INCOSE

MEMBERS NEWSLETTER

A Better World Through a Systems Approach

The International Council on Systems Engineering

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Editor's Letter

Honor Lind, Director for Marketing and Communications, honor.lind@incose.net

Hello INCOSE Members,

Welcome to our Third Quarter Members Newsletter as we celebrate the success of the INCOSE International Symposium 2022. This year, IS2022 brought the world of systems engineering together through a first-ever hybrid symposium experience. INCOSE never sleeps and neither did the team of volunteers who worked around the clock to bring it all together for a unique experience as we engaged with one another both on site and online.

INCOSE is committed to a better world through systems approach; this can only be achieved by working together to address complex societal and technical challenges.

To honor our goal of providing a focal point for the dissemination of systems engineering knowledge, and by enabling, promoting, and advancing systems engineering and systems approaches, IS2022 promoted international collaboration in systems engineering practice, education, and research.

We have grown a lot since INCOSE's beginning in 1990 and this issue showcases both the current and the historical. You will find an IS2022 summary, along with two, two-part series dedicated to the history of INCOSE, including an article about our first President, Jerry Lake, along

with recognition of those who have made a tremendous difference in the field like systems engineering pathfinder and pioneer Barry Boehm. It is fitting and proper to recognize these two men in this newsletter as we also recognize our current award recipients for their outstanding achievements and contributions to the field of Systems Engineering through academic and corporate global contributions. To see all our awardees, check out the first ever *INCOSE Recognition and Awards Yearbook* at www.incose.org/yearbook.

The INCOSE international community includes over 21,600 members and associates around the globe—you can read the details in our *Annual Impact Statement* at www.incose.org/impact. Together with our alliances and partner groups, our members work as a team to create the future of systems engineering.

The strength of the team is each individual member. The strength of each member is the team.
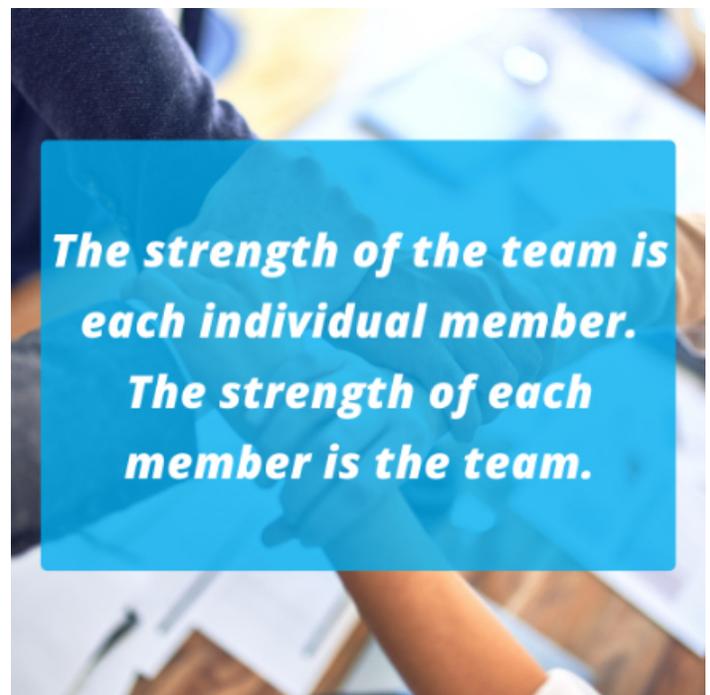
When you join INCOSE, you are connecting to resources, chapters, innovative working groups, industry leaders, and trend setters who are pioneering the way for systems engineering. Leading edge topics like AI, smart cities, diversity, and systems thinking approaches come alive through conferences, workshops, seminars, publications, outreach, certification, volunteerism, and our global network across the Asia-Oceania, EMEA, and Americas sectors.

Interns contributed much to the success of INCOSE in Q3 and we recognize their contribution to the field and spotlight their achievements as you will see reflected as a new column, *Meet the Interns*.

We are here to help you explore, connect, learn, lead, and prosper with opportunities, resources you need, and the working environment to network with leaders in your field. Join the Welcome Center Cafes to learn more on how to connect and tap into these remote resources www.incose.org/welcome.

This edition is dedicated to all the INCOSE Fellows, chapters, working groups, leaders, and volunteers who have worked to make a difference in the world by sharing their knowledge and wisdom. INCOSE is here to help you network and advance your career and impact.
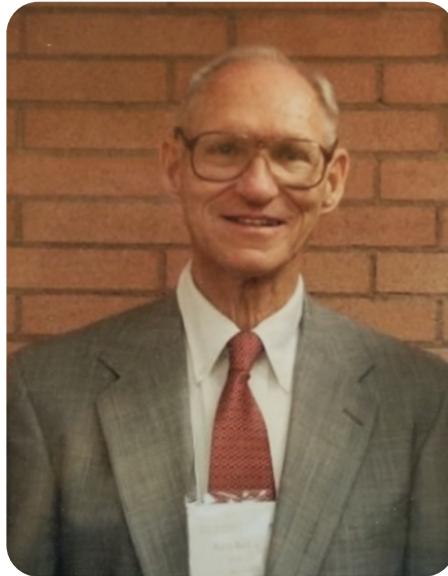
Thank you for being a valued part of the INCOSE community, and to our growing team of systems engineering leaders.

Honor A. Lind, INCOSE Director of Marketing and Communications

Editor In Chief, INCOSE Members Newsletter

In Memory of Dr. Barry Boehm

INCOSE would like to honor the legacy of Dr. Barry Boehm, INCOSE Fellow and Pioneer Award recipient for his work as a systems pioneer uniquely contributing to the advancement of systems engineering through extensive research, education and the application in industry. Dr. Boehm was the Director of the USC Center of Software and Systems Engineering (CSSE), which was the first center that was specifically created to exploit the synergy between systems and software engineering. The center was created to address the problems facing industry in the engineering of software-intensive systems. In addition, Dr. Boehm was General Co-Chair for the Conference of Systems Engineering Research (CSER). CSER has become the primary conference for disseminating systems engineering research and germinating new research ideas. Its primary objective is to provide a common platform for academia, industry, and government to present, discuss, and influence systems engineering research, practice, and education.

Words by Marilee Wheaton, INCOSE President

Full In Memoriam article coming in the next Issue of the Members Newsletter.

In Memory of Jerry Lake

Jerry was one of several others who became NCOSE's Founders in 1991. As its first President, Jerry spoke of his expectations for the new "Council" including his desire for NCOSE to become the predominate international advocate for the inter-discipline of Systems Engineering. Over time, Jerry continually expressed his views always as a gentleman and all members received his views with great respect. Jerry will always be remembered as a gentleman, a strong advocate for Systems Engineering, one of the giants among the Founders of INCOSE and a good friend for those of us who were able to get to know him."

Words by Bill Mackey

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President's Address: Marilee Wheaton

Dear Members,

This Q3 Members Newsletter focuses on topics across INCOSE, but also reflects especially on the 2022 International Symposium (IS) which took place at the end of June. It was great to have over 600 delegates in Detroit, meeting in person, with most of the board attending in person, and over 360 delegates attending virtually. We had a great opportunity to catch up with old friends and engage with new members and members attending IS for the first time.

A personal highlight for me was the How to be an Effective DEI Ally and Advocate panel session, which I had the honor of chairing. Members who attended the session told me it was very thought provoking. If you missed the session, there are two articles about the session in the IS section of this Newsletter.

I also have to say a big thank you to our Keynote Speakers, Dr. Christopher J. Scolese, Director, National Reconnaissance Office (NRO), Carla Bailo, President & CEO, Center for Automotive Research (CAR), Laura Doughty, Director, Peakfield Consultancy Ltd, and currently Head of Culture and Engagement, Project Delivery Directorate, Sellafield Ltd, and Christopher Davey, Global R&A Senior Global Manager for Systems Engineering, System Safety, Modelling & Simulation, and Senior Technical Leader in Software & Control Systems Engineering, Ford Motor Company. I know all of them have very busy schedules and we were honored that they found time to engage with INCOSE and our members.

It was amazing to have a hybrid event where people could have the option of attending online, however, being there in person reminded me of the benefits of face-to-face networking. And I was truly uplifted and joyful to be with system engineering colleagues in person!
Another personal highlight of the event was seeing Kerry Lunney, my predecessor as president of INCOSE, who I hadn't seen in person since Jan 2020 at IW!

Finally, I would just like to say thank you to everyone involved in making the event such a success, including the presenters, exhibitors, and sponsors, along with the team of volunteers who worked tirelessly to bring the event together and chair sessions. Also, a huge thanks to our teams of contract support, who are our valued partners, and of course special thanks to our members who attended the event in person and online.

Warm Regards,
Marilee

IS2022 by the Numbers

By Beth E. Concepción

The 32nd Annual INCOSE International Symposium, which took place June 25-30, attracted 602 people in person in Detroit, Michigan, and 366 online. These 968 people represented 63 chapters from 24 different nations. More than 78 percent of attendees came from the Americas sector, with nearly 14 percent from EMEA and nearly 9 percent from Asia-Oceania.
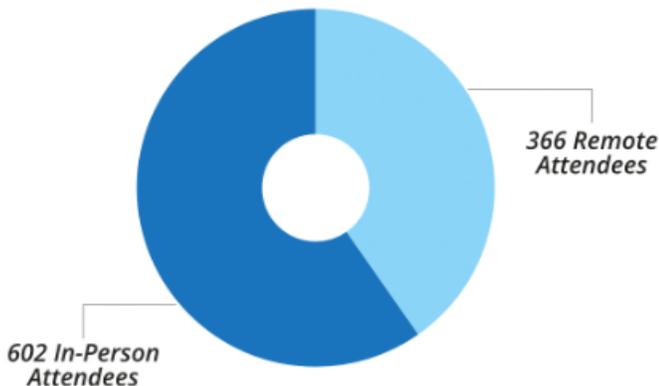
The international mix of professionals at all levels who attended included practitioners in government and industry, as well as educators and researchers. Attendees include representatives from BAE Systems, BMW, Jaguar Land Rover, GE, IBM, Lockheed Martin, Raytheon Technologies, Medtronic, Network Rail, Roche, Rolls-Royce and many more.

Four keynote sessions addressed the future of systems engineering, mobility and SE integration, and model-based systems engineering, among other topics.

Over the six days, attendees had a plethora of opportunities to learn about the latest in systems engineering. Scholars and industry leaders presented nearly 80 papers and conducted almost 40 presentations and six panels. There were nearly a dozen tutorials referencing fundamentals and conflict management to behavior control and artificial intelligence. More than a dozen invited content sessions covered everything from state of the practice to state of the art, plus the evolution and value of systems engineering.

Michael Vinarcik, INCOSE treasurer and former Michigan Chapter president said it was a great opportunity to "get involved in a global symposium, to share our knowledge and experience, and gain an understanding of how engineers from across the globe are engaged in the digital transformation of systems engineering."

The event was sponsored by 26 different corporate and academic organizations, with Dassault Systemes, IBM and Siemens signing on as Platinum sponsors.

The 33rd Annual INCOSE International Symposium will be held July 15-20, 2023, online and in person in Honolulu, Hawaii.
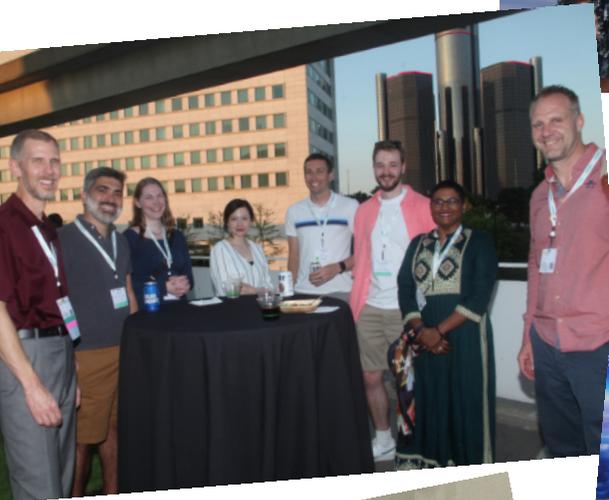
IS2022 Keynote Speakers

Dr. Christopher K. Scolese
Director, National Reconnaissance Office (NRO)

Keynote Title

Architecting the Future: The Role of SE and DE at the NRO

Carla Bailo
President & CEO, Center for Automotive Research (CAR)

Keynote Title

Mobility and Systsms Engineering Integration

Laura Doughty
Director Peakfield Consultancy Ltd and currently Head of Culture and Engagement. Project Delivery Directorate, Sellafield Ltd.

Keynote Title

The Power of Connection:
The power of influencing and how to do

Christopher Davey
Global R&A Senior Global Manager for Systems Engineering, System Safety, Modelling & Simulation and Senior Technical Leader in Software & Control Systems Engineering, Ford Motor Company

Keynote Title

Ford Connected, Agile, Model Based Systems Engineering and Simulation Journey... so far.

Thank you to the IS2022 Speakers

Put These IS2022 Best Paper Winners on Your Reading List

By Chase S. Wilkinson

INCOSE announced the six Best Paper Award winners from this year's International Symposium. With categories spanning topics such as Enterprise Systems Engineering, Needs and Requirements Definition, and Infrastructure, experts displayed most innovative and creative ideas in the systems engineering world. From a field of more than 100 submissions, these six papers stood strong through the rigorous review process and present truly exceptional ingenuity to the field at large.

James Martin of the Aerospace Corporation took home the **Best Paper for Enterprise Systems Engineering Award** with his work Extending UAF for Model-Based Capability Planning and Enterprise Portfolio Management.

The **Product Line Engineering** category went to the duo of **Marco Forlingieri** of Airbus and **Tim Weilkiens** of OOSE for their paper Two Variant Modeling Methods for MBPLE at Airbus.

The group of **Chamara Johnson** (WSP), **Dale Brown** (Hatch), **Allison Ruggiero** (New York City Transit), **Devon McDonnell** (WSP), **William Gleckler** (New York City Transit), and **Denis Simpson** (WSP) won the best paper for **Needs and Requirements Definition** for their paper Storytime, Audience to Authors: Enhancing Stakeholders Engagement.

Jaume Sanso and **David Martin** of SENER Engineering impressed with their **Infrastructure Paper**, Benefits of Systems Engineering in Large Infrastructure Projects: The Much-Anticipated Empirical Proof.

INCOSE awarded the **Modeling/Simulation/Analysis** category to the paper Applying Model-Based Systems Engineering Methods to a Novel Shared Systems Simulation Methodology written by the team of **Jeremy Ross, Chris Craft, Chris Caron, Stephen Pien, and Ashishkumar Prajapati** of the Ford Motor Company and Michael Vinarcik of University of Detroit Mercy.

The **Brian Mar Best Student Paper** went to **Takaharu Igarashi** from Perdue University for his work "Construction System Failures: Frame Notation of Project Pathogens and their Propagation Across Time and System Hierarchy."

This year's symposium theme was The Power of Connection and showcased experts from across the globe in disciplines such as aerospace, healthcare, AI, and more. For these authors to find success on so grand a stage is truly something to write home about!

How to be an Effective DEI Ally and Advocate

By Alice Squires, EWLSE Founder,

alice.squires@incose.net

Anyone can be an ally. All it takes is recognizing when an ally is needed, followed by taking supportive action. However, being an effective ally is easier said than done! For example, how do we recognize a situation that calls for allyship? How do we know that what we do is the right thing for all concerned and for the longer term? How can we be sure that what we do as an ally is truly effective? This topic was addressed in the IS2022 President-invited panel "How to be an Effective DEI Ally and Advocate" moderated by INCOSE President, Marilee Wheaton (Systems Engineering Fellow, The Aerospace Corporation). Distinguished panelists included Tamara Hambrick (Director of Systems Engineering, Integration, and Test (SEIT) Capability, Boeing Defense and Space), Alan Harding (Head of Information Systems Engineering, BAE Systems – Air). Gary Johansen (Vice-President of Power Systems Engineering, Cummins, Inc.), Rosalind Lewis (General Manager, Space Systems Group, The Aerospace Corporation), and Sonya Sepahban (Chief Executive Officer, OurOffice, Inc.). The panel featured corporate executives who shared their lessons learned, best practices and practical suggestions for allyship and advocacy in support of Diversity, Equity, and Inclusion (DEI) goals.

Marilee, the panel moderator, offered the following: *"Individuals who serve as allies become collaborators who fight injustice and promote equity in the workplace through supportive personal relationships and public acts of sponsorship and advocacy. Advocacy uses our resources to include time and talent to honor, support, and partner with people, institutions, and policies that align with our values and vision for a world of equity and justice."* During the panel, the panelists shared many insights through their personal stories and examples. A sampling of main take-aways is shared below, followed by questions developed for the panel to consider, a set of resources provided during the panel, a summary of the panel with specific guidance from the panelists, and a call to action.

