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Peace Engineering Consortium: Outcome of the First Global Peace Engineering Conference

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Abstract.

The creation of the Peace Engineering Consortium is an outcome of the First Global Peace Engineering Conference, held November 2018 in Albuquerque NM, USA (www.weef-gedc2018.org). A team of conference participants are collaborating to develop the 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. PEng is a call for action, in a new mindset not only for engineering, but for all existing and future disciplines to address global challenges. Current activities are:

- *Curricula and content* – Members are collaborating to define, create and share curricula for undergraduate minors, professional certificate programs and graduate work; Creating experiential laboratories with industry and practitioner partners; Facilitating information exchange and the symmetry of information/knowledge through globally accessible digital libraries; Incorporating engineering diplomacy, diversity and cultural awareness (including the arts, music and language) into the practice for peacebuilding, peacemaking and peacekeeping.
- *Research and Development* - The group is focused on collaborations, both domestic and international, and internal initiatives that advance the state of Peace Engineering. Key areas of focus have been developing metrics, data models, analytics, visualization and prediction. Some key initiatives include developing a modelling and visualizing conflict, Peace Data Standard, and pollution mitigation.
- *Entrepreneurial and Economic Development* – The consortium is pursuing entrepreneurial activities in peace technology. It has been invited to produce a special edition on Peace Engineering and Innovation in the high impact *Technological Forecasting and Social Change journal*.
- *Events* – In its charter year, the consortium organized a summer institute at The Hague and Peace Engineering workshops in Colombia – both models for future global workshops.
- *Case Studies* – Members are compiling and publishing case studies and collaborating with US National Laboratories, industry, and governments to create scalable Peace Engineering case studies.

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Keywords: Peace Engineering, consortium, peace technology, unintended consequences; global challenges;

1. Introduction

In November 2018 the first global conference on Peace Engineering was organized by the School of Engineering of the University of New Mexico (engineering.unm.edu) in collaboration with the Ibero-American Science and Technology Education Consortium (ISTEC, www.istec.org), and the Global Innovation and Network for Entrepreneurship and Technology (GINET, LLC, www.ginetllc.com). This event was held under the umbrella of the XII World Engineering Education Forum (WEEF, <http://www.ifees.net>), and the X Global Engineering Deans Council (GEDC, www.gedcouncil.org). The theme was “Peace Engineering,” which was apropos since New Mexico, USA gave birth to Big Science and the Manhattan project. Although often thought of as the genesis of nuclear weapons research, it was the birthplace of two National labs that today are charged with maintaining peace. In this conference we challenged people to think and contribute to the dialogue and the organizers wrote a thought-provoking paper to challenge people and submit their contributions [1].

One result of the global conference is that we have come up with a working definition for 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*. A team of conference participants are now collaborating to develop the Peace Engineering Consortium (PEC). 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. Regardless, PEng is a call for action, in a new mindset not only for engineering, but for all existing and future disciplines to address global challenges that are affecting the livelihood of all living species [2].

1.1. Peace Engineering Consortium Initiatives

The objectives of the Consortium are to conceive, plan, and carry out activities of higher education, research and development, and entrepreneurial activities for the purpose of facilitating scientific, technical and economic progress globally. PEC participants encourage the free flow and access of information in the pursuit of excellence. By coordinating personnel and resources from diverse geographical locations, PEC has developed a mechanism called the Initiatives, which is an organized effort to create activities to address specific areas of concern. The Initiatives are member-driven, flexible, and run concurrently. Within initiatives, projects are identified, planned, and implemented. The distributed structure from which the projects stem avoids duplication of efforts and inherently responds to the needs of the PEC membership organizations. Projects are designed with both short- and long-term goals, with consideration of peace and social impact. They are dynamic and expandable, and coordination and collaboration is encouraged in order to maximize the utilization of available resources.

The current initiatives/activities identified are listed below:

- *Curricula and content* – Members are collaborating to define, create and share curricula for undergraduate minors, professional certificate programs and graduate work; Creating experiential laboratories with industry and practitioner partners; Facilitating information exchange and the symmetry of information/knowledge through globally accessible digital libraries; Incorporating engineering diplomacy, diversity and cultural awareness (including the arts, music and language) into the practice for peacebuilding, peacemaking and peacekeeping.
- *Research and Development* - The group is focused on collaborations, both domestic and international, and internal initiatives that advance the state of Peace Engineering. Key areas of focus have been developing metrics, data models, analytics, visualization and prediction. Some key initiatives include developing a modelling and visualizing conflict, Peace Data Standard, and pollution mitigation.

- *Entrepreneurial and Economic Development* – The consortium is pursuing entrepreneurial activities in peace technology. It has been invited to produce a special edition on Peace Engineering and Innovation in the high impact *Technological Forecasting and Social Change* journal.
- *Events* – In its charter year, the consortium organized a summer institute at The Hague and Peace Engineering workshops in Colombia – both models for future global workshops. The members also participated in several other international conferences globally and delivered webinars.
- *Case Studies* – Members are compiling and publishing case studies and collaborating with US National Laboratories, industry, and governments to create scalable Peace Engineering knowledge base.

2. The Peace Engineering Consortium

The architecture of the Peace Engineering Consortium is described below.

2.1 Vision and Mission

The intent of the consortium is to be a major influence globally, where borders and old-world order concepts too often work against achieving a peaceful and sustainable future. The vision and mission of the consortium are as follows.

