EWLSE Updates

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Empowering Women
EWLSE Diversity Focus Update

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Empowering Women Leaders in Systems Engineering (EWLSE) sends our best wishes for your safety and health during the global pandemic as we continue to pursue our vision of a world where systems engineering leadership equally represents women and men. We have three diversity related panel reports for the second quarter. The American Society of Engineering Education's (ASEE) Corporate Member Council led "Diverse Voices from the Classroom", the first panel at the annual ASEE conference in June. The second panel, "The Role of Diversity, Equity, and Inclusion in the Future of Systems Engineering," was our first EWLSE event in Australia held at the SETE 2020 Virtual Systems Forum in early July. The third panel, "The Role of Diversity, Equity, and Inclusion in Sustaining Earth's Future," was our EWLSE panel at the INCOSE International Symposium 2020 in July. Please see separately written articles for each event following this short update.

For other news, the EWLSE Pubs team; comprising Lisa Hoverman, Alice Squires, and David Long; continues making progress on our *Letters to My Younger Self (LTMYS): How Systems Engineering Has Changed my Life*. 26 letters—written to 13 younger men and 13 younger women—give insights on the systems engineering journey. We plan to publish LTMYS, already INCOSE Impactful Products team approved, in 2021. A second EWLSE team; comprising Heather Feli, Alice Squires, and Marilee Wheaton; is progressing on a future Springer Hill book series for women authors: Emerging Trends in Systems Engineering Leadership. We anticipate around a dozen chapters.

Whether new to systems engineering or practicing for decades, if you are seeking a systems engineering mentor or ready to be a systems engineering mentee or both, please sign up here: https://bit.ly/2G6TJPL. And if you are passionate about helping with our mentoring initiative we need you, please contact use at incose-mentor@incose.org.

How do you advocate for women leaders in systems engineering? Please send your stories to ewlse@incose.org.

Diverse Voices from the Classroom

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Cynthia Murphy-Ortega (Chevron Corporation), supported by Stephanie Amrite (National Instruments) and Alice Squires (Washington State University), led the panel "Diverse Voices from the Classroom" for the American Society of Engineering Education's Corporate Member Council where recent engineering graduates shared their transitioning experiences from student to workplace. A short background and some lessons learned from each panelist is below.

Sarah Heywood (Figure 1) graduated October 2018 from Georgia Institute of Technology earning a bachelor's in aerospace engineering and currently supports The Boeing Company's planning and management. She found college classroom diversity a big positive change; more women came into her discipline at Georgia Tech than in high school. However the university could improve by continuing its diversity and hands-on activity support after admissions. When it came to industry, corporate representatives would come to

Figure 1. Sarah Heywood Enjoying Large Fumaroles in Hverir, Iceland

the university and share information on the company. Now she has been in industry; she appreciates Boeing's STEM outreach initiatives to many different groups and younger ages she did not experience as a student. One difference she found when it came to diversity acceptance was the university preferred you accepted your peers, the workplace expects it. At work, she said you either love your co-workers or you are done. She appreciates her workplace encouraging diversity and inclusion.

Owen Paul (*Figure 2*) graduated May 2018 from Florida State University with a mechanical engineering bachelor's degree and is the student ambassador technical program specialist at Mathworks. Owen noticed great diversity at Florida State and he appreciated finding peers who understood his family background from the Caribbean, but he did notice there were not as many women and especially he found all male teams did not perform as well as his teams with both women and men. He had two universities belonging to his program, and thought they could have better integrated the two universities within the classroom instead of students choosing separate classroom sides and forming teams only from their own university. When it came to industry, Owen found even greater diversity by participating at an international level. He found it daunting at first but it has been a great experience working with people from around the world and sharing different cultural experiences. For him, understanding the different experiences really made it feel more like a team.
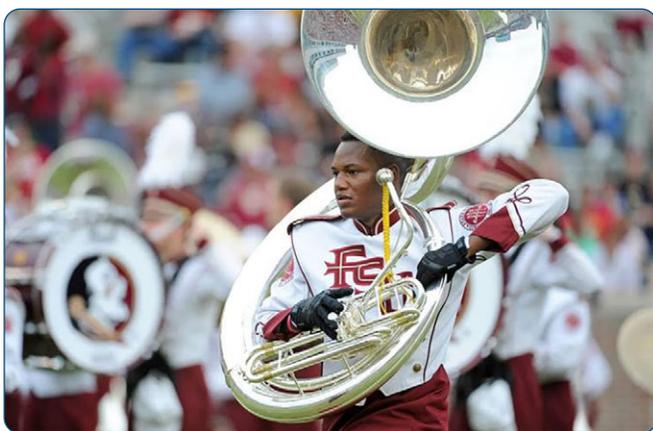