A Sample of Main Take-aways

There were many great stories and takeaways throughout the panel; below is a sampling:

- We need courage and care to explore uncomfortable or traumatic topics that are affecting our community. Being an ally is about getting comfortable with uncomfortable conversations and prioritizing courage over comfort.

- The empathy, love, understanding, and caring that we experience and build through our life experiences can serve as guidance to help us to withhold our assumptions and to recognize our biases, while being an effective ally and advocate for others. Empathy and listening are key, even across perspectives in our technical field.

- To be an effective ally, we need to first understand ourselves. We need to challenge our own perspectives and take time to understand others and be comfortable changing our mind based on what we learn and realize.

- Effective allies exercise personal mastery and a growth mindset and are committed to lifelong learning and exploring diversity related research.

- Equity and equality are not the same thing. Where equality is allocating the same resources and opportunities to each person or group; equity recognizes that people have different circumstances and seeks to apply

resources and opportunities as needed to result in equal outcomes. When the focus is on equal outcomes, more or fewer resources or opportunities are needed, depending on the circumstance, to support reaching equal outcomes.

• Allyship requires action and the time to ACT is now. Think ACT: Align, Connect, Transform for broader engagement.

• Use your professional and personal platforms

to advocate for DEI goals and to be a DEI ally.

Questions To Consider

In support of establishing a diverse, equitable, inclusive culture in your organization, consider these questions that were developed in the preparation phases of this panel, and consider applying them to you and your organization;

• What successful initiatives or best practices has your organization identified concerning diversity, equity and inclusion?

• How can you tell if an organization truly values diversity and inclusion (or is just all talk)?

• What has influenced your thinking around D&I and motivated you to get involved in being an advocate for change?

• Are there new and/or diverse groups of people in your organization? What new challenges do they bring?

• What are the barriers that limit our ability to truly realize an environment of D&I?

• What success/outcomes has your organization realized from diversity initiatives or best practices?

• What would you say is the most difficult part of implementing a D&I program?

• How do we involve our employees/members from underrepresented populations without making them feel tokenized?

• What strategies do you use for developing innovative diverse teams?

Resources

The following represent resources shared during the panel. General resources recommended for further reading:

• The INCOSE DEI policy leverages the ABET definitions of Diversity, Equity, and Inclusion

• Author and activist Rachel Ricketts can provide helpful guidance

• Greater Than Yourself: The Ultimate Lesson of True Leadership by Steve Farber

• (Psychology Today) For understanding personalities (alternative to Myers-Briggs)

• (Clifton Strengths) For identifying your strengths

• (IISC) Equality versus Equity picture

• (BBC) Personal Biases Cannot be Overcome (instead, we need to recognize): www.bbc.co.uk/programmes/m00139pn

• (Smart Consulting) Making Professional Spaces Safe and Welcoming

• (Lean In) "How to Be a Workplace Ally"

INCOSE-related resources recommended for further reading:

• SEBoK DEI article by Alan Harding and Alice Squires

• "Diversity in Systems Engineering" INCOSE Insight edition with chief editor Bill Miller and

theme editors Alice Squires, Lisa Hoverman, and David Long

• "Towards a More Diverse INCOSE" by Alan Harding and Andy Pickard

• Also stay tuned for INCOSE Systems Engineering Handbook 5.0 which will include a section on Diversity, Equity, and Inclusion

The Bottom Line

One of the many active virtual participants of the panel, Sharon Torres (Sr. Systems Engineer at Shell TechWorks), offered the following overview of the panel: "INCOSE is actively working to grow a sense of belonging both within our community and for systems engineering at large. I'm encouraged that we're trying and learning, that it seems we are valuing progress over perfection and courage over comfort. Our community has members from multiple technical and socioeconomic backgrounds, cultures, identities, genders, and perspectives, and we have both tremendous potential and real responsibility to support each other. The state of the art and the practice of SE does not improve so long as exclusion, apathy, and fear affect our members. I am proud to have INCOSE members acting as my ally, and to keep growing as an ally myself."

One goal of the panel was to encourage each of us to commit to action to support our DEI goals within our companies and within INCOSE.The panellists provide summarizing guidance as to how we can do this, in response to the final question: "What piece of advice would you give to those who are trying to identify and work with other DEI advocates and/or for those who want to be DEI allies and advocates?", in their own words:

Alan: *"I've actually rethought this during the discussion, and I think I'd just say three very short things: I'd say to listen and learn from others, to understand yourself, your biases and your strengths, and to be brave and get involved, and try and help. That's it."*

Sonya: *"I would say, just don't put it off...engineers have solved many problems in the world. and I think this is another one where we can really help...data speaks louder than anything and it is important for every organization. Some of these reports that come out...Sometimes we'll say "Oh, that doesn't apply to*

me," well, let's do our own assessment....At least get an assessment of where you're at and then, on its own...measuring things has an effect that things get better and so it's really important to do that as a first step...Yep, just do it. Just get started."*

Tamara: *"Find a trusted agent that...can ask you questions that are deep in your mind of what you learned and how you behaved and once you feel that someone has gotten you, your feelings and your behavior and how you grew up...become an ally for others. That internal empathy and love and care comes from a feeling of ... how I can now provide to others what I was lacking...It's a constant work...to bring out empathy and caring every single day."*

Gary: *"First of all - super important to create emotional safety for every single person that you're around by being vulnerable self-aware, empathetic transparent, ... then people will open up and ... it can be contagious, so create emotional safety. Number 2 is hold yourself and others accountable publicly for outcomes, not just good words and other things, but outcomes...Are you actually going out to those other schools creating a wider net in your recruiting?...And lastly, change the narrative... I've heard people say, "Well, we're gonna take a chance on this person right?" ... what we have just done is undermine them... Instead, talk about all the fantastic strengths they're going to bring ...let's change the narrative"*

Roz: *"If you want to be an advocate and ally, it's sort of a little bit depends on where you are. You've heard about 3 companies here who have a commitment through their actions and their efforts to support DEI, if you're in that situation, you're in a good spot, because you can leverage what's already being done. If you're someplace where you don't have that, recognize that all 3 of these companies didn't start*

there. They got there somehow. So, the lessons that we learned and developed are still available to anybody else. So, find someone else someplace else that is like minded and learn what you can do to bring it to your own situation. I'm going to mess the quote up and I'll tell you what it means in my own words. You know if you see something that needs to be done and nobody's doing it, then it must be for you to do. Thank you."

A Call to Action

One call to action is for each member of the systems engineering community to **consider the importance of DEI to realizing successful systems** no matter what their domain. A goal of this panel is to continue to raise awareness about DEI. Another way to support raising awareness is by recognizing DEI as a natural and integral component of your research and practice. Please note that the INCOSE IS Call for Papers includes a category for "diversity" as one of the choices for the systems engineering cross cutting enablers for authors to use as appropriate to their work.

Another call to action is to **take the next steps in your journey as a DEI ally or advocate**. Being an ally is an iterative process of learning and changing behavior that begins with the willingness to question one's own behavior and beliefs, letting others help with that questioning. As the panelists suggest, being an ally also requires educating yourself about others who are not like you. Allies are needed in any situation where standing up for oneself may incur a penalty. An allyship process that I have learned and try to use (a work in process) goes as follows: 1) Recognize when someone is being harmed. 2) Ask clarifying questions to make sure you understand the situation fully. 3) Highlight what is happening that is causing harm to a person or group. 4) Convey your non-acceptance of what is happening. 5) Take action to change the situation going forward over the long term. Ultimately, allies are critical to support the ongoing process of cultural diversity and inclusion.

IS2022 Past INCOSE President Alan Harding Shares Advice

By Beth E. Concepción

Panel Sessions are an integral part of the International Symposium and cover a whole range of topics. Moderated by Marilee Wheaton, INCOSE Past President, the 'How to be an Effective DEI Ally and Advocate' panel session took place on day 3 of IS2022. This panel featured corporate executives who shared their lessons learned, best practices and practical suggestions for allyship and advocacy in support of Diversity, Equity, and Inclusion (DEI) goals. The panellists in attendance were Tamara Hambrick (Boeing Defense and Space), Alan Harding (BAE Systems - Air), Gary Johansen (Cummins, Inc.), Rosalind Lewis (The Aerospace Corporation) and Sonya Sepahban (Chief Executive Officer, OurOffice, Inc.).
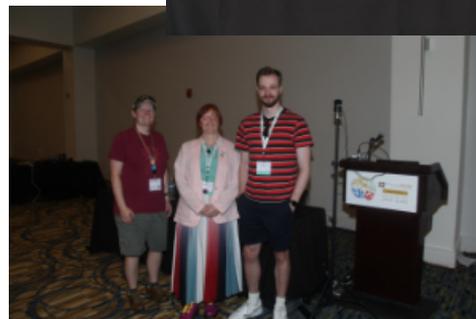
INCOSE Past President Alan Harding (2016-17) was one of the Diversity, Equity and Inclusion (DEI) panelists, and said he was happy to speak about DEI. "As a senior leader in INCOSE, and someone with a high degree of privilege, I am passionate about increasing access to systems engineering education and careers," Harding said. "This requires that we talk about the topic, develop our understanding, and continue to take concrete action."

Harding said he recognizes that it won't always be easy.

"The main point that I wanted to highlight is for all of us to try very hard to listen and learn to those speaking with personal experience of diversity issues, without leaping in with what we feel our solutions [are]," he said.

Harding has nearly three decades of experience in defense and security applications. He is the head of the Information Systems Engineering Discipline with the BAE Systems Military Air and Information business in the United Kingdom. Harding earned his B.Sc. (Hons) degree in physics from the University of Durham, United Kingdom.

"My advice to INCOSE (all of us) is to be brave enough to make change, while accepting that it won't necessarily be perfect," he advised. "With a culture of improving our diversity, equity and inclusion, we can move ahead together."

Daunting...

| Market Requirements | Ideation | RFP | Stakeholder Needs |

Build Visual Models
- SysML
- UML

Product / User Requirements

Manage Requirements
- Prioritize & Scope
- Reuse Requirements
- Change Management

Manage Products
- Components & Assemblies
- Product Variants / Branching-Merging

Functional / Non-Functional Requirements

Manage Traceability
- Gap & Impact Analysis
- Trace Matrix

Collaborate
- Electronic Approvals
- Digital Signatures
- Threaded Discussion

Detailed Specifications

Manage Risk
- Risk Register
- FMEA
- FUSA

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The Next Steps for Safer Complex Systems - An IS2022 President's Invited Content Session

By Kerry Lunney, kerry.lunney@incose.net

The Royal Academy of Engineering and the Lloyd's Register Foundation entered into a strategic partnership to deliver a 5-year programme to realise the "Safer Complex Systems Mission" to improve safety of the design, management and operation of complex systems globally. Two years into the programme a series of case studies across multiple industries and technologies have been compiled, accessible at www.raeng.org.uk/safer-complex-systems/case-studies. I urge all readers to download these case studies and peruse them at your leisure.

At IS2022 we were very fortunate to have a selection of these case studies across a variety of industries, presented by its researcher at one of the President's Invited Content (PIC) sessions. The case studies were:

- The 2005 THORP Internal Leak (Francis Liven and William Bodel),
- Social Innovators as a Human Sensing Network Solving Humanitarian Challenges (Matias Rojas),
- Delivering a Seasonally Agnostic Railway (John Beckford and Brian Haddock), and
- Beyond the Limits of Knowledge: Navigating Uncertainty in Complex Systems (Richard Judge)

The preliminary findings across the entire span of case studies indicate that safety is seen too often as an engineering or technology issue when often it is a cultural or social one. Other findings include a lack of systemic thinking and action over the lifetime of the systems, minimal attention to governance, unverified assumptions, to name a few.

To provide a greater diversity of thought, and help identify the path forward for the remaining three years of the programme, the PIC session introduced three qualified panelists from INCOSE to provide feedback on the case studies from three different perspectives as follows:

- Meaghan O'Neil on System Safety,
- Erika Palmer on Social Systems, and
- Michael Watson on Complex Systems.

Although each panelist critiqued the presented case studies from different viewpoints, it became apparent that one of the biggest take away points relates to social interactions. The case studies showed that complex problems are becoming more complex when the social context interacts with the system or system process flows. Social interactions are a confounding factor to system complexity, and in turn to system safety. The case studies showed that failures often stem from a lack of understanding of how humans, ie the social factors, play such a large role in system failures. This aligns with the preliminary findings from the programme.
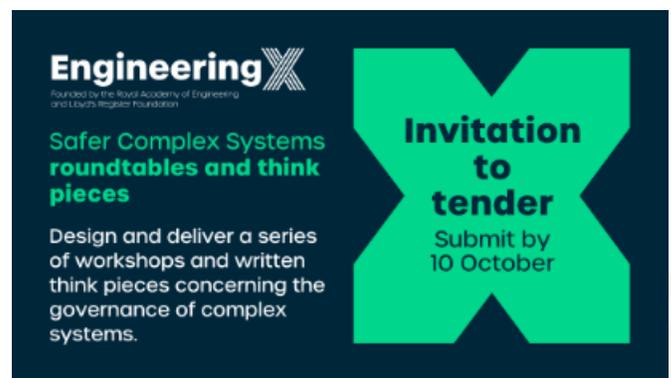
Since presenting and critiquing the case studies at IS2022, the research programme is moving forward along two pathways, taking our input into consideration. Firstly, discussions are underway to

produce some impactful communications, possibly considering a "storytelling approach". This is primarily due to the collaboration with one of our INCOSE Fellows, Dorothy McKinney, after she attending the PIC session. This is a great outcome – thank you Dorothy. The second activity is the recent announcement of a Govern Invitation to Tender (ITT). Details of the ITT can be found via the URL, https://engineeringx.raeng.org.uk/programmes/safer-complex-systems/invitation-to-tender-safer-governance-of-complex-systems. What may be of great interest to many of you is the series of five workshops and roundtables that you can participate in. Each will address a specific theme such as "From physical inspection to trustworthiness", "Learning from failures", and "Political actions have consequences". We will keep you informed when these are occurring.

I hope you can see that our involvement with the RAEng has been very fruitful and demonstrates a continuing collaboration between our two organisations. I am also very pleased that the PIC session was quite a success.

On that note, lastly, I would like to thank all of the team that made the session such a great, informative and interactive event - Brian Collins for his leadership of the Safer Complex Systems research programme; William Bodel, Matias Rojas, John Beckford and Richard Judge for their research and time; Michael Watson, Ericka Palmer and Meaghan O'Neil for their excellent review and critiquing of the presented case studies; and Duncan Kemp for his insights and co-leadership of the PIC session.

I look forward to continuing to collaborate on the next phases of the programme.

Cheers, Kerry Lunney
PIC Session Lead
INCOSE Immediate Past President

P.S. The PIC session led to many conversations at IS2022, resulting a follow-up talk on "Social Resilience in Complex Systems" by Erika Palmer on 17 Aug 2022, for the Cheasepeake Chapter. Great work team!

33rd Annual **INCOSE**
international symposium

hybrid event

Honolulu, HI, USA
July 15 - 20, 2023

Thank you to all the IS2022 Sponsors

Platinum

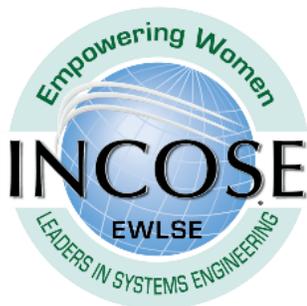### Silver

Bronze

Academic

An Update from EWLSE

By Anabel Fraga, EWLSE EMEA Sector Lead

The third quarter 2022 Empowering Women Leaders in Systems Engineering (EWLSE) update is provided to you by Anabel Fraga, EWLSE lead for the EMEA sector. This update covers the INCOSE IS 2022 and related events, future plans for EWLSE presence at the international SWE 2022 (WE22), Gordon Center for Systems Engineering "Women Advancing Systems Engineering", and AOSEC 2023 events. Finally, it includes reports on other current and future EWLSE related activities.

IS 2022 Activities

EWLSE held a reception at IS 2022 which was well attended by EWLSE current and potential future members. It was lovely to see so many women in one place at the conference. However, please note that EWLSE membership is not for women only and is open to all with an interest in the vision and purpose of the working group. At the reception, Erika Palmer presented EWLSE and her new role leading the EWLSE Americas Sector and introduced Anabel Fraga as EWLSE EMEA Sector lead. Erika then introduced Heather Feli as co-Editor of the book "*Emerging Trends in Systems Engineering Leadership: Practical Research from Women Leaders*". Please note: Heather received an Outstanding Service Award at the INCOSE IS 2022 conference for her unrelentless dedication to supporting the transition of the "Emerging Trends" book, and the goal of the 26 women authors; from

a dream to a reality. By her very nature, Heather is helping to improve the skills of INCOSE members based on her vast professional trajectory as a System Engineer and she remains an outstanding member of INCOSE! At the reception, Heather discussed the book's vision and contents. Heather also promoted the inaugural eBook "*Letters to My Younger Self: How Systems Engineering Changed My Life*" which contains letters from 25 men and women of INCOSE to their younger selves.

