge of ensuring proper, comprehensive, and superior quality datasets for AI development. This issue directly falls into the systems engineer's sphere: he needs to ensure the holistic understanding of the operational environment and its context feeds machine learning (ML) technology development within the system. Proper data requirements development is a skill systems engineers, involved with systems incorporating such technologies, need to acquire—and practice.

Finally, Mehran Irdmousa (CSEP, Principal Systems Engineer and Enterprise Architect at MZI Aviation) brought the audience a final and puzzling question. Why do most AI-related pilot initiatives never move to production? Or, for those that do move to production, why do so few companies seem to report deriving value from their AI technologies? This

"dissonance" between the promise of AI and value creation, misalignment between needs of organizations, and actual realization of AI-enabled systems motivated Mehran's curiosity. In "Increasing the Success Rate of AI and ML Systems Deployment at the Enterprise Level," Mehran shared his current interest in exploring this problem. He walked through applying Enterprise Architecture (EA) into AI and ML-enabled systems. The emerging field of Machine Learning Operations (MLOps) was a must-watch space within which practitioners and organizations are still experimenting and evolving their learning. He ended, leaving his invitation hanging in the air. "What critical considerations do we need when we decide to integrate MLOps into EA frameworks? Does this integration potentially slow down deploying AI-based systems? If so, how can we measure the organizational objectives against this velocity?"

After the four talks, Kerry joined in with the presenters and moderated a lively question and answer (Q&A) session. The various interests signaled the immense horizon of curiosity and interest natural to systems engineers and the uncertainty and immaturity of AI-based systems. The conversation flowed between the general (how to adapt current methods and practices to address AI) to the specific (data traceability and safekeeping). Comments arose on what new knowledge the systems engineer needs to develop and how to keep up with it (continuous learning is inescapable, there is no magic bullet). Parallels with other areas and other illustrative examples appeared in the live discussion from panelists and the audience alike. Among those highlighted is the difference between the desirable but more challenging live, adaptive learning systems (where the AI learns and self-updates while in operation) vs. offline machine learning AIs (which raised the question of how these offline-trained AIs differ from other technologies). As with everything in systems, the "magic" emerges from the connections established: The Q&A segment of the event delivered things to consider, crowning the previous talks.

The full recording will be available to INCOSE members, and it is worth a watch (or a revisit) due to the high-quality talks and follow-up discussion. The AI WG will keep fostering similar initiatives to increase systems engineers' understanding of AI and the issues of engineering AI into systems. Join in the discussions in the AI WG Yammer Community, read (and contribute to) the AI articles in the emerging knowledge section of the SEBoK, and watch for the subsequent AI-related events promoted by INCOSE.



Call for INSIGHT Articles

Nicole Hutchison, nicole.hutchison@incose.net

INCOSE INSIGHT, September 2022, Theme: The Unique Abilities of the Systems Engineer An Invited Article Series – INCOSE Membership not required

A joint project of INCOSE and The Systems Engineering Research Center (SERC)

Intro

The concept of "pi-shaped" skills and abilities is inherent to systems engineering. Most successful practitioners gain depth in at least one foundation discipline/ domain and add a second area of depth in the discipline of systems engineering to go with breadth across technical, stakeholder, and business acumen. The world is catching on, and with the rise of technology and automation many business leaders have started a call to "go pi-shaped" in both roles and training. In fact, many traditional systems engineering skills are just called "employability skills" in various workforce surveys. The discipline of systems engineering has emphasized the creation and value of these skills since its inception – but what can the world learn from systems engineering? Can the unique skills and abilities of the systems engineer be generalized across all of education and training, from early education to lifelong learning, to meet the needs of future workers?

Mission

These articles are intended to discuss the unique abilities of the systems engineer, and how they can inform a world demanding core skills like leadership, systems thinking, innovation, and design. The goal of this issue is to inform the world outside of our discipline to look toward systems engineering as a source to drive their future workforce strategies.

