47th Annual Meeting and Symposium of the
Antenna Measurement Techniques Association

AMTA 2025

November 2 - 7, 2025
Tucson, Arizona

Final Program

Hosted by

Raytheon
An RTX Business

Welcome

Welcome to the 47th Annual Symposium of the Antenna Measurement Techniques Association! Our host committee has prepared an outstanding Tucson area event. We continue the AMTA tradition of featuring a strong technical program and exhibition, as well as an exciting social program.

The technical program kicks off with both an AMTA Boot Camp and Short Course. Boot Camp is a 1-day course on antenna and related measurement fundamentals taught by a group of six industry and academic professionals. The short course is an intensive 1-day focus on modern near-field antenna measurements taught by industry experts. The technical sessions will be launched by keynote speaker Dr. Raymod Rumpf, Professor Electrical & Computer Engineering, University of Texas at El Paso. Dr. Rumpf will discuss disruptive technologies in electromagnetics and additive manufacturing. Our IEEE Invited Speaker, Dr. Christophe Fumeaux of The University of Queensland, will discuss beamforming with compact multi-port, multi-mode antennas. Our EurAAP Invited Speaker, Dr. Elena Saenz of the European Space Agency, will provide an overview of the latest antenna measurement developments and techniques at the European Space Agency. Mr. Chuck Penson, a Fellow of the Antique Wireless Association, presents our Thursday Lunch and Learn. This compelling presentation steps back to Cold War history to review the communication systems associated with the Titan II ICBM program. In between sessions, make sure you spend time in the Exhibits Hall meeting colleagues from over 30 industry companies. We close our week with a technical tour of the Pima Air and Space Museum, including a drive-by view of the largest aircraft boneyard in the world.

We have a full social calendar for you! Enjoy cocktails and mingle with friends and colleagues at the Welcome Reception Sunday evening. Relax and take in the views during our Monday Night Outing, a show and dinner at Old Tucson, an old west film set and entertainment park. Companion tours offer the chance to tour downtown Tucson, visit the Sonoran Desert Museum, and participate in a Tucson food tour.

Our venue is The Westin La Paloma Resort & Spa in the foothills of the Santa Catalina Mountains. The AAA Four-Diamond property offers 27-holes of Jack Nicklaus Signature Design golf, a full fitness center, a world-class spa, 5 swimming pools, and multiple on-site restaurants and bars.

On behalf of the AMTA 2025 Host Committee and Raytheon, we look forward to seeing you in the city known as The Old Pueblo in November.

Justin Dobbins,
Raytheon,
An RTX Business

Who is Exhibiting?

The following companies will be exhibiting this year:

- Advanced Test Equipment Corp (ATEC)
- Altair
- AMTA 2026
- Anechoic Solutions, Inc.
- Anritsu
- AP Americas
- Braden Shielding Systems
- Chamber Services, Inc.
- Delta Sigma Company (DSC)
- ETS-Lindgren
- Hiller Fire Protection
- Impulse Technologies, Inc.
- Junkosha
- Keysight
- Kraetonics
- MVG, the Microwave Vision Group
- Next Phase Measurements (NPM)
- NSI-MI Technologies
- Ophir RF
- PPG Cuming-Lehman Chambers
- Quantic PMI
- Raymond EMC
- Raytheon
- Resonant Sciences
- Rohde & Schwarz USA
- Samtec, Inc.
- Sensor Concepts, a Raptor Scientific Company
- SPEAG -Schmid & Partner Engineering AG
- Sprinkler Innovations
- STAR Dynamics
- TDK RF Solutions
- TEVET
- Virginia Diodes, Inc. (VDI)

Future Symposia

2026	Austin, TX	Hosted by ETS-Lindgren
2027	San Francisco, CA	Hosted by Quarterwave
2028	Savannah, GA	Hosted by NSI-MI Technologies
2029	Detroit, MI	Hosted by Oakland University
2030	Dallas, TX	Hosted by Rohde & Schwarz

Symposium Benefits

- High-quality technical papers presented on a continuous basis over four days
- A short course and boot camp led by world-class experts in antenna measurements
- Exhibits showcasing antenna and measurement related products and services
- The latest innovations in antenna and RCS measurements
- Known leading companies related to antenna measurements products and services
- Networking opportunities with industry experts
- A lunch and learn and technical tour showcasing historical programs that benefitted from industry techniques
- Unique social events in and around the Tucson, Arizona area
- Daytime guest tours to area highlights

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AMTA 2025 Host: Justin Dobbins, Raytheon, An RTX Business

AMTA 2025 Host Committee

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Best Paper Committee

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Alexander Knisely, University of Dayton Research Institute
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Teh-Hong Lee, The Ohio State University
Edward Urbanik, Applied Research Associates, Retired

Social Calendar

Sunday, November 2

Welcome Reception

6 - 7:30 p.m.

Sponsored by NSI-MI Technologies

Cost: Complimentary with Registration

Enjoy drinks and appetizers with friends and colleagues in the Arizona Foyer, while enjoying a dusk* view of the resort and the Santa Catalina Mountains from the adjacent Arizona Deck. This event is complementary to all registered symposium participants and their guests.
*Sunset is at 5:30 pm

Monday, November 3

Old Tucson 5:45 - 9:30 p.m.

Sponsored by Microwave Vison Group (MVG) and Next Phase Measurements (NPM)

Cost: $110

Built in 1939, Old Tucson is a renowned film set and family theme park located just outside Tucson, AZ. Nestled between Saguaro National Park and Tucson Mountain Park, this beautiful desert setting has been the filming location for hundreds of classic western films and TV shows. Join us for a wild west experience followed by a catered cowboy dinner. Buses will depart the hotel at 5:45 p.m.

Tuesday, November 4

Student Day 11 a.m. - 7 p.m.

Dinner Sponsored by STAR Dynamics

Team Prize Sponsored by IEEE AP-S TCAM

Location: Lantana Meeting Room

Cost: Complimentary

Student Day will provide an opportunity for local university students to get a taste of antenna engineering and related disciplines by interacting with practicing engineers in a variety of venues. As in previous years, students will be able to tour vendor exhibits, sit in on papers, and enjoy a complimentary meal while listening to a presentation targeting issues relevant to those soon entering the engineering profession. In addition, AMTA will host a hands-on Student Day Design Contest. This will give students an opportunity to show off their engineering skills to recruiters (students should bring their resumes!) and have fun at the same time. Details are forthcoming, so keep checking the AMTA 2025 website for the latest updates. Please register in advance on the AMTA 2025 website.

Tuesday, November 4

Young Professionals Reception 6 - 8 p.m.

(New for AMTA 2025!)

Sponsored by ETS-Lindgren

Cost: $24 per person,
Verbena Meeting Room

AMTA would like to invite all Young Professionals (BS within 15 years) and Undergraduates to our inaugural Networking Event at the AMTA 2025 Symposium! During the 2025 Symposium we will hold "AMTA Jeopardy!" – Trivia, with a Twist! This event is great at building your expertise in antenna measurement techniques as well as providing a welcoming, informal environment to network with Young Professional (YP) colleagues and experienced professionals alike. You'll have the opportunity to play alongside AMTA Experts and prizes will be awarded to the winners! Come mingle with your fellow YPs and the AMTA gurus, who will share their experiences and insights from volunteering within the AMTA community. We'll also be highlighting the student papers on the AMTA technical program! Heavy appetizers with beer and wine service included.

Wednesday, November 5

Banquet Reception 6:30 - 7:30 p.m., Arizona Deck

Banquet Dinner & Awards

7:30 - 9:30 p.m., Sonoran Ballroom

Banquet Wine Sponsored by the Microwave Vison Group (MVG).

Cost: Included in full registration; $90 per additional ticket.

We will start the Awards Banquet with a Reception on the Arizona Deck and Arizona Foyer at 6:30, then at 7:30 move into the Sonoran Ballroom for the Dinner and Awards. The Banquet is included with full registration; additional tickets can be purchased at a cost of $90.

Thursday, November 6

Women in Engineering Reception 6 - 8 p.m.

Sponsored by ETS-Lindgren

Cost: $25 per person, Verbena Meeting Room

This event welcomes all members of AMTA and IEEE, men and women, to promote collaboration. Join speakers Janet O'Neil with ETS-Lindgren, Colonel Carey "Mamba" Jones, US Air Force Retired, and Roger Richardson with Delta Sigma Company for enlightening presentations on innovation, leadership, and teamwork, then enjoy the networking opportunities during the reception! See the website for more information. Heavy appetizers with wine tasting and beer included.

Friday, November 7

Technical Tour – Pima Air & Space Museum

8 a.m. - 1:30 p.m.

Cost: $85 per person

The Pima Air & Space Museum is one of the largest non-government funded aviation & space museums in the world! It features about 400 historic aircraft, from a Wright Flyer to a 787 Dreamliner. Choose from a guided walking tour, a narrated driving tour, or a self-guided tour. Lunch is included.

Companion Tours*

Tucson Food Tour

Monday, November 3
10:30 a.m. – 3:30 p.m.

There's a reason Tucson is a star on the culinary map—not just in Arizona, but around the world. In 2015, UNESCO designated Tucson as the first Creative City of Gastronomy in the United States, celebrating an unparalleled agricultural tradition, a rich tapestry of cultures, and some of the most inspiring food experiences available anywhere. Here in Tucson, food isn't just about what's on your plate—it's about deep roots and bold flavors. Remember to bring your walking shoes, water bottle, and sunscreen.

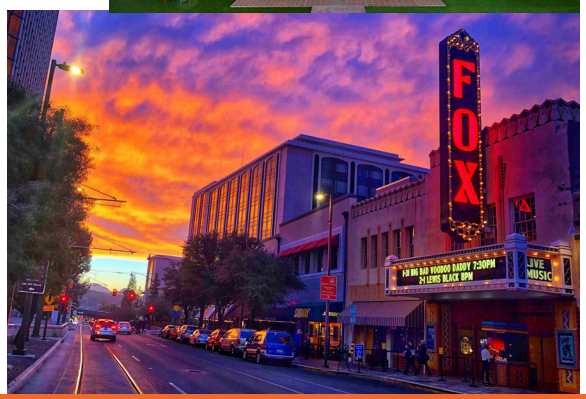
Arizona-Sonora Desert Museum

Tuesday, November 4
9 a.m. – 3 p.m.

The 98-acre Desert Museum is a fusion experience: zoo, botanical garden, art gallery, natural history museum, and aquarium with 2 miles of walking paths through the Sonoran Desert. You will need to bring your walking shoes, water bottle, hat, and sunscreen. Lunch at one of the restaurants on site is included.

Tour of Historic Downtown Tucson

Wednesday, November 5
8:30 a.m. – 1 p.m.



We will start at the Pima County Historic Courthouse which is among Tucson's most beloved landmarks. Designed by architect Roy Place, this iconic Spanish Colonial Revival-styled structure was built in 1929 and remained in service for an 86-year span during which time it served as the backdrop for numerous wedding proceedings and became home to several County departments.

In 1978, this building obtained its "Historic" designation from the National Register of Historic Places. It was dubbed the "most outstanding Spanish Colonial Revival building in Arizona" with its "elegant blue-tiled dome" recorded as the most prominent feature. Lunch is on your own at El Charro, the Nation's Oldest Mexican Restaurant in continuous operation by the same family. Remember to bring your walking shoes, water bottle, and sunscreen.

* Attendance is limited at all Companion Tours; tours will be filled on a first come, first served basis. Comfortable walking shoes are recommended for all tours. Please bring money for lunch on Monday and any incidentals throughout the week.

Boot Camp

Sunday, November 2

8 a.m. - 5:20 p.m.

The AMTA Boot Camp is a 1-day course on antenna and related measurement fundamentals. Live hands-on demonstrations complement the material presented. The Boot Camp is an ideal training opportunity for those new to the antenna and related measurements community and for those who would appreciate an update or "refresher" course on these topics. Instructors are academic and industry experts who were selected based not only on their expertise, but for their ability to communicate effectively.

The AMTA Boot Camp Back-to-Basics Topics Include:

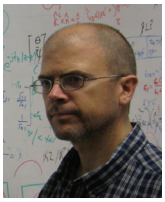
- General RF Measurements
- Material Measurements
- Antenna Measurements
- RCS Measurements
- EMC/EMI Measurements
- New Innovations and Trends

Technical Goals and Objectives of the AMTA Boot Camp Include:

- Gain basic understanding of the AMTA-relevant measurement systems and associated equipment
- Obtain basic understanding of the theory and physical principles of each measurement system
- Acquire technical vocabulary for each measurement system
- Gain appreciation for similarities and differences of each measurement system
- Establish appreciation for the challenges/applications that are driving the need for each measurement system
- Identify common themes in each measurement system (calibration, standards, best practices, uncertainties, etc.)

Mr. Bruce Williams
NSI-MI Technologies

Mr. Zhong Chen
ETS-Lindgren



Dr. Michael Havrilla
Air Force Institute of Technology

Mr. Stephen Blalock
NSI-MI Technologies

Dr. John Schultz
Compass Technology Group

Mr. Dennis Lewis
The Boeing Company

Ms. Kim Hassett
Next Phase Measurements

Time	Subject	Speaker(s)
7:15 – 8:00	Registration & Breakfast	
8:00 – 8:05	Introduction	Dr. Lydell Frasch, Dr. Daniel Aloi
8:05 – 9:05	General RF Measurements	Mr. Bruce Williams
9:05 – 10:05	Material Measurements	Dr. Michael Havrilla
10:05 – 10:20	Material Measurements Demo	Dr. John Schultz
10:20 – 10:35	Break	
10:35 – 11:35	Antenna Measurements	Ms. Kim Hassett
11:35 – 11:55	Antenna Measurements Demo	Ms. Kim Hassett
11:55 – 12:55	Lunch	
12:55 – 13:55	EMI/EMC Measurements	Mr. Zhong Chen
13:55 – 14:15	EMI/EMC Demonstration	Mr. Zhong Chen
14:15 – 14:25	Break	
14:25 – 15:25	RCS Measurements	Mr. Stephen Blalock
15:25 – 15:45	RCS Measurements Demo	Mr. Stephen Blalock
15:45 – 15:55	Break	
15:55 – 17:10	New Innovations & Trends	Mr. Dennis Lewis
17:10 – 17:20	Conclusions	Dr. Lydell Frasch

Short Course

Sunday, November 2

8 a.m. - 5:15 p.m.

A Practical Intuitive Approach to Modern Near-Field Antenna Measurements

One-Day Summary of a Career of Study into Near-Field Metrology

This one-day short course provides a grounded, measurement orientated, introduction to classical near-field theory. The planar, cylindrical and spherical transformations are developed from a practical, intuitive, measurement-oriented point of view that provides the attendee with the necessary foundations and understanding that are then harnessed to develop several important modern measurement techniques. These techniques place an emphasis on key developments in the last 15 years including near-field imaging, reflection suppression, and the use of sparse sampling and compressive sensing in antenna measurements that highlight the use of modern industrial, multi-axis, robotic antenna measurement systems. The course includes extensive data and numerous practical examples of real-world applications.

Instructors

Dr. Stuart Gregson
Next Phase Measurements & Queen Mary University of London

Mr. Dennis Lewis
The Boeing Company

Time	Subject	Duration	Speaker
7:15 – 8:00	Registration and Breakfast	45 mins	
8:00 – 8:05	Introduction	5 mins	Stuart Gregson
8:05 – 9:00	Background and Fundamentals	55 mins	Stuart Gregson
9:00 – 10:15	Planar Near-Field Theory (measurement view)	75 mins	Stuart Gregson
10:15 – 10:30	Break	15 mins	
10:30 – 11:45	Cylindrical Near-Field Theory (measurement view)	75 mins	Stuart Gregson
11:45 – 12:45	Lunch	60 mins	
12:45 – 13:30	Case Study – Boeing (Example Applications)	45 mins	Dennis Lewis
13:30 – 14:30	Spherical Near-Field Theory (measurement view)	60 mins	Stuart Gregson
14:30 – 14:45	Break	15 mins	
14:45 – 15:45	Advanced Antenna Measurements & Scattering Suppression	60 min	Stuart Gregson
15:45 – 16:00	Break	15 mins	
16:00 – 17:00	New Innovations & Future Trends (Inc. Compressive Sensing)	60 min	Stuart Gregson
17:00 – 17:15	Discussion, Q&A, Close	15 mins	Interactive

Keynote Speaker

Dr. Raymond C. Rumpf

FSPIE, SMIEEE

Monday, November 3

8:15 - 8:55 a.m.

Pursuing Disruptive Technologies in Electromagnetics & Additive Manufacturing

Pursuing high-risk/high-reward technologies is motivating and exciting, but it is plagued with frustrations in the lab, embarrassing failures of “crazy” ideas, and challenges obtaining funding for high-risk ideas. This presentation will cover some of my pursuits of highly ambitious technologies, and the experiences and lessons they gave me. The purpose of the presentation is not to encourage or discourage the most ambitious research, but to motivate all types of research and to help people get through the struggles using humor, humility, and tenacity.