Erika Palmer and Anabel Fraga were inducted as full members of the INCOSE Technical Institute of Leadership (Cohort 6) at IS 2022. TLI participants are inducted as full members of the TLI upon completion of the program. Erika and Anabel presented a joint paper with other members of Cohort 6; they also presented a poster and reserved paper at the conference. Inducted members of the TLI mentor new TLI cohort members, and Anabel had the opportunity to meet her TLI mentor, Heather Feli, for the first time at IS 2022. Stueti Gupta continues her preparation as part of the Technical Leadership Institute (Cohort 7) with plans to complete the program and be inducted to a full member during IS 2023.The EWLSE Sector leads are all part of TLI's journey in preparing to become the best version of themselves in continuous collaboration with the TLI. EWLSE members with an interest in being nominated for the INCOSE TLI, please email your interest to ewlse-leaders@incose.net.

Other Current News

In other news for the third quarter, Erika Palmer started this summer at Cornell University as Senior Lecturer on Systems Engineering. On August 17, Erika presented the Social Resilience in Complex Systems webinar where she discussed how social resilience aligns with systems engineering practice.
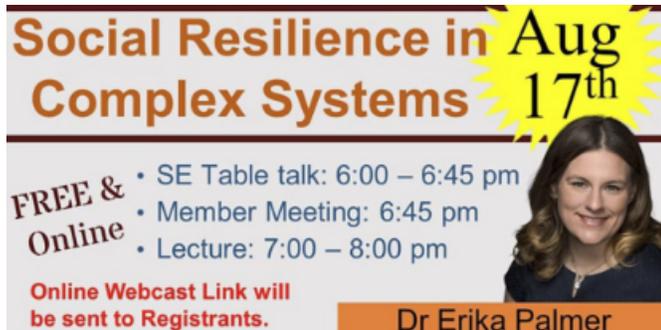
Anabel Fraga was selected as the EMEA DEI (Diversity, Equity, and Inclusion) representative as part of the DEI Advisory Council supporting Maria Romero, Associate Director of DEI. Anabel also signed an agreement with the Technological Woman Group in Spain, to collaborate with INCOSE Spain to promote STEAM activities in Universities, High Schools, and Elementary Schools. As INCOSE Chapter of Spain President, Anabel has been promoting a Volunteering group in Spain for STEM activities in collaboration with academia as well as creating a YouTube channel to incorporate a network of communication through social media with interested girls to follow a systems engineer and systems thinking career, promoting systems engineering and disseminating the added value of this transdisciplinary thinking. The YouTube channel will be available from September with the first video to be released and more to come!

Future Plans

Going forward, EWLSE has three activities underway. EWLSE members will be sponsoring an INCOSE and EWLSE booth at the Society of Women Engineering (SWE) annual conference on October 20-22, 2022 in Houston, Texas (www.we22.swe.org). Marilee Wheaton, INCOSE President, Heather Feli, Federica Robinson-Bryant,

and Alice Squires, EWLSE Founder, all plan to be there. If you live in the Houston area or will be attending the conference, please let us know by sending an email to ewlse-leaders@incose.net. EWLSE Founder, Alice Squires, will be presenting "Emerging Trends in Systems Engineering Leadership" as part of the "Women Advancing Systems Engineering" conference on January 24, 2023 at the Gordon Center for Systems Engineering in Israel. Alice looks forward to meeting the members of the Israel chapter and discussing related systems engineering topics and initiatives to support the EWLSE vision and mission. EWLSE is also planning events in support of AOSEC 2023, the Asia-Oceania Systems Engineering Conference to be held in India in 2023. In the past EWLSE has sponsored a panel and a workshop alongside the AOSEC conference and future plans are being discussed.

EWLSE sector leads continue to plan to reach chapter presidents in their respective sectors and raise awareness of the EWLSE mission and vision.The sector leads are also seeking volunteers to create a greater community and promote Women's Leadership. Stueti, Erika, and Anabel agreed to promote events for women and girls but also events led by women; to organize a meeting at the IS2022, to increase activity on social media, to promote joint events between sectors, and to create a yearly virtual EWLSE Event that serves as a meeting point for all the interested practitioners. Stay tuned for the first EWLSE virtual annual event (EWLSE 2023) which is planned to be launched in 2023.

EWLSE would like to express their thanks to SPEC Innovations and Caltech for their support as an EWLSE Sponsors.

Are There Gender-based Differences in the Professional Competencies? What Does It Mean if There Are?

By Dr Heidi Hahn, EWLSE Outreach

In a recent survey of gender-based differences in the INCOSE Professional Competencies, which encompass Communications, Ethics and Professionalism, Technical Leadership, Negotiation, Team Dynamics, Facilitation, Emotional Intelligence (EI), and Coaching and Mentoring, I found that evidence for gender-based differences was generally equivocal for all of the competencies, with some studies finding differences and others finding none. McCabe, Ingram, and Dato-on (2006) explain that this might be due to some authors treating the variable as sex, which they characterize as a biological variable, versus gender, which they view as a multidimensional construct that is based on gender identity theory. Gender identity theory says that gender consists of biological sex as well as instrumental (masculine) and expressive (feminine) psychological traits associated with males and females and gender-role attitudes. Gender-role attitudes refer to a person's beliefs about which roles are appropriate for men and women. Unfortunately, in many cases it is difficult to tell which definition authors were using, so it's impossible to confirm (or refute) this theory.

Nonetheless, common sense tells us that there really are differences. Here are a few:

- Women tend to communicate to build relationships, men tend to communicate to transmit information (vomSaal, 2005).

- Women are more likely to perceive unethical behavior as unethical than men, perhaps because they take a relativistic view that considers whether the action taken is culturally, individually, or traditionally acceptable, or acceptable to their family (Stedham, Yamamura, and Beekun, 2007).

- The genders are not different in (technical) leadership competence, but women are less likely to be seen as effective (Strebler, Thompson, and Heron, 1997).

- Women are less likely than men to initiate a negotiation and men tend to achieve better outcomes, probably as a result of women setting fewer and lower goals (Stuhlmacher and Linnabery, 2013).

The presence of women on teams enhances team processes but does not necessarily lead to better outcomes, especially in male-dominated disciplines (including engineering), where gender stereotypes are present (Bear and Woolley, 2011).

Gender differences in communication styles can affect facilitative leadership.

There are differences in EI, with women likely better at managing their own emotions and men likely better at managing the emotions of others (Dunaway, 2013).

Both O'Brien, Biga, Kessler, and Allen (2017) and Sosik and Godshalk (2000) provided examples of differences in mentoring behaviors, for example, female mentors tending to provide more psychosocial support and male mentors tending to provide more career advice.

Notice that I've used terms like "tend to" and "are more (or less) likely to." This is intentional – generalizations are not universally true! More importantly, while there may be differences, there's little evidence to suggest that one gender is better at the Professional Competencies than the other – they're just different.

These results have implications for selecting Systems Engineers and for forming systems teams. Not surprisingly, because the Professional Competencies all deal with Human Resources (HR) topics, the implications deal with addressing HR issues. Guidelines include:

- Using gender-neutral position descriptions and interview questions when selecting Systems Engineers.

- Balancing role modeling, and giving psychosocial support and career advice in mentoring relationships.

- Ensuring gender parity, that is, having equal numbers of men and women, if possible, when forming teams; this reduces gender stereotyping.

- Using assessment tools like DISC – Dominance, Influence, Steadiness, Conscientiousness – (Robbins, 2021) to help individuals understand their own strengths and weaknesses and sharing the results so that team members gain an appreciation of others; to the extent possible, select team members to balance the DISC dimensions.

- Avoiding gender-based stereotypes like having the women be the note takers and men be the

developers when making team role assignments.

- Educating team members about diversity-related differences and the need to avoid stereotypes.

Strebler et al. (1997) note that it is particularly important to have equity of inputs, such as those listed above, to help ensure that gaps related to pay disparities, promotional opportunities, and professional development for women can be closed. My personal opinion is that only in this way might we eventually be able to achieve equity of outcomes and do so fairly.

Finally, recognizing and appreciating gender-related differences in the Professional Competencies and effectively managing both individual strengths and weaknesses and team dynamics should maximize team success, in terms of both process and performance.
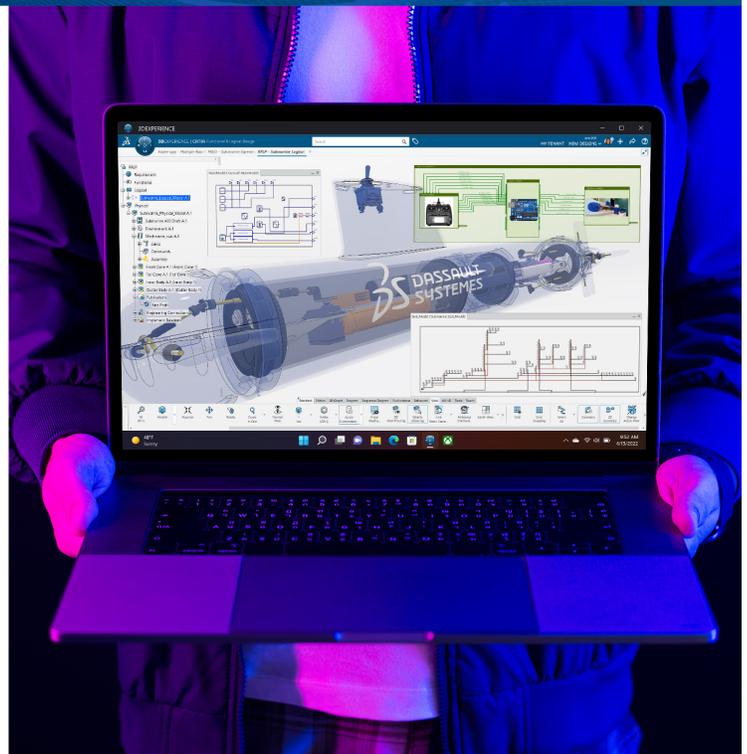
An Introduction to the INCOSE Outreach 'Champion Proposal'

Dr. Julia Taylor, Director for Outreach, julia.taylor@incose.net

INCOSE Outreach is currently developing the 'Champion Proposal'; a one-page proposal from any INCOSE member with suggestions for a potential collaboration that they would like to create between INCOSE and another organization or professional society.

For members whose cases are accepted, there will be financial support to aid with setting up the collaboration. Cases will be accepted based on their ability to create meaningful connections and building collaboration experiences between INCOSE and the other organization.

Applications are open to all INCOSE members.

What to include in your one page proposal:

- GOALS (identify)
- Describe your project. (a paragraph or two)
- Motivation
- Proposed Actions you will take.
- How you will evaluate whether your action contributed to your goal or not.
- Identify Milestones.
- Estimated timeframe for pertinent milestones.
- Ultimate results you want to achieve.

Please submit you proposals to Julia Taylor on julia.taylor@incose.net

Spotlight on Aleczander Jackson

At INCOSE, we know our employees' and volunteers' time is valuable. That is why we think it is important to recognize Aleczander Jackson, who has gone above and beyond to share INCOSE's mission and ideas in his outreach.

Aleczander was initially exposed to INCOSE when he was a solution architect with No Magic, Inc., a software company that develops object-oriented design and development solutions. While he was there, he was able to interact with INCOSE, providing support and technical advisory services on real-world problems. *"As my exposure to the industry grew, my interest and passion surrounding systems engineering grew proportionally. I joined Modern Technology Solutions, Inc., where I began the development of my published Model of Models methodology"* said Jackson. Shortly afterward, Aleczander was a presenter at INCOSE's Western States Regional conference and NDIA's Systems & Mission Engineering conference.

"It was through WSRC that I was exposed to INCOSE outreach and decided to dedicate more time to research that has a positive impact industry-wide," Aleczander continued. *"What I find important about outreach is increasing the industry's awareness of INCOSE as a whole, shortening the time for newer system engineers to advance their capabilities than those who pioneered before them."*

Inspired by INCOSE, Aleczander founded his own company, Enola Technologies, in 2021, which focuses on advancing the state of MBSE in a manner that evolves the capabilities of his clients to enable their independent success. *"I find this work meaningful in that I can learn from other industries on the processes and techniques to improve INCOSE and potential various applications of systems engineering"* said Aleczander.

Welcome to the new Corporate Advisory Board Members

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Mahindra University
Global Thinkers. Engaged Leaders.

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School of Systems and Enterprises

The **School of Systems and Enterprises (SSE)** at Stevens Institute of Technology is seeking a pool of qualified adjuncts for a range of part-time teaching assignments in the areas of software engineering, systems analytics, industrial and systems engineering and engineering management, with openings beginning in **Summer 2022**.

Visit **stevens.edu/careers** to apply.

INCOSE 2022 Recognition and Awards Yearbook

Debut Issue Out Now!
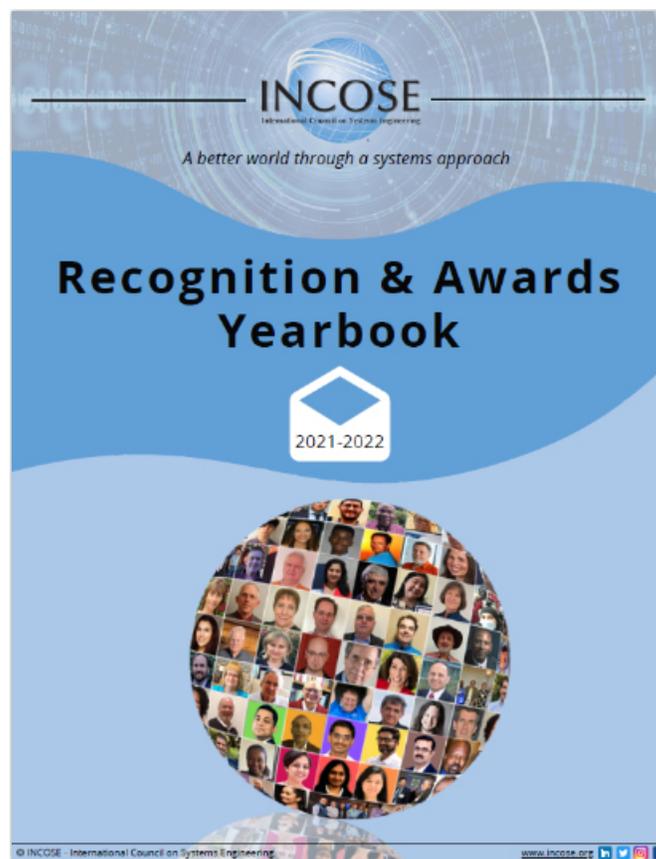
Sponsored by **QRA**

www.incose.org/yearbook

CHAPTER UPDATES

Click on the chapter to go straight to their update.

INCOSE Sector 3 (Asia and Oceania) Update

By Serge Landry, INCOSE Director for Asia and Oceania, serge.landry@incose.net
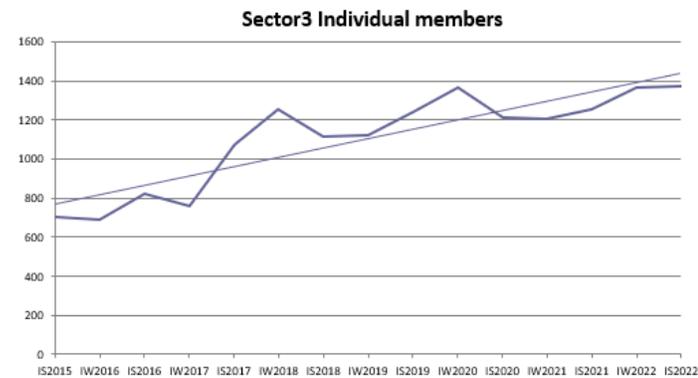
Historical Trend

While the 2021/22 Sector 3 growth is only at 9%, the historical individual membership curve indicates a healthy 10% historical growing trend since tracking started at IS2015; despite the recent slowdown (2019/20 and 2020/22) likely due to the economic hardships brought by the pandemic.

Sector3 Individual members

Other interesting metrics: Chapters 8 chapters – 1,370 Individual members – 14 CAB members.

Historical Share per Sector

Sector 3 today (30-May-2022) represents 12% of overall individual members of INCOSE (as of 30-May-2022, 1,370 out of 11,357) as compared to only 5% in 2015 (704 out of 10,476).

The population of Asia and Oceania today represents 60% of the world's population (data from www.worldometers.info/world-population/), therefore there is still room to grow.

Additional metrics of interest: 8 chapters – 1,370 Individual members – 14 CAB members

New Roles Coming Your Way

Check out the new 'IT Transformation facilitator for the Asia Oceania Sector' role posted on www.incose.org/about-incose/volunteer-opportunities/vo-request

Sector3 Meeting News

Lots of regional engagement from INCOSE central with life and remote participations from Certification, CAB member, Chapters, Events, IT Transformation, Marketing & Communications, New Member Engagement Committee, Nomination & Election, Outreach, PDP, and Product.