Approach

This Themed Issue is requesting articles specifically addressing generalization and application of systems engineering knowledge, skills, and competencies to challenges outside of our discipline. Authors may submit multiple offerings. Appropriate articles include competency models, assessment frameworks, case studies, and experienced workforce development programs, with applicability spanning early-stage to professional learning.

General guidance

- These are not journal articles, 2000-4000 words is the target. Use a presentation style that targets practitioners.
- Do not use the MS Word reference tool. Citations and references should comply with the Chicago Manual of Style, including citations and references. A descriptive guide with examples is available on the INCOSE website at https://www.incose.org/incose-member-resources/marcom/incose-writing-resources.
- Graphics are highly encouraged and do not take away from word-count.
- No PDF submissions.

Evaluation Criteria

- Articles must speak meaningfully to both systems engineers and a more general audience that may not be familiar with systems engineering specific terminology.
- Articles must be consistent with the theme.
- Articles should advance the mission statement, introducing new concepts to a non-SE community.
- Will strive for publishability: length, writing quality, logical, and comprehensible.

Schedule

Dec 1 2021: Call for articles issued.

Jan 15 2022: Initial submission: concept(s) being addressed, working title, and one page working abstract.

Jan 31 2022: Notification of abstract acceptance.

Mar 15 2022: First draft full paper submission.

Mar 31 2022: Feedback comments returned on first draft.

Apr 17 2022 : Second draft submission, if appropriate.

May 15 2022: Detailed comments returned to authors for improvement, as appropriate.

Jun 15 2022: Final draft submission, formatted for required style, with author-company release.

Jul 2022: INSIGHT editors may contact authors directly with copy-editing suggestions.

Sep 2022: INSIGHT publication.

Submissions

Please send submissions to both Theme Editors Nicole Hutchison (nicole.hutchison@incose.net) and Tom McDermott, (tom.mcdermott@incose.net), attached as an MS Word document. Be sure to include a title, and also author name(s) and email address(es) in the by-line underneath the article title. Also include short author bios.

Impacting Homelessness from a Systems Perspective: A Class Project Experience

Kristine Mantey & Christina Mastrangelo, kdmantey@uw.edu, mastr@uw.edu
Industrial & Systems Engineering, University of Washington, Seattle, WA

This article precedes a presentation planned to be presented to the Academic Council at IW 2022.

Preparing engineers for systems practice invites a unique laboratory experience. In the Global Integrated Systems Engineering (GISE) certificate and graduate program, the most valuable laboratory is the real world comprised of real clients with real problems to solve. As such, the GISE program concludes with a comprehensive team-based design effort involving a large-scale system. This project provides a culminating experience for an introductory course through which students bring together the systems analysis and design, project management, financial, and supply chain modeling skills they have learned in the previous two quarters and apply them to a problem. See **Figure 1** for an overview of this program. The program envisions that engineers need to become systems thinkers by combining their technical discipline with **systems engineering** skills while understanding the **business aspects** of successful product development and the **global environment** of engineering and business.

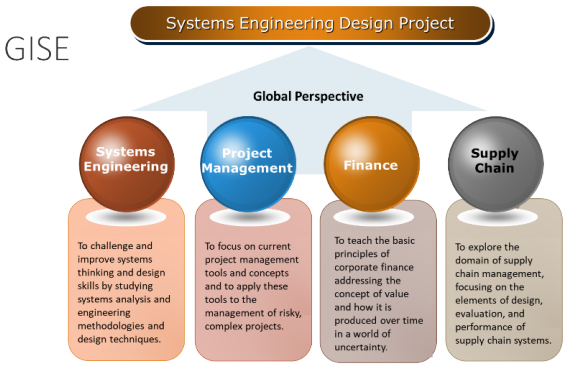


Figure 1. Structure of the global integrated systems engineering graduate program.

In the 2020-2021 program, the students and faculty of the GISE program focused on the issue of homelessness. The partner for this project was the mayor of the City of Burlington. The City of Burlington is in Skagit County Washington, an area of the state that is experiencing an unprecedented rise in homelessness (**Figure 2**). The mayor has widespread local support to address the issue. The GISE program worked with the City, County, and local service providers to establish a system of services to address the needs of the homeless in Burlington.

