2017 Technical Symposium Agenda, Friday 17 November, William Penn Hotel

7:30am	8:30am	Continental Breakfast served to all attendees	
8:00	8:15	Welcome & Introductions	John Facella, P.E.
8:15	9:00	***The KDKA Tower*** - Cavell & Mertz & Assocs.	Mike Rhodes, P.E.
9:00	9:45	***The New ASTV 3.0 TV Standard*** - Meintel, Sgrigoli, & Wallace, LLC	Dennis Wallace
9:45	10:00	Break	
10:00	10:45	***Robots and Radio*** - Youth Presentation	Carissa Ferguson
10:45	11:15	***Progress Report on RCA's Youth Initiative***	Carole Perry
11:15	12:00	***Datacasting for Public Safety*** - SpectraRep	Mark O'Brien
12:00pm	1:15pm	Lunch (outside of William Penn)	
1:15	2:00	***Amazing Breakthroughs and Future Trends in Radar***	Eli Brookner, Ph.D.
2:00	2:20	Break	
2:20	3:05	***TV Channel Repacking*** - GatesAir	Joe Seccia, P.E.
3:05	3:55	***Fractal Metamaterials and the New Class of Directional Antennas*** - Fractal Antenna Systems	Chip Cohen Ph.D., Ryan Thistle
3:55	4:15	***Mesh Network for Emergency Communications for the State of Delaware***	Bill Greenhalgh
4:15pm	4:30pm	Wrap up	John Facella, P.E.

This year, in concert with our special tour of radio station KDKA, the first broadcast station in the U.S., four of our presentations have a unique focus on broadcast technology.

The details on all the presentations and the presenters follow below.

"The KDKA Tower"

Mike Rhodes, P.E., Cavell & Mertz & Associates

Abstract

KDKA is generally attributed to be the first commercial broadcast radio station in the U.S..   The original 1938 KDKA tower was a sectionalized "Franklin" – a 3/4 wavelength tower insulated and fed in the center (a ¾ λ vertical dipole). Because of the configuration, the tower had a large amount of high angle vertical radiation that, at night, generated a sky-wave signal caused interference within the station's own nighttime groundwave coverage area. In 1994, the original tower was replaced due to structural concerns.   A new design was proposed that maintained the ground-wave efficiency of a ¾ λ tower but reduced the vertical radiation. This "modified Franklin" is a half-wave over a quarter-wave, and is still insulated and fed in the middle; but, it also has adjustable circuits at the feed point and at the base to modify the phase relationship of the two sections.

This presentation will describe the original tower design and will explain the design and construction of the current tower built in 1994. The presentation will also serve as an introduction to the tour of the KDKA site on Saturday morning.

Speaker Biography

Michael D. Rhodes, P.E., has spent the last 19 years at Cavell Mertz & Associates as a Senior Engineer working on radio and television allocation, coverage, and interference analysis. He has been involved in all aspects of studio, transmitter and antenna system, design, installation and repair. He is member of the team that maintains CMA's popular website FCCInfo.com. In addition to broadcasting, other interesting projects have included microwave system design and monitoring, satellite radio interference prediction, and serving as a fully cleared, subject matter expert on Full Motion Video for the U.S. Intelligence Community.

Prior to joining Cavell Mertz in 1998, Mike spent four years with Moffet, Larson and Johnson, Inc. (MLJ) where his work included the rebuilding of the KDKA(AM) and WINS(AM) antenna systems as well as the design and build-out of the first GSM cellular system in Houston, Texas. Mike began his consulting career as a staff engineer with Jules Cohen & Associates, in Washington, D.C. He is a member of SBE and SMPTE and a past president of AFCCE.

"The New ASTV 3.0 TV Standard",

Dennis Wallace, Meintel, Sgrigoli, & Wallace, LLC

Abstract

Today, the viewing public is no longer limited to sitting and watching the front of a console television set as they were in the 1950s. The public wants the ability to watch video material anywhere, anytime, and on any device they may be using. That device may have its content delivered over-the-air on traditional RF TV channels, or over satellite links, via wideband cable, or via local WiFi RF links.

