

MEMBERS NEWSLETTER

March 2019 - Q1



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President's Corner

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



It is hard to believe that I have already completed my first year as the President of INCOSE. It has been my honor to serve this great organization in this role, and I am looking forward to what we can do together during the next year. I fully expect 2019 to be a very impactful year for INCOSE.

We have recently completed a very successful International Workshop (IW). In addition to setting a record for attendance at the IW, we had a number of high-value strategic sessions and outcomes that should impact both INCOSE and the systems engineering community in general.

At the IW, we had 541 talented professionals highly engaged in technical work in their areas of systems engineering. One of the reasons that I continue to say that my favorite event anywhere is the IW is the level of interactive engagement of the people in the IW. Everyone has the opportunity to get involved and contribute, learn, share their thoughts, meet others with similar interests, network, and hopefully build lasting relationships. The IW allows participants to learn about the range of INCOSE technical projects and choose to support those projects that interest them. It is unique in the way that it focuses on engaging in and progressing a wide range of technical work rather than providing a set of predetermined presentations.

I would like to highlight a few of the many results from the workshop that can impact INCOSE and systems engineering for the future.

- The Board of Directors (BoD) conducted strategy sessions prior to the official start of the workshop that resulted in actions to address building a services portfolio and business model, determine how INCOSE can use systems engineering and approaches to help address societal grand challenges, define a streamlined events model that will help implement events for specific targeted needs, and establish new approaches and opportunities for membership engagement.
- There was a special strategy session with senior leaders from nearly a dozen associations, academic organizations, and government agencies to define the roadmap for the Future of Systems Engineering (FuSE) initiative that was kicked off at the IW last year. FuSE is focused on what is needed for systems engineering to be able to address the change, increasing complexity, and the learning, discovery, and evolution that accompanies more dynamic environments. During this session, the team established a set of priorities and defined projects that they will conduct through 2019. These projects include: (1) Systems engineering engagement-



Interactive participation in working groups and projects



We were also thrilled to have nine past and current INCOSE Presidents in attendance

building the awareness and community understanding of systems engineering for future application, (2) systems engineering for artificial intelligence and artificial intelligence for systems engineering the application of systems engineering to support artificial intelligence (AI) systems and the application of AI to support systems engineering activities, and (3) theoretical foundations of systems engineering—developing a stronger theoretical basis for systems engineering.

- We highlighted our progress on the development of a professional development portal, including some insights into the content of a first release planned for later in 2019. This included a Town Hall presentation and interactive discussion. Although we plan for the portal to be a comprehensive systems engineering professional development ecosystem, we will release it incrementally, starting with a minimum viable product (MVP) that provides an extensive search of professional development assets.
- The Systems Engineering Certification Program took steps forward through renewing the certification equivalency agreement with GfSE (German Chapter) and approving academic equivalency agreements with a few universities for which detailed evaluation of their curricula have demonstrated equivalency with the knowledge exam content.
- Additionally, there was excellent technical work across a large number of working groups and initiatives, including continued impact from the model-based systems engineering focus.
- The opening plenary session included the installation of the 2019 Board of Directors. I would especially like to welcome the

new members of the BoD: Kayla Marshall (Secretary); Lisa Hoverman (MarCom Director); Tony Williams (Sector 1 Director, renewed); and Gretchen Peacock (Deputy Technical Director).

- As we look forward, we need to continue to focus on the future needs of both INCOSE and our discipline. The following are priorities that were identified by the BoD for 2019.
 - Make progress on the newly approved strategic objectives:
 - Premier—make INCOSE the premier choice for systems engineering professional development needs by engineering professional everywhere
 - Future—ensure INCOSE leads the engineering community in shaping the future of systems engineering
 - Value—enable INCOSE to deliver ever-greater value to a growing and increasingly diverse membership



Renewed Systems Engineering Certification equivalency agreement with GfSE



2019 Board of Directors

- Make progress on value streams aimed at meeting member needs. A value stream (VS) is a portfolio of related products and services that deliver value to INCOSE and its alliances. It has policies, people, tools, funds, and other resources that enable INCOSE to grow the value. These include:
 - Membership–portfolio of the aggregated intellectual capital provided by INCOSE members of all types (full, student, associate, and corporate) and the services through which INCOSE recruits, engages, influences, and retains members
 - Training–portfolio of offerings by INCOSE and/or its alliances of both in-person and online courses to enhance a professional's specific knowledge, skills, and abilities in a topic relevant to systems engineers
 - Certification–portfolio of offerings through which INCOSE confirms a member's competency in systems engineering
 - Events–portfolio of conferences, workshops, seminars, and other physical and virtual gatherings offered by INCOSE alone or with its alliances
 - Products–portfolio of books, papers, videos, standards, tools, and other tangible high-value outputs created and distributed by INCOSE and/or its alliances
- Increase the effectiveness of INCOSE by continuing our focus on:
 - Building and leveraging alliances–We can achieve more through teaming and collaboration. We are working towards a set of strategic alliances with common objectives and expected outcomes that help ensure both partner organizations and the systems engineering discipline obtain value from the relationships.

- Improving inreach across INCOSE–We will strive to integrate across our geographic and organizational boundaries to be able to engage all stakeholders and leverage the talented resources of the entire organization.
- Improved infrastructure and operations–We are placing significant emphasis on improving our infrastructure to better support the needs of our organization and members. This includes our IT infrastructure, membership engagement and support, internal operations, and global operations.

Finally, I want to mention that our International Symposium (IS) will be held in Orlando, US-FL, during 20-25 July (<https://www.incose.org/symp2019/home>). The bar was set very high in 2018, when we had nearly 1300 participants at the IS in Washington, US-DC. All factors point to this year's IS being a great event, including a very exciting set of keynote speakers and a diverse and high-quality set of paper presentations and panels. It will also include a set of paperless presentations on systems engineering practice, which we initiated very successfully in 2018. We have arranged for a set of invited content that will focus on topics that look at the future of systems engineering and extended applications of systems engineering. Join us at the symposium to engage in a breadth of INCOSE activities, listen to thought-provoking presentations about the state of the practice, network with others, visit the exhibition hall, and get involved in the technical program.



29th Annual **INCOSE**
international symposium

Orlando, FL, USA
July 20 - 25, 2019

**Engage with your colleagues from
the Systems Engineering community!**

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

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

**Mark your calendar now!
July 20 – 25, 2019**



President-Elect's Letter

Kerry Lunney, kjlunney@tpg.com.au

Reflections of My First Year

Hello All,

I am finding it hard to believe that the first year of my four-year term has come and gone. Was it what I expected? I have to say unequivocally yes and possibly more! Here is a small insight into my experiences this year:

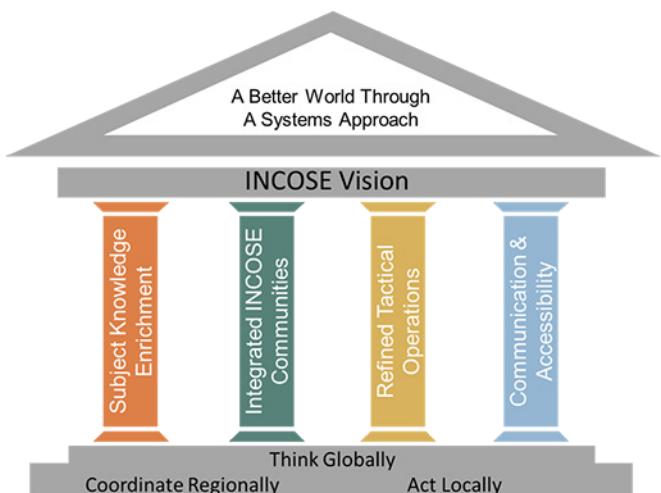
- Over 130 face-to-face INCOSE meetings across IW 2018 &2019 and IS 2018 alone
- Nine international events and numerous national events (in Australia), including presenting at 10 of these events, primarily in plenary and keynote sessions
- Four president/president-elect webinars
- One Town Hall meeting (at IW 2019)

This does not include my Board of Director (BoD) related meetings, running task teams, nor carrying out my day job working for Thales! From the perspective of supporting many meetings, working crazy hours, jumping from one time zone to another, and balancing the operational elements of INCOSE, while laying the strategic directions for the future, it is simultaneously energising, challenging, and at times, fun. However, none of this would be possible without the great, dedicated team of individuals on the INCOSE Board. For this, I am very lucky and most appreciative.