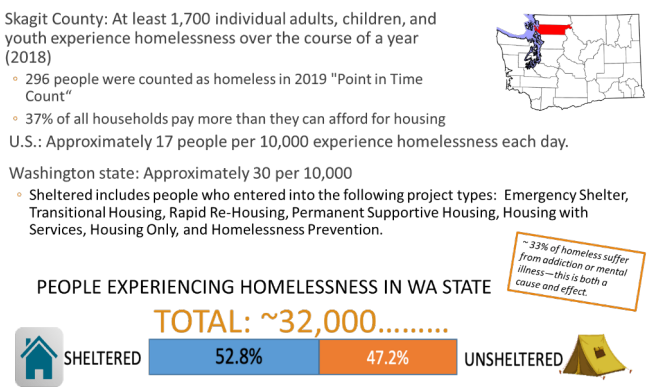


Figure 2. Size of homelessness in Washington state.

The system of services was established to support the newly opened Skagit First Step Center (SFSC). The SFSC is a city owned small (1 acre) parcel with a building already on site to serve as permanent transitional housing for up to 125 unhoused people. Friendship House will manage the site and services. Teams collaborated directly with the Mayor and Friendship House to determine the needs of the participants, what resources are available, and identify any constraints on those resources.

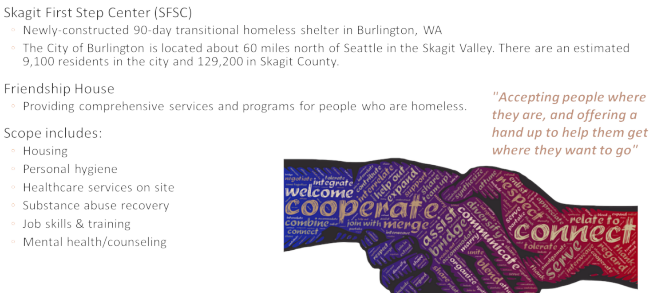


Figure 3. Project partnership and structure.

Before designing a solution, the teams applied the systems analysis method (How to Do Systems Analysis by Gibson, Scherer, Gibson; Wiley; 2007) which is summarized in **Figure 4. Figure 5** presents two examples of student work: the normative scenario and the criteria used to evaluate the potential of the alternatives to achieve the ideal or normative scenario. After an alternative was selected, the teams began the conceptual design process which led to the four projects.

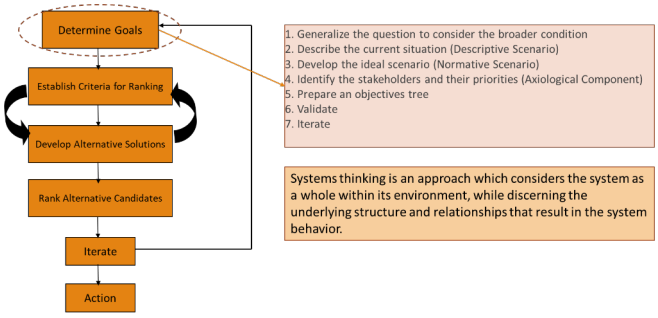
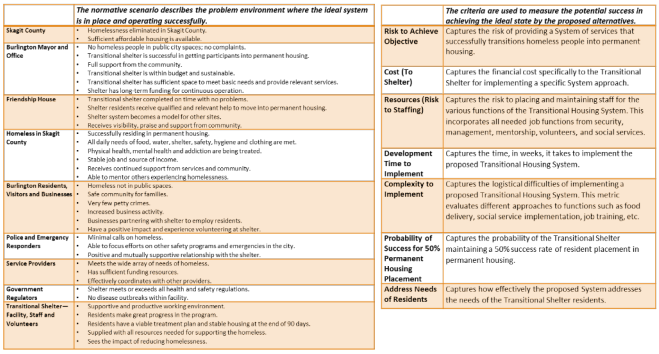


Figure 4. Overview of the systems analysis method.