The ATSC 3.0 next generation broadcast standard is meant to address the flexibility that will be needed by current and future broadcasters and content providers. Advanced transmission and video/audio encoding techniques are required to bring new content and services to the public. This standard is meant to evolve with new demands. The presentation will describe the many aspects of this new standard to meet those objectives.

Speaker Biography

Dennis Wallace is a partner and technical consultant at the consulting firm of Meintel, Sgrignoli and Wallace**.** He has an extensive background in Digital Television Systems. As the RF Systems Engineer at the Advanced Television Test Center (ATTC), Dennis managed all the Laboratory RF Testing of the Grand

Alliance ATSC HDTV System. He managed test plans, configurations, and operations for Grand Alliance Testing and several Datacasting Systems. Prior to joining ATTC, Dennis held positions in Field Operations Engineering, Applications Engineering, and was Product Manager for two Television transmitter manufacturers.

In July 1997, Dennis founded Wallace & Associates a broadcast engineering and consulting firm specializing in Digital Television, RF Propagation Measurements, Spectrum Policy issues, and Technical Consulting. His clients include major broadcast groups, The DTV Station Project, ATTC, Trade Associations, and both Professional and Consumer Electronics Manufacturers.

He has worked on the Broadcast side, as well, holding Chief Engineer and Operations Manager positions with both radio and television stations.

Dennis has authored several papers on the topics of Digital Television transmission and results of testing of the DTV systems, which have been published in the *IEEE Transactions on Broadcasting* and other publications. Dennis has been a presenter at the IEEE Broadcast Technology Symposium, NAB, and several SBE Conferences, as well as providing DTV presentations for SCTE and IEEE Chapters.

In 1999, Mr. Wallace was awarded the prestigious Matti S. Siukola award by the IEEE Broadcast Technology Society.

Mr. Wallace is a Certified Broadcast Television Engineer by the Society of Broadcast Engineers. He is also a member of the IEEE Broadcast Technology Society, SMPTE, an Associate member of the Federal Communications Bar Association, and is active on several industry standards committees and the ATSC.

"Robots and Radio" – Youth Presentation

Carissa Ferguson, Student

Abstract

In this brief we will compare both amateur radio and robotics and how they complement each other within each field. To demonstrate this, I will design, build, and fabricate simple and inexpensive microprocessors, as well as additional circuits, to control a wide range of tasks and functions seen in robotics and amateur radio.

Speaker Biography

After becoming a licensed ham at the age of 8, Carissa Ferguson, KJ4EZA, has enjoyed exploring and experimenting with all aspects of amateur radio, such as station optimization, home-brewing, and contesting. She also enjoys participating in robotics with her high school team. Upon graduation this year, she hopes to pursue a career in biomedical engineering.

"Progress Report on RCA's Youth Initiative"

RCA Director Carole Perry

Abstract

This presentation will highlight the latest RCA activities and work with youth and students to encourage them to pursue STEM-based (science, technology, engineering, mathematics) careers. It will include a video highlighting where some of RCA's earlier youth are today, and how RCA made a difference in their careers.

Speaker Biography

RCA Director Carole Perry has been the Chairperson of RCA Youth Activities since 2007. She created the RCA Young Achiever program which identifies and rewards students in high school and below who have demonstrated technical excellence and creativity. To date, 107 such awards have been presented. She

initiated the tradition of introducing an RCA Young Achiever to give a presentation at the RCA Technical Symposium every year. This has come to be valued as a very prestigious honor for the young person; both by colleges and by business people in the wireless industry. Ms. Perry also chooses the RCA Young Achiever recipient of the IWCE Scholarship at the RCA Breakfast event every year.

During the course of the year, Carole and her committee members visit various schools and Boy and Girl Scout troops to introduce the fun of ham radio and to encourage youngsters to pursue technical careers. Three years ago, Carole presented a Youth Forum presentation in Friedrichshafen, Germany that was very well received, and as a result three RCA Young Achievers were selected to participate in an exchange program with three young German hams. Her committee sent technical journals and books to the students and arranged for them to communicate via amateur radio.