If I reflect on my vision for INCOSE, which I presented in 2017, I wonder what scorecard you would give me. Have I succeeded in progressing subject knowledge enrichment, integrated INCOSE communities, refined tactical operations, and communication and accessibility? Well, the short answer is, it is work in progress.

For subject knowledge enrichment, I can point to our efforts under the Future of Systems Engineering (FuSE) and Digital Transformation, as well as initiating the Grand Challenge Practitioners' Task. Likewise, the building of our Professional Development Portal is taking shape and will offer a great service to our members.

Our various communities are becoming more open and integrated, both internally and



externally, largely through better supporting infrastructure, common initiatives, and our increasing number of alliances. I also am optimistic of the newly formed Digital Information Exchange Working Group, enabling a closer integration of our working groups' activities and outcomes.

On the tactical operational front, we have made great inroads with policy reviews, refinement of our budget and financial accounting practices, the start of utilising professional services based on priorities, and improvements in our underlying IT infrastructure and website.

As for communication and accessibility, the entire BoD and I have made ourselves available to meet and answer members' queries to the best of our abilities. I am also leading the task to deliver a volunteer opportunities website that will serve our members and INCOSE to grow and prosper. In all of our undertakings, we have strived to think and act globally but always with consideration to balance the regional and local needs of INCOSE.

I will continue to move forward under these four pillars over the next 12 months. It should not prove difficult as these activities very much align with the vision of our current President, Garry Roedler. I even expect this alignment goes further back to past INCOSE Presidents such as Alan, David, John, and so forth, as we appear to build on each other's achievements while at the same time adjust and refocus where appropriate as time moves on.

Lastly, I would like to leave you with this picture of the diversity of skills, experience, competencies, and inclusion our members bring to INCOSE. After the conclusion of a very successful IW 2019, a few of us had the pleasure of participating in an escape room experience. I can only comment on the team I was participating in, and this is what I observed:

- Trainers were good at finding clues and presenting them but not working out the practicalities.
- Researchers gathered and gathered and gathered all information before pausing to work out what to do with it.
- The architects and designers were good at putting the clues together and bridging the gaps with the trainers and researchers.
- The engineers ran with the inputs from all others and executed the instructions identified from the clues.
- The chief engineers/Fellows tended to stand back, ask questions, and challenge an activity.

Who would have guessed this work behaviour would manifest in a game so quickly? I can only say we were missing someone with very detailed skills for precise execution such as a nuclear engineer or similar, because our



Out of the Escape Room with 12 minutes to spare!

motley systems team proved to be terrible safe crackers. Or possibly, we lacked someone strong in patterns? Either way, we did get there, and we did get out of the Escape Room with 12 minutes to spare. Go team!

All the best for a terrific 2019. Let's make it a good one!

Cheers,

Notes from the Board

Lisa Hoverman, marcom@incose.org

The INCOSE Board of Directors (BOD) recently held the Q1 Board meeting in Torrance, California, the site of the 2019 INCOSE International Workshop (IW). This provided the board with a wonderful opportunity to experience the fantastic offerings of both participating in the INCOSE IW, seeing firsthand what our over 50 Working Groups are working on, and working together as a Board to further INCOSE. As always, our Associate Director for Events, Nicole Hutchinson and our contractor, Karin Moens and her KMD Events team delivered a wonderful INCOSE IW—a huge Thank You to this team!

Meeting agendas were very full as the BOD covered a variety of topics critical to the current and future health of the organization

and systems engineering. This BOD meeting focused on welcoming new members to the Board of Directors, setting the pace and tone for 2019 and reviewing new procedures the BOD has in place. There was a deliberate focus on how everything we are doing must align with our strategic objectives, value streams, and initiatives. The Board welcomed the following new Board members at the INCOSE IW: Kayla Mar-shall-Secretary; Lisa Hoverman-Director, Marketing and Communications ; Tony Williams-Americas Sector Di-rector (re-elected); Don Boyer–Associate Director, Membership Engagement; and David Mason–Assistant Di-rector, Membership for Early Career Professionals.

Further the following positions and individuals were reappointed in their respective roles: Andy Pickard, Chief of Staff; Bob Swartz, Policy Management Committee Chair; John Snoderly as Grievance Chair; and Marilyn Pineda as Associate Director for Professional Development.

New appointments included Kevin Weinstein as Grievance Committee Awareness Deputy; Bob Kenley as Nominations & Elections Co-Chair; Troy Peterson, as the Future Strategic Objective Champion; Kevin Weinstein as the Value Strategic Objective Champion; and Marilyn Pineda, as the Premier Strategic Objective Champion; Approved Appointments for Strategic Objective (SO) Champion. Note the Strategic Objective Champions fill roles as Associate Directors on the Board.

Plannings for 2019 and 2020 were also a key focus. The International Symposium (IS), both 2019 in Orlando and 2020 in Cape Town, South Africa were topics of discussion, as well as new international activities like the Human Science Institute Conference and a potential international IW in 2020. Nominations and Elections are looking to recruit and vet candidates now for Board Positions opening in 2019—the following are leadership positions that we are looking for nominations for:

- President-Elect
- Treasurer

- Director for Academic Matters
- EMEA Director (Can only be nominated by a current Chapter President in good standing of an active Chapter within that sector)
- Director Strategic Integration

You can self nominate, if you'd like to serve, or recommend a great candidate who would fit one of these roles. Please reach out to our Nominations and Elections Chair, Alan Harding at alandharding@gmail.com with your nominations.

In addition to focusing on events, the Board discussed strengthening our strategic alliances by increasing our holistic approach to tracking and measuring the alliances and their impact. Other topics included focusing in on our strategic objectives and value streams to increase efficiency and highlighting synergies to increase their potential impact on the systems engineering community - training was one of these specific value streams we examined as we look to build out the INCOSE Professional Development Portal (PDP) with appropriate near and long term content. The PDP was demonstrated at the IW.

The Board looks forward to meeting to continue their work in Q2 in Indianapolis, Indiana in the US, the 25-28 April.

Why a Member Demographics Survey?

Don Boyer, D3Boyer@verzion.net

INCOSE has more than 17,000 members in various chapters, working groups, corporate advisory board organizations, and academia. However, we know very little about our members. Why does that matter? Without actual data, we end up making assumptions about members to guide priorities on initiatives, programs, events, and information that INCOSE plans and provides.

