June 2022

MEMBERS NEWSLETTER

A Better World Through a Systems Approach

Connect. Learn. Lead. Prosper.

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The International Council on Systems Engineering

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Editor's Letter

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

"The Miracle is this,
The more we share,
The more we have."

Leonard Nimoy

Dear Members,

As we enter into the INCOSE Q2 Members Newsletter we will be highlighting everything new in 2022! We will be continuing to share with you the many value streams of WHY INCOSE? From new products and services, new virtual events, new platforms, new programs, new forms, new ways to share with each other around the globe.

The purpose of this issue is to highlight a few of our outstanding members, create awareness of some industry trends from working groups like AI Systems and the SySTEAM Initiative. Empowering Women Leaders in Systems Engineering (EWLSE) will shortly be releasing, "Letters to My Younger Self," a collection of insightful reflections on life and career. We also feature updates from the Diversity, Equity, and Inclusion initiative, and from Systems Engineering Vision 2035 team about the future impact of the vision.

An important part of the newsletter is to remind you about all the benefits and resources INCOSE has to offer you, as a new or longtime member. We also invite you to help spread the word about *your* global professional society for systems engineers and invite systems engineers you know to join INCOSE. We encourage you to be a leader among your peers and make a difference for yourself and the profession. Get involved as a volunteer, obtain your SEP certification, dive into a working group, and participate in your local chapter—the real benefits are when you use INCOSE to connect, learn, lead, and prosper.

Finally, what the next newsletter needs is something from you—an update on your group's accomplishments, a feature about a key member and their career, or some exciting plans for INCOSE's future. We want to hear from you.

Email us at marcom@incose.net so we may share your content with our global community.

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U.S. Citizenship is required for most positions. The Aerospace Corporation is an Equal Opportunity/Affirmative Action employer. We believe that a diverse workforce creates an environment in which unique ideas are developed and differing perspectives are valued, producing superior customer solutions. All qualified applicants will receive consideration for employment and will not be discriminated against on the basis of race, age, sex (including pregnancy, childbirth, and related medical conditions), sexual orientation, gender, gender identity or expression, color, religion, genetic information, marital status, ancestry, national origin, protected veteran status, physical disability, medical condition, mental disability, or disability status and any other characteristic protected by state or federal law.

The Annual Joint Leadership Meeting Outlines INCOSE's Health and Priorities

The annual INCOSE Joint Leadership Meeting was held May 18 online. During the two-hour meeting, nearly 20 INCOSE leaders summarized the priorities for the coming year and beyond. Generally speaking, the focus areas fall in six value streams: events, education and training, products, certification and membership.

President Marilee Wheaton opened the meeting by touting the theme of collaboration and community – a hallmark of most if not all of the new INCOSE initiatives. ***"We've had increased membership engagement capability,"*** she said, as evidenced by a new community platform introduced by Barclay Brown, Chief Information Officer.

IT activity hubs

"(We plan) to move INCOSE's communities and committees into the new paradigm of collaboration and communication," he said, revealing two hubs for activity: the new INCOSE website and the Microsoft 365 Suite that will operate as an intranet.

Professional Development Portal (PDP)

Perhaps the biggest news – touched on by many leaders – is the creation of a Professional Development Portal expected to launch around IS 2022. Don Gelosh, associate director for education and training, characterized the PDP as a knowledge portal intended to provide a "long-term service for systems engineers" including mentoring. In fact, all technical sessions at IS 2022 will be recorded, and some content will be released on the PDP.

Products and working groups

In addition to education and training through the PDP, INCOSE will offer new products for members including the Needs and Requirements Manual, coming soon. Technical Director Chris Hoffman also announced a new working group: Systems Engineering and Lawmaking. This group will advance the theory, practices and education of laws for government by applying systems engineering principles and discipline.

Certification

Other educational outreach includes Certification, of which the Academic Equivalency path through schoolwork is the most popular. Certification Program Manager Courtney Wright detailed the process by which INCOSE will beef up this pathway, encouraging universities to offer systems engineering coursework.

Membership

Operations Manager Christine Kowalski noted that the ***INCOSE international membership is up to 20,211 individual members with 126 corporate memberships*** as the "voice of the customer." These organizations value the knowledge that INCOSE has to offer," she said. CAB Chair Ron Giachetti said that it is an increasingly international mix with organizations from Japan, China and India recently joining. He said he is also interested in "increasing the value proposition of being a CAB member."

To welcome new members, Secretary Kyle Lewis said he wants to bring back the position of

Assistant Director of Early Career Professionals and added a new Membership Recruitment Assistant Director. He's hosting New Member Welcome Center Cafes. Associate Director of Diversity, Equity and Inclusion (DEI) Maria Romero said she is actively recruiting members for the advisory committee and for general members from diverse backgrounds.

Marketing and communications
Director for Marketing and Communications Honor Lind said she is taking a "proactive, aggressive approach" to identify value streams and focus on storytelling. She is planning a YouTube series to create more awareness, and noted that LinkedIn was by far the best performing platform for INCOSE social media.

Finances
All these activities, and INCOSE is still in a good financial situation, according to Treasurer Michael Vinarcik. *"By and large we are in good health," he said. "We hope to break even by year end."*

Marilee noted all the good work leaders have been doing during her tenure. "There's the standard value added in work that goes on every day across our leadership, our technical operations and throughout our working groups," she said. "There's been a consistent value added that I've been proud of that we've been able to keep delivering to our members throughout this whole time period."

Words by Beth Concepción

A replay of the Joint Leadership Meeting is available for all INCOSE members. To watch it visit:

www.incose.org/inet

32nd Annual INCOSE international symposium

Detroit, MI, USA
June 25 - 30, 2022

HYBRID EVENT

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KEYNOTE SPEAKERS

Dr. Christopher J. Scolese

Director, **National Reconnaissance Office** (NRO)

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

Carla Bailo

President & CEO, **Center for Automotive Research** (CAR)

Mobility and System Engineering Integration

Laura Doughty

Director Peakfield Consultancy Ltd and currently Head of Culture and Engagement, Project Delivery Directorate, **Sellafield Ltd**

The Power of connection: The power of influencing and how to do it

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**

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

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- **34** Topics Represented
- **7** Panels
- **12** Tutorials

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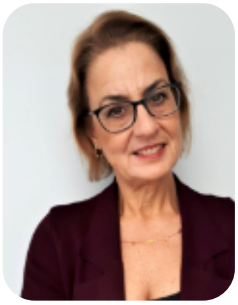
MEMBER SPOTLIGHT

INCOSE Past President, Kerry Lunney, Defies Pigeonholing Expectations



When Kerry Lunney started her career in systems engineering, she was one of few women in the industry. "Some organizations wouldn't even allow you to wear trousers [instead of dresses and skirts]," she recalled. There were no amenities for her as a woman.
Lunney said the dynamic is changing, though. "It's definitely getting better all around the world with regard to diversity and inclusion and gender," she said. "Are we there? No. Have we improved? Yes."

"People are adapting and adopting all the time," she said. "People themselves are changing. We're changing."

Kerry noted that is one of the necessary characteristics of the systems engineering field: The constant need to adapt and change. She pointed to System Engineering Vision 2035 as an example of that forward-thinking mentality.

"The System Engineering Vision 2035 is a very good collaboration across many different industries. INCOSE led it, but it's not just INCOSE. It's as good a crystal ball as you can have," she said. "You can't predict what you don't know. All we can do is look at the trends, look at the past, look what's going forward in the future and then try to elaborate from there."
Kerry is in a good position to try to predict the future. She has extensive experience developing and delivering large system solutions, including combat systems, flight simulators, vehicle electronic systems, gaming systems and ICT solutions for industries including ICT, gaming, transport, aerospace and defense in Australia, Asia and the United States. She is the Country Engineering Director and Chief Engineer in Thales, Australia.

She counts as one of the highlights of her career her role as president of INCOSE 2020-21. "Everyone should join INCOSE, just for sheer networking," she said.
Lunney said if you are good at what you do, you are going to stand out – especially if you are a woman – and you have to use that to your advantage.

"I think differently. The way I get to an end result is different from my male colleagues," she said. "The way I process and do things is quite different when we drill down to the way that they would think. And they've said that themselves. 'You always seem to take a different path.' Well, in my mind, it's a fine path."

One of the paths Lunney took that is different from most is the one that led to her M.B.A. "It fits very well with systems engineering," she said. "In the world of systems, if you are good, you end up leading, which means it's not just the technical side of life. I've got to understand contracts. I've got to understand strategies – set strategies – and all of that is covered in your M.B.A."

Even in her undergraduate degree program, she did things differently. She took music and theater for general studies where she was the only engineering student out of thousands enrolled. She also earned high distinction, even though some groused it was "a waste to give [the honor] to an engineering student."

She was showing early on her bright future in systems engineering.
"People will try to pigeonhole you," she said. "At the end of the day, it's really hard to pigeonhole a good systems person because they straddle so many topics. Or they should be very adaptable and open."

Words by Beth Concepción

New Member IS2022 Networking Lunch, Welcome Center IS Event and Café Guides

Dr. Shakila Khan, Associate Director for Membership Engagement, shakila.khan@incose.net

New Member IS 2022 Networking Lunch Welcome Center IS Event and Café Guides

IS2022 New Member Lunch

The International Symposium (IS) 2022, a hybrid event offered online and in-person in Detroit, is fast approaching. If you are a New Member and will be attending in-person, we look forward to seeing you at the New Member lunch planned for Monday, June 27th. This is a great opportunity to network with other INCOSE members in addition to the fantastic technical content.

New Member Guides

Volunteers are the heroes behind the effectiveness of and services provided by INCOSE. INCOSE Membership Engagement is an example of successful opportunities and services provided for the benefit of INCOSE members.

The New Membership Engagement Team (NMET) Guides are experienced INCOSE members who help to shepherd new members and orient them early in a member's INCOSE journey. The New Member Welcome Center Café's (WCCs) provide an opportunity for new members and Guides to connect and discuss topics of interest.

Become an INCOSE New Member Guide

As experienced INCOSE member volunteers, help shepherd new members by addressing inquiries, providing anecdotal experience and direction to informational sources.

To volunteer as an INCOSE Membership Engagement Guide volunteer, reach out to nme@incose.net to learn more and be added to the regular Welcome Center cafés.

Previous WCC recordings and presentations can be found on the new member page at www.incose.org/newmembers.

New Member Welcome Center Cafés

New to INCOSE? These new events are designed to help introduce you to the programs and resources of INCOSE and connect you to other INCOSE members.

We know it can be daunting to find your way in a big professional society, and we want to make it easy to find the right places to engage, based on your interests.

If you have missed any of the previous cafés, all of the recordings and presentations are available in the New Member page of the INCOSE website: www.incose.org/newmembers.

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Empowering Women Leaders (EWLSE) Update

Alice Squires, EWLSE Founder, alice.squires@incose.net

New Sector Leaders and #BreaktheBias Report

Please take some time to welcome two new Empowering Women Leaders in Systems Engineering (EWLSE) sector leads. As of April 2022, Erika Palmer is the EWLSE Americas Sector lead, Anabel Fraga is the EWLSE EMEA Sector lead and Stueti Gupta continues as the EWLSE Asia Oceania Sector lead.

Stueti Gupta
Asia & Oceania Sector Lead

Erika Palmer
Americas Sector Lead

Anabel Fraga
EMEA Sector Lead

The three EWLSE Sector Leaders held their first kickoff meeting on April 12th to plan future EWLSE events and activities to support a diverse, inclusive, and encouraged environment with challenging opportunities within INCOSE and beyond. Plans for 2022 include to reach out to Chapter presidents in their respective sectors and share the EWLSE mission and vision. The sectors leads are seeking volunteers in each of their sectors to create a greater community that promotes women's leadership; please contact them at their emails above to get involved. Stueti, Erika, and Anabel agreed to promote events for women and girls that were also led by women; to organize a meeting during IS2022, to increase activity on social media around EWLSE goals, to promote joint events between the three sectors, and to create a yearly virtual EWLSE Event that serves as a meeting point for all the interested practitioners. The first EWLSE virtual annual event (EWLSE 2023) is planned to be launched in 2023. Each of the sector leads also has the following to report.

EWLSE Asia Oceania

On International Women's Day every year on March 8, lots of groups and community members come together to bring focus on "gender equality today for a sustainable tomorrow", one of the United Nations Sustainability 2030 goals. This year the theme for 2022 is #breakthebias. Bias is a gender neutral word. Anyone can experience bias, stereotype and discrimination. There are several kinds of biases such as cognitive bias, affinity bias, and attribution bias, to name a few. The very first step to break the bias, is to acknowledge that we might have limited exposure to different thought models or preferences. However just knowing that unconscious bias and gender biases exist isn't enough. Breaking the bias requires conscious efforts, actions to sensitize all so there is less room for bias to creep in. INCOSE as a global community of systems engineers deems it is important to address diversity, equity and inclusion to make a better world.

INCOSE runs Systems Exchange Cafés which are virtual forums which run like a book club where members deliberate on a topic or theme. There are three exchange cafés so any member or interested individuals can join a café that is suitable to their time zone or schedule. In the month of March 2022, all three system exchange cafés focused on the theme of #breakthebias. All cafés were well attended with more than 15 participants in each session. Each participant shared their experience or views about bias and their interpretation and initiatives around biases. Richard Beasley, organizer of the cafés and Technical Services Director, scheduled yet another

exchange café to discuss the same theme but now with specific focus on what INCOSE can do within its own community to address the same.

EWLSE Americas

EWLSE Break the Bias events have led to breakout events and initiatives in the Americas! Organized by Raquel Hoffmann, INCOSE Brazil held a Break the Bias panel on April 27th. Powerful reflections emerged as five panelists – Ruth Martins, Flávia Zaratim, Claudia Tocantins, Marina Kallas and Fabricio Gonçalves talked about how they felt bias during their careers and/or how they understand and see bias in engineering. The psychologist on the panel (Zaratim), who is a diversity analyst, talked about how gender biases affected individuals and projects in the corporate environment. In the second half, the audience joined the discussion, which focused on what we can do to reduce biases. Racial diversity was also a theme of the panel.

Sierra Hicks, an NSF Graduate Fellow at Cornell University focusing on social systems engineering and an incoming chair of INCOSE's Social Systems Working Group (SocWG), will be organizing an INCOSE student-focused diversity team supported by both EWLSE Americas and the SocWG. Stay tuned as this initiative gets up and running this fall!