	The normative scenario describes the problem environment where the ideal system is in place and operating successfully.
Skagit County	• Homelessness eliminated in Skagit County. • Sufficient affordable housing is available.
Burlington Mayor and Office	• No homeless people in public city spaces; no complaints. • Transitional shelter is successful in getting participants into permanent housing. • Full support from the community. • Transitional shelter is within budget and sustainable. • Transitional shelter has sufficient space to meet basic needs and provide relevant services. • Shelter has long-term funding for continuous operation.
Friendship House	• Transitional shelter completed on time with no problems. • Shelter residents receive qualified and relevant help to move into permanent housing. • Shelter system becomes a model for other sites. • Receives visibility, praise and support from community.
Homeless in Skagit County	• Successfully residing in permanent housing. • All daily needs of food, water, shelter, safety, hygiene and clothing are met. • Physical health, mental health and addiction are being treated. • Stable job and source of income. • Receives continued support from services and community. • Able to mentor others experiencing homelessness.
Burlington Residents, Visitors and Businesses	• Homeless not in public spaces. • Safe community for families. • Very few petty crimes. • Increased business activity. • Businesses partnering with shelter to employ residents. • Have a positive impact and experience volunteering at shelter.
Police and Emergency Responders	• Minimal calls on homeless. • Able to focus efforts on other safety programs and emergencies in the city. • Positive and mutually supportive relationship with the shelter.
Service Providers	• Meets the wide array of needs of homeless. • Has sufficient funding resources. • Effectively coordinates with other providers.
Government Regulators	• Shelter meets or exceeds all health and safety regulations. • No disease outbreaks within facility.
Transitional Shelter—Facility, Staff and Volunteers	• Supportive and productive working environment. • Residents make great progress in the program. • Residents have a viable treatment plan and stable housing at the end of 90 days. • Supplied with all resources needed for supporting the homeless. • Sees the impact of reducing homelessness.

	The criteria are used to measure the potential success in achieving the ideal state by the proposed alternatives.
Risk to Achieve Objective	Captures the risk of providing a System of services that successfully transitions homeless people into permanent housing.
Cost (To Shelter)	Captures the financial cost specifically to the Transitional Shelter for implementing a specific System approach.
Resources (Risk to Staffing)	Captures the risk to placing and maintaining staff for the various functions of the Transitional Housing System. This incorporates all needed job functions from security, management, mentorship, volunteers, and social services.
Development Time to Implement	Captures the time, in weeks, it takes to implement the proposed Transitional Housing System.
Complexity to Implement	Captures the logistical difficulties of implementing a proposed Transitional Housing System. This metric evaluates different approaches to functions such as food delivery, social service implementation, job training, etc.
Probability of Success for 50% Permanent Housing Placement	Captures the probability of the Transitional Shelter maintaining a 50% success rate of resident placement in permanent housing.
Address Needs of Residents	Captures how effectively the proposed System addresses the needs of the Transitional Shelter residents.

Figure 5. Examples of student work from Determine Goals: Normative Scenario and Criteria for Ranking.

The projects that were completed for the City of Burlington included, 1) a shared system for coordination of service providers, 2) an integrated system for forecasting shelter services, 3) a design schematic for the transitional shelter, and 4) an administrative framework to improve the intake process and coordination of resources.

The system for service provider coordination

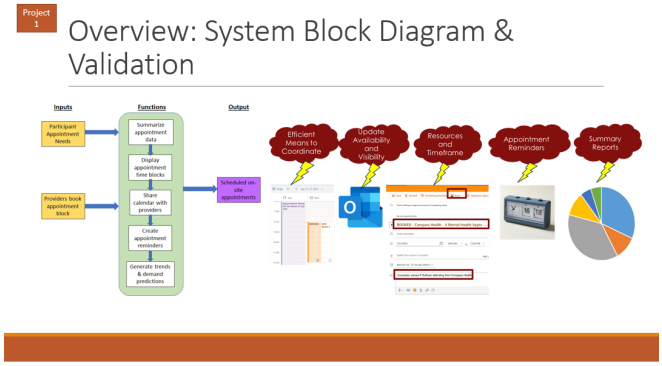


Figure 6. Project 1, System for Service Provider Coordination.

