

IEEE International Conference on Wireless for Space and Extreme Environments

16–18 December 2024



Program



Imprint

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Welcome by the Conference Chairs

Dear IEEE WiSEE Authors and Attendees,

It is with great enthusiasm that we welcome you to IEEE WiSEE 2024. As a valued member of the WiSEE community, we are thrilled to have you join us for this year's conference, which promises to deliver an extraordinary experience. From cutting-edge technical presentations to insightful special sessions, workshops, and short courses—all included in your registration—you are in for an enriching journey.

IEEE WiSEE 2024 also offers exceptional opportunities to connect, network, and enjoy time with colleagues and friends. Here are some of the highlights you won't want to miss:

- **Aerospace Night (December 16, Monday evening):** Sponsored by Embry-Riddle Aeronautical University, this exciting event features guided tours of ERAU's state-of-the-art engineering laboratories on the Daytona Beach campus, followed by a reception with stunning views of ERAU's airplane fleet and the Daytona Beach International Airport. Be sure to sign up early to secure your spot!
- **Gala Dinner and Bonfire (December 17, Tuesday evening):** Join us at the beachfront for an unforgettable evening! After our banquet, gather around bonfires to enjoy camaraderie and prepare the classic treat, s'mores.
- **Women in Engineering (WiE) Lunch Reception (December 18, Wednesday at noon):** Hosted by the WiE affinity group, this special event is an excellent opportunity to connect with fellow attendees. (Pre-registration is required for this event.)
- **Breakfast and Coffee Breaks with Patrons:** Throughout the conference, take a moment to thank our generous patrons, Anywaves and IEEE Leo Sats, while enjoying breakfast and coffee breaks.
- **Lunch Overlooking the Beach:** We will offer lunch Monday and Tuesday, please join us to connect with the great WiSEE community!

Additionally, we encourage you to explore the wonders of central Florida! Set against the backdrop of the world-famous Daytona Beach – with its pristine waters, soft sands, and the iconic Daytona International Speedway – our conference location is as inspiring as the event itself. With nearby attractions like NASA’s Kennedy Space Center and Orlando’s world-renowned theme parks, IEEE WiSEE 2024 offers the perfect balance of professional enrichment and personal enjoyment. We eagerly anticipate hosting you in Daytona Beach, learning about your remarkable work, and sharing this memorable experience together. Stay tuned for exciting surprises along the way!

We wish you a successful and interesting conference!

Eduardo Rojas
Conference Chair

Holger Maune
Technical Program Chair

Committees and Boards

Conference General Chair

Eduardo Rojas, Embry-Riddle Aeronautical University, USA

Conference General Co-Chair

Darren Boyd, National Aeronautics and Space Administration (NASA), USA

Technical Program Chair

Holger Maune, Otto-von-Guericke University Magdeburg, Germany

Technical Program Co-Chairs

Ilhan Akbas, Embry-Riddle Aeronautical University, USA

Workshops Chair

Jan Brudoweit, German Aerospace Center (DLR), Germany

Invited Papers Chair

Markus Gardill, Brandenburg University of Technology Cottbus–Senftenberg, Germany

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Seyed (Reza) Zekavat, Worcester Polytechnic Institute, USA

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Kate Graves, Georgia Institute of Technology, USA

Venue Chair

Ali Abedi, University of Maine, USA

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Ebonee Walker, IEEE Region 3 Women in Engineering Representative

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Ali Abedi, VP Conferences, IEEE Council on RFID

Amir Aghdam, Past President, IEEE Canada

Seyed (Reza) Zekavat, SSP Representative

Sessions

Session M1: Antennas and RF Systems I

(Grand Ballroom 4)

Chair: Holger Maune, Otto-von-Guericke University Magdeburg

08:20 **M1-1 Study of Additively Manufactured Channelized Metasurface Elements for Deployable Antennas**

Blake A Roberts, Cameron P Martinez, Bryce Gray, John T O'Keefe, Jayaprakash B Shivakumar, Eduardo Rojas

Embry-Riddle Aeronautical University

08:40 **M1-2 Machine Learning-Driven State Selection Method for Millimeter-Wave Reconfigurable Array Antenna With 360° Beam Scanning**

Md Shakir Hossain, Anim Kyei, Kapil Dandekar

Drexel University

09:00 **M1-3 A Low-Complexity LSTM Network to Realize Multibeam Beamforming**

Hansaka Aluvihare¹, Carina Shanahan¹, Sirani M. Perera¹, Sivakumar Sivasankar², Umesha Kumarasiri², Arjuna Madanayake², Xi-anqi Li³

¹ Embry-Riddle Aeronautical University

² Florida International University

³ Florida Institute of Technology

Session M2: Opening Session

(Grand Ballroom 4)

