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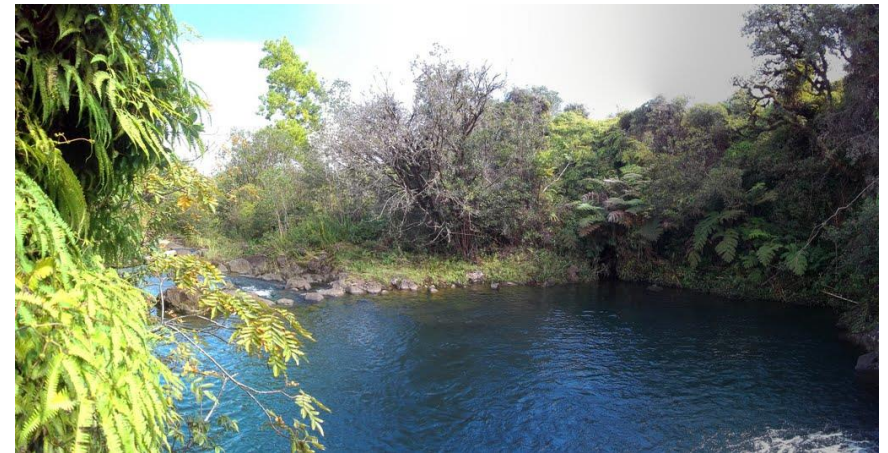
SOSE

12th Annual

SYSTEM OF SYSTEMS ENGINEERING
CONFERENCE

12th Annual System of Systems Engineering Conference

IEEE SMC

Conference Theme:
"Internet of Things as System of Systems"
June 18-21, 2017
Waikoloa, Hawaii, USA

ReliabilitySociety

LOCKHEED MARTIN

INCOSE   SOSE   mabl   R·I·T

07:45	Registration @Kona Promenade
08:40	Welcome @Kona IV
09:00	Keynote @Kona IV

Mr. Alan Harding†
Global Challenges for Systems Engineering and the vital role of SOS Engineering

10:00	Break @Kona Promenade	
10:30 Session MA*	MAX @Kona IV	MAY @Kona I
	Robotic Systems, UAVs, ROVs, Drones, etc. (A)	Special Session - Systems Governance and Policy
11:30	Lunch	
1:00p	Keynote @Kona IV	

Garry Roedler†
& Judith Dahmann†
The Future of Systems of Systems – Or is the future here today? Or are we back to the future?

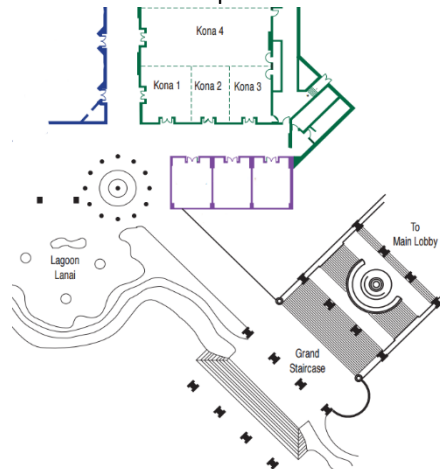|		
2:00p	Break @Kona Promenade	
2:30p Session MP*	MPX @Kona IV	MPY @Kona I
	Robotic Systems, UAVs, ROVs, Drones, etc. (P)	SoSE Simulation, Modeling and Analysis Methods
3:30p Session ML*	MLX @Kona IV	
	Robotic Systems, UAVs, ROVs, Drones, etc. (L)	

4:30p

3:30p	Registration @Kona Promenade

geocode

5:00p	Reception @Grand Staircase
6:00p	

† INCOSE Members

TUESDAY

Time	Event
07:45	**Registration** @Kona Promenade
08:00	**Panel I** @Kona IV — Garry Roedler (Moderator) Reggie Cole†, Dr. Stephen Cook, Dr. Judith Dahmann†, Alan Harding†, Dr. Mike Yokell
9:00	**Keynote** @Kona IV — Dr. Mark E. Davis — Review of LPWA standards and systems
10:00	**Break** @Kona Promenade
10:30	**Keynote** @Kona IV — Dr. John Fumo — Implementation of distributed sensing in loosely coupled fabrics
11:30	**Lunch**
1:00p	**Keynote** @Kona IV — Prof. Ian Gibson — How 3D Printing may change the manufacturing world as we know it
2:00p	**Break** @Kona Promenade