Membership, under the direction of the secretary (Kayla Marshall for 2019-2021), has a goal to better understand our members. We have planned several initiatives to achieve this goal. The first was to employ an outside researcher to conduct in-depth interviews of a set of newer members which they completed in

2018. The insights gained from the interviews helped in creating the second initiative which was ongoing through March 4th—surveying all members to understand the demographics of our membership. A third step will be to seek insights from members who have let their membership lapse to determine how INCOSE did not meet their expectations. A fourth step will be to invite members when they join/renew to let us know more about their interests, experience, and what areas/domains they are working in. This should help guide resources INCOSE offers and also facilitate in helping members find information relevant to their areas of interest.

Thank You to all who participated in our recently closed Member Demographics Survey. We appreciate your participation and look forward to sharing the insights from the data!

Already, we have gained some new insights into our membership. Did you know that we have members applying systems engineering in such diverse fields as finance, home appliances, mining, astronomy, and agriculture,

in addition to fields such as defense, space systems, academics and transportation? The areas members are currently reporting to be of highest interest are systems thinking and application, requirements, model-based and object-oriented systems engineering, architecture, and systems of systems, although there are several hundred members interested in all the listed topics. Stay tuned for more results...

Sector Updates—Americas

INCOSE LA

Phyllis Marbach, prmarbach@gmail.com

Thirty INCOSE LA members and guests ended 2018 with a holiday party at the Del Rey Yacht Club, thanks to the hospitality of Yacht Club member Bo Oppenheim, INCOSE Fellow. Fireworks and a lighted boat parade started the festivities, followed by a buffet dinner and entertainment from our favorite comedian and engineer, Don McMillan.

INCOSE LA started 2019 with our second annual Town Hall held at Buca de Beppo in Redondo Beach. Twenty-six members attended. In addition to enjoying the delicious food, the chapter recognized the 2018 board members, and 2010 INCOSE LA member and aerospace employee, Roz Lewis, inducted the new board for 2019. During the event, President Dr. Mark McKelvin spoke to those assembled about the upcoming planned speaker meetings and education events. Mark handed out a survey to the members regarding what they would like to see more of from our chapter during 2019. We have included the results of that survey in the INCOSE LA Newsletter available online at www.incose.org/los-angeles.

We have planned our first quarter strategic planning meeting for the 9th of March at the Manhattan Beach Community Church. The chapter is also planning a SysML tutorial in March at Dassault Systemes in Long Beach. More information will be available on our website as we solidify plans.

The first speaker meeting is 12 February, where Jorg Largent, retired engineer from Northrop

Grumman, will present "The Vision Statement: Step 1 for a Project, Though Oft' Overlooked." We are lining up other speakers for the second Tuesday of each month at The Aerospace Corporation in El Segundo. Check our website here to register and see the latest: www.incose.org/los-angeles.

INCOSE LA is hosting the second annual Western States Regional Conference (WSRC). The call for proposals was circulated during the International Workshop (IW) in Torrance, US-CA and the request for sponsorship and exhibitors is also being distributed. Please see our website here: www.incose.org/wsra2019 for the latest information and links to our flyers. The conference will be held at the lovely campus of Loyola Marymount University (LMU) on the 13th-15th of September. We have teamed with The Renaissance Hotel near the Los Angeles International Airport (LAX) for hotel rooms at a very reasonable price of \$139 a night. We will arrange a conference-sponsored shuttle to take conference attendees between the hotel and LMU. Our theme is Systems Engineering Relevancy: Time for a Sea Change! We are currently seeking abstracts at <https://easychair.org/cfp/wsra2019>. Please save the dates of 13-15 September for a terrific time in sunny (usually) Los Angeles, US-CA.

We plan to wrap up the conference with a tour of the Northrop Grumman Corporation (NGC) in Redondo Beach to see the James Webb Space Telescope, depending on its availability, and the NGC Museum. If you cannot attend in person, please plan to host or attend a remote site for the System Engineering

Professional Development Day (SE-PDD) to be broadcast on Saturday, 14 September 2019. Contact conference chair Phyllis Marbach at prmarbach@gmail.com for more information.

INCOSE Colorado Front Range Chapter Activities

Vice president of the Colorado Front Range (CFR) Chapter, Ms. Renee Steinwand, represented the CFR Chapter and the Western States Region at the recent International Workshop (IW) 2019. As always, the workshop provided a great opportunity to network with colleagues and coworkers.

The IW presented a great forum for discussing member retention and strategy through improving communication channels, web interface, and available resources. There was also significant discussion about professional development as an offering for members through a new web portal. Other important highlights included several meetings targeted toward regional conferences, chapter leaders, and best practices to provide information and resources to improve member outreach and participation. The America's Sector is continuing to provide suggested improvements to assist both active and struggling chapters.

INCOSE Denver area director and INCOSE lead ambassador, Mr. Valkand Jhaveri (VJ), travelled



IW 2019 (from left to right): some current and former Booz Allen Hamilton employees—Mike Vinarick, Tony Gigioli, Chris Giudice, Michael Williams, Kevin Weinstein, Renee Steinwand, and Former INCOSE President John Thomas.

to India where he attended the INCOSE India Chapter executive committee meeting in January. VJ introduced the ambassadors' program to the India Chapter, shared activities of the INCOSE CFR, and discussed mentorship of STEM students. Given the India Chapter's interest, VJ volunteered to stay in touch and provide guidance in these areas. During VJ's visit, he had the opportunity to participate in the local festival called Uttarayan (International Kite Festival) where people from all over the city fly kites from their roofs. Typically, one will see thousands of kites of varying sizes, colors, and shapes flying in the sky ending with a full fireworks display in the evening.



IW 2019 INCOSE Foundation Wine Tasting: Mike Vinarick, Lenny Delligatti, and Renee Steinwand.



The Uttarayan.



APRIL 3-4
2019

17TH ANNUAL CONFERENCE ON SYSTEMS ENGINEERING RESEARCH

NATIONAL PRESS CLUB
529 14TH ST NW, WASHINGTON DC



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Sector Updates—Asia-Oceania

India Chapter

Ramakrishnan Raman,
ramakrishnan.raman@hotmail.co.uk

INCOSE India Chapter held its committee and extended committee meeting on the 5th of January. The agenda of the meeting was to sketch out a detailed plan for the India Chapter for 2019. John Deere India hosted the meeting at their Pune office. The meeting started with a brief about INCOSE vision and mission statements to the new extended committee members followed by a recap of the activities from 2018. We spent the remainder of the day planning the activities for 2019. The chapter formed new small teams to specifically focus on chapter programs, communication, and membership growth. We also discussed some new initiatives like creating a membership outreach video and developing an improved quiz format, along with the support and budgetary needs for the chapter. The chapter team also spent considerable time discussing



INCOSE India Chapter Committee and extended committee meeting to plan 2019 activities, hosted by John Deere.

the planning and executing of the Asia Oceania Systems Engineering Conference (AOSEC 2019) (www.aosec2019.org) which will be held in Bangalore, IN and hosted by INCOSE India Chapter in collaboration with Society of Automotive Engineers (SAEINDIA) Bangalore Section. We ended the day with thanks and recognition of the contributions from all the chapter committee members.

Australia Chapter

Bill Parkins,
bill.parkins@bigpond.com



Systems Engineering Society of Australia (SESA) Report

Hello again from Australia!

It has been a quiet period for the Systems Engineering Society of Australia (SESA). We kept the traditional summer holiday break over the Christmas/New Year period clear of organised activities and members were free to enjoy their time with friends and families.