EWLSE EMEA

In the EMEA sector, Anabel presented her role as EWLSE EMEA Lead to all of the EMEA Chapter leaders during the last meeting held virtually on April 26th. She commented on the open activity right now looking for volunteers that might be willing to participate in events promoting women's participation in leadership roles, webinars, STEM activities, and more. Chapter Leaders will let their BoD know about the initiative and look for candidates.

On May 9th Anabel presented at SESE 2022. Anabel spoke about Spain's INCOSE Chapter (AEIS) activities and objectives with her as president during 2022, introduced the EWLSE mission, and served as master of ceremony in a joint role with Francesco Dazzi from the INCOSE Italy Chapter (AISE).

As President on the INCOSE Spain Chapter, Anabel is promoting a Volunteering group in Spain for STEM activities joint with academia, and 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.

Joint Sector Lead Actions

The three EWLSE Sector leads are part of the INCOSE Technical Institute of Leadership's (TLI) journey in preparing to become the best version of themselves. In this journey, Erika and Anabel presented a joint paper with Cohort 6 to the IS 2022 and they will be presenting the poster and reserved paper (if needed) in Detroit this year. Also, Erika and Anabel will co-host a social event for TLI during IS2022.

Final News and Announcements

If you are interested in hosting or facilitating a Systems Engineering café on EWLSE related topics, please contact your EWLSE sector lead; Richard Beasley and Deputy Technical Services Director Heidi Davidz are always looking for Systems Engineering café hosts and facilitators and you will be exposed to perspectives from around the world and great discussions in the process.

For those who want to lead the change in

diversity, equity, and inclusion (DEI) in the systems engineering community, please consider volunteering for the INCOSE DEI Advisory Committee; see: https://www.incose.org/about-incose/volunteer-opportunities/vo-request

EWLSE members, please stay tuned for announcements about an EWLSE gathering at IS2022 which is still in process at the time of this writing!
As a reminder, EWLSE is now in the Yammer community which allows anyone who is a member of INCOSE to join the discussion. The tool allows postings similar to how one might post on LinkedIn or even Facebook, but only INCOSE members can see and respond to the discussions. Please join EWLSE there and start a conversation on a topic that you have wanted to share with the EWLSE community. We are especially excited to hear your positive news and examples of empowered women leaders in systems engineering! Please feel free also to follow up privately with greetings, queries, comments or stories to ewlse@incose.org.

*The **"Emerging Trends in Systems Engineering Leadership: Practical Research from Women Leaders"** book written by twenty-six female authors and leaders within INCOSE has been completed and is in the hands of the Springer publisher. Stay tuned for instructions on how to pre-order this unique book which will be available in both hardcover and eBook format.*

***"Letters to My Younger Self: How Systems Engineering Changed My Life"** is also complete and is in the final stages with INCOSE MARCOM and should soon be available in eBook format.*

EWLSE Imagines a World Where Women and Men Are Equally Represented as Leaders

Systems engineering has historically been a field dominated by white men – in general and certainly in leadership positions. Empowering Women Leaders in Systems Engineering (EWLSE), an INCOSE group that started in 2015, is gaining momentum in inspiring change inside the organization and out.

"Our goal is to be open, welcoming and inclusive," said Alice Squires, EWLSE's founder and leader. ***"Men and women are welcome in the group, and we are pretty open about our goal. We'd like our systems engineering leadership to reflect the diversity around the world, but we focused originally on gender parity."***

EWLSE started after a young woman asked Squires about INCOSE: "Where are all the women?"

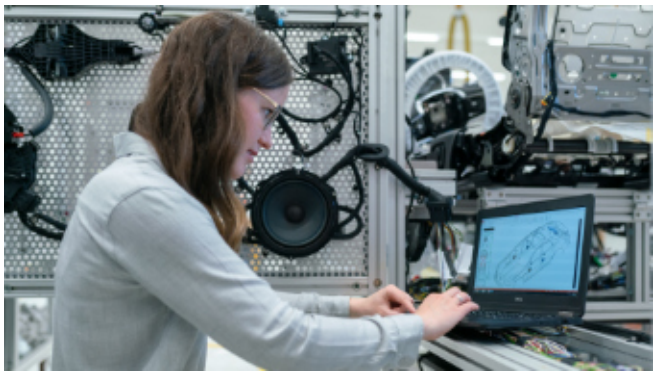
Squires said, "You know, we should do something about that." And she built the group from the ground up. "I want a forward-looking group that is going to change things and have an impact," she said.

EWLSE is focused on raising awareness, increasing the number of advocates, and doing some training events such as IW sessions about gender issues in

systems engineering and IS panels such as "The Role of Diversity, Equity, and Inclusion in Sustaining Earth's Future."

"It's because of our efforts that we now have an Associate Director of Diversity, Equity and Inclusion that reports to the President of INCOSE," Squires said. "When I say 'our efforts' it's about raising awareness that there is a problem. People are in denial that there's even a problem in the world."

"We just expected more and more women would appear (in SE)," Squires said. "And it just didn't happen at the rate we expected."
Squires and the rest of the EWLSE leaders show there is a problem by gathering and reporting research and data.



"I'd say it's important that we are talking to engineers and scientists and technical people," she said. "It's not about touchy feely. It's about what the data says. And then they can hear about the life experiences. We want to share stories – success stories mostly but stories about challenges and how we overcame the challenges."

One of the ways EWSLE is sharing stories is through publications such as "Letters to My Younger Self: How Systems Engineering Changed My Life" – an initiative Squires developed with Lisa Hoverman and one that should have broad attraction.

"How can we appeal to the younger generation in a way that is engaging and explain to them what it has been like in SE and why we love it so much and why we are so passionate about it?" Squires said. "How can we do that without everybody lecturing?"

"(LTMYS) is important because we are increasingly moving into a digital age and globalization of society," Hoverman said. "Systems are increasingly complex, software being the backbone of every system. There are systems engineers who have been around a long time. This is a look at systems engineering through the lens of someone who has done it."

Squires said that her work with INCOSE is similar to systems engineering work.

"It's inclusive, not exclusive. It's broad, not narrow. It considers the whole system, not just one small aspect of the system. It goes long term, not short term," Squires said.

She recommends INCOSE membership not just because it is a good career move.

"You start in the professional society because you see the value of that professional society to your career," she said. "You stay in that society because you see that you belong. It's more like a home."

Neurodiversity Can Make the Workplace Stronger

Emma Jane Taylor, Marketing and Communications Team, emmajane.taylor@incose.net

In last quarter's newsletter we looked at the meaning of 'Neurodiversity' and we touched on the benefits of recruiting neurodiverse people in your workplace, organisation, local chapter or working group.

It is estimated that 15% of the population have dyslexia and/or other specific learning differences (SpLD), therefore it is highly probable that there already is neurodiversity within most workplaces.

Neurodiversity can be a significant asset to an organisation; bringing a different dimension to problem-solving or creativity in the way that an organisation operates and delivers its products and/or services.

However, we as individuals and organisations need to open up to the benefits that neurodiversity can bring. An excellent illustration of this is in the TEDx talk by Andrew Whitehouse titled 'From Disability to Superpower' which can be watched here: https://www.youtube.com/watch?v=8wWak50vq0Y

Whitehouse talks about the importance of visuals when trying to get your message across; stating "One picture says a thousand words" is very true for many people. In fact, one of the golden rules on social media is to include an image in all your posts to make them more accessible and improve performance.

Andrew also illustrates how looking at the situation from a different angle helps you see the benefits rather than the challenges which neurodiversity brings.

For example, he references an incident in which he was contacted by a friend to say they had a group of dyslexic architecture students who were all arriving for a training course. Andrew's observation was ***"dyslexic people struggle to track text on a page, they see it from behind, above, and around, they see it holistically. Isn't that architecture? Isn't that what you need?"***

To ensure we have an inclusive work force, we need to look at how we work and communicate to ensure information is as accessible as possible.

There are various ways of doing this and a mix of them needs to be deployed to ensure successful outcomes. These include:

- Leadership - The leadership being seen to embrace all and acknowledge the benefits of having neurodiverse employees and volunteers in the team.
- Awareness - increase awareness, with articles, examples of good practice, and access to training.
- Foster an environment that encourages 'fearless work' for all.
- Host events and forums to discuss DEI. Create opportunities for discussion.
- Creating the toolsets to help everyone make the environment more inclusive.

One small step taken by the INCOSE MARCOM team is to start updating the style guides and templates to make them neurodiversity friendly. Some changes that you can make in your organisation include:

- Using sans serif fonts, such as Arial and Calibri, as letters can appear less crowded. Alternatives include Verdana, Tahoma, Century Gothic, Trebuchet and Open Sans.
- Use images to support text. Flow charts are ideal for explaining procedures. Pictograms and graphics can help to locate and support.
- For headings, use a font size that is at least 20% larger than the normal text. If further emphasis is required, then use bold.
- Ensure hyperlinks look different from headings and normal text.

- Left align text, without justification.
- Be concise; avoid using long, dense paragraphs.
- Consider using bullet points and numbering rather than continuous prose.
- Avoid abbreviations where possible; always provide the expanded form when first used.
- Give instructions clearly.

The list above is a snapshot from the British Dyslexia Association's Dyslexia Style Guide 2018: Creating Dyslexia Friendly.

Being dyslexia-friendly in our communication makes good business sense, not only for our members but also for the good of Systems Engineering across the world.

Why Join the INCOSE Corporate Advisory Board (CAB)

Ron Giachetti, CAB Chair, ron.giachetti@incose.net

The Corporate Advisory Board (CAB) is the voice of the customer to the INCOSE leadership. The Cab provides strategic guidance to technical leadership, leading to the development of Systems Engineering products and standards to meet their needs. There are many benefits to joining the INCOSE CAB.

1. CAB membership allows your company to guide the direction of the discipline.
2. Employees can gain access to the state-of-the-art products.
3. Align with peers and fellow industry leaders, grow your global footprint, and learn about how other industry leaders are applying Systems Engineering to solve business problems.
4. Gain better access to talent – find and hire competent, certified Systems Engineers through your INCOSE connection.

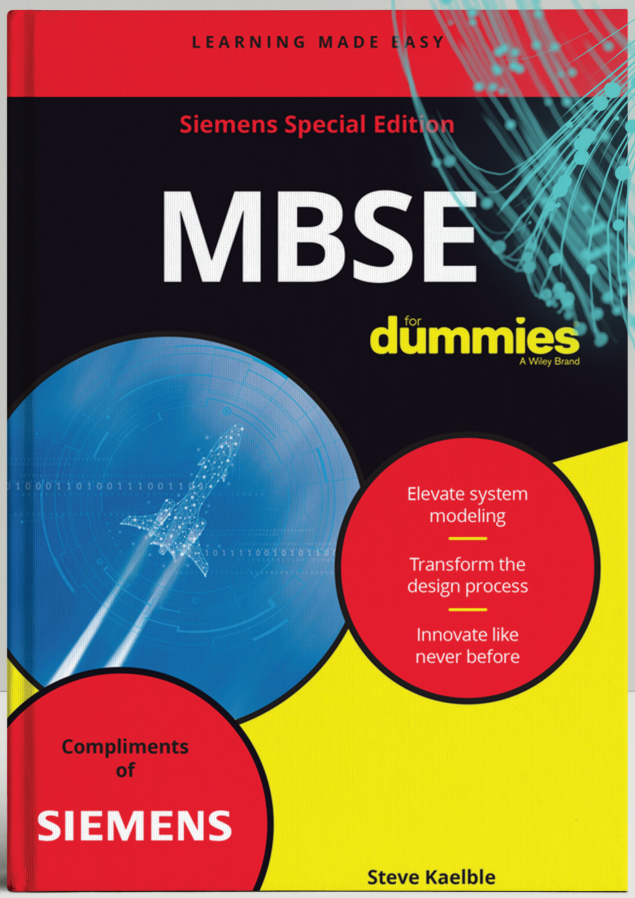
INCOSE would like to welcome all the new CAB Members

ChangeVision

Lawrence Livermore National Laboratory

AVIAGE SYSTEMS 昂际航电

Loyola Marymount University



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Volunteer With INCOSE

Volunteer Opportunities Administrator, voadmin@incose.net

Successful organizations such as ours owe their success to involvement of our volunteers who take time away from their daily engagements and contribute to INCOSE. We are eternally thankful and commend them for their dedication. Have you considered becoming involved in your chapter or a working group. This can be a great opportunity to increase your network, grow your experience and give back to the systems engineering community.

There are a range of volunteers and paid opportunities on the INCOSE website. Find the right opportunity for you on www.incose.org/volunteer.

www.incose.org/volunteer

Building STEAM: The Continuing Work of the INCOSE SySTEAM Initiative

Caitlyn A. K. Singam, SySTEAM Program Director, caitlyn.singam@incose.net

Summer is here once again, and while schools may be on hiatus, the INCOSE SySTEAM community continues to be moving at full steam (pun intended!) towards its goal of developing a framework for integrating systems engineering/ systems thinking competencies into STEAM curricula and achieving its mission of "Improving education for all students, everywhere".

Embracing the Arts

Eagle-eyed readers may have noted the subtl, yet significant, change in our community's name from *INCOSE SySTEM* to *INCOSE SySTEAM*. The new SySTEAM name, which stands for "Systems, Science, Technology, Engineering, Arts, and Mathematics" change reflects our group's dedication to including the arts and humanities, not just STEM fields, in our efforts. It's our belief that students in every field can benefit from the interdisciplinary systems thinking/systems engineering skills that SySTEAM seeks to promote, and that every student, no matter where in the world they live or what career they want to pursue, has a fundamental right to a quality education that teaches those skills. With the new SySTEAM name, we want to recognize that the arts and humanities – which are represented by the 'A' in STEAM – are just as much a part of that vision as STEM fields are, and also wish to celebrate the contributions that the arts and humanities offer to STEM fields (and vice versa). With this name change, we hope to welcome an even wider diversity of participants from different academic, geographic, and personal backgrounds into our community.

A Productive Start to Quarter 2

The poet T.S. Eliot may have bemoaned April as the cruelest month, but the start of the Quarter 2 proved itself to be kind to SySTEAM. April saw our group celebrate a new redesign of the INCOSE SySTEAM webpage (incose.org/systeam), which now features new content, key SySTEAM documentation, and an improved layout and color scheme. The webpage improvement effort continues to be a work in progress as we strive to improve the accessibility of our documentation for new community members and other interested parties. Quarter 2 also saw the continuation of SySTEAM's biweekly general body meetings (GBMs), which have provided ample opportunity for our community to work towards our main deliverable of a systems thinking/ systems engineering competency integration framework for STEAM curricula at all levels of education. **Our community GBMs, which are held every other Thursday at 10AM Eastern (Zoom registration link: bit.ly/3B8Waf7) serve as a form of 'mini-workshop'**, where community members have the opportunity to engage in face-to-face collaboration as part of working sessions where they can delve into in-depth work and discussion related to developing SySTEAM's products.