Carole has been invited to conduct Youth Forums in Michigan, California, and Orlando in the upcoming months at major national radio conventions. As a contributing columnist for *CQ Magazine*, Carole has the opportunity of publicizing RCA's youth initiatives and successes with young students.

Director Perry has been an RCA member since 1991, and was elected an RCA Fellow in 1995. She is a retired New York City middle school teacher.

"Transmitting Encrypted Public Safety Video and Data over Broadcast Television Signals"

Mark O'Brien, SpectraRep

Abstract

Broadcast television's digital transition created new capabilities, opportunities and business models. Some are obvious (multicasting), some not (datacasting). This presentation will show how public television is supporting public safety by provisioning a portion of their digital broadcast stream to deliver encrypted and targetable incident response video, files, notifications and other data to targeted public safety users.

Datacasting is the process of transmitting internet protocol (IP) data to computers that cannot be seen on television sets. Doing so provides the benefits of broadcast television – wireless, one-to-many, resilient infrastructure; with the benefits of IP data – encryption, receiver targeting and content routing. The result provides a new capability that neither network could accomplish separately. Many of these capabilities will become native in the next digital transition to ATSC 3.0, but the transition is happening now, and it will be enhanced in ATSC 3.0. Based on the capabilities in use today, FirstNet (www.FIrstNet.gov), a new nationwide public safety network, is considering including public television datacasting in their nationwide buildout starting next year.

With support from the Department of Homeland Security, Johns Hopkins Applied Physics Laboratory and police, fire and other public safety organizations around the country, SpectraRep is bridging the gap between broadcasters and public safety. A live demonstration of this capability will be included in the presentation.

Speaker Biography

Mark O'Brien is President and CTO of SpectraRep, where he partners with public television stations nationwide, leveraging their broadcast signals to improve public safety communications. The datacasting technology he developed delivers encrypted and targetable video, files, alerts and other data to specifically targeted recipients and is hidden from the public.

Mark works with the Department of Homeland Security, Johns Hopkins University and multiple local police and fire departments around the country delivering helicopter, surveillance, traffic and other video, as well as incident data, alerts and notifications.

He brings his background in satellite, digital television, IT systems, IP networking and software design to the new challenge of assuring public safety has the information they need, when and where they need it.

"Amazing Breakthroughs and Future Trends in Radar"

Eli Brookner, Ph.D

Abstract:

Dr. Brookner will provide a survey discussion and offer his personal observations regarding a number of interesting areas and developments involving radar, including:
- MMIC (integration at microwaves frequencies) which enabled deployment of low cost active electronically steered arrays (AESA)
- GaN power amplifiers, which enabled Ultra Wide Band (UWB) AESAs
- Extreme MMIC integration: a 256 element 60 GHz phased array on a chip- radar in a watch
- Silicon RF performance to greater than 100 GHz
- Moore's law is not dead
- Digital Beamforming (DBF)
- Making objects invisible at L-band over a 50% bandwidth using fractal metamaterials
- Low cost metamaterial electronically scanned array for radar and worldwide internet access through satellites
- 1970s Patriot radar upgraded to 2015 with state-of-the-art with GaN array and 360 degree coverage
- New Multiple Input Multiple Output (MIMO) architecture
- Electro-optic integration.

Speaker Biography

Dr. Eli Brookner is well known for his contributions to radar technology. He retired from Raytheon as Principal Engineering Fellow in 2014 after a long and distinguished career. He has contributed to radars for air traffic control, defense, space and navigation – virtually every major defense radar program. Eli has been recognized with numerous awards and honors, including Fellow of the IEEE, AIAA, and MSS and the 2006 IEEE Dennis J. Picard Medal for Radar Technology and Application and the 2003 IEEE Warren White Award. He has written numerous papers and articles and four books on radar systems, phased arrays and tracking. Eli received his bachelor's degree in electrical engineering from the City College of New York and his master's and Dr.Sc. from Columbia University.