For the committee, it has been a time to prepare for the program for the year, including the following:

- We finished our first Strategic Plan on a Page (SPOP), which we have in turn used to guide the 2019 annual operating plan and budget.
- One emphasis this year is to continue to build the strength of the state branches. We currently have six branches with membership varying from 150 to 13. The larger branches are actively planning activities including working groups of local interest. Transportation is a common application domain in most states, with major rail and road transport projects in progress, which need systems engineers to contribute to their execution.
- Charles Homes has commenced a three-year term on the Certification Advisory Group (CAG), which is a significant commitment in time and travel as he needs to attend International Workshops (IW) and

International Symposiums (IS) for the whole term, in addition to regular meetings in the wee hours. In return, we expect to have up-to-date advice on certification, which will help with our Chartered Australian Systems Engineer (CASE) program.

- The defence industry also has a number of major projects in their early definition phase with a high demand for systems engineers. The gap between available and required systems engineers is a problem requiring creative solutions. The introduction of the Systems Engineering Competency Framework (SECF) has been timely, and we are using it to identify education, training, and development initiatives for stakeholder organisations to utilise.
- SESA is actively engaging stakeholders to provide feedback on effectiveness of our program and to identify areas needing attention. It is important for us to provide quality programs to our members and also recognize what our stakeholders value. SESA will link the external engagement initiative to our annual events (conference and workshops) and provide opportunities to meet with stakeholders at event locations.
- Preparations for our annual Systems Engineering Test and Evaluation (SETE) conference are well under way, with review of papers and finalisation of the program currently in progress. This year SETE is in Canberra from 29 April-1 May. Registration is now open and we

hope for strong support from our membership and others interested in systems engineering, particularly from Canberra, our seat of national government agencies.

- This year there is also an opportunity for selected SETE papers to be published in the Engineers Australia Journal of Multi-Disciplinary Engineering. This is the first time this has been offered, and if it is successful, it will provide an incentive for academics and practitioners to pursue research topics in systems engineering.
- Upcoming events:
 - National Speaker Program, 26 February. Mark Eggler will give a talk on Project Bushranger, an army land vehicle project with emphasis on systems engineering experiences. Members can view the video conference from Engineers Australia offices in state and territory capital cities. Further information on upcoming dates will be advised.
 - SETE 2019, Canberra, AU, 29 April-1 May
 - INCOSE International Symposium 2019 (IS 2019), Orlando, US-FL, 19-25 July
 - Australia Systems Engineering Workshop (ASEW), Melbourne, AU, 28-30 October
 - World Engineering Convention, Melbourne, AU, 20-22 November



Submit your abstract today!
<https://sete2019.com.au/call-for-abstracts/>

Sector Updates—EMEA

INCOSE UK Turns Silver

Richard Tingley,
publications@incoseonline.org.uk

2019 is the year INCOSE UK turns silver. It is our 25th Anniversary and it is shaping up to be a big year. To start with, we revealed our new Silver Jubilee logo on the cover of the latest issue of Preview magazine.

In this issue, we include a welcome from the new INCOSE UK president, look back at ASEC 2018, and highlight INCOSE UK local, working, and interest groups.

We also feature an article from Dr. Catherine Stace who writes about the "Application of Systems Engineering to Biotechnology Platform Development," based on her prize-winning presentation at ASEC 2018, and Ian Presland presents the case for using competence-based assessment within the INCOSE systems engineering professional program.



We have exciting plans throughout the 25th Anniversary year looking to the future of INCOSE UK and systems engineering. With this in mind, the Silver Jubilee will culminate in the ASEC 2019 at the historic Royal Armoury in Leeds. From the 20th to 21st of November 2019, this year's theme is "Celebrating the Future of Systems Engineering" and will focus on inspiring the next generation of systems engineers, advancing practices, and pushing the boundaries of system engineering, ensuring INCOSE UK will continue for another 25 years and beyond.

Requests for papers and presentations will soon be issued, so to keep up with all the latest news, please visit the conference website at www.asec2019.org.uk.

Working Group Updates

Oil and Gas

Cindy Chen, C.Chen@shell.com

Advancing Systems Engineering in the Oil and Gas Industry

The INCOSE Oil and Gas Working Group (O&G WG) aims to provide tools to meet the world's oil and gas needs through safer, more reliable, and cost-effective solutions. Where 2018 brought the O&G WG through its first successful co-chair transition with founding Co-Chairs Mia Zager (Shell) and Phil Schoonover (BHGE) passing their responsibilities on to Chris Bellows (BP) and Alisha Pate (Chevron), 2019 seeks to build on the energy their efforts brought forward. Focused activities include highlighting new success stories related to systems engineering tools, sharing requirements development and management coaching tools, and developing a new subgroup to look at designing and delivering digital solution-agnostic data exchange for the implementation of systems engineering across the O&G value chain and life cycle.

Bellows and Pate are full of enthusiasm as they lead the O&G WG into its next season. The working group has scheduled a systems engineering session on the 7th of May at the 2019 Offshore Technology Conference (OTC), one of the largest O&G Conferences in the world. BP will host the third annual Texas Gulf Coast Chapter Aerospace and Oil & Gas INCOSE Conference in Houston, US-TX on 10 October. There are also plans to continue growth in the Europe, Middle East, and Africa (EMEA) region, building upon the O&G session held at the 2018 EMEA Systems Engineering Conference



New co-chairs of the Oil and Gas Working Group, Chris Bellows (BP) and Alisha Pate (Chevron), lead the group after its first successful co-chair transition

(EMEASEC) in Berlin, DE and leveraging the opportunity to meet at the 2019 EMEA Workshop in the Netherlands.

The INCOSE O&G WG co-create strategies to advance systems engineering within the oil and gas industry and develop work processes, tools, and competencies to mature the systems engineering thinking and ways of working. Additional goals for 2019 include piloting a third project with the American Petroleum Institute (API) to convert standards from prose to requirements and continuing the digitalization and transformation of standards with more standards bodies (IOGP, ASTM, DNV).

As the O&G WG looks forward to a busy 2019, they would like to thank Mia and Phil for their dedicated leadership of the O&G WG through amazing progress in 2016-2018, which culminated in the 2018 INCOSE award for "Achieving the Systems Engineering Vision."



In addition to BP, Chevron, Shell, and Baker Hughes GE, other working group participants include Barrios Technology, TransOcean, Technip FMC, Hicor, Jacobs, and IBM

You can find more information on the O&G Working Group's website, <http://www.incose.org/ChaptersGroups/WorkingGroups/Application/oil-and-gas>.

Contact co-chairs Chris Bellows, Christopher. Bellows@bp.com, or Alisha Pate, AlishaPate@chevron.com, if you are interested in getting involved.

Upcoming Events:

- The Offshore Technology Conference for the "Systems Engineering in the Offshore Industry" session, 9:30 a.m. on Tuesday, 7 May 2019. For more information, go to <http://2019.otcnet.org/seminar>
- The Third Annual Texas Gulf Coast Chapter Aerospace and Oil & Gas INCOSE Conference in Houston on Thursday, 10 October 2019, hosted by BP. More information can be found at <https://www.incose.org/incose-member-resources/chapters-groups/ChapterSites/texas-gulf-coast/chapter-events/conferences/tgcc-2019-conference>

Object-Oriented Systems Engineering Method (OOSEM)

Howard Lykins, howard.lykins@incose.org

In 2019, the INCOSE Object-Oriented Systems Engineering Method Working Group (OOSEM WG) will continue a strong technical collaboration with the INCOSE Critical Infrastructure and Recovery (CIPR), Power & Energy Systems, and Systems Science Working Groups, as well as with decision makers and other subject matter experts from the IEEE Computer Society, FBI/InfraGard, and stakeholders in health care and disaster recovery. This ongoing collaboration has so far resulted in the successful start of a model-based systems engineering (MBSE) project to develop a first-of-its-kind resilient hospital reference model (RHRM). Beginning in 2017, and continuing in 2019, the INCOSE OOSEM WG, has hosted a total of six, day-long workshops at the Johns Hopkins University Applied Physics Laboratory (JHU/APL), attended by INCOSE, IEEE, InfraGard, and health care professionals, where participants applied the lean startup method (LSM) and agile systems engineering to collaboratively develop a set of initial project planning (IPP) artifacts for

the RHRM project. These artifacts, currently under review, will form the basis for reference models developed using the object process methodology and OOSEM.