Welcome Address

Eduardo Rojas, Conference Chair

Keynote Talk

Title



Dr. Janet Kavandi
Senior Advisor
WestExec Advisors, LLC

Dr. Janet Kavandi is a highly accomplished leader in aerospace and technology who leverages her extensive experience in human spaceflight, aerospace research and development, and strategic planning to enhance national capabilities in space exploration and commercial aerospace advancements. Dr. Kavandi, currently an aerospace consultant, most recently served as the President and Chief Science Officer at Sierra Space. Prior to that, she was the Executive Vice President in the Space Systems Group at Sierra Nevada Corporation (SNC). Preceding her tenure at Sierra, Dr. Kavandi served 25 years at NASA where she was Director of NASA's Glenn Research Center, overseeing innovative advancements in aeronautics, space propulsion, and energy storage technologies. Under her leadership, the center significantly contributed to the U.S. space exploration agenda and collaborated extensively with the international space community. Prior to her time at Glenn, Dr. Kavandi was Director of Flight Crew Operations and Deputy Director of Health and Human Performance at NASA's Johnson Space Center. She was selected as a NASA astronaut in 1994 and flew on three space shuttle missions, logging 33 days in space and 13.1 million miles in 535 Earth orbits. The recipient of two Presidential Rank Awards, two NASA Outstanding Leadership Medals, two Exceptional Service Medals, three NASA Space Flight Medals and the Distinguished Service Medal, Dr. Kavandi was inducted into the Astronaut Hall of Fame in 2019. Her educational background includes a Bachelor of Science degree from Missouri Southern State University, a Master of Science from the Missouri University of Science and Technology, and a PhD in analytical chemistry from the University of Washington.

Session M3: Antennas and RF Systems II (Grand Ballroom 4)

Chair: Wael M. Fathelbab, Northrop Grumman Corporation

10:30 **M3-1 Comprehensive Synthesis of Dual-Band Filters Comprising Cascaded Network Configurations**

Wael M Fathelbab

Northrop Grumman

10:50 **M3-2 Design and Implementation of a Sub-Millimeter Wave Upconverter for High Data Rate CubeSat Communications**

Lucien L Hammond, John T O'Keefe, Cameron P Martinez, Blake A Roberts, Eduardo Rojas

Embry-Riddle Aeronautical University

11:10 **M3-3 Radio-Frequency Characterization of Indium Tin Oxide (ITO) on Alkaline Earth Boro-Aluminosilicate Glass**

John T O'Keefe, Blake A Roberts, Bryce Gray, Eduardo A Rojas-Nastrucci

Embry-Riddle Aeronautical University

11:30 **M3-4 Impact of Reconfigurable Intelligent Surfaces (RIS) on Communication Enhancement in Complex Confined Areas, With Emphasis on the Vehicle Equipment Bay (VEB) of Space Launchers**

Aurélien Surier¹, Nadir Hakem¹, Nahi Kandil¹, Michel Misson²

¹ Université du Québec

² Université de Clermont Auvergne

Session M4: Plenary Session (Grand Ballroom 4)

Keynote Talk

Assessing and Developing Communications and Sensing Technologies for Space and Aeronautics Extreme Environments



Dr. Félix A. Miranda

Deputy Chief, Communications and Intelligent Systems Division

NASA Glenn Research Center

NASA is striving in advancing space exploration via the Artemis campaign. The Moon-to-Mars efforts seek to return humans to the moon for a period longer than that attained during the Apollo program as a prelude to the more ambitious Mars exploration, and beyond. To achieve these goals the assessment and development of current and novel communications and sensing technologies, capable to optimally perform in extreme and non-traditional environments, is of utmost importance. Accordingly, NASA Glenn Research Center is partnering with other NASA Centers, Industry, and Academia to evaluate and/or develop communications and sensing technologies that can support the communications needs of crew and robotic entities in scenarios such as the surface of the moon, high-radiation environment, difficult to access areas, high-temperature/caustic atmosphere environments, and extremely cold environments, among others. The benefits of these technologies to NASA's current and planned initiatives, as well as examples of the challenges yet to be addressed, will be discussed in this presentation.

Session M5: Channel Modelling

(Grand Ballroom 4)

Chair: Eduardo Rojas, Embry-Riddle Aeronautical University

15:10 **M5-1 Development of Predictive Mathematical Model for Millimeter Wave Degradation in Sandstorm Regions**

Esmail M M Abuhdima¹, Gurcan Comert¹, Chin-Tser Huang², Pierluigi Pisu³, Jian Liu², Amir Nazeri³, Abdulmajid Mrebit¹, Ricsheia Barr¹, Avery Basden¹

¹ Benedict College

² University of South Carolina

³ Clemson University

15:30 **M5-2 Soil Subsurface Channel Statistical Characterization for Drone-Borne Intelligent GPR Advancement**

Noushin Khosravi Largani, Seyed (Reza) Zekavat, Vincent J Filardi
Worcester Polytechnic Institute

15:50 **M5-3 Design and Simulation of a Passive Wireless Sensor Array System for a Spacecraft Inflatable Habitat Using Shooting and Bouncing Rays Electromagnetic Simulations**

Donald Garbarino, Eduardo Rojas

Embry-Riddle Aeronautical University

16:10 **M5-4 LUNAR LTE: A Mathematical Path Loss Prediction Model for Lunar South Pole**