(**Figure 6**) connects program participants with the appropriate services at the appropriate time. This system addresses the number one issue in providing services to the homeless, not being able to find them and check in with them regularly. Built off the establishment of the new Skagit First Step Center where participants can find themselves with stable housing the system for provider coordination presents a calendaring solution that schedules services providers time at the center to meet with participants.
This solution not only provided participants

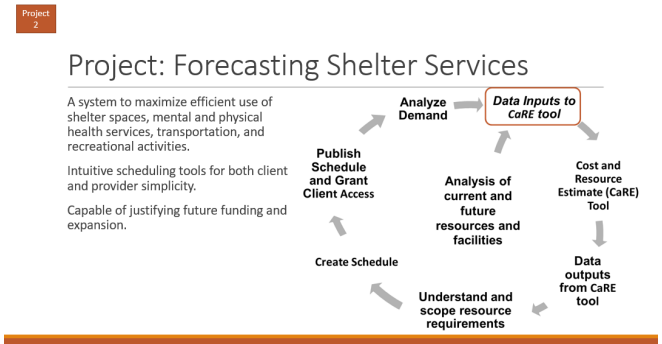


Figure 7. Project 2, Shelter forecasting system.

with better service it decreases the costs associated with those services by providing a single point of contact for the center, service providers, and participants.

The second system that was explored **(Figure 7**) was to provide forecasting for the SFSC. Providers of services to the homeless pursue grant funding on a regular basis. This team's system provides a tool for analyzing where the funding would be best allocated. The tool is based off a schedule of services that are being provided at the SFSC. When services are in demand resources are expanded in that area. The tool provides for the financial analysis of the change in services to show the cost and the benefits that the reallocation would provide. For example, an increase in the number of hours of mental health care services that are needed at the shelter could be modeled by the system by inputting the number of hours that are needed and the cost of those hours. The model would provide the added cost per person that would then receive services.

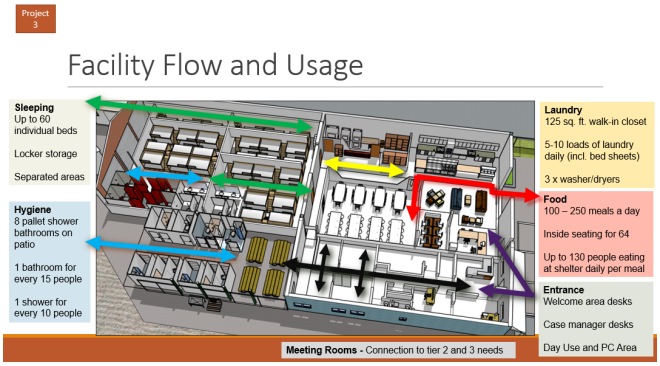


Figure 8. Projects to design the facility to support the flow of services.

The design of the facility was key to many of the projects. To support a wide variety of services in a compact space while providing for shelter the team looked at the flow of people and services in the shelter facility (**Figure 8**). A staged model was generated so that the facility could begin housing participants for basic needs while building out the facility for the full range of services that would eventually be provided. This type of modeling allowed for funding for the shelter to be raised over time and for those providing that funding to see what they were paying for providing accountability and buy in among constituents.

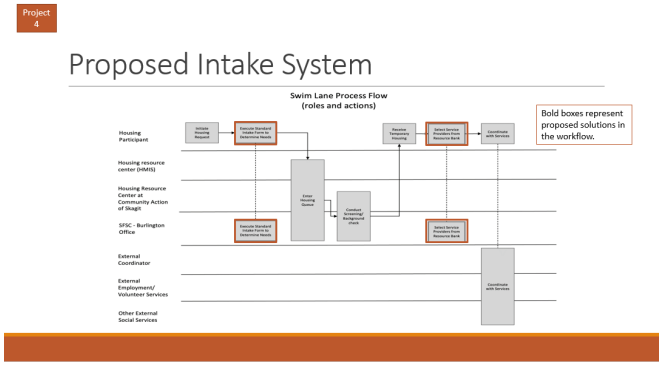


Figure 9. Project to improve the intake process and coordinate service delivery.