TOP 20 Activities for This Year

Activities ongoing with Certification on the expansion of Academic Equivalency in Asia Oceania with discussions in progress in India and Singapore.

Japan Chapter: Japan Council on Systems Engineering (JCOSE)

By Maz Kusunoki

On July 30th we held our "Highlights of IS2022" workshop in Japanese, with topics shared by Midori Daida and Yutaro Ito followed by group discussions.

On September 6th we will be hosting our second online symposium JS2022 which will consist of two keynotes in English and seven talks in Japanese (https://www.jcose.org/event/js2022/).

On September 8th JCOSE together with SDM will be hosting a symposium titled "VISION FOR A BETTER WORLD" in which invited speaker Sandy Friendenthal will present the Systems Engineering Vision 2035 (http://www.sdm.keio.ac.jp/2022/06/30-085555.html).

Finally, JSAE (Society of Automotive Engineers of Japan) and JCOSE have collaborated to deliver a two day introductory course on Systems Engineering for the Automotive Industry due to take place on September 28th – 29th (https://www.jsae.or.jp/ikusei/systemsengineering.php). Led by Prof. Nishimura, we hope this will be the first of a series of educational courses in collaboration with JSAE.

www.jcose.org
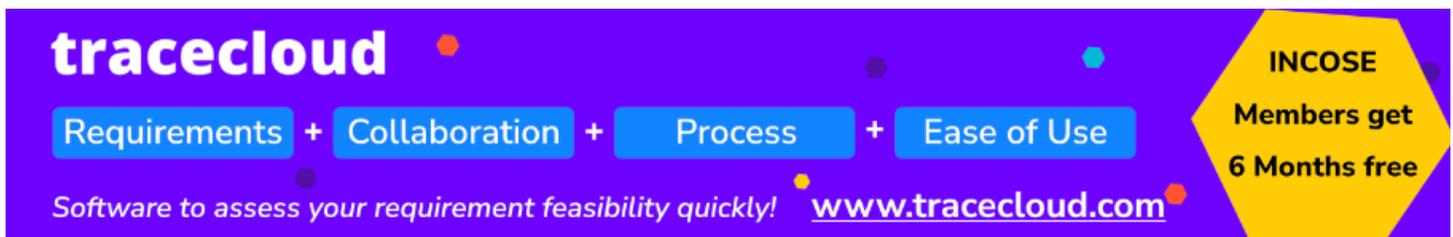
Brazil Chapter: INCOSE Brasil

By Diego Rangel,
diego.rangel@incosebrasil.org.br

INCOSE Brasil Has a New Board of Directors

By the exact date of its 10th anniversary, INCOSE Brasil had elected a new board of directors initiating the 2022-2024 term; bringing members from different regions and professional domains with the purpose of consolidating the structuring work undertaken by the last BoD and expanding the chapter's reach by an organized approach to key stakeholders in the country.

As a result of crucial strategic planning work performed during 2021, the new BoD was able to start the term with a solid understanding of key aspects that INCOSE Brasil should prioritize in 2022 and how roles and responsibilities should be distributed.

The new BoD defined the following goals for the year:

1. Establish/strengthen institutional relationships with companies, universities, and governmental organizations to understand how INCOSE might help them to increase value by enhancing systems engineering processes. The exchange with other professional societies may represent another great opportunity for partnerships and benchmarking.

2. Enable a proper knowledge-sharing environment – Creating a space where the systems engineering community feels motivated to share experiences and seek expert advice.

3. Promote SEP Certification – Describe the value of certification to organizations, trying to influence the adoption of certification as a recommended requirement for systems engineering roles. Celebrate newly certified members, sharing their

impressions on the certification process and how it has been important for them.

4. Increase volunteering engagement – The expected growth of the chapter will only come with an engaged community. Members and non-members should be able to participate, allowing broader engagement and potentially motivating non-members to become members. A call for volunteers has been designed by specific roles based on each director's needs.

INCOSE Brasil accomplishments so far:

- Initiated regular meetings with two universities whose courses cover systems engineering content. Discussions proposed a standard syllabus for a systems engineering fundamentals course and a potential MOOC course in Portuguese. Discussions are ongoing to add more universities to this initiative

- Introductory meetings with Brazilian and international companies as part of INCOSE's Corporate Advisory Board. After an active engagement from the chapter, companies are approaching INCOSE Brasil for meetings.

- Regular campaign to promote certification through social media with significant engagement.

- Call for volunteers released with impressive feedback – More than ten new volunteers have joined our activities so far.

With structured work and a motivated team, INCOSE Brasil has seen membership and certification growing steadily. The BoD has been working hard in the last four months to set the groundwork for a solid growth of systems engineering in Brazil for the following years.

INCOSE Brasil Website

Israel Chapter: INCOSEIL

Where Are We Wrong? Integration of Human-System Considerations in Ventures

By Nirit Gavish –Braude Academy of Engineering Karmiel, Avigdor Zonnenshain - Gordon Systems Engineering Center, Technion & INCOSEIL and Ami Harel - End To End Systems & INCOSEIL

Human-system integration combines two disciplines, that of systems engineering, which deals with designing whole systems composed of subsystems and the interactions between them, and that of human factors engineering, which focuses on imp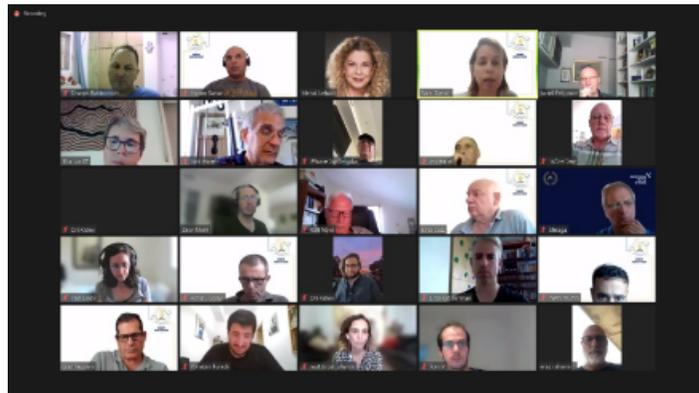roving the interaction between the human and the system. Linking the two requires the systems designer to take into account human factors from the very first stages of design. The Israeli HSI (Human-System Integration) group, which operates on behalf of the Israeli Society of Systems Engineering and the Gordon Systems Engineering Center of the Technion, has been working together for several years to promote the symbiosis of systems engineering and human factors engineering and pass it on to all systems developers. As part of the group's activities, lectures, workshops, seminars and conferences are regularly held.

The group has recently chosen the path of a hackathon to encourage the incorporation of human-system considerations into various relevant ventures. The topic chosen was smart transportation. The number of private and commercial road vehicles is growing, and it creates a burden that impairs the quality of life,

the health of residents and subsequently productivity. There is therefore a need to encourage the use of public transportation, travel sharing, bicycling and walking instead of driving. However, technological developments that fail to consider the behavior of road users are unhelpful, and it is necessary to combine both technology and psychology in order to reach optimal solutions. The hackathon, which took place during May 2022, dealt with finding solutions to challenges in the field of smart transportation, and integrating systems and human factors engineering problems which arose in the field.

For months, the group worked with stakeholders to define challenges that combine a high-tech system with human factors. Finally, five such challenges were outlined by five different organizations. The Tel Aviv-Yafo Municipality has sought an ongoing and strategic management solution in the commercial / business and entertainment areas of the city where there is competition for space between pedestrians and various means of road transportation, and therefore flexible rules must be set that can vary according to needs. Raphael was looking into the use of artificial intelligence and the utilization of passengers' emotional metrics, analyzed in real time, to try to reduce the level of stress and adrenaline arousal in an effort to create a more pleasant travel experience. The Ayalon Highway Company was interested in collecting real-time data on the stress / pleasure levels of pedestrians in the urban space in order to identify the factors which encourage or deter walking. The Future Mobility Center sought to increase the use of collaborative or public transportation and the willingness of the student

public to share travel. The Superbus Company - the "Matronit", has sought to develop a real-time alert system for vandalism at the "Matronit" stations in order to reduce the number of these incidents.

The hackathon was attended by dozens of students, engineers, entrepreneurs, developers, transportation professionals, human factors engineering and human-computer interface experts from across the country, who came together to develop technological products that would address solutions to these complex challenges for future transportation. The hackathon was assisted by mentors and guest lecturers who emphasized the importance of taking users and the human factors into consideration when developing solutions.

At the end of the hackathon, after the award ceremony for the winning solutions, one of the judges sent us, the hackathon organizers, this message: "There are many areas in life, perhaps all of them, for which a technological solution is only partially relevant. In my opinion, we must pay attention to the matter. On the issues of the last hackathon, it stood out, for me at least, that in the thought processes for the solutions, most focused on technology."

The success of the hackathon and the proposed creative solutions which were praised by the enterprises involved, who expressed a desire to continue working with the development teams, was tempered by the fact that, despite all the efforts, the importance of addressing human factors in the development of an endeavor has hardly matured? Where did we go wrong?

For many years, the "Human Factors Engineering" course has been taught to students in the Department of Industrial Engineering and Management at the Braude Academy of

Engineering in Karmiel, in order to impart to them, the future engineers, approaches that take into account users' needs and their characterization in the very early stages of design. In the 2002 academic year, it was proposed to combine this course with the "Golden Hackathon" organized by Braude, which develops technologies for the elderly population in Israel to help the aged population improve their quality of life. The hackathon focused on three areas: Remote health and rehabilitation such as index monitoring, adoption of technologies and remote support for elderly deaf mute people, dealing with mobility limitations at home and in the public space, as well as technologies that will support and facilitate the aging process such as encouraging healthy living, relieving loneliness and maintaining physical and cognitive function. I jumped at the opportunity to allow my students to obtain a deep familiarity with the target population, tackling real challenges coming from the field and emphasizing aspects of human factors engineering within an interdisciplinary team that develops the project.

During the semester, the students in the course got to know the target population through interviews, observations and joint activities. They attended lectures by experts in the field of aging and technologies for the elderly population, all in addition to the usual content taught during the course: human cognition, task analysis, information gathering, display design, etc. During the hackathon, which took place at the end of the semester, they teamed up with students from other fields, and together they tried to meet the challenges, raised and develop solutions. Some of the course assignments were done during the hackathon itself: interviews with potential users to understand their needs and opinions of developed systems, examination of existing solutions in human engineering and analysis of developed
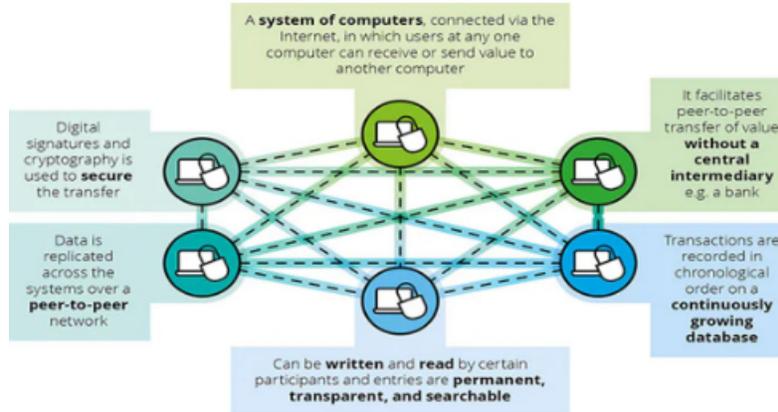
systems and its degree of compliance to the cognitive needs of the seniors. The hackathon schedule and judgment criteria were adjusted to adequately reflect the process of human factors integration into the system design.

During the hackathon, lecturers, mentors and the organizing staff randomly went from team to team. The students in the course complained that the assignments they had to prepare for the course took up lots of time and hindered them from progressing in the development of their systems. "We are busy with chores and do not have time to engage in the hackathon," was the prevailing claim. "How come they do not understand," a person from the organizing team told us, "That these tasks, are actually the hackathon?". Once again satisfaction for an extraordinary experience we provided to the students in the course, which resulted in the development of exciting solutions was tempered by frustration. How come they do not understand? Where did we go wrong?

Stress Relief in Public Transportation
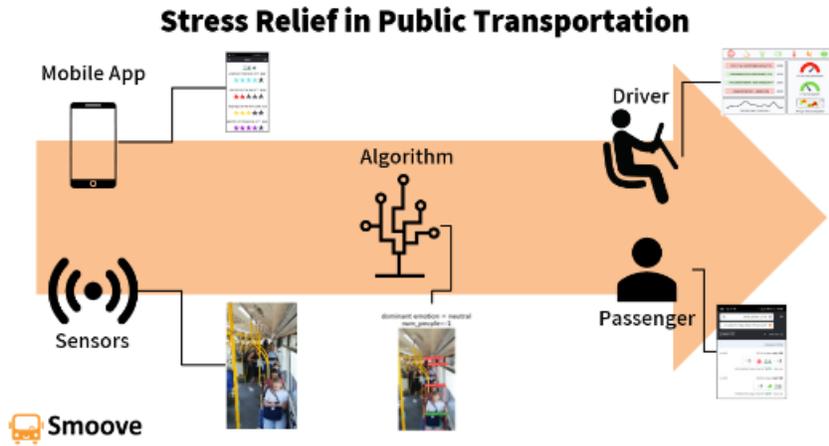
Where are we, the human-system integration people and members of the Israeli and the global HSI community, who have worked tirelessly for years on end, trying to instill the thinking that human aspects must be integrated into system design from the beginning wrong? When called to the flag after the system is ready, without talking to even one user in the process, we are asked "just to define which icon is appropriate". Why do we fail again and again and again?

Returning to the human factors engineering course, the first task in the course was task analysis, in which students were asked to think of some future system they would like to develop as a "black box". In fact, they were required to think about the uses of the system, the characteristics

of the user, the characteristics of the environment and the interaction with the system without illustrating what the system will look like. When students presented this task, I often saw drawings of the planned system with the explanation: "Here there will be a green button that will be pressed to activate." Our response was to challenge them with questions: And why a button? Maybe the user will wink at the system to run it? Maybe he will make a gesture with his hands? Maybe the system will read his thoughts?

Moreover, we asked the students: Do you think that the iPhone, Waze, virtual reality systems, would have been created if people had continued to think in the conventional ways they are familiar with? In order to attain groundbreaking results and inventions it is necessary to ignore what immediately jumps to mind, which is usually a picture of what the system will look like. It is difficult, it is not intuitive at all, but it is necessary. We, along with the rest of the Israeli HSI group and the range of experts in the fields of integrating human factors engineering and systems engineering in Israel and around the world - have the unenviable task of continuing to roll the stone to the top of the mountain, much as did Sisyphus of Greek mythology fame. Where are we wrong? We are not wrong. We can only make mistakes if we drop the stone of understanding the needs and expectations of the intended users along the way.

Indeed, the Israeli HSI Group, which has been operating for over 6 years, works tirelessly to instill HSI awareness in systems engineers and project managers. As part of the group's activities, we promoted many issues, including:

- Formulation of processes for integrating HSI aspects into the project life cycle

- Training of systems engineers in aspects of HSI
- Participation and Contribution to the efforts of the HSI Global Working Group in the preparation of the HSI chapter in the next systems engineering guide at INCOSE
- Participation and contribution to the efforts of the global working group in the preparation of PRIMER HSI.
- Hosting Prof. Guy Boy, Chairman of the Gloabl HSI Group, at a seminar of the Gordon Center and the Israeli Soceity of Systems Engineering INCOSEIL
- Significant professional participation in INCOSE's HSI conferences - in France and the USA.
- Conduct of an international HSI workshop in October 2020 to which more than 350 participants from more than 25 countries registered

- Joint development of HSI's concept as an advanced socio-technological system.
- Formulation and development of an advanced online course for HSI as part of the CAMPUS IL platform.

It seems to us that we are pushing the rock of HSI up the mountain, and do not intend to stop this journey thanks to the great dedication of the members of the working group under the excellent management of Ami Harel. Thanks to the continued support of the Gordon Center for Systems Engineering at the Technion, the Israeli Soceity of Systems Engineering INCOSEIL and the HSI International Group headed by Prof. Guy Boy. Also, thanks to our language editor Mr. Aron Pila.

www.incoseil.org

Spain Chapter: Asociación Española de Ingeniería De Sistemas (AEIS)

By Anabel Fraga, AEIS President

- The Spain chapter launched the Requirements, MBSE, Volunteering, and CSOST (Complex Systems, Ontologies, and System Thinking) Working Groups (WG) during the summer.
- The new Working Groups will start operations during Q4 of 2022 .
- AEIS now has three new CAB members: Universidad Carlos III de Madrid (UC3M), INDRA and CT Ingenieros. Increasing

academic and industrial participation, creating better bonds between INCOSE and the organisations in Spain.

www.aeis-incose.org

UK Chapter: INCOSE UK

By INCOSE UK Secretariat,
publications@incoseuk.org

ASEC 2022 Booking Now Open

We are pleased to announce that booking for the INCOSE UK Annual Systems Engineering Conference (ASEC2022) is now open.