Each GBM meeting follows a standardized format of a short logistical status update followed by a themed discussion conducted in breakout sessions, with the aim being to empower SySTEAM community members to drive the direction of SySTEAM's activities. Previous discussion topics have ranged from addressing the importance of

the humanities in developing systems thinking skills (and vice versa), to envisioning means of improving accessibility of systems engineering and systems thinking skill-development resources to educational institutions. All of our meetings are recorded via Zoom, and meeting agendas, minutes, slides, and online resources are shared with our online community via our Discord community hub. All in all, SySTEAM's community members and their efforts remain at the driving force behind SySTEAM, and with the help of our community, our group has continued to make excellent progress towards its mission and goals.

Improving education for all students, everywhere.

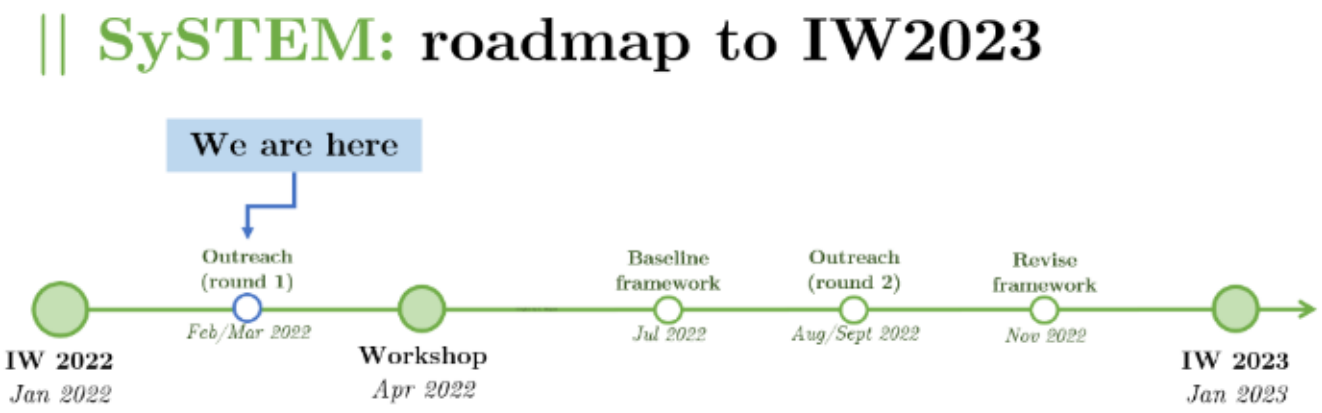
Join INCOSE SySTEAM

We always remain on the lookout for new community members, and welcome any interested individuals to join us online via our free Discord community hub (join link: https://bit.ly/3oy1GmF). Regardless of your professional background, location, or level of commitment, there's likely something you can contribute to SySTEAM. If you would like to join SySTEAM, or are interested in learning more about the initiative, please contact the SySTEAM initiative lead and Program Director, Caitlyn Singam, at caitlyn.singam@incose.net.

We hope you'll join us as we look forward to another productive quarter, and continue to work towards our goal of improving education for all students, everywhere!

SCAN ME

Scan the code to join the Discord community hub



New Professional Development Portal (PDP) Launching in June 2022

It's almost here! INCOSE is launching a Professional Development Portal this June

Searching for professional development tools in the systems engineering sphere? Look no further! We're excited to share that INCOSE is launching a new Professional Development Portal for everyone. Debuting at the International Symposium 2022 in June (and then on the INCOSE site by the end of summer), the PDP will offer exclusive capabilities to INCOSE members, including access to most of our recorded content. And with more than 700 learning materials available right off the bat including books, lectures and full-length courses, there will be no shortage of resources for those who wish to strengthen their skills in the field.

Features that will be available immediately include:

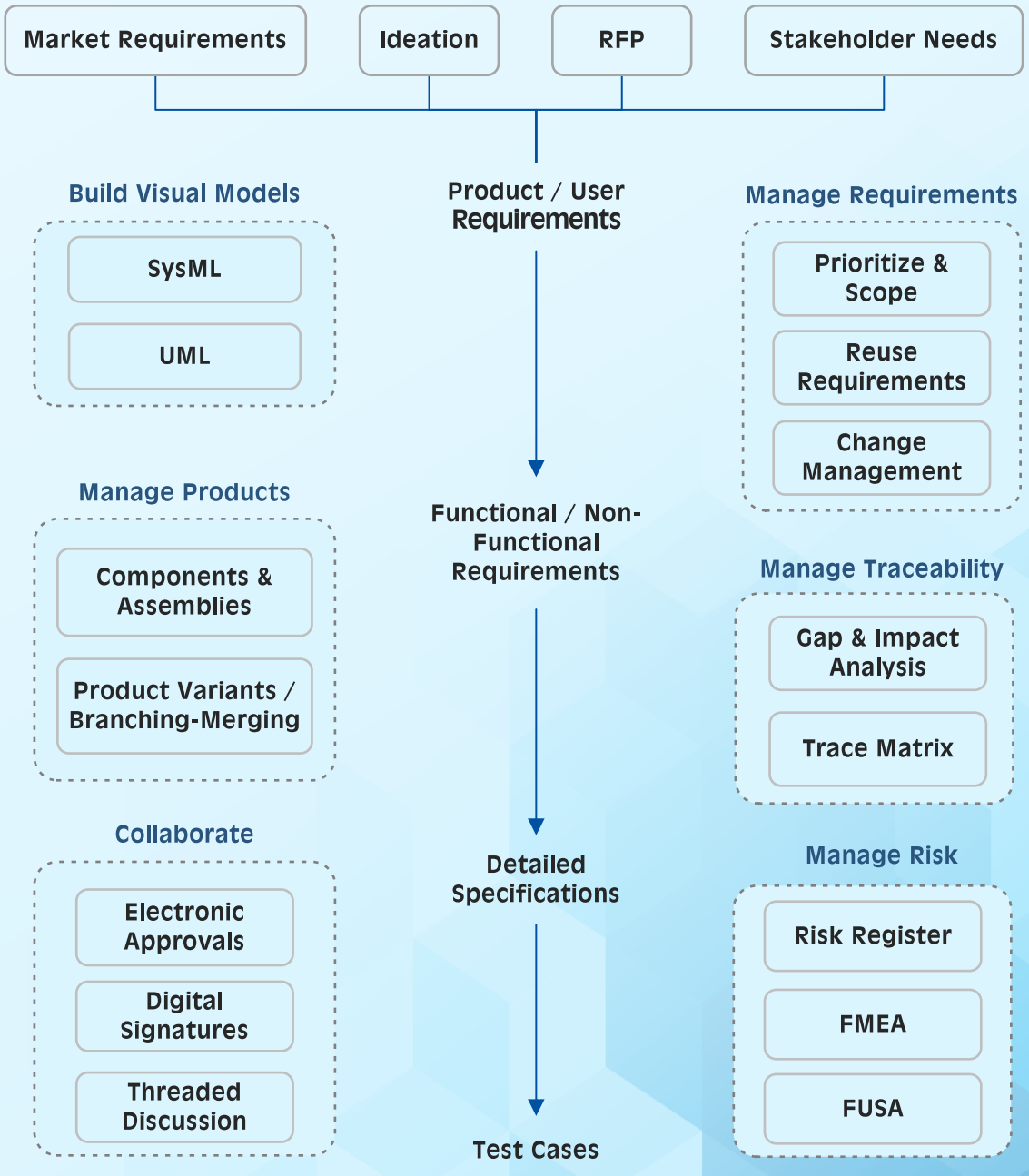
- A competency self-assessment based on INCOSE's System Engineering Competency Framework (ISECF) to help you determine which learning resources will benefit you most.
- The ability to browse and search the PDP Content Catalog to find needed learning resources. Content will be added regularly. However, only about 700 learning resources will be available upon launch, which include INCOSE products, the SE Handbook, some textbooks, and SE mini courses. Each learning resource will have the title, publication date and type of media available (including videos, webinars, documents, courses and websites) along with a description. Additionally, the results will include which SE competency(ies) each is classified under as well as more information, when available.
- The option to save or bookmark search results on your bookshelf. This way, you can always return to your lessons or reading material later and pick up right where you left off.

If you would like, you can also provide feedback. This includes letting us know if/when you spot broken links or website bugs, identifying learning resources that are classified incorrectly and recommending additional learning resources you think we should include in the PDP Catalog.

Will you be attending the 2022 International Symposium? Stop by our booth and say hi! We'd love to answer your questions in person.

Words by Beth Concepción

Daunting...



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CHAPTER UPDATES

Click on the chapter to go straight to their update.

Australia Chapter: Systems Engineering Society of Australia (SESA)

SESA is excited to announce that the Systems Engineering Test and Evaluation (SETE) conference for 2022 will be held as a physical event in Canberra, Australia between the 12th and 14th September in collaboration with the International Test and Evaluation Association (ITEA).

The theme for SETE 2022 is ***"enabling resilience through disruption"*** with sub-themes spanning resilience, methodology, digital innovation, HSI and Social factors across sectors and domains.

The sub-themes that will be explored are:

Resilient systems
Critical infrastructure, resilience and sovereignty, sovereign industry capabilities, system integration and interconnectivity, technical accountability and governance

Methodology advances
Agile approaches, model-based approaches, systems methodologies and frameworks, experimentation, test and evaluation

Digital innovation
Big data, data analytics, machine learning and Artificial Intelligence, Digital Twins, cyber capability, information assurance

Human and social factors
Ethical design, human capability and competency, human-systems integration, social disruption and wellbeing

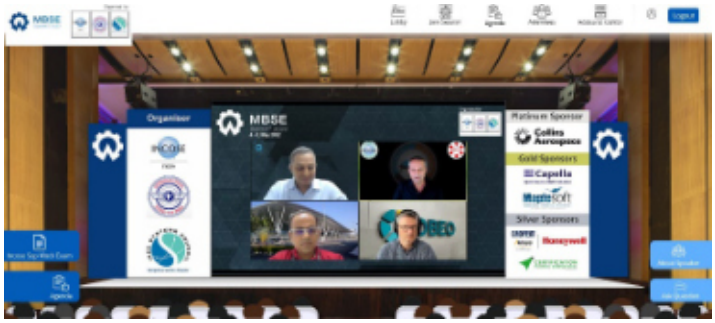
More details on the event can be found here:
https://portal.engineersaustralia.org.au/event/2022/03/systems-engineering-test-evaluation-sete-conference-41566

www.sesa.org.au

India Chapter: INCOSE India

A look back at the MBSE Summit 2022.

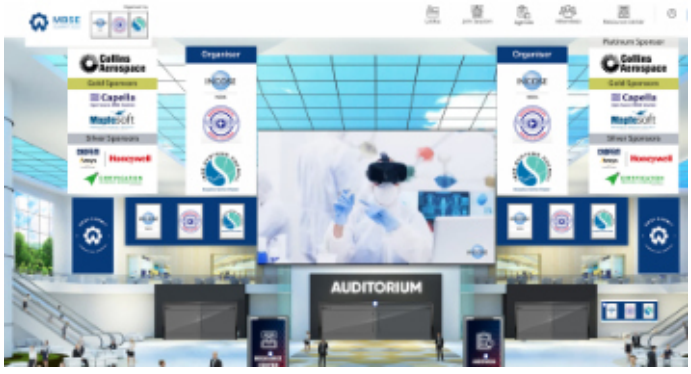
The INCOSE India Chapter, in collaboration with The Aeronautical Society of India and IEEE Systems Council Bangalore Section Chapter, organised the 2nd MBSE Summit which took place on 4th and 5th May 2022. The virtual event marked grand success with over 18 hours of informative and engaging sessions on MBSE in various sectors, workshops, and panel discussions. Sponsored by industry leaders (Platinum Sponsor: Collins Aerospace, Gold Sponsors: Capella and Maplesoft, and Silver Sponsors: CTI, Honeywell and CADFEM ANSYS), the Summit was a virtual treat offering an in-person like experience.



As more and more industries are dealing with complex systems and employing Model-Based approaches, this year's summit expanded discussions on MBSE applications in various domains and offered all participants, whether students or professionals, a valuable insight into the world of MBSE.

Day 1 of the Summit began with informative Career Mentoring sessions for students and professionals, led by our industry experts and practitioners from various domains of MBSE, where they lay the foundation for anyone who wants to steer their career towards Systems Engineering. The morning session also had an engaging MBSE workshop by our Gold sponsor, Capella, where Stephane Lacrampe (Obeo) introduced the participants to their Open Source MBSE tool.

Dr. Kota Harinarayana (SERB Fellow at CSIR-NAL, and Chairman-DD Aeronautical Society of India) commenced the evening session with his inaugural address. After speaking about the role and importance of Systems Engineering, he segued on to why it is important to advance towards MBSE. The evening continued with talks from various dignitaries highlighting the theme of the Summit. Dr. Sukanta Bhatt (Head, University/ Clinical Program at Philips) spoke on how we can bring Systems Thinking, Systems Engineering and MBSE under one umbrella and gave a thoughtful insight on how 'zooming-out' is important to solve complex problems. Mr. Niranjan M. (General Manager at Bosch) took the audience through the Systems Engineering framework at his company encompassing software, hardware, and mechanical engineering. The evening progressed with a thought-provoking panel discussion on the Future of Digital Engineering, moderated by Rajesh Singh (Lead Systems Engineer, MBSE at Boeing India). The Summit was honoured by esteemed panellists including Ettiene Juliot (Founder and Vice-President of Obeo), Vijay Doddavaram (Director-Digital Tech at Collins Aerospace) and Jawahar Bhalla (Principal at JB Engineering Systems). Later, Dr. Ranjan Vepa



elocuted his thoughts on MBSE from an Aerospace perspective and the evening concluded with Dr. Manju Nanda (Chief Scientist at National Aerospace Laboratories) showing us the challenges and reality of MBSE vs the industry claims through her Model Based Software Engineering for Flight Software- CSIR-NAL Story.

