

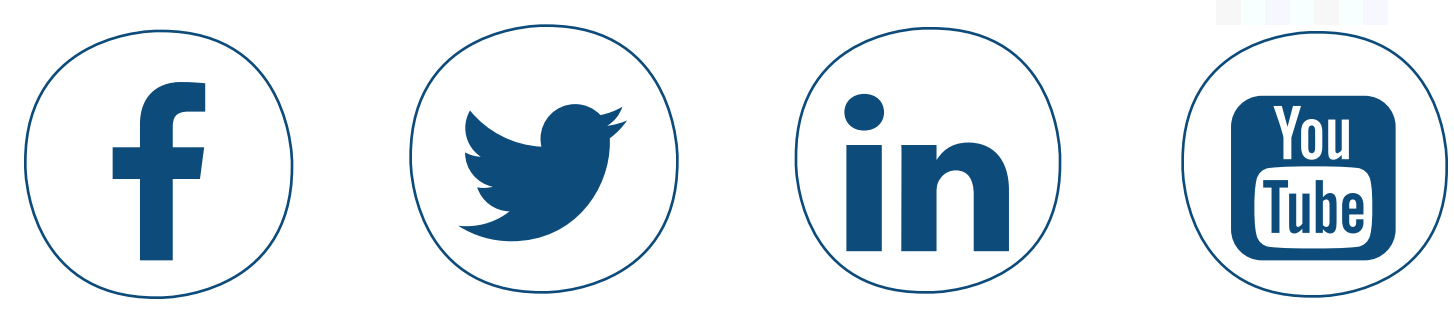
MEMBERS NEWSLETTER

December 2018 - Q4



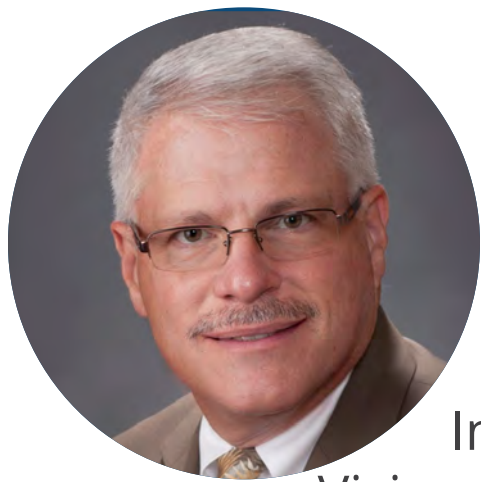
President's Corner • President-Elect's Letter • Notes from the Board • INCOSE Updates • Sector Updates • Working Group Updates • Academic Council News • EWLSE Update • ISEF • Spotlight ON! • Note from *INSIGHT* Editor Report from FEAPO • Social Media Update • Note from the Editor

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President's Corner

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



In my first newsletter article, I highlighted several things that we need to address to take INCOSE and our systems engineering discipline into the future. One of these is INCOSE Outreach: We believe we can achieve more through teaming and collaboration. We are working towards a more strategic and systematic approach to match alliances with common objectives and expected outcomes that help ensure both “partner” organizations and the systems engineering discipline obtain value from the relationships.

In July 2014, INCOSE published the Systems Engineering Vision 2025. “The purpose of the Vision 2025 is to inspire and guide the direction of systems engineering across diverse stakeholder communities...”

The Vision has been serving us well by guiding our community to try to achieve its objectives to align systems engineering initiatives and promote systems engineering research to address the future system engineering challenges and broaden the base of systems engineering practitioners. We will need to leverage the broader systems engineering and adjacent communities to be able to adequately meet these objectives and address the potential changes in the future systems and the environments in which they operate.

As we look forward, it is essential for us to lead the evolution of the systems engineering discipline, as I described in my Q2 2018 newsletter article. Today, we are seeing the systems environment changing more quickly than our practices. The Vision provides the following systems engineering imperatives to guide our path forward to provide the needed change:

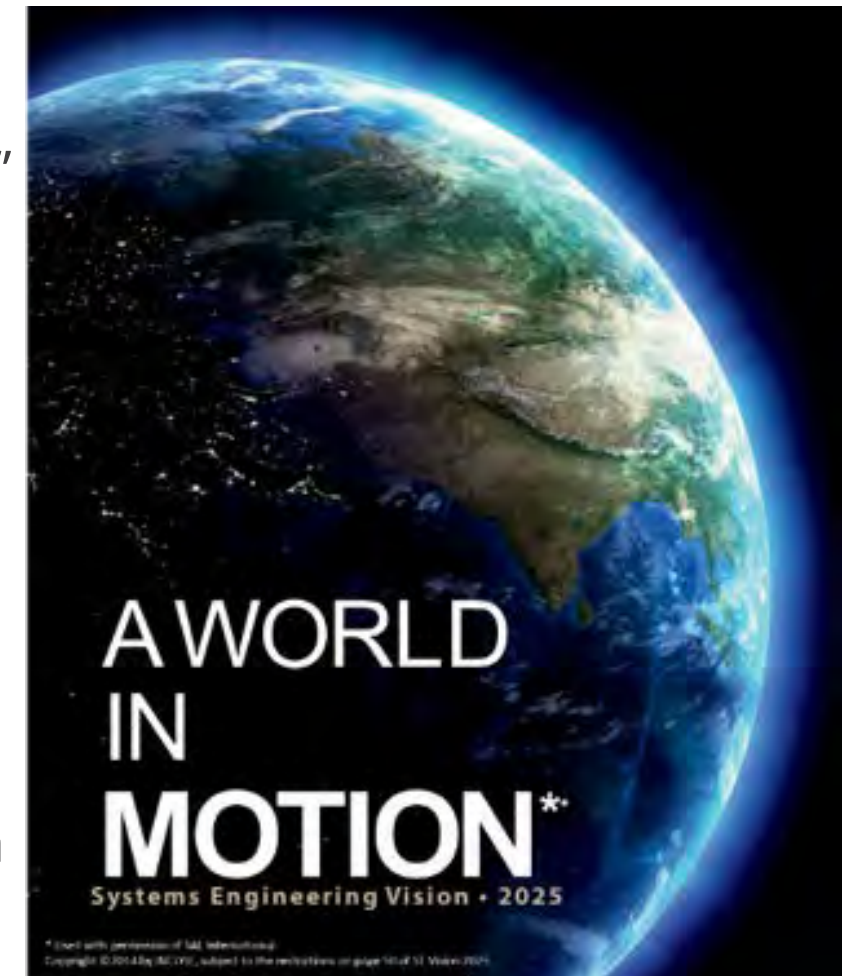
- Expanding the application of systems engineering across industry domains
- Embracing and learning from the diversity of systems engineering approaches
- Applying systems engineering to help shape policy related to social and natural systems
- Expanding the theoretical foundation for systems engineering
- Advancing the tools and methods to address complexity
- Enhancing education and training to grow a systems engineering workforce that meets the increasing demand

We have been establishing many strategic alliances and collaboration with other organizations to help shape and drive the change needed in accordance with the Vision. We have formalized many initiatives or projects that cross the industry, working with other industry associations, institutes, agencies, and diverse organizations. Just a few examples of our outreach to address these imperatives and our objectives include the following:



- Future of Systems Engineering (FuSE): intended to evolve systems engineering to enable us to leverage the new technologies that drive us fully into a dynamic, nondeterministic, and evolutionary environment. This initiative started in early 2018 and includes over a dozen other organizations.

- Digital Engineering Information Exchange Working Group: this new INCOSE-led working group was started in mid-2018 as a collaboration between INCOSE, the National Defense Industry Association (NDIA), and others. Members established this effort to respond to common needs to identify and define a finite set of digital artifacts across the life cycle of a system that stakeholders can use to exchange digital engineering information.
- Systems engineering principles: this effort has grown over the past couple of years and includes INCOSE and the International System Science Society (ISSS) to define systems engineering principles as part of establishing a stronger foundation for systems engineering.
- Integration of systems engineering and project management (PM): this alliance with the Project Management Institute (PMI) has been in place for several years and has resulted in a leading textbook on this topic. We are currently revising the objectives in a renewal of the alliance.



President's Corner

We have worked diligently to identify effective alliances and enter into agreements that will benefit all parties.

During the past year, we have signed a few memorandums of understanding (MOUs) and have several others in progress. We will continue to look for opportunities to build strategic alliances that move the global systems engineering community forward and:

- ❖ Focus on the future of systems engineering, systems thinking, and systems approaches
- ❖ Reach across disciplines to integrate systems approaches with other disciplines, both engineering-related and enterprise-related
- ❖ Expand our reach across domains to bring systems engineering value-added approaches to a wide variety of products, systems, and services
- ❖ Build stronger education and training of systems engineering, systems concepts, and systems thinking, not only within systems engineering, but also across other engineering and non-engineering disciplines

Finally, as a reminder, the INCOSE International Workshop (IW) is coming up soon – 26-29 January 2019. It will be back in Torrance, US-CA this year. Registration is open on the [INCOSE IW 2019 website](#).

The [schedule](#) is starting to populate and looks exciting!

	Start	End	IBD	Institute for Technical Leadership	MBSE Initiative	CAB	Awards Comm.	TechOps Leadership	Working Groups	Sector / Chapter Leaders	Events Comm.	IS2019 Technical Planning	Policy Management Committee	Certification	Fellows	Academic Council	Budget & Planning	Foundation	
Friday	07:00	18:00																	
Friday	08:00	12:00	Registration																
Friday	08:00	12:00		Institute for Technical Leadership															
Friday	13:00	17:00																	
Friday	18:00	21:00																	
Saturday	07:00	12:00																	
Saturday	08:00	12:00	Registration																
Saturday	08:00	12:00																	
Saturday	13:00	17:00																	
Saturday	18:00	21:00																	
Sunday	07:00	12:00																	
Sunday	08:00	12:00	Registration																
Sunday	08:00	12:00																	
Sunday	13:00	17:00																	
Sunday	18:00	21:00																	

Come, be part of impacting the future of systems engineering!



2019
Annual **INCOSE**
international workshop
Torrance, CA, USA
January 26 - 29, 2019



President-Elect's Letter

Kerry Lunney, kjlunney@tpg.com.au

Hello All,
2018 has almost come and gone with 2019 knocking on our door. The last few months have continued to maintain the fast and vibrant pace with which the year started.

Since the last newsletter, the Board of Directors (BoD) has focused on continuing the refinement of the INCOSE value streams and searching for volunteers and professional services to execute numerous tasks for the betterment of INCOSE. This includes seeking to fill a new role-product portfolio manager. If you are interested, please let us know!

We have aggressively worked our 2019 budgets to best align our funds to support our value streams, as well as maintain our strong base of activities and events. 2019 will see new initiatives, such as the inaugural Human Systems Integration (HSI) Conference in Biarritz, FR, 11-13 September. Likewise, we will be implementing a volunteers opportunities website late in the year. Please take a look when it is up and running—there may be something that you can be part of, and at the same time earn professional credits towards your systems engineering certification, as well as boost your resume.

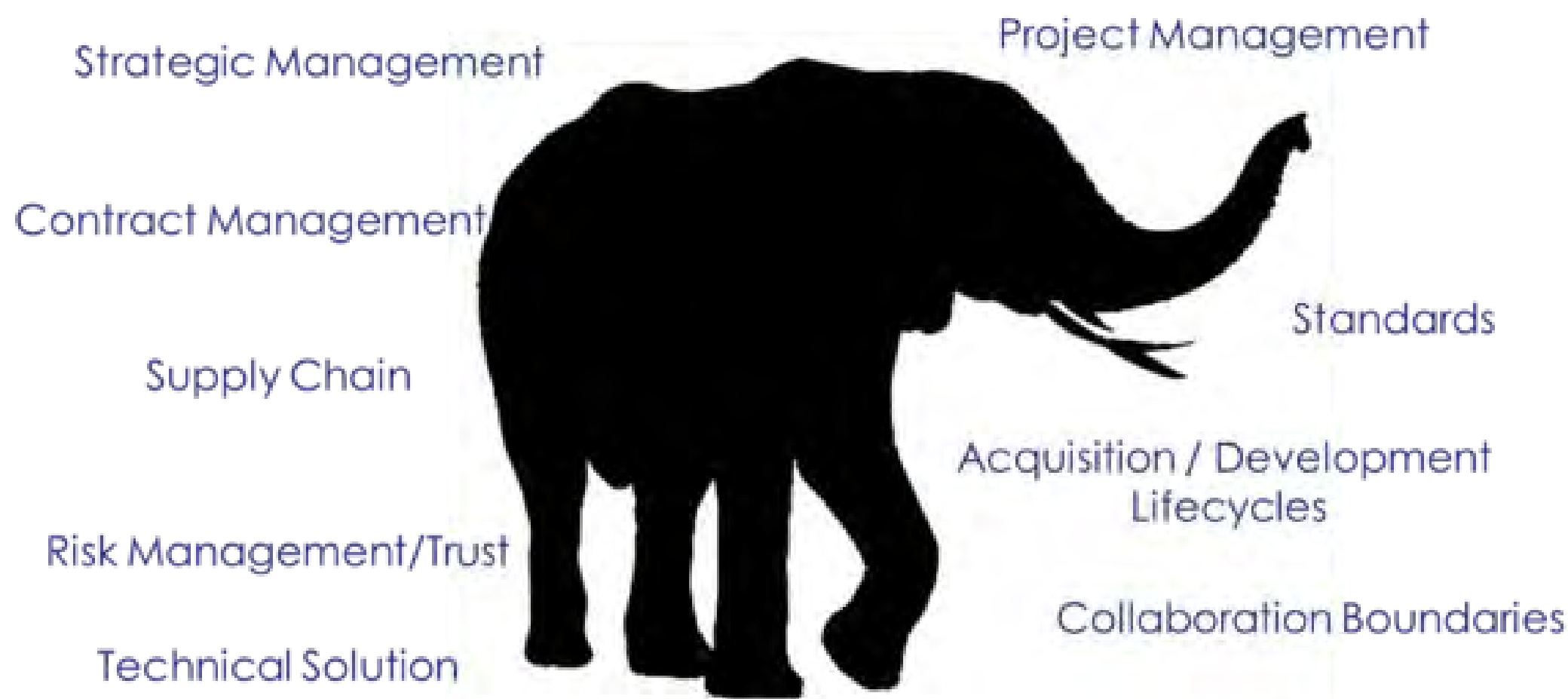
In addition to the Board activities, I had the opportunity to present with other INCOSE colleagues at the INCOSE China Systems Engineering Summit in Beijing, CN. What a great event! Presentations flowed around the theme of “Leading Innovation.” The topics ranged from the possibilities to support the goals of the World Sustainment Group in our “systems capacity” from Alan Harding, to look at four axes of innovation in systems engineering from yours truly, and to consider implications for systems engineering in the future of commercial space from Heinz Stoewer.