Taking place at the The Crowne Plaza, Newcastle on 22nd and 23rd November 2022, ASEC is the UK's premier Systems Engineering event, attracting a wide range of industry, academic and government professions.

We have announced two Keynote speaker:
Laura Doughty
Speaking on Day 2 of the event, Laura has over 25 years' experience in designing, building and leading multi-agency teams to achieve results from strategy, inception and planning through to delivery and operations.

Mark Wild
Mark Wild has more than 30 years of experience leading complex and critical infrastructure. An Engineer with Hons Bachelor's Degree in Electrical and Electronic Engineering and Masters in Business Administration from Leeds University and is the Chief Executive of Crossrail Limited.

INCOSE UK Member in WES50 Top 100.

We are pleased to announce that Jessica Korzeniowska was shortlisted in the 100 finalists list for the Top 50 Women in Engineering Awards in 2022. Jessica, who has previously won Best Paper, Best Paper by a new author and Best Presentation at ASEC 2021, says of this accolade "It

was an honour and a privilege to be named one of the 100 Highly Commended Finalists for the Top 50 Women in Engineering 2022: Inventors and Innovators awards, alongside some truly remarkable engineers.

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As an established publisher of well received and high-quality Systems Engineering publications, INCOSE UK is proud to introduce the INCOSE UK Enterprise License.

This new scheme offers companies the opportunity to purchase eBook Enterprise Licenses in flexible quantities (minimum 100) at a competitive rate.

Titles are available from the Don't Panic and Advanced Application ranges, and with a range of options to suit any budget, it is a great opportunity for companies to share Systems Engineering knowledge, techniques and ideas with their employees.

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ePreview: INCOSE UK Newsletter

In this issue we announce the start of the INCOSE UK elections, give you an update on the INCOSE UK name change, reveal the dates of the next Endorsed Training Provider Courses and provide you with an ASEC 2022 update. Read it here.

2023

CSER

conference on systems engineering research

20 YEARS

CSER 2023:

Systems Engineering Toward a Smart and Sustainable World

March 16-17, 2023

IMPORTANT DATES

Submissions Due	December 5, 2022
Notification to Authors	January 9, 2023
Final Papers Due	January 23, 2023
SEANET & Tutorials	March 15, 2023
Conference	March 16-17, 2023

INFORMATION

cser.info/cser2023

LOCATION

Stevens Institute of Technology
1 Castle Point Terrace, Hoboken, NJ 07030 USA

STEVENS

SYSTEMS ENGINEERING RESEARCH CENTER

www.cser.info/cser2023

INCOSE Technical Director Explains Why the Working Groups are so Important

By Beth E. Concepción

As Technical Director for INCOSE, Chris Hoffman oversees 52 active working groups. It's the perfect role for a person who values knowledge. "What I found [through the Clifton StrengthsFinder] was that one of my top strengths is learning, and I love to learn," he said. "I'm always trying to learn something new."

The benefit of being the Technical Director is that "you've got visibility to all of that new 'stuff' coming." 'Stuff' being results of group work such as products (white papers, primers, formal books, training manuals, etc.), panels, and developing and reviewing standards.

"I've been able to bring those contacts and those products once they're published into my company and say, 'Hey, this is something that has already been done and a lot of smart people that I already know personally have worked on this. I think we ought to look at this,'" Hoffman said. "It's a seed I can plant within my company."

It's a way to give back to Cummins, Inc., which is the reason he got into INCOSE in the first place. Chris joined INCOSE in 2011 as a Corporate Advisory Board (CAB) Member for Cummins, Inc., where he has worked for nearly 25 years.
"I found a lot of really good peers, people I could talk to about problems I was trying to understand at my work and how to make things better," he said.

One of the reasons Chris enjoys being Technical Director is that it helps him hone various skills. "Some of it is very much about the interpersonal relationships that you build," Hoffman said. "[You gain] the ability to communicate and influence direction when you don't have a command-and-control structure."

Hoffman can't say enough about the importance of the working groups.

These working groups are really the focal points of getting stuff done to advance systems engineering in a formal fashion," he said. "These are the folks who are taking an idea or several ideas and then converting them into an actual artifact. Their work advances the documented state of the art for anyone in the world to use."

Hoffman wants INCOSE to be more well known for this meaningful work.
"I never knew the level of impact we have, and sometimes I would say we are too quiet about it" he added.

In INCOSE and in his regular work, translating important information for others is another one of his skills.
"Being that Rosetta stone for communicating the complexity of that rocket or that engine or fuel cell or whatever it was that I was doing -- that was a skill that not many had around me," Hoffman concluded. "I was able to leverage that, get paid for it, and have fun with it."

Requirements Working Group: Spotlight on Tami Katz, Working Group Chair

By Beth E. Concepción

Tami Katz has spent 32 years in the aerospace industry – often the only woman in her aerospace engineering classes at California State Polytechnic University-Pomona, where she earned a B.S. degree, or University of Southern California, where she earned an M.S.

That distinction continued to the workplace, but it's a climate that is changing. "It's way better now," she said. "It's really cool not being the only one."

Since she graduated with her undergraduate degree, she has worked for three major aerospace companies, including Boeing Satellite Systems, Sierra Nevada Corporation and her current employer, Ball Aerospace, where she serves as chief engineer for OPIR Polar Sensor.

At Ball, she was part of a team that purposely put a spacecraft into an asteroid to see what it was made of. Though she said she loves her work, this was not the plan when she was growing up. "I was going to work on airplanes," Katz said. "I was so excited about aerodynamics and how planes work that I went to university to learn about aerospace engineering."

But at the time she graduated, companies were hiring for spacecraft designers, not airplane designers. "[Boeing] put me on as a design engineer," she said. "I pretty much learned on the job how a lot of the things I needed to know about how to design spacecraft components."

That's also when she segued into systems engineering. "As a design and test engineer, I was doing a lot of system engineering components without realizing the name 'systems engineering,'" she said.

Katz said she learned about INCOSE in the mid 2000s when someone handed her an INCOSE Systems Engineering handbook. "I still have it," she said. It was this involvement that made her realize there was a better way to approach systems engineering. "It wasn't until I joined INCOSE that I learned that we were kind of in the Stone Age a little bit with some of our techniques," Katz said.

She decided to learn more. Katz just earned a Ph.D. in Systems Engineering from Colorado State University in May 2021.She pursued the idea of better ways of doing requirements management via her dissertation, titled, "Cost Optimization in Requirements Management for Space Systems."

"What I felt passionate about was improving how people like myself and my peers can practice their systems engineering field without being stuck in old ways where they are pretty much being administrators," Katz said. "They get stuck managing this tool instead of being engineers."

She was so interested in the concept of focusing

efforts on the right aspects that she attended a Requirements Working Group meeting at a symposium in 2018. "I met this passionate group of folks who wanted the same thing," she said. Within a year, Katz became chair of the group.

As chair, she started monthly meetings, an Exchange Café, and even a YouTube Channel – all to engage more people. The group ultimately created a "product family" of documents.

The Working Group has recently released the Needs and Requirements Manual in an updated format, as well as two new guides that are practical applications: Guide to Needs and Requirements and Guide to Verification and Validation. The team also is refreshing the Guide to Writing Requirements. "The more people that use this material, the better we can make it with their feedback," Katz said. "We're very excited about having people join the conversations."
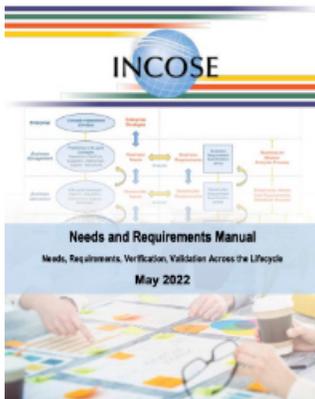
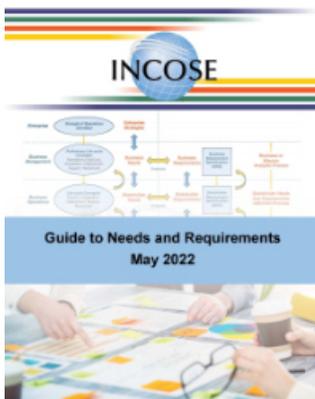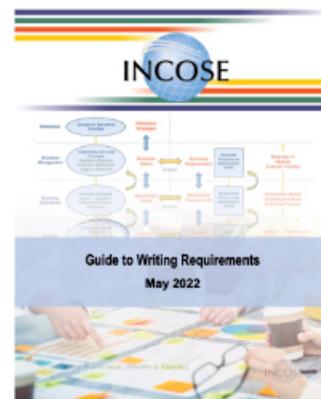**Needs and Requirements Manual**

Download Here
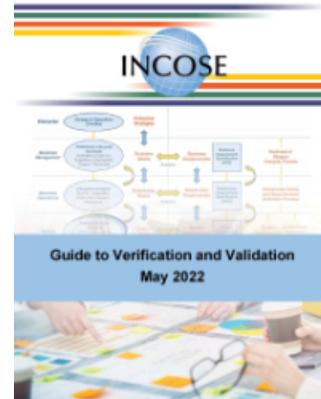
Guide to Verification and Validation

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Guide to Needs and Requirements

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Guide to Writing Requirements

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⚡ Requirements Working Group Web Page

HSI and Social Systems Working Groups: The Social Dimensions of Human Systems Integration

IS 2022 Panel Report

Words by Guy A. Boy, Shamsnaz V. Bhada, Charlotte N. Dunford, John Gill, Grace Kennedy & Avigdor Zonnenshain

20th century engineering was mainly based on mechanical engineering, physics, and mathematics. During the last three decades of the 20th century, electronics and computer science considerably increased their influence on engineering by providing greater and greater automation. Work shifted from physical to cognitive. Human operator's job shifted from doing to thinking. People who were used to manipulate hardware-based machines had to adapt to software-based systems. The shift was from hardware to software. Cognitive engineering was born in the beginning of 1980s. It led to interaction design, user interface design techniques and tools, and usability engineering (UX).

Since the beginning of the 21st century, we are experiencing an opposite approach where the shift is not only from software to hardware (e.g. 3D printing), but also from single agent facing a machine to multi-agent sociotechnical systems. This is the reason why social aspects have become so important today. At the same time, digital modeling and simulation techniques and tools continue to develop and are more effective and realistic. Human factors and ergonomics can be considered seriously during the early stages of the design process, as well as during the whole life cycle of a sociotechnical system. This is currently done using virtual prototypes, digital twins, human-in-the-loop simulations, formative evaluations, agile developments and so on. Participatory design and development have become extremely effective. Human-Centered Design (HCD) is now a reality (i.e., considering people and organizations at design time effectively).

The association of HCD and Systems Engineering (SE) led to Human Systems Integration (HSI) (Boy, 2020; Boy & Kennedy, 2021). Performing HSI in industrial settings requires appropriate knowledge representations, which are relevant representations of what a system is about. This leads to a systemic approach of human-machine systems that turns out to be social, or socio-cognitive (i.e., multi-agent). This panel will discuss the social dimension of HSI during the whole life cycle of a sociotechnical system.

This panel was a cooperation between two INCOSE Working groups: HSI and Social Systems. Professor Guy André Boy was the Chair of this panel.

1. Revisiting the concept of system

Guy André Boy stated that there is clearly a contemporary need for an appropriate sociotechnical framework to support HSI in research, development, manufacturing, training, operations, maintenance, and dismantling. The very notion of a system should be understood as a representation of Technology, Organizations and People (the TOP Model) involved during the whole life cycle of a sociotechnical system. In our growing digital society, the concept of tangibility should be an important topic of research, more specifically in the context of increasingly autonomous systems. It entails complexity analysis, organization design and management, and maturity management at three readiness levels: technology (TRLs); organizations (ORLs); and humans (HRLs). The socioergonomics approach was recently introduced (Boy, 2021). It supports the investigation of systemic properties such as flexibility, separability, and emergent social facts.

2. Engineering is a social system

Charlotte N. Dunford described how systems engineering processes and techniques look not at the systems we engineer but the generic activities and techniques engineers use to engineer them. It engineers the engineering. It helps us plan our work and inform the engineering judgements we need to make from initial requirements capture to solution retirement. This makes it important for systems engineers to have an appreciation of social systems that is often not part of our formal training. This will help us from better understanding the human factors of the systems we are creating, to improving our study of systems engineering and ultimately help us to create better solutions more effectively.

3. Perspectives of sociotechnical framework for Human Systems Integration through Society 5.0 approach

Avigdor Zonnenshain proposed a Human Systems Integration (HSI) approach toward the sociotechnical systems engineering approach in the context of Industry 4.0 toward Society 5.0. The current definition of Society 5.0 (which is practiced for now in Japan is "A human-centered society that balances economic advancement with the resolution of social problems by a system that highly integrates cyberspace and physical space (Industry 4.0)." HSI concept is evolving through the years from Human Factors & Ergonomics (HFE) to Human Centered Design (HCD), to HSI as an integral part of systems engineering. The Fourth Industrial Revolution-INDUSTRY 4.0 poses new challenges and opportunities for the HSI discipline and practical processes. Systems automation and autonomy, digital communication of people through IoT, AI, AR with different types of systems in their environment, induce creation and incremental modification of sociotechnical systems in an advanced ecosystem. Therefore, the next stage of HSI is sociotechnical SE that supports design, manufacturing, and operations of these systems in the ecosystem. Overlapping domains of these building blocks reflect the cooperative interfaces of human and AI, in human-system integration. The 4th industrial revolution is

potentially considering and integrating the social perspectives through Society 5.0. This vision is only in its preliminary steps, further investigations and developments are needed, to fulfill the potential of such a relationship.

4. What is the System behind the System?

John Gill stated that Sociotechnical Systems Engineering (SSE) has many facets that extend well beyond what has evolved to become the SE process (Gill, Zonnenshain & Lamoureux, 2021). The product and system boundaries we define as part of the SE process focuses our immediate attention on delivering profitable and novel system solutions to meet highly specific needs. Our efforts are often funded by profit-motivated venture capitalists and others pursuing advanced capabilities to meet technical challenges. We are motivated to achieve our goals at any cost. The product boundary we establish in our process pushes these unavoidable costs outside of the product boundary and onto society. We routinely exclude and defer these latent societal and environmental costs to meet immediate goals. These issues become "someone else's problem". Using a simple System Dynamics model for insight, John highlights the overwhelming influence of profit motivations that guide our decisions during product development. He then exposes an underlying mechanism asserting that our often hidden and easily manipulated inner human thought process is driven by our survival instinct - gorge when we can. It is our human instinct to obtain and consume the resources we need to survive, our most basic instinct. This mechanism accelerates our pursuit of instant gratification (and profit!) as we develop and deploy capabilities. Consequently, we broadly deploy point solutions that often render dire and unintended consequences on society. These consequences are merely deferred, not avoided. John Gill's conclusion was that we must grow beyond the SE product boundary that limits our focus as Systems Engineers. This breakthrough is essential if we are to cope with Sociotechnical issues and, even better, avoid or prevent them. John Gill asserted that understanding this pattern of deferring the consequences of our design choices before deploying global solutions will help break the
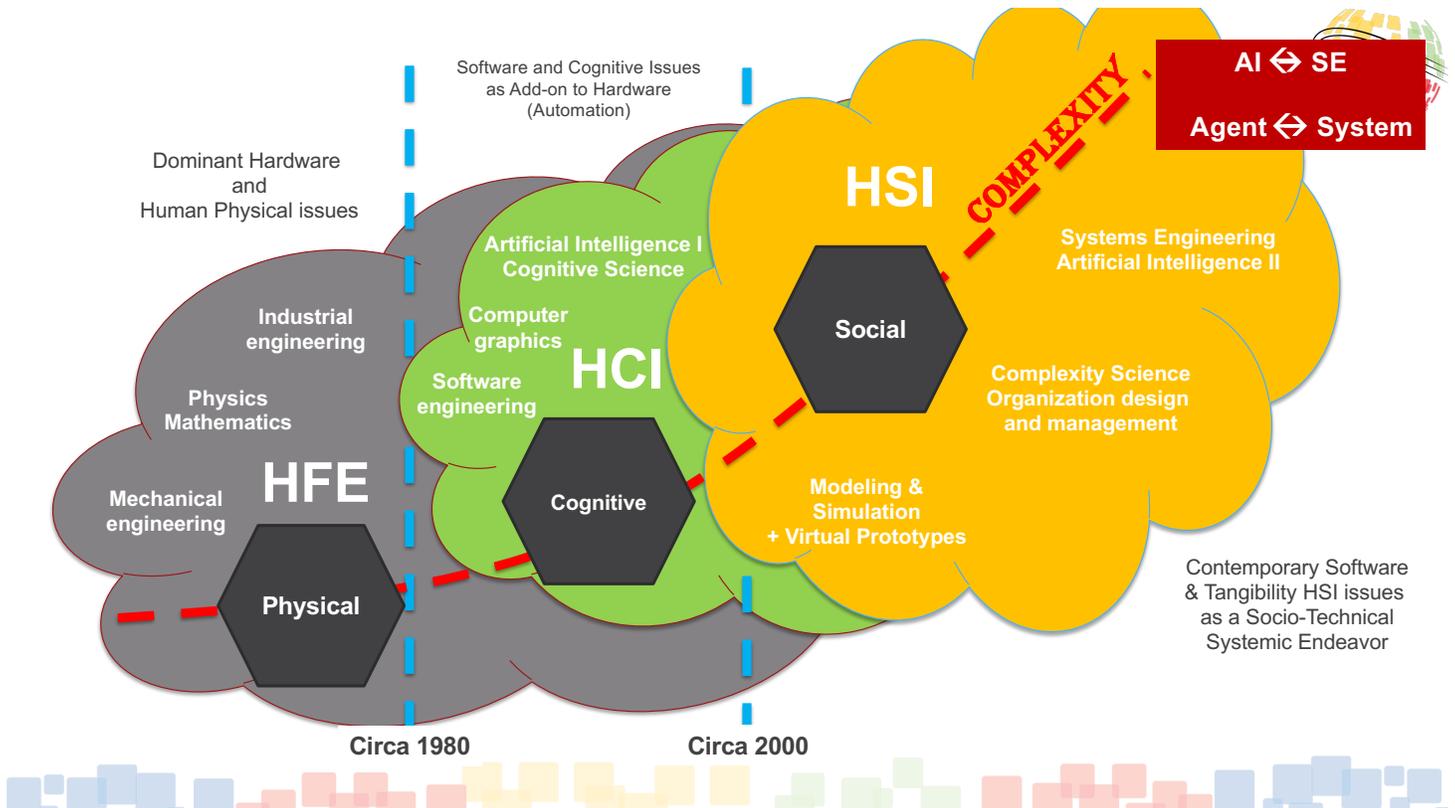
cycle. "Influencing" on behalf of the global society is now more important than meeting the needs of a few individuals. Understanding this pattern is an essential element of SSE and has the greatest potential to attenuate social issues by exposing long term consequences of our design decisions. SSE is about delivering a balanced solution across our society of global stakeholders while we continue to meet the essential needs of those who set and pay for us to satisfy system requirements. SSE as the natural evolution of our vital and vibrant SE endeavors. John Gill closed by saying that it's time for us to integrate sociotechnical considerations more formally into our design processes by including requirements and expectations that are normally and traditionally pushed outside the SE product boundary.