Day 2 of the summit started with a SEP Mock Exam created and conducted by INCOSE India volunteers, providing a self-check for the attendees regarding their SE knowledge. Over 55 people attended the mock test, which gave a fair idea on the number of INCOSE ASEP/CSEP aspirants in India. This was complemented with a SEP mentoring session through a panel of ASEP, CSEP and ESEP certified INCOSE India members, and a pre-summit webinar on the INCOSE SEP Certification process.

Another event conducted by the INCOSE India Chapter's MBSE Woking Group, was a SysML V2 workshop which gave a hands-on experience on the SysML V2 prototype.

During the second half of day 2, Kevin Robinson and Tim Carter from Shoal Group spoke on demystifying MBSE for rail acquisition agencies and challenges in implementing the same, thus providing a broader perspective on the applications of MBSE. Carrying the torch, Dr. Sudarshan Rachuri (Technology Officer at Office of Energy Efficiency and Renewable Energy) shared his knowledge and experience on Model-Based Systems Thinking in Sustainable and Smart Manufacturing where the need for the concept of Systems of Systems is questioned. The evening

also presented the audience with a second panel discussion of the Summit focusing on MBSE in Healthcare and Medical devices. The discussion was moderated by Ajay Thukral (Principal Systems Engineer at Raytheon Intelligence and Space) and the panel included industry experts like Muralikrishna Menon (Site Leader, Bector Dikinson Technology Campus), Saket Kulkarni (Associate Vice President at Agiliad), Suraj Kamath (Systems Engineering at Philips Mobile Surgery Business) and John Anderson (Managing Director at Addiva AB) where they discussed how MBSE can help reduce complexity in this domain. Coming towards the end of the evening and the summit, Dr. Ravi Rajamani spoke about Model Based Methods used in Aerospace.

In all, the Summit gave the attendees an insight into current trends, and also food for thought to shape the future trends in MBSE.

Words by Mansi Agrawal,
mansi.agrawal@boeing.com

INCOSE India Web Page

INCOSE India LinkedIn Group

Japan Chapter: Japan Council on Systems Engineering (JCOSE)

Over the last few months, we have held two virtual workshops in Japanese. The first event covered highlights of IW2022 (including Vision 2035 and SysML v2 updates) delivered by Midori Daida, Yutaro Ito and Yukimi Mizuno. The second event was a talk and panel discussion on system safety, particularly ISO 21488 and a recently published JASPAR paper which explores the use of a system model for the SOTIF standard. The panel was comprised of members from the automotive industry, facilitated by Prof. Nishimura. There were several questions asked by the audience in the QA session, one of which triggered an interesting discussion on the use of RAAML and alternatives.

Update by Maz Kusunoki, m.kusunoki@jcose.org

JCOSE Web Page

Singapore Chapter

INCOSE Singapore Chapter: AGM 2022 and moving forward

With the easing of community and border measures on COVID-19 announced in late April 2022, the Singapore chapter is looking forward to its mission of promoting INCOSE on Systems Thinking as well as connecting socially with our members. We are excited to collaborate and learn from diverse stakeholder communities and to make tangible transitions toward the Systems Engineering Vision 2035.

Update by Meng Seng Toh, mengseng.toh@incose.net

INCOSE Singapore Chapter – Onwards! A Message from the President, Ming Wah Tham

Our online AGM was held on 30th March 2022. We had a pretty good turnout, with veterans as well as young engineers taking an interest in our council matters. We also had the good fortune of having Dr Lui Pao Chuen gracing our occasion. He shared his views on Systems Engineering in Singapore, and the emerging trends of SE development in the near future. In 2021, we organized an MBSE webinar, conducted by Robert Ong, a veteran in the MBSE domain. This year, as Singapore opens up, we will look towards organizing more face-to-face activities for our members.

Update by Ming Wah Tham,
MingWah.Tham@incose.net

INCOSE Singapore Web Page

New Zealand Chapter: INCOSE NZ

A New Zealand Chapter Case Study: City Rail Link

The City Rail Link (CRL) project in Auckland, New Zealand is planned for completion in 2024 and will contribute to a vibrant Auckland by doubling the capacity of Auckland's rail network. The project provides twin 3.45km underground tunnels with two new underground stations. The project also includes enhancements around the Auckland network to double the capacity of the Auckland rail network.

The following points list some challenges with the application of systems engineering on the CRL and how they were solved:

- The project is 'requirements led' with all suppliers contracted against project requirements, however NZ suppliers and contractors were not accustomed to delivering against requirements. This has required some adjustment and learning, including the requirement to demonstrate achievement of written requirements. While there were some initial differences in understanding between systems engineers, procurement, contract managers, and designers on the use of requirements, these were overcome through training presentations and ongoing explanation to senior leaders, including identification of quick wins where scope was being managed. The allocation and demonstration process is now working reasonably well. The main benefits realized by the project include the tight management of scope to avoiding scope creep and good visibility of changes though the formal change process.
- The CRL project includes significant civil works with new stations, buildings, and tunnels, and a relatively small rail systems component. While the project has adopted the European railway safety and reliability standard 'EN50126' that does include engineering principles drawn from ISO/IEC/IEEE 15288, one of the key challenges was managing the application of systems engineering to civil works. Many participants viewed this as unnecessary and adding process for no perceived benefit. This was overcome by tailoring and minimizing systems engineering process while leveraging local civil engineering practices, including adaption of civil delivery

language and terms. This has enabled us to gain the confidence in delivery provided by systems engineering with minimal imposition on traditional civil delivery.

- The CRL project created high-level operationally-focused requirements early in the project and this set of requirements was given the rather unconventional name of 'Operating Principles for Design Definition'. There was some initial confusion with this naming with contractors because it did not conform to standard systems engineering terminology, which eventually resulted in the creation of a formal 'Concept of Operations' document that more closely aligned with INCOSE principles and painted a much richer picture. While it was undesirable and risky to scope to revisit the high-level requirements,

the process of creating the concept of operations helped improve a better understanding of the operational intent that was previously hidden within the rail operators 'business as usual'.

- The project utilizes IBM Rational DOORS for requirements management and there were some practice challenges working with procurement and contract managers to understand how a requirements database could be used in formal contractual materials. Contract management in New Zealand relies on the issue of traditional documented baselines which are then varied through contract changes where the original contract is not updated. This was resolved by ensuring the strict requirements management changes were visible to the contract management team, with regular issues of DOORS baselines in contractual form that were checked to ensure they matched the contractual baseline with agreed contract updates.

Overall, the success in the application of systems engineering on the CRL project can be attributed to good communication and engagement with others, as opposed to a rigid process. The greatest lesson is the importance of understanding other's needs and their exiting processes and then tailoring the systems engineering processes to provide the benefits of the systems engineering approach without creating unnecessary bureaucracy. While the project still has some way to go, the benefits of scope management toward ensuring that the high-level requirements can be achieved are already evident.

Russell McMullan, General Manager Assurance and Integration, City Rail Link Limited,
Russell.McMullan@CityRailLink.Govt.NZ

A New Zealand Case Study: Neutron Launch Vehicle

In April, Rocket Lab successfully completed the System Requirements Review for their next-generation reusable medium lift launch vehicle: Neutron. The milestone included definition of programmatic needs, goals and objectives (NGO's), preliminary concept of operation (CONOPS), system requirements, and high-level system architecture, underlining Rocket Lab's commitment to developing a high assurance launch system through application of systems engineering principles.

See here for more info.

Words by Evan Simmers, Systems Engineering Manager, Neutron, e.simmers@rocketlab.co.nz

Brazil Chapter: INCOSE Brasil

In March, 2022 INCOSE Brazil celebrated its 10 years anniversary.

It is a good time to look back and remember the efforts made to start the Chapter, from 2005 to 2012. There were isolated efforts before that time. The main challenge was to achieve the minimum number of 25 INCOSE members in the country in order to create the Chapter. In 2005, Robert Halligan and Geilson Loureiro met at MIT (Massachsetts Institute of Technology) and discussed how to promote systems engineering in Brazil. In 2006, Robert Halligan started to deliver, twice a year, his Systems Engineering courses in São José dos Campos with an attendance of, on average, 20 attendees per course. Geilson used to teach systems engineering at gradutae level at ITA (Technology Institute of Aeronautics), since 2003. In 2008, INPE (Brazilian Institute for Space Research) started its graduate course "Space systems engineering and management". In 2010, ITA started its undergraduate course on Aerospace Engineering with Systems Engineering being one of the subjects taught at undergraduate level. At that time, Carlos Lahoz, Geilson Loureiro and George Sousa started a series of events that happened at INPE and were used to promote systems engineering awareness and the idea of a Brazilian INCOSE Chapter. Robert Halligan also took part in some of those events.

The chapter was finally created on March 26th, 2012. Since then, many more aerospace engineering courses have been created in Brazilian Universities. The Federal University of Minas Gerais has an undergraduate course on Systems Engineering. EMBRAER, which has been practicing systems engineering since 2000, has become a leading force at INCOSE Brazil promoting annual events on the subject and systems engineering awareness in the country.

Systems engineering has been adopted, systematically, by the governmental defense institutions in the country and that impacts the whole supply chain of defense products. In terms of results of complex products developed in the country, during this 10-year period, we highlight the satellites CBERS 3, CBERS 4, CBERS 4 A and Amazonia 1 and the aircraft EMBRAER KC 390.

Words by Geilson Loureiro, First INCOSE Brasil President

INCOSE Brasil LinkedIn

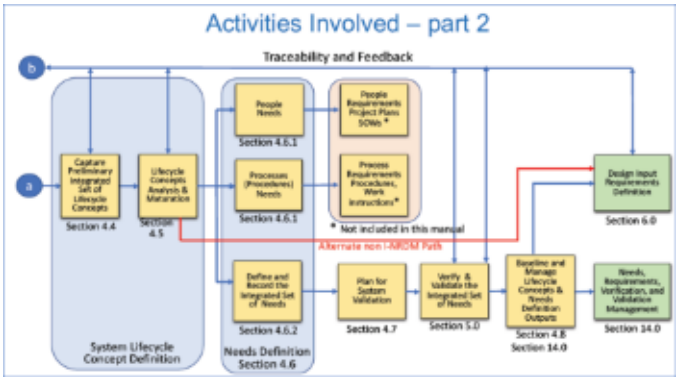
INCOSE Brasil YouTube

INCOSE Brasil Web Page

Chicago Chapter: Chicagoland

The INCOSE Chicagoland Chapter hosted over forty-five engineers for our May 2022 Spring Tutorial, "Lifecycle Concepts and Needs Definition."

The tutorial was led by Lou Wheatcraft of WheatLand Consulting LLC. Through presentations over three days and hands-on exercises, Lou shared how to define needs prior to creating design input requirements."



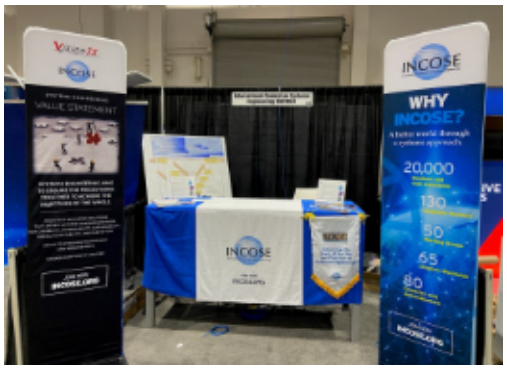
The INCOSE Chicagoland Chapter strives to foster a world-class systems engineering environment for its current and future membership.

Chicagoland Chapter Web Page

Texas Chapter: Texas Gulf Coast (TGCC)

The Texas Gulf Coast Chapter (TGCC) successfully completed the first in a series of MBSE Tool tutorials from Dassault Systemes with 12 attendees on April 23rd 2022.

The chapter also represented INCOSE and System Engineering to the offshore energy community at the Offshore Technology Conference from May 2nd through May 5th. Request TGCC Announcements tgcc.incose@outlook.com



TGCC Web Page

Colorado Chapter: Colorado Front Range

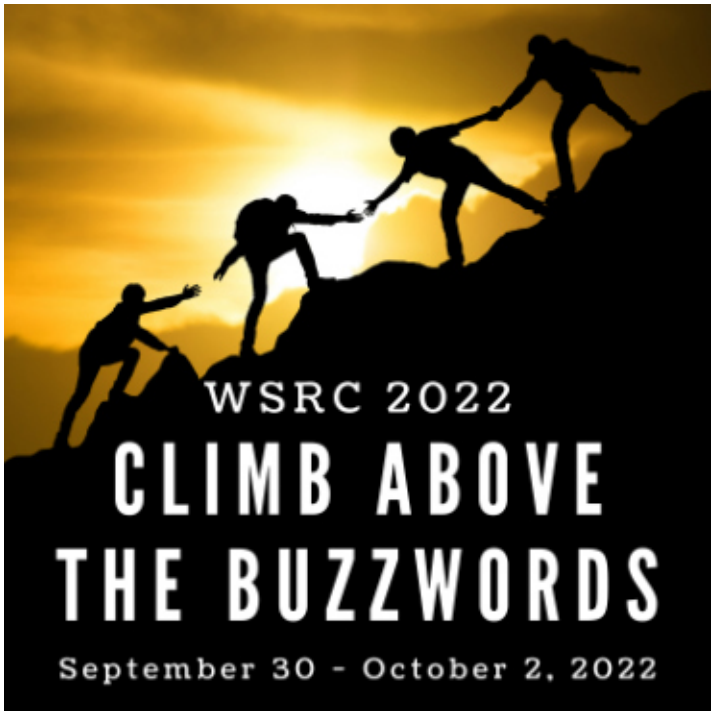
Colorado Aerospace Day, March 8 2022

COLORADO FRONT RANGE

Background: The State of Colorado conducts an Aerospace Day every year. Typically, this event is held on the second Tuesday of March at the Colorado State Capitol in Denver, Colo. This year's event was held on March 8th and due to the Pandemic (COVID-19), the event was held at one of the state buildings nearby. Many local and surrounding area Aerospace Companies were represented. Sponsors set up tables/booths at this event. The local Universities and schools were also represented. A few, local manufacturing industries were also present. Local elected representatives and their support staff visited many of the booths. The event is attended by industry employees, various university and high school (STEM) students and other engineering people. It is a one-day event and free of charge to the public who attend.

Jim Adams and VJ- Valkand Jhaveri, members of the Colorado Front Range (CFR) Chapter held an INCOSE table at this event to advertise INCOSE and connect with the attending public. This year's event was attended by a considerable number of people and was a very successful event. We displayed our INCOSE flier and provided material fliers and give-ways for INCOSE. INCOSE was well received. University and STEM school students also inquired about INCOSE and Aerospace industries and local political folks stopped by the table for some lively discussions on INCOSE. The Colorado State Governor addressed the event.