Figure 3. Sarah Ben Rejeb Hiking Mt. Fuji at 5am

Sarah Ben Rejeb (*Figure 3*) graduated May 2020 from Montreal, Canada's Concordia University with an electrical engineering bachelor's degree and is an electrical engineer at Digital Industries' Siemens Canada. She felt she belonged more in university because the diversity—she found both people from her own background and many from other backgrounds— which enriched her experience as an engineer. Montreal is a diverse city and diversity reflects in the university and she found great diversity in her group projects. Expanding Owen's gender diverse team value point, she provided an example where an all-male team designed an innovative bathroom but forgot to include sanitary baskets for women showing a lacking diversity decreased the project's value in including all people. Her university encouraged self-expression and welcomed joining any group on campus. Her university had many clubs and groups with industry participation and this helped her forge relationships with industry. She completed an internship at Siemens the summer before her senior year and Siemens considered her an employee during her final university year allowing her to participate in Siemens training opportunities. This preparation supported her transition to industry. However, when she started at work, she found she was very different from everyone else there. She came from a francaphone (French speaking) province where the majority speak French and the minority speak English, at the university it was mostly anglophone (English speaking). When she moved to work

Figure 2. Owen Paul in Marching Band (High School and College) Playing the Tuba

at Siemens, everyone was mostly francophone, male, 30 and older, and, in her experience, women did not typically enter the sales and technical support division she was in. Being a woman, anglophone, and a visible minority, everyone wondered who was this young woman coming into the division? It was a very interesting experience but also very welcoming. Everyone shared their experience with her, as much as she wanted to learn, and they were very keen in teaching her what they knew.

The Role of Diversity, Equity and Inclusion in the Future of Systems Engineering

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"The Role of Diversity, Equity and Inclusion in the Future of Systems Engineering" panel (*Figure 4*), a paper presentations and invited talks series part, is one of the first Australia EWLSE events. The panel, originally planned for the SETE 2020 conference postponed due to the pandemic and reformatted to Virtual Systems Forum, took place at the end of June, beginning of July. The panel included challenges and success stories in this area and leading industry practices including panelist personal stories on the topic.

The following were panel members (*Figure 5, on the following page*):

- [Moderator] Serge Landry: Principal Consultant & Trainer at Equilibrant Force and INCOSE Director for Asia Oceania (https://www.linkedin.com/in/landryserge/)

- Ruth Harrison: Rocket Woman Founder (https://www.linkedin.com/in/rocketwoman/)

- Stueti Gupta: BlueKei Solutions Co-Founder and Director and INCOSE India Chapter President (https://www.linkedin.com/in/stueti/)

- Kathryn Burr: Systems Engineering Integration and Test Director at Boeing Defence Australia (https://www.linkedin.com/in/kathryn-burr-a94bba27/)

- Helen Williams: Director Transport Integrated Systems Capabilities, Transport for New South Wales (https://www.linkedin.com/in/helen-williams-beng-mraes-ceng-58867430/)

The panelists covered various topics, some insights are below.