5. Organizations as Systems – a Neglected Perspective in SE?

Grace Kennedy stated that traditionally HSI efforts revolve around the consideration of the users of the system from as early in the conceptual design phases through the entire lifecycle of the system and how these considerations are integrated into the wider Systems Engineering efforts (Kennedy, Zonnenshain, Gill & Bhada, 2021). Whilst we can design for a given set of characteristics of an intended type of user(s), we should not fall into the trap of only thinking about users as a static set of characteristics (i.e., at the point when the technical system is mature, we cannot assume the individuals who become the users will be automatically able nor willing to use the new technology). Put simply, people have 'baggage'; they have both technical experiences (to build knowledge, skills, ability), but are also shaped by the history of the organizations that they have been part of (e.g., culture, processes, team working, role models, organizational structures, policies, etc.).

6. Organizations, Policies and Engineering

Shamsnaz V. Bhada represented the INCOSE social systems working group that addresses the role of social sciences, policy modeling and systems dynamics in systems engineering. In this panel discussion I will outline the goals of the INCOSE social systems working group and the interface points with the system of systems group. Along

with that I will also introduce the challenges I face in my research in addressing policy issues in rural broadband, health care and public transportation all of which are social systems but are also multiple independent systems coming together for achieving common goals.

7. Conclusions and perspectives

After a long discussion among the panelists, we all agreed that there is a starting shift from Industry 4.0 to Society 5.0, where we need to seriously consider the role of people and organizations in the design and development of large complex sociotechnical systems. We also need to consider a joint contribution of Human and Social Sciences together with Systems Engineering. A strong requirement was stated on the development of Human Systems Integration (HSI) courses for SE students, where people are considered during the whole life cycle of a sociotechnical system. For that matter, policies should be developed and followed to frame this HSI sociotechnical approach to SE.

Panelists repeatedly came back with the need for an ontology of HSI that can be used constantly to define and redefine HSI of sociotechnical systems. HSI is no longer a matter of user interfaces developed late (sometimes too late) during the life cycle of a sociotechnical system, but about human and machine function allocation. Using the orchestra metaphor, this ontology could be used as a music theory shared among the various stakeholders who need to deal one day or another with the system. We also need to better investigate who the integrators (composers in the musical sense) will be, and how stakeholders (musicians) will be guided to articulate a successful system being designed and developed (the symphony).

It was also clear that we cannot talk about systems without keeping in mind the concept of systems of systems involving people and machines. Finally, we all agree on the fact that sociotechnical systems design involves concurrent development of technology, organization and people's activities or jobs. The question of maturity is crucial, not only using TRL (Technology Readiness Levels), but

also HRL (Human Readiness Levels) and ORL (Organizational Readiness Levels) to conduct successful life-cycled sociotechnical systems.

➤ **Social Systems Working Group Web Page**

➤ **Human Systems Integration Working Group Web Page**

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Smart Cities Working Group: Smart Cities Initiative Focuses on Human Interactions

Words by Beth E. Concepción

Parking at a meter via an app on a smartphone is an example of smart city technology. But that's just one element in a vast network of city services.

The members of the INCOSE Smart Cities Initiative would argue that the tech shouldn't be the focus.

"A lot of smart cities programs are oriented towards the technology – can we get new computers, new sensors?" said Joe Sweeney, a leader in the initiative and a lecturer in the systems engineering department of the Naval Postgraduate School. "We're focused on how do we help the people. It should be centered around the people."

The formal INCOSE definition of a smart city is one that "is capable of identifying its problems and mitigating root causes by generating and processing engineered quality data in a continuous and inclusive manner."

Perhaps a better way of explaining a smart city is that it is a city that functions well in support of meeting a common goal.

"The people's interaction makes cities – not the buildings, not the roads, not the beaches. The interactions between people," said Jargalsaikhan Dugar, another initiative leader and founder/chair of Mongolian Young Researcher's Foundation. "They interact with each other to be happy, to make a living, to fulfill fundamental needs."

The team, which formed in 2019 and has five leaders and about 30 active members, wanted a human-centric model and used Chilean Economist Manfred Max-Neef's taxonomy of fundamental human needs. They devised a set of metrics to examine how a city is organized around achieving those needs and how well the city works.

Initiative co-chair Jennifer Russell, program and management support leader at Garver, said it is key to be "looking at the common goal and looking at the city systems to see how they are set up to achieve that."

By using the metrics, the resulting analysis can "help the city see where the connections are in between existing systems and where new efforts can be brought online to help improve the lives of their citizens to achieve this common goal," Russell said.

Rael Kopace, initiative leader and director of systems engineering for Robotic Research, said, "In a way all cities are smart. When we are talking about smart cities, one perspective that we always have to keep in mind is investment -- investment in human capital, in social capital and infrastructure and in technology."

However, "tech comes in after you look at the city and see how the city works," Russell said.

The human-centric model the team created is the INCOSE-TUS Smart Cities Reference Model. They have done a case study with Ulaanbaatar, the capital city of Mongolia, and are working on

"socializing the metrics," according to Kopace. To do that, they are working with other organizations working on smart cities initiatives, such as the International Electrotechnical Commission. They are using INCOSE local chapters to share the metrics. They are doing personal outreach to cities such as Kansas and Monterey and hoping for a pilot program.

"In practice, the main obstacle that could prevent city governments from applying this framework is just their old, conventional way of thinking – old concepts," Dugar said.

"We started just at the right time," said co-chair Marcel van de Ven, contract manager and risk manager for Heijmans. "It's getting traction all over the place. People are reaching out to us instead of us reaching out to them. That's really great."

"We believe this framework will serve as the foundation for collaboration and that will generate the systems engineering tradition for a lot of social systems like education, healthcare and sustainable development," Dugar said.

"We're just getting started," Russell said. "We may have something pretty big here pretty soon, I hope."

Dugar agreed: "This is just the beginning. We are very optimistic."

Smart Citites Web Page

EMEA WSEC 2023
Europe, Middle East, Africa
HYBRID EVENT
Workshop and Conference
April 2023

The Europe, Middle-East, and Africa (EMEA) sector of INCOSE is delighted to host
a joint Workshop and Systems Engineering Conference (WSEC)
in April 2023
The theme for EMEA WSEC is

Engineering a Sustainable World

Inspired by the key role Systems Engineering can play in achieving the United Nations Sustainable Development Goals (UN SDGs), targeting Societal Challenges and focusing on highly complex/chaotic systems aligned with the INCOSE Vision 2035 for a better world

Key Dates

Paper, Panel, Tutorial Submission	**October 15, 2022**
Abstract only	**December 15, 2022**
Acceptance Notification	**End of January, 2023**

More information @ www.incose.org/emeawsec2023

How to make complex systems a little less complex.

SYSTEMS ENGINEERING PRINCIPLES

CONTRIBUTORS

Michael Watson – Chair, Bryan Mesmer, Garry Roedler, David Rousseau, Javier Calvo-Amodio, Chuck Keating, William D. Miller, Scott Lucero, Rob Gold, Cheryl Jones, David Long, R. W. Russell, Aileen Sedmak

INCOSE

A better world through a systems approach

Systems engineering principles have been percolating in the systems engineering community for 30+ years.

Based on the work done these past three decades, INCOSE has produced this first formal set of systems engineering principles peer reviewed by our sister organizations: AIAA, IEEE, and NDIA. These principles are not the final set but an initial set to help advance the discipline of systems engineering in application of the systems engineering processes, provide an indication of the basis of systems engineering, and spur further systems engineering research. INCOSE is excited to provide a further step in the advancement of the Systems Engineering discipline through the publishing of this first set of principles.

DR. JAVIER CALVO-AMODIO (Associate Professor, Industrial Engineering, Oregon State University) contributed to the development and applicability of the principles. Dr. Calvo-Amodio significantly contributed conceptual and theoretical foundations that support the validity of the systems principles.

ROB GOLD contributed to the development and review of the principles.

CHERYL JONES (Systems Engineer, US Army RDECOM) contributed to the development and review of the principles.

DR. CHUCK KEATING (Professor, Engineering Management and Systems Engineering, Old Dominion University) contributed to the development and critique of the principles. Dr. Keating significantly contributed to the underlying Systems Theory foundations embedded in the principles.

DAVID LONG (INCOSE Past President, CEO ViTech) was instrumental in orchestrating the initial INCOSE discussions on the Systems Engineering Principles emerging from literature in 2018.

D. SCOTT LUCERO (Research Faculty, Virginia Tech National Security Institute) provided early guidance that influenced development and applicability of the principles.

DR. BRYAN MESMER (Associate Professor, The University of Alabama in Huntsville) contributed to the overall consistency of the principles. Dr. Mesmer significantly influenced the decision-making aspects of the principles.

WILLIAM D. MILLER – MR. MILLER (Adjunct Professor, Stevens Institute of Technology; Editor-in-Chief, INSIGHT magazine; and 2013-2014 INCOSE Technical Director) ensures the principles are and remain fit for purpose as the keystone of the hard and soft sciences foundations (SF4SE) for the systems community's future of systems engineering (FuSE) initiative.

GARRY ROEDLER (INCOSE Past President, INCOSE Fellow & Retired Senior Fellow, Lockheed Martin) contributed to the development and review of the principles, and promoted the project across INCOSE and collaborating organizations.

DR. DAVID ROUSSEAU (Director, Centre for Systems Philosophy, INCOSE Fellow) contributed to the refinement and consolidation of the principles. Dr Rousseau significantly contributed to the conceptual clarity of the principles and the mapping of the principles to align inputs from across the published literature.

R. W. RUSSELL contributed to the development and review of the principles.

AILEEN SEDMAK contributed to the development and review of the principles.

DR. MICHAEL D. WATSON (NASA MSFC Advanced Concepts Office Technical Advisor) led the development, review, and maturation of these systems engineering principles at both NASA and as chair of the INCOSE Systems Engineering Principles Action Team.

INCOSE

A better world through a systems approach

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PM-SE Working Group Update

PM-SE Integration Working Group to present at PMI Global Summit 2022.

Dr. Tina P. Srivastava, PM-SE Working Group Co-Chair and Mark Kaufman, Initiative Leader, will be presenting at the PMI Global Summit 2022 taking place from November 30 to December 3, 2022. The PMI Global Summit 2022 will bring together the largest community of changemakers, leaders, and project professionals committed to making ideas reality with up to 5,000 delegates expected to be in attendance.

Tina and Mark's talk, titled 'Tensions and Opportunities: Program Management and Systems Engineering' will address instances when there is tension and confusion over the roles of Project Managers vs. Systems Engineers which causes programs to suffer from deadline overruns and failures.

The target audience includes professionals from both systems engineering and project management spheres, including those new to either discipline. Program managers must understand key systems engineering fundamentals, and vice versa, in order to critically evaluate and, when necessary, credibly challenge management on potentially unrealistic expectations related to project cost, schedule, scope, and risk. The Learning Objectives are:

Learning Objective 1: Critically evaluate and, when necessary, credibly challenge management on potentially unrealistic expectations related to project cost, schedule, scope, and risk.

Learning Objective 2: Identify opportunities to achieve improved program outcomes and reduced overruns in complex environments.

Find out more about the PMI Global Summit 2022 by visiting https://pmiglobalsummit2022.gcs-web.com/

The PM-SE Integration Quiz

The PM-SE Integration Working Group has created a quiz to test your knowledge of Project Management and Systems Engineering. This a short quiz is consisting of 35 multiple choice questions. Test your knowledge today!

Step 1: Follow this link https://www.socrative.com/
Step 2: Click 'Login' followed by 'Student Login'

Step 3: Enter to following Room Name: INCOSEPMSE

The point of contact for this quiz is Jean-François Veron (jean-francois.veron@incose.net)

Good luck!

PM-SE Integration Working Group contribution to SE Handbook V5

Our Working Group has been actively contributing this year to the update of the SE Handbook V5 and was again recently solicited with the last loop of revisions in September following comments of the SEH V5 editorial team. This includes the following sections of the new SE Handbook :

- Agreement Process
- Acquisition Process
- Supply Process
- Portfolio Management Process
- Project Planning Process
- Project Assessment and Control Process
- Technical Reviews and Audits
- SE and Project Management

The points of contact are Jean-Claude Roussel and Tina Srivastava.

A big thanks again to those who supported us in this big task.

PM-SE Working Group Web Page

Community Transformation Project: Yammer Hub Creation

By Barclay Brown, INCOSE CIO and Molly Kovaka, INCOSE IT Project Manager

In the last issue, we talked about the "big move" of member content from INCOSE's Connect collaboration platform and onto a combination of web pages, Yammer, and Teams.

Because Yammer is the primary destination for much of the content that is being moved off Connect, the IT team has been busy in the past few months creating Yammer communities for nearly 200 Chapters, Working Groups, and other INCOSE communities. As of mid-August, we are 85% complete with this task, which includes adding the members-of-record to each Yammer community.

Now that we have several thousand members added to these INCOSE Yammer communities, let's take a closer look at the Yammer platform and how it can *support the mission of easy, productive, and enjoyable engagement for active INCOSE communities across all sectors and domains.*

So, what is Yammer, anyway?

Yammer is an app in the Microsoft 365 product family. It functions as a social networking tool for connecting and engaging with INCOSE community members across the organization. Think of Yammer like INCOSE's own personal LinkedIn, but focused on Systems Engineering, and accessible only to INCOSE members.

How do I access INCOSE Yammer?

Members need to use their INCOSE-issued Microsoft credential to login. Credentials are in the form first.last@incose.net (or incose.buzz for some folks). Using a standard internet browser, go to www.yammer.com/incose.net/ and login with your credential. The password will be the same across all the Microsoft 365 apps to which you have access (different INCOSE users will have access to different apps based on need). You can use the "Forget Password" link at sign-in to reset your password, if needed.

**I'm new to Yammer, can you show me around?**

A new platform and set of tools can be overwhelming for anyone. It makes sense to take a little time to get acquainted with the layout before diving in.

Your Yammer homepage is divided vertically into three sections. One the **left** side are your main navigation links to take you to Home, your Communities, and your Inbox. This section will remain stationary while the other two panels scroll.