While in Beijing, Alan and I assisted our certification program manager, Courtney Wright, in proctoring the certification paper exams. I believe we had over 200 members sit the exam in one week, setting a new INCOSE record. Well done INCOSE China! All exam sessions ran smoothly with only the one surprise that I witnessed—the falling of flower petals over a desk. One of the examinees opened his heavy family English dictionary for a translation only to find out his mother had been using it to press flowers. A nervous moment then followed.

President-Elect's Letter

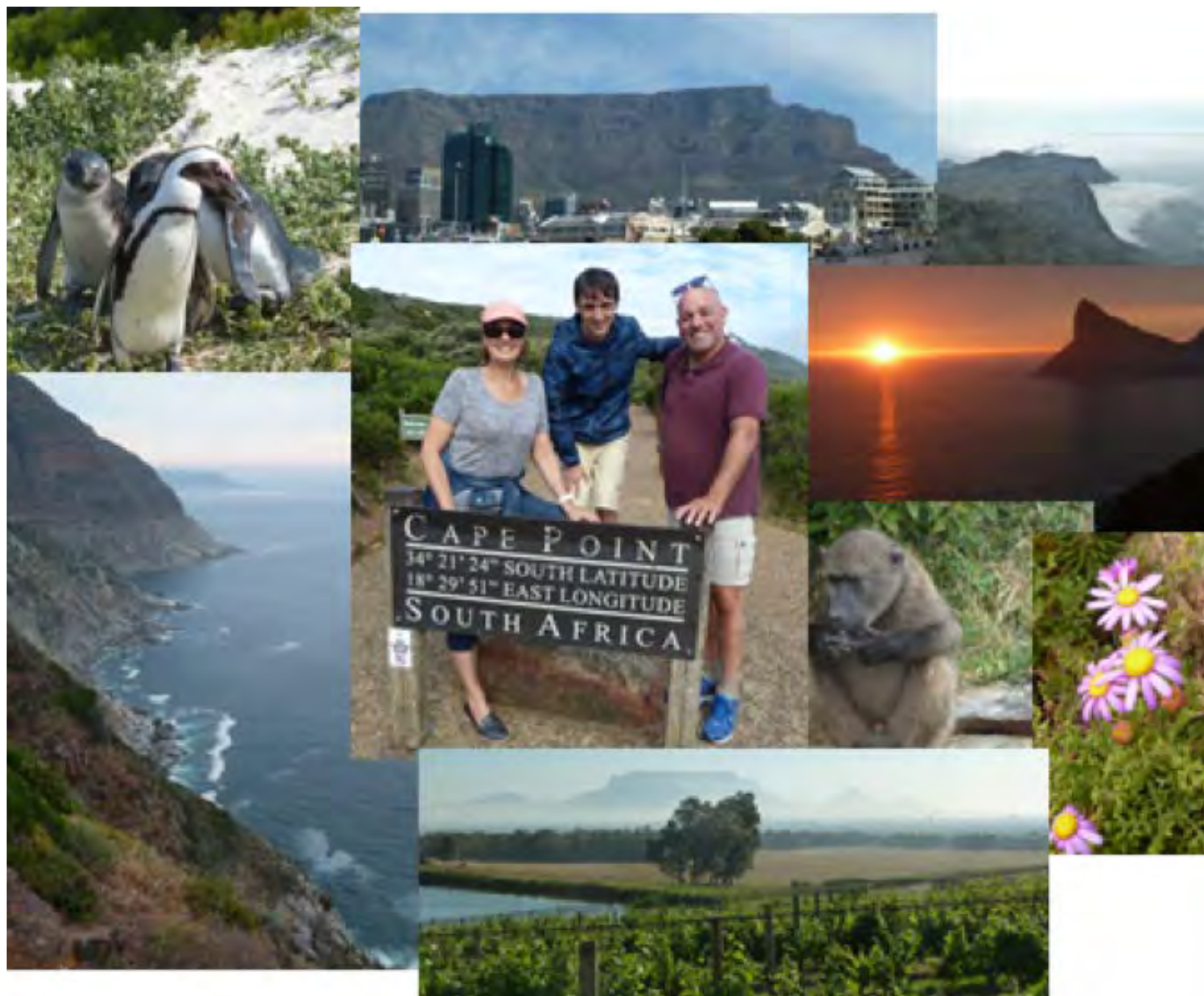
Just prior to the Beijing SE Summit, I had the pleasure of presenting in a webinar on the internet of things (IoT) and the challenges this presents for integrating into large systems solutions, particularly in the defence domain. Members appreciated that to fully gain the benefits of implementing the IoT as part of a larger system, one must also modify the current approaches in other non-technical disciplines—those black elephants (see figure below)—acknowledged but not addressed adequately in the acquisitions of such systems.



Those Black Elephants to be Tackled to Fully Gain the Benefits of IoTs Implementation in Large Systems

Implementing the IoT offers advancements in such areas as equivalency analysis, development lifecycles, problem definition, technology, and the creation of the digital twin. These in turn can address such challenges posed by privacy, security, safety, resilience, intentional obsolescence, rate of change, and data ownership, when balanced with the handling of those black elephants.

I was also fortunate to attend the EMEA Sector Systems Engineering Conference 2018 (EMEASEC2018) event in Berlin, DE. It was well-attended with over 400 participants, and it offered a varied and interesting program. Topics on agile approaches, the future of systems engineering, and the importance of resilience, to name a few, generated much interest and discussion. But the topic that resonated with me was the final keynote speaker on “Water Pumps—Pumps in Perspective.” This presentation showed the evolution of the simple mechanical pump to the interconnected, digitally-controlled pumps of today, operating in a much larger system and working towards addressing goal six of the UN Sustainable Development Goals, “clean water and sanitation.” It highlighted the fact that, with increasing interoperability and connectedness, almost every sensor and control mechanism will be part of a system in the future—exciting times for us all!



Lastly, just for your consideration in early planning, below is a collage of photos from different sites around Cape Town, South Africa that a few of us managed to see at the conclusion of the recent INCOSE BoD meetings, before we flew out the next morning.

If this was possible to do in a few hours, think of what you and your family could experience should you visit in 2020 as part of the INCOSE International Symposium (IS2020)!

I hope the year was successful and happy for you. All the best, and enjoy the end-of-year festivities. I wish you well and look forward to an exciting 2019.

Cheers, Kerry

Notes from the Board

Rachel LeBlanc, marcom@incose.org

The INCOSE Board of Directors (BOD) recently held the Q4 Board meeting in Cape Town, South Africa. This will be the site for the 2020 International Symposium and being there provided the board with a wonderful opportunity to experience how fantastic this location is and how much it has to offer conference goers and visitors. I would like to send out a big thank you to our hosts during the meeting!



30th Annual **INCOSE**
international symposium

Cape Town, South Africa
July 18 - 23, 2020

Meeting agendas were very full as the BOD covered a variety of topics critical to the current and future health of the organization. Per usual, this BOD meeting focused on budgets for the end of this fiscal year and the start of the new fiscal year. There was a deliberate focus on how the proposed budget aligned with our strategic objectives, value streams, and initiatives.

Planning for 2019 was also a key focus. The International Workshop (IW) and International Symposium (IS) were topics of discussion, as well as new international activities like the Human Science Institute Conference and an initiative to launch a Corporate Advisory Board Executive Forum. In addition to focusing on events, the Board discussed strengthening our alliances by increasing our holistic approach to tracking and measuring the alliances and their impact. Other topics included strengthening our strategic objectives and value streams to increase efficiency and highlighting synergies to increase their potential impact on the systems engineering community; creation of a volunteer board to more effectively match members to opportunities; creation of a media kit for increased opportunities to provide value to our community; and a review of the status of action items from the International Workshop (IW) strategy sessions.

The Board looks forward to connecting with members at the International Workshop (IW) in Torrance, US-CA in January! We will welcome the following Board members at this time.

- Kayla Marshall–Secretary
 - Lisa Hoverman–Director, Marketing and Communications
 - Tony Williams–Americas Sector Director (re-elected)
- New INCOSE appointments:
- Don Boyer–Associate Director, Membership Engagement
 - David Mason–Assistant Director, Membership for Young Professionals

INCOSE Updates

IT - Check Whose Message It Is!

Bill Chown, cio@incose.org

We have all seen examples of identity abuse, and this can impact our INCOSE activities as well as any personal matters. We would like to alert all members that we have seen more than a few instances of attacks on chapter and group activities lately, and we recommend that you take any steps you can to identify false challenges, check to prevent loss of funds, and be safe.

In a recent example, an email from a chapter president requested the treasurer to make a wire payment. This was not a planned or budgeted payment, but the request initially looked perfectly legitimate. After more investigation, the sender's name was correct, but the email address from which it was sent was bogus. Checking with the actual president confirmed that this was a scam attempt, not a part of any known major identity theft, but an illegal challenge none the less.

Several simple precautions can help validate INCOSE messages, confirm the source, and help us identify any recurring issues.

When sharing INCOSE information, making financial transactions, or in any way reacting to a request for INCOSE, please look at the sender's email address, and not just the apparent name. If the address is not recognized, please check with the apparent sender, save the message, and let the INCOSE Chief Information Officer (CIO) know. This is a common characteristic of many spam email messages, and you can use the facilities of your email tool to see more details of the sender email.

If an INCOSE financial transaction is requested, please immediately question, is it in the planned budget? Is it going to the expected destination, by the expected method? Most often, a fraudulent request will ask for an electronic transfer, but the chapter would expect to send a check, for instance.

If someone asks for members' information, that is something to be treated as seriously as any financial request, as personal information is also valuable to a perpetrator, allowing correlation of various sources. Additionally, our and your responsibilities under personal data privacy rules – and here INCOSE follows the European General Data Protection Regulation in all our worldwide dealings– mean that you cannot share any personal information without having received individual explicit permission for that usage from the person or persons concerned.

If you experience any of these situations, or have any questions, please contact our CIO at cio@incose.org so that we can investigate.

INCOSE Updates - Technical Operations

Mike Celentano, mike.celentano@roche.com and David Endler de@davidendler.de

INCOSE Technical Operations (TechOps) leadership would like to invite you to join us for the 2019 International Workshop (IW) in Torrance, US-CA, 26-30 January 2019. The following will give you an update on what we have been working on to make the INCOSE IW even more effective and valuable.

We have been working with INCOSE's Events Committee to continuously improve the event by listening to the feedback we obtained from past years. This feedback helped us to develop those areas where we received inputs and ideas to increase the value of the event, and to strengthen those areas that are already well-received. For IW2019, we will have about the same balance between working group (WG) sessions, invited presentations, and networking opportunities as in the past.

At the beginning of IW, we will have an orientation meeting for all first-time attendees. In case IW2019 is your first one, please check the corresponding field when you register. Before the IW, you will receive some information that will help you to prepare the event. Also, INCOSE will pair you with an "INCOSE IW veteran" whom you will meet at the First-Time Attendee Reception right after the Opening Plenary. Your veteran will help introduce you to the right people and subsequently get you involved in the WGs that match your interests. He or she will know INCOSE, INCOSE's topics, and the IW structure very well, so you will get answers to all questions you may have. Your veteran will support you throughout the whole IW, and we encourage you to stay in touch even after the event.

There will also be many opportunities for networking for those of you who have already attended an IW. As in past years, there will be the INCOSE Foundation Soirée, several receptions, such as Systems Engineering Professionals, and Model-Based Systems Engineering, the Market Place, and

breaks between the sessions to network with other participants. The INCOSE IW is an excellent opportunity to get in touch with experts in various areas of systems engineering.

Just as in the years before, at the 2019 IW there will be town hall sessions on Sunday and Monday mornings. They cover a variety of subjects, typically cross-cutting, and therefore of interest to all participants. For the 2019 IW, the town hall sessions include status presentations on impactful topics like Future of Systems Engineering (FuSE), Professional Development Portal, and the Model-Based Systems Engineering (MBSE) Initiative. In addition, INCOSE president, Garry Roedler, will provide important information related to the growth of INCOSE. Each slot is 30 minutes in total, with 15 minutes of presentation and another 15 minutes for audience discussion. All town hall sessions will be video recorded and made available via the INCOSE YouTube channel later for those not in attendance.

The heart of the 2019 will be the WG sessions which will be either led by a single WG or by several WGs. To help potential participants get a better idea of what they can expect and to ensure that we get the most out of our volunteers' time, we have introduced a couple of improvements in the planning phase of the IW.

To get a better idea of INCOSE's more than 45 WGs, all WGs will update the information provided on their website and provide a summary in a working group information sheet (WIS). WGs will publish all sheets prior to the IW to help you plan which sessions to attend.

Also, when booking meeting space for the sessions, INCOSE is requiring all WG chairs to add some more information about the session content, such as whether the session

is a working session or an outreach session. These improvements should help you put together your own agenda for the 2019 IW.

One thing you definitely should not miss is the Market Place at the end of the IW where all WGs present the progress they have made in a poster session. This is a great opportunity to see the impact of INCOSE's IW and to get in touch with the WGs that did not fit in your schedule. The WG's will also present planned work and upcoming products. All the presented information comes from the aforementioned WIS, which the WGs update during the IW.

In conclusion, there are multiple ways to get involved and to benefit. We are looking forward to welcoming you at IW2019. There, you can make a difference in our global systems engineering community by contributing to one of INCOSE's WGs, helping first-time attendees to feel welcome, serving in an INCOSE leadership position, sharing your knowledge with others, or by simply building a strong systems thinking network.

Sector Updates Americas

CFR Attends the WSRC

Renee L Steinwand,
steinwand_renee@bah.com

The Western States Regional Conference (WSRC) was the inaugural INCOSE Regional Conference for the western states, held in September 2018. The Western Region Chapters represented the conference well. The location in Ogden, Utah in the US was beautiful. WSRC had six tracks with 26 papers presented. There were four key note speakers. Local industries and academic institutions participated in the conference as well. We are planning the 2019 WSRC in the Los Angeles, California area.

Sector Updates - Americas

CFR Attends the WSRC

Four members from the Colorado Front Range (CFR) INCOSE Chapter attended/presented at the WSRC. The CFR team consisted of Renee Steinwand, Valkand Jhaveri (VJ), Morgan Nicholson, and Casey Medina.