Words by V Jhaveri, valkandj@gmail.com



WSRC Western States Regional Conference

The fifth annual WSRC, hosted by the Colorado Front Range Chapter (CFR), will showcase the latest innovations in Systems Engineering research and demonstrate practical, real-world application of that research. To rise to this challenge, our presenters will "Climb Above the Buzzwords" to highlight the utility of their cutting-edge work.

The WSRC 2022 will have multiple Tracks and Tutorials. The WSRC 2022 will be held in the town of Golden, Colorado at the Golden Hotel; nested in the foothills of Colorado's majestic mountains. It will be held on Sept. 30th thru Oct 2nd 2022. Please join us at the WSRC 2022 during beautiful fall time in Colorado.

Please visit www.incose.org/wsrc/program

Washington Chapter: INCOSE WMA & PMIWDC

PMIWDC INCOSE WMA Collaboration Joint Working Group

In June 2021, INCOSE Washington Metropolitan Area (WMA) Chapter teamed with PMIWDC Chapter to establish a Collaboration Joint Working Group. A joint charter was signed and a joint working group convened. The objective of this initiative was to explore joint activities that would enhance the understanding of project management and systems engineering for the membership of both organizations.

The joint working group recommended the following 2022 activities:

- Reciprocal presentations that provide an overview of each professional organization and what each chapter had to offer at each other's monthly meeting.
- Reciprocal invitations to monthly meetings and special events to encourage cross fertilization.
- Continue the PMIWDC INCOSE WMA Collaboration Joint Working Group to explore additional joint activities. The Joint Working Group will meet every two weeks to plan and execute 2022 activities and explore activities for 2023.
- Dr. Tika Raj (PMIWDC) presented "Emergence of systems thinking in PM practice and why both PM and SE professionals benefit from it" at the INCOSE WMA March monthly meeting. Attendees included members from both PMIWDC and INCOSE WMA. PMIWDC CEO and Chair Ms. Dannette Richards provided opening remarks prior to Dr. Raj's presentation.
- INCOSE WMA is scheduled to present "The Intersection of PM-SE" at an upcoming PMIWDC monthly meeting.
- The PMIWDC INCOSE WMA Collaboration Joint Working Group will have a one-hour slot for a PM SE collaboration panel discussion at PMIWDC's 2022 DC-Maryland-Virginia (DMV) Project Management Symposium, 20 September 2022. The Symposium theme is: Engage. Empower. Transform. The JWG is working on defining the panel discussion topic(s), selecting panel members and selecting the moderator.

The INCOSE WMA student division at Virginia Tech was nominated for two Student Organization Leadership Awards (SOL Awards).

This award celebrates the phenomenal contributions Virginia Tech students make across campus and within the greater community through their membership in student organizations (Registered Student Organizations, University Chartered Student Organizations, and University Student Life Programs).

This is the second year in a row the Virginia Tech INCOSE WMA Student Division was nominated for the "New Organization of Excellence" award for impressive efforts in unprecedented times. This year, the student division President, Paul Wach, was also nominated for the "Outstanding Graduate Student Leader of the Year Award" for his leadership in founding and driving the new student division at VA Tech.

Left to right: Sami Acharya (Secretary), Niloofar Shadab (Treasurer), and Paul Wach (President).

George Mason University INCOSE WMA Student Division

Bench painting is an honored tradition at George Mason University. There are 55 benches on the mid-campus quad, which are brightly painted each year by student organizations. Here is the bench art from this year's INCOSE WMA Student Division at Mason!

Front view, with officers. Left to right: Paige La (Vice President), Mahati Malladi (Events Coordinator), Habiba Salad (Treasurer), Madeline Haas (President), Emma Devine (Secretary), Darius Jack (Outreach Coordinator)

The 5th Annual Andrew P. Sage Memorial Capstone Design Competition

Source: Winners of the 5th Annual Andrew P. Sage Memorial Capstone Design Competition announced. (April 27th, 2022 / By CEC Communications)

The 5th Annual Andrew P. Sage Memorial Capstone Design Competition held on Mason's Fairfax Campus April 25, 2022. Fifty-one System Engineering teams from eight universities competed in 10 tracks. The projects were evaluated by 58 judges representing local companies and the government.

"The quality of the presentations was outstanding," says Conference Chair and System Engineering & Operations Research (SEOR) professor Songjun Luo. "Preparing for the conference was a lot of work. The reward was seeing these amazing students addressing hard real-world challenges."

The awards were presented by SEOR Professor Emeritus George Donohue. "Our planet and our communities are facing some of the most difficult challenges I have experienced in a long career as a System Engineer and analyst. The next generation of System Engineers demonstrated they are up for the challenge."

"Topics ranged from climate change to social justice," added SEOR Department Chair John Shortle. "Solutions include AI/Machine Learning, optimization, simulation and Digital-Twin. It is extremely pleasing to see the energy and creativity of the next generation of System Engineers."

For more information on the Annual Andrew P. Sage Memorial Capstone Design Competition and the GMU System Engineering & Operations Research Department contact Dept Chair John Shortle jshortle@gmu.edu

Capstone Competition Winners and Projects were:

Track 1A, Machine Learning and Data

Best Paper: Team 2 Virginia Tech
Authors: Kayla Castro, Robert Kaldec, Sam Indest, Shayan Waqar and Natalie Cherbaka
Title: Computer Vision System for Dairy Cattle Weight Estimation

Track 2 Process Improvement

Best Paper: Team 3 Worcester
Authors: Kyle Mikolajczyk, Jenna Charron, and Noelle Morgan
Title: eTextile Interface for Generative Design Software

Track 3 System Design (I)

Best Paper: Team 3 Virginia Tech
Authors: Bartholomew Nicholas, Baker Gallagher, Seung Jin Choi Nathan Marraccini, and Natalie Cherbaka
Title: Self-Learning Sensor Network
Honorary Mention: Team 1 University of Chinese Academy of Sciences, Beijing, China
Authors: Yihao Xiong, Yuanlin Xin and Yatao Liu

Title: SuperCubeRobot: Rubik's Cube Restoration Robot

Track 4 Climate & Transportation

Best Paper: Team 1 University of Pennsylvania
Authors: Arnav Joshi, Andy Eskenazi, Landon Butler and Megan Ryerson
Title: Equitable Optimization of U.S. Airline Route Networks

Track 5 Communications and Networks

Best Paper: Team 1 George Mason University – Cyber Security Engineering
Authors: Kylie Amison, Ghizlane Maazouz, Rahul Pathepuram, Brendon Shao, and Benjamin Thong
Title: Risk Sniffer Tool: Cyber Security Risk Assessment

Track 6 Decision Support and Software Systems

Best Paper: Team 6 George Mason University – System Engineering
Authors: Mahati Malladi, Swathi Potti, Marwa Zubair, and Roja Wazed
Title: A Decision Support Tool to Evaluate Navy Future Vertical Lift Manpower
Honorary Mention: Team 2 George Mason University -- Cyber Security Engineering
Authors: Sean Chacon Cai, John Mai, Po Chi Su and Talal Alyacoub
Title: ChatApp Vulnerability Research

Track 7 Military and Government

Best Paper: Team 2 George Mason University -- System Engineering
Authors: Wyatt Mingus, Reed Lawrence, Abdulrahman Albawardi, and Mohanned Yasin
Title: Design of a Predictive Maintenance System for Navy Jet Engines
Honorary Mention: Team 5 George Mason University – Cyber Security Engineering
Authors: Kaityln Malone, Josh Minick, Vi Nguyen, Jack Raymond, and Kelly-Ann Downer
Title: Bluetooth Vulnerability Research (EvilSmurf)

Track 8 Modeling and Digital Twin

Best Paper: Team 3 George Mason University Cyber Security Engineering
Authors: Saeed Alkaabi, Esraa Elshaer, Sharon Alabarado, Mansoor Almazrouei, Bader Alkaabi, and Ghena Alfaiz
Title: Interactive Cybersecurity Incident Response (IR) Tabletop Exercise Method

Track 9 System Design (II)

Best Paper: Team 3 George Mason University - System Engineering
Authors: Madeline Haas, Nana Yaa Baidoo, Hary Nayer and Megan Woodmancy
Title: Design for a Wave Adaptive Modular Vessel Guidance and Control System
Honorary Mention: Team 5 University of Pennsylvania
Author: Adam Liang, Andrew Garrett, Justin, Duhamel, Zach Goldberg, and Jason Friedman
Title: BoomBoat: A multi-robot automated oil spill containment system

Track 10 System Improvement

Best Paper: Team 6 Institute of Business Administration, Karachi, Pakistan
Authors: Syed Waqas Ahmed and Imran Khan
Title: Framework for the digitization and automation of rapidly changing business processes within SMEs
Honorary Mention: Team 1 George Mason University – System Engineering
Authors: Sean Becker, Rashed Almazrouei, Nicholas Lechner and Brian Romero Lopez
Title: Design of a Battlebot System to Maximize the Probability of Winning the Competition

For more information go to: https://www.gmu.edu/news/2022-04/winners-5th-annual-andrew-p-sage-memorial-capstone-design-competition-announced

Words by Paul Wach, paulw86@vt.edu

www.incosewma.org

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

The Spanish Chapter has been busy engaging with the Spanish and Eruopean systems engineering community with events and new initiatives. Here are some of the highlights:

- The chapter was awarded the INCOSE Silver Circle Chapter Award.
- AEIS organized the "Systems Validation Strategies" with Alberto Sols from Universidad Europea de Madrid.
- The chapter co-organized and participated in SESE 2022, alongside four other European chapters.
- We are launching a Volunteering group. A kick-off meeting and following up meeting have already been held. Promising activities will be started: YouTube Channel, White papers, a workshop dedicated to MBSE, and expectations to launch two or three Working Groups in the next few months.
- We have a new CAB member: Universidad Europea de Madrid. Joining the efforts to increase academic participation.

Update by Anabel Fraga, AEIS President

www.aeis-incose.org

UK Chapter: INCOSE UK

Annual Systems Engineering Conference (ASEC) 2022

We are pleased to announce that ASEC 2022 will be taking place at The Crown Plaza, Newcastle upon Tyne, UK on 22nd and 23rd November 2022.

Work towards putting the event programme together is hotting up, and we have already contacted the potential 22 presenters for their six-page draft papers.
From the submissions, the event is shaping up to be an exciting and educational experience, and we look forward to sharing further details with you as the programme comes together.

Visit www.asec2022.org.uk for more information.

Exhibiting at ASEC 2022

ASEC 2022 offers opportunities to promote your business to the ASEC delegates. Our event attracts a wide diversity of attendees from the Systems Engineering community and delegates from other communities interested in taking a Systems Engineering approach to complex systems; many of whom help to shape investment decisions within their organisations. You can display your company's products and services at an exhibition stand.

For more information about securing an opportunity to exhibit at ASEC 2022, please download the Exhibitor Opportunities document from the ASEC 2022 website.

Professional Development Online Sessions

In order to provide information and guidance, we have set up a series of interactive Professional Development Zoom sessions. These sessions are open to all and there is no requirement to be a member in order to attend. The following sessions are available to book by emailing profdev@incoseuk.org.

- 13 July 2022 – Professional Registration Webinar
- 17 August 2022 – Interview Preparation Clinic
- 14 September 2022 – SEP Certification Clinic
- 12 October 2022 – C/D/E Competences Clinic
- 16 November 2022 – Professional Registration Webinar

Endorsed Training Provider Event

The first in-person INCOSE UK Endorsed Training Provider (ETP) event was held in April at Marsh Farm, Royal Wootton Bassett, Swindon.

The course for this event was run by Scarecrow Consultants and was attended by a select group of keen participants.

Despite the small group size, the feedback from the course was positive with one attendee saying that the size of the group meant that is was very interactive and attendees to ask deeper questions

and maximise the usefulness of the course.

Another participant stated that they found the course engaging and fully met their expectations.

We would like to thank all those who attended the course and would like to announce that the next ETP course is scheduled for the 4th - 6th October 2022.

More details will be released in due course.

INCOSE UK Paper Presentations

As part of the ASEC 2021 event, we held some presentations in reserve in case of any last-minute changes to the schedule. Instead of letting these go unseen we featured both in two Zoom sessions, giving the presenters the opportunity to showcase their presentations. Both are available to view on the INCOSE UK YouTube channel.

"Making the technical Processes work for you – a new perspective" presented by Dr. Keith Collyer, Liz Wright and Alexander Hill.

"Bringing the Seven Samurai to Life: Managing complexity in capability delivery through time using Systems Thinking" presented by Tom Ogden.

ePreview: INCOSE UK Newsletter

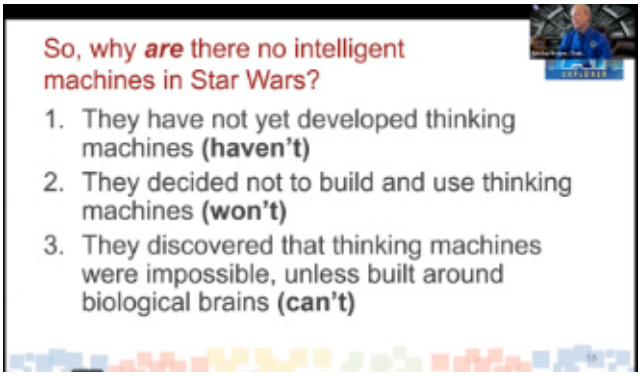
In this issue we look at the future of INCOSE UK, announce the start of the INCOSE UK election, give an update on ASEC 2022 and take a look at the recent Inclusion and Diversity event that took place in March 2022. Click here to read ePreview.

www.incoseuk.org

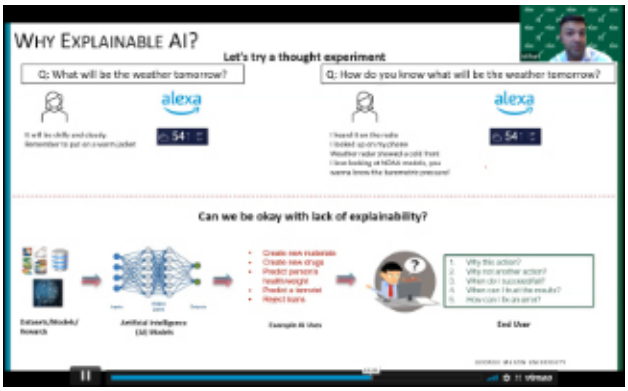
Artificial Intelligence Working Group (AI WG)

AI Explore Series Kick-Off: An AI WG Initiative

The INCOSE AI WG kicked-off on May the Fourth, its AI Explore Series. These Series aim to be short, bi-monthly interactive talks to explore & educate in key issues regarding Artificial Intelligence (AI); both for those that want to understand how to leverage AI to the work of Systems Engineering (AI4SE) and those focused in understanding the implications of AI to the life of Systems (SE4AI). The series is structured around two joint talks: one around applications and the other tutorial based, both followed by lively discussions.



