
# IEEE Broadcast Technology

The technologies to deliver information and entertainment to audiences worldwide, at home and on the go

**BTS Fall Symposium Returns To Washington – See story on p. 7**

BTS IEEE

First Quarter 2024

# President's Message

Paul Schulins, BTS President

Greetings fellow BTS Members! As I write this, we are just getting into the coldest part of the year here in the northern hemisphere. I won't comment on global warming, but parts of North America have been seeing the coldest temperatures in years! My friend who lives in Iowa just returned from the Consumer Electronics Show (CES) in Las Vegas, and a combination of the snow and extreme cold caused many issues for travelers to this important trade show. Of course, broadcasters have and always will play an important role in informing and helping to protect the public when it comes to weather, and other natural and man-made dangers we face in the world today. That's one of the reasons that so many of us are in this industry in the first place!

The Consumer Electronics Show (CES) is the largest show of its kind in the world, and one of the largest, if not the largest convention hosted in Las Vegas. The length of the show does not allow any one person to visit all the thousands of booths, demonstrations, and seminars that this event has to offer, so careful planning before you arrive is key to getting the maximum value out of your trip.

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I am often asked if the CES is relevant to broadcasters since the focus in terms of equipment, content, and technology here is on the consumers and not necessarily on the broadcasters. I would argue that the value here is critical to broadcasters because we need to keep our finger on the pulse of consumer demand and manufacturer's response to that interest to guide our choices in what we as broadcasters should be focused on to stay in sync with the public. Sure, trade shows like NAB and IBC are directly focused on our needs, but from an overall perspective our strategy needs to be guided by our customers, and that is what CES offers us an excellent window into.

One of the hottest topics we discuss today in North America is the new TV standard now being rolled out known as ATSC 3.0. Anybody familiar with this new standard probably appreciates and understands many of the advantages of NextGen TV, and the *dozens of possible* new business opportunities it offers. However, ATSC 3.0 is just the next step in digital TV transmission, and the challenge these days is that the public is not aware of this service, and how it can enhance their lives in many different ways. This is especially troubling to me since we see more and more people "cutting the cord" and installing their own over the air antennas to save monthly subscription fees. Our industry needs to do a better job promoting our next layer of broadcast technology, and informing the public about the extraordinary potential this new standard offers, in most cases for free.

Another hot topic here in the United States in the inclusion of AM radio receivers in automobiles. With the growing popularity of electric cars, shielding electrical noise from inverters, and other electronics in cars today have made AM radio reception more challenging. Many car manufacturers have opted to not offer AM receivers in their cars due to the extra cost to make them work in electric cars. Besides, younger folks don't listen to the radio much, especially AM radio that is considered by many to be a dinosaur. Now I don't want to debate the relevancy of AM radio today, but automobile manufacturers don't place a high value on AM radio, or even FM Radio as we can see that over the air reception functions are often buried several layers deep in cars. But the US Congress and the National Association of Broadcasters have been supporting efforts to force the car companies to keep AM radio in cars. And they have some good reasons. AM radio is one of those services that can extend for long distances and many AM Stations are fortified with government subsidized backup generators, and studios that can keep people informed in the event of an emergency when cell towers, or VHF line-of-sight operators may not be able reach their targets. But on the other hand, there is the basic question of how much regulation and control the government should have on private industry. This debate continues to roar as

we move into 2024. What's your opinion?

Here at BTS, I continue to seek comments and input from our members. Our membership needs to grow, and we need to make sure our purpose remains relevant during these changing times. How can we help you grow your career and knowledge base? What is the value you would like to see from your society? We have so much history, success, and talent behind us here. We are struggling to find out what we should be as we dive deeper into the 21st century and are constantly strategizing and reviewing where we put our resources to maximize our benefits to you and our relevance to this industry. Part of what I am pushing for is to collaborate with other related and allied societies to offer the best of both worlds to our members. For example, we are talking with the Society of Broadcast Engineers as well as SMPTE and the Association of Federal Communication Consultants along with other organizations to offer as much diverse educational and scholastic opportunities to your professionals and students. In fact, this spring at the NAB show in Las Vegas we will be co-sponsoring a prize for the best student paper as well as a one-hour session on ATSC 3.0 Business opportunities.

CES attendees using today's consumer tech to capture tomorrow's consumer tech.

Finally, I would like to Welcome Bill Hayes to this newsletter as the managing editor in chief that starts with this issue. Bill as you probably know is a long time BTS member and has been president for several terms. We are grateful for his contributions over the years, and especially today as he volunteers to help fill the rather large shoes of James O'Neal! Thanks Bill and we look forward to your expertise!