Quadri R Adebawale^{1,2}, Shawn Ostermann¹

¹ Ohio University

² University of Ilorin, Nigeria

Session T1: Optical Communications (Grand Ballroom 4)

Chair: Ali Abedi, University of Maine

08:00 **T1-1 Autonomous Max-Flow Interplanetary Laser Link Scheduling for Martian Exploration**

Jason Gerard¹, Andre Ibrahim¹, Juan Fraire^{2,3}, Sandra Cespedes¹

¹ Concordia University

² Institut National des Sciences Appliquées de Lyon

³ National University of Córdoba

08:20 **T1-2 Characterizing Stability of Bulk Nanobubbles in Micro-Gravity Using Dynamic Light Scattering**

Arman Kiani, Ali Abedi

University of Maine

08:40 **T1-3 Data-Aided Multi-Format DSP for Robust Free-Space Coherent Optical Communication**

Abraham Johst^{1,2}, Lutz Molle¹, Nicolas Perlot², Marcel Rothe², Michael Rohde³, Markus Nölle¹

¹ Hochschule für Technik und Wirtschaft Berlin

² Fraunhofer Heinrich-Hertz-Institute

³ Berliner Hochschule für Technik

09:00 **T1-4 Cuboid-Based Signal-Space Symbol Generation for Intra-Satellite Communication**

Marek Jahnke¹, Ulf Kulau^{1,2}

¹ Hamburg University of Technology

² DSI Aerospace Technology

Session T2: Plenary Session (Grand Ballroom 4)

Keynote Talk

Data Downlink Antennas for Small Satellites in the NewSpace Era: Review and Perspectives



Nelson Fonseca
Innovation Manager
Anywaves

This talk provides a review of commercially-available data downlink antennas for small satellites, with particular focus on NewSpace applications. Various mission needs and associated solutions are discussed, from very low data rate requirements to very demanding high-resolution microwave and optical instrument missions. The antenna products covered include S-band TT&C antennas and X-band data downlink antennas. The evolution of the market is also addressed with a discussion of on-going product developments for future space missions, including millimeter-wave solutions and reconfigurable antenna systems. The solutions presented are mostly relevant for Earth observation missions, although some also find use cases in low Earth orbit satellite communication constellations, as well as deep space exploration missions.

Session T3: Networks and Communication Systems I (Grand Ballroom 4)

Chair: Shawn Ostermann, Ohio University

- 10:30 **T3-1 A Study of Lunar Proximity Networks: Scenarios and Architectures**
 Chehaitly Mouhamad¹, Hocuine Chougrani¹, Sumit Kumar¹, Yousouf Drif¹, Jorge Querol¹, Stefano Petri², Leonardo Turchi², Symeon Chatzinotas¹
¹ University of Luxembourg
² European Space Agency (ESA)
- 10:50 **T3-2 Wireless Sensors Networks for Aerospace Telemetry Data Acquisition**
 Francesco Silino¹, Pietro Savazzi¹, Marco Alberti², Marco Tatangeli², Federico Brega², Marta Albano³, Enrico Cavallini³
¹ University of Pavia
² Temis Srl
³ Agenzia Spaziale Italiana
- 11:10 **T3-3 Body Area Network Design for Spacewalk Nonverbal Communication in Extreme Conditions**
 Thuy T. Pham^{1,2}, Veronica B H Nguyen¹, Philip Leong¹
¹ University of Technology Sydney
² Garvan Medical Institute
- 11:30 **T3-4 Mutual Information Analysis of Neuromorphic Coding for Distributed Wireless Spiking Neural Network**
 Pietro Savazzi, Anna Vizziello, Fabio Dell'Acqua
 University of Pavia

Session T4: Networks and Communication Systems II (Grand Ballroom 4)

Chair: Sreejith Vidhyadharan, University of North Dakota

13:30 **T4-1 BALSAs: Bundle Abstraction Layer for Socket Applications**

Silas Springer, Shawn Ostermann
Ohio University

13:50 **T4-2 Adaptive SI Cancellation Using Measured Impulse Responses for STAR Radio**

Gayani Rathnasekara, Hasitha Weerasooriya, John L. Volakis, Arjuna Madanayake
T4

14:10 **T4-3 Securing Satellite Link Segment: A Secure-By-Component Design**

Olfa Ben Yahia¹, William O Ferguson², Sumit Chakravarty³, Nesrine Bouchouane¹, Gunes Karabulut Kurt¹, Gürkan Gür⁴, Gregory Falco⁵

¹ Ecole Polytechnique de Montréal

² 303 Overwatch A.S.B.L

³ Kennesaw State University

⁴ Zurich University of Applied Sciences

⁵ Cornell University

14:30 **T4-4 DTN-COMET: A Comprehensive Operational Metrics Evaluation Toolkit for DTN**

Tobias Nöthlich, Felix Walter
D3TN GmbH

Session T5: Networks and Communication Systems III (Grand Ballroom 4)

