The 9th World Engineering Education Forum (WEEF - 2019)

Outcomes of the First Global Peace Engineering Conference

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Abstract

This paper summarizes the overall results of the VIII World Engineering Education Forum, X Global Engineering Deans Council, XIV Global Student Forum, held in November 2018 in Albuquerque, NM USA, and discusses the emerging global collaboration for Peace Engineering (PEng) and Peace Engineering education.

The theme of this first ever global conference on Peace Engineering was in tune with global events and developments. Participants were a confluence of practitioners, researchers, policy makers and educators from all over world, encompassing academia, multinational industry, US national labs and multilateral organizations. Results from a formal survey show that participants rated the conference as very good or excellent in all aspects and asked for more coverage of the topic of Peace Engineering and teaching material and strategies that embody Peace Engineering learning and teaching. The Conference succeeded in catalyzing conversations and idea exchanges for concrete plans for the next steps to advance a movement for Peace Engineering education, including

- A Global Peace Engineering minor
- Peace Engineering Certificate program
- Master of Science in Peace Engineering
- Database of Peace Engineering case studies
- Workshops and other forums to promote discussion and planning for Peace Engineering programs and curricula
- Data models, metrics, analytics and simulations: fine grain to large grain
- Development of Peace Engineering as the new global engineering mindset

Participants were engaged and enthusiastic about the concept and a Peace Engineering movement was born, along with the idea of creating a Peace Engineering Consortium.

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1. Introduction

This paper summarizes the overall results of the VIII World Engineering Education Forum and X Global Engineering Deans Council (WEEF-GEDC 2018), held in November 2018 in Albuquerque, NM, USA. Hosting this first global conference on Peace Engineering in the state of New Mexico, the organizers wanted to commemorate the birth of Big Science and the National Laboratories [1][2], and look forward to a future with a new engineering education mindset that integrates multiple disciplines with a focus on sustainability, peace and the good of all.

The organizers envisioned this gathering as one where questions of how to articulate and implement a system of “Peace Engineering education” while maintaining the technical capabilities that engineers are expected to possess [3].
The focus of the Conference was to gather emerging models of Peace Engineering and start a concerted and organized effort for Peace Engineering. After a set of pre-Conference Workshops, the program consisted of thought-provoking plenary panels whose members have spent the last decades educating in an engaged, compassionate, competent way with problems of necessity and wellbeing. This was followed by technical peer-reviewed paper sessions. The idea was that through these interactions and discussions, a set of concepts and skills would evolve that could be developed as core elements of Peace Engineering [4].

2. **Summary of WEEF-GEDC 2018 and Outcomes**

2.1 Participation

In addition to the 301 institutions from around the world, there was a significant amount of participation, sponsorship and commitment from the industrial, non-profit, and governmental sectors. In all there were over 500 participants for this three-day intensive conference, encompassing people from 44 countries. Details of the conference are available at the website: https://weef-gedc2018.org.

2.2 Evaluation of the Conference and Takeaways

The organizers asked for feedback through a cell phone-based survey during the last session of the conference and with a follow-up survey. Overall the participants rated the conference as very good to excellent in all aspects. When there was a “less than satisfactory” response, the respondent seemed to be looking for more complete coverage of the topic of Peace Engineering, and for more teaching material or strategies. However, Peace Engineering is in its infancy and is yet to coalesce to the structure of a curriculum.

_A sample of questions asked on the conference based on *=very poor, *****=very good scale:

- How would you rate the overall conference? Result: average = 4.06
- Was the conference theme of Peace Engineering valuable in terms of understanding what Peace Engineering is and how it impacts various aspects of what you do (e.g. faculty development, curriculum, organizational challenges, global partnerships and opportunities)? Result: average = 4.34

Following are samples of takeaways and general comments from the event submitted by respondents.