To lift-off the series from the launch pad, Barclay Brown (ESEP & WG chair) ignited the discussion under the banner **"Everything I Know about Artificial Intelligence I Learned from the Movies"**. Threading through Start Wars, Star Treck and other Sci Fi classics, Barclay weaved a tapestry about the evolution of ideas about the capabilities of AI, finalizing with an open conversation on the strange absence of AI in such classics.



Ali Raz (CSEP & WG co-chair) then took to the task of explaining AI explainability: what it is about, why it is needed and a glimpse of the state of the art. In particular, he drilled down on Machine Learning AI systems and how explainability links to the issues of Trust, V&V and Certification. Understanding AI explainability is thus a key asset into the SE toolbox when engineering such systems, although, as it emerged through the subsequence discussion, the field is still wide open for research and understanding.

Head to www.incose.org/ai to check the series archives & stay tuned for future editions. Join the WG to explore SE4AI, AI4SE, contribute or review the ongoing AI primer and.. beyond!

Words by Ricardo Reis, rjreis@embraer.fr

www.incose.org/ai

SE Principles Working Group

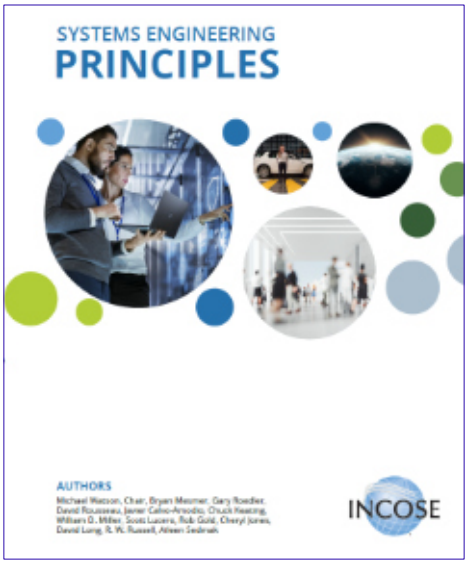
Action Team Prepares to Publish SE Principle Publications

Michael D. Watson, Ph.D., has spent nearly 33 years at NASA in the Marshall Space Flight Center, so the man knows a thing or two about systems engineering. Now he will be the man who literally wrote the book on systems engineering principles.

Of course, he didn't do it alone. He led a team of a dozen authors/contributors as chair of the INCOSE Systems Engineering Principles Action Team to create the Systems Engineering Principles Publication, scheduled to be launched in conjunction with the 32nd annual International Symposium 2022.

The publication is a result of years of work – beginning in 2011 with the NASA Systems Engineering Research Consortium that Watson put together in 2011.

Michael Griffin of NASA was co-investigator. Watson said, "He kind of challenged me and said, 'We need to look for the postulates of SE.'"



The team came up with an initial set of principles and some hypotheses, then turned it into an INCOSE project with an action team instead of a working group.

"We got to work," Watson said. ***"We looked at other publications that had been put out there on principles. We basically took all the principles in those publications and mapped everything together. What came out of that was a realization that systems engineering principles and systems principles are dependent but different. That was a big realization for all of us."***

The action team met face to face for two days in December 2018 in Crystal City, Virginia. What came out of that retreat was a set of 15 principles and three hypotheses that they then started shopping around peer organizations for feedback.

"We had systems engineering committees from AIAA, IEEE and NDIA review and comment" Watson said. "We have updated the draft with the feedback we received from these three peer societies. The feedback was really good and helped quite a bit in formatting and presentation of the principles and hypotheses."

Now it is ready for publication.

"We felt like we had carried it as far as we needed to for a maturing of an initial set of principles," Watson said. "And that's important. It's the initial set. It's not the final set. We are at the starting point, not the ending point."

In fact, in the preface of the publication, Watson specifically asks for feedback.

"It's sort of like the Process Handbook," Watson said. "We're on version 5. Somewhere you had to have Version 1. Until you put Version 1 out, you're not going to improve on it in any kind of systematic manner. That's what we're doing here. This is Version 1. We get to Version 5, hopefully it's stabilized. That's where we're at."

It's taken 11 years to get to this point, and Watson could not be happier.
"It's extremely exciting," Watson said. "It's the first piece of a decades' worth of work that really coming out into a full public view. Having it adopted by INCOSE and being able to benefit

systems engineers around the world -- being able to advance the discipline of SE a step further towards what its roots are, what its basis is – is so significant. It's one of the highlights of my career."

The Systems Engineering Principles Publication also furthers efforts outlined in Systeam Engineering Vision 2035.

"It accomplished at least a part of the goals of the vision," Watson said. *"It takes a first step toward accomplishing those goals and sets us up to be able to accomplish more."*

Watson's professional accomplishments are many. In addition to chairing the INCOSE action team, he chairs the Complex Systems Working Group. His career with NASA includes developing International Space Station operations capabilities and remote operations support capabilities for the Spacelab Program in the United States, Europe and Japan. He also led the branch responsible for the fabrication of large x-ray telescope mirrors, diffractive optics and telescope systems. Watson later led a NASA team defining Vehicle Management System capabilities for human missions to Mars.

His degrees include a Ph.D. and MSE in Electrical and Computer Engineering from the University of Alabama in Huntsville and a BSEE from the University of Kentucky.

Even with all that, Watson says he is incredibly proud of the Systems Engineering Principles Publication.

"It's a big deal," he said.

Words by Beth Concepción

Digital Engineering Information Exchange (DEIX WG) Working Group

About the DEIX WG

DEIX WG aspires to ensure Digital Artifact conventions are transferable between complex systemsbased industries such as aerospace and defense, oil & gas, transportation, automotive, medical and utility industries. Finally, the successful fulfillment of this purpose allows the free flow of digital artifacts between buyers and suppliers throughout a global supply chain. Within INCOSE, this DEIX WG supports the strategic objective to accelerate the Transformation of Systems Engineering to a model based discipline.

Join the DEIX WG

The DEIX WG is made up of two active teams: Standards Framework (SF) and Digital Viewpoint Model (DVM), with a biweekly Working Group (WG) update. The SF team is forming an ISO WG to define standards for digital engineering concepts and vocabularies. The DVM team is validating the DVM Concept Model.

If you interested in taking part, please contact Sean by emailing Sean.MCGERVEY@3ds.com.

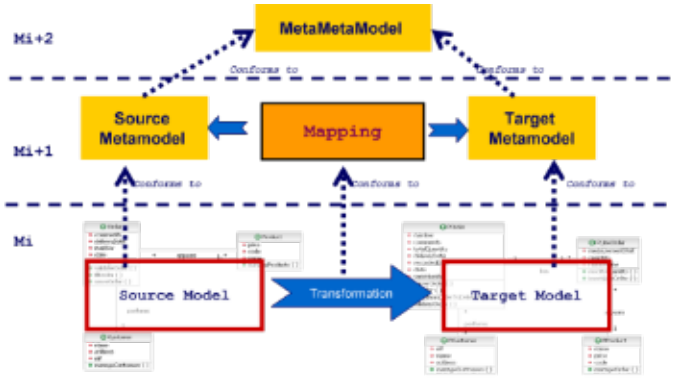
DEIX Web Page

Configuration Management Working Group

The Configuration Working Group has written an article with the working title *'Providing Truth, Trust, and Traceability to Modeling'*. Below is a summary of the article.

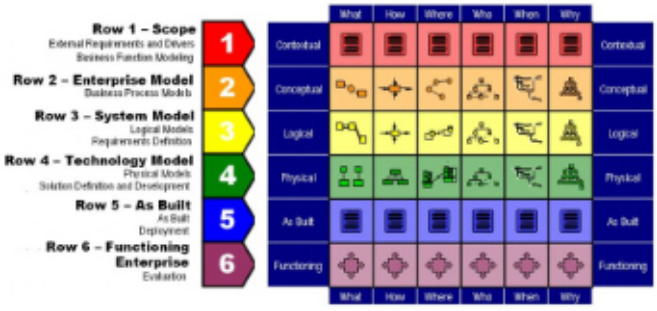
Theme: Systems Security in the Future of Systems Engineering (FuSE)

Concept addressed: Modeling trust



"Model Based Systems Engineering (MBSE) has taken off with many organizations striving for and attempting to achieve their digital twin. However, models and modeling are not a panacea for traceability issues.

Outdated information, unauthorized changes, poor information quality, data loss schedule delays, and late deliveries are still possible in a model-based world. In order for models to provide and sustain truth, trust and traceability appropriate Configuration Management (CM) must be planned and orchestrated throughout the modeling landscape. Truth allows users to choose what road to go down, Trust allows users cooperatively travel the road, and Traceability provides users evidence to guide decision-making.



Operating within these constructs will establish the model's integrity, prevent the use of outdated or poor-quality information, and ensure unauthorized changes to the model are not propagated. Efficient, effective, lean, and resilient operation, are all dependent on CM functions. By integrating CM into modeling execution frameworks, CM practitioners better ensure the developed architecture for modeling trust.

Modeling trust is a long journey, and every little hiccup undermines the sense of security in the new world burgeoning CM practitioners embark upon. CM exists to provide added security and reliable direction to better ensure enduring truth, trust, and traceability are available along the entire journey."

For more information about the article and the working group contact Leah Sutton on leah.sutton@collins.com

Configuration Management Web Page

Systems Engineering and Lawmaking (SELAW) Working Group

The SELAW Working Group will explore the application of systems engineering to the design and validation of laws. We have many initiatives, come join us as a charter member of INCOSE's newest working group!

The purpose of the working group is to advance the theory, practises, and education of laws of government, for example, legislative statutes, by applying systems engineering principles and discipline.

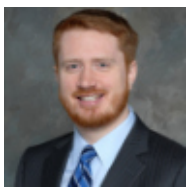
Below are our initiatives:

1. Document the defects and omissions in traditional lawmaking.
2. Derive law design standards based on systems engineering principles (e.g., the IEEE-15288).
3. Create a model of sanctions (fine, tax, tariff, subsidy, licensure, etc.) to select the most appropriate sanction to achieve the desired outcome.
4. Create a comprehensive cost model for laws.
5. Create of a risk-assessment model for laws.
6. Create standards for the periodic follow-up evaluation and validation of existing laws.
7. Establish credentials for designers (drafters) of law-design.
8. Create and publish a law-design manual based upon systems engineering standards.

www.incose.org/selaw

Training Working Group

The INCOSE Training WG welcomes the new co-chair, Stephen Wolf, of Northrop Grumman. Huge thanks to Gabriela Coe for all her work previously as she moves into new roles.



Have any trainings you want to share with the community? Please email Stephen at Stephen.wolf@ngc.com with your ideas!

Training Working Group Web Page

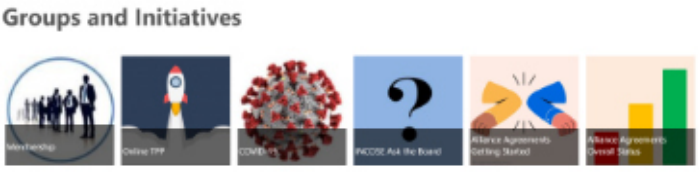
An Update on the Technical Product Plan (TPP) and Community Transformation Project

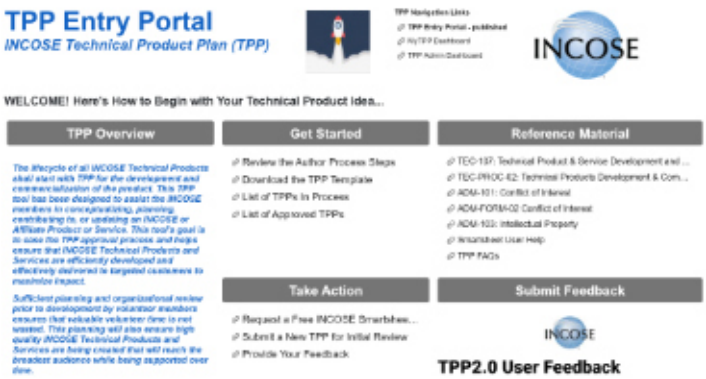
The INCOSE Technical Product Plan (TPP)

The lifecycle of every INCOSE Technical Product starts with a Technical Product Plan (TPP). The TPP process has been designed to assist INCOSE members in conceptualizing, planning, contributing to, or updating an INCOSE or Affiliate Product or Service. In April, an updated TPP intake and processing tool was launched which leverages two of INCOSE's newer IT Systems, Smartsheet and Teams, and their native features to streamline the TPP review and approval process. The goal is to ensure that INCOSE Technical Products are efficiently developed and effectively delivered to targeted customers to maximize impact.

We recognize the level of thought and planning that our members go through during this TPP process and that proper organizational review prior to product development ensures that your valuable volunteer time is not wasted while developing INCOSE Technical Products and Services. After 6+ months of development and testing, we are so excited to release the new TPP process to all INCOSE members and cannot wait to see what ideas come from the brilliant minds of INCOSE's finest System Engineers!

Come visit the new TPP Entry Portal and get started today! From https://connect.incose.org scroll down the page to Groups and Initiatives section and click on the TPP rocketship icon:





Community Transformation Project

INCOSE's IT services and capabilities have expanded and evolved significantly over the past few years, in response to an increased need for online and virtual collaboration among INCOSE's global membership. Many new IT tools, products, and platforms have been suggested, vetted, tested, and adopted by proactive INCOSE community members to meet specific community needs.

Now, the INCOSE IT Team is rolling this bundle of **expanded capabilities** out to the **general INCOSE membership** so that everyone has the opportunity to experience enhanced collaboration and engagement in service of INCOSE's mission. Over the next 6 months, the IT team will be working with INCOSE community members and leaders to bring each INCOSE community group, one by one, into the new paradigm of digital collaboration and communication.

The Community Transformation Project includes the major steps outlined below:

- Confirming that **Working Group and Chapter** leaders have access to Zoom for meetings, and Teams for group or project management, if needed.
- Establishing a new community collaboration

and communication hub using **Yammer** and new incose.net logins for INCOSE members.