Vision

- Create Peace Engineering as a transdisciplinary program, bridging the hard and soft sciences, to address global challenges
- Set standards for measuring Peace and its derivatives
- Create a Peace Industrial Complex where economic impact is measured through the cost of peace
- Create the World Peace Engineering Forum (global and regional), a sister organization to the World Economic Forum

Mission

- Develop and disseminate the knowledge, tools and talent to influence peacebuilding, peacemaking and peacekeeping globally and foster social and business entrepreneurial activities

2.2 Governance

The governance of the consortium is broken down into three major areas of responsibility for the operation of the consortium:

1. Board of Directors, responsible for the strategic plan and tactical plans of the consortium
 - Chairman of the Board
2. Investment Committee, responsible in part for the sustainability of the consortium and its growth and the investment of PEC resources into curriculum, research and development and commercialization activities
 - Managing director
3. Executive Committee and Administration, responsible for the daily operation of the consortium
 - Executive Director

NOTE: Merit and commitment of consortium members will determine position in a committee. The time period of service is a maximum of two 3-year terms. Each committee will replace its members by 1/3, staggered annually.

2.3 Business Structure: profit and non-profit

Ideas are not good enough – we need funding to help us execute. The consortium needs two (2) feet to walk to identify and secure funding. One foot being for-profit, and the other not-for-profit. Both will deal with institutions

that see peace engineering and peace technology (PeaceTec) as a means to address the global challenges, that believe Peace can be profitable, can cooperate with the military industrial complex and strive to execute efforts for the benefit of all living species.

- For-profit Peace Engineering Consortium entity, incorporated in the USA
 - Flexibility to take equity positions in various companies (JVs, SAs, other)
 - Attract impact investment
 - Provide IP protection in the US to foreign partners and funding opportunities for soft landing of start-ups (replicate model to other countries like The Netherlands and Colombia)
 - Products and services - “Engineered for Peace”
 - Membership fees
 - Geared toward universities (e.g. IFEES, ISTE, GEDC), industrial partners (e.g. SensorComm Technologies, Peace Innovation Labs, Quanser, etc.) and others
 - Accept donations in kind, cash and other mechanisms
 - Flexibility to partner with other non-for-profits globally (JVs, SAs, other)
 - Alliances with non-profits
- Initial Budget Allocation
 - 20% education/curriculum development activities
 - 35% research and development activities
 - 35% commercialization activities
 - 10% other (to innovate)

2.4 Membership: annual

To get a sense of belonging and ownership there has to be “skin in the game” otherwise we risk wasting resources, especially expending time, resources and efforts that lead nowhere. We strongly believe that if you want to play there has to be a minimum engagement of funding and donations in-kind. Therefore, there is an annual membership fee that can be scaled based on the World Bank country classifications [3].

Members from all areas - Academia (public and private), Industry (public and private), Multilateral organizations, NGOs, Foundations, Government entities and Concerned global citizens – are invited to join the consortium.

2.5 Growth and Sustainability through Content Development, Research & Development and Commercialization Efforts

The consortium needs to be grown sustainably, thus we have initially identified the different avenues listed below:

- Content Development
 - Academic content and executive training
 - Digital libraries, databases, case studies, videos, games [4]
 - Curricula, program certifications, assessments, executive programs, engineering minors
 - Digital content: libraries, databases, case studies, videos, games
- Research and Development (R&D)
 - Develop and protect Intellectual Property (IP)
 - Provide talent
 - Provide access to facilities/laboratories
- Commercialization (economic development)
 - Soft landings – flow of global IP
 - Tech transfer, IP/patents, licenses, trademarks “Engineered for Peace”
 - Consulting
 - Social or business
 - Contract implementation

- Investments and fund-raising
 - Impact investments
 - Crowdfunding
 - Donations in-kind

2.6 R&D Themes

We have currently identified themes/areas for R&D. These include, but not limited to, based on the membership and global needs.

- Climate change, sustainability
- Metrics, simulation, modelling, big data, data analytics
- Mathematical models for positive and negative peace, sustainability and other topics
- Emergence engineering and biological systems
- Peace Technology: Engineered for Peace (products and services)

2.7 Founding Members

- University of New Mexico
- University of Colorado - Boulder
- Drexel University
- Peace Innovation Lab at Stanford
- Peace Innovation Institute The Hague
- SensorComm Technologies
- Alliance for Peacebuilding
- Ibero-American Science and Technology Education Consortium
- Global Innovation Network for Entrepreneurship and Technology

2.8 Core Group

Founding members +

- Purdue University
- Quanser
- Morgan State University
- Sandia National Laboratories
- Santa Fe Network
- Mr. Prediction - Brazil
- Delft University of Technology – The Hague
- Pontificia Universidad Javeriana – Colombia
- Others will be added, depending on organizational commitment and level of activities

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References

- [1] Jordan R., Agi K., Nair I., Maio E., Nair I., Koechner D., Ballard D. (2018) “Invitation to Shape Peace Engineering from November 12-16, 2018”. <https://weef-gedc2018.org>
- [2] Jordan R., Nair I., Agi K., Koechner D. (2019) “How do we frame Peace Engineering education? A complex, but vital quest.” *ASEE 126th Annual Conference & Exposition*, June 16-19, 2019, Tampa, Florida, USA. <https://www.asee.org/public/conferences/140/papers/25534/view>
- [3] <https://datatopics.worldbank.org/world-development-indicators/stories/the-classification-of-countries-by-income.html>
- [4] Jordan R., Giusi M., Franco P., Koechner D., Agi K. (2019) “28 Years of Walking the GLobal Streets and Challenges: ISTE C 1990-2018.” *WEEF-GEDC 2018*, November 12-16, 2018, Albuquerque, NM, USA.