Topics will include my team’s exploration of antenna technologies including ultra-thin all-dielectric antennas, 3D printed volumetric antennas, and antennas approaching and exceeding fundamental limits. It will include my team’s contributions to additive manufacturing in the pursuit of 3D volumetric circuits and electromagnetic devices. It will cover preservational spatially-variant lattices (PSVLs) and the numerous breakthroughs this new concept has enabled. A PSVL is a periodic structure (array antenna, frequency selective surface, metamaterial, photonic crystal, etc.) that is bent, twisted, conformed, or otherwise adjusted as a function of position in a special way that preserves the electromagnetic properties by minimizing deformations to the unit cells. The presentation will include my beginnings in electromagnetics, as well as the various skills and practices I have observed that help advance people’s careers and contribute to their success.

Dr. Raymond C. Rumpf is a pioneer in electromagnetics, photonics and additive manufacturing. He founded the EMLab at the University of Texas at El Paso to focus exclusively on developing disruptive technologies in these areas. He co-founded Kraetonics LLC to commercialize the breakthrough technologies and develop the tools to put these new capabilities in the hands of others. Key achievements include a 3D printed antenna operating closer to the fundamental limit than any other known 3D printed antenna, developing the first-ever layout and routing tool for 3D volumetric circuits, automating hybrid 3D printing to build 3D parts with any distribution of conductors and dielectrics, constructing the world’s highest power frequency selective surface (> 2.0 GW), inventing a new mechanism to control light that led to world’s tightest bend of an unguided optical beam and Best Photonics Technology 2015, and more. Rumpf is currently working on many other exciting topics in the areas of antennas, frequency selective surfaces, hybrid 3D printing, 3D volumetric circuits, new CAD tool capabilities, metamaterials, metasurfaces, photonic crystals, and computational electromagnetics.

Dr. Rumpf is a Professor of Electrical and Computer Engineering at The University of Texas at El Paso (UTEP) and has a joint appointment in the Computational Science program. He is a Founder and Chief Technology Officer of Kraetonics LLC. Prior to these positions, Rumpf was the Chief Technology Officer for Prime Photonics and a senior electrical engineer for Harris Corporation (now L3Harris). Raymond earned his BS and MS in Electrical Engineering from the Florida Institute of Technology in 1995 and 1997 respectively. He earned his Ph.D. in Optics in 2006 from CREOL at the University of Central Florida. In 2010, Raymond was awarded the prestigious DARPA Young Faculty Award that seeded multiple breakthroughs. In 2015, Raymond was awarded the highly esteemed University of Texas Regents’ Outstanding Teaching Award, the top teaching award offered by the largest university system in the United States. In 2020, he was inducted into the Florida Tech Career Hall of Fame. Rumpf has been awarded over a dozen United States patents and has authored dozens of peer-reviewed journal articles. He published a Best-Selling book through Artech House that teaches the art of computational electromagnetics to the complete beginner through the finite-difference frequency-domain method. He is a Fellow of SPIE, Senior Member of IEEE, and a member of the Optical Society (Optica). He is a member of ARRL and an Extra Class amateur radio operator (call sign is AG4YV). He holds five world records in skydiving for largest parachute formation. Raymond is active in outreach and philanthropy, including coaching of numerous students in third-world countries and throughout the world.

Featured Speaker
IEEE AP-S

Dr. Christophe Fumeaux

University of Queensland

Tuesday, November 4

8 - 8:25 a.m.

Beamforming with Compact Multi-Port Multi-Mode Antennas

The growing requirements of wireless communications technologies place unique challenges on antenna design. Antenna systems with increasing complexity and multiple dynamically accessible functionalities are required to enhance capacity and/or serve various purposes, such as simultaneous communications and sensing.

This presentation will focus on the concept of multi-port multi-mode antennas, where several independent radiating modes operating in the same frequency band are generated in a shared aperture (or a shared volume). Such uncorrelated modes packed in a compact form factor can be exploited to enhance the agility and capacity of a communications link, either through pattern diversity or Multiple-Input Multiple-Output operation (MIMO).

In this context, this presentation will describe various techniques for packing multiple independent modes in a limited volume. It will then demonstrate how a large number of collocated radiating modes can enable beam-steering and nulling in a full hemisphere, with high consistency and in any polarization. The presented concept opens new perspectives for future distributed sensing and communications systems.

Featured Speaker
EurAAP

Dr. Elena Saenz

European Space Research and Technology Centre (ESTEC) European Space Agency (ESA)

Wednesday, November 5

8 - 8:25 a.m.

Overview of the latest antenna measurement developments and techniques at the European Space Agency

The ESA/ESTEC Antenna Laboratory is committed to the mission of developing new state-of-art RF testing facilities in collaboration with European companies aiming at supporting the growth of the European industry in this domain. Subsequent ESA missions will benefit from these R&D activities, allowing a better definition and validation of their requirements.

During recent years, the ESA/ESTEC Antenna Laboratory has been working on several projects: The Low-temperature Near-field Terahertz chamber (LORENTZ), which supports planar nearfield measurements from 50 GHz up to 1.5 THz at cryogenic temperatures. In addition, a submmVAST (Validation Standard) antenna has been developed which is stable and robust at cryogenic temperatures.

Deployable antennas of several meters (between 10 and 20 meters) are currently under development and measurement, as well as high-accuracy L-band antennas for navigation. Several other R&D activities are planned to start very soon or have shortly started.

This presentation gives an overview of these activities and explains how they effectively support future space missions. It concludes with a discussion of recent trends, challenges in antenna and RF material characterization measurement for space applications, and approaches to cope with them.

Lunch & Learn Featured Speaker

Chuck Penson

Fellow, Antique Wireless Association (AWA)

Thursday, November 6

Noon - 1:30 p.m.

Waiting for the Go Code: Communications in the Titan II ICBM Program

Titan II was the nation's preeminent nuclear deterrent and a cornerstone of the United States' Cold War deterrence strategy, standing guard for 25 years from 1963 to 1987. The missile represented a significant leap in nuclear capabilities, with storable propellant, a 58-second response time, and a nuclear punch more than 600 times that of the bomb dropped on Hiroshima. Titan II was designed specifically to convince the Soviets that any nuclear attack on the United States would be answered with a counterstrike of unspeakable devastation.

This talk will explore the critical role of command and control systems in the Titan II program and how its effectiveness hinged on robust, reliable, and secure communication.

We will delve into the various layers of communication infrastructure, from the hardened underground launch control center to the missile itself, and discuss the wireline and redundant radio links designed to ensure command and control even under duress.

By analyzing the Titan II's communication architecture, this presentation aims to shed light on the complex interplay of technology, strategy, and human factors in maintaining nuclear readiness during a pivotal period in global history.

For added clarity and context we will also review key design features of the complex and talk about the very simple but extremely secure process of launching the missile.

I would like to dedicate this presentation to the men and women of the United States Air Force who worked in the Titan II program, to the civilians who built the system, and to those who died in several accidents.

Chuck Penson served as archivist and historian for the Titan Missile Museum and National Historic Landmark from 1997 to 2020, retiring at the onset of the pandemic. He is regarded as the world's foremost authority on the Titan II missile weapon system, and is the author of The Titan II Handbook: A Civilian's Guide to the Most Power ICBM American Ever Built. He also scripted, directed, and presented an hour-long film–Big, Fast, Deadly: Titan II, America's Biggest ICBM.

In addition to his work in the archives, Penson wrote, produced, and presented the museum's visitor orientation video; wrote docent training manuals; wrote, produced, and presented numerous informal docent training videos (many of which are still on YouTube); developed a browser-based information kiosk for visitors; engineered the construction of a full-scale replica nuclear warhead; and provided extensive technical support for both topside and underground structures and artifacts. Over time, these efforts transformed the museum from a simple tourist attraction to a sophisticated educational experience.

Penson has also acted as technical advisor to two PBS documentaries, Uranium (2015) and Command and Control (2016); numerous History Channel programs; and a soon-to-be-released Hollywood feature film–a fictional story based on an actual missile silo crisis.

From 1981 to 1997 Penson worked as director of the Computer Education Center at the Science Museum of Minnesota, in St. Paul. He started the Center from scratch and grew it into a multi-million dollar program. He also served as the museum's unofficial astronomer, writing for its monthly magazine and leading various field trips.

Penson holds an amateur radio license, and in 2020 was invited to sit on the Historical Committee of the ARRL: The National Association for Amateur Radio. In 2021 he was named a Fellow of the Antique Wireless Association.

With a life-long passion for the history of science and technology, Penson has done extensive research into the history of twentieth century electronics, resulting in five books on the subject. Currently, he is developing an online research library documenting the history of amateur radio, on behalf of the ARRL.

A native of St. Paul Minnesota, after herniating a disk in his back while shoveling snow, he made the decision to move to sunny Arizona where he lives with his wife on a small ranch west of Tucson.

Invited Session Speakers

New this year

Monday, November 3
3:00- 3:20 p.m.
Session 4: Antenna Measurements I

Dr. Vince Rodriguez

AMTA Fellow
IEEE Senior Member
ACES Fellow
Manager, Electromagnetic Engineering Analysis and Senior Staff Electromagnetics Engineer at NSI-MI Technologies

Modeling The Effect Of Disruptions On The Absorber Treatment On Antenna Measurements

Abstract:
Anechoic ranges require constant temperature and humidity control, proper lighting for safe work inside the chamber, and closed-circuit television (CCTV) cameras to monitor the system during measurements. In addition, anechoic chambers require fire detection and suppression systems. Traditionally, such penetrations are minimized and placed in non-critical areas, with the assumption that their effects would be negligible if located away from sensitive regions. However, the true impact has not been fully investigated.

In this study, antenna measurements are simulated in an indoor far-field range. A range antenna (or near-field probe) and an antenna under test (AUT) are placed in free space, and the AUT is rotated at discrete angles. A second model then introduces CCTV cameras, HVAC vents, light fixtures, air sampling tubes, and fire suppression nozzles positioned around the chamber. The simulation with these added features is repeated at the same discrete angles.

The model assumes a perfect absorber and does not account for the potential shadowing effects of pyramidal absorbers. While approximate, the results provide a worst-case estimate of the measurement error introduced by necessary chamber penetrations. These results can be used to assess potential uncertainties in measurements caused by support systems within the anechoic enclosure. The technique is demonstrated for indoor far-field ranges but can also be applied to near-field and compact ranges. Results show that, for a typical roll-over-azimuth positioner, the effects of ceiling penetrations are minimal, with differences in the -35 to -40 dB range.

Bio:
Dr. Vince Rodriguez earned his B.S.E.E. (1994), M.S. (1996), and Ph.D. (1999) in engineering science with emphasis in electromagnetics from the University of Mississippi. He began his career at ETS-Lindgren, contributing to RF design of anechoic chambers and later advancing to senior antenna design engineer and antenna product manager, where he introduced the open-boundary quad-ridged horn. In 2014, he joined NSI-MI Technologies, where he has led projects in antenna design, RCS, radome measurement, and absorber development, rising to senior staff engineer and later manager of chamber engineering and electromagnetic analysis groups.

Dr. Rodriguez has authored over 30 journal papers, 70+ conference papers (25+ at AMTA), and a well-regarded book on anechoic chamber design. He is a senior IEEE member, ACES Fellow, and has served on multiple IEEE and ACES boards and standards committees. He is also an Adjunct Research Professor at Ole Miss, a reviewer for leading journals, and a long-time AMTA member, serving on its Board of Directors, including Vice President in 2012.

Tuesday, November 4
10:00-10:20 a.m.
Session 6: Robotic and UAV Antenna Measurements II

Dr. Goutam Chattopadhyay

President, IEEE Microwave Theory and Technology Society (MTT-S)
Visiting Professor, California Institute of Technology, Pasadena, California USA

Space Exploration and Our Place in the Universe

Abstract:
Space exploration captivates us because it speaks to one of humanity's deepest instincts—the desire to understand our origins and our place in the cosmos. By venturing beyond Earth, we not only uncover the mysteries of distant planets, stars, and galaxies but also gain profound insights into our own world. From searching for signs of life on other planets to studying the birth of stars and the evolution of galaxies, each discovery reshapes our understanding of the universe and ourselves. Space exploration challenges us to innovate, to collaborate across borders, and to dream beyond what we think is possible. Ultimately, it reminds us that while we are a tiny part of the universe, we are also a curious and resilient species capable of reaching for the stars.

Space exploration is driven by fundamental scientific questions and the pursuit of innovative instruments to answer them. Our work focuses on designing and building advanced instruments that enable precise measurements to support these scientific investigations. In this presentation, we will provide an overview of the state-of-the-art instruments currently under development and highlight the key science questions they are designed

New this year

to address. Rapid advancements in areas such as commercial modeling software, low-loss circuit and interconnect technologies, mobile device innovations, and submicron scale lithography are now making it possible to develop smart, low-power, and highly capable instruments—many of which are compact enough to be deployed on Small Sat or CubeSat platforms. We will also explore the challenges and opportunities associated with next-generation instruments and their role in meeting the demands of future scientific missions.

Bio:
Goutam Chattopadhyay is the 2025 President of the IEEE Microwave Theory and Technology Society (MTT-S). He is a Senior Scientist at NASA's Jet Propulsion Laboratory (JPL) at the California Institute of Technology (Caltech) and a Visiting Professor at Caltech in Pasadena, USA. Dr. Chattopadhyay earned his Ph.D. in Electrical Engineering from Caltech in 2000. He is a Fellow of both IEEE (USA) and IETE (India), serves as a Track Editor for the IEEE Transactions on Antennas and Propagation, and is an IEEE Distinguished Lecturer. His research interests include microwave, millimeter-wave, and terahertz receiver systems and radars, as well as the development of space instruments for the search for life beyond Earth. Dr. Chattopadhyay has published over 400 papers in international journals and conferences and holds more than 20 patents. He has received over 35 NASA Technical Achievement and New Technology Invention Awards. In 2024, he was honored with the Armstrong Medal from the Radio Club of America (RCA) for his outstanding contributions for radio science. He also received the NASA-JPL People Leadership Award in 2023. He was named IEEE Region-6 Engineer of the Year in 2018 and received the Distinguished Alumni Award from the Indian Institute of Engineering Science and Technology (IIEST), India, in 2017. Additionally, he has won the Best Journal Paper Award from IEEE Transactions on Terahertz Science and Technology in both 2020 and 2013, the Best Paper Award for Antenna Design and Applications at the European Antennas and Propagation Conference (EuCAP) in 2017, the IETE Prof. S. N. Mitra Memorial Award in 2014, and the IETE Biman Bihari Sen Memorial Award in 2022.

Tuesday, November 4
3:00-3:20 p.m.
Session 8: Advanced Measurements

Dr. Dirk Heberling

AMTA Fellow and IEEE Senior Member
Full Professor at RWTH Aachen University Director, Fraunhofer FHR

Exploring the Potential of Robotic Systems for Antenna Measurements

Abstract:
Industrial robots offer significant potential for advancing antenna measurement methodologies, due to their high flexibility, precision, and reliability. Their ability to follow complex trajectories and accommodate unconventional test setups enables innovative approaches for both production testing and the development of multifunctional measurement facilities, especially in spatially constrained scenarios. Although the use of robotics in antenna measurements is still relatively new, the increasing maturity of robotic antenna measurement systems is driving their adoption in both industrial and academic settings. These systems are being applied not only to standard pattern measurements but also to more advanced and customized testing scenarios. In particular, robotic systems show great potential in spherical near-field (SNF) antenna measurements. The flexibility in defining arbitrary sampling grids allows for the application of irregular sampling schemes and compressed sensing (CS) techniques. These approaches can substantially reduce the number of required measurement points, thereby decreasing the overall measurement time, an improvement that is often not feasible with conventional mechanical positioning systems. Despite these benefits, unlocking the full potential of robot-based antenna measurement systems involves overcoming several technical challenges like ensuring precise alignment, optimizing trajectory planning algorithms, and integrating radio frequency (RF) subsystems with robotic motion control. This talk presents current developments in robotic antenna measurements and showcases practical implementations using the robot-based millimeter-wave test facility at the Institute of High Frequency Technology, RWTH Aachen University.

Bio:
Dirk Heberling (Senior Member, IEEE) received the Ph.D. degree (Dr.-Ing.) in 1993. In 1993, he joined IMST GmbH, Kamp-Lintfort, Germany, to establish a new antenna section. From 1995 to 2003, he was the Head of the Antennas Department. He has been a member of European Competence Projects for Antennas COST 260, COST 284, IC0603, and IC1102. From 2003 to 2008, he took over the Department of Information and Communication Systems, IMST GmbH, and in 2008, he moved to RWTH Aachen, where he is currently the Head of the Institute and the Chair of High Frequency Technology. In 2016, he became the Head of the Fraunhofer Institute for High Frequency Physics and Radar Techniques FHR. Dr. Heberling is a member of VDE and from 1998 to 2017 he has been a member of the ITG expert group 7.1 "Antennen" which he directed as a chairman from 2002 to 2003 and from 2014 to 2017 again. He is a member of VDE and is the German delegate to IC1102. He is a member of the Steering Committee and Organizing Committee of European Conference on Antennas and Propagation. During this time he was responsible as General Chairman and organizer of the international antenna conference INICA 2003, September 2003, Berlin and the

Invited Session Speakers

New this year

German Microwave Conference GeMiC 2014, March 2014, Aachen. Since 1998 he has been a member of the European competence projects for antennas COST 260, COST 284, IC0603 and IC1102, from 2002 to 2007 he was the German delegate of COST 284 and from 2011 to 2016 the German delegate and secretary of IC1102. From 2002 to 2003 he was co-organizer of the European network of excellence on antennas ACE. He is member of the steering committee and organizing committee for the European Conference on Antennas and Propagation, EuCAP. From 2016 to 2019 he was member of the Board of Directors of the Antenna Measurement Techniques Association (AMTA) and became president in 2018 and senior member since 2020. In 2016, he was elected for four years in the technical decision board (Fachkollegiat) of the German Research foundation DFG.