Serge Landry—Overcoming Data Biases

Data proliferation and rapid unchecked new data set use inside the latest applications regularly leads to disastrous results and public credibility loss.
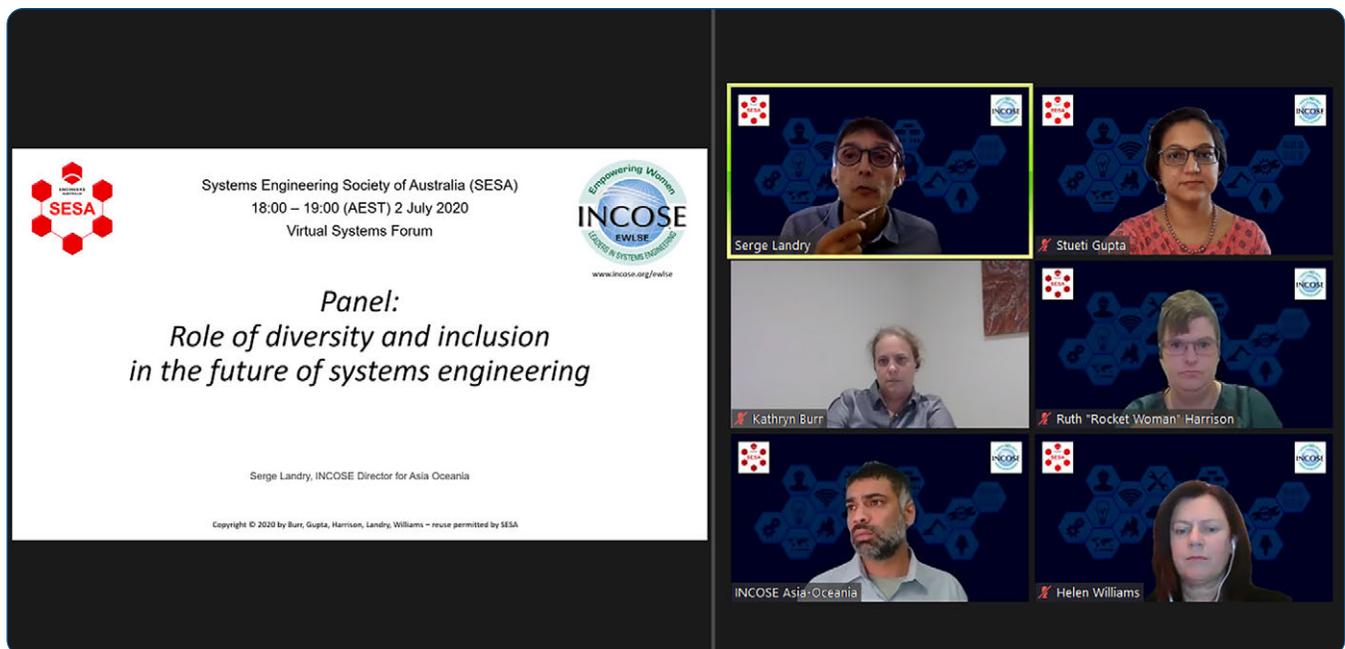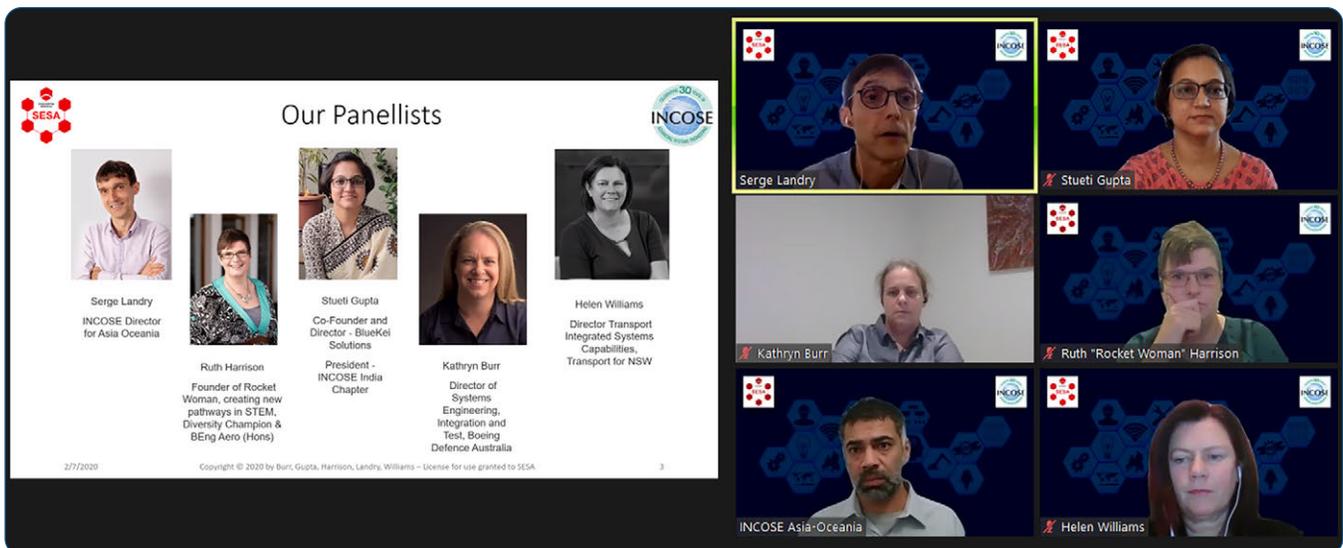

Figure 4. Panel Introduction

Figure 5. Our Panelist

If engineers are serious about achieving the intended results, they need to increase their data bias understanding to better apprehend:

- how to deal with data choices,
- their adequacy for solving certain problems and,
- how to rectify the possible data set imbalances.