2:30p — Session TP*

TPX @ Kona IV	TPY @ Kona I	TPZ @ Kona III
Big Data Anal., Cloud Comp., Svc. Oriented Arch	SoSE Arch., Design and V & V Methods	Internet of Things / Control

3:30p — Session TL*

TLX @Kona IV	TLY @Kona I	TLZ @ Kona III
Big Data Anal., Cloud Comp., Svc. Oriented Arch. / Enterprise & Business. Arch.	SoSE Arch., Design and V & V Methods	Defense, Space, National Security
4:30p	4:30p	4:15p

Time	Event
7:00p	**Banquet** @Lagoon Lanai
9:00p	

WEDNESDAY

Time	Event
07:45	**Registration** @Kona Promenade
08:00	**Panel II** @Kona IV — Mo Jamshidi (moderator) Gary Langford†, Kristin Giammarco†, Timothy LJ Ferris†, Paul C. Hershey

9:00 — Session wA*

WAX @ Kona IV	WAY @Kona I
Misc. (Energy, Smart Grid Technologies, SoSE Availability, Maintainability, Reliability, Resilience, Safety, etc.)	Special Session - Alternative Research Proposals for Engineering Emergence

Time	Event
10:00	**Break**
10:30	**Keynote** @Kona IV — Prof. Micheal Henshaw† — Modeling and Simulation for Cyber-Physical Systems
11:30	**Lunch**
1:00p	**Keynote** @Kona IV — Prof. Imre J. Rudas — Internet of Anything as a Pillar of Intelligent System of Systems
2:00p	**Break**

2:15p — Session wP*

WPX @ Kona IV	WPY @Kona I
Automotive	Misc. (Human Centered, etc.)

Time	Event
3:00p	**Keynote** @Kona IV — Prof. Francois Coallier — SoSE Challenges in IoT based Systems
4:00p	Future SoSE planning
	4:30p

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KEYNOTES

MONDAY

MR. ALAN HARDING†
President of INCOSE

Global Challenges for Systems Engineering and the vital role of SOS Engineering

9:00am
chair: Garry Roedler†

GARRY ROEDLER†
INCOSE President-Elect, Lockheed Martin Senior Fellow

JUDITH DAHMANN†
Senior Principal Systems Engineer at MITRE

The Future of Systems of Systems – Or is the future here today? Or are we back to the future?

1:00pm
chair: Mo Jamshidi

TUESDAY

DR. MARK E. DAVIS
Vice President of Platform Engineering Group and Chief Technology Officer of CDMA Products and Development, Intel Corporation

Review of LPWA standards and systems

9:00am
chair: Ted Shaneyfelt

DR. JOHN FUMO
Kona Scientific, Hawaii USA

Implementation of distributed sensing in loosely coupled fabrics

10:30am
chair: Ted Shaneyfelt

† INCOSE Members

KONA I ROOM WEDNESDAY JUNE 21ST SESSION WAY CHAIR: JAMSHIDI

Special Session - Alternative Research Proposals for Engineering Emergence

9:00am
The Making of a System of Systems: Ontology Reveals the True Nature of Emergence
Gary Langford† (Portland State University, USA); Teresa Langford (Portland Community College, USA)

Paper #1570340366
Session WAY — Room Kona I

9:15am
Practical Modeling Concepts for Engineering Emergence in Systems of Systems
Kristin Giammarco† (Naval Postgraduate School, USA)

Paper #1570346500
Session WAY — Room Kona I

9:30am
Emergence as a Subject of Research, Research Methods, and Engineering Knowledge and Practice
Timothy LJ Ferris† (Cranfield University, United Kingdom)

Paper #1570345407
Session WAY — Room Kona I

9:45am
Multi-dimensional Information Filter for Space-Based Platforms (MIFS)
Paul C. Hershey (Raytheon, Inc., USA)

Paper #1570349685
Session WAY — Room Kona I

KONA I ROOM WEDNESDAY JUNE 21ST SESSION WPY CHAIR: SEONG

Misc. (Human Centered, etc.)