Representatives from all of the collaborating organizations have formed a volunteer cross-domain resilient hospital systems engineering team (RHSET). Anyone wanting to know more about this ongoing collaborative effort should contact howard.lykins@incose.org.

The RWG Sessions at IW 2019

Lou Wheatcraft, louw@reqexperts.com

A special thanks goes out to all that attended the Requirements Working Group (RWG) sessions at the 2019 INCOSE International Workshop (IW 2019) along with those that volunteered to give a presentation and lead a discussion on their topic. Without your active involvement and dedication, IW 2019 would not have been the success it was!

Over the four days, we had 120 attend the various RWG sessions. There were a number of attendees that were new INCOSE members and several existing members that were attending an IW for the first time. Their common interest was requirements! Several said their main reason for attending IW 2019 was the variety of topics on the agenda. At this year's workshop, the RWG gained 24 new members, growing the RWG membership to 520 members, making it the largest working group by far.

The theme of the RWG for IW 2019, "The Role of Requirements in an MBSE World," was very popular among the attendees. We had 10 presentations resulting in a good cross section of perspectives and insights. The RWG provided a format for these sessions that encouraged questions and comments during the presentations, making the presentations much more interesting and engaging.

While members made many good points over the four days, several thoughts that emerged during our sessions and really stuck with me were:

- The concept of duality as applied to requirements and models—Depending on the what is being done and what is being communicated, textual requirements and models are two sides of the same systems



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engineering coin. Neither is solely sufficient—both are needed!

- Requirements do not just happen—they are a transformation from a set of needs that transformed from a set of concepts that address a feasible solution to a problem.

The quality of the requirements is directly proportional to the quality of the set of stakeholder needs from which they were transformed. Likewise, the quality of the set of needs is directly proportional to the quality and quantity of the work systems engineers do to define the problem, understand the stakeholder expectations, and identify the drivers, constraints, and risks, as well as the time and effort they spend in defining a feasible, logical, and physical concept (model) based on this information prior to documenting the needs.

- Preliminary conceptual and physical architectural models are both the source of the stakeholder needs and resulting requirements, as well as the tools systems engineers can use to implement those same sets of needs and requirements in the form of the design and the engineered system of interest.
- 20th century systems engineering methods and practices are often not adequate to address the challenges of increasingly complex, software-centric systems of the 21st century!

Finally, we also developed and submitted technical project plans for two new products: "Guide to Developing and Managing Requirements" and "Guide to Verification and Validation." In addition, we developed and submitted a technical project plan for an update to our popular "Guide to Writing Requirements."

All IW 2019 RWG presentations and associated materials are available on the RWG Connect website: <https://connect.incose.org/WorkingGroups/Requirements/Pages/Home.aspx>. Once there, click on the "RWG sessions at IW2019" link on the left to see what we accomplished. You can then select "Documents" to download any of the presentations and background materials you are interested in.

IW 2019 was an exciting kick off to a new year! Thank you all for your interest, involvement, and support!

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IW 2019 was an exciting kick off to a new year! Thank you all for your interest, involvement, and support!

INCOSE Systems Science

Peter Toddham, Peter@coexploration.net

Systems Literacy

The INCOSE Systems Science Working Group (SSWG) has sponsored the Systems Literacy project for the past few years. The SSWG has joined efforts with the International Society for the Systems Sciences to further develop and evolve this emerging project. During recent INCOSE International Workshops, we have explored the context, potential content, relevance, and importance for systems engineers. Recently, the SSWG conducted a full-day workshop at the INCOSE International Symposium 2017 (IS 2017) in Edinburgh, GB.

We are basing our work loosely on models developed over the past few years in the geosciences. Ocean literacy, earth science literacy, atmospheric literacy, and energy literacy guides have been developed for the United States to help direct educational priorities in K-12 education and beyond. We hope to produce a guide based on these models for systems literacy.

An important contribution to the development of a guide for systems literacy is the United States' Next Generation Science Standards (NGSS). We are particularly focusing on one aspect of these standards—crosscutting concepts. These seven concepts include approaches to learning about models, patterns, and systems, and system models. Our work on systems literacy is building on these concepts.

At the INCOSE IS 2019 in Orlando, US-FL, we will be holding a full-day workshop on systems literacy. We are inviting participants to review the progress made so far, and to contribute to the work and the development of a more detailed guide on systems literacy for systems engineers.

INCOSE Hampton Roads Area Chapter Offers Free Systems Engineering Handbook, v4.0 Training

John Clark, john.clark@incose.org

The INCOSE Hampton Roads Area Chapter and the INCOSE Training Working Group are providing free INCOSE Systems Engineering

Handbook, V4.0 training and other free systems engineering training for all INCOSE members, employees of INCOSE Corporate Advisory Board (CAB) organizations, employees and students of INCOSE Academic Council organizations, and INCOSE student members.

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

- Log in to Connect (connect.incose.org), then click on Library, Tutorials, and Training WG Tutorials. Scroll down to SE Handbook V4.0 Tutorial, click on Tutorial ID: 01_October 2015, click on the tutorial session you want, right click on the file you want, click on Save Target As, and save the file on your drive.
- Click on <https://connect.incose.org/Library/Tutorials/training/SitePages/Home.aspx>, log in to Connect, scroll down to SE Handbook V4.0 Tutorial, and follow the above.

Tutorial Session: 00_Shared Documents contains the schedule and reference

Preliminary Technical Program



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documents.

Other past recorded tutorial sessions include: SE Fundamentals (Tutorial ID: 02_October 2014), SE Handbook V3.2.2 (Tutorial ID: 02_October 2014), Leadership Skills (Tutorial ID: 01-04), and Systems Engineering Technical Processes (Tutorial Session: 01-04).

The Systems Engineering Handbook, V4.0 tutorial also provides tips and personal help in systems engineering. We will provide a certificate of completion on request. The tutorial consists of weekly 60-minute sessions. There is no need to register, just join in. We strongly recommend reading the applicable sections of the INCOSE Systems Engineering Handbook, V4.0 before each session. Course materials include the shared documents, tutorial slides, questions, and audio and video recordings for download and use at your convenience. Most slides contain speaker notes in the PowerPoint Notes view.

Questions? Contact gabriela.coe@incose.org or john.clark@incose.org.

Certification Updates

INCOSE Academic Equivalency Awarded for Cornell University

Courtney Wright,
Courtney.Wright@v1decisions.com

INCOSE has awarded Cornell University with an Academic Equivalency Award. INCOSE first awarded this academic equivalency in July 2018. Now that this equivalency is in place, students who demonstrate knowledge of systems engineering through coursework will not have to take the INCOSE Knowledge Exam. 130 students who met requirements in Fall 2018 are now eligible to become INCOSE Associate Systems Engineering Professionals (ASEPs).