**Takeaways:**

- _A better understanding of what Peace Engineering is_  
  - The incredible need for Peace Engineering Ethics and compassion
  - A sense of the connection between everyday engineering practice and upstream or downstream impacts on peace/conflict
  - Values [are] not key performance indicators
  - Engineers need to get more in Social Sciences and Politics
  - How to use engineering to improve the quality of life of humanity
  - Need for change in university culture to support broad concepts like Peace Engineering
  - Engineers have many roles in creating a positive peace and supporting a negative peace
  - Peace is actionable, holistic, and must question the status quo
  - Global innovation – working towards sharing technology and knowledge to create sustainability
  - Work with the communities to meet their needs not just our ideas of their needs
  - Disruption engineering approach
  - Cross cultural collaboration is key (by discipline & by country)
  - Academia is diminished by its lack of generosity of spirit and lack of collaboration
  - Peace Engineering is the way we connect engineering with world needs and challenges
  - Curricula and/or philosophy changes needed to support engineering for peace
  - What others are doing such as the Stanford Peace Innovation Lab
  - The strain this will put on educators to add this to already "loaded" schedules and student workloads.

**General Comments:**

- Every engineering student needs to be exposed to the inspiring content of this conference. Maybe an hour video with selected highlights could be produced to teach engineering students what their potential role is in making the world a better place.
- I believe the concept of Peace Engineering is the "why" for the entire field of engineering. Peace Engineering should be the frame to draw more students to the field.
- Great conference. I learned a lot and the quality of the sessions was great. The plenaries were way too vague.
- One of the best that I have attended.
Knowing that engineers “make a difference” will be key to getting more kids interested in a career in engineering! The theme of Peace Engineering certainly resonates. Peace Engineering referring the planet, should indeed include more people from different countries and not only North Americans, the world is not North America! The topic could continue growing and we need to accommodate this growth. Un buen evento. Felicidades! A very interesting, challenging, at times depressing conference. I came looking for leadership and guidance on this subject, and was disappointed to find out that as a sector, we are far further behind that I thought. Not enough self-critical reflection is going on about how we as educators need to evolve. Conversion of discussions into action in technical education around the globe will be highly appreciated. A breakthrough, courageous act for the organizers to introduce and seat this concept; a surprise to see how much momentum and appetite exists for Peace Engineering. The challenge is to open up to co-create it without politics of sector (academe v business; engineering v business schools) or internal politics. Walk the talk of system wellbeing.

Among the aspects of Peace Engineering education, the participants agreed that the new global engineers, leaders and professionals need to be multi-disciplinary with a new mindset to solve global challenges. Peace Engineering includes teaching students about compassion, the skill changes needed and the strain on an already loaded curriculum as we add dimension like ethics, security and understanding of information technology, and an understanding of “good” and “bad” [4].

2.3 Significant Outcome

The Conference succeeded in catalyzing conversations and idea exchanges for concrete plans for the next steps to advance Peace Engineering education. A core team of conference participants joined efforts to quickly move Peace Engineering forward and developed a Peace Engineering Consortium. That is, to define and implement its charter, identify initiatives and preliminary activities, and continue to identify definitions of what Peace Engineering (PEng) – or Engineering for Peace – is.

3. 2019 Activities

The core PEng team has been energetic and productive in collaborating to create the Peace Engineering Consortium and advancing the Peace Engineering Movement. Below is a summary of events, activities and projects the team has accomplished since the WEEF-GEDC 2018 conference.

3.1 Workshops, Conferences and Special Events

- Peace Engineering Summer Institute, The Hague, Netherlands, August 19-23, 2019
  - Outcome: Strategic approach to engaging current engineers in the workplace
  - Outcome: Strategy for ensuring current and future students have PE employment waiting for them when they graduate
  - Outcome: Clarified key connections between peace, finance, and global capital markets
  - Outcome: Formation of the Global Society of Peace Engineering (GSPE)
  - Online workshop on The Hague Peace Data Standard: October 2019
- NSF Nanotechnology and Sustainability Workshop, Singapore, August 2019
  - Presented Peace Engineering Consortium, which includes development of new academic content, innovation and research, and commercialization (PeaceTech). Outcome is to establish collaboration with the National University of Singapore as a node. SensorComm Technologies (www.sensorcommtech.com) presented a real time vehicular emissions monitoring solution, which is an example of PeaceTech and sustainability.
- Workshop on Peace Engineering, Pontificia Universidad Javeriana (PUJ), Colombia, September 23-24, 2019
  - Organized the workshop and presented Peace Engineering, conversations underway to create a global Peace Center (academic, R&D, commercialization)
- Wells Fargo Speaker Series, University of New Mexico, Albuquerque NM, USA
A collaboration between the UNM School of Engineering and Anderson School of Management, sponsored by Wells Fargo. Topics include: Peace Engineering and Innovation, academic and professional content, case studies, PEng minors and graduate studies, employability, R&D (PeaceTech), commercialization, and a new technology social economic development plan for New Mexico. The National labs (Los Alamos, Sandia, Air Force) are also engaged in this activity.