The final project aims to address the need for better coordination of resources for the shelter personnel. As the shelter opens to participants the success or failure depends on developing an action plan that is appropriate for each individual participant. No two participants are the same, and this system recognizes that and develops an action plan based on a wide variety of intake questions. The plan can then be tracked and altered as the participant moves through the program.

The project with SFSC redefined how the project partners look at their decision-making. The use of simple systems tools and methods are not typically in skillset of homeless providers. Homelessness is a big dollar project with a substantial risk of failure. Systems thinking can be applied to social problems such as homelessness to improve decision making and result in better outcomes.

INSIGHT Preview from the Editor-in-Chief

William Miller, insight@incose.net

We are pleased to publish the December 2021 issue of INSIGHT published in cooperation with John Wiley & Sons as a magazine for systems engineering practitioners.

The focus of the December issue of *INSIGHT* is the French Chapter of INCOSE, Association Française d'Ingénierie Système (AFIS) Doctoral Symposium: New challenges and Advances in Systems Engineering at French Universities. This is our seventh issue devoted to doctoral research in France. The previous issues were July 2008 (Volume 11, Issue 3), December 2011 (Volume 14, Issue 4), December 2013 (Volume 16, Issue 4), December 2015 (Volume 18, Issue 4), December 2017 (Volume 20, Issue 4), and December 2019 (Volume 22, Issue 4). Articles were selected after peer reviews from a larger set of doctoral presentations in collaboration with French universities and industry. Articles from theme editors David Gouyon and Hervé Panetto, and authors address the following topics:

1. Theme Editorial
2. AFIS Academy-Industry Forum 2020 in Compiègne
3. Modelling Cyber-Physical Systems using Data-driven Patterns
4. A semantic model framework for cyber-physical production system in system engineering perspective
5. Using Synthesis and Analysis for Design in Systems Engineering: an Integrated Approach
6. Qualimetry Essentials Applied to Embedded Software Development
7. Harmonica: A Framework for Semi-automated Design and Implementation of Blockchain Applications
8. Towards a Method to Operationalize Modelling, Verification and Evaluation of Architectural Solutions in the Field of Nuclear Critical Infrastructure Engineering
9. Contribution to Nuclear Safety Demonstration through System Modelling and Artificial Intelligence
10. Model Based Commissioning, a New Methodological Approach for Commissioning of Nuclear Basic Facilities
11. Simulation System Design Methodology in Extended Enterprise Context
12. Intensive Data and Knowledge-based Approach for Sustainable and Circular Industrial Systems

The editors of *INSIGHT* would be pleased to accept proposals from other INCOSE chapters, working groups, and affiliated bodies for themed issues centered on systems engineering practices beginning in the second quarter of 2023. The *2022 INSIGHT* themes and articles are already committed: 1) Digital Engineering, 2) Systems Security in the Future of Systems Engineering (FuSE), 3) Unique Abilities of the Systems Engineer, and 4) Systems Engineering Grand Challenges. The first 2023 issue theme is Model-Based Test and Evaluation.

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.

Note From the Editor

Lisa Hoverman, newsletter@incose.net

We are at the end of 2021! This year has so, so much in it that we will look back on. The Q4 2021 Newsletter is being published as INCOSE and the world continue to work through and with the COVID-19 Pandemic in many different ways, as vaccinations and variants have become available and more contagious, and increasingly novel. The 'emergent' properties are something we as systems people are prepared to examine and adjust to, if we haven't planned for them already! A great article on the Western States Regional Conference 2021 (WSRC 2021), is a prime example of this!

As we work through this 31st-32nd year of INCOSE in the 'new normal' we are encouraged by the work we see continuing in INCOSE, mostly remotely, but powerfully, at the Central, National, Chapter, and Individual levels. All of this was powered by brilliant INCOSE Volunteers. We want to hear your stories so please send them in! This Newsletter reflects all of that, and we hope you enjoy the read.