- Chair: Darren Boyd, National Aeronautics and Space Administration
- 15:10 **T5-1 Optimizing Size and Transmission Power of Near-Ground Device-To-Device Wireless Sensor Networks**
Mersedeh Najishabahang, Ali Abedi
University of Maine
- 15:30 **T5-2 Toward Multi-Layer Networking for Satellite Network Operations**
Peng Hu
University of Manitoba
- 15:50 **T5-3 A Novel TDMA Based Protocol Stack With Virtual Circuit and Priority Queues for Multi-Class Wireless Traffic in a Space Environment**
Dalia Ammar Khodja, Ryan S. Adams, Sreejith Vidhyadharan, Ronald A. Fevig
University of North Dakota
- 16:10 **T5-4 A Software Defined Networking Architecture for Time Triggered Ethernet in Space Systems**
Matteo Calabrese¹, James R Curbo², Gregory Falco¹
¹ Cornell University
² Johns Hopkins University

Session W1: Tests and Materials for Extreme Environments

(Grand Ballroom 4)

Chair: Holger Maune, Otto-von-Guericke University Magdeburg

08:00 **W1-1 Configurable Radiation Test-Suite: A Tool for Simplified and Remote Radiation Testing**

Jan Budroweit, Ferdinand Stehle, Felix Eichstaedt

German Aerospace Center (DLR)

08:20 **W1-2 A Surface Acoustic Wave (SAW) Temperature and Strain Sensor for Cryogenic Sensing Applications**

Fang Li, Michael C Kohler

New York Institute of Technology

08:40 **W1-3 High-Temperature Characterization of Lithium Niobate for mmWave Sensing in Extreme Environments**

Callen MacPhee¹, Bahram Jalali¹, Zane Cohick², Cesar A Nieves², Michael McCaffrey³, David Casale³, Aaron Buck³, Young-Kai Chen³

¹ University of California Los Angeles

² Air Force Research Laboratory

³ Coherent Aerospace and Defense

09:00 **W1-4 Wi-Fi Signal Survey of the International Space Station by Autonomous Free-Flying Robot**

Everest Yang¹, Shian Hwu², Chatwin Lansdowne¹, John P Boster³, Kanishka deSilva³

¹ National Aeronautics and Space Administration (NASA)

² Barrios Technology

³ Jacobs Technology

Session W1a: BioMed and Extreme Environments (Grand Ballroom 5)

Chair: Eduardo Rojas, Embry-Riddle Aeronautical University

08:00 **W1a-1 Interval Timing Under Microgravity Stressor**
Jason M Fitzgerald, Sorinel Oprisan, Catalin V. Buhusi
Medical University of South Carolina

Wednesday 18th December
08:00–08:20

Session W2: Closing Session (Grand Ballroom 4)

Closing Remarks

Eduardo Rojas, Conference Chair

Keynote Talk

Advances and Challenges in Airborne wide Beam-Scanning Heterogeneously Integrated Phased-Arrays



Dr. Julio A. Navarro
Principal Senior Technical Fellow
The Boeing Company

Over the last several decades, challenges in military applications have driven technology in terrestrial, airborne, naval and space applications for beam-scanning phased array antennas (PAA) with large field of regard (FOR). More recently, the expansion of key commercial applications with very large markets has made the typical phased-array a commodity. The advances in PAAs are attributed to several technologies including highly-integrated RFICs, improved multi-layer printed-wiring boards (MLPWB), improved materials and processes along with high-speed computing and improved numerical analysis techniques. Heterogeneously-integrated packaging technologies are now included in advanced front-end sensors for communications and radar in both military and commercial applications. 5G, SATCOM and Line-of-Sight (LOS) communications in both narrow and wideband applications are rapidly advancing in various critical industries including security, autonomy and IoT. The trend continues with the use of machine learning, AI and quantum technologies to enhance PAA missions and sensor performance.

Session W3: Remote Sensing Systems (Grand Ballroom 4)

- Chair: Darren Boyd, National Aeronautics and Space Administration
- 10:30 **W3-1 Joint Supervised and Unsupervised Machine Learning for Spaceborne Spectrum Sensing**
Bisma Manzoor, Akram Al-Hourani
RMIT University
- 10:50 **W3-2 Minimizing Communications in Partially-Observable Multiagent Systems**
Joseph Patton¹, Alex Barrie², Ali Abedi¹
¹ University of Maine
² Aurora Engineering
- 11:10 **W3-3 Toward Intelligent Adaptive Airborne GPR, Implementation and Data Acquisition**
Saeed Haghniaz Jahromi¹, Vincent J Filardi¹, Seyed (Reza) Zekavat¹, Zhonghai Wang², Joshua Thurber¹, Dylan Hoffman¹, Charlotte Larson¹, Doug T Petkie¹
¹ Worcester Polytechnic Institute
² Intelligent Fusion Technology, Inc.
- 11:30 **W3-4 RFID-Assisted Indoor Localization Using Hybrid Wireless Data Fusion**
Abouzar Ghavami¹, Ali Abedi²
¹ Georgia Institute of Technology
² University of Maine

Short Courses

Short Courses SC1: An Introduction to Intelligent Green Aviation Transportation via Space Solar Power (SSP)