- Assessing each community's content on the **Connect** platform and migrating that content to the appropriate new spot: **Yammer, community webpage, community intranet page**, or Teams document library.
- Updating each **community's public webpage** with INCOSE's new template and creating **members-only intranet pages**, where needed.
- Creating new **dynamic email groups** for community communications and retiring offline group email lists.
- Moving community events to the new TeamUp calendar platform.
- **Training** all interested members on how to use the tools effectively to make their INCOSE collaboration effective and enjoyable.

Big Move" and we need your help.

The IT team will be contacting Chapter and Working Group leaders to complete an assessment of their Connect content and determine suitable destinations for each item. Community leaders may choose to move their own content, or to request that IT move it for them.

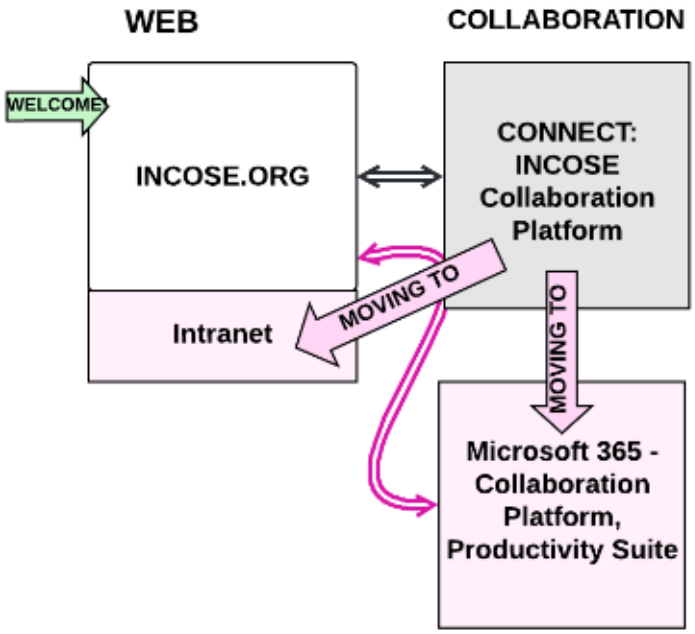
If YOU are a Chapter or Working Group leader, please keep an eye out for emails requesting your action to support the migration of your community's content. If you want to get started now, please click below to fill out a brief self-assessment form and get the process started for you and your community.

Words by Molly Kovaka

Community Transformation Project - Connect: The Big Move

For years, active INCOSE members have been using the Connect platform for Chapter, Working Group, project, and other community collaboration and document storage. However, Connect is based on a 9-year-old version of Microsoft SharePoint, which is hosted on an expensive private server, and INCOSE now has capabilities through Microsoft 365 and our web platform (Sitefinity) to provide much better user experience.

In 2020 and 2021 INCOSE leadership began moving select communities, documents, and processes to newer platforms, knowing that the Connect platform would eventually have to be retired. **Now, over the next 6 weeks, INCOSE IT is moving the rest of the content off of Connect and onto a combination of Yammer, webpage, intranet, and Teams platforms.** We call this "The



INCOSE Systems Exchange Cafés

The Systems Exchange Cafés are regular monthly virtual meetings run on Zoom. They are intended to be an informal conversation, and attendees can drop in and out to discuss ideas related to systems. Open to all.

Maple Café

11 AM US Eastern Time

incose.org/maplecafe

Oak Café

8 AM London Time

incose.org/oakcafe

Fir Café

9 AM Japan Time

incose.org/fircafe

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

Conference on Systems Engineering Research (CSER) Post Event Update

CSER 2022 – the Conference on Systems Engineering Research took place on campus and virtually over 2 days on March 25th and 26th.

Eighty persons from around the world registered to attend; including EMEA, Asia & Oceania, and the USA. Since this is a conference that is held traditionally in the USA it was no surprise that the number of Americans and Europeans registered was 41 and 42 respectively. The theme - Transdisciplinary Nature of SE: Impact on Traditional and Novel Applications – attracted many excellent papers of which 22 were presented over the two days.

CSER opened with a welcome from the two co-chairs – Torgeir Welo, who profiled the transdisciplinary nature of MTP research, and Annik Magerholm Fet, who could draw from her 25 years of experience applying systems engineering to sustainability topics. Dean Olav Bolland also graciously welcomed the participants with information about Norwegian University of Science and Technology (NTNU) and wishing we could have seen more persons on campus. Gerrit Muller from the University of South-eastern Norway (USN) engaged the audience immediately with a challenge to name the three most important concepts related to systems engineering.

Each day, the technical aspect of the program began with a plenary keynote. MTP Professor Antoine Rauzy kicked-off the conference with a talk entitled "Towards Executable Models in Systems Engineering" which generated a lively Q&A. Saturday's keynote by Professor Michael Wilkinson entitled "A systems journey - from practice to theory and back again" gave a similar topic with a slightly different viewpoint and equally lively audience participation.

A networking café closed each day in plenum giving everyone an opportunity to open their cameras and engage in informal discussion of the day, and other friendly exchanges.

The traditional PhD colloquia, called SEANET (Systems Engineering and Architecture Network), took place the day before CSER on March 24th. Eighteen PhD candidates joined this workshop which gave each of them an opportunity to ask questions relevant to their own research. We also invited Richard Malak of Texas A&M to open the SEANET with a stimulating look at "How to change someone's mind" and a second presentation from a finished PhD candidate who describes their PhD journey. The post-SEANET survey indicates that the attendees received good value despite the virtual nature of the interactions.

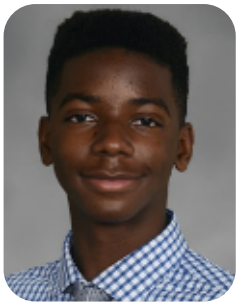
CSER is the brainchild of Stevens Institute of Technology and the University of Southern California, who continue to support each conference, including this year at NTNU. The International Council on Systems Engineering (INCOSE) also promote this event and provided discounted access to the KMD events program managers who provide both technical and administrative services. We were also grateful for support from Jotne and the Project Performance International (PPI).

The 20th anniversary of CSER is scheduled for March 16-17, 2023, with a theme "Systems Engineering Toward a Smart and Sustainable World" at the Stevens Institute of Technology, Hoboken, NJ. MTP researchers and PhD candidates are encouraged to maintain the momentum built this year and plan to write papers and attend SEANET.

Words by Cecilia Haskins, PhD, ESEP

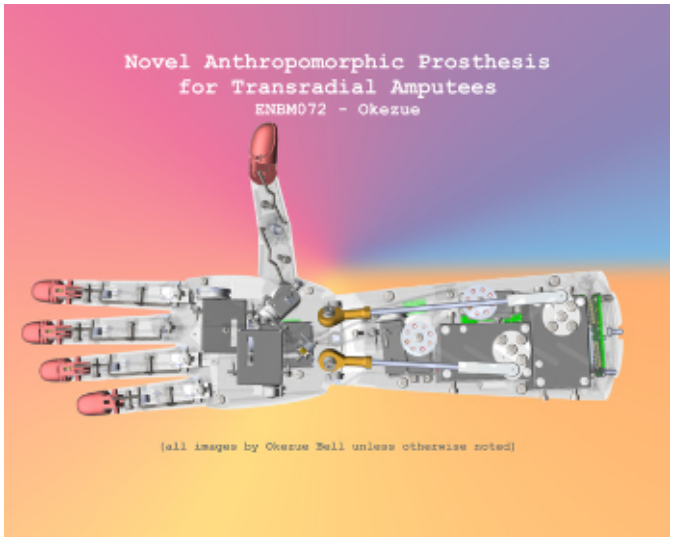
The INCOSE Foundation

Led by John Snoderly who chairs The INCOSE Foundation, the eleven board members are dedicated to making a difference in people's lives by advancing the development of systems thinking and systems engineering practices throughout the world. In this, we are closely aligned with the values and goals of INCOSE, the organization.



Okezue Bell, winner of the Bill Ewald Award

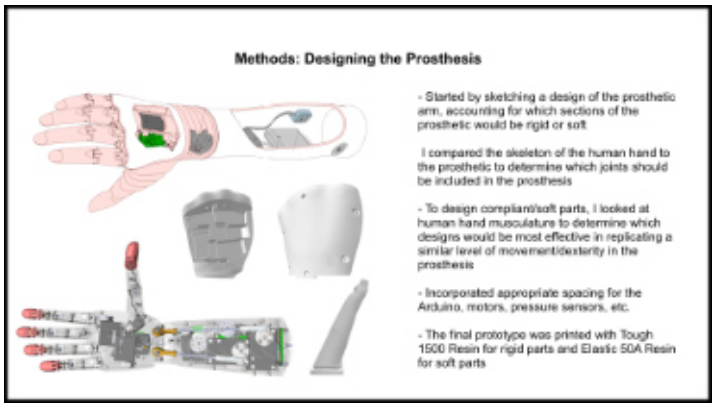
Many of INCOSE members know the work of The Foundation through its several scholarship programs. The newest of those is the Bill Ewald Award, established by Maryann Ewald to recognize Bill's outstanding achievements. The Awards are made through the ISEF program and the first one has just been given to a young man who is a junior in high school for his work with prosthetics. (https://projectboard.world/isef/project/enbm072---low-cost-and-non-invasive-upper-limb-myoprosthesis)



Our greatest achievement of the last two years has been a thorough strategic examination of how we can deploy our considerable human resources to create a global systems engineering community. With the full support of INCOSE, we are about to launch The Foundation Member program to engage people in geographic regions that seek to enhance their systems knowledge and information but cannot afford the privilege of INCOSE membership. Phase I of our program will make this possible for participants from two universities in Africa and eventually to many regions throughout the world. A complete description will shortly be sent to the entire INCOSE membership.

We believe this new initiative will help to build a global SE community, providing the benefits of systems engineering to a much broader cohort. Everything we do is only made possible through the support of our donors and for that, we thank you.

Words by Holly Witte



Illustrations of Okezue Bell's bionic hand prototype

www.incose.org/foundation

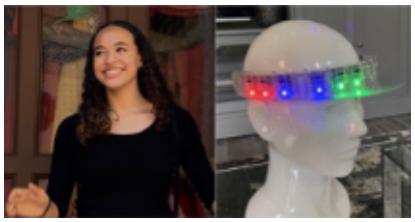
INCOSE Awards Thirteen Students at the 2022 International Science and Engineering Fair (ISEF)

INCOSE has participated in the International Science and Engineering Fair (ISEF) as a Special Award Organization since 2009 to provide awareness of Systems Engineering for very talented high school students from all over the globe. This year students were awarded a total of over $7 million in special awards from 40 organizations and INCOSE provided three cash awards and ten Honorable Mentions that totaled $11,000 in cash and non-cash awards.

Our awards include, a first and second place for the INCOSE Best Use of Systems Engineering, a new award donated by the INCOSE Foundation INCOSE Bill Ewald Socio-technical Systems Engineering, and ten Honorable Mentions. The first-place winner is invited to the INCOSE Symposium and offered a booth at which to exhibit their project. All other awards including the honorable mention awards are provided a one-year free student membership to INCOSE and free virtual admission to the 2022 International Symposium. INCOSE ISEF Special Awards were judged in-person and virtually this year for the first time; making all projects displays available virtually. The INCOSE Fellows lead the effort with ISEF and this year there were six INCOSE members that served as judges, two virtually and four attending the ISEF 2022 event in person. The ISEF was held in Atlanta, Georgia USA on May 8-13, 2022, with the Special Awards Announced on the evening of May 12th. INCOSE ISEF judges started by targeting ISEF Categories of projects that were likely to have systems engineering content, reviewing around 350 abstracts; from there we narrowed to 59 projects that we were able to visit virtual booths and using qualitative criteria narrowed to 28 projects for which we were able to conduct interviews with students either live or virtually. Every project is impressive, and the hardest part of our participation was choosing the winners. We applaud our winners and wish them success.

Tiffani Rai Gay - First Place INCOSE Best Use of Systems Engineering Award, Dr. Regina M Griego – INCOSE Fellow, Okezue Alexander Bell - INCOSE Bill Ewald Socio-technical Systems Engineering Award. The INCOSE Best Use of Systems Engineering awards are awarded to the best interdisciplinary projects that can produce technologically appropriate solutions that meet societal needs.

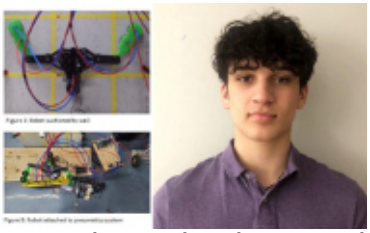
INCOSE Best Use of Systems Engineering Award of $1,500 and free registration and Exhibitor Booth at a future INCOSE Symposium



Designing a LiDAR Topographic Navigation System: A Novel Approach To Aid the Visually Impaired – Tiffani Rai Gay from Orlando Science Schools in Apopka, FL developed a haptic feedback navigation device for the visually impaired that is lightweight and low-cost. She notes that an estimated 2.2 billion people have a visual impairment and conventional white cane assistive technologies are ineffective in many

situations. Her device comprises a band of LiDAR sensors worn on a user's head. The headband provides colored light and vibration feedback as a function of the distance from the nearest object. Ms. Gay established three engineering goals: 5-10 ms latency between measurement and notification, a mass of less than .5 Kg, and a cost < $350. After experimenting with ultrasonic sensors and small LiDAR sensors, her third attempt used a new LiDAR that achieved the engineering goals. The LiDAR device was tested under several stressing and nominal scenarios and out-performed conventional white cane use. (https://projectboard.world/isef/project/86227)

Second Place INCOSE Best Use of System Engineering Award of $800, a 1-year free student membership to INCOSE, and free virtual admission to the 2022 International Symposium of the INCOSE



Detecting Cracks in Concrete Structures Using a Deep Learning Wall-Climbing Robot – Anthony Matteo Saturnino from Bishop Ryan Catholic Secondary School in Hamilton, Ontario, Canada designed a robot that can climb vertical walls and identify and provide the location of cracks in the concrete wall. The robot consists of a body with two arms, pneumatic suction cup feet and four motors controlled by a 3D printer board. The data collected by the robot is analyzed by a trained neural network to reliably identify the cracks in the concrete within a 10 cm tolerance. (https://projectboard.world/isef/project/86207)

INCOSE Bill Ewald Socio-Technical Systems Engineering Award of $1000, a 1-year free student membership to INCOSE, and free virtual admission to the 2022 International Symposium of the INCOSE