2:15pm
A System of Systems Approach to Patient Treatment with the Left Ventricular Assist Device
Viswajith Vasudevan and **Marwan A. Simaan** (University of Central Florida, USA)

Paper #1570340231
Session WPY — Room Kona I

2:30pm
Human Machine Interface in the Internet of Things (IoT)
Joseph Nuamah and **Younho Seong** (North Carolina A&T State University, USA)

Paper #1570347159
Session WPY — Room Kona I

2:45pm
Towards an Approach for Analyzing Trust in Cyber-Physical-Social Systems
Mohamad Gharib, Paolo Lollini and Andrea Bondavalli (University of Florence, Italy)

Paper #1570340931
Session WPY — Room Kona I

Rev 6.12.5

Note: **Boldface** *indicates presenting author.*

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Misc. (Energy, Smart Grid Technologies/ SoSE Availability, Maintainability, Reliability, Resilience, Safety, etc.)

9:00am
Systems Architecture in Failure Analysis
Stephen Rambikur (Naval Post Graduate School & Naval Undersea Warfare Center, USA); Kristin Giammarco† and **Bryan O'Halloran** (Naval Post Graduate School, USA)

Session WAX — Paper #1570345479 — Room Kona IV

9:15am
A Design Flow with Integrated Verification of Requirements and Faults in Safety-Critical Systems
Wei Yan, Daniel Fontaine, Laurent Michel and John A Chandy (University of Connecticut, USA)

Session WAX — Paper #1570344409 — Room Kona IV

9:30am
Distributed Data Fusion in the Dempster-Shafer framework
Orakanya Kanjanatarakul (Chiang Mai Rajabhat University, Thailand); **Thierry Denoeux**† (Université de Technologie de Compiègne, France)

Session WAX — Paper #1570344197 — Room Kona IV

9:45am
Developing the Stakeholder Requirements Definition Process - A Journey of Customization
Simon Aasheim (HENT AS, Norway); Yang Yang Zhao (University College of Southeast Norway, Norway)

Session WAX — Paper #1570335723 — Room Kona IV

Automotive

2:15pm
An Internetworked Self-Driving Car System of Systems
Jeremy Straub, Wafaa Amer, Christian Ames, Karanam Dayananda, Andrew Jones, Goutham Miryala, Nathan Olson, Noah Rockenback, Franklin Sslaby, Santipab Tipparach, Samuel Fehringer, David Jedynak, Haiming Lou, Dakota Martin, Marc Olberding, Austin Oltmans, Alec Witte, Brady Goenner, Jessie Lee and Dylan Shipman (North Dakota State University, USA)

Session WPX — Paper #1570344839 — Room Kona IV

2:30pm
CyberSecurity Considerations for an Interconnected Self Driving Car System of Systems
Jeremy Straub, John McMillan, Brett Yaniero, Mitchell Schumacher, Abdullah Almosalami, Kelvin Boatey and Jordan Hartman (North Dakota State University, USA)

Session WPX — Paper #1570345560 — Room Kona IV

2:45pm
A Cyber Energy System Design (CESD) for Electric Vehicle Applications
K. Tehrani (ESIGELEC-IRSEEM, France)

Session WPX — Paper #1570345528 — Room Kona IV

KEYNOTES

TUESDAY (CONTINUED)

IAN GIBSON
Professor of Industrial Design & Head of School and School of Engineering Deakin University, Australia

How 3D Printing may change the manufacturing world as we know it

1:00pm
chair: Matthew Joordens

WEDNESDAY

PROF. MICHAEL HENSHAW†
Loughborough University, UK

Modeling and Simulation for Cyber-Physical Systems

10:30am
chair: Mo Jamshidi

PROF. IMRE J. RUDAS
Óbuda University, Budapest, Hungary

Internet of Anything as a Pillar of Intelligent System of Systems

1:00pm
chair: Ferat Sahin

PROF. FRANCOIS COALLIER
Ecole de Technologie Superieure, Canada

SoSE Challenges in IoT based Systems

3:00pm
chair: Paul Hershey

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Robotic Systems, UAVs, ROVs, Drones, etc. (1 of 3)

A Novel 3D printed leg design for a Biped Robot

Matthew Haywood and **Ferat Sahin** (Rochester Institute of Technology, USA)