(Grand Ballroom 5)

Organizer: Seyed (Reza) Zekavat, Worcester Polytechnic Institute

The transition towards fully electric transportation has accelerated, with numerous orders for all-electric aircraft (AEA) and a commitment by the International Air Transport Association (IATA) to achieve net-zero carbon emissions by 2050. This tutorial introduces Space Solar Power (SSP) as a pivotal enabler of green air transportation, focusing on mid-air recharging (MAR) for AEAs. We explore the essential infrastructure components of SSP, including high-capacity energy storage, wireless power-beaming (WPB) technologies, antenna systems, and the fundamentals of low earth orbit (LEO) space-based technology. The potential of SSP for MAR is examined, including the cost structure related to manufacturing, launch, and operational expenses. Moreover, we highlight the role of Artificial Intelligence (AI) in optimizing antenna array-enabled power beaming for localization, tracking, and beam steering, which is critical for effective SSP-based MAR. We also discuss the challenges and regulatory considerations surrounding wireless power transmission, emphasizing the need for frequency spectrum allocation and system safety.

Short Courses SC2: Space Hardware Design: From the Idea to a Successful Demonstration in Space (Grand Ballroom 5)

Organizer: Jan Budroweit, German Aerospace Center (DLR)

This half-day workshop presents practical guidelines and experiences on hardware and system design for space applications. A specific focus is made on the (reliable) usage of commercial of the shelf (COTS) components which are essential for low to mid budget space missions and which currently drives the NewSpace era. We will address the general environmental conditions and constraints for space missions, incl. radiation effects and what system designers and test engineers needs to consider for a reliable and affordable operation in harsh environment. Furthermore, we will explore existing system-level qualification standards and how to tailor these for a cost-efficient verification process. The shown approaches will be presented based on the development of a software-defined radio (SDR) that uses latest COTS technologies and enables new opportunities for radio-based space applications.

Topics

- Space Environment
- Radiation Effects in Electronic Components and Systems
- Standards for Space Qualification and Testing
- Use of Commercial of the shelf (COTS) Components
- Hardware Design for Reliable Space Systems based on a Software-Defined Radio
- Tailoring of Qualification Standards
- Best Practices for Space Environmental Testing
- Lesson Learned and Guidelines

Workshops

Workshop WS1: Space Solar Power

(Grand Ballroom 5)

This workshop explores the many emerging technologies for collecting solar power in space and beaming it to earth or elsewhere to do meaningful work. Encompassing breakthroughs in photovoltaics, spacecraft subsystems, wireless power transfer, and energy conversion, the space solar power workshop offers a unique, multi-disciplinary survey of the technologies that will enable this future energy source.

Organizers: Reza Zekavat, Worcester Polytechnic Institute
Gregory Durgin, Georgia Institute of Technology

08:00 **WS1-1 PaddleSats and the Future of Space Solar Power**

Gregory Durgin

Georgia Institute of Technology

08:20 **WS1-2 PaddleSAR: Design of a Synthetic Aperture Radar on a PaddleSat**

Celi Johnson, Christopher Saetia, Gregory Durgin

Georgia Institute of Technology

08:40 **WS1-3 Design of Solar Charge Controller and Power Converter With the Multisim**

Sohal Latif

Transtech Electronic Sloutions

09:00 **WS1-4 A Nearly Metal-Only Origami Reconfigurable Phased Array Antenna for Space-Based Solar Power Transmission Using PaddleSats**

Xiaohong Zhang, Yue Lu, Alexander Mills, Gregory Durgin

Georgia Institute of Technology

09:20 Opening Session & Coffee Break

10:30 **WS1-5 Novel Solar Power Satellite of the Gravity-Gradient Attitude Stabilization and Comparison With the Formerly-Proposed Models**

Tadashi Takano^{1,2}, Yasuyuki Miyazaki², Osamu Mori²

¹ Nihon University

² Japan Aerospace Exploration Agency (JAXA)

- 10:50 **WS1-6 Why We Must Build a Moon-Base - Its Roadmap & Commercial Basis**
Darrell W Preble
Space Solar Power Institute
- 11:10 **WS1-7 Rectenna Characterized Under Varying 2D Transmitter Positions and Power Beaming Amplitude Levels at 5.8 GHz**
Hannah Xiao, Viktor Raykov, Emma McClellion, Kaitlyn Graves, Gregory Durgin
Georgia Institute of Technology
- 11:30 **WS1-8 Opterus Structures Technologies for Space Solar Power**
Kiel Davis
Opertus

Workshop WS2: Photonics for Harsh Environments (Grand Ballroom 1–2)

Organizers: Midya Parto, University of Central Florida

14:50 **WS2-1 Towards Fully Stabilized Chip-Scale Optical Frequency Comb Sources**

Peter J. Delfyett

University of Central Florida, USA

15:10 **WS2-2 Data Management and Data Products of a Daily Optical Communications Ground Station for Laser Communications Relay Demonstration**