In response to Cornell receiving this award, INCOSE Garry Roedler stated, *"At INCOSE, we are pleased to have the Systems Engineering Certification Academic Equivalency in place with Cornell University. Academic equivalency demonstrates the strength of specific university systems engineering programs in meeting the knowledge requirements for systems engineering certification. It also shows the strength of universities working closely with INCOSE to embrace and evolve the requirements in their systems engineering programs towards meeting the accepted competencies for systems engineering."*

For further information, contact Patrick Gillespie patgillespie@cornell.edu and David R Schneider dr.drschneider@gmail.com.



INCOSE Academic Equivalency Awarded for University of New South Wales

Courtney Wright,
Courtney.Wright@v1decisions.com

INCOSE has awarded the University of New South Wales as Academic Equivalency Award. INCOSE first awarded this equivalency in January 2019. Because of this award, students who demonstrate knowledge of systems engineering through coursework will not have to take the INCOSE Knowledge Exam. Knowledge demonstration is a mandatory part of the path to becoming Associate Systems Engineering Professionals (ASEP) and Certified Systems Engineering Professional (CSEP), so this award is an exciting development for New South Wales University students.

Garry Roedler has the following words of congratulations for the university. *"At INCOSE, we are pleased to have the Systems Engineering Certification Academic Equivalency in place with the University of New South Wales. Academic equivalency demonstrates the strength of specific university systems engineering programs in meeting the knowledge requirements for systems engineering certification. It also shows the strength of universities working closely with INCOSE to embrace and evolve the requirements in their systems engineering programs towards meeting the accepted competencies for systems engineering. The University of New South Wales is the first university in Australia to be awarded the academic equivalency. We have seen an increase in certification applications from Australia over the past two years, and this award will help us sustain that growth."*

For further information, contact Natalie Kimber, n.kimber@adfa.edu.au



AOSEC 2019

<http://www.aosec2019.org/>

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Call for Submissions

Refereed Papers

Authors are invited to submit only original papers (written in English) not published or submitted for publication elsewhere. The length of the paper should not exceed 15 pages in length. Papers exceeding these limits, multiple submissions, and self-plagiarized papers will be rejected without further review. All submitted papers will be subject to a peer-review process. Authors need to submit an abstract first, and after notification of shortlisting, should submit the full paper. Please refer conference website for paper formatting requirements. Academic papers should cover from theory to theory validation, although papers presenting research proposals coupled with initial results will also be considered. Practice-focused papers should include problem space and approach through implementation. Papers that provide insight into critical applications of systems engineering that address complex problems will align well with the conference theme.

At least one author of an accepted paper needs to register for the conference and present the paper during the conference, for the paper to be included in the conference proceedings. The proceedings of the conference will be published in Wiley Online Proceedings Library. Invitations will be made to the authors of the best papers to submit an extended version of papers for consideration as book chapters.

Non-refereed Presentations

Non-refereed presentations are reviewed by the Conference Technical Committee for inclusion in the program, but are not subjected to the formal peer-review process as for refereed papers. Presentation format (e.g. power point) is suitable —there is no need for a formal paper. Presenters need to submit an abstract first, and after notification of shortlisting, should prepare a presentation deck to facilitate a 15 minute presentation during the conference. Non-refereed presentations may also not be included in the conference proceedings (only the abstract may be included). All presenters of non-refereed presentations must register for the conference before the presentation is admitted in the final conference program.

Panel Sessions

The conference program plan is to incorporate relevant panel sessions. Prospective panel chairs should formulate a proposal that articulates a question, problem or theme which is important or contested, and is relevant to the topics of interest of the conference.

All panel proposals should be written in English and provide a panel title, name(s), affiliation(s) and email address(es) of the panel chair(s) & potential panel participants (3 or 4), panel proposal and a brief outline of the proposed panel format. Please submit expressions of interest directly to the Conference Technical Program Chair via aosec2019@gmail.com.

Sponsors & Exhibitors

Sponsoring and exhibiting at AOSEC 2019 gets you across to the wide systems engineering community across various domains including aerospace, automotive, defense, space and healthcare. Expressions of interest are sought from potential sponsors and exhibitors. Sponsors will have their logo/ banner prominently displayed in the conference arena. Exhibitors will be provided a booth for promotion.

Key Dates

Abstracts Due: 15 March 2019

Papers Due: 4 April 2019

Notifications: 15 June 2019

Learn more at: <https://easychair.org/conferences/?conf=aosec2019>

EWLSE Updates

Alice Squires, ewlse@incose.org

Nearly 30 men and women gathered at the INCOSE International Workshop (IW 2019) to participate in the Empowering Women as Leaders in Systems Engineering (EWLSE) working session, outreach session, or both. The meetings kicked off with participants contributing their top empowering event of 2018, examples include:

- Closing the doors of a business and opening a new door for what is next
- Securing a challenging management role
- Being part of the Boeing Women in Leadership (BWIL) organization
- Recruiting 30 students for a CubeSat team
- Meeting Marillyn Hewson, chairman, president, and CEO of Lockheed Martin when invited to a women's leadership forum
- Being nominated to be INCOSE Secretary
- Hearing from the project manager after some difficult discussions on a challenging project, "We couldn't have done it without you."
- Being asked by company executives to officially work on life cycle management and systems engineering activities for the company
- Writing an e-book, Dandelion Wishes: A World Where We Collaborate as Equals
- Helping Tyler Trent fundraise for cancer research in the last months of his career for Purdue University Center for Cancer Research
- Taking my first timed midterm after 15 years while holding my baby the entire time and earning an A
- Being selected to start on a new program because of my systems engineering background
- Leaving the Air Force and starting a consulting career with Deloitte
- Supporting the Medtronics NSC STEM project for the Works Museum Girl Time K-12 program

- Advising a high school team on building a greenhouse with water bottles
- Finding a position at my company where I can work remotely and live where I want
- Leading outreach for EWLSE at the Society of Women Engineers (SWE) Conference, mentoring students for systems engineering and the INCOSE certificate program
- Helping a junior team member take on a bigger role

During the working session, Marilee Wheaton and Alice Squires led a discussion on a notional table of contents for a book on systems engineering for the IEEE Women in Engineering (WIE) series (published by Springer Hill), Lauren Stolzar and Stephanie Chiesi led a group discussion on mentoring and leadership resources, and Lisa Hoverman and Marilee Wheaton led a discussion on inreach and outreach in support of a world where women and men are equally represented in engineering. The team also discussed possibilities of supporting an INCOSE grand challenge effort that is potentially underway and brainstormed how to integrate diversity-related topics, such as user and stakeholder diversity and cognitive diversity, into the INCOSE Systems Engineering Handbook V5.0.

Mike Pennotti of the INCOSE Technical Leadership Institute (TLI) made a guest appearance and encouraged systems engineering leaders interested in applying to the institute to further their leadership reach and take on the next INCOSE-led leadership initiative, to work with their chapter or working group leaders, and apply by 15 March for the next cohort. The 2018 TLI cohort includes three members of EWLSE: Heidi Davidz, Heather Feli, and Lauren Stolzar. EWLSE member, Stephanie Chiesi, from the original 2014 TLI cohort, commented on the value of the experience.

The theme of EWLSE's outreach session was "Teaching Females, and Males, Science and Engineering." Facilitators Allison Weigel, Lisa Hoverman, and Alice Squires led three round-robin activities focused on developing projects, identifying role models, and acknowledging



Figure 1. The EWLSE team at INCOSE IW 2019

a time when another person made you feel empowered. The conference ended with a presentation at the closing marketplace of EWLSE accomplishments and plans for the year (see Figure 2).