Wednesday, November 5
10:00 - 10:20 a.m.
Session 11: RF Material Design and Characterization

Dr. Mauro Ettorre

Professor, Electrical and Computer Engineering, Michigan State University, East Lansing, Michigan
IEEE Fellow

Wideband Long Slot Arrays: Analysis, Design, and Applications for Next Generation Communication Networks and Beyond

Abstract:
In the near future, high-speed wireless networks will leverage the abundant bandwidth available in the sub- and millimeter frequency ranges, mainly through XG systems and New Space technologies. Innovations in antenna technology are essential to fully exploit these wide bandwidths and provide efficient data links for mobile users. Long slot arrays present a very attractive solution, offering decade-wide bandwidths, a very large field of view, and a low-profile design. During this presentation, I will discuss the modeling of long slot arrays and highlight their advantages in terms of bandwidth and scanning capabilities, as well as their physical implementation. We will explore how quasi-optical planar systems can be used to feed these arrays, functioning as efficient beamformers for multi-beam, wide-scanning antennas. Quasi-optical systems help to minimize the losses and costs associated with beamforming networks for arrays operating at higher frequencies while maintaining the flexibility of the radiating unit. I will also cover the implementation of long slot arrays across various technologies, particularly in millimeter and sub-millimeter frequency bands, aimed at next-generation terrestrial and non-terrestrial networks. Finally, I will showcase the capability of these arrays to radiate short, high-power pulses, extending their applications into high-power scenarios.

Bio:
Dr. Mauro Ettorre received a Laurea degree summa cum laude in Electrical Engineering and a Ph.D. in Electromagnetics from the University of Siena, Italy, in 2004 and 2008, respectively, with part of his Ph.D. work carried out at TNO, the Netherlands. Since 2023, he has been a Professor at Michigan State University, USA. Previously, he was a Research Scientist at CNRS, IETR laboratory, France, where he co-led the multi-beam antenna activity with Thales Alenia Space (2014–2020), served on the French National Committee for Scientific Research (2016–2021), led the mm/sub-mm waves team (2016–2021), and co-chaired the Antennas and Microwave Devices Department (2021–2023).

His research interests include quasi-optical systems, periodic structures, wideband arrays, millimeter-wave antennas, non-diffractive radiation, and localized waves. He has authored over 95 journal papers, 230 conference papers, and holds 14 patents (2 licensed). An IEEE Fellow, he served as Associate Editor (2017–2023) and now Track Editor for the IEEE Transactions on Antennas and Propagation. He is the 2024 IEEE MTT-S and AP-S Inter-Society Distinguished Lecturer.

His work has received several prizes, including the 2009 French Ministry of Research Award, the 2014 Young Investigator Award from the French National Research Agency, the 2018 ESA Antenna Workshop Innovation Award, Best Paper Awards at EuCAP 2018 (UK), EuCAP 2021 (Germany), and iWAT 2023 (Denmark).

Wednesday, November 5
3:00-3:20 p.m.
Session 13: Imaging, Algorithms, and Processing Techniques

Dr. Olav Breinbjerg

AMTA Distinguished Speaker
ElMaReCo, Copenhagen, Denmark

Correction of Smearing Error due to Signal Averaging with On-The-Fly Sampling for Electromagnetic Field Measurements

Abstract:
Measurements of spatially distributed fields require a relative motion between the field source and the sampling probe to reach the designated sampling points distributed over the spatial extent of the field. For stop-go sampling, where the motion is stopped at the sampling points while the data acquisition system

New this year

samples the probe signal, the measurement time can become unacceptably long due to the mechanical deacceleration, fine-positioning, and acceleration of the positioning system at each sampling point. For on-the-fly sampling, where the motion is continuous and the data acquisition system is triggered-by-position as the sampling points are reached, the measurement time can be significantly shorter. Since all measurements are affected by random measurement noise, the sample of the probe signal at the individual sampling point is almost always formed by combining multiple individual A/D conversions in the measurement receiver. Here, we refer to this as signal averaging; it is well known that by averaging N independent A/D conversions, the signal-to-noise power ratio increases by a factor N; e.g. averaging 1000 A/D conversions increases the signal-to-noise ratio by 30 dB. With go-stop sampling, all A/D conversions are made at the same spatial point, the sampling point, and thus for the same field; this corresponds to coherent sampling. However, for on-the-fly sampling, the A/D conversions are – due to the continuing relative motion between source and probe – made at slightly different spatial points and thus for slightly different fields; this corresponds to incoherent sampling and it results in smearing of the probe signal. For increasing number of averaged A/D conversions or for increasing speed of the positioner, the resulting smearing error may become unacceptably large. This presentation will demonstrate how the smearing error due to signal averaging for on-the-fly sampling can be exactly quantified and also exactly corrected - for both non-periodic and periodic bandlimited signals.

Bio:
Dr. Olav Breinbjerg received the M.Sc. and Ph.D. degrees in electrical engineering from the Technical University of Denmark (DTU) in 1987 and 1992, respectively. He was on the Faculty of DTU's Department of Electrical Engineering as Assistant Professor from 1991 to 1995, Associate Professor from 1995 to 2005, and Full Professor from 2006 to 2021. From 1997 to 2021 he was also Head of the Electromagnetic Systems Group and the DTU-ESA Spherical Near-Field Antenna Test Facility, and he founded the DTU Electromagnetic Test Centre. He resigned his position at DTU in 2021 and founded ElMaReCo for independent research consultancy. Olav Breinbjerg was a Visiting Scientist at Rome Laboratory in 1988, a Fulbright Research Scholar at the University of Texas at Austin in 1995, and a Visiting Professor at the University of Siena in 2011 and 2022. His research is generally in applied electromagnetics - and particularly in antennas, antenna measurements, computational techniques, and scattering - for applications in wireless communication and sensing technologies. He is the author or co-author of more than 75 journal papers, 250 conference papers, and 250 technical reports. Dr. Breinbjerg was a recipient of a U.S. Fulbright Research Award in 1995, the 2001 AEG Elektron Foundation's Award, the 2003 DTU Student Union's Teacher of the Year Award, the 2013 and 2015 European School of Antennas Teacher of the Year Awards, the 2020 Hans Christian Ørsted Award, and the 2023 AMTA Distinguished Achievement Award. Dr. Breinbjerg is Fellow of AMTA, Fellow of IEEE, Knight of the Order of Dannebrog, and the 2024-2025 AMTA Distinguished Speaker.

Thursday, November 6
10:30-10:50 a.m.
Session 15: Antenna Design and Analysis

Dr. Oscar Quevedo-Teruel
Professor at KTH Royal Institute of Technology
EurAAP vice-chair
IEEE Fellow

Efficient and Fast Ray Tracing Method for Antenna Performance Simulation

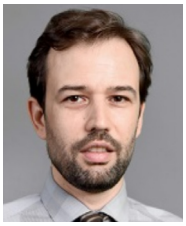
Abstract:
In recent times, we have become familiar with the use of commercial software for designing our antennas and microwave devices. This is very common since it is easy to find high-performance desktop computers at affordable prices in our daily lives. The use of general-purpose commercial software is widespread because it allows for the simulation of any arbitrary configuration. However, many of us have experienced, given the ease of using commercial software, trying to simulate electrically large electromagnetic devices which take days or, in some cases, cannot be completed at all. While it is true that we now have very powerful simulation tools, by making a few simple assumptions, we can significantly reduce computational time without sacrificing accuracy.

In this talk, I will introduce a simple ray-tracing technique that can be used, in combination with physical optics, to calculate the radiation pattern of antennas, as well as directivity, gain, mutual coupling, and even early-time response in complex configurations. The results are not only faster than those produced by conventional commercial software, but also more accurate, as they avoid many of the numerical errors that typically arise when computing electrically large structures.

Bio:
Oscar Quevedo-Teruel received his Telecommunication Engineering and Ph.D. degrees from Carlos III University of Madrid, Spain, in 2005 and 2010. From 2010-2011, he joined the Department of Theoretical Physics of Condensed Matter at Universidad Autonoma de Madrid as a research fellow and went on to continue his postdoctoral research at Queen Mary University of London from 2011-2013. In 2014, he joined KTH Royal Institute

New this year

of Technology in Stockholm, Sweden, where he is a Professor in the Division of Electromagnetic Engineering and Fusion Science and Director of the Master Programme in Electromagnetics Fusion and Space Engineering. He has been an Associate Editor of the IEEE Transactions on Antennas and Propagation from 2018-2022 and Track Editor since 2022. He has been a member of the European Association on Antennas and Propagation (EurAAP) Board of Directors since January 2021. Since January 2022, he has been the vice-chair of EurAAP. He was a distinguished lecturer of the IEEE Antennas and Propagation Society for the period 2019-2021. He is an IEEE Fellow for contributions to glide symmetry based metasurfaces and lens antennas. He has made scientific contributions to periodic structures, higher symmetries, transformation optics, lens antennas, physical optics, and high-impedance surfaces. He is the co-author of more than 150 papers in international journals and 250 papers at international conferences.



Thursday, November 6
3:00-3:20 p.m.
Session 17: Range Design, Instrumentation, and Characterization

Dr. Georgios Trichopoulos

Associate Professor, Electrical, Computer & Energy Engineering
Arizona State University

Reconfigurable Intelligent Surfaces for Antenna Measurements

Abstract:
Reconfigurable intelligent surfaces (RISs) - or programmable metasurfaces- have recently attracted the attention of several diverse research communities, mostly for applications related to wireless communications and sensing. RISs are relatively low-cost structures that are scalable to large apertures and provide electronic beam reconfiguration (focusing, beamscanning, etc.). As such, RISs exhibit many attributes that could be used to simplify the antenna measurements. By leveraging its ability to steer reflections dynamically in both azimuth and elevation planes, the RIS can act as a programmable probe to illuminate the antenna under test (AUT) from multiple incident angles without requiring mechanical movement. In this way, the RIS can generate a diverse set of measurement bases that, when combined with near-field scanning or a compact sensor array, enable efficient reconstruction of the AUT's far-field radiation pattern. Compared to conventional mechanical goniometers or large anechoic chambers, this approach provides a more compact and reconfigurable testbed.

Our group has designed and prototyped several RISs in the microwave and millimeter wave bands. In a recent work, we devised a mmWave (28 GHz) RIS that offers electronically controllable high-resolution beam steering with strong suppression of quantization lobes. The scalability of our tiled RIS architecture provides flexibility for measurement setups. Larger apertures can generate narrower beams with finer angular selectivity, which is advantageous for high-directivity antenna characterization. At the same time, the low-cost PCB-compatible fabrication of RIS allows deployment in practical over-the-air (OTA) test environments for 5G/6G antennas, user equipment, or phased arrays. Furthermore, the pseudo-random pre-coding of the RIS suppresses spurious lobes that could otherwise corrupt measurements, ensuring that only the desired beam is used to interrogate the AUT. This feature enhances measurement accuracy and reduces ambiguities in pattern reconstruction—an advantage over traditional binary RISs. During the conference, we will present the design of the scalable mmWave RIS and discuss the measured radiation and beam shaping properties. Then, we will present various approaches in using the RIS as a component of a measurement system to characterize directive mmWave antennas.

Bio:
Georgios Trichopoulos is currently an Associate Professor with the School of Electrical, Computer, and Energy Engineering, Arizona State University, Tempe, AZ, USA. From 2013 to 2015, he was a Postdoctoral Researcher with the ElectroScience Laboratory, The Ohio State University. His research areas include antenna engineering, terahertz imaging, antenna design for millimeter-wave and terahertz sensors, and high-frequency device and circuit characterization methods. He has led the design and fabrication of the first real-time terahertz camera that operates in extremely high frequencies (600 GHz – 1.1 THz) and is comprised of more than 5,000 on-chip miniaturized antennas. Additionally, he has designed and tested various programmable metasurfaces for wireless communications and sensing applications. Dr. Trichopoulos has been the recipient of several awards, including the Best Student Paper Award of the 2013 IEEE Antennas and Propagation Symposium and the NSF CAREER. He is currently serving as an Associate Editor for IEEE Transactions on Antennas and Propagation.

AMTA 2025

Distinguished Achievement Award

Antenna Measurement Techniques Association
Distinguished Achievement Award
Presented to

Mr. Jeff R. Guerrieri

The 2025 AMTA Distinguished Achievement Award is presented to Mr. Jeff R. Guerrieri, who has exemplified and promoted the goals and objectives of the Antenna Measurement Techniques Association throughout his career.

Jeff Guerrieri received his Bachelor of Science in Electrical Engineering from Colorado State University in 1986. He started at the National Bureau of Standards (NBS) in 1986 which later became NIST in 1988. Early years in the Antenna Metrology Lab were spent performing on-axis antenna gain calibrations, (extrapolation gain technique) and near-field antenna measurements (planar, spherical and cylindrical near-field), and later progressed to calibration and measurement reviewer, evaluating results and uncertainties. He developed a multi-purpose antenna measurement facility in 1992 that was configurable for spherical near-field, cylindrical near-field, extrapolation gain and far field probe calibration. In 2010, he became the Quality Manager for the Antenna Metrology Lab, where the first use of a robotics for antenna measurements was developed (Configurable Robotic Millimeter-Wave Antenna "CROMMA" facility) and later oversaw the construction of the dual robotic Large Antenna Positioning System (LAPS) facility, which was instrumental in the transfer of this emerging technology to the commercial antenna measurement industry. Jeff served as Group Leader for the RF Fields Group in the NIST Communications Technology Lab (CTL) from 2018 to 2020 and as the Safety Program Coordinator for CTL from 2014 to 2020, where he was responsible for the setting up the safety programs for the newly formed operating unit. In 2020, he transferred to the NIST Standards Coordination Office and is currently serving as a Program Manager for the National Voluntary Laboratory Accreditation Program (NVLAP).

He has over 90 publications and presentations, was leading author on 34 of these, including a Bureau International des Poids et Mesures (BIPM) Key Comparison CCEM.RF-K23.F "Measurement Techniques and Results of an Intercomparison of Horn Antenna Gain at Frequencies of 12.4, 15.0, 18.0 GHz"

In 2007, he received the Department of Commerce (DoC) Gold Medal for creating and implementing the rigorous testing protocols and benchmarks needed to ensure the security and integrity of the of the new U.S. ePassport, and in 2009 he received two DoC Bronze Medals: one for the analysis and certification of the U.S. Passport Card architecture resulting in a mitigation of security threats and privacy concerns, and one for creating the World's first extrapolation range for measuring the on-axis gain and polarization of antennas for frequencies from 50 GHz to 110 GHz. In 2016, Jeff was awarded a DoC Silver Medal for development of the world's first "Configurable Robotic Millimeter-Wave Antenna" (CROMMA) Facility.

Jeff has been a member of the Antenna Measurement Techniques Association (AMTA) since 1988. He became a Senior Member in 2007, an AMTA Fellow in 2012 and received the AMTA Distinguished Service Award in 2016. He served on the AMTA Board of Directors from 2007 – 2010 in the roles of Secretary and President, as Host for the 2022 AMTA Symposium, and as Historian from 2011 to 2023.

Jeff is an Institute for Electronics and Electrical Engineers (IEEE) Senior Member, member of the IEEE Antenna and Propagation Society (APS), the APS Standards Committee, and has participated on the working groups for IEEE standards 149, 145, and 1720. He is also a member of the IEEE Electromagnetic Compatibility Society (EMC), the European Association on Antennas and Propagation (EurAAP), and National Conference on Standards Laboratories International (NCSLI).

For outstanding and pioneering contributions to the practice of antenna design, analysis, and measurements.

AMTA 2025

Distinguished Service Award

Dr. Lydell L. Frasch

The AMTA herby cites Lydell Frasch for:

Serving on the Board of Directors as Treasurer from 2011-2012, as President in 2013, and as Past President in 2014.

Serving on Host Committees in 2007 and 2019 – 2025.

Long time participation on the Technical Program Committee as a reviewer and session chair 2006 – 2025.

Serving on the Student Paper Contest Committee 2007 – 2025.

Serving on the Student Travel Scholarship Committee 2019 – 2025.

Serving on the AMTA Awards and Nominating Committee 2014 and 2024.