10:30am

Session MAX   Paper #1570346575
    Room Kona IV

A Novel Hexapod Robot Design with Flight Capability

Mark Pitonyak and **Ferat Sahin** (Rochester Institute of Technology, USA)

10:45am

Session MAX   Paper #1570345434
    Room Kona IV

A Framework for an Adaptive Human-Robot Collaboration approach through Perception-based Real-Time adjustments of robot behavior in industry

Shitij Kumar and Ferat Sahin (Rochester Institute of Technology, USA)

11:00am

Session MAX   Paper #1570345503
    Room Kona IV

Quadruped Implementation Using Parallel Jointed Leg Architecture

Steven Giewont and **Ferat Sahin** (Rochester Institute of Technology, USA)

11:15am

Session MAX   Paper #1570345421
    Room Kona IV

Robotic Systems, UAVs, ROVs, Drones, etc. (2 of 3)

Multi-Pursuer Pursuit-Evasion Games Under Parameters Uncertainty: A Monte Carlo Approach

Shahriar Talebi and Marwan A. Simaan (University of Central Florida, USA)

2:30pm

Session MPX   Paper #1570340685
    Room Kona IV

A Deep Vision Landmark Framework for Robot Navigation

Abhijith Ravikumar Puthussery, Karthik Haradi, Patrick J Benavidez, **Berat A. Erol**, Paul Rad and Mo Jamshidi (University of Texas at San Antonio)

2:45pm

Session MPX   Paper #1570345652
    Room Kona IV

Improved Route Optimization for Autonomous Ground Vehicle Navigation

Ibrahim Mohammed, **Berat A. Erol**, Ikram Mohammed, Patrick J Benavidez and Mo Jamshidi (University of Texas at San Antonio)

3:00pm

Session MPX   Paper #1570345584
    Room Kona IV

Development of Robot Operating System (ROS) Compatible Open Source Quadcopter Flight Controller and Interface

Abhijit Majumdar, Nicholas Gamez, Patrick J Benavidez and Mo Jamshidi (University of Texas at San Antonio)

3:15pm

Session MPX   Paper #1570347307
    Room Kona IV

SoSE Architecture, Design and V & V Methods

Architecturally Describing the Emergent Behavior of Software-intensive System-of-Systems with SosADL

Flavio Oquendo (IRISA (UMR CNRS) - University of South Brittany, France)

3:30pm

Session TLY   Paper #1570340809
    Room Kona I

A Novel Methodology for Retrofitting CNC Machines Based on the Context of Industry 4.0

Romulo Lins (Faculdade SENAI Mariano Ferraz, Brazil); Robert Schmitt (Laboratory for Machine Tools and Production Engineering WZL, Germany); Bruno Guerreiro (Fraunhofer Institute for Production Technology, Germany); Marcio Corazzim (Faculdade SENAI Mariano Ferraz, Brazil); Francis Silva (Thyssenkrupp, Brazil)

3:45pm

Session TLY   Paper #1570340951
    Room Kona I

Evaluating a computational support tool for set-based configuration of production systems

Johannes Unglert, Sipke Hoekstra and Juan Jauregui-Becker (University of Twente, Faculty of Engineering Technology, Enschede, The Netherlands)

4:00pm

Session TLY   Paper #1570340786
    Room Kona I

A Conceptual Model for Analyzing Information Quality in System-of-Systems

Mohamad Gharib, Paolo Lollini and Andrea Bondavalli (University of Florence, Italy)

4:15pm

Session TLY   Paper #1570340925
    Room Kona I

Banquet 7pm at Lagoon Lanai

Big Data Analytic, Cloud Computing, Svc. Oriented Arch. (2 of 2) / Enterprise and Business Architecture

3:30pm

A Deep Learning Approach for Mapping Music Genres

Sharaj Panwar, Arun Das, Mehdi Roopaei and Paul Rad (Universiity of Texas at San Antonio, USA)

Session TLX — Paper #1570345535
Room Kona IV

3:45pm

Autonomous Decision Making for a Driver-less Car

Nicholas Gamez and Nicolas Gallardo (University of Texas at San Antonio, USA); Paul Rad (Rackspace, USA); Mo Jamshidi (University of Texas at San Antonio, USA)