Ruth Harrison—How do we grow diversity within STEM?

Systems engineering has a unique placement for diversity to have the greatest impact and ethics helps attract diversity and future engineering design. Diversity within systems engineering is vital going forward and must include considering different viewpoints at every development cycle stage.

Would you want to work for a company which does not care about the things important to you? Would you want to join an industry which does not care you have a different viewpoint or different experience?

Systems engineers can look to the challenges your user group may face, how to rememberyour system's legacy and what will be your project's external influences.

By increasing representation within Systems Engineering we will not only create more direct spaces for diversity but will also have a knock-on impact to ensure including more diverse thoughts in engineering projects.

Stueti Gupta—Thinking "Systems"

As it has been evident in the last few months, we have seen immense participation from industries not catering to healthcare but still coming together to manufacture ventilators in preparing to meet the healthcare system's needs and addressing the pandemic. And there are many solutions at the ground level not covered in the news channels, but were innovations by communities fighting the pandemic. Did we include them to solve any past healthcare problems when there was no pandemic, even though they are part of the system? Do we implicitly assume we cannot involve them even though they are part of the system?

The call for action and why it matters. It is important to be contextually and culturally sensitive as not everyone sees the world through the same lens, have the commitment and courage to bring more voices to the table, be curious and empathetic to how others see and dissect the problem at hand and thereby make informed design choices and build what we will use. Perspective diversity will help uncover why systemic events happen and help understand the system structure, the relationships, and mental models of people in the system influencing the structure and behaviour.

Kathryn Burr—Intrinsic Barriers to Diversity

Systems engineering is fundamentally about managing risk. The ability to assess risk comes through experience in a domain or through longevity within a systems engineering lifecycle. As an inter-disciplinary approach, systems engineering practically requires an engineering background before moving into systems engineering. This creates difficulty for those outside the domain or early career engineers to bring new, diverse ideas into a systems engineering program. Often, incremental improvement is the best achievement, rather than transformational improvement.

Some ways we can address the barriers are:

- Make diversity in team composition a priority by including experience balance and an outsider's voice
- New pathways for early career engineers need to help them enter systems engineering programs
- Make space for non-engineers within systems engineering teams

Helen Williams—Members' value proposition for SESA

After hearing how perspective diversity can create a better outcome, SESA should provide a collaborative and collegiate space for a diverse range of engineering, technology, and human centred disciplines from various industries, an environment which leverages and integrates knowledge and experience. The question becomes how to attract and retain a diverse membership, embracing all diversity forms. We should focus on identifying who is our current and future membership, understanding their needs and expectations, and continually evolving the professional society's offering and delivery. Through leadership and culture, we can achieve engagement and thereby growth and increasing group effectiveness.

Learn more about EWLSE vision and mission here—http://incose.org/ewlse. To contribute to Diversity, Equity, and Inclusion within systems engineering community, please contact the INCOSE EWLSE leadership team.

The Role of Diversity, Equity and Inclusion in Sustaining Earth's Future

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We had the privilege of hosting this panel discussion at the first International Symposium 2020 virtual event (*Figure 6, on the following page*). We explored how our ability to integrate diversity, equity, and inclusion (DEI) in our approaches and practices will affect the planet, its resources, and the human race's long term sustainability. As the more diverse world population and increasingly interdependent global community trends continue, underrepresented communities could impact imbalances in access, opportunity, and power having far-reaching negative effects on the planet's future.

We started off by sharing what it is we mean when we use the terms diversity, equity, and inclusion.

- Diversity is appreciating and respecting all the ways people differ not strictly visible differences (gender, age, race, disability). It is about diverse thinking achieved through creating a team with diverse personalities, thinking styles, working styles, background, expertise, and life experience. The question we seek to address is, "Who has a seat at the table?"
- Equity is having equal opportunities and support to succeed and grow. The question we reflect on is, "Who is trying to secure a seat at the table but can't?"
- Inclusion is a sense of belonging and here the question is, "Has everyone's ideas been heard in a respectful manner and not just tolerated?"