Some of Dr. Brookner's many awards and accomplishments include: IEEE 2006 Dennis J. Picard Medal for Radar Technology & Application; IEEE 2003 Warren White Award; IEEE AESS Outstanding Organizational Leadership Award 2017; Journal of Franklin Institute Premium Award best paper 1966; IEEE Wheeler Prize for Best Applications Paper 1998.

Dr. Brookner is a Fellow of IEEE, AIAA, & MSS. He has written four books: Tracking, Phased Arrays & Radar. Over 10,000 engineers have attended his courses in 25 countries. He has been a banquet and keynote speaker 13 times. He has over 230 publications, and 6 of his papers are in books of reprints. Dr. Brookner has been issued 9 patents.

"TV Channel Repacking"

Joe Seccia, P.E., GatesAir

Abstract

TV channel repacking involves reorganizing television stations in the broadcast television bands so that stations which remain on the air after the FCC's incentive auction occupy a smaller portion of the UHF band, thereby freeing up a portion of that band for new wireless services uses. The details are complex. They involve many changes for broadcast television stations and impact other parties including FM radio broadcast, TV translators, and commonly shared towers, and antennas. This presentation will explain what' is involved, the history, and where we are today on repacking.

Speaker Biography

Joe Seccia manages Market and Product Development Strategy for the TV transmission products area at GatesAir.

Joe received his Bachelor of Science (B.S.) in Electrical Engineering from Michigan Technological University, Houghton, Michigan in 1990 and his Master of Science (M.S.) in Electrical Engineering from National Technological University, Fort Collins, Colorado in 1997.

Since joining GatesAir (formerly Harris Corporation's Broadcast Division) in 1990, Joe has held positions of increasing and varied capacity within GatesAir's engineering and product management groups, including component engineering, solid-state amplifier design, and digital signal processing. Joe has been a key part of GatesAir's digital television development beginning in 1995, most recently leading GatesAir's technology evolutions in software configurable exciters that support all popular worldwide DTV standards as well as high efficiency transmitter platforms.

Joe is an active participant in ATSC activities and other industry activities. Joe is a member of the IEEE Broadcast Technology Society and is a registered professional engineer in Michigan. Joe holds five U.S. patents.

"Fractal Metamaterials and the New Class of Directional Antennas"

Chip Cohen, Ph.D, and Brian Thistle, Fractal Antenna Systems

Abstract

Although the term 'Yagi' has come to mean directional parasitic antennas, we demonstrate here that they constitute a restricted sub-class of such antennas that assume sparse, narrow band, and electrically large (1/2 wave or greater) elements arranged in a 'fishbone-like' form factor. Using the design tool of fractal elements, a far broader insight into surface wave propagation in the near field is explored, with highly useful embodiments. These advantages include, among others: 1) their smaller size compared to Yagis of the same gain; 2) broader bandwidths; 3) more cost effective fabrication; 4) enablement of 'lensing' ability; and, 5) versatile choice of the form factor compared to Yagis. The new technology is dubbed 'FM/R' as 'fractal metamaterial nearfield' design. We show data and a real-time demonstration to reveal the FM/R technology and advantages.

Speaker Biographies

Dr. Nathan Cohen is the CEO, founder, and technology visionary behind Fractal Antenna Systems, Inc. An accomplished academic and astrophysicist, Dr. Cohen is widely recognized as the "father" of fractal element antenna technology.

Dr. Cohen began his academic career studying under some of the world's foremost scientists, including Jack Pierce and Irwin Shapiro at Harvard and Frank Drake at Cornell. He has spent three decades as an active radio astronomer, with special emphasis on antenna and array techniques.

In 1988, Dr. Cohen built the world's first fractal element antenna; and, after working to perfect his methodology, he founded Fractal Antenna in 1995 to commercialize his research. He has since become recognized as one of the world's most innovative antenna designers, with fractal element antennas proving to be far more compact, versatile and powerful than traditional antenna designs.