INCOSE went truly virtual in 2020 and we have emerged from that this year, with recent hybrid, in-person, and remote conferences – all of which enabled INCOSE to have booths, an opportunity to share with the community our vision for a better world.

The opportunity to meet in person again, when and where it is safe is terrific. INCOSE continues in serving our membership with improved IT offerings that make chapter meetings, symposia, conferences, cafés and membership communication more accessible remotely, and in some cases, to more systems engineers than ever before! Have you joined INCOSE Yammer? If not, please do – reach out through your chapter leader or working group chair to learn more! If they don't know, our CIO does! Please reach out at CIO@incose.org for more information. We work hard to make sure that systems engineers keep connecting, networking, and working together, and much of this is reflected in the quarterly updates in this issue, highlighting great virtual events from our Central and Sector Chapters. This newsletter sets the stage for our 1st EVER fully hybrid International Workshop (IW) 2022, necessary as the world is still largely in a quarantine status, with travel uncertainties coming down to the last minute.

We hope you fully enjoy this fourth issue of the Newsletter with highlights of INCOSE from Q4 of 2021 and the impactful work systems engineers continue doing together. As a reminder, we are many — more than 19000 systems people strong, spanning more than 65 chapters, 76 countries, with 124 Corporate Advisory Board Members and working in over 50 working groups on the state-of-the-art products, standards, and research that will continue to improve and keep systems engineering relevant and of increasing relevance and value to our world.

The Newsletter continues to grow to inform our readership on all things INCOSE, both current, upcoming, and historical. There are some interesting previews on the many upcoming and exciting end of 2021 happenings. We have upcoming powerful virtual chapter meetings, working group sessions, webinars and other initiatives of INCOSE reported on in this Newsletter. Important to this Newsletter are some great articles from practitioners—practitioners tackling both the real and grand challenges of our times that apply to the Future of Systems Engineering.

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 contributions at newsletter@incose.net (note the update from .org!).

We look forward to seeing you participating virtually as we network at, and present at, and gather at one of the many terrific upcoming virtual INCOSE events. I end with a sincere note of appreciation to all who contributed to this Newsletter.

I want to sincerely thank the wonderful President I have served under as MarCom Director for the last two years, Kerry Lunney. Her drive, professionalism, and friendship are inspiring, and she has been the leader INCOSE needed for an unprecedented pandemic. Thanks for your tremendous leadership, Kerry! As she and I both transition off of the INCOSE Board at the Director Level, we will both continue to interact and serve in new ways in INCOSE. I am so excited to welcome our current President-Elect (P/E) Marilee Wheaton to lead INCOSE for the next two exciting years, with Ralf Hartmann, serving as our new P/E and the new Director for Marketing and Communications, Honor Lind, to the Board. Welcome, welcome!

Have a wonderful December, stay healthy and safe I really hope to see you at an upcoming online chapter meeting, a Café, or the INCOSE International Workshop!

INCOSE Member Newsletter

Publication of the International Council on Systems Engineering

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On the Web http://www.incose.org

Article Submission newsletter@incose.net

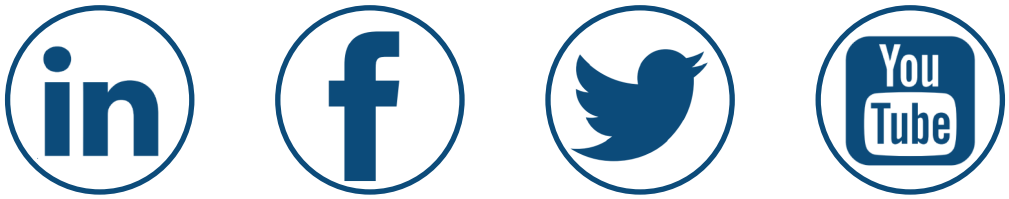
Publication Schedule. The INCOSE Member e-Newletter is published four times per year. Issue and article/ advertisement submission deadlines are as follows:

- 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: 15Nov; LBN: 25 Nov.

For further information on submissions and issue themes, visit the INCOSE website as listed above.

Who are we? INCOSE is a 19,000 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.

Follow us



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