Addressing DEI is important to potential engineering growth and innovation. It creates opportunities to adapt and find creative approaches to the engineering grand challenges we face, including the United Nations Sustainable Development Goals.

As stated earlier, diversity is not strictly visible differences. It is creating teams with diverse thinking and as a result the team members

Figure 6. Diversity, Equity, and Inclusion in Sustaining Earth's Future Panel.

will experience multiple viewpoints, have their own views and contributions challenged, and in the process, formulate sustainable solutions achieving better results for the world's future.

This will only work if the environment is also inclusive. Inclusion is creating the space team members, customers, and communities work and live in and have a sense of belonging. When team members are their authentic selves in the workplace and feel valued, they willingly sharing their thoughts and ideas. In both instances, research shows diversity and inclusion encourage better creativity and innovation.

In the following paragraphs, we share thoughts from four vantage points.

Stueti Gupta. Sustainability is meeting the present needs without compromising future generation's ability to meet their needs. As Nelson Mandela said, "It is in your hands, to make a better world for all who live in it," the simplest and maybe the toughest is starting with oneself.

We need to deepen our system challenge understanding and keep educating ourselves. We need to recognize and test assumptions as our learning and experiences condition our thinking. It is time to uncover what implicit assumptions we may hold.

We need to build micro habits to initiate the action. We cannot solve the grand challenges in one day. Employee Resource groups, Business Resource groups, community groups, and working groups are great forums for underrepresented voices to build community and bring impact. The engagement in these forums can help address system challenges by defining local and global strategies.

Finally, silo approaches have limited our ability to build a comprehensive understanding of system challenge's interconnected nature. Systems approach will help form the common ground for cultural changes, enabling us to better forecast or understand policy decision outcomes with not just technical analysis but the underlying structure, interconnectedness, feedback loop impact, and delays. This will empower us to synergize and collaborate when generating and using evidence based on concepts and formal methods.

Our approach to sustaining earth's future is only possible when we go beyond our siloes and think "systems." Band-aid fixes or ad-hoc solutions will not work anymore.

Lamona Rajah. My position was how a DEI mindset may accelerate environmental sustainability effort adoption at community

grass root level. However, lacking cultural intelligence, ignorance, beliefs, and assumptions about how solutions, developed for a developed market, integrate into developing markets are barriers. We should address mindset barriers and find ways to overcome them. We discussed a few tips to start this journey:

Challenge our beliefs about talent. Perceiving the world solely through our personal worldviews causes blind spots, because we look for what we already know. Talent in local markets may look different, speak differently, and approach problem-solving differently. Leverage knowledge, skills, and talent in local communities to develop relevant sustainable engineering solutions to human issues.

Harness indigenous knowledge, skills, and historical solutions to problems. Learn problem solving customs and social norms. Refine existing knowledge and skills if necessary and develop new ones through collaboration. Disrupt relying on external expertise to develop solutions not consumable by local communities. You may need to return to language barrier and difference basics in understanding words and phrases from culture to culture.

Understand cultural norm's dynamics. Know where knowledge and power reside. For example, some cultures feel less comfortable engaging superiors or people in authoritative positions and may be uncomfortable challenging ideas from superiors or sharing ideas unless invited to do so. In these situations, the way we position proposals and seek information is critical.

Beyond applying cultural intelligence, learn advocacy and allyship to tap into "protected" knowledge and gain buy-in for solutions. You must learn where power lies, and who to get buy-in from first, this serves as a catalyst for accelerating acceptance. Allies from the community help win over detractors and gain public support for interventions from within the group we are trying to influence.

Make a conscious effort to learn more about inclusive behaviours to improve cultural intelligence and truly embrace and leverage diversity.

Alice Squires. According to the Global Challenges Foundation "... the next 50 years will set the pace for humanity's survival in the next 10,000 years." My position is division over how to proceed with global challenges drives exclusive behaviour and inequities remaining largely unrecognized today by those involved, creating obstacles to our achieving the best possible long-term solution for our planet and the human race's future. I propose the following:

At the individual level, we need to develop competencies in cognitive and affective perspective-taking—followed by cognitive and affective empathy. Cognitive perspective-taking supports the ability to infer another person's thought or beliefs. Affective perspective-taking supports our ability to infer another person's feelings or emotions. The empathic equivalent allows us to think and feel what others think and feel; to take on another's mental perspective and share the emotional experience.