Casey Medina and Morgan Nicholson presented papers and VJ conducted an INCOSE ambassador meeting. Renee participated on the planning committee for WSRC as part of being the associate director for the Western Region. We all volunteered and helped in many tasks including photographer, easy chair review, session chair, set up, and welcome team. What a great start for the WSRC!



INCOSE Western United States Chapters Host Inaugural Western States Regional Conference

Phyllis Marbach, prmarbach@gmail.com;
Paul White, paul.white@kihomac.com

The INCOSE Western United States Chapters held the Inaugural Western States Regional Conference (WSRC) on 20-22 September 2018, in Ogden, US-UT. The conference took place at the Northrop Grumman Conference Center in the scenic Ogden Canyon. The technical program featured 41 presentations, panel discussions, tutorials, and workshops. On Thursday, the 20th of September, Richard Jee, chief engineer for BAE Systems, kicked off the opening plenary by speaking about the complexity of defense systems and the importance of managing workforce development. Following Richard Jee's opening remarks, the conference continued with a choice between tutorials or presentations. Several individuals took the SEP Beta Exam, offered that morning. The next day, Friday, 21 September, included three tracks of presentations and panel discussions about topics spanning agile, model-based systems engineering (MBSE), project management, resilience,

sustainability, systems engineering across the enterprise, and ground-breaking specialties.

A systems engineering professional development day (SE-PDD) track of presentations were broadcast live to four satellite sites—two in Seattle, US-WA and two in Los Angeles, US-CA. Garry Roedler, INCOSE president, senior fellow, and Engineering Outreach Program manager at Lockheed Martin, delivered a keynote about the Future of Systems Engineering (FUSE), the Systems Engineering Primer, and the updated definition of systems engineering developed by INCOSE fellows. During the evening banquet, Dr. Benjamin E. Goldberg, senior director of Science and Engineering at Northrop Grumman, delivered a dynamic speech how to apply systems engineering principles to solve current technological challenges.

The last day, Saturday, 22 September, concluded with two tracks of presentations and two workshops. Justin McMurray, director of Programs at Northrop Grumman, gave a keynote about the future of systems engineering. Paul White, WSRC 2018 chair and senior systems engineer for Kihomac, thanked participants for their attendance, and Phyllis Marbach, WSRC 2019 chair and retired engineer at Boeing, spoke briefly about next year's WSRC.

The committee is grateful to the sponsors of the conference, namely INCOSE Americas Sector, Lockheed Martin, No Magic, Northrop Grumman, Siemens, The AnyLogic Company, California Institute of Technology (Caltech), Capella, i3Day Innovation, Kihomac, Sysnovation, The University of California at San Diego Extension, Weber State University, Project Performance International, charlesvono.com, NYMBYSYS, and Utah Advanced Materials and Manufacturing Initiative (UAMMI).

The Western United States INCOSE Chapters who planned the event included Wasatch (Utah (UT)), the host chapter; Cascade (Oregon and Southern Washington); Central Arizona; Colorado Front Range; Enchantment (New Mexico); Los Angeles; San Diego; Seattle Metro; Snake River (Idaho); and Southern Arizona. Participants traveled from 16 US states and one Canadian province to attend. 119 attendees participated—92 in UT, 27 at a satellite site.

Thanks go to all the attendees and those who provided tutorials, presentations, and panel discussions in addition to the invited keynote speakers. The exchange of ideas, challenges, past experiences, and future goals of systems engineering were very stimulating. We indeed discussed the theme, "Systems Engineering out W.E.S.T. in the Workplace, Environment, Sustainment and Technology." Participants enjoyed delicious food, ample networking, and stunning scenery. The conference chair, Paul White, and the committee members were very happy to provide this conference for our western chapter members and invited guests.

Sector Updates - Americas

INCOSE Western United States Chapters Host Inaugural Western States Regional Conference

The WSRC Committee is busy planning the Second Annual WSRC which will be in Southern California. The location of the conference tracks will be Loyola Marymount University where the Regional Mini-Conference 2016 was held. The conference is teaming with the Renaissance Hotel near the Los Angeles International Airport (LAX). Transportation will be provided from the airport to the hotel by the hotel shuttle. Another shuttle will provide rides to the campus from the hotel.

Save the date of 13-15 September 2019 for the 2nd WSRC in sunny Southern California. We hope you will attend in person; and if that is not possible, please consider hosting a remote site to keep your systems engineering practices current—learning about leading-edge practices and solutions to challenges the technical community is facing. Contact Phyllis Marbach, WSRC 2019 Conference chair, at prmarbach@gmail.com, for more information.

CFR Members enjoying dinner while at WSRC



INCOSE LA

Phyllis Marbach, prmarbach@gmail.com;

INCOSE LA members and guests heard the relevant topic, “What is a System and What is Systems Engineering?” by INCOSE Fellow, Dr. Scott Jackson on 7 August 2018. An international body of INCOSE fellows developed the presentation, and the following members developed recommendations: Hillary Sillitto, from Edinburgh; Scott Jackson, Los Angeles; Regina Griego, New Mexico; Dov Dori, Tel Aviv; Daniel Krob, Paris; Eileen Arnold, Minneapolis; Dorothy McKinney, California; Patrick Godfrey, Bristol, England; and James Martin, Virginia. The team wrote a white paper to distill the discussion of the definition of systems engineering so it is constructive and helpful, both to systems engineering practitioners, and to those INCOSE is reaching out to, to educate the value of systems engineering. Dr. Jackson’s presentation summarized their findings and seeks feedback from the membership.

On 11 August, several members of the INCOSE LA board gathered at the Manhattan Beach Community Church for a strategic planning meeting. Dr. William Good, our speaker, explained the need to mitigate the risk of unconventional terrorist attacks. For more information, see The Cameron Group’s article, “Cameron Vehicle-Based Threat Detection System (VBTDS) for WMD/Explosives in Air Cargo,” at <http://bit.ly/CameronVBTDS>.

Several members of the chapter spent many stimulating days at the Inaugural Western States Regional Conference in Ogden Utah, 20-22 September 2018. Details of this event are in the previous article by this author in this newsletter.

October was an especially busy month with the speaker meeting on the 9th of October where Dr. James Humann presented, “Modeling and Simulation of Distributed Human-Agent Teams.” On 13 of October, the chapter participated in a science, technology, engineering, and mathematics (STEM) outreach event to local schools with other professional organizations and Northrop Grumman in Redondo Beach, California. Despite the rainy weather, hundreds attended to learn more about the Mars Rover missions and the James Webb Space Telescope. Chapter members also supported the PMI Global Conference, 5-8 October, at the Los Angeles Convention Center. On the 10th of November, LA Board members met again for the Fourth Quarter Strategic Planning Meeting where we set the budget for 2019, filled committee positions for the 2019 Western States Regional Conference, and verified that the chapter is continuing to meet the vision and mission outlined in our planning documents. The topic of the 13 November speaker meeting, held at The Aerospace Corporation in El Segundo, California, was “Systems Engineering for Space Science Missions” with Jon Arenberg. There, we had an interesting discussion about the value that systems engineering brings to the successful development of complex systems.

INCOSE LA published the 2019 INCOSE LA potential officer biographies in their October-November 2018 newsletter, and the election is taking place as this newsletter goes to press. In December, the loyal volunteers will meet at the Del Rey Yacht Club in Marina Del Rey, US-CA, as a courtesy of our member Bo Oppenheim, to celebrate the end of another good year and to look forward to the future. In January 2019, the chapter will host a town hall meeting at a local restaurant to induct the elected officers and conduct a member survey.



Sector Updates - Americas



Yvonne Bijan, yvonne_bijan@hotmail.com

The INCOSE North Texas Chapter has had a busy year. We delivered a professional growth opportunity to members by starting a Model-Based Systems Engineering (MBSE) Interest Group with the purpose of improving our professional skills through learning how to apply MBSE on a project. The intent of this group is to model the processes in the INCOSE Systems Engineering Handbook using Cameo and SysML, which will improve our knowledge of the systems engineering processes and our modeling skills.

Presentation of the results will provide chapter members with the opportunity to contribute to the MBSE body of knowledge and the national organization. Results will be presented at one or more future INCOSE International Working Group events.

North Texas members also had several members attend the INCOSE International Symposium (IS) held in July with members Barry Papke, Kayla Marshall, Ken Garlington, Susan Ferreira, and Tyson Browning speaking. Papers include:

- Barry Papke and Gan Wang: "Integration of Parametric Cost Estimation with System Architecture-It's a Dirty Job but Someone Has to Do It!"
- Rick Dove, William (Bill) Schindel, and Ken Garlington: "Case Study: Agile Systems Engineering at Lockheed Martin Aeronautics Integrated Fighter Group"
- Clement Smartt, William Casey, and Susan Ferreira: "Using Force - Field Analysis as Part of Systems Engineering Strategy to Achieve Goals"

These papers are available to all INCOSE members on Wiley. Also covered at the INCOSE IS was a tutorial by Tyson Browning on "Project Design and Management with the Project Value, Risk, and Opportunity (PVRO) Framework" and a presentation by Kayla Marshall on "A Systems Thinking Approach to Philanthropy: How a Systemic Approach Could Strengthen our Impact."

The North Texas Chapter has increased its online presence through the creation of Twitter and Instagram accounts. The Twitter account is [@incosentx](https://twitter.com/incosentx), the Instagram account is [incose.ntx](https://www.instagram.com/incose.ntx). Through these accounts, members are posting about systems engineering related research, interests, or projects. Posts will also include news and updates about ongoing events.



INCOSE North Texas Chapter is Posting on Instagram & Twitter!!

North Texas members had the opportunity to attend the annual No Magic World Symposium and staff a booth in the exhibit hall.

There, we observed an excellent line up of speakers that are experts on MBSE. This symposium provided opportunities to network and interact with experts in aerospace, automotive, manufacturing, healthcare, financial services, and other industries.

INCOSE North Texas Chapter attends NMWS!



Participants received presentations on the latest advances in MBSE, SysML, product lifecycle management, product line engineering, enterprise architecture/Unified Architecture Framework (UAF), conceptual modeling and ontology. Members can find presentations from the symposium at <https://nmws2018.com/>.

The North Texas Chapter sponsored and proctored three INCOSE certification exams in 2018. Special thanks go to Dani DeRoche, Tim O'Conner, Matt Hayden, and Mike Yokell for making sure the exams took place, as well as No Magic and the Benbrook Library for hosting us.

The chapter held eleven meetings this year with speakers presenting on various topics, ranging from MBSE to agile systems engineering to blockchains. Presentations from these meetings are available on our website at <https://www.incose.org/incose-member-resources/chapters-groups/ChapterSites/north-texas/library-and-resources>.

The chapter has experienced continuing growth in 2018, with 35 new members joining in 2018. Seven of our members achieved INCOSE SEP certifications this year. We would like to extend our congratulations to:

- Thaddeus Milburn, ASEP (Medtronic, Inc.)
- Nicholas Dew, ASEP (Triumph Group Inc.)
- Justin C' de Baca, ASEP (Lockheed Martin Corporation)
- Justin Kieser, ASEP (Lockheed Martin Corporation)
- Marcus Payne, ASEP (Lockheed Martin Corporation)
- David Brynell, CSEP (Lockheed Martin Corporation)
- Timothy O'Conner, ESEP (Lockheed Martin Corporation)

The Chapter toured the Bureau of Engraving and Printing (BEP) in Fort Worth where we discovered there are only two locations that print our paper money: one in Fort Worth and the other in DC. We learned about the whole printing process. Here are some interesting takeaways:

- Money is not made from paper!
- Printed currency goes under 20,000 pounds of pressure during part of the process.
- Other parts of the process include drying and curing the ink for three days in between some of the print steps. A lot of engineering went into the design of the equipment and processes involved.

Sector Updates - Americas & Asia-Oceania



- Star notes are used by the BEP to replace misprinted/damaged currency before it goes into circulation. These replacement notes are printed just like normal notes, except there is a star printed in the serial number. On Federal Reserve Notes, the star is where the block letter normally is (the last letter of the serial number). On Legal Tender Notes and Silver Certificates, the star is where the prefix normally is (the first letter of the serial number). Star notes are printed in what are called runs. For the current printing systems used by the BEP, the maximum run size for star notes is 3.2 million notes (100,000 32-note sheets). Sometimes, this many notes are not needed, in which case less are printed. If a partial run is printed, the next run will start at the next closest multiple of 3.2 million. Star notes get their rarity from the quantity printed and released into circulation.

Our chapter member, Brian Kennedy, authored the book, "Success Is Assured: Satisfy Your Customers on Time and on Budget by Optimizing Decisions Collaboratively Using Reusable Visual Models." The book teaches how to consistently satisfy your customers on-time and on-budget by optimizing decisions collaboratively using reusable visual models.

The North Texas Chapter sponsored multiple teams in The Association of Old Crows (AOC) Fort Worth Chapter Scholarship Golf Tournament with all proceeds benefiting the AOC Fort Worth Scholarship Fund.

The North Texas Chapter held its End of Year Networking Event on the 8th of December at La Hacienda Ranch. At this event, members networked with their peers in the chapter over a buffet-style dinner.

We look forward to many enriching chapter meetings and continuation of our MBSE activities next year.

Other highlights included:

- Operating a SESA booth at the Australian Engineering Conference, where over 1000 engineers of all disciplines met to hear excellent presentations on the big topics in engineering. See <https://ausengcon.com.au/> for details.
- Participating in the Engineers Australia Engineering Practice Advisory Committee (EPAC) meeting, where leaders from all technical societies (of which SESA is one), colleges, and interest groups get together to hear about future planning for Engineers Australia (EA). Some notable activities and presentations included:
 - Briefings on EA Plan, Engineering Futures, Graduate Strategy and Professional Development Stages
 - Planning for EA Centenary celebrations and World Engineering Conference (WEC) <https://www.wec2019.org.au>
- Planning for the 2019 Systems Engineering Test and Evaluation (SETE) Conference
- Conducting a SESA strategic planning meeting on the day after ASEW, using the INCOSE Guide to Strategic Planning in the Guide for Effective Chapters wiki. We have several exciting new initiatives which we need to develop and promulgate on our SESA Strategic Plan (on a page) by the end of 2018. We are also busy on more detailed planning for our 2019 annual operations. Budget inputs are due by end of November.

Ongoing activities included monthly committee meetings and regular Asia-Oceania Sector meetings.

ASEW 2018

SESA holds the Annual ASEW in October/November each year and rotates the event around the major cities in Australia. This year it was Adelaide's turn and what a great event it was! Local Adelaide leaders Brad Spencer (convener) and Charles Homes (technical chair) produced a memorable combination of technical, competency development, networking, and social activities over a two-day event. We had a modest target of 80 participants, and, thanks to great local support, we exceeded our most optimistic expectations. Well-attended workshops addressed transportation, telecommunications, model-based systems engineering, system of systems, modelling and simulation, competency framework, and development of early career systems engineering, project management and systems engineering integration, and decision analysis and lifecycle.