Dr. Lydell L. Frasch received the B.S. degree in physics in 1979 and the B.S. in Electrical Engineering in 1980, both from the South Dakota School of Mines and Technology. He received the M.S. and Ph.D. degrees in electrical engineering from Michigan State University in 1983 and 1987, respectively

After completing his graduate studies in 1987 Lydell joined the Boeing Company where he worked in a variety of areas including antenna design and testing, RCS testing, material properties testing and compact range operation. He has been involved with the electromagnetics community for over 40 years. Prior to his retirement in 2020, his research focus had been in the general area of the electromagnetic characterization of materials. Since his retirement, he has been consulting part time for the Boeing Company.

Lydell has served for many years as a member of the AMTA Technical Program Committee, the Student Paper Contest Committee and the Student Travel Scholarship Committee. He was a member of the Host Committee in 2007, 2012, 2019 - 2025. He was a co-organizer and co-instructor for two AMTA Short courses on material measurements in 2010 and 2016. He organized the first AMTA Student Day event in 2007 and has participated in almost every subsequent event. He was instrumental in creating the concept of AMTA Nodes. He served as AMTA Treasurer, President and Past President from 2011 through 2014. He has served as the Boot Camp and Short Course Coordinator since 2019 and was an instructor in 2019. Dr. Frasch is a Fellow of AMTA and a life senior member of the IEEE. He has authored or coauthored 29 journal and conference papers and 5 US patents in the area of materials characterization and scattering measurements.

For outstanding contributions to AMTA in numerous areas of service.

Distinguished Speaker Award

Antenna Measurement Techniques Association
Distinguished Speaker Award
Presented to

Dennis Lewis

AMTA Distinguished Speaker Award is bestowed on an AMTA member that is a proven expert in the field of electromagnetic measurements and has excellent presentation and communication skills. The awardee is expected to travel internationally for invited presentations or lectures to AMTA regional events, AMTA nodes, meetings arranged by AMTA members or to present at other meetings to increase interest in AMTA.

Dennis Lewis received his BS EE degree with honors from Henry Cogswell College and his MS degree in Physics from the University of Washington. He has worked at Boeing for 36 years and is recognized as a Technical Fellow. He currently has leadership and technical responsibility for the RF, Microwave and Antenna test capabilities. Dennis holds 12 patents and is the recipient of the 2013 & 2015 Boeing Special Invention Award. He is a Senior Member of the IEEE and several of its technical societies including the Microwave Theory and Techniques Society (MTT-S), the Antennas and Propagation Society and the Electromagnetic Compatibility (EMC) Society. He actively contributes to these societies as a member of the IEEE MTT-S TC-3 on microwave measurements and as a Board Member, past Distinguished Lecturer and 2019 conference chair for the EMC Society.

He is an Ed Gillespie Fellow and served on the Board of Directors for the Antenna Measurements Techniques Association (AMTA) and chaired its annual symposium in 2012 and 2023. Dennis is a part-time faculty member teaching a course on Measurement Science at North Seattle College. He's also an active member and past chairman of the Technical Advisory Committee where he mentors engineering students. His current technical interests include aerospace applications of reverberation chamber test techniques as well as microwave/antenna measurement systems and uncertainties.

The Antenna Measurement Techniques Association Distinguished Speaker Award is presented to Dennis Lewis for a period of two years effective from January 1, 2026.

AMTA 2025

Board of Directors Candidates

Amanuel Haile

Amanuel Haile is a Boeing Technical Fellow and Boeing Designated Expert with over 30 years' experience at Boeing in all aspects of Antenna near-field measurement and analysis. As a technical lead, Amanuel supports test facility enhancements across Boeing and provides the necessary software and hardware training. Amanuel developed a multi-day training course in antenna near field measurement that he has presented across Boeing facilities. The training course was tailored for lab technicians and engineers, as well as business partners which has yielded measurable improvements in laboratory efficiency and accuracy. He has also written and published the Boeing Design Practice for Antenna Near Field measurement and error analysis.

Amanuel is highly involved in all phases of flight antenna testing: pre-range requirements, scheduling, probe calibration, range configuration, test support/troubleshooting/processing, and post-range data reduction. He is the Antenna range test focal/lead for One Boeing efforts and for Industry test capability needs Boeing in El Segundo. Amanuel has significantly impacted Boeing's business by developing new, enabling technologies to save significant cost and schedule on antenna testing across all space programs, providing key technical solutions, and input to proposals to win new business. Amanuel has been a member of the Antenna Measurements Techniques Association (AMTA) since 1997. He presented his first AMTA paper in 1998 in Probe calibration using Time Domain gating and has authored and co-authored many other papers for Boeing and AMTA. His Paper in Near Field Measurement Errors Due to Neglecting Probe Cross-Polarization which he presented in 2007 was selected as the best paper in the session.

Amanuel was awarded AMTA Fellow in 2024 and serves in the AMTA Technical Committee, Student Paper review and AMTA growth and retention Committee.

Amanuel holds a MS in Electrical Engineering and a BS in Electrical Engineering, both from the California State University of Long Beach.

Dr. Jonathan L. Frasch

Dr. Jonathan L. Frasch is currently an Electrical Engineer with the Material Measurements Lab of The Boeing Company in St. Louis, MO, focused on material research and testing activities. His current duties involve contributions to several proprietary programs developing new tools and test methodologies in preparation of production testing.

Jonathan has over 13 years of experience in electromagnetic characterization of materials; optimization algorithm development; and design and testing of radomes, single element antennas, and phased array antennas. Prior to joining Boeing in 2022, he was employed by Resonant Sciences in Dayton, OH, and the Raytheon Technologies Radome and Aperture Products Group in McKinney, TX.

He was awarded a Ph.D. degree from Michigan State University in 2017 after serving as a Graduate Research Assistant from 2012 to 2016. Before switching to the study of electromagnetics, he taught mathematics and engineering courses at a Missouri community college from 2009 to 2012, and served as a Graduate Teaching Assistant for the Missouri University of Science and Technology from 2006 to 2009 with the Mathematics Department and the Nuclear Engineering Department.

Dr. Frasch received his B.S. and M.S. degrees in Nuclear Engineering from the Missouri University of Science and Technology (formerly UMR) in 2006 and 2008 respectively in Rolla, Missouri. In 2005, he attended a special summer training program at Los Alamos National Laboratory with the non-destructive testing unit.

Jonathan has been an AMTA member since 2013 and has served on the Technical Program Committee, Student Paper and Travel Scholarship Award Committee, and Student Best Paper Committee, and as a Technical Program Session Chair. In addition, he has also been actively involved in Student Day. He is also a member of the IEEE and the American Nuclear Society, and has been awarded membership in Tau Beta Pi, Phi Kappa Phi, Alpha Nu Sigma, and Phi Theta Kappa honor societies.

Jonathan is running for the board of directors to continue supporting AMTA's ongoing mission of promoting the antenna measurements community. AMTA should continue to be a gathering place for all who love electromagnetics and all of the wonderful things that we can do with EM technologies. We should continue to promote outreach and opportunities to future generations of scientists and engineers. Youth are the lifeblood of any organization, and they will be the ones to push the frontiers of science if we give them the support and guidance that they need to grow.

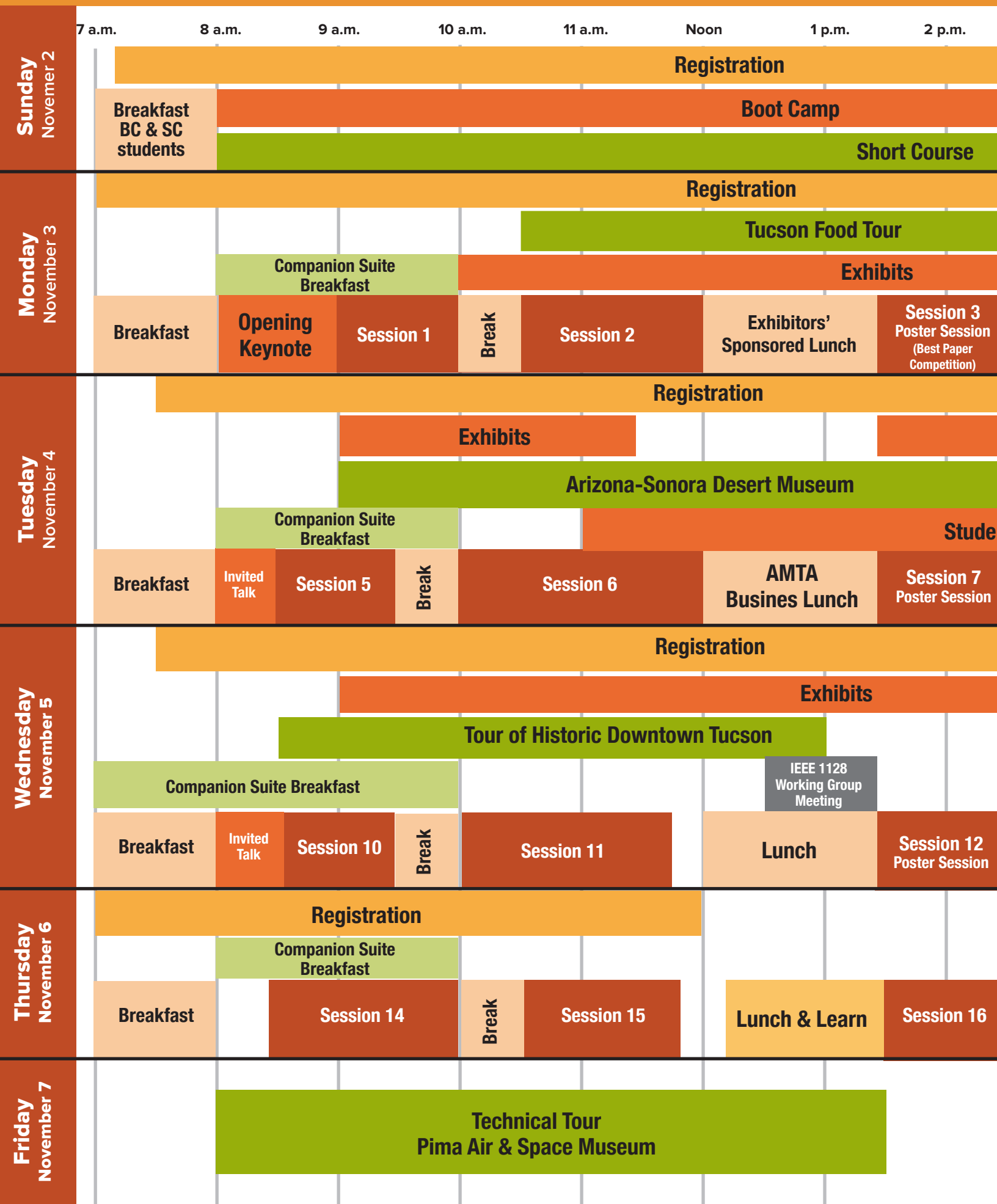
Dr. Michael D. Foegelle

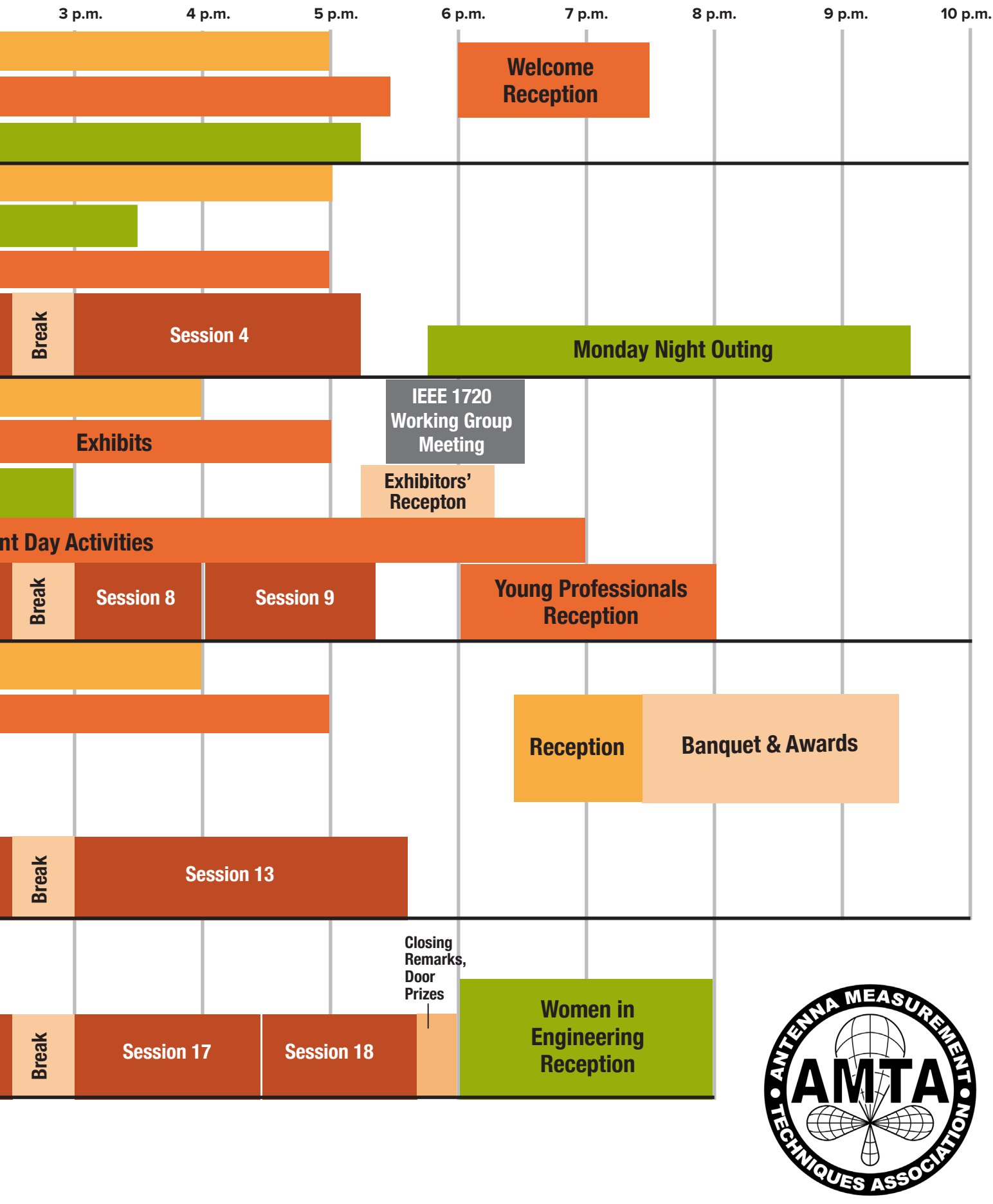
Dr. Michael D. Foegelle received his Ph. D. in Physics from the University of Texas at Austin, where he performed theoretical and experimental research in both Condensed Matter Physics and Electromagnetic Compatibility (EMC). In 1994 he began working for EMCO in Austin Texas (now ETS-Lindgren) where he most recently held the position of Director of Technology Development. There he was integral to the development of hardware, software, and test methods for Wireless, RF, and EMC testing. In 2023, Michael accepted a position as Product Planner for Keysight Technologies' Over-the-Air Test Solutions Group. There, he has focused on the design and automation of compact antenna test ranges (CATRs) for evaluation and calibration of large phased array antennas and antenna systems, as well as new measurement technologies and methodologies for over-the-air testing of wireless devices.

Over the years, Michael has been involved in numerous national and international standards committees on EMC and wireless. He has served as chair or vice-chair of various working groups in those organizations and most recently co-chaired the CTIA MIMO OTA Subgroup and the CTIA Measurement Uncertainty Subgroup. He has contributed substantial draft text to many of those standards and was also the editor and principal contributor for the WiMAX Forum™ Radiated Performance Tests (RPT) for Subscriber and Mobile Stations test plan. Michael has authored or co-authored numerous papers in the areas of Electromagnetics, EMC, Wireless Performance Testing, and Condensed Matter Physics, holds dozens of patents on wireless and electromagnetic test methods and equipment, and is dedicated to advancing the state of the art in radiated RF testing of emerging wireless technologies.

Michael lives and works at his homestead on Orion Ranch in Oatmeal, TX with his wife, Machael. When he can find the time, he enjoys reading, movies, video games, working on his land, raising Texas Longhorn cattle, amateur photography, astrophotography, and visual astronomy at Orion Ranch Observatory.

AMTA 2025 SCHEDULE




3 p.m.
4 p.m.
5 p.m.
6 p.m.
7 p.m.
8 p.m.
9 p.m.
10 p.m.
Welcome Reception
Break
Session 4
Monday Night Outing
IEEE 1720 Working Group Meeting
Exhibits
Exhibitors' Recepton
nt Day Activities
Break
Session 8
Session 9
Young Professionals Reception
Reception
Banquet & Awards
Break
Session 13
Closing Remarks, Door Prizes
Break
Session 17
Session 18
Women in Engineering Reception

AMTA 2025

Edmond S. Gillespie Fellows

The following outstanding contributors were awarded Fellow membership status in 2025

Ryan T. Cutshall received his B.S. degree in engineering mechanics from the University of Wisconsin–Madison in 2008 and his M.S. degree in electrical engineering from the University of Arizona in 2013. He was awarded a certificate of specialization in Analog, Mixed Signal, and RF Circuit Design from the University of California Los Angeles in 2024. He has been with Raytheon, an RTX Company, for 17 years, with work experience at both the Tucson, Arizona and Andover, Massachusetts locations. His work has been primarily related to antenna design, measurement, and calibration, specializing in near-field antenna measurements and direction-finding phased array calibration. He has been a member of the Antenna Measurement Techniques Association since 2013 and was awarded Senior membership in 2022. He has been a member of IEEE since 2009. He holds two trade secrets and one US patent, and he has been lead author or co-author on several peer reviewed journal publications. Ryan currently lives with his wife in Waltham, Massachusetts.