At the team level, global decision-making teams need to be both cognitively diverse and representative of the global community. The focus needs to be on enabling thought diversity in an open environment where each person has communication equity and psychological safety. We need to seek multiple perspectives and embrace a paradoxical mindset (the ability to seamlessly hold two opposing ideas in our mind—both true) to effectively develop superior and equitable global solutions.

At the global level, we need to embark on a path to developing a total optimal affordable—as measured by Earth's ecosystems—global solution for all people supporting Earth's sustainability for as long as feasibly possible and also supports the even longer term human race viability.

Alan Harding. My position combines two topics about which I am passionate—sustainability and DEI. I made two points:

Clearly "sustaining earth's future" requires us to meet the UN Sustainable Development Goals, which comprise 17 goals further broken down into 174 targets. Each goal and target demands a socio-technical system change, which may be a change in governance, behaviour, or even culture—hard to achieve. Getting away from the

jargon, this means people are at the heart of the systems needing to change. All the evidence suggests we must have these stakeholders make these changes, and therefore we must include everyone concerned and ensure they have an equal (equitable) seat at the table.

My second point is simpler: We need to apply systems approaches to help address the Sustainable Development Goals and do it to the best degree possible. The evidence is clear; organization and team performance is best when the team fully embraces all diversity aspects in an effective and integrated team. Therefore, in forming systems engineering teams we must have DEI at our thinking's forefront. For more background on this point please go read "Towards a more inclusive INCOSE" published in INCOSE INSIGHT Volume 22, Issue 3.

To conclude, the following quote by Susan Freeman-Greene, Engineering New Zealand's CEO, captures this dialogue's essence,

"Unless engineers represent the world they serve and the communities they serve, then engineers will design a world that doesn't reflect those communities and that perpetuates these global challenges."

How are you participating in this conversation?

Please feel free to connect with us to continue the dialogue.

Mentorship: A Win-Win Proposition
Heather Feli & Terje Fossnes

Mentee's Perspective by Heather:
I was registering for International Symposium 2015 in Seattle, Washington and there it was—A checkbox

> *"Would you like to participate in the mentorship program at IS2015'?"*

Even though I had been an INCOSE member since 2009, attended two International Symposiums (IS) and became a Certified Systems Engineering Professional (CSEP) in 2014, I still felt alone, shy, and overwhelmed at the symposiums. Perhaps you have experienced it too? The anxiety of finding a table to join at meals or the awkwardness of attempting small talk at the social events.

Thankfully when asked 'Would you like to participate in the mentorship program at IS2015'? I checked the "yes" box. I did not know it at the time, but I had hit the mentor jackpot. My IS2015 assigned mentor was Terje Fossnes. Yes, Terje and I had the typical mentor-mentee conversations; and yes, I got more out of IS2015 than any symposium before. That was just the beginning of a winning proposition.

IS2015 advertised a new working group called Empowering Women as Leaders in

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FYI
Information and Tools for Now

Presidential Feedback on the First-Ever Virtual IS
Hello Everyone,

We held a meeting this week with the Past Presidents Advisory Group (PPAG). At the meeting and after we received a big thank you for our efforts and notes of encouragement. I would like to forward you some shared words—"What a long way you have come in four months!! I am so impressed at the agility of the Board and INCOSE leadership in general!"

"The creation of a virtual IS at only a couple of months' notice, the adaptation of INCOSE operations and the delivery of new, remote services to the membership are a huge credit to all those involved, and I would encourage you to share this message with the Board and with the leadership in general. INCOSE continues to be a very special organisation with a bright future! Congratulations!!"

"Great job. And let us know if there is anything we can do to help."

Once again, thanks everyone for great efforts, diligence, and passion to keep INCOSE moving forward.

Cheers, Kerry

Systems Engineering (EWLSE). I could not find the meeting details, so I asked Terje. Within a few hours Terje had the EWLSE meeting time and location and personally introduced me to EWLSE founder, Dr. Alice Squires. Terje continued to check in and introduce me to other INCOSE members including his wife, Cecilia Haskins. We all joined EWLSE propagating the win-win.

Fast forward to 2016, I received an invitation from Alice Squires to be a panelist at IS2016 for Empowering Women as Leaders in Systems Engineering in Edinburgh, Scotland. My first time speaking at an International Symposium. During my presentation I looked over the audience, front and center was Terje (and Cecelia a few rows back). Two of the busiest INCOSE members had "shown up" for me.