The main content and interaction takes place in the **center** panel. This is where you can browse posts and files and add to the conversation.

The **right-hand** panel contains community membership information, pinned content, quick links, and direct access to the community SharePoint library, OneNote, and Planner apps.
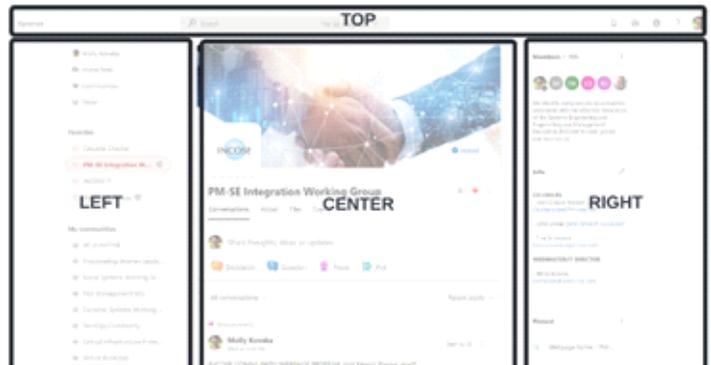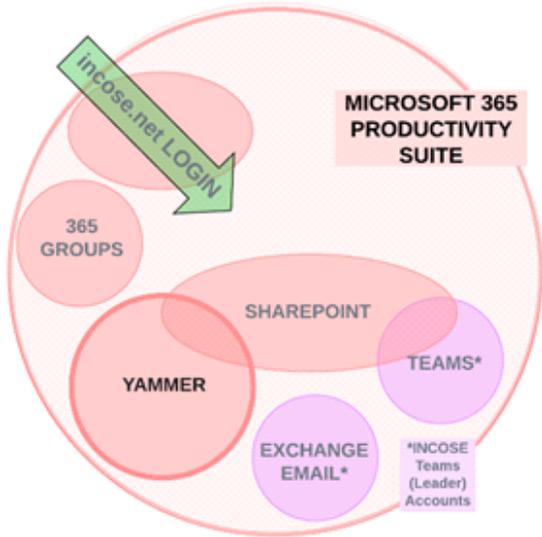
At the **top of the page** is a search bar in the center, and icons for your settings, profile and help on the right side.

What kind of things can I do on Yammer?

Now that you've had the tour, it's time to start getting involved. Here's a partial list of things you can do in Yammer:

- Post a question or start a discussion in one of the communities you have joined
- Interact with your INCOSE friends by using the "@" symbol and their name in posts
- Search for communities that you haven't joined and explore their content and activity
- Visit the All of INCOSE community and see what's new
- File your community content in the SharePoint library provided with each Yammer community
- Organize and document your community activities using the integrated OneNote and Planner apps
- Use the Announcement feature in your community to push a notification out to all community members about an upcoming event or important message

How is SharePoint involved with my Yammer community, and is this the same SharePoint that was used for Connect?

SharePoint is the Microsoft file storage and sharing platform. SharePoint is integrated with

Yammer, providing a location for INCOSE communities to store and access their content. SharePoint is also integrated with the Teams app (available to INCOSE members working on projects for INCOSE), and serves the same content storage function.

The SharePoint version supporting these Yammer and Teams accounts is current and cloud-based, provided as part of the Microsoft 365 package that INCOSE uses.

The SharePoint version supporting the legacy Connect collaboration platform is an outdated version and is locally-hosted, making is slower and more expensive for INCOSE to maintain. This Connect SharePoint version will be retired soon.

Is there a standard folder structure that my Chapter or Working Group can use on Yammer?

Yes. The IT team worked with TechOps and Chapter leadership to develop two recommended standard folder structures for use by Working Groups and Chapters in their Yammer communities. Blank copies of both structures are stored in the SharePoint Library of the INCOSE IT Yammer community and can easily be copied to any Yammer community.
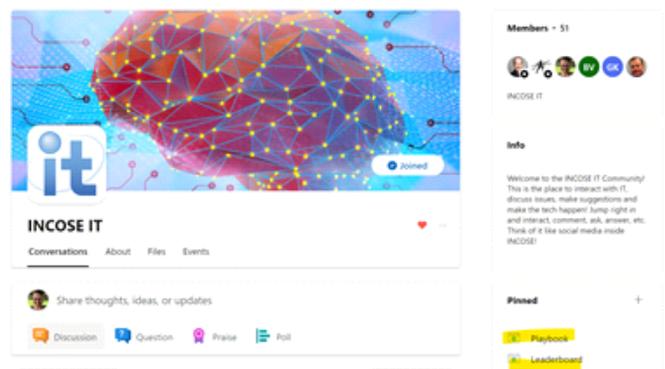
What type of content belongs in my Yammer community files?

Yammer content is viewable by all INCOSE members (just like INCOSE Connect has been for years), unless more restrictive permissions are set by the community owners. Appropriate community content posted to Yammer could include:

- Things clearly from the community (chapter, WG, committee), like notes, event flyers, and

presentations
- Things that are intended to be accessible by active members, such as papers, products, recordings, minutes
- Things primarily shared with the community and that are related to the community purpose, like photos, archives, and operational documents

Do NOT post sensitive, personal, protected, or inappropriate content to INCOSE Yammer communities. If you are not OK with all 12,000+ INCOSE members potentially accessing your content, then don't post it to Yammer.

How is Yammer different for Teams, and when should I use one or the other?

Yammer is an interactive social platform accessible to all INCOSE members and provided to facilitate community collaboration, engagement, and sharing of files.

Teams is a controlled, small-group collaboration space for INCOSE leaders to manage their communities and active projects and to store community content that should not be publicly posted, such as financial information, private data, or document drafts prior to publication.

Where can I go for more information about Yammer?

The IT team has been assembling a collection of tips, tricks, examples, resources, and guides to support the roll out of the Community Transformation Project. We call it our Transformation Playbook and have linked it on the INCOSE IT Yammer community page – come visit us and check it out!

If you have questions as you begin to use Yammer in your INCOSE communities, you can email the INCOSE helpdesk at helpdesk@incose.net.

Using Multiple Microsoft Teams Concurrently

By Eric Specking, PhD, and Brian Pearce

The Problem

If you are an INCOSE leader or on a team working on a project for INCOSE, you may have an INCOSE Teams account. How you access Teams and your INCOSE email depends on your computer. If it's your personal computer, you can access Teams either online (http://teams.microsoft.com) or by installing the Teams desktop client. You can access email online (http://outlook.com) or by adding the account to Outlook in Windows or Mac. But what if you are on your work computer and your company also uses Microsoft Teams and you can't open INCOSE Teams directly. You will find that when you try to login to your INCOSE Teams account, your current account might stay connected with you being unable to access the INCOSE account. This is especially true if your computer uses single sign-on (SSO). If you are like me, this created a feeling of frustration. If you do a quick web search, you will find that Microsoft currently does not allow multiple Teams accounts logged in to the Teams client.1 This makes it difficult to keep track of what is going on in your business Teams and your INCOSE Teams. So, how can you get around this software limitation? This article provides a few solutions to this problem.

Browser Solution

One option is to turn on private browsing before navigating to www.outlook.com. All major web browsers (i.e. Chrome, Safari, Edge, FireFox, Samsung Internet, and Opera) have this capability. For example, Chrome calls it incognito mode, while Safari, FireFox, and Opera calls it private browsing. FireFox provides a great explanation on what an incognito browser means and does.2 After starting this mode, you should be able to login with your INCOSE Microsoft 365 credentials.

If you use Google Chrome, you can create a separate Google Chrome profile for your INCOSE account. Chrome keeps history, shortcuts, and more independent between the multiple accounts. This means you can be logged into a Chrome window in one office account and a chrome window in another office account at the same time. You can go between browser windows since Outlook, Teams, and SharePoint are all grouped for that one account in each window. You can learn more about how to add new user profiles to Google Chrome by going to https://support.google.com/chrome/answer/2364824?hl=en&co=GENIE.Platform%3DDesktop. When you launch Chrome, it asks which account you want to use and you can open the other accounts from the profile icon in the upper right of the menu bar. If you do not have privacy setting setup to clear your history upon closing of your browser, you will stay logged into each account.
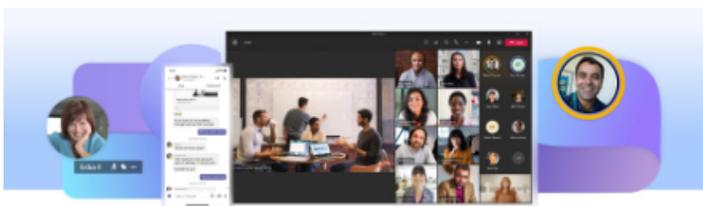
Progressive Web Application

Another option is to setup your INCOSE account as a progressive web application (PWA) in Google Chrome or Microsoft Edge. Then you can add it as shortcut to your toolbar or desktop. This solution enables you to create shortcuts for each of your desired INCOSE signed-in applications, such as Outlook or Teams. You can learn how to setup a PWA by going to https://365tips.be/en/install-outlook-as-an-app-in-google-chrome/. Creating a PWA using Microsoft Edge browser is especially easy—just one click.
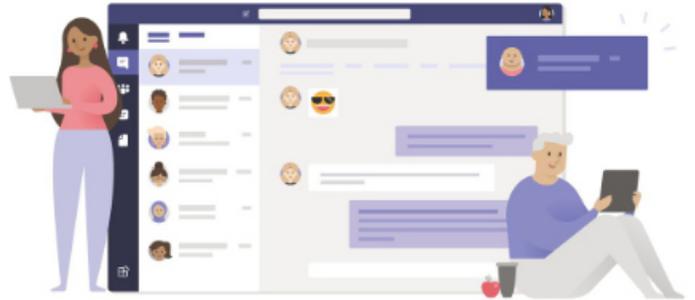
Other options

The above options should work well in many work environments. If not you can always access INCOSE Teams from a personal computer, and Microsoft also makes Teams and Outlook apps for Android or iOS.

Intern Contribution: Importance of Systems Engineering for a Student Project

By Mrunmayi Joshi (mrunmayi.joshi@student.isae-supaero.fr) **and Jorge Galvan Lobo** (Jorge.galvan-lobo@student.isae-supaero.fr)

Mrunmayi Joshi and Jorge Galvan Lobo are working on a student project titled "Artery in Microgravity (AIM)" at ISAE SUPAERO in collaboration with ESA and Torino Politechnical University. This article talks about their experience on the application of Systems Engineering to this project. It consists of two perspectives mainly (1) How the systems engineering practices applied helped the projects? (2) How the lack of certain systems engineering practices affected the project? It also discusses their plan for implementing Systems Engineering on the next iteration of the project based on their experience and learnings, and the challenges they anticipate.

What is "Artery in Microgravity (AIM)"?

AIM is the first project selected to participate in the ESA Academy's 'Orbit Your Thesis!' program. The experiment consists of an experimental cube designed for the ICE cube facility, onboard the ISS. The project is managed by Masters and Ph.D. students of the ISAE Supaero University and the Torino Politechnical University. The project has gone through phases of concept studies, concept and technology development, preliminary design and technology completion, final design and fabrication, and assembly, integration and testing. The project has cleared the Flight Acceptance Review and will soon be sent to ISS thanks to ESA Academy's 'Orbit Your Thesis!' program.

This experiment cube is a test bench designed to observe hemodynamics in microgravity with a big emphasis on coronary heart disease, which is the most common form of cardiovascular disease and the cause of approximately 9 million deaths per year. On the one hand, this project has great scientific relevance in the field of biomedicine, more specifically in the study of coronary heart disease. On the other hand, this project has allowed the participating students to receive a rich learning experience in different fields. It has provided an insight into the functioning of space systems and some experience with the stages that an experiment sent into space has to go through, as well as the opportunity to face a real engineering challenge.

The test bench simulates blood flow through stented and stenotic (constricted) arteries. Equivalents of stented and stenotic arteries were 3D printed, and a blood mimicking fluid was prepared. The blood mimicking fluid is pumped through the simulated arteries using a pump. Dye is injected into the fluidics path at regular intervals in order to visualize and observe the flow. Cameras and sensors are used to record the required data in order to observe the difference in the flow of blood mimicking fluid through the arteries in ISS and on earth. Here is the schematic and the picture of the experiment.
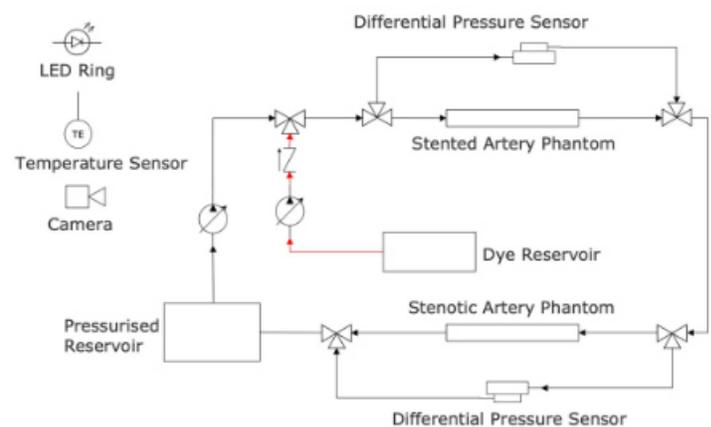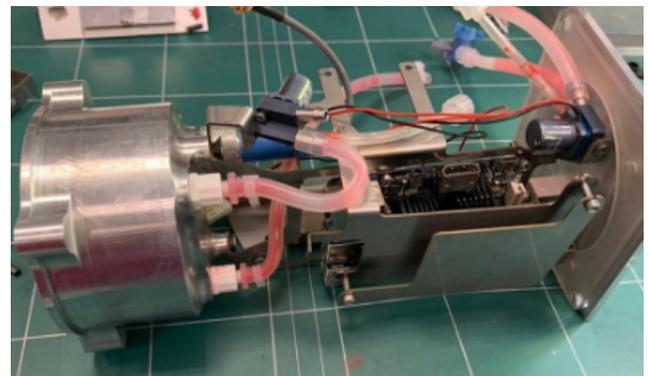

Schematic of the AIM experiment

How was Systems Engineering implemented to the project? How did it help the project?

An approach aligning with the **"V" cycle** was taken for the design and development of the test set-up. It started with the development of the mission statement by students which described what the purpose of the experiment was. A proposal of the experiment was created which described the concept of the experiment. The mission statement and proposal helped to identify and engage the necessary stakeholders. Stakeholder, System, and Sub-system requirements were elicited. Interface requirements were identified. Even though the Stakeholder, System, and Sub-system requirements were documented in the same artifact with no specified hierarchy, there was traceability between the requirements.

Complete sets of requirements with traceability between them provided the project with a clear idea and goal of what had to be done. It also provided the basis for testing (verification). Design of the test setup was done with a top-down approach, starting with design of the system, hierarchy of the system and system architecture was developed using simple block diagrams. Sub-systems and their components were recursively and iteratively developed and tested. **The top-down approach streamlined the design process and helped to keep the functions of the system as the focus even during sub-system and component design. It created a clear vision of how the system (test set-up) should look like and behave.** After the design and development of the sub-systems, they were integrated based on an assembly procedure. Coming to the verification, test cases were written in order to test the functionalities of the system (the test set-up), its interfaces with the environment, and to test the system against the requirements. The test cases were reviewed by the stakeholders, which reduced the scope of errors in testing. **Well written test cases led the team to test effectively what was required to be verified rather than performing tests that were out of the scope. The testing provided inputs for the design process as well which led to recursive and iterative development of the components**

and the system. After the design of the system was finalized and all the tests were performed, the test results were traced/mapped to the requirements. **This provided a proof that the system worked as expected and added to the confidence that the project would succeed. On the other hand, it could also have helped the team to find out if any of the requirements were not verified.** This traceability can also be helpful for the next iterations of the project by providing an idea on how a particular requirement or a set of requirements can be tested. AIM had some design issues that arose from testing and inspections.

The methodical approach of solving the problem helped the project. Whenever there was an issue, a root cause analysis was performed, the test set-up was assessed from system level to the component level to assess where the problem was and what caused the problem. Post the root cause analysis, more than one way to solve the problem were found. These solutions were discussed and compared to land on the solution to be implemented. After the solution was implemented, tests were performed not only to make sure that problem is solved but also to ensure that functions of the system are not

Picture of the AIM experiment

affected. **This methodical approach towards problem solving saved the team time and helped them make the optimal decisions. What helped the most throughout the project was the involvement of the stakeholders; ESA academy was involved throughout the developmental cycle. There was a clear communication with them and their inputs were very valuable** towards the success of the project, especially

during the problem-solving phases of the project. Following the design and testing of the system, Flight Acceptance Review took place as the final review, intermediate reviews also took place with ESA academy which helped the team to assess the state of the project and take necessary actions to improve it.