Christine P. Chen, Sabino Piazzolla, Tom Roberts, William Buehlman, Thang Trinh, Danny Luong, Michael Cheng, Arvid Croonquist, Vachik Garkanian, Emilio Vazquez, Joe Kovalik

Jet Propulsion Laboratory, California Institute of Technology

15:30 **WS2-3 Turbulence-Resistant Free-Space Optical Communication Using Space-Division Multiplexing and Photonic Integration**

Guifang Li

University of Central Florida

15:50 **WS2-4 Characteristics of Modulated-Wavefront Beams for Active Sensing through Strong Scattering Obscurants**

Kang-Min Lee, Cristian Hernando Acevedo, Aristide Dogariu

University of Central Florida

16:10 **WS2.5 Frequency Synthesis Across the Electromagnetic Spectrum with Optical Frequency Combs**

Scott A. Diddams

University of Colorado Boulder

Workshop WS3: Additive Manufacturing of Passive RF-Components for Space Applications (Grand Ballroom 5)

Additive manufacturing technology not only brings great geometric freedom, which leads to compact and therefore lighter components, but also to a greater variety of materials, which also helps to save weight while being equipped for harsh operating conditions. This workshop brings together scientists, developers and potential industrial users in the specialized field of additive manufactured high-frequency components to share experiences and knowledge about the current state of research and to discuss the potential for future applications in space. The focus is on highly integrated, printed front ends, such as feeding networks and array antennas.

Organizers: Gerald Gold, Friedrich-Alexander-Universität Erlangen-Nürnberg
Holger Maune, Otto-von-Guericke University Magdeburg

- 08:00 **WS3-1 Slotted Waveguides: From Lab Into Space**
Konstantin Lomakin
Friedrich-Alexander-Universität Erlangen-Nürnberg
- 08:20 **WS3-2 Reconfigurable RF-Frontend Technologies for SatCom**
Holger Maune
Otto-von-Guericke Universität Magdeburg
- 08:40 **WS3-3 3D Printed Phase Shifters Based on Liquid Crystals for Inter-Satellite Links**
Simon Pietschmann
Friedrich-Alexander-Universität Erlangen-Nürnberg
- 09:00 **WS3-4 Investment Casting of mmWave Antennas for Harsh Environments**
David Panusch
Friedrich-Alexander-Universität Erlangen-Nürnberg

Workshop WS4: IEEE LEO Satellites and Systems (Grand Ballroom 5)

The "IEEE LEO Satellites and Systems" special session at WiSEE 2024 highlights the latest innovations and research in low Earth orbit (LEO) satellite technologies, underscoring their pivotal role in advancing global communication, navigation, and space system optimization. The session covers a wide range of studies that address both challenges and solutions across multiple LEO satellite applications.

The session provides a comprehensive overview of cutting-edge research driving the evolution of LEO satellite systems, highlighting their growing significance in global connectivity, navigation resilience, and network stability.

Organizers: Markus Gardill, Brandenburg University of Technology
Zak Kassas, Ohio State University

| | |
|-------|--|
| 10:30 | WS4-0 Welcome & IEEE LEO SatS Overview Markus Gardill ¹ , Zak Kassas ² ¹ Brandenburg University of Technology ² Ohio State University |
| 10:40 | WS4-1 Small-Satellite-Mounted Ka-Band Phased-Array Transceivers for LEO Constellation Atsushi Shirane Tokyo Institute of Technology |
| 11:00 | WS4-2 Reflectarray Antennas: An Effective Solution for Small Satellites in the Newspace Economy Michele Del Mastro, Nelson Fonseca, Gautier Mazingue, Maxime Romier, Nicolas Capet Anywaves |
| 11:20 | WS4-3 Sensing for Space Safety and Sustainability: A Deep Learning Approach With Vision Transformers Wenxuan Zhang ¹ , Peng Hu ² ¹ University of Waterloo ² University of Manitoba |
| 11:40 | WS4-4 Evaluation of Starlink LEO Satellite Signals for High-Altitude Platform Station Opportunistic Navigation Will Barrett, Jennifer Sanderson, Sharbel Kozhaya, Joe Saroufim, and Zaher M. Kassas Ohio State University |
| 12:00 | Lunch Break |