Paul J De Groot is a Technical Fellow at The Boeing Company with expertise in RADAR Cross Section (RCS) measurements, measurement chambers and systems, antenna measurements, and frequency spectrum management and allocation. For over 35 years, Paul has engineered complex systems and lead teams to conduct RCS and antenna measurements at both the Boeing Enterprise and national levels.

Paul represents Boeing and the industry on the National RCS Measurement Facilities Certification Program Executive Committee. Paul is an Edmond S. Gillespie Fellow of AMTA, was AMTA Meeting Coordinator and Vice President while serving on the AMTA Board of Directors and is a member of IEEE and IEEE Antennas and Propagation, and has published multiple papers on measurements.

Paul has been the chief engineer for multiple technology development programs at Boeing over his 35 years and he was the Common Lo Observables Verification System (CLOVerS) $60M EMD Program Chief Engineer and System Test and Evaluation IPT Lead from 1999 to 2007. Paul led the team developing, automating, and delivering the hardware, software, and processes for deployable and affordable ground measurements for the Air Force. Paul has managed and engineered multiple test chambers and measurement systems used for RCS, Antenna, and Quality Assurance measurements at Boeing. Paul supports STEM outreach by co-founding a FIRST Robotics Competition (FRC) team in 2011, the Cyborg Cats, and continuing to coach the Cyborg Cats and mentor high school students while illustrating careers in engineering.

Benoit Derat received the Engineering degree from SUPELEC in 2002 and the Ph.D. degree (Hons.) in physics from the University of Paris XI, Orsay, in 2006. From 2002 to 2008, he was with SAGEM Mobiles, where he served as an Antenna Design and Electromagnetics Research Engineer. In 2009, he founded ART-Fi, pioneering the first vector-array specific absorption rate measurement system, and held roles as CEO and President. In 2017, he joined Rohde & Schwarz GmbH & Co. KG, Munich, Germany, where he led multiple development teams for over eight years as Senior Director of Engineering, overseeing R&D for products and solutions as well as customer implementations in areas including Over-The-Air and Antenna Measurement, Electromagnetic Compatibility, and Vector Network Analysis. In 2025, willing to get more actively involved in the significant expansion of AI and data center technologies, he joined VIAVI Solutions, Eningen, Germany, as Senior Director of R&D for Computer Systems and Optical Transport Testing Solutions. Dr. Derat is a Senior Member of the Antenna Measurement Techniques Association (AMTA) since 2023 and a Distinguished Lecturer of the IEEE EMC Society (2024–2025). He is the author of more than 100 scientific journal and conference papers and the inventor on over 45 patents, with a primary focus on antenna systems and near- and far-field characterization techniques.

Ryan Cutshall,
Raytheon, An RTX Business

Paul De Groot,
The Boeing Company

Dr. Benoit Derat,
VIAVI Solutions

Dr. Sergiy Pivnenko,
Antenna Systems Solutions

Sergiy Pivnenko was born in Kharkiv, Ukraine, in 1973. He received the M.Sc. and Ph.D. degrees in electrical engineering from Kharkiv National University, Ukraine, in 1995 and 1999, respectively. From 1998 to 2000, he was a Research Fellow at the Radiophysics Department, Kharkiv National University. From 2000 to 2015, he was an Associate Professor at the Electromagnetic Systems Group, Department of Electrical Engineering, Technical University of Denmark (DTU), where he was doing research and teaching in antenna measurement techniques and was responsible for operation of the DTU-ESA Spherical Near-Field Antenna Test Facility. While at DTU, he participated to multiple research projects related to design, development, and characterization of satellite antennas, development of new near-field probes and probe correction techniques for near-field antenna measurements. In 2015, Dr. Pivnenko joined Antenna Systems Solutions as Technical Director, where he is responsible for scientific and technical tasks related to development of antenna measurement ranges of all possible kinds. He was invited teacher in summer schools and PhD courses and is continuing teaching in several courses of the European School of Antennas on the topics of antenna measurements. He is the author or co-author of 3 book chapters, 26 journal papers, and more than 100 conference papers. Dr. Pivnenko is a member of IEEE, EurAAP, and AMTA.

In 2007, AMTA created the Edmond S. Gillespie Fellow membership grade to recognize those members for their outstanding and pioneering contributions to the theory, practice, and art of antenna and RF measurements. Membership in the Fellow grade is to honor the memory of Dr. Edmond. S. “Stan” Gillespie who made many contributions to the antenna community as a professor at California State University, Northridge, and his activities in both the AMTA and the IEEE Antennas and Propagation Society.

The criteria for being named a Fellow are through contributions to AMTA in two of the following three areas:

1. Significant technical contributions through publications,
2. Excellence in education in the field of antenna measurements, and
3. Dedication through active AMTA service.

A complete list of AMTA Fellows can be found on the AMTA web site www.amta.org.

2025 Outstanding Service Awards

Brian Fischer, 2024 Host Chair

Kim Hassett, 2024 Co-Host

Raytheon, 2025 Host Organization

Cosme Culotta-López, 2024 Vice President, 2022-2023 Technical Coordinator

Lars Foged, 2024 Past President, 2023 President, 2021-2022 Treasurer

2025 AMTA TICRA Foundation Travel Winners

Alexis Oblitas Mantilla
The University of Oklahoma, USA

Alejandro Antón Ruiz
University of Twente, The Netherlands

Henrik Jansen
RWTH Aachen University, Germany

2025 Senior Members

Hirsch Chizever, Delta Sigma Company, USA

Michael S. Emire, Advanced Research and Technology Corporation, USA

Papa Ousmane Leye, Technology Innovation Institute, United Arab Emirates

Kenneth Vaccaro, Advanced Research and Technology Corporation, USA

Craig Wheeler, BAE SYSTEMS, USA

Growth Committee

Chair: Lars Foged, Microwave Vision Group

Vice Chair: Dan Aloi, Oakland University

Ryan Cutshall, Raytheon, An RTX Business

Marc Dirix, Emerson & Cuming

Mike Francis, National Institute of Standards and Technology, Retired

Stuart Gregson, Next Phase Measurements

Amanuel Haile, The Boeing Company

Ben Moser, National Institute of Standards and Technology

2025 Eric Walton Student Travel Scholarship Recipients

Akshita Yadav
University at Buffalo, The State University of New York

Jorge Frovel de la Torre
Universidad Politécnica de Madrid

Francisco Jose Escobedo Segovia
Universidad Católica San Pablo

Web Oversight Committee

Chair: Tony Sanchez, Antenna Systems Solutions

Zhong Chen, ETS-Lindgren

Justin Dobbins, Raytheon, An RTX Business

Katie Fernstaedt, Global Management Partners (Support Staff)

Brian Fischer, Resonant Sciences

Jeff Fordham, NSI-MI Technologies, Retired

Alex Matveyenko, NSI-MI Technologies

CJ Reddy, Altair

Ed Urbanik, Applied Research Associates, Retired

Exhibitors

Advanced Test Equipment Corp (ATEC)

Advanced Test Equipment Corp (ATEC) is a leading provider of test and measurement solutions, offering a comprehensive inventory of equipment for EMC/EMI and RF testing, along with electrical, environmental, and power quality applications, supporting key compliance standards, including MIL-STD-461, IEC 61000, CISPR, and RTCA DO-160. With over 40 years of industry experience, ATEC is trusted by EMC engineers, manufacturers, and compliance labs across aerospace, defense, automotive, energy, and medical device sectors. ATEC's flexible rentals and extensive EMC/RF inventory give compliance engineers fast, reliable access to the equipment they need to stay on schedule.

Altair

Altair is a global leader in computational intelligence that provides software and cloud solutions in simulation, high-performance computing (HPC), data analytics, and AI. Altair is part of Siemens Digital Industries Software. To learn more, please visit www.altair.com or sw.siemens.com.

AMTA 2026

ETS-Lindgren is proud to host the 48th Annual Meeting and Symposium of the Antenna Measurement Techniques Association (AMTA). Join us in Austin, Texas—the "Live Music Capital of the World"—from November 1–6, 2026. Experience the city's vibrant blend of culture, innovation, and natural beauty while connecting with antenna measurement experts from around the globe. AMTA 2026 will feature a short course, boot camp, and technical program highlighting the latest research and industry advancements. The Symposium concludes with a technical tour of ETS-Lindgren's world headquarters in nearby Cedar Park. Beginning in March 2026, the Call for Papers will open, inviting professionals and students to showcase their innovative work. For details and updates, visit 2026.amta.org. We look forward to welcoming you to Austin!

Anechoic Solutions, Inc.

Anechoic Solutions, Inc. – Leading the way in experience and technical installation, we are an industry trusted resource for civilian and defense applications. We build, relocate, reconfigure, repair, and maintain your chambers to keep your chambers looking good and work as it should. We are all proud citizens of the United States of America.

Anritsu

Anritsu is a provider of innovative communications test and measurement solutions. Anritsu engages customers as true partners to help develop wireless, optical, microwave/RF, and digital solutions for R&D, manufacturing, installation, and maintenance applications, as well as multidimensional service assurance solutions for network monitoring and optimization. Anritsu also provides precision microwave/RF components, optical devices, and high-speed electrical devices for communication products and systems. The company develops advanced solutions for emerging and legacy wireline and wireless technologies used in commercial, private, military/aerospace, government, and other markets.

AP Americas

AP Americas is a leading global manufacturer of RF/anechoic chambers for various applications in antenna measurement, radar signature, EMC and high-frequency technology. Our expertise lies in the development, design and realization of test environments for electromagnetic properties research in industries including military, aerospace, wireless, automotive, and OTA.

Exhibitors

Braden Shielding Systems

Braden Shielding Systems manufactures, tests and installs a wide range of environmental radio frequency enclosures specifically designed for medical, commercial, government and military applications to meet and exceed all shielding requirements and specifications. Its wide range of capabilities, including consultation, complete design, fabrication, turnkey installation services and testing, allows the Company to ensure outstanding quality control throughout each project. Braden Shielding Systems' shielding technology utilizes a totally integrated design concept which guarantees performance of all required project standards. From the first customer nearly 40 years ago to the countless companies and organizations the Company now serves across the US, its mission remains the same: "To provide customers with the finest radio frequency and magnetic shielded enclosures in the world through uncompromising quality control, quick and accurate response to client needs and reliable, competent, on-time service."

Chamber Services, Inc.

Chamber Services, Inc. is a forward – thinking, Anechoic Facility Design, Construction and Services Company committed to delivering the highest level of service and superior quality products to valued customers. Our services include Anechoic Chamber Design, Consultation and Construction. Including Architectural, Modular and Welded RF Shielded Enclosure Installations/Relocations, RF Shielded Enclosure Maintenance, RF Absorber Material Removal/ Installation, RF Absorber Material Maintenance, RCM and Pneumatic RF Shielded Door Installation and Maintenance, Zinc and Copper Coatings Flame Spray Service. Chamber Services Inc. association with the leading RF Shielding and RF Absorber manufactures provides a factory direct source for RF Shielded Enclosures, RF Shielded Doors, RF Absorber Materials, Power and Signal Line Filters, Waveguides, Pipe Penetrations, Custom Test Fixtures, Portable RF Absorber Panels and much more.

Delta Sigma Company

Delta Sigma Company (DSC) offers comprehensive Antenna measurement solutions and Radar Cross Section (RCS) for aerospace, defense, and research applications. Our high-precision systems integrate state-of-the-art technology, ensuring accurate and repeatable electromagnetic testing data. DSC's experienced engineers customize each solution to meet unique project requirements, delivering hardware, software, and unparalleled support. From concept to installation and training, DSC's end-to-end services guarantee streamlined implementation and optimized performance. Partnering with DSC means reducing project risk, improving measurement accuracy, and maximizing return on investment. Experience industry-leading expertise and service excellence by choosing DSC as your trusted provider for cutting-edge RCS and antenna measurement solutions.

ETS-Lindgren

ETS-Lindgren solutions include systems for Government/Aerospace, Automotive/EMC, and Wireless applications. We offer RF/Microwave Far-field, Near-field, and Compact Range Chambers for Radar Cross Section as well as Antenna Measurement Systems for 5G NR, OTA, and MIMO OTA performance testing. ETS-Lindgren antennas are available in standard and custom designs. Our diverse absorber line is known for its durability, high-performance, non-hygroscopic design, and high-power handling capabilities. We also manufacture positioners, probes, and monitors, to name a few. System solutions feature EMQuest™ Software for fully automated 2- and 3-D antenna pattern measurement for passive antennas and active wireless devices.

Exhibitors

Hiller Fire Protection

Hiller Fire Protection offers fire protection and life safety solutions that have been preserving lives and property worldwide for over 100 years. As a full-service provider with over 40 locations across the United States, Hiller is laser-focused on one goal – making the world a safer place. The Hiller team of experts has extensive knowledge in special hazards, energy storage systems, marine applications and more. We are proud to be at the forefront of technology and innovation by creating adaptable safety solutions and offering a wide range of services, including design, installation, inspection and maintenance of fire protection and life safety systems. With a commitment to safety and quality, Hiller is a trusted partner for businesses and organizations of all sizes. Visit HillerFire.com to learn how we can help protect your assets and ensure compliance with industry standards.

Impulse Technologies, Inc.

Impulse Technologies, Inc. stands at the forefront of RF component manufacturing and distribution, specializing in innovative Microwave & Millimeter-Wave technologies. Our product offerings include in-house manufactured standard gain horns, adapters, attenuators, phase shifters, and various other waveguide products. In addition, we supply a broad range of high-performance antennas—including broadband, dual-polarized, and space-grade models—sourced through trusted international partners. These antenna solutions support cutting-edge work in antenna testing, aerospace programs, and research environments. As an ITAR-registered and ISO 9001:2015 certified company, we ensure top-tier quality, solidifying our role as a trusted advisor and provider in the industry for over three decades.

Junkosha

Junkosha are pioneers of sophisticated fluoropolymer application technologies across various sectors including semiconductor manufacturing, microwave interconnect and medical devices. Our RF cable is known as excellent “Phase & Amplitude stable” cable over flexure and temperature change, and it covers DC~145GHz. Please stop by our booth to see our low IL and TVAC option.

Keysight

Keysight enables innovators to push the boundaries of engineering by quickly solving emulation, and test challenges to create the best product experiences. Whether you’re looking to improve your development process, optimize and secure your network, or get a head start on technologies like 5G, 6G, electronic or autonomous vehicles, IoT, or quantum — Keysight accelerates innovation with intelligent insights built on the most accurate measurements to reduce risk and speed time-to-market. Our fusion of technology knowledge, measurement science expertise, and tailored solutions help you forge ahead with confidence in our connected and dynamic world. What’s next starts here, with Keysight.

Kraetonics

Kraetonics is pioneering disruptive advancements in additive manufacturing (AM) software, enabling the manufacturing of parts with advanced electromechanical functionality. Their cutting-edge software, OmniSlice®, empowers innovators to design and build complex 3D structures with any distribution of conductors, dielectrics, magnetics, and other materials. This capability enables 3D and volumetrically complex antennas that push performance limits. With OmniSlice®, you can craft 3D volumetric circuits, print functionally-graded materials (FGMs) with ceramics or metals, and perform conformal printing. You can even conformally print onto near-vertical sidewalls using standard three-axis machines.

Exhibitors

Microwave Vision Group

MVG, the Microwave Vision Group, offers cutting-edge technologies for the visualization of electromagnetic waves. With advanced test solutions for antenna characterization, radar signature evaluation and electromagnetic measurements, we support company R&D teams in their drive to innovate and boost product development. Dedicated to the aerospace & defense, satellite, telecommunications, automotive, EMC & CE industries as well as research institutes, we are the one-stop shop for turn-key systems, solutions and services for near-field and far-field antenna measurement, CATR, RCS, radome & radar, 5G OTA, and EMC testing. MVG: fast, accurate and reliable test and measurement solutions.

Next Phase Measurements

Next Phase Measurements (NPM) is a California-based US company with a management team of industry pioneers recognized all over the world having over 100 man-years of experience in antenna measurement systems. NPM leverages world class established products like industrial robots and receivers integrating them with its state-of-the-art software, NPM-AMS 2.0, to provide turnkey antenna measurements and upgrades for Near-Field, Far-Field, CATR, and RADOME systems. NPM is also the distributor and value-added-reseller across the American continents for Antenna Systems Solutions, providing antenna measurement systems to the worldwide Aerospace, Defense, Commercial, Automotive, Wireless, Academic and Research markets.