Session TLX — Paper #1570341909
Room Kona IV

4:00pm

Enabling Design of Agile Security in the IOT with MBSE

Barry Papke† (No Magic Inc, USA)

Session TLX — Paper #1570340698
Room Kona IV

4:15pm

Systems Engineering Competencies for Enterprise Transformation

Rabia Khan†, Clifford Whitcomb† and Ronald Giachetti (Naval Postgraduate School, USA)

Session TLX — Paper #1570341069
Room Kona IV

Defense, Space, National Security

3:30pm

Defining an Enterprise Lead Systems Integration (LSI) Framework

Warren K. Vaneman† (Naval Postgraduate School, USA); Ron Carlson (Stevens Institute of Technology, USA)

Session TLZ — Paper #1570340859
Room Kona III

3:45pm

Using Social Network Analysis to Quantify Interoperability in a Large System of Systems

James Enos and Roshanak Nilchiani (Stevens Institute, USA)

Session TLZ — Paper #1570339163
Room Kona III

4:00pm

Trends in Large Scale Systems-of-Systems for Multi-National Missile Defense

Tod Schuck (Lockheed Martin & Rowan University, USA); James Kilian (Lockheed Martin, USA)

Session TLZ — Paper #1570340879
Room Kona III

Special Session - Systems Governance and Policy

10:30am

Emergence as Innovation in Systems of Systems - a Three Systems Model

Thomas A McDermott, Jr† (Georgia Tech Research Institute & Georgia Tech Sam Nunn School of International Affairs, USA); Molly Nadolski (Georgia Institute of Technology, USA)

Session MAY — Paper #1570345612
Room Kona I

10:45am

Incentivising the Dissemination of Truth Versus Fake News in Social Networks

Abbas Ehsanfar and Mo Mansouri† (Stevens Institute of Technology, USA)

Session MAY — Paper #1570347637
Room Kona I

11:00am

Sustainability policy-making as a dynamic, agent-based system of systems

Steven Hoffenson (Stevens Institute of Technology, USA)
Session MAY — Paper #1570348363
Room Kona I

11:15am

Applying Social Network Analysis to Systems of Systems: The Case of the 2016 Puerto Rico Power Outage

James Enos, Mo Mansouri† and Roshanak Nilchiani (Stevens Institute, USA)

Session MAY — Paper #1570339409
Room Kona I

SoSE Simulation, Modeling and Analysis Methods

2:30pm

Identifying Decision Patterns Using Monterey Phoenix

John Quartuccio, **Kristin Giammarco**† and Mikhail Auguston (Naval Postgraduate School, USA)
Session MPY — Paper #1570341093
Room Kona I

2:45pm

Deriving Stochastic Properties from Behavior Models Defined by Monterey Phoenix

John Quartuccio, **Kristin Giammarco**† and Mikhail Auguston (Naval Postgraduate School, USA)
Session MPY — Paper #1570345214
Room Kona I

3:00pm

Data Dependency Network Analysis in SoS

Reggie Cole† (Lockheed Martin Corporation, USA)
Session MPY — Paper #1570338483
Room Kona I

3:15pm

Modeling Human-Technology Interaction as a Sociotechnical System of Systems

Jessica Turnley (Galisteo Consulting Group Inc, USA); **Amanda Wachtel**, Karina Munoz, Matthew Hoffman, John Gauthier, Ann Speed and Robert Kittinger (Sandia National Laboratories, USA)
Session MPY — Paper #1570339824
Room Kona I

3:30pm

System of Systems Architecture Feasibility Analysis to Support Tradespace Exploration

Ronald Giachetti, Eugene Paulo, Paul Beery and Alejandro Hernandez (Naval Postgraduate School, USA); Stephen Gillespie (United States Military Academy & United States Army, USA)
Session MPY — Paper #1570340877
Room Kona I

Kona IV Room Monday June 19th Session MLX Chair: Champion

Robotic Systems, UAVs, ROVs, Drones, etc. (3 of 3)

3:30pm — Design and Development of a Low-Cost Autonomous Surface Vehicle
Benjamin Champion (Deakin University, Australia); Van Thanh Huynh (Colleague, Australia); Gokul Thirunavukkarasu, Lachlan Patrick, Lloyd Hock Chye Chua and **Matthew Joordens** (Deakin University, Australia)
Paper #1570345550
Session MLX · Room Kona IV