Informal activities completed at the INCOSE IW 2019 included work on the "Letters to My Younger Self" and the systems engineering and diversity-themed edition of the third quarter INCOSE INSIGHT by the EWLSE publications team—Lisa Hoverman, David Long, and Alice Squires; work on these initiatives is ongoing. For further information, email ewlsepubs@incose.org. EWLSE team members Lisa Hoverman and Alice Squires, with support from Brad Spenses, met with Gretchen Peacock, associate director for Technical Operations, on the establishment of a new best paper on topics related to diversity, including working across cultural boundaries and institutional considerations for creating the right culture.

Summaries of the working and outreach sessions are included in the next section, and there is an open invitation for participation in activities that you are passionate about pursuing. Please email ewlse@incose.org with your interests. We invite and encourage men and women to join EWLSE and support women in engineering by adding "Empowering Women" to your committee/working groups under your

INCOSE profile (click on your name after you log into INCOSE, select Profile, and proceed from there).

A New Kind of Book, Mentoring, Resources, Inreach, and Outreach

Marilee Wheaton, marilee.j.wheaton@aero.org; Lauren Stolzar, lstolzar@gmail.com; Stephanie Chiesi, schiesi@gmail.com; Lisa Hoverman, marcom@incose.org; Alice Squires, ewlse@incose.org

Marilee Wheaton kicked off the work portion of the working session by presenting the Springer Women in Engineering and Science series which highlights women's accomplishments in critical fields such as security, sustainable agriculture and food biology, and industrial



Figure 2. President-elect Kerry Lunney and EWLSE founder Alice Squires discuss future plans for EWLSE at the Working Group Marketplace

and systems engineering. Marilee explained that the foundational volume in the series provides a broad overview of women's multi-faceted contributions to engineering over the last century. Each subsequent volume is dedicated to illuminating women's research and achievements in key, targeted areas of contemporary engineering and science endeavors. The goal for the series is to raise awareness of the pivotal work women are undertaking in areas of keen importance to our global community. The series includes author's biographies to motivate and inspire those entering the field. Marilee proposed the idea of EWLSE members writing a new book in the series focused on systems engineering content. Marilee and Alice Squires facilitated a session where the group brainstormed topics that we can bring to the table that are novel and different than current textbooks, such as persistence in engineering, workforce culture, technical satisfaction, emerging topics in systems engineering, soft skill advantage, systems engineers as superheroes, and other fun and energizing topics.

Lauren Stolzar and Stephanie Chiesi kicked off the next session on mentoring and resources. The team discussed the newly created mentor/mentee program, which will be available to all INCOSE members (see Figure 3). Ideas for making the program more widely useful included adding structure around the program. This included ideas such as providing training and workshops for mentors and mentees to help people get the most out of a mentor/mentee relationship. It also included the idea of providing online events and resources for everybody to use. Finally, the group wanted to encourage the use of peer mentors as a way to engage with other people at similar stages in their career. Members also suggested building a database of existing mentor relationships as a way to provide outreach and support for those currently working with mentors. Finally, the team suggested advertising via the INCOSE LinkedIn and utilizing the INCOSE LinkedIn space as a way to provide resources.

Lisa Hoverman and Marilee Wheaton rounded out the working sessions with a discussion on inreach (within INCOSE) and outreach activities. Members suggested establishing an EWLSE liaison in every INCOSE chapter around the



Figure 3. INCOSE needs you! For mentors and mentees: <https://bit.ly/2G6TJPL>

world. Plans for 2019 include a sponsored INCOSE/EWLSE booth at the Society of Women Engineers (SWE) Conference in Anaheim, US-CA, 7-9 November, and potentially sponsoring attendance at a second leadership conference.

Teaching Females, and Males, Science and Engineering

Allison Weigel, Allison.Weigel@toraycma.com; Lisa Hoverman, marcom@incose.org; Alice Squires, ewlse@incose.org

For EWLSE's outreach session, the audience was divided into three groups to perform activities in support of the "SciGirls Seven: How to Engage Girls in STEM" resource (see www.incose.org/ewlse and click on the Resources tab). The team used guidance from a prior workshop led by Rose Delaney, president of the Society of Women Engineers student chapter of the University of New Mexico (see "Educating Future Female Engineers," by Delaney Rose Heileman in the Q4 INCOSE 2018 newsletter). Everyone in attendance participated and worked on the following three activities, each group working simultaneously on one of the activities at a time in a round-robin approach with a summary of outcomes included below.

Activity 1: Define a lab project for a student team that supports the SciGirls Seven strategies for engaging girls in STEM. Include the problem or opportunity for the students to address, objectives of the lab, anticipated steps, and the anticipated outcomes.

The three groups developed ideas for projects that emphasized collaboration with fair participation and communication, personally relevant projects, hand-on/open-ended projects, and projects that they could apply their own creativity, talent, and learning styles

to. These projects supported the SciGirls Seven, but did not limit the projects to something just girls would be participating in. Participants considered not just the projects themselves, but also what age ranges and timeframes would be appropriate for the projects, and what type of resources the projects would require. They focused the projects on systems engineering principles and practices such as modeling, integration, and understanding stakeholder requirements. Groups were able to come up with multiple projects and concepts that could be used across many ages and backgrounds that would allow project participants to make a change to their environment.

Activity 2: Create a list of female role models. For each, you must include a bit about them, their characteristics, and what characteristics you have in common—tally them up! This activity supports the SciGirl strategy that girls benefit from relationships with role models and mentors.

The three groups did an excellent job identifying female role models and then focused on not only what attributes they shared with them, but also the type of attributes that were important for the future.

Activity 3: Think about a time that someone else did something that made you feel empowered. Describe the situation to the group and then write a short letter to yourself about the event and how it made you feel. This activity supports the SciGirl strategy that girls gain confidence and improve performance with specific positive feedback on effort, strategies, behavior, and when encouraged to think critically.

The three groups talked about how others have in the past said or done something that made them feel empowered and then wrote a private letter to themselves about the experience and how it made them feel. Examples of empowering moments are included in the beginning of this article.

Are you interested in supporting the field of systems engineering by becoming a mentor for a systems engineer, or are you seeking an experienced systems engineer as a mentor who can help you navigate the field and INCOSE? Please email incose-mentor@incose.org or complete the brief survey at the QR code in Figure 3 or at <https://bit.ly/2G6TJPL>.

INSIGHT Preview

William Miller Editor-in-Chief, insight@incose.org

We are pleased to announce the April 2019 issue of INSIGHT published in cooperation with John Wiley & Sons as a magazine for systems engineering practitioners. The INSIGHT mission is to provide informative articles on advancing the state of the practice of systems engineering. The intent is to accelerate the dissemination of knowledge to close the gap between the state of practice and the state of the art as captured in Systems Engineering, the Journal of INCOSE, also published by Wiley. The focus of this April issue of INSIGHT is systems science and systems engineering principles as foundations for the future of systems engineering.

We thank theme editor Michael Watson, who leads off with the context for the future of systems engineering. Systems engineering has evolved as a practice-based discipline with

a matured set of processes covering the life cycle of the system. The engineering basis is, however, tenuous, as we cannot always ensure the system will be successful. All engineering disciplines have started in practice, and over time evolve with the discovery of the underlying scientific principles that provide a solid foundation for the discipline. Systems engineering is following a similar course, with the recognition that it is also a sociological endeavor, integrating, coordinating, and facilitating all the engineering disciplines. As a direct step from the systems engineering heuristics, a set of systems engineering principles have emerged that incorporate the engineering basis and the sociological basis and are broader than system principles, that is, principles that define how a system functions. Systems scientists have researched the

mathematical basis of systems engineering for some time. The future of systems engineering intertwines the scientific/mathematical engineering basis, system modeling advances, and advancements in technological and sociological practices to advance the ability of systems engineering to define systems, shorten design analysis cycles, validate systems, and effectively operate and maintain systems.