- 13:30 **WS4-5 Semper Supra: The Impact of the Space Domain on North American Arctic Communities**
David E. Marsh
Voyager Space
- 13:50 **WS4-6 An Analysis of the Short-Term Time Stability of the Starlink Ku-Band Downlink Frame Clock**
Wenkai Qin, Zacharias Komodromos, Andrew Graff, Zach Clements, Todd E Humphreys
University of Texas at Austin
- 14:10 **WS4-7 Opportunistic Positioning With Starlink and OneWeb LEO Ku-Band Signals**
Sharbel Kozhaya, Joe Saroufim, Zaher M. Kassas
Ohio State University
- 14:30 **WS4-8 Resilient Navigation in GNSS-Denied Conditions Using Novel LEO-Based Fusion Positioning**
Mahmoud Elsanhoury¹, Janne Koljonen¹, Fabricio S. Prol², Mohammed Salem Elmusrati¹, Heidi Kuusniemi¹
¹ University of Vaasa
² Finnish Geospatial Research Institute
-
- 14:50 Coffee Break
-
- 15:10 **WS4-9 Advances in LEO PNT With Noncooperative Satellites**
Zak (Zaher) Kassas
Ohio State University
- 15:30 **WS4-10 LEO-PNT Payload Architecture and Satellite Design Analysis**
Mayank Mayank¹, Fabricio S. Prol², Ville Lunden¹, Elena Simona Lohan^{3,4}, Zainab Saleem¹, Shikha Sharma¹, Mohammad Zahidul Hasan Bhuiyan², Sanna Kaasalainen², Heidi Kuusniemi⁵, Jaan Praks¹
¹ Aalto University
² Finnish Geospatial Research Institute
³ Tampere University
⁴ Universitat Autònoma de Barcelona
⁵ University of Vaasa
- 15:50 **WS4-11 Correlation-Based Doppler Shift Estimation for Opportunistic LEO-PNT With Starlink Signals**
Winfried Stock, Christian A Hofmann, Andreas Knopp
University of the Bundeswehr Munich

16:10

WS4-12 Robust Lyapunov Optimization for Multihop Communication in LEO Satellite Networks

Zhemin Huang¹, Zhong-Ping Jiang², Zhu Han³, Yong Liu¹

¹ New York University

² Tandon School of Engineering

³ University of Houston

Workshop WS5: Advanced Cellular Communication for Space

(Grand Ballroom 2)

This workshop presents a distinguished group of wireless leaders from academia and industry, who will explain the 5G capabilities of supporting secure and reliable communications in space. To provide 5G coverage and connectivity in space, 3GPP Release 17 introduced 5G support of Non-Terrestrial Networks (NTN) with satellite base stations located in space, as opposed to the base stations located on the ground. This significant extension of 5G radio coverage into space will transform 5G operations with new use cases including continuation of 5G coverage in flight, service to remote areas, and enhancing coverage worldwide. This workshop will summarize these advances as well as the associated challenges such as increased time delays.

Organizer: Arupjyoti (Arup) Bhuyan, Idaho National Laboratory

- 10:30 **WS5-1 5G Support of Non-Terrestrial Networks (NTN) with Satellite Base Stations Located in Space**
Sheryl M Genco
Ericsson
- 11:00 **WS5-2 AERPAW and Its Digital Twin for Supporting Autonomous NTN Research**
Ismail Güvenç
North Carolina State University
- 11:30 **WS5-3 Performance Analysis of Orthogonal-Time-Frequency-Space Modulation Scheme in Space Communications**
Kamesh Namuduri¹, Atif Iqbal¹, Amjad Soomro², Sumit Chakravarty³
¹ University of North Texas
² U.S. Department of Defense - Chief Information Officer
³ Kennesaw State University

Special Events

Aerospace Night

The Aerospace Night, sponsored by Embry-Riddle Aeronautical University (ERAU), will take place on Monday, 16th December 2024. This exciting event features guided tours of ERAU's state-of-the-art engineering laboratories on the Daytona Beach campus, followed by a reception with stunning views of ERAU's airplane fleet and the Daytona Beach International Airport. The bus to ERAU will depart at 16:45 at the North Tower Entrance of the hotel. We plan to go back to the conference place at 22:00. As space is limited, please pre-register with the QR code.



Gala Dinner and Bonfire

Join us for the conference banquet, Tuesday, December 17th in the Oceanview Room & Terrace at 17:30, followed by an unforgettable evening on the beach. Gather around bonfires to enjoy camaraderie and prepare the classic treat, s'mores.

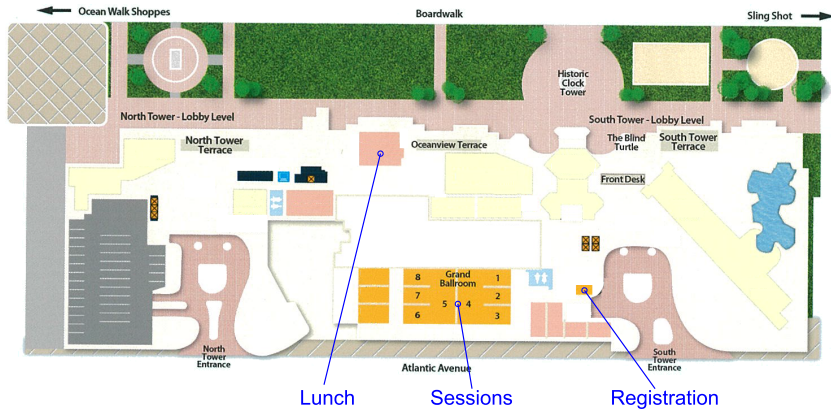
Women in Engineering (WiE) Lunch Reception

The Women in Engineering (WiE) Lunch Reception on Wednesday 18th December 2024, starting at noon, is an excellent opportunity to connect with fellow attendees. Pre-registration is required for this event.