NSI-MI Technologies

NSI-MI Technologies is the global leader in advanced RF measurement solutions for aerospace, defense, satellite, and wireless industries. From turnkey systems to custom components, NSI-MI delivers unmatched performance, accuracy, and quality. Our expert team oversees every stage—from design to integration—supported by a robust global service network. We're more than a supplier; we're a long-term partner committed to your success. With reliable, high-precision test equipment and ongoing support, we help you maximize productivity and innovation. Partner with NSI-MI today and elevate your RF testing capabilities to the next level.

Ophir RF

Ophir RF – Since 1992, Ophir RF has been designing and manufacturing High Power RF/Microwave Amplifier Systems and Modules for Defense Applications, EMC, and Test & Measurement purposes. Our capabilities include broadband, multi-octave amplifiers from 10 kHz to 40 GHz. Power ranges up to thousands of watts are achievable CW, and pulsed power in the tens of thousands of watts are no problem. All Ophir RF Amplifiers are made in the USA.

PPG Cuming-Lehman Chambers

PPG Cuming-Lehman Chambers specializes in the design and construction of RF shielded anechoic chambers for the commercial and defense markets. Our staff has the expertise and dedication to provide quality turnkey anechoic chamber facilities for EMC and high frequency applications. With over fifty years of construction experience, our company has built a solid reputation of completing our projects on time and within budget. Our company was established as a general construction firm, we're capable of building host building structures to house our anechoic chambers. Our past project references demonstrate the quality of our workmanship and the vast experience we've gained over the years. Our design/build approach ensures that our chambers meet the specifications the first time, on time and without expensive modifications or retrofits.

Exhibitors

Quantic PMI

Quantic PMI (Planar Monolithics), established in 1989, is a leading provider of high-performance RF and microwave components and subsystems spanning DC to 70 GHz. For over three decades, we have earned the trust of defense, communications, commercial, and consumer industries by delivering reliable, custom-engineered solutions for mission-critical applications. Our growing portfolio includes advanced hybrid MMIC components, modules, and subsystems designed to meet the most demanding requirements. At Quantic PMI, our mission is simple: to provide cutting-edge RF and microwave solutions that help our customers succeed today and give them a competitive edge for tomorrow.

Raymond EMC

Raymond EMC specializes in the engineering, design, fabrication, installation, and testing of custom radio frequency (RF) shielded enclosures, reverb, and anechoic chambers for military, government, automotive, high-tech, medical, medical, and industrial applications. Raymond EMC prides itself on being an industry leader in product quality, performance, and innovation while providing unmatched client care and product support.

Raytheon

Raytheon – The Effector RF Products Department provides innovative, reliable, and affordable RF Product and Wireless Communications solutions for missile system applications for our customers across all Mission Areas. We proactively leverage successes from previous designs while focusing on future technologies, process improvements, and efficiency gains. RF and Communication Products include: Data Links, Exciters, Receivers, Transmitters, RF Sensors, Phased Arrays, Antennas, Radomes, Test Hoods, RF Mechanical Design, Target Detection Devices, and RF Labs Support. We support all phases of program execution from initial concept through development, transition to production, and sustainment efforts.

Resonant Sciences

Resonant Sciences LLC is a growing leader in the defense industry with world-class experts in six focus areas: Advanced Apertures, EM Measurement Systems & Analysis, Aerospace Manufacturing, Integrated Electronics, EO/IR, and Instrumentation Radars. Resonant Sciences' facilities include an electronics lab, a 60-foot anechoic chamber, a pick and place machine, and a variety of specialized test equipment. Our team also has significant experience sup porting down range installations and flight testing. With our vertical integration and dynamic culture, Resonant Sciences can move quickly from prototypes to fully fielded operational systems.

Rohde & Schwarz USA

Rohde & Schwarz is one of the world's leading manufacturers of Test & Measurement, Secure Communications, Monitoring and Network Testing, and Broadcasting equipment. Founded more than 80 years ago, the independent company has an extensive sales and service network with subsidiaries and representatives in more than 70 countries. Incorporated in the United States since 1978, Rohde & Schwarz USA, Inc. has a large team of sales and application engineers throughout North America with regional offices in Maryland, Texas, California, and Oregon.

Exhibitors

Samtec, Inc.

Samtec, Inc., a worldwide manufacturer of electronic interconnect solutions, is dedicated to developing and advancing technologies that optimize performance through the entire signal channel, from transmit to receive. Samtec offers high-frequency, Precision RF solutions exceeding 110 GHz. Precision RF solutions are manufactured with precise tolerance interfaces to ensure superior electrical repeatability and high mechanical stability. Solutions include cable assemblies, cable connectors and board connectors for push-on, threaded and high-density ganged applications. Understanding the interface between a high-frequency air dielectric coaxial connector and a PCB is complex, Samtec's team of RF and Signal Integrity engineers can assist with optimizing RF launch design,and provide simulation and physical test-and-measurement verification. Custom product solutions are also available. For a complete listing of products and services visit samtec.com/PrecisionRF.

Sensor Concepts

Sensor Concepts, a Raptor Scientific® company, has a deep legacy of providing field-level RCS measurement systems for 5th and 6th generation platforms. Founded as SCI in 1996, the company's dedication to field-ready RCS measurement systems is unrivaled. Our new flagship product line, NEXIS (NEXt generation Inspection System), introduces cutting-edge modular technology building blocks, enabling tailored system configurations for virtually any test environment, from flightline to manufacturing to R&D settings. Modular payloads provide coverage from UHF thru Ka Band, with full scan speeds under 30 seconds. NEXIS represents a bold step forward in delivering agile, mission-ready inspection systems for current and future platforms.

SPEAG – Schmid & Partner Engineering AG

SPEAG – Schmid & Partner Engineering AG is the leading developer of advanced test equipment for evaluating electromagnetic (EM) fields. Our smart, high-performance products have a plethora of applications, including future technologies such as 6G. On the booth: DASY8 – the high precision EM near-field scanning platform covering 3KHz to 110GHz for SAR, PD, APD, WPT, HAC; DAK Dielectric Assessment Kit and DAK-RES (Resonator) for high-precision dielectric parameter characterization (permittivity, conductivity, loss tangent); EM Phantoms reproduce the effect of the body on electromagnetic fields; SIM4LIFE – simulation platform for cloud and desktop for EM design and safety evaluation of wireless devices.

Sprinkler Innovations

Sprinkler Innovations manufactures the only FM-approved, self-retracting telescoping sprinkler assemblies specifically designed for Anechoic and EMC chambers. We offer comprehensive services including design, installation, maintenance, and testing for our retractable sprinkler head systems. Proudly made in the USA, our assemblies have been installed in thousands of facilities worldwide. Whether you're planning a new build or retrofitting an existing chamber, our team can help seamlessly integrate self-retracting sprinkler technology into your next project.

STAR Dynamics

STAR Dynamics – Inspiring Innovation in people, technology and the nation. With extensive history in the international, defense-related R&D, Test and Evaluation community, leveraging a product legacy of ultra-wideband RCS/Imaging and precision Time Space Position Information tracking Instrumentation Radar systems. Established in 1988, STAR Dynamics has a strong pedigree of more than thirty-five years of development, manufacturing, sales and aftermarket support of industry-leading systems, globally recognized as the industry leader of instrumentation systems for commercial and military applications. STAR Dynamics is a

Veteran-Owned Small Business, which has facilitated expansion of its technology within the international defense community. STAR Dynamics is focused on providing the best technology and support possible to its domestic and international customers, and investing in technologies to maintain market superiority.

TDK RF Solutions

TDK RF Solutions Inc., belonging to TDK Corporation's EMC & RF Engineering Business Division, was established in Cedar Park, Texas in 1987 and acquired by TDK in 1998. TDK RF Solutions is a world leader in the design, development, and manufacture of technical solutions for the electromagnetic compatibility testing and antenna measurement industries. We offer a complete range of solutions including automated test systems, TDK anechoic chambers, RF absorbers, antennas, software, and a wide range of test products.

TEVET

TEVET specializes in acquiring technical equipment, test systems, and lab and production supplies for engineers and scientists. We are committed to delivering high-quality solutions throughout the supply chain that return value and reduce risk. We bring an additional layer of unmatched service to our customers while providing transparency and improvements into the procurement process, all while increasing the velocity of the transaction. We understand the speed of need. Your trusted source of award-winning solutions!!

Virginia Diodes, Inc. (VDI)

VDI manufactures state-of-the-art test and measurement equipment for mm-wave and THz applications. These products include Vector Network Analyzer, Spectrum Analyzer and Signal Generator Extension Modules that extend the capability of high-performance microwave measurement tools to higher frequencies. VDI's component products include detectors, mixers, frequency multipliers and custom systems for reliable operation at frequencies between 50 GHz and 2 THz. All VDI components include in-house fabricated GaAs Schottky diodes and microelectronic filter structures.

Technical Co-Sponsors

ACES

The Applied Computational Electromagnetics Society (ACES) provides a forum for issues relevant to numerical modeling in applied electromagnetics. The primary focus of ACES is on computational techniques, electromagnetics modeling software, and applications. The Applied Computational Electromagnetics Society offers the ACES annual symposium, publications, code user groups, benchmark problem solution workshops, short courses, software demonstrations, and other activities which serve the professional community.

EurAAP

The European Association on Antennas and Propagation (EurAAP) is an international not-for-profit Association with a scientific, educational and technical purpose, registered in Brussels, Belgium, under European law. The 4 pillars of EurAAP are the European Conference on Antennas and Propagation (EuCAP), the European School of Antennas (ESoA), the Reviews of Electromagnetics (RoE) and the Working Groups (WG).

IEEE Antennas and Propagation Society (AP-S)

The field of interest of the AP-S encompasses: antennas, including analysis, design, development, measurement, and testing; radiation, propagation, and the interaction of electromagnetic waves with discrete and continuous media; and applications and systems pertinent to antennas, propagation, and sensing, such as applied optics, millimeter- and sub-millimeterwave techniques, antenna signal processing and control, radio astronomy, and propagation and radiation aspects of terrestrial and space-based communication, including wireless, mobile, satellite, and telecommunications.
Learn more about:
AP-S: https://ieeeaps.org/AP-S Young Professionals: https://ieeeaps.org/committees/ypa
AP-S Awards: https://ieeeaps.org/awards/complete-list-of-ap-s-awards

IEEE Electromagnetic Compatibility (EMC) Society

The IEEE EMC Society is committed to advancing technology through engineering related to the electromagnetic environmental effects of systems - to be compatible with themselves and their intended operational environment. Founded in 1957, the EMC Society addresses standards, measurement techniques and test procedures, instrumentation, equipment and systems characteristics, interference control techniques and components, education, computational analysis, and spectrum management, along with scientific, technical, industrial, professional or other activities that contribute to this field. With more than 3,500 members around the world, over 80 chapters globally, active Young Professionals and Women in Engineering communities, an annual symposium, as well as five peer-reviewed publications available on IEEE Xplore, the EMC Society welcomes your involvement! Visit www.emcs.org for more information.

Technical Co-Sponsors

IEEE Microwave Theory and Technology Society (MTT-S)

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JOE PAGAC

Monday, November 3

8:00–9:00 am Meeting Opening/Keynote Address

8:00–8:10 am Welcome and Introduction of Keynote Speaker: Michelle Lepage (AMTA President)

8:15–8:55 am Keynote Speaker: "Pursuing Disruptive Technologies in Electromagnetics & Additive Manufacturing": Dr. Raymond C. Rumpf, FSPIE, SMIEEE

8:55–9:00 am Opening Remarks and Technical Session Overview: Dr. Jorge L. Salazar-Cerreno (Technical Coordinator)

Session 1

9:00–10:00 am Robotic and UAV Antenna Measurements I
Chair: Olav Breinbjerg (ElMaReCo)

9:00–9:20 am *000079: *Linear Rail Kinematic Calibration Using a Legendre Polynomial Model,* Benjamin L. Moser[1], Joshua A. Gordon[1], Andrew J. Petruska[2] ([1]National Institute of Standards and Technology, NIST, [2]Colorado School of Mines).

9:20–9:40 am 000102: *Automated Scan Plane Alignment for Robot-Based Planar Near-Field Antenna Measurements,* Roland Moch, Quang Ton, Patrick Pelland (NSI-MI Technologies).

9:40–10:00 am 000105: *Drone-Based Measurement of Patterns in HF Band,* Gabriel F. Altman, Songyi Yen, Dejan S. Filipovic (University of Colorado Boulder).

10:00–10:30 am MORNING BREAK

Session 2

10:30am–12:10 pm Near-Field Measurements I
Chair: Daniel Aloi (Oakland University)

10:30–10:50 am 000069: *A Study on the 3-D Probe Position Errors Correction in a Non-Redundant Spherical NF/FF Transformation For Quasi-Planar Antennas,* Francesco D'Agostino, Flaminio Ferrara, Claudio Gennarelli, Rocco Guerriero, Massimo Migliozzi, Luigi Pascarella (Department of Industrial Engineering, University of Salerno - Italy).

10:50–11:10 am 000083: *Derivative Probes and Optimized Sampling in Planar Near-Field Antenna Characterization,* Florindo Bevilacqua[1], Olav Breinbjerg[2], Amedeo Capozzoli[1], Claudio Curcio[1], Angelo Liseno[1] ([1]Dipartimento di Ingegneria Elettrica e delle Tecnologie dell'Informazione, DIETI, Università di Napoli Federico II, [2]ElMaReCo).

11:10–11:30 am 000086: *Efficient Spherical Near-Field Characterization by Means of Singular Value Optimization,* Amedeo Capozzoli, Claudio Curcio, Angelo Liseno, (Dipartimento di Ingegneria Elettrica e delle Tecnologie dell'Informazione, DIETI, Università di Napoli Federico II).

11:30–11:50 am 000062: *Exploration of a More Conformal AUT Volume for Wide-Mesh PNF Sampling,* Scott T. McBride (NSI-MI Technologies).

11:50am–12:10 pm 000121: *Investigating the Uncertainty Contribution of the NF/FF Transformation Processing for Electrically Large Antennas,* Francesco Saccardi[1], Stephane Issartel[2], Nicolas Gross[2], Lars J. Foged[1] ([1]Microwave Vision Group, MVG, Italy, [2]Microwave Vision Group, MVG, France).

12:10–1:30 pm EXHIBITOR SPONSORED LUNCH

Session 3

1:30–2:30 pm Poster Session (Best Paper Competition)
Chair: Peter Collins (Resonant Sciences)

2:30–3:00 pm AFTERNOON BREAK

Session 4

3:00–5:20 pm Antenna Measurements I
Chair: Fabian Bette (Rohde & Schwarz)
Invited Speaker: Vince Rodriguez (NSI-MI Technologies)

3:00–3:20 pm 000046: *Modeling the Effect of Disruptions on the Absorber Treatment on Antenna Measurements,* Vince Rodriguez (NSI-MI Technologies).

3:20–3:40 pm 000064: *Enhanced Gain Extrapolation,* Joshua A. Gordon, Benjamin L. Moser (National Institute of Standards and Technology, NIST).

3:40–4:00 pm *000152: *Efficient Phase-Only Pattern Optimization for Phased Array Apertures,* Brendan W. Wilson, Spencer Wallentine, Ian J. Gecse, R. Jerry Jost (STAR Dynamics).

4:00–4:20 pm 000120: *Planetary Radar High Power Array Feed Calibration,* Zachary Dunn[1], Domingo Cruz-Pagan[1], Steven Wilkinson[1], Patrick Taylor[2] ([1]RTX Raytheon, [2]National Radio Astronomy Observatory).

4:20–4:40 pm *000054: *How Pink Noise Limits the Achievable SNR of an Antenna Measurement System,* Ryan T. Cutshall (Raytheon, An RTX Company).

4:40–5:00 pm 000126: *NASA's Horizontal Planar Near-Field Facility: A Large-Scale, High-Accuracy System for Spaceborne Antenna Testing,* Domenic Belgiovane[1], Jim Downey[2], Bryan Schoenholz[2], Felix Miranda[2], Evan Beers[1], James Caputo[1] ([1]MVG - OATI, [2]NASA Glenn Research Center).

* **Best Paper Competition finalists** are identified by an asterisk (*) and
+ **Student Best Paper Competition finalists** are identified by a plus (+) in this program.

5:00-5:20 pm 000148: *Experimental Validation of a Plane Wave Generator for Low Frequency Applications,* Francesco Saccardi, Vincenzo Schirosi, Andrea Giacomini, Jaydeep Singh, Lars Foged, Nicolas Gross, Evgueni Kaverine, Edward Szpindor, Tom McKeown (Microwave Vision Group, MVG).