David Rousseau, Javier Calvo-Amodio, and James Martin have contributed an article on the future of systems sciences and system theory as foundational for the future of systems engineering. This is the follow-up to David Rousseau's article in the December 2018 INSIGHT on "*A Framework for Understanding Systems Principles and Methods*."

Five additional articles follow:

- "*Systems Engineering Principles and Hypotheses*" by Michael Watson articulates the basic concepts that guide systems engineering. He based this work on a review of various sources of systems postulates, principles, and hypotheses identified in literature, particularly from the multi-year work of the NASA Systems Engineering Research Consortium which looked at the work of Ludwig Boltzmann and his postulates on gas distributions as an early example of how to characterize the interactions of complex systems.
- "*Structuring the Problem Space for MBSE*" by J. Craig Wrigley addresses the concern that while modelling of the structural aspects of a system is well developed, the modelling of requirements is still evolving.
- "*The Afsluitdijk as a Complex System*" by Berber de Liefde-Vogt and republished in INSIGHT with the permission of Project Performance International (PPI) discusses the objective and current challenges of the Afsluitdijk (Enclosure Dam) completed in 1932 to provide better protection of the Netherlands hinterland against flooding and to reclaim new land from the sea.

• "*Controlling Costs and Margins of Engineered Systems*" by Haifeng Zhu summarizes recent work on adaptability studies for engineered systems, the evaluation of missions/requirements that are needed for adaptability, the improved system design methods needed, and the impact of adaptability to procurement methods and risk management.

• "*Value Engineering as a Specialty for Systems Engineering: Exploring Opportunities*" by Robin de Graaf, Gido van der Linde, Hein de Jong, and Berber de Liefde-Vogt describes the pillars of value engineering: (1) the definition of value, (2) the use of multi-disciplinary workshops, and (3) the application of function diagramming with the FAST (function analysis system technique) method.

In this issue we also review INCOSE Fellow Azad Madni's 2018 book that is highly relevant to the future of systems engineering, *Transdisciplinary Systems Engineering: Exploiting Convergence in a Hyper-Connected World*, with a forward by Norman R. Augustine.

We also announce a call for papers for the March 2020 INSIGHT on critical infrastructure protection and recovery (CIPR) to follow-up the December 2016 INSIGHT. The focus of the March 2020 issue is the application, development, and dissemination of systems engineering principles, practices, and solutions for critical infrastructure protection and recovery with regard to the 16 critical infrastructure sectors in US Presidential Policy Directive 21 (PPD-21). Abstracts are due 1 May 2019 and full papers 1 November 2019 to Dr. Mitchell Kerman, INCOSE CIPR Working Group chair (mitchell.kerman@inl.gov).

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

Social Media Update

Alan Harding, alandharding@gmail.com

We had a record-breaking IW19 in Torrance, with highest-ever attendance of 541 people from 62 chapters in 22 countries. As well as over 100 working group meetings, and over 40 business meetings we had an active online presence - posts from our @incose_org Twitter account reached over 2,000 people a day during IW19, and our President @incosepres and President-Elect @KerryL888 were also part of the conversation.

We now have over 2,500 people following us on Twitter; over 4,900 people in our LinkedIn group, and over 2,000 people in our Facebook group. During 2019 we are keen to build the conversation – to help and encourage everyone to share information on upcoming events, their projects and surveys, ask questions, and be part of the conversation. The first place we will do this is in INCOSE, the Official Group.

Please accept this invitation to join in whether you are one of our most experienced systems engineers like our ESEPs or Fellows, fellow

practitioners, students or those starting out exploring systems engineering and systems thinking. The INCOSE network is a phenomenal resource and a great way of asking that question that has been bothering you, or getting fresh insights on a discussion you have been having. So why not join the conversation now, join the group if you have LinkedIn or even register with LinkedIn today and get involved!

One thing though please– while we encourage vigorous debate on these forums, they are places where we should all be safe to share ideas and news, without having to see any offensive content, spam or hostile messages. We ask that everyone ensure that they are reasonable and sensible when participating online, and of course that INCOSE members comply with the INCOSE Code of Ethics. The INCOSE Social Media team monitors postings and remove anything unsuitable, and take action where appropriate.

INCOSE @incose_org

Troy Peterson talking about #SystemsEngineering #MBSE the "Essential Discipline for #DigitalTransformation at #incoseIW ... the same message as at @NASAJPL earlier in the week



INCOSE @incosepres

Welcome to the #incoseIW here in Torrance – so many good things going on in #systemsengineering #systemsthinking



16:47 · 26/01/2019 · Twitter for iPhone

INCOSE @incosepres

It's been a fantastic #incoseIW here in Torrance – so many insights from meetings and informal conversations. Let's all make the most of the plans we've made and get ready for #incoseIS in #Orlando in July!



Note From the Editor

Lisa Hoverman, newsletter@incose.org

Welcome to the first Newsletter of 2019! We are coming off of our largest attended INCOSE International Workshop (IW) ever, held in Torrance, California this year. We have some great recaps from our INCOSE Leaders, Chapter, Initiative, and Working Group attendees that speak to our many collaborations, memorandums of understanding, and growing initiatives across the systems fields. We share some very exciting news around Certification in this issue and look forward to sharing more as more and new disciplines engage in systems engineering. We have some great videos of the INCOSE IW available on the INCOSE YouTube channel. I encourage you to check them out!

The Newsletter continues to grow and improve in content to inform our readership on all things INCOSE, both current, upcoming, and historically. There are some interesting previews on the many upcoming and exciting regional 2019 conferences, chapter meetings, working groups, and other initiatives of INCOSE

in this first Newsletter of 2019. As stated already, important to this Newsletter are some great articles from practitioners—practitioners tackling both the real and grand challenges of our times that apply to the Future of Systems Engineering.



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

We look forward to seeing you participating, networking at, and presenting at, one of the many terrific upcoming INCOSE events. I end with a sincere note of appreciation to all who contributed to this Newsletter. Have a wonderful March 2019, I hope to see you at the upcoming IS if not before!

INCOSE Member Newsletter

Publication of the International Council on Systems Engineering

Editor: Lisa Hoverman, newsletter@incose.org

Member Services: INCOSE Administrative Office
info@incose.org

+1 858 541-1725

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

Article Submission newsletter@incose.org

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

- Q1 Newsletter, General Content (GC): 15 Feb, Late
- Breaking News (LBN): 25 Mar
- Q2 Newsletter, GC: 15 May, LBN: 25 May
- Q3 Newsletter, GC: 15 Aug., LBN: 25 Aug
- Q4 Newsletter, GC: 15 Nov; LBN: 25 Nov.

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

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Who are we? INCOSE is a 17,000+ member organization of systems engineers and others interested in systems engineering. Its mission is to share, promote, and advance the best of systems engineering from across the globe for the benefit of humanity and the planet. INCOSE charters chapters worldwide, includes a corporate advisory board, and is led by elected officers and directors.

Follow us



7670 Opportunity Rd, Suite 220
San Diego, CA 92111-2222
USA

info@incose.org
www.incose.org
+1 858 541-1725