Venue

WiSEE'24 will be held in the Hilton Daytona Beach Oceanfront Resort. Situated at the heart of Ocean Walk Village, we are at the epicenter of Daytona Beach activities, including shopping, dining, family fun and nightlife.



Registration is located in the South Tower at Lobby Level

Sessions are taking place in Grand Ballroom 2 to 5

Lunch is served in the Oceanview room

Coffee breaks are located in Grand Ballroom Foyer area as well as Salon 3 & 6.

| Monday 16.12.2024 | | Tuesday 17.12.2024 | | Wednesday 18.12.2024 | |
|-------------------|---|--------------------|--|----------------------|---|
| 07:00 | Registration opens at 7am | 07:00 | Registration opens at 7 am | 07:00 | Registration opens at 7 am |
| 07:20 | | 07:20 | | 07:20 | |
| 07:40 | ☕ Breakfast* | 07:40 | ☕ Breakfast* | 07:40 | ☕ Breakfast* |
| 08:00 | | 08:00 | | 08:00 | |
| 08:20 | Session M1 Antennas and RF Systems I 08:20—09:20 | 08:20 | Session T1 Optical Communications 08:00—09:20 | 08:20 | Session W1 Tests and Experiments for Environments 08:00—09:20 |
| 08:40 | Workshop WS1 Space Solar Power 08:00—11:50 | 08:40 | Workshop WS3 Additive Manufacturing 09:00—09:20 | 08:40 | Short Course SC2 Space Hardware Design 08:30—11:50 |
| 09:00 | Session M2 Opening Session 09:20—10:10 | 09:20 | Session T2 Plenary Session 09:20—10:10 | 09:20 | Session W2 Closing Session 09:20—11:10 |
| 09:40 | | 09:40 | ☕ Coffee Break* | 09:40 | ☕ Coffee Break* |
| 10:00 | ☕ Coffee Break* | 10:00 | | 10:00 | |
| 10:20 | | 10:20 | | 10:20 | |
| 10:40 | Session M2 Antennas and RF Systems II 10:30—11:50 | 10:40 | Session T3 Networks and Communication Systems I 10:30—11:50 | 10:40 | Session W3 Remote Sensing Systems 10:30—11:50 |
| 11:00 | Workshop WS1 Space Solar Power 08:00—11:50 | 11:00 | Workshop WS4 LEO SAs 10:30—16:30 | 11:00 | Workshop WS5 Advanced Cellular Communication for Space 10:30—12:00 |
| 11:20 | | 11:20 | | 11:20 | |
| 11:40 | | 11:40 | | 11:40 | |
| 12:00 | | 12:00 | | 12:00 | |
| 12:20 | ☕ Lunch Break** | 12:20 | ☕ Lunch Break** | 12:20 | ☕ Lunch Break** |
| 12:40 | | 12:40 | | 12:40 | |
| 13:00 | | 13:00 | | 13:00 | |
| 13:20 | | 13:20 | | 13:20 | |
| 13:40 | | 13:40 | | 13:40 | |
| 14:00 | Session M4 Plenary Session 13:30—14:50 | 14:00 | Session T4 Networks and Communication Systems II 13:30—14:50 | 14:00 | |
| 14:20 | | 14:20 | | 14:20 | |
| 14:40 | ☕ Coffee Break* | 14:40 | ☕ Coffee Break* | 14:40 | |
| 15:00 | | 15:00 | | 15:00 | |
| 15:20 | Session M5 Channel Modelling 15:10—16:30 | 15:20 | Session T5 Networks and Communication Systems III 15:10—16:30 | 15:20 | |
| 15:40 | Short Course SC1 Space Solar Power 15:10—16:30 | 15:40 | Workshop WS4 LEO SAs 10:30—16:30 | 15:40 | |
| 16:00 | | 16:00 | | 16:00 | |
| 16:20 | | 16:20 | | 16:20 | |
| 16:40 | | 16:40 | | 16:40 | |
| 17:00 | | 17:00 | | 17:00 | |
| 17:20 | | 17:20 | | 17:20 | |
| 17:40 | ERAI Aerospace Night 17:00—22:00 | 17:40 | Gala Dinner and Bonfire 17:00—21:00 | 17:40 | |
| 18:00 | | 18:00 | | 18:00 | |
| 18:20 | | 18:20 | | 18:20 | |
| 18:40 | Bus departure 16:45 at North Entrance of the Hotel | 18:40 | | 18:40 | |
| 19:00 | | 19:00 | | 19:00 | |
| 19:20 | | 19:20 | | 19:20 | |
| 19:40 | | 19:40 | | 19:40 | |
| 20:00 | | 20:00 | | 20:00 | |
| 20:20 | | 20:20 | | 20:20 | |
| 20:40 | | 20:40 | | 20:40 | |
| 21:00 | | 21:00 | | 21:00 | |
| 21:20 | | 21:20 | | 21:20 | |
| 21:40 | | 21:40 | | 21:40 | |
| 22:00 | | 22:00 | | 22:00 | |

* Breakfast and coffee breaks are located in the Grand
Atrium
** Lunch breaks are located in Oceanview Room &
Terrace