Tuesday, November 4

8:00–8:25 am IEEE AP-S Invited Speaker: Dr. Christophe Fumeaux, The University of Queensland, "Beamforming with Compact Multi-Port Multi-Mode Antennas"

8:25–8:30 am Daily Announcements and Technical Session Overview: Dr. Jorge L. Salazar-Cerreno (Technical Coordinator)

Session 5

8:30–9:30 am Antenna Measurements II
Chair: Stuart Gregson [1,2] ([1]Next Phase Measurements, [2]Queen Mary University of London)

8:30–8:50 am 000104: *Spatial Averaging Technique For Improved Mimo Radar Calibration In Compact Antenna Test Ranges,* Simon Heining[1], Reinhard Feger[1,2], Christoph Wagner[3], Andreas Stelzer[1] ([1]Johannes Kepler University Linz, [2]Christian Doppler Laboratory for Distributed Microwave- and Terahertz-Systems for Sensors and Data Links, [3]Silicon Austria Labs).

8:50–9:10 am 000142: *Technique For Antenna Gain Correction Based On Return Loss Compensation,* Aidan Hynes[1], Greg Brzezina[2], Ken Oueng[2], Adrian Momciu[2] ([1]University of Waterloo, [2]Canadian Space Agency).

9:10–9:30 am 000146: *IEEE Std 1720: Near-Field Measurement Standard 2025 Update,* Lars Jacob Foged[1], Vicente Rodriguez[2], Jeffrey Fordham[3], Justin Dobbins[4], Vikass Monebhurrun[5] ([1]Microwave Vision Group, MVG, Italy, [2]NSI-MI Technologies, [3]Retired, AMTA, [4]Raytheon Technologies, [5]CentraleSupélec).

9:30–10:00 am MORNING BREAK Please join Next Phase Measurements at their booth for a special live demonstration!

Session 6

10:00am–12:00 pm Robotic and UAV Antenna Measurements II
Chair: Lars Jacob Foged (Microwave Vision Group)
Invited Speaker: Goutam Chattopadhyay[1,2] ([1]President, IEEE Microwave Theory and Technology Society, [2]California Institute of Technology)

10:00–10:20 am Invited: *Space Exploration and Our Place in the Universe,* Goutam Chattopadhyay (California Institute of Technology)

10:20–10:40 am 000063: *Compressive Sensing Techniques For Rapid Production Test And Diagnostics Of Electrically Large Nose-Mounted Commercial Radomes,* Stuart F. Gregson[1,2], Clive G. Parini[2] ([1]Next Phase Measurements, [2]Queen Mary University of London).

10:40–11:00 am 000158: *Multi-Functional Robotic Antenna Measurement System Automated Probe Changer,* Patrick Schluper, Bert Schluper, Kim Hassett, Greg Masters (Next Phase Measurements).

11:00–11:20 am 000047: *On The Effects Of Industrial Robotic Arms On The Pattern Of The Probe For Near-Field Measurements,* Vicente Rodriguez[1], P. Mark Ingerson[1], Gwenaël Dun[2], Esra Celenk[1] ([1]EM Analysis Group, NSI-MI Technologies, USA, [2]EM Analysis Group, NSI-MI Technologies, France).

11:20–11:40 am +000115: *Robot-Based Near-Field Antenna Measurements On Polyhedral Sampling Surfaces,* Henrik Jansen[1], Adrien A. Guth[1], Dirk Heberling[1,2] ([1]Institute of High Frequency Technology, RWTH Aachen University, [2]Fraunhofer Institute for High Frequency Physics and Radar Techniques, FHR).

11:40am–12:00 pm +000080: *Autonomous Adaptive Sampling For Planar Antenna Measurements With A Robotic-Arm System,* Celia Fontá Romero[1,2] Ana Arboleya[2], Manuel Sierra Castañer[1] ([1]Information Processing and Telecommunications Center, Universidad Politécnica de Madrid, [2]Microwave Engineering and Radiocommunication Systems Group, Universidad Rey Juan Carlos).

12:00–1:30 pm BUSINESS LUNCH

Session 7

1:30–2:30 pm Poster Session I
Chair: Elizabeth Joyce (Raytheon, An RTX Business)

+000101: *Design of 2P3T Switch Modules for a Multiple Probe Near-Field Measurement System,* Hui-Jun Woo[1], Kyeong-Min Na[1], Jeong-An Le[2], Jong-Hyuk Lim[2], Soon-Soo Oh[1] ([1]Dept. of Electrical Engineering, Chosun University, [2]Communications Conformity Assessment Center, National Radio Research Agency, RRA).

000133: *A Novel Multi-Functional Lens-Integrated Metasurface Antenna for Sub-THz 6G Communication,* Awais K. Bangash, Syed S. Jehangir (Materials, Antennas, Radar, and Sensors, MARS, Lab, School of Electrical and Computer Engineering, ECE, Oklahoma State University).

+000053: *Advanced Multi-Probe Near-Field Scanner System Utilizing Bi-Polar and Phased Array Antenna Technology,* Edgar A. Oblitas[1,2], Luis Felipe Moncada-Calmet[1,2], Jorge L. Salazar-Cerreño[1,2,3] ([1]Advanced Radar Research Center, ARRC, [2]The University of Oklahoma, [3]eMWave-Tech).

000138: *An Integrated UWB GRIN Lens Probe for UAV-Based In-Situ Characterization Of Radars And Communication Systems,* Syed S. Jehangir[1], Jorge L. Salazar-Cerreño[2,3,4] ([1]Materials, Antennas, Radar, and Sensors, MARS, Lab, School of Electrical and Computer Engineering, ECE, Oklahoma State University, [2]Advanced Radar Research Center, ARRC, [3]The University of Oklahoma, [4]eMWave-Tech).

000100: *Anechoic Chamber Reflection Localization Using Range Estimation and Trilateration,* Oren Longman, Igal Kotzer (General Motors Corporation).

000098: *Antenna-Coupled Electrode Electro-Optic Modulator for 80 GHz Band Time Domain Measurement,* Satoru Kurokawa[1,2], Michitaka Ameya[1], Masahiro Sato[3], Masatoshi Onizawa[3], Hiroshi Murata[4] ([1]National Institute of Advanced Industrial Science and Technology, AIST, [2]7G aa, Tsukuba, [3]Seikoh Giken, [4]Mie University).

000108: *Design and Analysis of a mmWave 5G-DSRC MIMO-Array Antenna for Automotive V2X Applications,* Mohammad Shahed Pervez[1], Amanpreet Kaur[2], Daniel N. Aloi[3] ([1]Vice President, AMTA, PhD Student, Oakland University, [2]Assistant Professor, Oakland University, [3]Director of Research, Oakland University).

000056: *Enhanced Transmission Measurements Using Gaussian Far Field Weighting,* Garrett Harris, Carl Pfeiffer (Air Force Research Laboratory).

000067: *High-Resolution mmWave Imaging Using MIMO Antenna Arrays for Non-Invasive Diagnostics,* Mohammad Shahed Pervez[1], Amanpreet Kaur[2] ([1]PhD Student, Oakland University, Assistant Professor, [2]Oakland University).

000135: *Improving Simulation Accuracy of Printed Antennas Via Frequency-Dependent Permittivity Adjustment,* Emiliano Campitelli[1], Indra Fuentes[1], Javier Areta[1], Mariano Gomez Berisso[2] ([1]Universidad Nacional de Rio Negro, CITTECA, [2]Instituto Balseiro, CNEA-CONICET).

000057: *In-Situ Radome Measurement with USRP,* Garrett Harris[1], Matthew Stepaniak[2], Chad Shaffer[3] ([1]Air Force Research Laboratory Sensors Directorate, AFRL/RY, [2]Rose-Hullman Institute of Technology, [3]Defense Engineering Corporation).

000154: *Reconstruction of Scattering Signatures via Computational Imaging Using a Metasurface-Based Transmitting Antenna,* Yeonghoon Noh[1], Aaron Diebold[2], David R. Smith[1] ([1]Department of Electrical and Computer Engineering, Duke University, [2]Metacept Inc).

000065: *Wall-Reflectivity Technique; Improvements in the Instrumentation,* Marc Dirix[1,2], Amin Enayati[1], Joachim Vanwesemael[1] ([1]E&C Anechoic Chambers NV, [2]Institute of High Frequency Technology).

2:30–3:00 pm AFTERNOON BREAK

Session 8

3:00–4:00 pm Advanced Measurements
Chair: Jeffrey Fordham (NSI-MI Technologies, Retired)
Invited Speaker: Dirk Heberling (Institute of High Frequency Technology, RWTH Aachen University & Fraunhofer Institute for High Frequency Physics and Radar Techniques FHR)

3:00–3:20 pm 000112: *Exploring the Potential of Robotic Systems for Antenna Measurements,* Dirk Heberling[1,2], Henrik Jansen[1] ([1]Institute of High Frequency Technology, RWTH Aachen University, [2]Fraunhofer Institute for High Frequency Physics and Radar Techniques FHR).

3:20–3:40 pm *000165: *Free-Space Characterization of Modulation Effects on Reflective Reconfigurable Metasurfaces,* Christopher T. Howard, David R. Reid, Christopher W. Peterson, Kenneth W. Allen (Advanced Concepts Laboratory, Georgia Tech Research Institute).

3:40–4:00 pm 000143: *Near-Field Nondestructive Measurements of Complex Permittivity for Woody Breast Detection in Chicken Meat,* Ren D. Geryak[1], Samir Trabelsi[2], Brian Bowker[2], Zachary Jones[3] ([1]Compass Technology Group, LLC, [2]Quality and Safety Assessment Unit, U.S. National Poultry Research Center, [3]Hacu Student, Quality and Safety Assessment Unit, U.S. National Poultry Research Center).

Session 9

4:00–5:20 pm Antennas and Measurements for 5G and Future Communication Systems
Chair: Ryan T. Cutshall (Raytheon, An RTX Business)

4:00–4:20 pm 000110: *Cost Effective Ku-Band Antenna Passive Positioning and Navigation Using LEO Satellites,* Chi-Chih Chen (Electroscience Lab, The Ohio State University).

4:20–4:40 pm 000092: *Cellular Vehicle to Vehicle Antenna Placement Measurement on a Motorcycle,* John F. Locke[1], Daniel N. Aloi[2], Zahra Katbay[1] ([1]Molex CVS, [2]Oakland University).

4:40–5:00 pm *000172: *Demonstration of Accurate Near-Field Pattern Measurement on Satellite Payloads Driven by External 10 MHz Reference Signal,* Antonio Riccardi[1], Giulia Putortì[2], Luis Rolo[1], Damiano Trenta[1] ([1]ESA-ESTEC, [2]Thales Alenia Space).

5:00–5:20 pm 000131: *Evaluating Reconfigurable Intelligent Surfaces Under Plane Wave Conditions,* Michael D. Foegelle (Keysight Technologies).

5:30-6:30pm IEEE 1720 (Near-Field) Working Group

Wednesday, November 5

8:00–8:25 am EurAAP Invited Speaker: Dr. Elena Saenz, European Space Research and Technology Centre (ESTEC), European Space Agency (ESA), "Overview of the latest antenna measurement developments and techniques at the European Space Agency"

8:25–8:30 am Daily Announcements and Technical Session Overview: Dr. Jorge L. Salazar-Cerreno (Technical Coordinator)

Session 10

8:30–9:30 am Near-Field Measurements II
Chair: Pat Pelland (NSI-MI Technologies)

8:30–8:50 am 000159: *Investigation of the Optimal Sampling Criteria for Antenna Measurements in the Reactive Near-field Region,* William D. Dykeman[1] , Ryan B. Green[1], Dale Canterbury[2], Christopher Headrick[2], Ali Sabet[3] ([1]Department of Electrical and Computer Engineering, Mississippi State University, [2]Raytheon Technologies, [3]EMAG Technologies, Inc.).

8:50–9:10 am +000155: *Low-Cost Modular Planar Near-Field Scanner,* Jacob Stewart, Jeremiah Schwartz, Cody Scarborough (The University of Colorado Boulder).

9:10–9:30 am 000150: *Predicting Near-Fields from Wave Parameter Measurements of Microwave Devices,* Vishnuvardhan V. Iyer[1,2], Jacob D. Rezac[1], James C. Booth[1] ([1]Communications Technology Laboratory, [2]Dept. of Physics, CU Boulder).

9:30–10:00 am MORNING BREAK

Session 11

10:00am–11:40 am RF Material Design and Characterization
Chair: Hirsch Chizever (Delta Sigma Company)
Invited Speaker: Mauro Ettorre (Michigan State University)

10:00–10:20 am Invited: *Wideband Long Slot Arrays: Analysis, Design, and Applications for Next Generation Communication Networks and Beyond,* Mauro Ettorre (Michigan State University)

10:20–10:40 am 000061: *A Microwave Spot-Probe Method For Tuning Aircraft Radomes,* John Schultz (Compass Technology Group).

10:40–11:00 am 000044: *Optimizing Wi-Fi Access Points in an Airplane Fuselage,* Shriya Kapoor[1], Gopinath Gampala[2] ([1]School of Electrical and Computer Engineering, Georgia Institute of Technology, [2]Altair Engineering, Inc.).

11:00–11:20 am 000171: *Measuring Scattering Characteristics Caused by Imperfections in CATR Panel Gaps with Conductive Filler,* Antonio Riccardi, Luis Rolo, Damiano Trenta (ESA-ESTEC).

11:20–11:40 am +000122: *PiCi For Stripline,* Seth Myers, Michael Havrilla (Air Force Institute of Technology, AFIT).

11:40am–12:00 pm Free time.

12:30-1:30pm IEEE 1128 EMC Standard (Absorber) Working Group

12:00–1:30 pm LUNCH

Session 12

1:30–2:30 pm Poster Session II
Chair: Brendan Wilson (STAR Dynamics)

000090: *International Comparison of Antenna Calibration Results for EMC Applications in 18-40 GHz Band,* Jerdvisanop Chakarothai[1], JeongAn Lee[2], Lira Hamada[1], Jong-Hyuk Lim[2], Katsumi Fujii[1] ([1]National Institute of Information and Communications Technology, NICT, [2]National Radio Research Agency, RRA).

+000167: *Microwave Non-Destructive Sensing Using Conformal Metasurface Antennas,* Michael Inman, Sajedeh Keshmiri, Mohammadreza F. Imani (Arizona State University).

000103: *Over-The-Air Testing of Automotive UEs in an Anechoic Chamber,* Igal Kotzer (General Motors Corporation).

000161: *Point Cloud Generation with mmWave MIMO Radar: Measurements And Analysis,* L. Felipe Moncada Calmet[1,2], Nathan Goodman[1,2], Jorge L. Salazar-Cerreño[1,2] ([1]The University of Oklahoma, [2]Advanced Radar Research Center, ARRC).

000073: *Practical Implementation of a 3-Axis, Dual-Feed, Shielded Loop Probe Incorporating a Re-Entrant Infinite Balun,* James McLean, James Wooten, Ted Harmon, Robert Sutton (TDK Corp).

000168: *Reconstructing Microwave Synthetic Aperture Images Using Neural Fields,* Cecilio Obeso, Kavian Zirak, Omkar Shailendra Vengurlekar, Suren Jayasuriya, Mohammadreza F. Imani (School of Electrical, Computer and Energy Engineering, Arizona State University).

+000137: *RF Energy Harvesting in Connected Vehicles: A Dual-Use Antenna Approach for V2X and Power Collection,* Mohammad Shahed Pervez[1], Amanpreet Kaur[2] ([1]PhD Student, Oakland University, [2]Assistant Professor, Oakland University).

000094: *Spain AMTA Node: Promoting Antenna Measurement Activities in Spain,* Manuel Sierra Castañer[1], Tony Sánchez[2], Javier Portilla[2], Fernando Las-Heras[3], Jorge Calatayud-Maeso[1], Celia Fontá-Romero[1], Ana Arboleya[4], Pablo Padilla[5], Juan Fran-

cisco Valenzuela[5] ([1]Universidad Politécnica de Madrid, [2]Antenna Systems Solutions, [3]Universidad de Oviedo, [4]Universidad Rey Juan Carlos de Madrid, [5]Universidad de Granada).

000113: *System-Level Simulation of Large Active Antenna Arrays Using Load-Pull-Based Power Amplifier Measurements,* Wissam Saabe[1], Md Khadimul Islam[2], Enow Tanjong[2] ([1]Dassault Systèmes SE, [2]Dassault Systèmes Americas Corp.).

000106: T*rue Far-Field Distance of Lens Antennas,* Jaegeun Ha (Nokia Bell Labs, NBL).

000089: *Updating Antenna Ranges for Improved Performance and Extended Lifetime,* Michael Ungureanu, Christopher G. Hynes, Rodney G. Vaughan (Sierra Wireless Lab, Simon Fraser University).

000097: *Machine Learning Methods Applied to Broadband Electromagnetic Characterization,* Aymar Cublier Martínez[1], Jorge Frövel de la Torre[2], Ruy Sanz González[1], Borja Plaza Gallardo[1], David Poyatos Martínez[1] ([1]National Institute for Aerospace Technology, [2]Universidad Politecnica de Madrid).

000170: *Characterization of an On-Chip THz Hybrid-Fed Dual-Polarized Antenna,* Russell W. Raldiris Torres, Georgios C. Trichopoulos (School of Electrical, Computer, and Energy Engineering, Arizona State University).