I have highlighted some of the events in the following pictures, starting with Brad's closing plenary introduction.

...that's a wrap!

Asia-Oceania



Australia Chapter

Bill Parkins, bill.parkins@bigpond.com

Australia-Systems Engineering Society of Australia (SESA) Report

Hello again from Australia!

It has been another active quarter for the Systems Engineering Society of Australia (SESA), with the main focus on preparation for and delivery of the Australian Systems Engineering Workshop (ASEW).

Sector Updates - Asia-Oceania

Australia-Systems Engineering Society of Australia (SESA) Report



Some photos from a very successful ASEW2018 - 130 registered participants, 58.5 hours of aggregated content, 19 Sessions, 5 parallel streams. Top center: Bradley Spencer, SESA President at the Closing Plenary; top left: the SESA Committee at the Opening Plenary; bottom right: early career systems engineers; bottom left: Engineers Australia National President Trish White and board member Greg Walters in discussion with INCOSE Past President David Long at the INCOSE Technical Working Group poster display

A special note of thanks to Charles Homes who, in addition to his ASEW technical chair, has handed over the role of SESA technical director to Jawahar Bhalla. In his time as technical director, Charles has re-architected ASEW and SETE, and has introduced the National Speaker Program which is re-invigorating local state branch meetings at our state capital cities. As we move towards a membership of 600, the value of the programs that Charles has piloted for two years is evident.

The TWG quad chart poster display was very popular as it gave the attendees an introduction to the broad range of topics available in INCOSE. We also took the opportunity to engage with members of the Engineers Australia board and discussed areas where SESA's two parent organisations (INCOSE and EA) had common ground and areas for future collaboration. In particular, these include:

- Future of engineering (studies in progress in both EA and INCOSE)
- Graduate programs and early career systems engineering
- Women in engineering and Empowering Women Leaders in Systems Engineering (EWLSE)
- Corporate engagement and relationships to other engineering groups
- Training, professional development, certification, and competency framework



One of the primary objectives of ASEW is to generate topics of interest to the systems engineering community and to seek contributions to our annual conference. Please look up the website and contribute if you can. Even better, contribute in person in Canberra next April at SETE! <https://sete2019.com.au/call-for-abstracts/>

Beijing Chapter

Jiaqi Zhang, jiaqi.zhang@incose-beijing.com

The Second INCOSE Beijing Chapter Summit

The second INCOSE Beijing Summit was held in Beijing, CN on 26 September 2018. The INCOSE Beijing Chapter, the Department of Industrial Engineering, Tsinghua University, and AVIC Digital (AVIC, Aviation Industry Corporation of China, Ltd.) jointly organized the summit. The one-day summit was themed "Systems Engineering—Leading Innovations" and featured several exciting keynotes. After the summit, the Beijing Chapter organized the Academic Council and INCOSE paper certification test on the 27th of September, to provide more opportunities for candidates to get involved in INCOSE.

Sector Updates - Asia-Oceania

Beijing Chapter



Dr. Zhang, Xinguo, president of the INCOSE Beijing Chapter and EVP/CIO of the Aviation Industry Corporation of China (AVIC), attended the summit and delivered a keynote entitled “Model-Based Systems Engineering Transformation and Innovation.” Kerry Lunney (INCOSE president-elect), Alan Harding (immediate past president of INCOSE), Cihan Dagli (professor of Engineering Management and Systems Engineering at Missouri University of Science and Technology), Bruce Douglass (chief evangelist at IBM), Heinz Stoewer (INCOSE past president), and other experts made brilliant speeches on different topics, such as the development trend of systems engineering, model-based systems engineering methods in the development of complex systems, advanced system architecture theory, and system modeling language.

The Beijing Summit attracted nearly 300 experts from government, universities, and many other industrial domains, such as aerospace and electronics





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Engage with your colleagues from
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Learn about state-of-the-art
methods and essential skills for
Systems Engineers.

Find out how people are making a
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Sector Updates - Asia-Oceania

India Chapter

Sewalkar Swarupanand, SewalkarSwarupanand@JohnDeere.com

INCOSE India Chapter Pune Circle Event

On the 28th of September, the INCOSE India Chapter conducted the 7th Pune Circle Event at SKP Business Consulting, in Pune, India. Several industry professionals from different organizations around Pune attended the event. The event started with a presentation about SKP Consulting by Mr. Lalit Kathpalia followed by an introduction to INCOSE India and its functions by Stueti Gupta, president of the INCOSE India Chapter.

The highlight of the event was the "Beer Distribution Game" which is a simulation of dynamics in supply chain. Initially, details of beer distribution game were explained to the attendees. There were 3 teams and every team had 4 members playing different roles - Factory, Distributor, Wholesaler, and Retailer. During the game every participant was simulating supply chain activities like checking demand, fulfilling the order, logging deficit, and placing orders. As the game proceeded week by week in simulation, it did not take very long to realize the complexity created by simple delays added in the system. Nikhil Joshi, secretary of the INCOSE India Chapter, guided players through the game during the session. Post-game discussions revealed some interesting learning and takeaways, most notably, the "bullwhip effect." Amazingly, every team felt the same "bullwhip effect"-a small change in demand at the retailer end which created drastic changes at further levels in the supply chain.

Throughout the game the energy level of participants was high and everyone was engaged in the game. The event concluded with networking over high tea.

Systems Engineering Student Competition

The INCOSE India Chapter and PES University (www.pes.edu) jointly organized "Systems Engineering 2018"-a project competition for final-year engineering students.

The intent of the competition was to enhance the awareness of systems engineering concepts among students, illustrating the benefits of following the systems engineering principles and practices. The student teams were expected to illustrate how they had adopted systems engineering principles and practices while working on the problems.



Pune Circle Event Attendees

Dr. Venkatarangan of PES University coordinated the competition. The respective teams presented the final shortlisted projects on the 22nd of September 2018, at the PES University campus. A panel comprising Professor Mahendra Nayak (PES University), Ramakrishnan Raman (Assistant Sector Director, INCOSE Asia Oceania) and Priyasloka Arya (INCOSE India Chapter, executive committee member) evaluated the student team presentations. Professor Keshavan (head of the Electrical and Electronics Engineering Department, PES University), Ramakrishnan Raman, and Professor Mahendra Nayak presented the award certificates and prizes to the winning teams.

The winning teams were:

- First prize:
 - Design and Coordination of Robots for Tasks
 - Team: Aditya Y. Kashyap, Chandrashish Prasad, Nandish M. S.
- Second Prize:
 - Aquaponics: An Integrated and Automated Modern Organic Farming System
 - Team: Parvathi Nair Bindhu and Pranitha Chappidi



Sector Updates - Asia-Oceania and EMEA

India

INCOSE India Conducts National Institute of Industrial Engineering Model-Based Systems Engineering Workshop

An INCOSE India member who arranged and participated in the workshop shared the following experience:

"It is not every day that you get to go to one of the most prestigious institutes in India to teach, to share your work experience, and to interact with their faculty and students. This year, on the 20th of October, I got a chance to conduct a workshop on model-based systems engineering (MBSE) along with Stueti Gupta and Dr. Nikhil Joshi, president and secretary of the INCOSE India Chapter respectively. Professor Mukundan, operations manager at the National Institute of Industrial Engineering (NITIE), Mumbai, requested this workshop for his PhD and executive program students to focus on applications of MBSE, and specifically SysML in the industrial context.

The workshop started with an introduction to INCOSE, its efforts in India, and how students can contribute and benefit from participating in other events and conferences. The workshop continued with "The Basics of Systems Engineering," "Why MBSE?," and a hands-on session with SysML tools, including modelling problems, related manufacturing, and real-world examples that everyone could relate to. We ended the workshop by shedding light on an alternate modelling language called OPM (Object Process Methodology).

I must say, it has been a satisfying and great learning experience for me. I hope it was equally satisfying for the twenty-seven participating students. I would like to thank NITIE, Professor Mukundan, and the students for their hospitality, and showing us a glimpse back into college life. I wish them all the best for future endeavors, and hope they "keep calm, and keep modelling!" - *New kid on the block, Mudit Mittal – Member INCOSE India*



Attendees at the NITIE MBSE Workshop

INCOSE India Chapter Launches Online Quiz for Certification Aspirants

Based on member's feedback to a survey that the India Chapter held, they introduced an online quiz introduced for all INCOSE India certification aspirant members. All the questions relate to specific topics of systems engineering. This will help those members who are planning to take the certification exam in the near future.

All the questions are based on the Systems Engineering Handbook and the answer key also provides a reference to the specific sections. The frequency for the quiz will be once every two weeks. We are getting an excellent response for the quiz. INCOSE India also maintains an archive of the past quiz questions for those members who want to visit the past question papers.nce behind the systems engineering that we practice.

EMEA Update

Paul Schreinemakers, schreinemakers@how2se.nl

The 3rd EMEA Systems Engineering Conference (EMEASEC2018) took place in Berlin, Germany from the 5th-7th of November. This conference was a great success with 412 participants representing all three sectors. EMEASEC dedicated day one to tutorials only, and both day two and three were loaded with keynotes, panels, tutorials, and exhibitor presentations. I would like to thank the organizing committee for putting this excellent conference together. We will combine the next EMEASEC with the INCOSE International Symposium (IS2020) in Cape Town, South Africa.

After the United Kingdom in 2014, the Netherlands in 2017, and GfSE last year, 2018 was AFIS's turn to celebrate their 20th anniversary. On the 5th and 6th of December, the French Chapter held its RobAFIS event as part of this milestone celebration in the city of Nancy, France. Congratulations AFIS on this milestone!

Every year, the EMEA Chapters hold many local events during the course of 2019.

Let me point out to you two of the cross-cutting EMEA events:

- ❖ INCOSE Human Systems Integration 2019 Conference, 11-13 September, Biarritz, FR
- ❖ EMEA Workshop 2019, 10-11 October, Utrecht, NL

At this time of the year, candidates are on the ballot for many of the chapter board positions. As a member, please cast your vote in these local elections. I wish all candidates success and I am looking forward to working with those elected soon.

INCOSE UK

Molly Stone, Richard Tingley, publications@incoseonline.org.uk

It is a very busy time of year for INCOSE UK! Debuting at the INCOSE UK Annual Systems Engineering Conference, 2018 (ASEC 2018) are two new INCOSE UK publications. TeamStorming, devised by Professor Jon Holt and Simon Perry, is a unique brainstorming and team-building technique that has no need for complex notations or tools, but which is built on the rigour of systems thinking.

The TeamStorming methodology enables the benefits of systems thinking and systems engineering through several well-proven brainstorming exercises that allow a group of people to work together to answer specific questions related to their business, all underpinned by a systems model that produces an output that can be used as a formal input to systems engineering activities. Both TeamStorming guides will be available to purchase from the INCOSE UK website after ASEC 2018.

For the very first time, the INCOSE UK will publish ASEC 2018 speaker's papers and they will be available to purchase at ASEC 2018 and afterwards from the INCOSE UK online store. Member feedback informed us there was a need to publish a physical copy of the proceedings and we felt it would be a good way to enhance public awareness of INCOSE UK.



In addition, INCOSE UK is beginning the preparations for the 2019 Training Day and is inviting individuals and organisations to deliver full-day training sessions on the 6th of June. The proposed venue is Marsh Farm near Royal Wootton Bassett and we hope to confirm this in the new year.

The Training Day provides an opportunity for INCOSE members to explore new topics and extend their knowledge of systems engineering practice. The aim is for each session to cover either an introduction to a subject, such as requirements for model-based systems engineering, or a more detailed insight into a specific topic like running a successful requirements review. Members can find details of timelines in the most recent issue of ePreview.

In 2019 INCOSE UK is celebrating its 25th Anniversary. The UK Council is considering how to mark this event but it has been decided that, as part of the anniversary, the Royal Armoury in Leeds will be the venue for ASEC 2019 from 20-21 November 2019.



Competency

Don Gelosh, dsgelosh@wpi.edu

Please Provide Feedback to The Competency Working Group! The Competency Working Group (CWG) would appreciate your feedback on the recently released **INCOSE Systems Engineering Competency Framework**. In particular, the CWG would like to know who has used the framework, how they applied it, and what aspects of it they found most valuable. Suggestions for improvements, corrections, or additional content learned from using the framework are greatly appreciated. General feedback and comments are always welcome. Please send your feedback to: info@incose.org.

IV&V

Jim Armstrong, jimarmstrong29@aol.com

Interested in the IV&V Working Group? We are planning two sessions for the Integration, Verification & Validation (IV&V) Working Group at the 2019 International Workshop (IW). The first will discuss methods for automated test case generation. The second will be a discussion of experiences and issues that engineers need address in systems integration. All are welcome to attend and bring inputs for these interesting subjects.

Training

John Clark, john.clark@incose.org

The INCOSE Training Working Group (TWG) presents free systems engineering training webinars for all INCOSE members, employees of INCOSE Corporate Advisory Board (CAB) members, and employees and students with INCOSE Academic Council membership. The INCOSE TWG would like to invite you to the following current series of five webinars by Dick Fairley based on ISO/IEC/IEEE Standard 15288:2015 (technical processes).

This series began on Thursday, the 8th of November 2018. Each session starts at noon US eastern standard time and will last approximately one hour. To access the live webinars per the dates on the initial schedule below, click on <https://incose.pgimeet.com/GlobalmeetOne>, log in as a guest, and follow the prompts. The initial schedule is subject to change.

Date	Time	Topic	Presented by
8 Nov 2018	Noon (EST)	Requirements Engineering Part 1	Dick Fairley
15 Nov 2018	Noon (EST)	Requirements Engineering Part 2	Dick Fairley
3 Jan 2019	Noon (EST)	System Architecture	Dick Fairley
10 Jan 2019	Noon (EST)	System Design	Dick Fairley
17 Jan 2019	Noon (EST)	System Implementation	Dick Fairley

Working Group Updates

Training

To access the latest schedule, slides, and past webinar recorded files, log in to INCOSE Connect using your username and password, click on <https://connect.incose.org/Library/Tutorials/training/SitePages/Home.aspx>, scroll down to Systems Engineering Technical Processes, click on Tutorial Session: 01 Requirements Engineering, the Tutorial ID that you want, and download the files.