What were the issues faced? Which Systems Engineering practices could have helped the project?

While the AIM project took a methodical approach towards design, testing, and problem solving, there were issues faced during the project which provided the team with learning opportunities. The team faced the following issues with the documentation:

- There was no clear plan on what document has to be produced/updated at a particular stage of the project; the documents were created/updated at as and when needed.
- Documents were not maintained in an organized way.
- There was no clear plan on configuration management of the documents. It was difficult to track which documents were up to date and which were not.
- Since the design and development took place for 5 years, the design and its documentation changed several times; an impact analysis was not done while changing the documentation, as in it was not anticipated if change in a certain document affected any other document. The affected documents were changed accordingly as the need arose.
- As mentioned in the previous point, the design changed or rather evolved with time, some of the design decisions and their rationales were either not captured clearly or captured in different documents which made it difficult to access them.
- Even though there were clear and complete list of requirements which helped the project, the rationale for requirements were not captured clearly. This resulted in the team taking more time to understand the rationale for the requirements before making decisions.

- Even though a methodical approach was taken to problem solving, the documentation for it was spread across various documents which made it difficult to track and access.
- Knowledge management is an important aspect for a student project as the team changes every year. The current team was fortunate enough to obtain all the documentation and information needed from the previous team, but this was not possible during the COVID-19 pandemic period due to lack in interactions between the teams and limited access to the university and labs. The documentation required for knowledge transfer can be made clearer so that a new team member with limited knowledge on the project can grasp the information.

Introspecting on the above problems, the team thinks that the above problems can be tackled by implementing Model Based Systems Engineering which could potentially reduce the amount of documentation needed, make the communication clearer, provide better understanding of the system, and help in managing the changes in design effectively. Other solutions that can be used are:

- Having a Change Management Plan, which will ensure that any change in design and documentation is thoroughly assessed, the impacts of the change on the rest of the design and documentation is assessed, and the impacted design and documentation is also updated/changed accordingly with the intended change.
- Having a Configuration Management Plan, to better track the versions of the documents and design artifacts and keep them updated.
- Making the documentation clearer and easily understandable to team members or stakeholders from any domain.

The team also faced issues with the assembly and maintenance of the test-set up. Problems in this regard were not anticipated during the requirement writing and design phases. The ease of assembly and maintenance can be increased by incorporating it in the requirements and the design. Assembly and maintenance should not

only be thought of when in assembly, integration and testing phase but in the previous stages of development.

Having a fair understanding of interactions and interfaces between the subsystems could have simplified the system and helped in problem solving. The team understands the need to focus on this aspect from their experience.

What is the "next iteration" of Artery in Microgravity project?

Thanks to the 'Orbit your thesis!' Program and guidance from ESA academy, the team has gained experience and learnings on space projects, which motivated them to extend their knowledge and experience with a new iteration of AIM. The team is looking into developing extended and short flight experiments which will make use of the presence of microgravity and radiation in space.

What is the plan for the implementation of Systems Engineering in the next iteration?

Based on the problems faced and experiences from the journey of AIM, the team understands the importance of implementation of Systems Engineering to the project. The team will be working on using model-based systems engineering practices for the abundant advantages it offers over document-based systems engineering, such as better communication, risk management, change management, and knowledge transfer for the next teams. They plan to establish a framework which can be modified and reused with ease. Following the V cycle has been proven to be beneficial to the AIM project as it streamlined, and provided a direction for the design process. The team intends to apply it to the next iteration as well with the required tailoring. Well planned verification (based on the requirements) has also improved the AIM project significantly through identification of issues/problems, and by providing a confidence in the test set-up developed. The team will plan the tests while documenting the requirements and perform enough yet effective testing in the next iteration.

They will also incorporate requirements on assembly and maintainability along with the functional, and interface requirements and try to anticipate and fix problems that could arise in the design, rather than fixing them at later stages. The team understands the importance of managing changes, configurations, and knowledge transfers, they will have a plan in place to handle these aspects. Interfaces and interactions between system, sub-systems, and the environment not only helps to understand the functioning of the system but also helps simplifying the system and troubleshooting it. Hence, more focus will be provided on this. The team plans to document all the decisions, and changes made, problems solved, and rationales in order to no repeat mistakes and help with decision making.

What are the anticipated challenges for implementation of Systems Engineering to the next iteration of the project?

Even though implementation of Systems Engineering to a Student Project has advantages, it requires efforts from the team members. Creating awareness regarding the systems engineering practices and its importance amongst the team which consists of students from different domains is a challenge. Another challenge anticipated on these lines is encouraging the next teams who will work of the project in future to continue to implement and improve on the Systems Engineering Practices implemented.

The other anticipated challenges are:

1. Implementing Systems Engineering Practices that are flexible and support the changing and evolving designing.
2. Tailoring the Systems Engineering processes to the project and eliminating the processes which will not add any value.

The upside of working on a student project is that the team can and is willing to work on and explore all approaches and methods, but the downside is that they will not have dedicated time to work on the project as a working

professional could, hence why the tailoring and streamlining of the processes is of importance.

Conclusion

One might wonder if the application of Systems Engineering is important for a student project as there are a smaller number of team members and stakeholders involved, and the system under consideration might not be complicated and complex. Systems Engineering is in fact important to student projects because it reduces the risks, and errors, it helps anticipating problems while in early phases of development, it provides a directional approach, it increases the probability of success of the project, and the

confidence of the team members, and stakeholders in the project. There will be extra effort and learning required from the team members but it prepares them for the real-world problems. Having presented their experience, problems, and learnings from the "AIM project" in this article, the AIM team encourages students to try to learn and apply Systems Engineering to their projects on whichever level possible. The AIM team looks forward to enhancing their knowledge and implementation of Systems Engineering in order to further improve their upcoming project.

Author Biographies

Mrunmayi Joshi is an Associate Systems Engineering Professional (ASEP) and current Master's student in Aerospace Engineering at ISAE SUPAERO; majoring in Systems Engineering. She is currently a part of a project titled "Arteries in Microgravity" at ISAE SUPAERO. Her research interests include Model Based Systems Engineering (MBSE), tool integration with MBSE, and application of Systems Engineering to aerospace systems. She previously worked as a Systems Engineer for two years in the healthcare domain, and interned as a Production Engineer in automobile domain prior to her Master's. She has a Bachelor's degree in Mechanical Engineering.

Jorge Galvan is an Industrial Engineer from Valladolid, Spain. He is currently studying for his Masters of Science in Aerospace Engineering at ISAE SUPAERO; Majoring in Space Systems. He is the current Project Manager for the 'Orbit Your Thesis!' "Arteries in Microgravity" Experiment. He hopes to pursue a career in the Space sector, particularly in Space medicine and Life Support Technology.

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A better world through a systems approach

Jerry Lake: Beginnings, Endings, Perpetuation

By Holly Witte

The original catalyst for the emerging organization that became INCOSE was a small cohort of dedicated people who, as far back as 1989, believed that engineering needed more systems thinkers. That group of visionaries represented industry, government and academia and had the bold thought that engineering curricula should expand to include systems thinking. They also believed that the future should be populated with educated systems engineers able to develop systems that would be produced at a lower cost, delivered on schedule through better processes, methods and automated tools.

To animate the concept, the decision was made to create a professional association representing all disciplines involved with systems engineering. Thirty-five people met in Seattle, WA and agreed to form a council to explore the best way to achieve the goal. The first people who stepped forward to take leadership positions were: Brian Mar, Harry Carlson, Jerry Lake, John Howe, Col.

Charles Brown, Wayne Wymore, Carl Spiegelberg, and Barney Morais. By 1991, with a charter in hand, The National Council On Systems Engineering (NCOSE) was incorporated in the U.S. From this point on, NCOSE started to become influential throughout the world of engineering.

Elected as NCOSE's first President, Jerry Lake and the first elected officers set a pace for achievement.

Jerry Lake died in 2021 only two months after his wife, Claudette, to whom he was devoted. He leaves a remarkable legacy, which in great part is entwined with INCOSE. His influence was and is indelibly felt by many he knew and many more he did not. INCOSE Fellow, Sarah Sheard highlights the vastness of Jerry's mark:
"...In the 1990s, there was a movement to create a systems engineering maturity model to mirror the recently developed software engineering maturity model, and various commercial process standards. Eventually there was significant confusion on the part of companies as to how exactly they were supposed to comprehend all these various so-called standards and process models, and put them into practice. In 1997 I created a chart showing how a large number of these models evolved from each other ("the Frameworks Quagmire"). As part of an effort to provide information on each framework, I discovered that only one person was an author of BOTH systems engineering standards and systems engineering process models. That person was Dr. Jerry Lake.

With that in mind, when I wrote my 1998 INCOSE paper called "Systems Engineering Standards and Models Compared," my choice of co-author was a foregone conclusion. Jerry was a dream co-author, providing context, background, and details. Research Gate says the paper is still being read and cited 24 years after publication, having been read thirty-four times recently out of a total of

6400 reads since Research Gate began counting."

NCOSE grew quickly in 1992, reaching one thousand members spread across nine chapters in the U.S. Attendance at the second NCOSE Symposium doubled from 1991. Selected papers from the first Symposium were published in the Engineering Management Journal and internal publications were produced for members; a prelude for today's portfolio of publications.

The first meeting of the Corporate Advisory Board (CAB) was held in Los Angeles in August 1992. Known from the beginning as the "Voice of the Customer," the CAB has had an active role ever since as a conduit between the council and the corporate and academic community for information and best practice exchange, and to identify issues and needs where systems engineering applications would provide a solution.

The early leaders had decided to postpone defining systems engineering until a solid organizational structure was in place. By 1993, under the leadership of Brian Mar as President, a definition emerged: "Systems Engineering is an interdisciplinary approach and means to enable the realization of successful systems." The definition has evolved over the years, as the organization has matured; yet, it stays true to its origin.

A cycle of annual workshops was established and Jeff Grady was named as editor-in-chief for a peer-reviewed journal of Systems Engineering. The 1993 Symposium, which brought together military systems engineers and contractors, software engineers and academia, saw the beginning of the evolution of Systems Engineering Capability Maturity models (which subsequently were subsumed into Capability Maturity Model Integration [CMMI]).

Finding a way to spread the rapidly developing body of knowledge from NCOSE became the task for 1994 President George Friedman. Establishing the Technical Board and the organization's first web page were high on the list of achievements along with the publication of the inaugural issue of the peer-reviewed Systems Engineering Journal.

As the importance of what NCOSE was generating became obvious, membership growth and communications became prominent activities, ushering in several years of a steady growth in membership. The first five years were capped with the change from NCOSE to INCOSE in 1995. Having put the building blocks in place earlier with the recognition that members were being drawn from outside the U.S., the true nature of the organization began to take shape.

Under the leadership of President James Brill, founding documents were amended to broaden the scope and NCOSE became the International Council on Systems Engineering. In 1994, the first non-U.S. Chapter was formed in the United Kingdom and has continued to flourish to this day. Also, an agreement was forged that year with SESA, the Systems Engineering Society of lia, giving INCOSE a presence half a globe away.

Firmly set on advancement and breaking new ground, 1996 was the year INCOSE committed to Canada and the United Kingdom for the 1998 and 1999 International Symposia, respectively. This was also the first year that a woman was elected to lead the organization. Ginny Lentz oversaw organizational growth through the addition of new Working Groups and the emphasis on issues in the commercial workplace.

Eric Honour, serving as President in 1997, noted something important about the fundamental and distinctive character of INCOSE. He acknowledged that systems engineers work with people whose goals and tasks may be different in the workplace, an often challenging situation. When we gather at the International Symposium, however, we have the luxury of surrounding ourselves "with those who understand…"

As past leaders reflect on Jerry's passing, we hear about much more than his professional achievements. Eric continues: "Jerry's vision took on a life of its own. Rather than an elite council, it quickly became a professional society in which members shared knowledge and research with each other.

As it grew, Jerry continued to be a mainstay for the burgeoning organization. He believed strongly that the issues being addressed went beyond the national interests, so he supported its growth to become the International Council on Systems Engineering (INCOSE). As a respected Founder, Fellow, and First President, when Jerry Lake spoke people listened.

Jerry was a gentleman in attitude and deed. He was kind and generous to others. He spoke quietly, yet with impact. He influenced thousands of others through gentle insistence on correct paths."

Bill Schoening, 1998 President, acknowledged that growth in strength and reputation focused on enhancing INCOSE's organizational structure to support continued development around the world. Membership was growing around the world, which meant making sure systems were in place to serve them efficiently and effectively. With working groups collaborating across countries, IT and website updates moved to a priority position. Taking the INCOSE Symposium to British Columbia, Canada in 1998 was a milestone—the first symposium held outside of the United States. A dawning recognition in 1998 was the need to find a balance between volunteers and professional staff. The growth demanded time—perhaps a volunteer's most valuable commodity along with talent. If volunteers were to be able to contribute, help was needed in the form of the day-to-day administration activities of the organization, particularly in conference management. INCOSE engaged a professional management company so the volunteers could direct their energies toward mission and vision outreach.

INCOSE was already hosting a Workshop and a Symposium each year, and the Systems Engineering Journal had reached a point of importance so that Wiley & Sons Publishers were contracted to publish it four times a year, drawing an ever-widening audience of contributing scholars and readers.

Many iterations have occurred in the way INCOSE works since those early years and pioneering

leaders. Much of Jerry's leadership legacy is in how an organization develops and matures over time and changes as members reflect their own times. As many great leaders, Jerry was able to share the spotlight – in fact, allow the spotlight to move away from him as time passed. As Heinz Stoewer put it, "Jerry was most content to witness this growth and provide some gentleman-like advice as needed. He was a wonderful personality, a foresighted systems entrepreneur and a leader with clear opinions and words. Without Jerry, INCOSE would not have become as profound and as professional as it has during the past 3 decades. We are deeply grateful to his initiative and leadership!"

Given all his professional accomplishments, it is perhaps more important to remember him as the person he was. Bill Mackey sums it up here:

Jerry was one of several others who became NCOSE's Founders in 1991. As its first President, Jerry spoke of his expectations for the new "Council" including his desire for NCOSE to become the predominate international advocate for the inter-discipline of Systems Engineering. Over time, Jerry continually expressed his views always as a gentleman and all members received his views with great respect. Jerry will always be remembered as a gentleman, a strong advocate for Systems Engineering, one of the giants among the Founders of INCOSE and a good friend for those of us who were able to get to know him."

While Jerry Lake cannot be present for future generations of systems engineers, he will always be known by his thoughts, deeds and dedication.

Part Two - Jerry Lake's Legacy will be published in the Q4 2022 edition of the INCOSE Members Newsletter.

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The **INCOSE Assistant Director, Member Recruitment** is an appointed position with a three-year term of Office. The position reports to the Secretary. Successful recruiting of new members must involve clearly conveying the INCOSE value proposition including opportunities and how to maximize the benefits available with membership.

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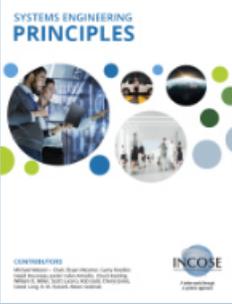
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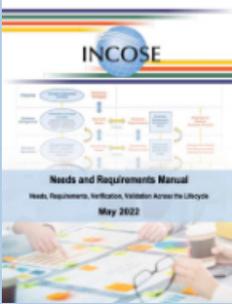
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HSI2022
Human Systems
Integration
Workshop

www.incose.org/hsiws2022

Torrance, CA, USA
November 16–18, 2022

SAVE THE DATE

INCOSEUK

INCOSE UK Annual Systems
Engineering Conference 2022

Building Towards a Brighter Future

22nd & 23rd November 2022
The Crowne Plaza, Newcastle, UK
www.asec2022.org.uk

INCOSE Webinar 161

Agile SE in the Future of Systems
Engineering
with Rick Dove

Weds, September 21 @ 11AM US Eastern /
UTC -4

Webinar Sponsors: LOCKHEED MARTIN   SPEC INNOVATIONS

INCOSE A better world through a systems approach / www.incose.org

33rd Annual **INCOSE**
international symposium

hybrid event

Honolulu, HI, USA
July 15 - 20, 2023

REGISTER NOW: www.incose.org/symp2023/register

Systems Exchange Cafés

Maple Cafés

11 AM US Eastern Time

incose.org/maplecafe

Oak Cafés

8 AM London Time

incose.org/oakcafe

Fir Cafés

9 AM Japan Time

incose.org/fircafe

In Memory of Bill Parkins

In memory of Bill Parkins, one of the most genuine and creative leaders in the world of Systems. He was inspirational and supportive to all, a champion of diversity, and an advocate for empowerment of women in his field. Thank you Bill for sharing your journey with us.

Words by Kerry Lunney, INCOSE Past President

INCOSE Members Newsletter

Who are we? INCOSE is a 22,600 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.

INCOSE

A Better World Through a Systems Approach

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