It was also at IS2016 I started hearing about INCOSE's new Technical Leadership Institute (TLI). Terje connected me with all the TLI information. In 2018 with a nomination from Alice with Terje's support I applied and TLI Cohort #4 accepted me. As part of TLI Cohort #4 my INCOSE network immediately grew by 20 people and my ties to INCOSE grew exponentially. This represented the win-win-win proposition for me, two seasoned members, and for INCOSE at large.

This brings us to present day. INCOSE's Technical Leadership Institute inducted me at IS2020 last month. Our cohort successfully completed two IS products—an international leadership panel and a published paper. I am currently co-editing the Emerging Trends in Systems Engineering Leadership book with Alice Squires and Marilee Wheaton.

What originally was a 4 day IS mentorship in 2015 has evolved into 5 years. Terje is not officially my mentor and we followed no traditional mentoring "rules." We have made it a tradition to meet at each International Workshop or Symposium to catchup and we email. The relationship has included Terje generously listening, providing feedback, sharing stories and experiences, helping me making connections, and often just being a friendly person in the room at INCOSE social events. This emphasizes not all mentoring relationships need to be formal, regimented, or

Terje & Heather at IS2019, Orlando.

time and effort consuming to be effective, and to encourage others to engage in this process.

I cannot quantify the impact this chain of events has had on my life and career over the last 5 years. The word "gratitude" does not feel adequate.

- *Cecilia Haskins*—Thank you for your generous social capital and positional power. You have a gift for bringing others along and not letting us get lost in the crowd.

- *Alice Squires*—Thank you for your continued opportunity, time, and support gifts. I am so grateful to you for helping me make TLI's two years of leadership experience a reality for me.

- *Terje Fossnes*—You embody mentorship's truest form: Generously listening, being supportive and trust worthy, helping me navigate and network within INCOSE, advocating for me, and most importantly consistently being there. These last 5 years have not felt like mentoring but more like conversations with a friend. I am so grateful

when I look back at my experiences and opportunities over the last 5 years and see us meeting at IS2015 was the catalyst.

Mentor's Perspective by Terje:

Volunteering to be a mentor at IS2015 has been, in retrospect, a very personally rewarding decision. At the time I checked the "yes" box in my registration form, I did not have a clear picture of what I was committing to, other than possibly making the symposium experience easier to navigate for another INCOSE member. I am very thankful Heather and I matched to each other.

In addition to my accumulated knowledge and experiences about INCOSE, I perused the INCOSE website in order to prepare for the assignment. In my mind, sharing information and knowledge works best as a dialogue. The mentorship program also encouraged 'meet and greet' opportunities with people in different INCOSE leadership and influential roles, as well as other symposium attendees during lunches and breaks. At the same time, the mentorship program did not prohibit other commitments, presentations, or events I wanted to attend during the symposium.

Heather's dedication to systems engineering and INCOSE, to better herself by learning from others, and her challenging me on many levels motivated me. It soon turned out we also had great personal chemistry and respect for each other, which made the interaction easy and enabled good communication. It has been— and still is—an inspiration to continue the interpersonal professional relationship started 5 years ago.

It is our hope this editorial can inspire and motivate others to engage in mentoring and informal information sharing about INCOSE and systems engineering, with or without an organized mentorship program.

[*Editor's Note:* Nancy Rundlet proposed the first IS mentor program for IS2013 in Philadelphia and periodically revived it at other events].

[*Lisa: a note from Cecilia*—give a point of contact for "finding a mentor"—use me if you want to Cecilia.haskins@incose.org]

FYI

Information and Tools for Now

System Engingeering Return on Investment

One of the most common question for Systems Engineers is to justify the Systems Engineering effort – as it looks like "extra work." What is the Return on Investment? This webinar showcase explores the Return on Investment from Systems Engineering. Eric Honour presents over a decade of research results into the quantified systems engineering value. These major results, based on interviews with 51 programs, show the statistically proven relationships between systems engineering activities and the technical, schedule, and cost success of programs. The results show nearly all systems engineering activities correlate with better project success, and provides detailed values beginning to answer how much is enough. Results also show, somewhat surprisingly, current systems engineering activities do not correlate with the technical quality of the product systems. If you missed this truly seminal information this showcase is an opportunity to catch up.

Additionally, there will be a Zoom Q&A – on Friday 25th September at 6pm BST – see the Webinar Showcase home page to register.