Other past TWG tutorial sessions include: Systems Engineering Fundamentals (Tutorial ID: 02_October 2014), Systems Engineering Handbook v3.2.2 (Tutorial ID: 02_October 2014), Systems Engineering Handbook v4.0 (Tutorial ID: 01 October 2015), and Leadership Skills (Tutorial ID: 01 thru 04). INCOSE records all sessions for later download. Questions? Contact gabriela.coe@incose.org or john.clark@incose.org.

Academic Council News

Ariela Sofer, ariela.sofer@incose.org

International Federation of Engineering Education Societies (IFEES) News

In our continuing effort to spread the concept of education in systems engineering for every engineer world-wide, Ariela Sofer, Alice Squires, and Delaney Heileman attended the joint International Federation of Engineering Education Societies (IFEES)/Global Engineering Deans Council (GEDC) annual conference known as the World Engineering Education Forum–Global Engineering Dean’s Council (WEEF-GEDC) from 12-15 November in Albuquerque, US-NM.

INCOSE has been a society member of the American Society of Engineering Education (ASEE) for several years, and has now gone international by joining IFEES in January 2018.

The theme of the conference was "Peace Engineering" where the focus was on engineering for solving the world's major problems of well-being: environment, health, education, climate change, human disasters, and more. These are all complex problems where systems engineering has an important role. The term systems-wide thinking arose often and was a key element in the path to world peace.

At the conference, IFEES elected Ariela Sofer into one of five open slots for the Executive Committee. Her speech emphasized the importance of promoting systems-wide holistic thinking among engineers worldwide. This gives INCOSE representation on the International Society for Engineering Education Board as well as two boards within ASEE: the Corporate Member Council and Systems Engineering Division Boards.

Peace Engineering:

A Call to Action for Systems Engineers Around the World

Alice Squires, alice.squires@incose.org

The World Engineering Education Forum–Global Engineering Dean’s Council (WEEF-GEDC) 2018 Conference organizers define peace engineering as “the intentional application of systemic-level thinking of science and engineering principles to directly promote and support conditions for peace. (Jordan et al. 2018).” This definition is a call to our systems engineering community to share systems-related concepts, principles, practices, and the corresponding thinking that have matured through the systems sciences and systems engineering fields. The focus on engineering education is the foundation of both ASEE and IFEEES. Putting systems engineering in the context of global challenges, such as sustainable world peace, but also the National Academy of Engineering Grand Challenges and the United Nations 2030 Sustainable Development Goals, provides an excellent context for teaching systems engineering in an engaging and meaningful way. These alliances support INCOSE in bringing systems thinking to the broader population—a goal of SE Vision 2025.

Dr. Squires presented a paper on “Maturing Systems Competencies for Engineering a Better World,” authored by Drs. Squires and Sofer. The paper reviewed ongoing global challenges, work that the INCOSE Academic Council and others have done, and recommendations for moving forward. Dr. Squires also participated in a workshop with the Stanford Peace Innovation Lab on defining the body of knowledge of peace engineering and a systems framework towards world peace, and we are hoping to continue a collaboration with the Stanford Peace Innovation Lab and INCOSE moving forward.

Dr. Squires also attended a student-sponsored workshop activity, “Educating Future Female Engineers,” (see below) that was sponsored by the Global Student Forum and provided by the Society of Women Engineer (SWE) Student Chapter of the University of New Mexico. One of the main points presented was that girls score higher on science and math than boys at a young age, so what happens when they get older? It is a very good question. The group did their research and presented seven strategies for how to teach female engineers. The presenters then asked the faculty attending the workshop to experience the strategies through a set of four activities. As teams of men and women, we walked away with several insightful *a ha!* moments about the differences in approaches each team member had in working together to solve problems, no matter what their country of origin or gender. Overall, it was a good experience to be taught by the team of young women and men.

Reference:

Jordan R., K. Agi, E. Maio, I. Nair, D. Koechner, and D. Ballard. 2018. “Peace Engineering.” *Global Engineer: IFEEES-GEDC Bulletin* 3 (3): 16-19.

Academic Council News

Educating Future Female Engineers

Delaney Rose Heileman, sweunm@unm.edu

The path to becoming an engineer is paved with difficult coursework and rigorous studying, but for many women there are additional road blocks that pop up when they express interest in STEM (science, technology, engineering, and math). These barriers start appearing at a young age as conscious and unconscious biases in the classroom push girls away from their interests. The result of this is a dramatic lack of women in engineering careers; in the United States they only make up ~15% of the industry. As engineers design roads, computers, and a variety of technologies, they are in fact designing the world around us. With a small number of women in engineering, a significant portion of the population is being left out of crucial designs.

Presentation on best practices for educating future female engineers



The University of New Mexico Society of Women Engineers wanted to address the discrepancies in education that lead to a lack of women in engineering. Many of the members remembered fighting for their voices to be heard and for their interests to be taken seriously in primary education. With this context and personal experience, the section wanted to present WEEF-GEDC attendees with tangible skills that would enable them to understand their biases and move forward. The presenters based the workshop around the “SciGirls Seven”–seven proven strategies that engage young girls in STEM activities. The strategies promote collaboration, creativity, and engaging learning.

For the workshop, four tables were set up to each highlight different strategies. The activities were designed to give participants an in-depth understanding of their current deficits and tangible ways to move forward. One table had participants list as many female STEM role models they could think of in a three-minute time period. Most groups struggled to list more than four women. To follow up this activity, workshop leaders gave each participant a photo of a different influential women in STEM and a small biography about her. They were then asked to list traits they shared with her. This allowed participants, male and female, to understand how they related to these women and gave them a new role model to share with students and peers.

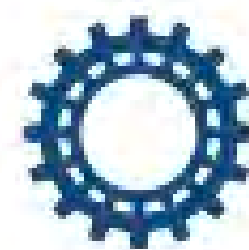
As the groups rotated through the four activities, they were able analyze their own group dynamic, how they worked collaboratively, and how their dynamic changed as they rotated through the different stations.



Breakouts where faculty attendees learned from “SciGirls Seven”–seven proven strategies that engage young girls in STEM activities



When the groups came together for a closing discussion, participants discussed these dynamics and brainstormed ways to promote collaborative environments based on their own experience in the workshop. Unanimously, group members decided that a good team relationship is vital to the success of any group, whether it be in a conference workshop or a physics lab. Participants then discussed different strategies for implementing ice breakers and team building exercises in educational settings where this typically does not occur, and how to make these activities accessible to all students.



EWLSE Update

Empowered Leaders Ready to Reach out to Women in Engineering: We Need You!

Alice Squires, ewlse@incose.org

Supportive people and relationships, female role models, and self-efficacy (the belief in one's ability to accomplish a specific task) in engineering are several of the top factors that influence whether women enter into engineering. To this end, representatives of the Empowering Women as Leaders in Systems Engineering (EWLSE) team reached out to members of the Society of Women Engineers and the American Society of Engineering Management at their annual fall conferences, to share the INCOSE and EWLSE vision and mission along with research and initiatives related to women, engineering, and leadership. In a related outreach effort, the INCOSE Academic Council report on the World Engineering Education Forum–Global Engineering Dean's Council includes a summary of a workshop given by the Global Student Forum on "Educating Future Female Engineers" which readers can find in the Academic News section of this newsletter. 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).

INCOSE / EWLSE Outreach at the 2018 Society of Women Engineers (WE18) Conference

Cornita Bullock, cbullock@alionscience.com; Federica Robinson-Bryant, robinsof@erau.edu;
Marilee Wheaton, marilee.j.wheaton@aero.org

The Society of Women Engineers (SWE) held its annual Women in Engineering (WE18) Conference, 18-20 October 2018, at the Minneapolis Convention Center, in Minnesota. This year's theme, "Let's Break Boundaries," motivated the atmosphere of the conference to encourage leadership in engineering and foster the professional growth of women. WE18 was the largest ever with over 14,000 exhibitors, professionals, collegians, and academia in attendance. WE18 was a fantastic opportunity for INCOSE and EWLSE outreach!

INCOSE, through the EWLSE team, served as an exhibitor at the WE18 Exhibit and Career Fair among hundreds of corporations, professional organizations, government agencies, academic institutions, and more. At the INCOSE booth, a steady stream of attendees visited throughout the conference. Some were unfamiliar with professional standards, so it was an opportunity for INCOSE EWLSE members, Cornita Bullock, Federica Robinson-Bryant, and Marilee Wheaton, to share the purpose of INCOSE and its benefits to organizations and individuals, and to encourage INCOSE membership and certification. Specifically, many of the engineering student attendees expressed interest in the INCOSE certification program to enhance their education and training. Additionally, former INCOSE members received information about several INCOSE working groups and publication opportunities, and were encouraged to re-establish their involvement in the organization.

Dr. Robinson-Bryant mentioned that "INCOSE's presence at the conference seemed to be well-received. Individuals asked me a range of questions and actively engaged in conversations across a range of topics. While some participants seemed to be more aware of INCOSE's offerings and focused more on SEP certification requirements, others had no prior exposure to INCOSE and were open to receiving several takeaways." Other areas of engagement included specific EWLSE activities and initiatives, and professional mentoring for women in engineering.

The INCOSE booth had frequent visitors at the 2018 Women in Engineering (WE18) Conference.

Left: Federica greets INCOSE booth visitors; Right: Cornita and Federica at WE18!



EWLSE Update - SWE & ASEM

Throughout the conference, Ms. Bullock led an effort to provide one-on-one resume reviews with young professionals and job seekers across many engineering disciplines. She feels “it was very special to provide impromptu resume critiques and mentoring for young professionals seeking the best way to represent their work and education experiences.” This demonstrates the value of INCOSE’s presence at the conference to provide mentoring to engineers; these opportunities unveiled a pathway to discuss the relationship of many engineering disciplines to systems engineering, INCOSE support-oriented groups like EWLSE, certification, and other initiatives. The winner of the t-shirt giveaway was one such participant and she expressed her esteemed gratitude in being able to explicitly exhibit her engineering identity via the INCOSE-branded shirt that read, “The Woman. The Myth. The Engineer.”

The WE18 main events included:

- ❖ Career Fair–Exhibits from a variety of large engineering and technology corporations were present to screen the best and brightest candidates for positions at their companies. The opportunity to meet hiring managers and have an on-the-spot interview was offered to attendees.
- ❖ Keynote Speakers–Special presentations by dynamic keynote speakers, Cindy Kent, Marillyn Hewson, and Kim Underhill. Each speaker shared their unique backgrounds and gave inspirational speeches that reverberated the rhythm of the conference theme of “Let’s Break Boundaries.”
- ❖ State of Women in Engineering–SWE researchers and other industry leaders presented the latest research and data on the state of women in engineering, STEM leadership, gender bias, and STEM workplace culture.
- ❖ Invent it. Build it–Focused on peaking the interest girls in grades 6-12 in the field of engineering through discussions on how engineers help solve problems for people around the world, conversations with women engineers, and fun hands-on engineering activities. In addition, the workshop provided information on engineering clubs and scholarships.
- ❖ Other events–WE18 offered opportunities to attend other activities, such as virtual participation, general breakout sessions, plenary sessions, mega sessions, CEU credit educational events, as well as elegant banquets to honor SWE award recipients.



WE18 granted an exciting experience to the thousands in attendance to become more informed about how women can push pass boundaries to impact the future of engineering. In addition, the conference provided engineering students and professionals with valuable access to major companies, organizations, and academic institutions seeking qualified recruits in the most convenient way possible.

“As an exhibitor, participation gave me the opportunity to meet and work with successful women within INCOSE and build relationships among participants that will impact my perspective of the field and extend my own support system. While much of the efforts with the participants was a conversation to expose them to INCOSE, there were many opportunities to get to know them better and improve my own understanding of the experiences of women in engineering.” said Robinson-Bryant.

In reflecting on the event, Ms. Wheaton adds, “Participating each year in the SWE National Conference, which I have attended since my first one in Cherry Hill, US-NJ in 1980, is part of my commitment and passion. I even attended the 1988 conference in Puerto Rico when I was pregnant with my now 30-year-old twins! So that’s how I knew that SWE would be a great outreach event for INCOSE and EWLSE.”

INCOSE plans to continue outreach activities to women in engineering at WE19 in Anaheim, US-CA. Any INCOSE or EWLSE member that is planning to attend the WE19 and is willing and able to support our INCOSE/EWLSE SWE booth, please email EWLSE at ewlse@incose.org.

EWLSE UPDATE - ASEM

Where are the Women in Engineering?

Federica Robinson-Bryant, robinsof@erau.edu;

Alice Squires, ewlse@incose.org

EWLSE sponsored a technical session on "Exploring Why Women Enter, Leave, Return to, or Stay in Engineering and Engineering Leadership Roles" developed by Federica Robinson-Bryant and Alice Squires at the American Society of Engineering Management Annual Conference, 17-20 October 2018 in Coeur d'Alene, Idaho, US. The Washington State University Engineering and Technology Management Department team, including students, attended the conference in large numbers.

The conference theme of "Bridging the Gap Between Engineering and Business" was a portent to bridging the gap between the 47% of women in the US labor force and the 12% of women in engineering in the US. In the United States in 2010, about 20% of engineering bachelor's graduates were women; similarly, 25% of earned engineering masters and 23% of earned engineering doctorate degrees were women. We have a long way to go to bridge the gap and at this pace of female engineering graduates, with nearly four times as many women as men leaving the engineering workforce, the gap will not close for decades to come.

As reported in the presentation, a 2017 study of 1,464 women (Fouad et al. 2017) who left engineering jobs did so primarily because of the work environment, including poor or inequitable compensation, poor working conditions, and an inflexible and demanding work environment that made work-family balance difficult. Following this, women left due to a dissatisfaction with effective utilization of their math and science skills resulting in unmet achievement needs. And finally, there was a lack of recognition at work and lack of adequate opportunities for advancement.

However, as shared directly by women, there are many reasons why women enter into engineering:

- ❖ Finding out about engineering and seeing a good 'fit'
- ❖ Attracted by what current engineers said they worked on
- ❖ Excelled at math, science, technical drawing: self-efficacy
- ❖ Family encouragement and support; one or more parents are engineers; father's influence; a belief that they can do anything
- ❖ Encouraged by a teacher or school program; success in school
- ❖ Based on job; career options; attractive salary
- ❖ After seeing the NASA moon landing video/other major events

The presentation concluded with some steps we can all take to support women in engineering:

- ❖ Raise awareness—yours and others
- ❖ Consider becoming an advocate or spokesperson for diversity and inclusion

- ❖ Be a workplace ally: when we see someone being treated as a target, stop the behavior in the moment, convey non-acceptance, change the situation going forward
- ❖ Assign non-technical and administrative tasks to all participants, share the load
- ❖ Become a mentor and a mentee to young engineers
- ❖ Set up open inclusive self-development workshops and training events
- ❖ Establish directors of diversity, equity, and inclusion across our institutions.
- ❖ Research uncovered one very effective step that we can take that makes the most difference for women and underrepresented minorities in choosing a career— *offer internships to women and underrepresented minorities!*

After the presentation, one female faculty member was heard saying, "This has really convinced me that I really need to get more involved in the Society of Women Engineers Chapter on my campus. I am going to do that." To which another female faculty mentioned, "I feel exactly the same way."