2:30–3:00 pm AFTERNOON BREAK

Session 13

3:00–5:40 pm Imaging, Algorithms, and Processing Techniques
Chair: Amedeo Capozzoli (Università di Napoli Federico II)
Invited Speaker: Olav Breinbjerg (ElMaReCo)

3:00–3:20 pm *000074: *Correction of Smearing Error due to Signal Averaging with On-The-Fly Sampling for Electromagnetic Field Measurements,* Olav Breinbjerg (ElMaReCo).

3:20–3:40 pm 000134: *A Novel Method for Anechoic Chamber Evaluation Using Convenient Circular Movement and Modal Analysis in Place of Linear Scanning,* Yibo Wang, Zhong Chen, Garret McKerricher (ETS-Lindgren).

3:40–4:00 pm 000129: *A Numerical Investigation of the Application of Compressed Sensing in Spherical Mode Filtering for Near- or Far-Field Antenna Measurements,* Zhong Chen[1], Stuart F. Gregson[2,3], Yibo Wang[1], Rostyslav F. Dubrovka[3] ([1]ETS-Lindgren, [2]Next Phase Measurements, [3]Queen Mary University of London).

4:00–4:20 pm 000162: *Adaptive and Compressive Near-Field Sampling of Embedded Systems,* Jacob D. Rezac[1], Vishnuvardhan V. Iyer[1,2], James C. Booth[1] ([1]Communications Technology Laboratory, National Institute of Standards and Technology, NIST, [2]Department of Physics, University of Colorado).

4:20–4:40 pm *000109: *Assessing the Accuracy of Huygens Boxes for Flush Mounted Antenna Placement Applications from VHF Measurements,* Zain Haider[1], Francesco Saccardi[2], Lars J. Foged[2] ([1]Microwave Vision Group, MVG, France, [2]Microwave Vision Group, MVG, Italy).

4:40–5:00 pm 000164: *C2MI: A Covariance-Coupling Sparse Recovery Algorithm for Metasurface-Based Microwave Imaging,* Firas Slewa Dawod[1], Mohammed H. Arif[2], Renato Negra[2], Sayan Roy[1] ([1]AERIAL Lab, School of Science and Engineering, University of Missouri-Kansas City, [2]Chair of High Frequency Electronics, RWTH Aachen University).

5:00–5:20 pm 000139: *Traceable Designer Channels for Device Testing in Reflective Environments at 60 GHz,* Iyemeh E. Uchendu[1,3], Mohamed Kashef[2], Kate A. Remley[1], Joshua M. Kast[1], Richard Candell[2], Robert D. Horansky[1] ([1]National Institute of Standards and Technnology, NIST, Colorado, [2]National Institute of Standards and Technnology, NIST, Maryland, [3]University of Colorado).

5:20–5:40 pm 000160: *Emissivity Measurements Of Microwave Blackbody Using Terahertz Focusing Lenses,* Rixi Peng[1], Dazhen Gu[1], Benjamin L. Moser[2], Joshua A. Gordon[2] ([1]National Institute of Standards and Technology, NIST, Communications Technology Laboratory, CTL, Spectrum Technology and Research Division, [2]National Institute of Standards and Technology, NIST, Communications Technology Laboratory, CTL, RF Technology Division).

Thursday, November 6

8:15–8:20 am Daily Announcements and Technical Session Overview: Dr. Jorge L. Salazar-Cerreno (Technical Coordinator)

Session 14

8:20–10:00 am Recent European Activities on Antenna Measurements
Chair: Tian Hong Loh[1] and Francesco Saccardi[2] ([1]National Physical Laboratory, [2]Microwave Vision Group)

8:20–8:40 am *000051: *Use of the Generalized Addition Theorem for Spherical Waves for the Reflection Suppressioin by Spherical Mode Filtering,* Marc Dirix [1,2], Stuart Gregson [3,4], Rostyslav Dubrovka[4] ([1]Emerson & Cuming Anechoic Chambers, [2]Institute of High Frequency Technology, [3]Next Phase Measurements, [4]Queen Mary University of London)

8:40–9:00 am +000075: *Automotive OTA Near-Field Measurements with SDR-Enabled Phase Retrieval,* Alejandro Antón Ruiz[1], Lukas Berkelmann[2], Andrés Alayón Glazunov[1,3] ([1]Department of Electrical Engineering, University of Twente, [2]Volkswagen AG, [3]Department of Science and Technology, Linköping University).

9:00–9:20 am 000111: *Extended Uncertainty Analysis of a Multiprobe Antenna Measurement System for Complex Platform Testing,* Francesco Saccardi[1], Andrea Giacomini[1], Jaydeep Singh[1], Lars Foged[1], Thierry Blin[1], Nicolas Gross[1], Arthur Romeijer[2] ([1]Microwave Vision Group, MVG, [2]Pulsaart by AGC).

9:20–9:40 am 000077: *RF Assessment of the Mechanical Design of the Compact Antenna Test Range for HERTZ 2.0,* Cecilia Cappellin[1], Pasquale Nicolaci[1], Giuseppe Valsecchi[2], Claudio Franchini[2], Mauro Maggioni[2], Luis Rolo[3], Antonio Riccardi[3] ([1]TICRA, [2]MediaLario SRL, [3]ESA ESTEC).

9:40–10:00 am 000076: *A Rigorous Evaluation of Total Active Reflection Coefficient-Based Radiation Efficiency for MIMO Antennas in a Reverberation Chamber,* Jerdvisanop Chakarothai[1,2], Tian Hong Loh[2] ([1]National Institute of Information and Communications Technology, NICT, [2]National Physical Laboratory, NPL).

10:00–10:30 am **MORNING BREAK**

Session 15

10:50 –11:50 am Antenna Design and Analysis
Chair: John Schultz (Compass Technology Group)
Invited Speaker: Oscar Quevedo-Teruel (KTH Royal Institute of Technology)

10:30–10:50 am 000059: *Efficient and Fast Ray Tracing Method for Antenna Performance Simulation,* Oscar Quevedo-Teruel (Division of Electromagnetic Engineering and Fusion Science, KTH Royal Institute of Technology).

10:50–11:10 am 000156: *Design of Radar Antenna and Performance Analysis for V2V and V2I Communications,* Apurva Shekar[1], Anudeep Bellary[1], D.V.B. Murthy[2] ([1]Altair Engineering India Pvt. Ltd., [2]Altair Engineering, Inc.).

11:10–11:30 am 000123: *Modeling of Standard Gain Horns Using Advanced Electromagnetic Simulation Techniques,* D.V.B. Murthy[1], C.J. Reddy[1], Afifeh Khatabi[2], Justin Dobbins[2], Domenic Belgiovane[3] ([1]Altair Engineering, Inc., [2]Raytheon, [3]MVG - Orbit Advanced Technologies, Inc.)

11:30–11:50 am 000071: Ellipsoidal Material Characterization System, Hirsch Chizever (Delta Sigma Company).

11:50 am–12:10 pm Free time.

12:10–1:30 pm **LUNCH & LEARN**
Speaker: Chuck Penson, Fellow, Antique Wireless Association (AWA), "Waiting for the Go Code: Communications in the Titan II ICBM Program"

Session 16

1:30–2:30 pm RCS Measurements
Chair: Benjamin Moser (National Institute of Standards and Technology)

1:30–1:50 pm 000084: *Full Wave Monostatic Radar Cross Section Computation for Challenging RF Problems,* Mark Whale, Edoardo Baldazzi, Cecilia Cappelin, Martin Haulund Gaede, Oscar Borries (TICRA).

1:50–2:10 pm 000068: *Monostatic to Bistatic Equivalence Theorem for 2-Dimensional Reflection Pattern Measurements of Reconfigurable Intelligent Surfaces,* Fabian T. Bette[1], Onur Kasap[1], Thomas M. Gemmer[1], Hendrik Bartko[1], Benoit Derat[1], Wilhelm Keusgen[2] ([1]Rohde & Schwarz GmbH & Co. KG, [2]Technische Universitaet Berlin).

2:10–2:30 pm 000050: *Validating the Forward Scattered Wave in Bistatic Radar Geometries,* Donald P. Hilliard[1], Michael S. Emire[1], Kenneth Vaccaro[1], Gary Salvail[2], David Marron[2], Jose Cahue[2], Javier Godina[2], Joseph Mesa[2], Lizet Ramirez[2] ([1]Advanced Research and Technology Corporation, [2]Naval Air Warfare Center Weapons Division).

2:30–3:00 pm **AFTERNOON BREAK**

Session 17

3:00–4:40 pm Range Design, Instrumentation, and Characterization
Chair: Yibo Wang (ETS-Lindgren)

Invited Speaker: Georgios C. Trichopoulos (Arizona State University)

3:00–3:20 pm Invited: *Reconfigurable Intelligent Surfaces for Antenna Measurements,* Georgios C. Trichopoulos (School of Electrical, Computer, and Energy Engineering, Arizona State University).

3:20–3:40 pm +000060: *Beyond Conventional Probes: Comparing the Impact of the Geometry on Coaxial Probe Aperture for Medical Applications,* Francisco Escobedo-Segovia[1], Elizabeth Fernandez-Aranzamendi[1,2], Patricia Castillo-Araníbar[1], Ebert San Roman Castillo[1], Adrián Amor-Martín[2], Daniel Segovia-Vargas[2] ([1]Electrical and Electronics Engineering Department, Universidad Catolica San Pablo, [2]Dept. Signal Theory and Communications, Universidad Carlos III de Madrid).

3:40–4:00 pm 000147: *Comparison of Compact Range Quiet Zone Performances as Predicted by Asymptotic Methods vs. Method of Moments,* P. Mark. Ingerson, Vicente Rodriguez (NSI-MI Technologies).

4:00–4:20 pm 000082: *Controlling Undesired Effects in the Design of Complex Waveform Generators,* Amedeo Capoz-

zoli, Claudio Curcio, Angelo Liseno (Dipartimento di Ingegneria Elettrica e delle Tecnologie dell'Informazione, Università di Napoli Federico II).

4:20–4:40 pm 000132: *A Novel Wide-Beam Broadband Feed Enabling Ultra-Compact Antenna Test Ranges,* Adam Tankielun, Shreyas S. Bharadwaj, Ramy A. Gerguis, Fabian Bette, Benoit Derat (Rohde & Schwarz GmbH and Co. KG, Munich, Germany).

Session 18

4:40–5:40 pm The Evolution of Instrumentation and its Impact in Antenna Measurement Techniques
Chair: Tony Sánchez (Antenna Systems Solutions)

4:40–5:00 pm 000136: *Over-The-Air Group Delay Measurements of Frequency-Converting Devices Using a Harmonic Phase Reference,* Benoit Derat[1], Daniel Mueller-Renner[1], Thorsten Lueck[1], Jaydeep Singh[2], Andrea Giacomini[2], Francesco Saccardi[2], Nicolas Gross[2], Lars Jacob Foged[2] ([1]Rohde & Schwarz GmbH and Co. KG, Munich, Germany, [2]MVG, Microwave Vision Group).

5:00–5:20 pm 000116: *The Evolution of RF Instrumentation and Antenna Measurements: Bridging the Gap in Active Device Testing,* Lars Jacob Foged[1], Francesco Saccardi[1], Nicolas Gross[2] ([1]Microwave Vision Group, MVG, Italy, [2]Microwave Vision Group, MVG, France).

5:20–5:40 pm 000095: *Thirty Years of Antenna Characterization in the Millimeter Wave Range at IETR,* Laurent LE COQ (Université de Rennes - IETR).

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November 4
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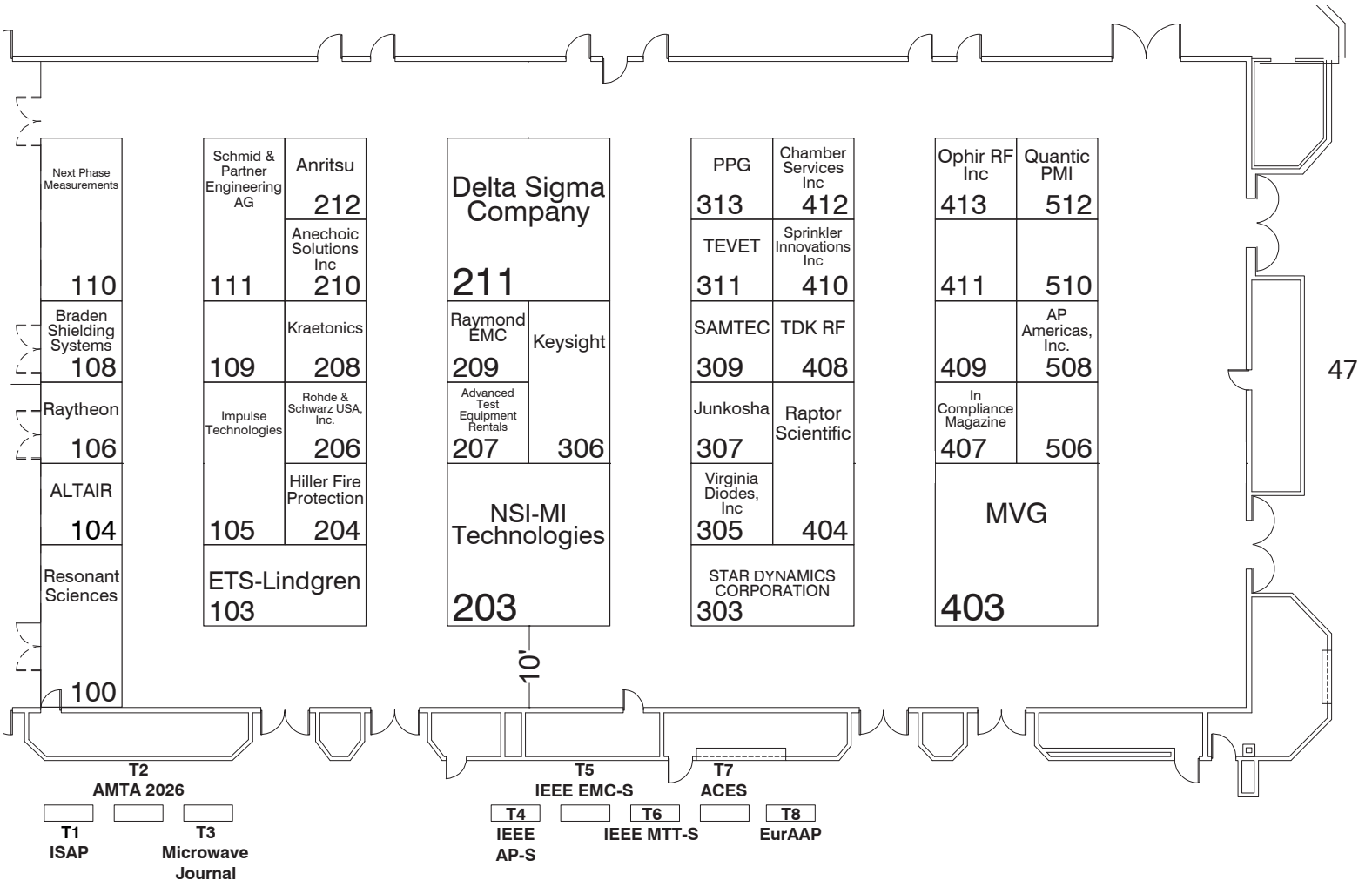
(Closed during Business Lunch from 11:30 a.m. - 1:30 p.m.)

Wednesday
November 5
9 a.m. - 5 p.m.



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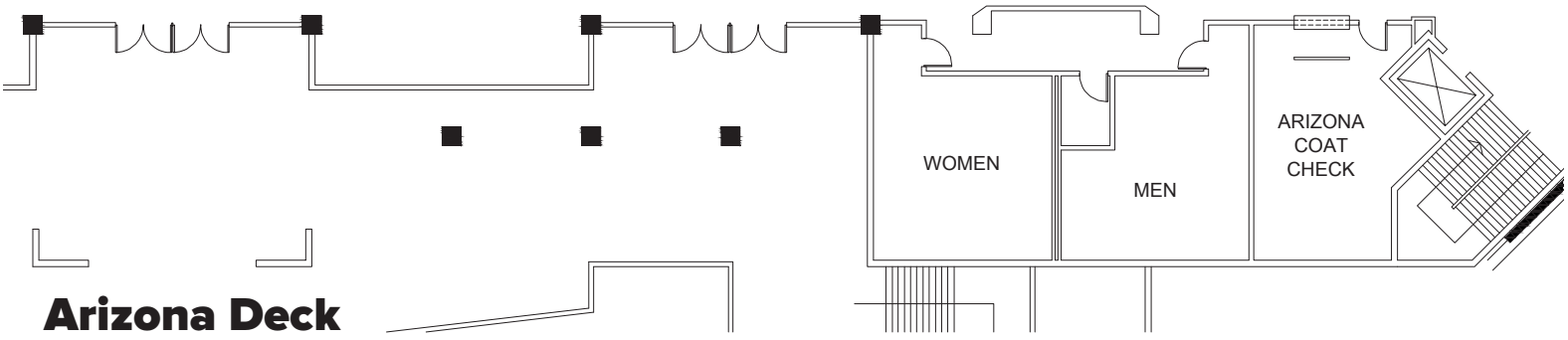

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