- November 8, 2019 – “Peace Engineering and Innovation – Call for Action: Developing the Sustainable Peace Industrial Complex”.

- Positive Peace Conference, Stanford University, October 29, 2019
  - Presented Peace Innovation Network as an online community of practice for entrepreneurs, impact companies and other stakeholders looking to tackle United Nations Sustainability Development Goals (SDGs) through a positive peace toolkit
  - Discussed strategies and uses cases of engaging business in building PeaceTech products and services.

- AI Index Roundtable Workshop on Measurement in AI Policy: Opportunities & Challenges, Stanford University Oct 30, 2019
  - Discussed potential of peace engineering and Peace Data Standard to provide a frame for the integration of human rights and safe and ethical research and deployment of AI.

- Hague Peace Data Standard Webinar, Oct 28, 2019
  - Review of the Hague Peace Data Standard (HPDS)
  - Outcome: Developing standard presentation of HPDS

In addition to publications, PEng team organizations have published books, given Peace Engineering talks, keynote presentations and served on panels at several conferences and events [5-12]

### 3.2 IFEES Webinar Series

The Peace Engineering initiative is presenting webinars, hosted by IFEES, on topics surrounding Peace Engineering and Ethics [13-33]. Webinars leading up to and following the WEEF-GEDC 2018 event can be found on the IFEES website, www.ifees.net/webinars.

### 3.3 Other Activities

- Sandia National Laboratories – Peace Engineering and Sandia: A Concept Paper
  “Sandia has the opportunity and expertise to work in partnership with academia and key institutions to shape the discipline of peace engineering and its application to complex problems facing the nation and the world in a way that supports the Labs’ strategic priorities and purpose to ensure global peace through advanced technology development.”

- Global Peace Centers – Initiated the creation of a Global Peace Center (academic, R&D, commercialization) in Colombia, and started conversations to replicate in Ethiopia. Global Peace Centers will be linked.

- Case studies: A collection of over 20 case studies of engineering projects in conflict regions was developed and is available online through a web-based database. The objective of this work is to provide a contextual platform for the presentation of engineering content and curricula. The Peace Engineering Case Study Database introduces a series of peace engineering case studies that highlight both the technical and the socio-political aspects of engineering projects in conflict regions. Case studies are categorized and searchable by engineering category (communications; water, sanitation and hygiene; environment; infrastructure; data visualization and tracking; extractive; power and energy) and by peacebuilding category (justice and rule of law; inclusive security; social and cultural wellbeing; stable political governance; sustainable livelihoods and economy). Each case study includes a description of the problem, the solution and the peace engineering
takeaway. Quantitative problems suitable for undergraduate engineering courses are included for a select number of case studies.

- Congressional Funding initiative for the PEC is in the works. Distribution of budgeted dollars are allocated to: Academic Curriculum Development, Research and Commercialization
- Santa Fe, NM, Midtown Campus – Proposal has been submitted to the city of Santa Fe to create a node for global Peace Engineering activities in education, R&D, innovation, commercialization and global soft-landings.
- Global Development Collective (GDC) – UNM students instituted the GDC, a philosophical interdisciplinary discussion group intended to grow a community of students, faculty and professionals interested in work related to sustainable and culturally aware global development. GDC discussions address questions such as; What are your intentions when working with communities in other nations? How can we limit the unintended consequences when implementing a project? What can we do to help develop a world which provides basic human needs and freedoms to all? With the goal of interdisciplinary collaboration, GDC strives to make all findings and projects easily communicable to people of any background.