Are you interested in supporting the field of systems engineering by becoming a mentor for a systems engineer, or alternatively, 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 to start the process.

Reference:

Fouad N. A., W. S. Chang, M. Wan, and R. Singh. 2017. "Women's Reasons for Leaving the Engineering Field." *Frontiers in Psychology* 8:875. doi: 10.3389/fpsyg.2017.00875.



The Washington State University Engineering and Technology Management team - INCOSE EWLSE Founder Alice Squires at the far back left



INTEL ISEF 2018

Every year since 2009, INCOSE has sent a team of judges to the International Science and Engineering Fair (ISEF). In 2018, the team of INCOSE judges was (left to right in the picture below): Chandru Mirchandani (INCOSE fellow); Dorothy McKinney (INCOSE fellow), lead; John Walker (INCOSE Southern Maryland Chapter member); Judy Walker (INCOSE Southern Maryland Chapter member); Shazad Contractor (INCOSE SFBA Chapter member); Bill Mackey (INCOSE fellow); Nancy Roseberry (INCOSE Pittsburgh Chapter member).

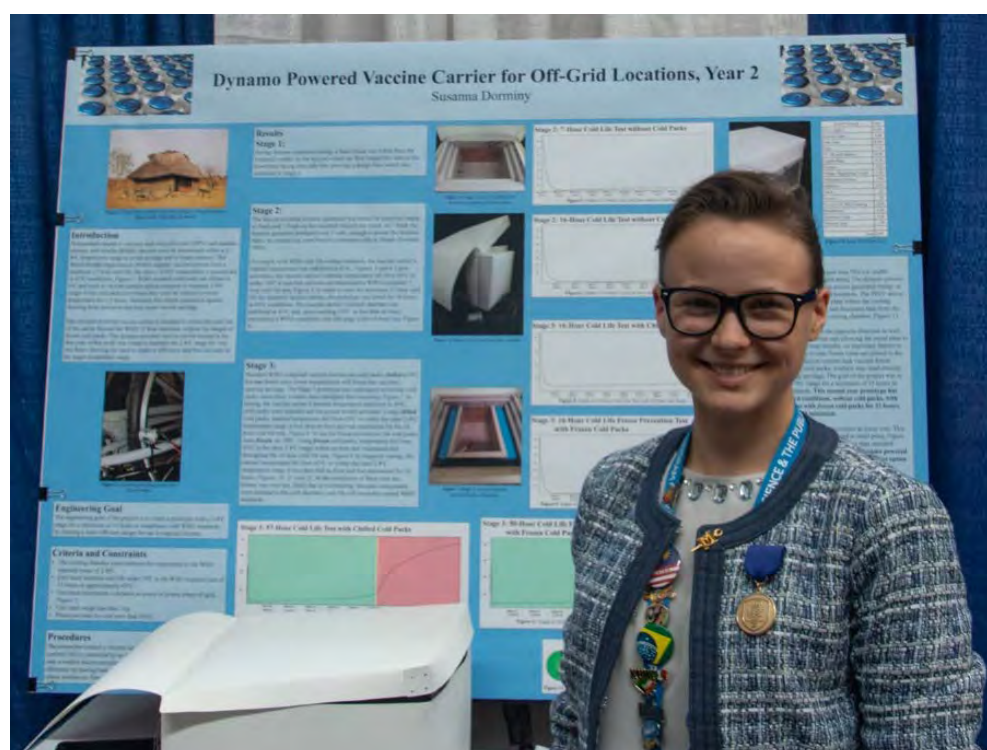


- **Best Overall Systems-Engineered Project winner: Susie Dorminy**
- **Best Systems-Engineered Prosthetics Project winner: Everett Kroll**

Covering a field of over 1800 high school student projects from over 100+ countries around the world, in 2018, the four INCOSE judges selected twelve honorable mentions and two winners:

Descriptions of the winning and honorable mention projects follow below. If any INCOSE members are interested in serving as judges for ISEF in 2019, which requires being in Phoenix, US-AZ from the evening of 13 May to early evening on 15 May 2019, please contact Dorothy McKinney at dorothy.mckinney@icloud.com.

The winner of the Best Overall Systems-Engineered Project was Susie Dorminy from US-GA. Susie is shown below in front of her project poster, which she also displayed at the 2018 INCOSE Symposium (IS2018). She developed a low-cost way to transport vaccines by bicycle. International standards require vaccine transport to keep vaccines refrigerated for at least 36 hours.



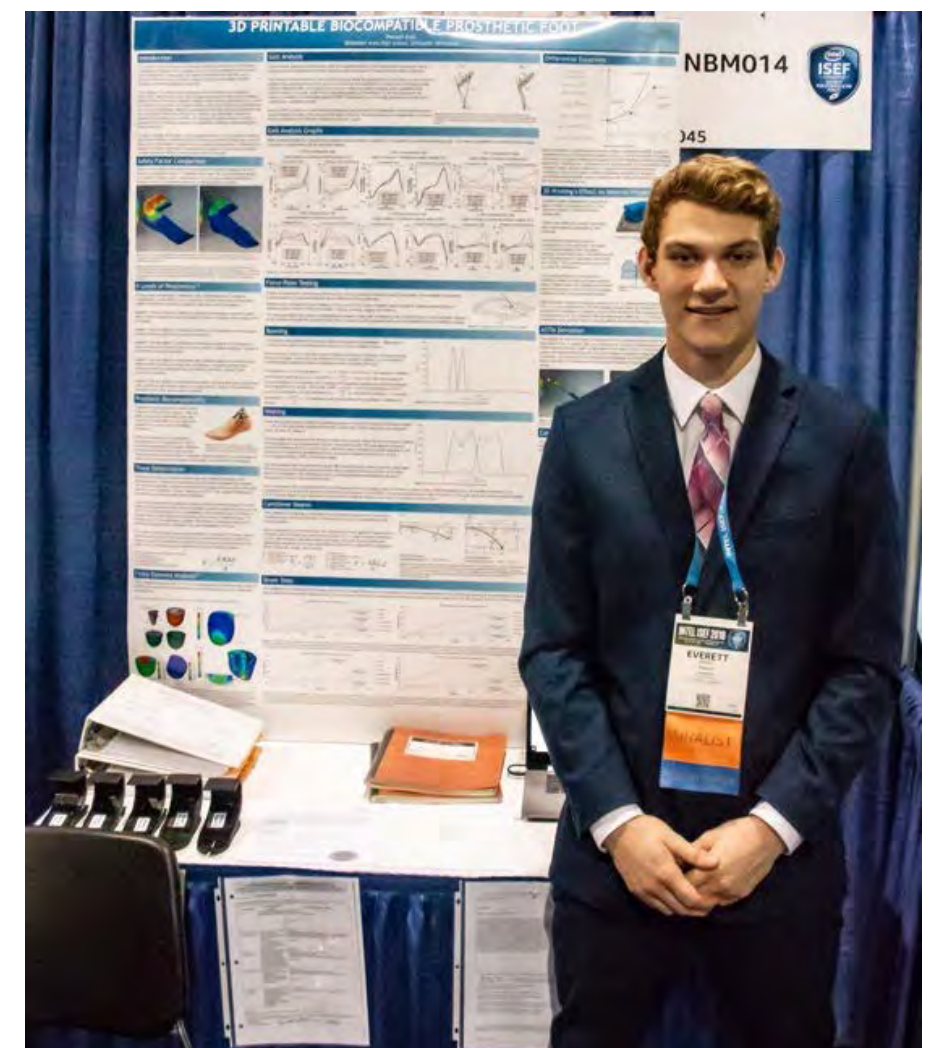
Current practice in the field uses cold packs, which are subject to human error in packaging; sometimes aid workers have the packs too cold, which kills the vaccine. Other times, workers do not cool the packs sufficiently, and the temperatures get too high, which also kills the vaccine.

Susie's innovative approach works with chilled, frozen, or even un-chilled packs, and keeps the vaccines at the right temperature from over 48 hours, with refrigeration powered by the bicycle which transports the vaccine carrier. When we talked with her, we suggested she talk to the International Red Cross. Two ladies standing behind us then spoke up, told us they were from the Red Cross, and were waiting to talk to her after we finished our conversation. We stayed to hear their conversation, which concluded with the Red Cross team agreeing to adopt and deploy this new system for transporting vaccines where bicycle is the most appropriate form of transport!

INCOSE awarded the prize for the Best Systems-Engineered Prosthetics Project in 2018 to Everett Kroll of Woodbury, US-MN. His project was a 3-D printable prosthetic foot. The goal of his project was to design a cost effective, 3-D printable biocompatible prosthetic foot, capable of facilitating full function with little compromise in gait. Being an athlete, Everett used his physical attributes of running, walking, and other high-stress activities a young person would indulge in, as guidance for needed performance.

Since 3-D printing enables the optimization of material properties, he aimed to mimic the function of the limb the prosthetic foot is replacing.

Everett's research included the analysis of forces that affect movement in high school runners, which led to a final design that delivered



over 120% in kinetic energy transfer and output. This level of potential energy storage resulted in an increased safety factor with a very low variance of less than 0.4%. His extensive use of empirical and applied physics and mathematics held to quantify the adverse impact of gap co-linear compression and its effect on material properties and structural integrity. Essentially, he developed two equations to calculate discrepancies between ASTM standards and each 3-D printed part, where the discrepancies resulted from the gap co-linear compression. He verified this through graphical analysis and confirmed biocompatibility associated with this level of prosthetic which has 5.3% compromised gait, capable of sustained intensive movement.

INTEL ISEF 2018

Not only did he experiment with different designs and materials, he also kept the cost down so that a person could use this throughout the life cycle, from childhood to adulthood. Today, a prosthetic costs over \$18,000, which the person must replace as the limbs start growing. Everett's innovative 3-D printed nylon design can be easily scaled, redesigned, and reprinted as needed to accommodate human growth. The result is an affordable, 3-D printable prosthetic foot that exceeds basic ambulation capability and allows active adult function for a fraction of the cost.

Everett has tested his product not only in the US, but in many places over the world, and he believes this low-cost, highly effective prosthetic will improve the quality of life for millions. In addition to the INCOSE award for innovation in robotics, Everett also won first place in the Grand Award in his category.

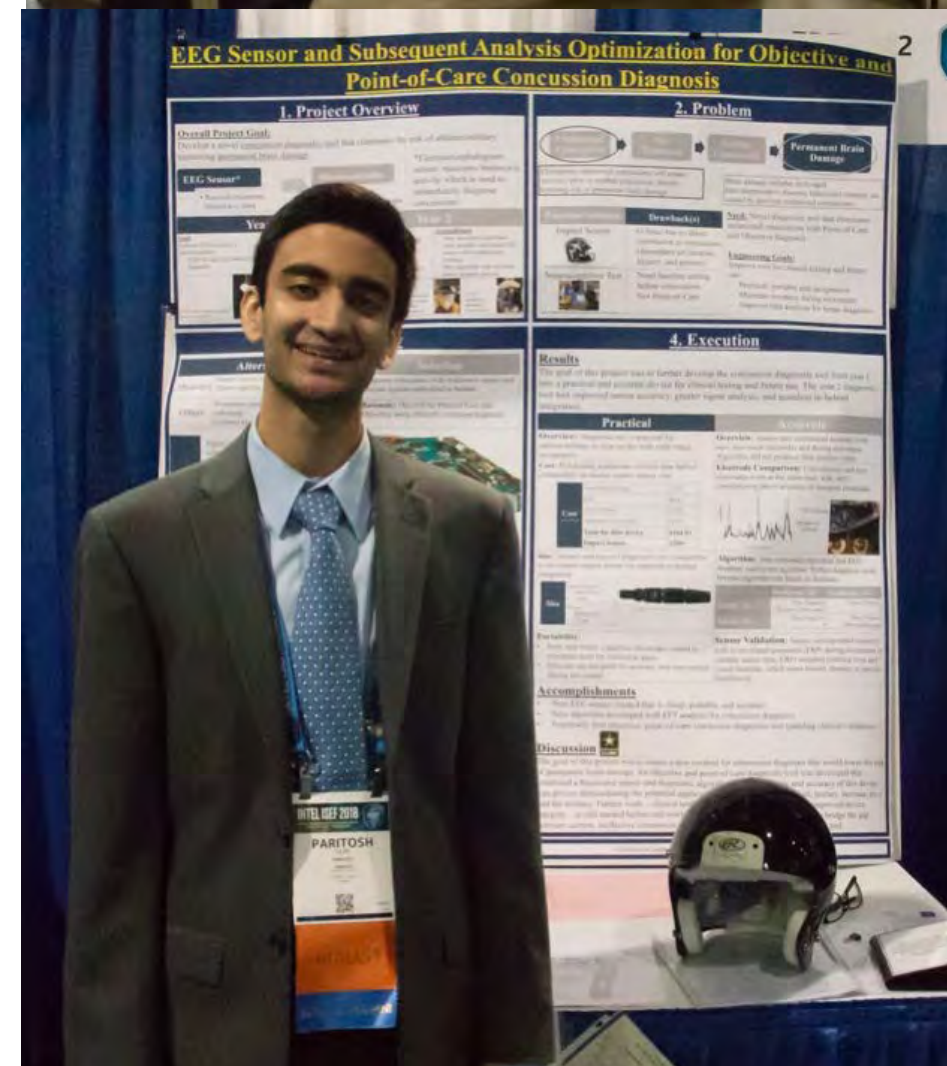
In 2018, INCOSE also awarded 12 Honorable Mention Awards to the following students:

Oliver Nicholls of Turramurra, AU developed an autonomous robot for cleaning windows in high rise buildings. The robot is suspended and tethered from a driven track secured above the building. It uses horizontally-mounted drone motors and propellers for propulsion onto and off the window. It autonomously senses the window geometry, cleans the entire pane, then crosses the mullions to the next pane. One of the most impressive features of this robotic system is that it compensates for crosswinds, measuring the wind speed and direction, and tilting its propellers to offset the wind energy. The need for this struck us judges as obvious and we were impressed with the ingenious application of such an appropriate solution, so we rated this project very highly. Oliver also won the top ISEF Prize, the Gordon E. Moore Award for 75,000 USD, the Best of Category Award for 5,000 USD, and a first place in Robo Robotics and Intelligent Machines for 3,000 USD. He also won a second award of 750 USD from NASA, and the IEEE Foundation Second Place Award for 600 USD.