Dr. Cohen holds a bachelor's degree in physics from Brandeis University, and a master's degree and Ph.D. in astrophysics from Cornell University. He retired as a professor from Boston University in 2002. He holds 40 U.S. patents; has published over 100 articles, and four books. His innovations have been widely recognized in *Scientific American*; *Discover*; CNN; *Business Week*; *Wireless Week*; and in many other forums. He is widely sought as a speaker at technical and business conferences.

Ryan Thistle is an engineer at Fractal Antenna Systems, exploring FMR technology.

Ryan began his higher education at Pratt Institute in Brooklyn, NYC, studying industrial design. He quickly developed an affinity for working with wood and metal shop machinery to create products. After graduating with a Bachelor of Industrial Design, Ryan spent several years consulting for a variety of consumer electronics companies, including Grado Labs and ZVOX Audio. This experience inspired him to pursue a second Bachelor's degree in Electrical Engineering, so he could be a more capable designer of consumer electronics.

Ryan began working with Fractal Antenna Systems through the co-op program at the University of Massachusetts Lowell, and his experience fit the company's hands-on approach to antenna design. He recognizes that the future of consumer electronics is wireless, and understanding antenna design is crucial to developing products that will excel in the IoT and telecommunications space. Ryan is currently working full-time at Fractal Antenna on FMR technology and other metamaterial research, while finishing his degree.

"Mesh Network for Emergency Communications for the State of Delaware"

Bill Greenhalgh

Abstract

Mesh networks self-organize to deliver, wirelessly, high-speed internet connectivity and, with it, all the associated modern forms of communication such as full-duplex telephony, video conferencing, and web-based services. Repurposing commercial, off-the-shelf equipment for use on amateur-radio UHF and SHF bands, these services can be permanently installed or, in theory, quickly deployed for field and emergency communications.

When translating that theory into practice, however, significant difficulties can arise. Fixed backbone infrastructure is relatively straightforward to deploy where towers or tall buildings are available for mounting mesh nodes with larger antennas, but the "last-mile" designs used in other areas have largely depended on widely visible relay sites. In contrast, Delaware's very flat terrain and ubiquitous tall trees require different approaches such as the use of lower UHF frequencies and more densely deployed relay nodes under the tree canopy.

Our long-term goal is to provide mesh links at every EOC, at state and local government offices, area hospitals, and the like. The mesh infrastructure is also available for amateur radio operators involved in emergency communications to connect from field or disaster deployments and, to promote readiness, from their own homes or vehicles. Mesh networks appear to EOC staff and volunteers in familiar technologies such as telephone sets, web browsers, security-camera views, and desktop video conferencing that require no special communications training.

Speaker Biography

Bill Greenhalgh was recruited in Point Pleasant Beach High School to become a radio operator and was featured in the local newspaper for delivering homework assignments over the airways. While earning his Bachelors of Science degree from Buena Vista in Storm Lake, Iowa, Greenhalgh worked for a local radio station, KAYL, setting up remote studio locations for local churches, social events, and gathering local weather information. As a graduate student in Microbiology at the University of South Dakota in Vermillion, Greenhalgh built electronic devices that were used in a Microbiology Lab.

After graduation, he worked with several Johnson and Johnson family companies as a microbiologist, until he was recruited by Applied Data Research, Princeton, New Jersey. He was a "C" programmer at Applied Data responsible for developing an interface editor between IBM microcomputers and IBM mainframe. He subsequently worked at Rutgers University in New Jersey as an Administrator for Computing Services where he was responsible for the three major campuses - New Brunswick, Newark and Camden. While at Rutgers, he installed Kurzweil Reading Machines to accommodate the blind in all the libraries, and he wrote software which received a patent, the Diagnostic Reasoning Evaluation System. This patent inspired Greenhalgh to apply for and receive another patent on a novel idea to silence jet noise, A System for Suppressing Sound from a Flame. His latest project is MESH networking

and linking EOCs, Hospitals, Police, Fire, and Rescue departments throughout Delaware, the First State in the U.S.