3:45pm — Eye Sensor for Swarm Robotic Fish
Nnamdi Elege, Suhasini Solapurkar and **Matthew Joordens** (Deakin University, Australia)
Paper #1570344806
Session MLX · Room Kona IV

4:00pm — Implementation of Automated Vanilla Pollination Robotic Crane Prototype
Tuan Giang, **John Kuroda** and Ted Shaneyfelt (University of Hawaii at Hilo, USA)
Paper #1570331183
Session MLX · Room Kona IV

4:15pm — A Research Framework on Mission Planning of the UAV Swarm
Xin Zhou, Weiping Wang, **Xiaobo Li**, **Tao Wang** and Zhifei Li (National University of Defense Technology, P.R. China)
Paper #1570352258
Session MLX · Room Kona IV

Kona IV Room Tuesday June 20th Session TPX Chair: Benavidez

Big Data Analytic, Cloud Computing, Service Oriented Archi. (1 of 2)

2:30pm — The Internet of Simulation: Enabling Agile Model Based Systems Engineering for Cyber-Physical Systems
Stephen Clement and David McKee and Richard Romano and Jie Xu (Leeds University, United Kingdom); Jose Lopez (Simware Solutions, Spain); David Battersby (Jaguar Land Rover, United Kingdom)
Paper #1570340957
Session TPX · Room Kona IV

2:45pm — Model-based Assessment of QoS Adaptation in Complex Networked Systems
Kaliappa Ravindran, Yassine Wardei and **Michael Iannelli** (City University of New York, USA)
Paper #1570344848
Session TPX · Room Kona IV

3:00pm — Pedestrian Detection System Using Deep Convolutional Neural Networks
Jonathan Lwowski, Prasanna Kolar, Patrick J Benavidez, Paul Rad, John J Prevost and Mo Jamshidi (University of Texas at San Antonio)
Paper #1570345515
Session TPX · Room Kona IV

3:15pm — Deep Voice Identification
Andrew Boles and Paul Rad (University of Texas San Antonio, USA)
Paper #1570345545
Session TPX · Room Kona IV

Kona I Room Tuesday June 20th Session TPY Chair: Giachetti

SoSE Architecture, Design and V & V Methods

2:30pm — Quality metrics for descriptive models in model based systems engineering
Ronald Giachetti (Naval Postgraduate School, USA)
Paper #1570340808
Session TPY · Room Kona I

2:45pm — Architecture Modeling Software Analytics: Model quality and maturity assessment using automated tools
Kristin Giammarco† (Naval Postgraduate School, USA)
Paper #1570345349
Session TPY · Room Kona I

3:00pm — Comprehensive Use Case Scenario Generation: An Approach for Modeling System of Systems Behaviors
Kristin Giammarco†, Clifford Whitcomb† and Kathleen Giles (Naval Postgraduate School, USA)
Paper #1570341061
Session TPY · Room Kona I

3:15pm — Red Teaming in the Age of IOT: Thoughts on Framing the Next Generation of Technical Vulnerability Assessment
Richard Craft, II (Sandia National Labs, USA)
Paper #1570341050
Session TPY · Room Kona I

Kona III Room Tuesday June 20th Session TPZ Chair: Kelley

Internet of Things / Control

2:30pm — An IoT Self Organizing Network for 5G Dense Network Interference Alignment
Anil Kumar Yerrapragada and Brian T Kelley (University of Texas at San Antonio, USA)
Paper #1570345200
Session TPZ · Room Kona III

2:45pm — Software Architecture of Self-Organizing Systems-of-Systems for the Internet-of-Things with SosADL
Flavio Oquendo (IRISA (UMR CNRS) - University of South Brittany, France)
Paper #1570344966
Session TPZ · Room Kona III

3:00pm — Using a Systems of Systems modeling approach for developing Industrial Internet of Things applications
Aurelijus Morkevicius† (Kaunas University of Technology & No Magic Europe, Lithuania); Lina Bisikirskiene (Kaunas University of Technology, Lithuania); Graham Bleakley† (IBM Uk Ltd, United Kingdom)
Paper #1570340827
Session TPZ · Room Kona III