Paritosh Suri of Plano, US-TX presented a project that addresses the issue of undiagnosed concussion injuries in sports. Concussion injuries and their impact on athletes, both adult and younger players, have been in the news lately. Paritosh states that "an undetected concussion can lead to permanent brain damage if another concussion is sustained before recovery." He also says that current methods for diagnosing concussions in the field "rely heavily on subjective data and inconclusive tests." This project designed electrodes that are integral to the helmet so diagnosis of a concussion is practical and inexpensive in the field. He improved the electrodes used and utilized electronic amplification and filters to more clearly identify the brainwave patterns that indicate a concussion injury. The researcher validated the operation of the sensors and the system output to the extent that this was possible in the absence of an actual concussion injury. Paritosh hopes to have the system more extensively tested by actual use on the sports field.

Pooja Jain of West Linn, US-OR developed a low-cost rapid response communication system for use in emergency situations. Her system combines ham radio, mesh networking, Wi-Fi, battery power, and delivery mechanisms using off-the-shelf and low-cost items to rapidly deploy emergency communications for citizens to contact first responders and each other. She turned multiple Wi-Fi routers into ham radios and linked them together as a mesh network to cover a wide area. Portable cell phone battery chargers power these Wi-Fi routers which citizens can deploy using drones or as backpacks dropped in strategic locations for maximum coverage. Citizens use the Wi-Fi on their smartphones, tablets, or laptops to communicate with the mesh network. To ensure there is enough Wi-Fi bandwidth available for as many citizens as possible to communicate, a text-only chat service will be available to send messages to a base station which search and rescue personnel will monitor. Ms. Jain also won an Agni First Place Award of 1,000 USD and full tuition scholarship to Drexel University in Philadelphia, US-PA worth 194,000 USD. (Pooja pictured on the following page at the top).

Sathvik Nallamalli of Olympia, US-WA developed a portable Android-based system to detect chronic respiratory illnesses. This system addresses the need to proactively detect the disease even when a qualified health professional is not available, as is the case in many under-developed countries. The system uses an Arduino microcontroller, a pressure sensor, a low energy Bluetooth link, and a 3-D printed spirometer. The device has a calibration procedure, and the pressure differential measured when the user breathes into the device is analyzed using regression equations and algorithms to calculate lung metrics. The device was successful in detecting five diseases:



INTEL ISEF 2018



Pooja

asthma, emphysema, chronic bronchitis, restrictive lung disease, and levels of Chronic Obstructive Pulmonary Disease (COPD). Sathvik also earned a fourth place in his category, Embedded Systems, worth 500 USD.



Sathvik and Rei

Rei Landsberger of Rancho Palos Verdes, US-CA presented a novel design for a hip replacement. As many of us INCOSE judges get older, we are keenly aware of the real possibility of a joint replacement in our future. Rei's project is about hip joint replacement and investigates a gimbal-based hip joint instead of the conventional ball and socket design. He did a mechanical analysis on his design using computer tools to predict and compare the movement range and load-carrying capability and predict the durability of his design versus the conventional design. His analysis shows promise. All the judges wish him well as he continues testing the design. In addition to impressing the INCOSE judges, Rei also impressed the grand award judges and received a fourth place award in the Biomedical Engineering category which comes with a 500 USD prize. Rei is shown above next to Sathvik in front of their posters.

Editor's Note: The following four Honorable Mentions are all pictured on page 25.

Matthew Graham of Auburndale, US-FL designed and built an electromagnetic wall climber to be used as a tool to facilitate the inspection of metal structures. Matthew explained that the current inspection protocol often calls for the construction of expensive scaffolding inside large utility boilers and other similar structures to perform mandated safety inspections. Sometimes the presence of tubes, exit holes, and other structural components make access and the task more difficult. As a result, inspections are expensive and performed only when mandated by the regulations. Matthew's goal with this research was to demonstrate that the electromagnetic crawler was a viable option for industrial inspections of steel structures. Matthew's current design allows the crawler to traverse a metal surface tilted up to a 45-degree angle, but it cannot climb vertically. As it now drags its power cord behind it, its range is also limited. Next steps in the design are to provide the crawler with a camera, a temperature sensor, and a sample collection arm. There also needs to be a new means of powering the crawler so it can go longer distances independently.

Tyler Robertson of Fresno, US-CA developed a low-cost device which provides warning when a river has high enough velocity to pose a danger to people. Every spring, people drown in rivers because they underestimate the power and danger of the river flow from melting mountain snow. He developed a portable swift water warning system that visually alerts swimmers to dangerous water conditions. Testing of the device in a river demonstrated the potential to save lives by alerting swimmers to quickly developing unsafe river, tidal, or even flood conditions.

William Wang of Sammamish, US-WA developed an interesting concept in a gyroscopically-leveled spherical drone for reconnaissance and imaging of the Martian environment. It looks much like R2D2 from the Star Wars films. Wireless communication devices inside the drone allow for autonomous transmission to other drones of its kind, allowing for synchronized shots using the cameras mounted on the head for detailed three-dimensional imaging. In addition to the stabilization programming, the drone uses a machine learning algorithm, applied using a fitness function and numerous neural networks, which allows the drone to essentially optimize itself to any surface geometry. He has obviously spent enormous time and effort in creating this Mars aerial rover. He may well have the correct idea in designing rovers in this manner. Mr. Wang demonstrated effective use of systems engineering principles in conducting this project. Mr. Wang also won third place in his category, Engineering Mechanics, from ISEF.

Michael Wolfe of Burlington, CA-ON. Elon Musk has made this decade exciting for young systems engineers with all the high-energy systems he is pushing to market. One I especially like is the all-electric, autonomous ready long-haul truck. Michael's project, "Electric Vehicle Energy Recovery and Safety Enhancement," in the Engineering

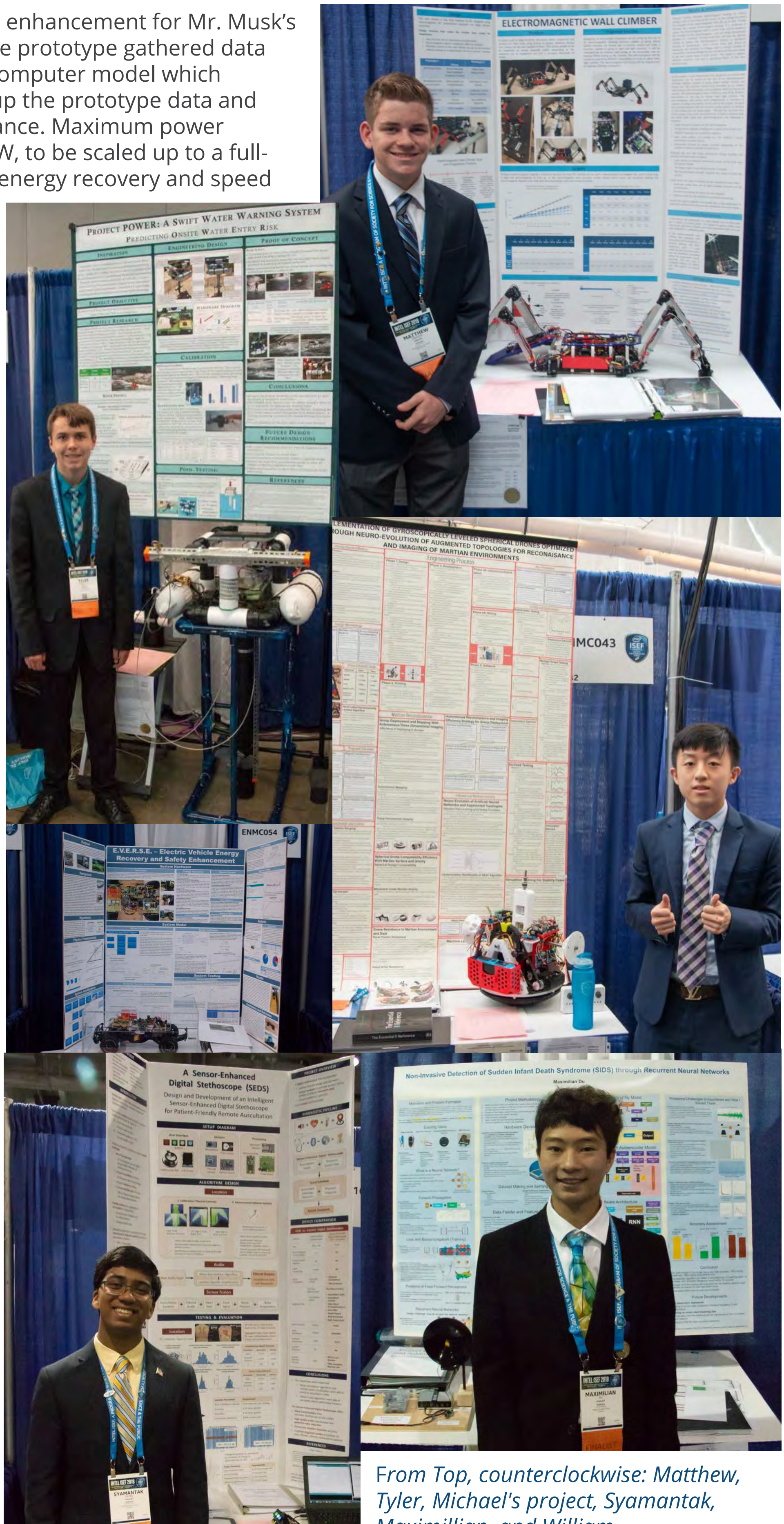
INTEL ISEF 2018

Mechanics category is a good product enhancement for Mr. Musk's truck remake. Michael built a sub-scale prototype gathered data and then developed a parametrized computer model which subsequently could be used to scale up the prototype data and predict full-scale production performance. Maximum power recovered for the prototype was 4.43W, to be scaled up to a full-scale truck. Michael further validated energy recovery and speed control systems with empirical data.

Syamantak Payra of Friendswood, US-TX developed a sensor-enhanced digital stethoscope which allows patients to perform their own auscultation and then automatically sends their doctor relevant information, including heart rate, body temperature, auscultation audio, and pinpointed auscultation location. His device used signal processing to reduce background noise 75% compared to a conventional stethoscope. This is the second year that our evaluation committee has encountered Mr. Payra.

Last year Mr. Payra developed, "Brace Yourself: A Novel Electronically Aided Leg Orthosis," for elderly persons so that someone like his grandfather can easily move around his home environment. He won our prosthetics award for 2017 for his earlier project. This year, he also won a first place in his category, Robotics and Intelligent Machines, from ISEF. He also won a Fondazione Bruno Kessler summer school fellowship to the research center in Italy, plus 1,000 USD from King Abdul-Aziz & his Companions Foundation for Giftedness and Creativity, and a 5,000 USD award from Oracle Academy.

Maximillian Du of Manlius, US-NY developed a non-invasive monitor to detect sudden infant death syndrome. He developed a parabolic concentrator with a specially designed and fabricated amplification circuit used to record the sound of a baby breathing. A special adaptive noise reduction and feature extraction algorithm cleaned up the resulting audio data, which filters out excessive background noise, as well as extracting key frequencies using a Fourier transform.



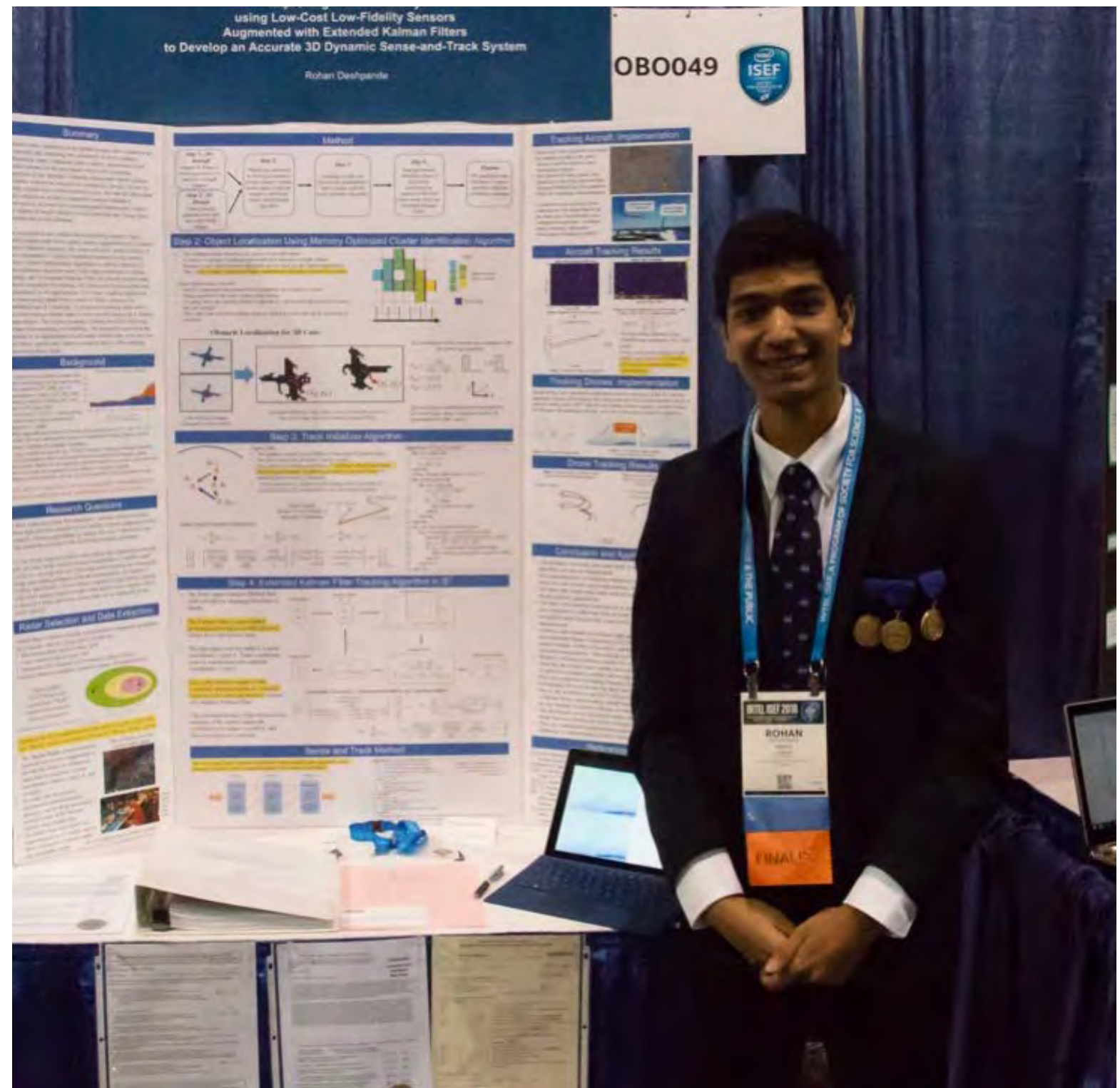
From Top, counterclockwise: Matthew, Tyler, Michael's project, Syamantak, Maximillian, and William.