A Novel Robust and Low-Cost Anthropomorphic Myoprosthesis: Utilizing an Articulated Soft Robotic System and Convolution Kernel

Compensation-Based Non-Invasive EMG Decoding for Bionic Restoration of Upper Limb Function to Amputees – Okezue Alexander Bell from Moravian Academy in Easton, PA used a socio-technical approach and solution to design a low-cost, non-invasive, robust/ human-like prosthetic to enable complete biomimetic performance in a bionic hand, accurately integrating haptic pressure feedback in all fingers with a soft 3D-printed polyarticulated robotic design. He conducted multiple trials, collaborating, validating, and adjusting the software and hardware design to accommodate input from a dozen amputee stakeholders experiencing his device. Desired force levels, haptic feedback, dexterity, and performance were all achieved. The amputees reported the prosthesis was easy to use and that they could feel the pressure the device was applying. The device and associated algorithms are usable for other applications in neuromedicine and robotics. The prosthetic manufacturing cost was $369.41 and the non-invasive EMG decoding had a 94.6% accuracy and 0.43s delay which is an industry-leading metric. He hopes to work with developing countries to make this prosthetic widely available.
(https://projectboard.world/isef/project/86710)

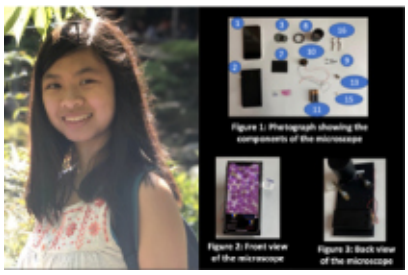
Ten Certificates of Honorable Mention, each with a 1-year free student membership to the INCOSE and free virtual admission to the 2022 International Symposium of the INCOSE

Landfill SCADA System: A Next-Gen Prescriptive IoT Solution Engineered To Detect, Transmit, and Mitigate Fugitive Methane Emissions via a Long-Range Supervisory Control and Data Acquisition System

Lavanya S. Natarajan from Viera High School in Melbourne, FL developed a system which continuously detects and mitigates methane emissions from landfills, collects data on soil

temperature and moisture levels, plus other environmental measures including CO2 , and transmits data to a central control system using an IoT approach. She developed a predictive algorithm which helps control methane levels. The need she is addressing: landfills are the third largest source of methane emissions, and optimized methane extraction is critical to avoid either explosions (since methane can auto-combust) or avoidable emissions. This system is scalable to handle multiple landfills, and is significantly better than current processes, which require landfill engineers to carry bulky equipment to multiple landfill sites and provide only occasional data measurements. This project showed effective use of systems engineering approaches from mission needs analysis and stakeholder identification and interactions to trade-off analyses to field testing. (https://projectboard.world/isef/project/83277)

Smart Leukemia Labs: A Low-Cost Microscope and Diagnostic Tool That Use Semantic Segmentation, Image Processing and Object Detection To Detect Acute Lymphoblastic Leukemia

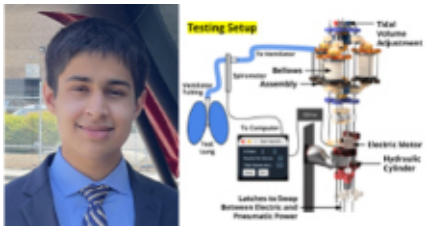


Adelle Jia Xin Yong from Westlake High School in Austin, TX found a way to provide a cheap, portable and reliable device that would diagnose Acute Lymphoblastic Leukemia without a trained expert. The project consists of software design, hardware design, data base searches and testing. She sought advice and help in improving the accuracy of diagnosis using morphological differences, decision tree on structural cell parameters and imagery recognition. By using the hybrid approach, she was able to achieve between 93% and 97% accuracy with a much shorter time than when experts have to review the data under a microscope. She was able to do this using a cell phone case, a styree sheet, 0.5mm glass sphere, plastic pipe, LED light, Polarized sheets, 4 AA batteries and a cell phone. The total cost without the cell phone was $28.00. (https://projectboard.world/isef/project/82754)

Speculor: A Comprehensive Teleophthalmology Platform for People Centered Eyecare

Hardit Singh from Cameron Heights Collegiate Institute in Waterloo, Ontario, Canada developed two versions of a low cost diagnostic instrument to diagnose eye diseases at an early stage. The problem he is addressing: The World Health Organization estimates at least one billion people have vision impairments that could have been avoided by proper diagnosis and care. Without dilating the eye (which is difficult or impossible in many underdeveloped regions of the world), his low cost (under $96 CAD) version can diagnose glaucoma. His high end version (costing under $240CAD) obtained better results in identifying glaucoma samples than instruments costing 50 times as much, and can identify AMD and even predict the likelihood of AMD developing. His invention is scheduled to be tested in both India and South Africa in the summer of 2022. (https://projectboard.world/isef/project/85133)

Designing, Prototyping, and Testing a Novel, Portable, Energy Efficient, 3D Printed Ventilator With a Diaphragm Mimicking Membrane and an Intuitive User Interface



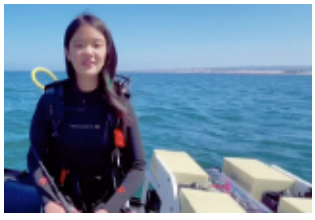
Harjaisal Singh Brar from Stockdale High School in Bakersfield, CA developed a 3D-printed ventilator, created with a modular design for low power

consumption use in remote areas, portability (affecting size and weight), and the need for no or limited training. His design includes 3-D printed parts, software, electrical, and mechanical designs. It also accommodates multiple power sources after recognizing the non-conformity of power sources in remote areas. The system uses bellows as an energy efficient source of compression. Testing was done with a commercial test lung and a spirometer on four simulated model patients, with phase 2 ventilator results indicating comparable results to that of a hospital grade ventilator. Power consumption is 2% of hospital grade ventilators. He plans to incorporate solar sources in future work.
(https://projectboard.world/isef/project/85623)

Eqwis: Rapid Animal Detection and Driver Warning System To Mitigate Animal Vehicle Collisions Using Artificial Intelligence

Vedant Malolan Srinivas from Eastlake High School in Redmond, WA developed a system that detects animals near highways and alerts drivers through intelligent road signs. The system uses an optical and thermal camera so animals can be tracked in the day and at night with an AI system that determines if there is an animal and whether it is moving towards the road. The systems has already been used on roads in Nevada and the student is now working with WA officials to determine the effectiveness of a animal crossing bridge in WA state.
(https://projectboard.world/isef/project/85071)

WAL-SEA: Development of a Homebuilt, Multifunctional Remotely Operated Vehicle for the Study of the Near-Shore Ocean Ecosystems



Faye Lin from Mission San Jose High School in Fremont, CA designed, developed, and thoroughly tested a remotely-operated underwater vehicle which surveys and culls sea urchins. The problem she is addressing: without culling, sea urchins multiply and cause the collapse of kelp forests necessary for coastal ecosystems. Tests of the system showed it travels about 4 times faster than a human diver and can successfully operate at depths up to 200 feet (while the volunteer divers currently doing the culling can safely go to less than half of this depth). Other applications which have been identified for this system include oyster farm monitoring, kelp forest surveying, culling invasive lionfish, and collection of various underwater samples for research. This project showed effective use of systems engineering approaches from requirements analysis to iterative design and testing.
(https://projectboard.world/isef/project/86126)

Around the World in Eighty Days: Small Radiosondes on a Great Mission

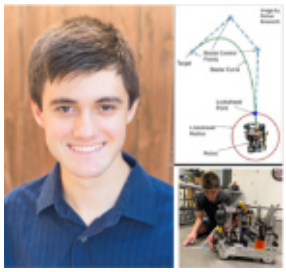
Amon Christopher Schumann from Robert-Havemann-Gymnasium in Berlin, Germany demonstrated an excellent example of multi-discipline systems engineering and thinking. He observed that several thousand weather balloons are launched worldwide to gather essential weather data. These balloons burst after a few hours adding to our already polluted world. His work addresses the short lifespan of current weather balloons and the pollution they cause by creating small radiosondes. He wanted his radiosondes to weigh less than conventional devices, last for several weeks, and have low cost. His design comprised a solar power supply, the latest environmental sensors, homemade lightweight and low gas diffusion balloons, a small camera, a communications subsystem, and APRS telemetry module. His device had a mass of 4.8g in contrast to a commercial radiosonde with a 97g mass. He successfully flew fourteen balloons that have circumnavigated the Earth during multi-week flights. He validated his radiosondes by comparing his data to currently flying commercial radiosondes.
(https://projectboard.world/isef/project/82797)

Development and Construction of a Low-Cost Six-Axis Robot Arm

Noa Sendlhofer from the Academia Engiadina in St. Moritz, Graubunden, Switzerland showed us how just using information gathered from internet searches he was able to gather a broad set of knowledge in the fields of mechanical engineering, electrical engineering, computer science, mathematics and physics. He used this knowledge to develop a six-axis robotic arm that could hold more than 3 Kgd out to a distance of one meter with a repeatability of +/- 3.mm. With the sensors on the arm, he was able to locate objects, grab them and manipulate the objects in the six axis. He used a set of standard software library in conjunction with his control applications running of a distributed system to optimize the hardware needed. He was able to use industry standards to allow the robot to work within the software framework. The use of system engineering methods allowed him to make a six-axis robot for far less that it would cost otherwise ($4472 vs $72,800). The project was not intended to be a commercial venture but to be used for educational purposes. (https://projectboard.world/isef/project/85181)

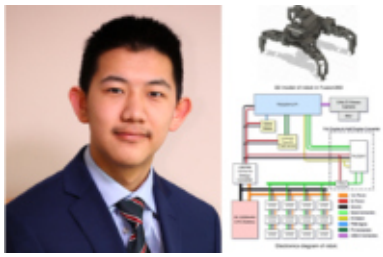
PathFinder: Novel Inverse Kinematical Path Tracking for Autonomous Vehicles Using Pure Pursuit and Bezier Curves

Rohan Bosworth from Poway High School in San Diego, CA developed a solution to the shortfalls of motion planners for autonomous cars without precise real-time correction. Autonomous cars have become a safer and more efficient alternative to driver-operated vehicles although they often fail to accurately respond to a dynamic environment. He developed PathFinder around a Pure Pursuit algorithm that follows a smooth Bezier Curve, defined by four control points to efficiently, smoothly, and quickly track a solution path which was tested against the criteria he established. Pathfinder was able to reach target points with less than an inch of error, excluding outliers, and traveled to target points twice as fast as control methods in simulation. (https://projectboard.world/isef/project/85890)



Low-Cost Quadruped Robot With Rough Terrain Traversal, Obstacle Avoidance, and Autonomous Navigation

Zhao from Collingwood School in Burnaby, B.C., Canada developed a cost-effective walking robot (<$700) that could perform autonomous movement and navigation in unfamiliar terrain, avoid obstacles, and traverse through a variety of terrain types. He created the robot based on his own design using 3D modeling and he manufactured and constructed the robot that enclosed the electronics. The electronics included a vision system with augmented ground detection and used a novel fast voxel occupancy grid construction, enhanced path planning, and gait generation algorithms. The robot is capable of fully autonomous navigation without prior information about the environment; it avoids obstacles, detects slopes, and chooses different walking modes to navigate different terrain. (https://projectboard.world/isef/project/85136)



Congratulations to all the award winners and we look forward to seeing where the future takes you!

Words by Regina Griego

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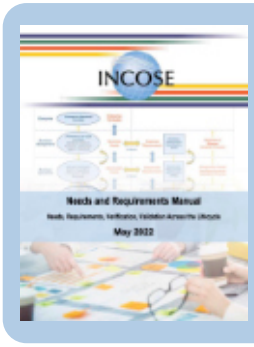

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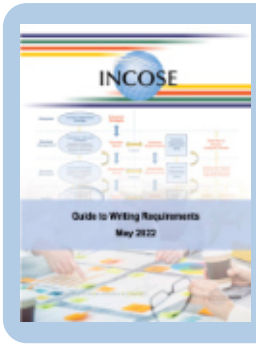

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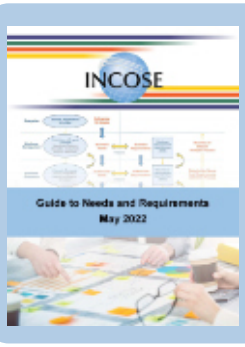

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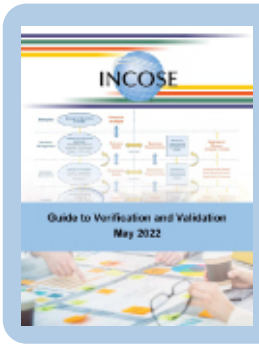

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hybrid event

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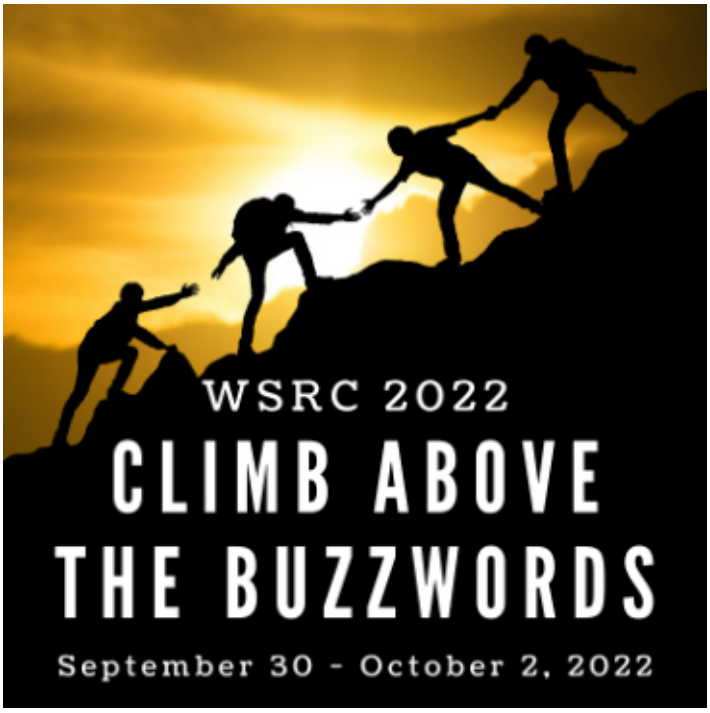
Upcoming Events



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- Q3 Newsletter, General Content (GC): 15 Aug
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A Better World Through a Systems Approach

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