4. **R&D Initiatives**

- Digital Libraries: symmetry of information and knowledge – Build on ISTEC’s 30-year experience in open repositories [34] to foster creation of digital content, curation, security, trustworthiness of content, certification of repositories and training.
- Metrics
  - Develop the theory and processes for measuring positive and negative transactions which are linked to peace and conflict. We strongly believe this will be a great contribution from engineering to the social sciences, humanities, and arts
  - Integrating Data Sources and Models (fine grain, coarse grain), Processes, Analytics, Prediction, study and incorporate existing efforts (Hague Peace Data Standard, Global Peace Index, US Peace Institute, World Economic Forum’s strategic intelligence models, etc.)

5. **Future Events and Activities**

- WEEF 2019, Chennai, India November 13-16: Workshop on Peace Engineering and keynote talks
- BuildPeace Conference, November 14-16, Kroc School, University of San Diego & Tijuana, Mexico, “Can we Innovate Our Way to Peace? Establishing the Field of Peace Engineering”
- Drexel Seminar Series: Philip Breedlove
- ISTEC General Assembly, November 20-22, Argentina: Presentations and discussions on Peace Engineering
- The Hague Peace Data Standard Workshop, Feb 2020, The Hague, Netherlands
- WEEF-GEDC 2020, Nov 15-20 2019, Cape Town, South Africa
  - Workshop in Peace Engineering and keynote talks
  - Engineers Without Borders international design contest
- ASEE 2020 Deans Conference in April 2020
  - Deans event produced in collaboration between School of Engineering Deans from UNM, Drexel & UCLA – Peace Engineering Track
- Webinars to include certificate academic offerings, flip classroom mode. Topics will be centered around the seventeen Sustainable Development Goals of the United Nations, launching with “Sustainability”.
- The Hague Peace Engineering Summer Institute, August 2020
- Colombia Workshop, September 2020 (date may change)
- ASEE 127th Annual Conference & Exposition, June 21-24, 2020, Montreal, Quebec, Canada.
- Peace Engineering Special Issue in Technological Forecasting and Social Change Journal
  - Deadline for abstract submissions December 7, 2019
- World Economic Forum Strategic Intelligence Website – create Peace Engineering Insight Area
6. Collaborations

- Digital Libraries – collaborate with ISTEC on digital content creation, curation, certification, and training
- Peace Engineering Minor at UNM and certificate program, with some courses tailored from the Business School. Collaborate with University of Colorado-Boulder, Drexel University, Purdue University, Peace Innovation Lab-Stanford, Pontificia Universidad Javeriana - Colombia
- “Introduction to Peace Engineering” offered by the Dean of the School of Engineering for undergraduate engineering honors program at UNM. Collaborating with National Laboratories.
  - WHY Lab – Quanser (https://www.quanser.com/)
- Development of Case Studies by Drexel University
  - Drexel has developed curriculum in collaboration with the United States Institute of Peace (USIP).
- Develop new academic content under IFEES
  - Use webinars to include certificate academic offerings, flip classroom mode. Topics will be centered around the seventeen SDGs of the UN. Plan is to launch with “Sustainability” (not scheduled yet).
- Peace Engineering metrics, data models, analytics, predictions
  - Collaborations with University of Colorado-Boulder, Drexel University, Purdue University, Peace Innovation Lab-Stanford, Pontificia Universidad Javeriana-Colombia
- Global Society for Peace Engineering (GSPE)

7. Conclusion

Peace Engineering is not just about engineering, it is about changing the mindset of all existing disciplines and the creation of new disciplines to address global challenges. It is about information/knowledge being symmetric, about transparency and accountability, policy, metrics, analysis and prediction with facts of positive and negative human interactions and decisions.

We have taken the Peace Engineering definition to a new level. We define Peace Engineering as the application of science and engineering principles for trans-disciplinary systemic-level thinking to directly promote and support conditions for peace, and the safe and ethical deployment of emerging technologies. We identified the overarching components of Peace Engineering education as educating students to be global thinkers.

At the core of Peace Engineering is our planet’s sustainable future, which is calling leaders to act in concert from a systems mindset. It is a call to develop solutions differently: that is, collaboratively; integrating transdisciplinary expertise and education programs; simultaneously applying technology solutions while supporting ethics, policy and living systems. And it is a call in the mingled vernacular of civil society, global institutions, and science and technology. Further, beyond addressing today’s challenges, we must cultivate together the development of next generation leaders to continue to drive momentum.

Peace engineering is the pathway and mindset that solves global challenges, and we are moving forward on that path.

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