INTEL ISEF 2018

He then fed this filtered audio data into a custom-coded recurrent neural network model which he had previously trained on large amounts of recorded breathing data. This neural net's purpose was to distinguish each inhale and exhale from any other unknown noise. He then fed each occurrence of detected respiratory activity into statistic inference algorithms that detected dangerous trends in the breathing. The system achieved 92.5% accuracy on continuous data and had a 10 second response rate on sudden stops of breathing, which provides time for a caretaker to respond before the baby is in serious danger. Mr. Du also won a Geno Third Place from the Samvid Education Foundation and an IEEE Foundation Third Place of 400 USD.

Rohan Deshpande of Chapel Hill, US-NC developed an innovative low-cost airspace tracking system. His project developed a system titled, "Improving Aviation Safety Using Low-Cost Low-Fidelity Sensors Augmented with Extended Kalman Filters to Develop an Accurate 3-D Dynamic Sense-and-Track System," which had the mathematical ingenuity to replace high-fidelity sensors with low-quality, filter-augmented complex filters that achieved the accuracy of their expensive counterparts. Essentially his sense-and-track system used a memory-efficient cluster identification algorithm to identify objects which he fed into state estimation equations using Euler approximations to predict a third point to ensure accuracy and initiate tracking. Finally, his innovation used extended Kalman filters creating refined predictions through an iterative process to accurately track aircraft position and estimate velocity.

We have seen that, in addition to the escalation of congestion in the global airspace at an exponential rate, there is an increase in the probability of an air collision; many companies plan to deploy autonomous aerial vehicles (drones) in the near future, which will exacerbate congestion at low altitudes. Even though transponder-based collision avoidance systems are mandatory on commercial aircraft, due to their high cost, they are not required on smaller aircraft. However, with his innovation, Rohan's on-board, low-cost transponder-independent system will enable all aerial vehicles to sense and track any flying object to predict and avoid collisions. He has tested his system successfully in two phases, once through a drone-tracking application using inputs from a series of stereo cameras (for omnidirectional R3 tracking), and finally, through an aircraft tracking application using a marine radar to track aircraft taking off at Boston Logan Airport. The system accurately tracked aircraft in the local airspace demonstrating its feasibility. In addition to the INCOSE Honorable Mention, Rohan Deshpande also won third place in the Grand Award in his category. He is pictured at the top right of this page.



Spotlight ON!

Interviewed by Sandy Young, info@incose.org



Name: Lou Wheatcraft

Title/Organizations: Senior Product Manager, Seilevel/Requirements Experts

Place of Birth: Aitkin, US-MN

Current Residence: Clear Lake, Houston, US-TX

Domains: Aerospace and edical device development

Studied in college: Electrical engineering, computer information systems, environmental management, and studies of the future

Year joined INCOSE: 2000

Role(s) in INCOSE: Chair of the Requirements Working Group, member of the Texas Gulf Coast Chapter

Years in systems engineering and program

management: 45 years – I was practicing systems engineering before I heard of systems engineering as a discipline.

How would you describe yourself in three words?

Jack-of-all-trades, effective, and practical

What are you working on today?

I am working on information-based requirement development and management. This approach is based on the premise that well-formed requirements do not come out of thin air. Rather, there is a lot of work and analysis that must be done first that results in an underlying set of data and information from which stakeholder needs are

Spotlight ON!

derived and transformed into system requirements. This data and information represent the beginning of a model of the system under development.

I am submitting a paper for the INCOSE International Symposium 2019 that goes into more detail on this topic. The Requirements Working Group will also be addressing this at the Symposium.

What is the Requirements Working Group working on now?

We are working on a white paper, "Integrated Data as a Foundation of Systems Engineering," as well as "Guide to Developing and Managing Requirements." The Requirements Working Group is producing the integrated data white paper from the perspective that underlying sets of data and information represent requirements, along with all work products (models, designs, documents, diagrams, and drawings) generated during the performance of system life cycle process activities. I am currently incorporating the last round of review comments into the white paper and hope to have it available in the INCOSE Store in time for the INCOSE International Workshop (IW) 2019.

The "Guide to Developing and Managing Requirements" is meant to be a companion guide to the existing "Guide to Writing Requirements." While the focus of the "Guide to Writing Requirements" is on the characteristics of well-formed requirements and the rules that result in those characteristics, the "Guide to Developing and Managing Requirements" will focus on activities, approaches, and tools used to develop and manage requirements.

What tool or method is most helpful to you as a systems engineer?

What is most helpful to me is focusing on stakeholder needs and resulting requirements. If the system being developed does not meet the stakeholder needs and resulting requirements, the system is a failure!

What are your thoughts about systems engineering tied to product development?

Systems engineering is critical to developing and delivering winning products. Yet, I am amazed at how many organizations do not include basic systems engineering concepts in their product development processes—especially well-formed requirements.

What is your favorite saying or quote?

I have two: (1) "Requirements are the common thread that ties all system lifecycle activities together." And (2) "Writing requirements is not an exercise in writing; it is an exercise in engineering. Every requirement is an engineering decision as to what the system must do or a quality the system must have in order to satisfy stakeholder needs."

What do you like to do outside of work?

I regularly volunteer at the Armand Bayou Nature Center located in the Houston, Texas area, one of the largest urban wilderness preserves in the US.

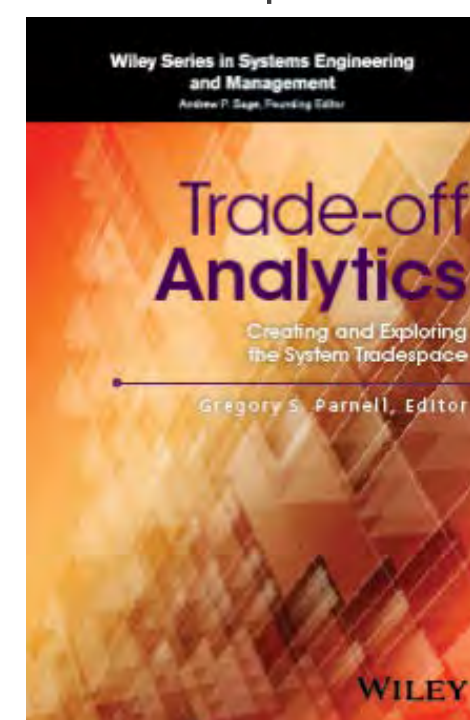
INCOSE *INSIGHT*

William Miller, insight@incose.org

We hope you are looking forward to the Q4 2018 issue of *INSIGHT* published in cooperation with John Wiley & Sons as a magazine for systems engineering practitioners. *INSIGHT's* 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.

The focus of this December issue of *INSIGHT* is trade-off analytics. We thank theme editors Frank Salvatore and Haifeng Zhu.

As a highlight and a preview from the issue, our opening article: "Trade-off Analytics: Creating and Evaluating the Trade Space" by Greg Parnell describes the book of the same title supported by INCOSE Technical Operations and its Decision Analysis Working Group in response to the INCOSE Corporate Advisory Board's stated need for a guidebook on best practices for trade studies. The resulting published work serves as a textbook at both undergraduate and graduate levels, and as a professional reference for systems engineers, project managers, and engineering managers. The book describes and illustrates sound trade-off analysis techniques to identify value and risk to help decision makers make the necessary trade-offs to provide affordable systems that meet performance and schedule objectives. Excitingly, the Decision Analysis Working Group intends to publish a decision analysis primer in 2019!



Many other great articles can be found in this upcoming issue, so we hope you enjoy the read.

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. practitioners' magazine for systems engineers, informative and relevant.





30th Annual **INCOSE**
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Cape Town, South Africa

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Report from FEAPO

Richard Martin, richardm@tinwisle.com

The Federation of Enterprise Architecture Professional Organizations (FEAPO), a collective of fifteen global professional and standards associations that includes INCOSE, held their annual forum and board meeting at the Institute of Electrical and Electronics Engineers (IEEE) Headquarters in Los Alamitos, California.

John Zachman, early pioneer of enterprise architecture, was joined by Dr. Brian Cameron, Associate Dean of the College of Information Sciences and Technology at Penn State, to provide a lens on the changes occurring in the enterprise architecture profession from an industry and academia perspective.

Members participated in the exchange of information and the cross-pollination of ideas to help standardize and advance the field and profession of enterprise architecture within their organizations. IEEE, International Institute of Business Analysis (IIBA), Institute of Information Technology Professionals South Africa (IITPSA), National Association of State Chief Information Officers (NASCIO), DAMA International, Chartered Institute of Procurement & Supply (CIPS), Business Architecture Guild (BAS), and INCOSE presented reports.

Richard Martin, INCOSE delegate to FEAPO and INCOSE Architecture Working Group (AWG) co-chair, reported on 2018 achievements and planned work. Of interest was the enterprise/system architect competencies workstream, Standards Development (ISO 15704), and architecture primer.

Mr. Martin co-led the FEAPO Enterprise Architecture Taxonomy Working Group which published in 2017 a consensus set of enterprise architecture genre definitions. He will spearhead the second revision of "The Common Perspective on Enterprise Architecture" paper first published in 2013 and will continue leading the work to add information and security terms to the taxonomy genre. Loretta Mahone-Smith, new president and delegate of DAMA International, will lead a group focusing on data/information architecture best practices as a collaborative effort across member organizations. The progression of "The Guide to Careers in Enterprise Architecture" and a new program to normalize enterprise architecture across various books of knowledge is under consideration.

If you would like to volunteer to participate in any of these programs, please contact Mr. Martin, tinwisle@bloomington.in.us, or contact FEAPO.org.

#SocialMediaUpdate

Alan D. Harding, alandharding@gmail.com

As the end of the year is approaching, I thought I would take the opportunity to talk about the progress we have made in our use of social media, and our plans going forward. If any of you are interested in getting involved with our social media activities, please contact us at socialmedia@incose.org.

At the International Workshop (IW) in January, we appointed our first assistant director for social media. The aim was to give more focus to this growing area of communications, to become more organized and effective, and to allow us to build the number of volunteers bringing our social media to life. We have created our first Social Media Plan (available to members in Connect) to ensure that we are organized and efficient in how we manage social media. Also, we have created and updated guidance on how to use social media effectively.

I am pleased that we ran an effective and enlarged social media campaign for our #incoseIS International Symposium (IS) in Washington, DC across Twitter, Facebook, and LinkedIn, including promoting the event itself, keynote speakers, social events, and recognizing the contributions of our sponsors. We were particularly successful in promoting Facebook posts about the IS. We are now helping highlight the upcoming #incoseIW International Workshop (IW) in Torrance, California, US in January 2019.

Over the year, our followers/likes on all social media have continued to grow, giving our activities greater visibility and giving us greater potential to engage with the wider community. And I am very happy to announce that we have recently welcomed a new volunteer to the team: Daniel Lee just started leading on LinkedIn for us. Thank you, Daniel. I look forward to working with you. Looking ahead to 2019, I think there are two priorities for social media:

- (1) To continue to use social media to communicate with increasing numbers of members, potential members, and the wider systems engineering community; We will be making sure we get information to people in a timely and useful manner, and, exploring use of some automated tools to plan some of our postings.
- (2) To get more engaged in conversations across our social media channels: This will enable us to be more directly helpful to people in their careers, giving guidance on continuing professional development, and helping them find useful information on systems approaches, for instance in the Systems Engineering Body of Knowledge (SEBoK).

That is a short summary and a taster of what we will be doing next year. If you have any comments or want to volunteer to help, please contact us at socialmedia@incose.org.

Note from the Editor

Lisa Hoverman, newsletter@incose.org



Welcome to the 4th Newsletter of 2018, and our 2nd largest! We set out 3 years ago to grow this publication into something of value, and under our very first, and wonderful MarCom Director, Ms. Rachel LeBlanc, we've reached this goal. Continuing in vein with our last newsletter, and a long-term goal of INCOSE Communications,

especially their Assistant Director, there are great practitioner pieces in the Newsletter - these speak to our many, many collaborations, memorandums of understanding, and collaborations across the engineering fields. These primarily speak to the exciting advances, changes, insights, and strategies we are seeing in systems engineering education. When you consider that our complex societal problems today, are systems problems, these articles inspire great hope! I hope you continue to enjoy the evolution of this Newsletter.

With the exciting [IW just ahead](#), 2018's end has promise, with 2019 promising to elucidate even further how INCOSE leads for the Future of Systems Engineering.

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 updates on the regional 2018 conferences, chapter meetings, working groups, and other initiatives of INCOSE in this 4th Newsletter of 2018. 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. We have a great INCOSE member highlighted in this issue - be sure to read up on his long experience to think on how we build on this heritage from our diverse backgrounds.

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 and our amazing 28th year! Many will know that in 2019 I will have the humble honor of joining INCOSE as not only a member, but as the 2nd MarCom Director. I stand on broad, strong shoulders. I look forward to serving you, and to your upcoming contributions (submission dates follow). Have a wonderful start to 2019, I hope to see you in Torrance!

Warmly,

Lisa

INCOSE Member Newsletter

Publication of the International Council on Systems Engineering

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

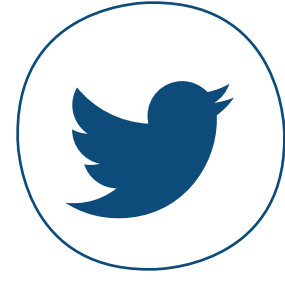
Q1 Newsletter, General Content (GC): 15 Feb, Late Breaking News (LBN): 25 Mar; Q2 Newsletter, GC: 15 May, LBN: 25 May; Q3 Newsletter, GC: 15 Aug, LBN: 25 Aug; Q4 Newsletter, GC: 15 Nov; LBN: 25 Nov. For further information on submissions and issue themes, visit the INCOSE website as listed above.

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