And to our loyal members around the world, I want to thank you for your ongoing support and always welcome your input. My email is *paulshulins@gmail.com* so please give me your feedback on how we can serve you best. Until next time, stay healthy and safe and support your society by participating and communicating.

All the best for 2024,

Paul Shulins
President IEEE Broadcast Technology Society

# From The Editor

**By William Hayes, BTS Editor in Chief, The Broadcast Technology**

Hello everyone and welcome to my first column as the editor of Broadcast Technology. I suspect this is going to be an adventure for all of us. While I have written numerous articles and columns for trade publications and the BTS since my first user report was published in 1986, I have never been or aspired to be an editor. I like making observations, documenting what I see, and providing some thoughts on who, what, when, where, and why. The idea of reading and editing the writings of others, many of whom are more knowledgeable and conversant in the topics they are writing about is daunting to say the least. However, I was asked if I would do this and since I recently retired from full time work, I thought I would give it a try.

Part of the challenge that I will face is that I am trying to fill the void left by long time editor James O'Neal. If you didn't read his final "From the Editor" column in the fourth quarter edition of Broadcast Technology, I heartily recommend that you do. James faithfully documented how he took what was a fairly pedestrian society newsletter and remolded in the look and feel of a polished trade magazine. James applied his decades of experience and attention to detail into this publication and the results have been stunning. Now I come in as successor with my focus on the big picture and I hope to be able to add some value to the product without doing any harm to what has been accomplished.

To this end, I will need the help of the BTS staff, the leadership of the BTS, the general membership of the BTS, and everyone who reads any or all of Broadcast Technology. One of the challenges any publication like this faces is providing compelling content on a regular basis. Part of the challenge is getting people to realize that they have interesting things to share. The projects that we all are working on, the challenges we all are facing, the successful solutions we have implemented, and the near misses and failures we all have endured make for compelling content. Sharing those experiences with others is one way of contributing to the growth and well-being of the Society and our industries and ultimately ourselves. There is a catharsis that happens when we share our experiences with others that lets us put things in proper perspective. Our failures don't seem to so soul crushing and our successes don't seem so ego inflating.

I'd like to use myself as an example. When I started working at Iowa PBS (then IPTV) in May of 1999, I was approached by colleagues from TV Technology magazine. My charge at Iowa PBS was to plan and execute the conversion of their statewide television broadcast network to digital. My friends at TV Technology asked if I would be willing to journal the process. We agreed that I would do this but if it was to truly document what was happening, it would include "the good, the bad, and the ugly" which ended up being the sub-title to a presentation I did at the 2000 BTS Annual Broadcast Symposium. As I wrote the Digital Journal, I often struggled with anger and embarrassment. Anger at manufacturers and suppliers that exaggerated the capabilities of their products or couldn't deliver on their promises and embarrassment at myself for some of the poor decisions I made by believing the hype and not really testing the validity of the claims. Occasionally I would get a call from a supplier that was upset at me for documenting an issue and while those conversations were tense, I don't think they ever ended with an irreparable relationship. Ultimately what came out of the Digital Journal was a compelling series that many of my colleagues at stations around the USA read and benefitted from. It kept some from making the same errors, it gave others information to ask the right questions, and still others were helped to see that they weren't the only ones that had missteps that needed to be corrected. Probably some of the best times of personal growth for me are when I am sitting at the keyboard documenting an event or a project or a situation.

I don't want to sound like I am appealing for you to do something easy, because it isn't. Writing a complete story is challenging because it is about balancing details and headlines. Too much or too little detail and the readers lose interest. All headlines and no substance and you have sensationalism but no story and at best the readers lose interest and they may become angry. You see a lot of the latter on social media where sensational or controversial statements are made and are followed by a frenzy of sensational or controversial responses. It is easy to write a headline if you don't have to write the story that supports it and just as easy to respond to an unsupported, inflammatory headline in a like manner. Effectively writing an article for publication requires discipline and a willingness to invest the time to make sure that it includes what is necessary to comprehend the piece. But the beauty of writing for the BTS Newsletter is that we are looking for people to share their experiences and offer their advice or points of view, not defend their thesis.

Still using myself as the example, I'd like to talk a little bit about my recent attendance of the Consumer Electronics Show (CES) in Las Vegas and offer some observations

and opinions. When first entering the show the Consumer Technology Association (CTA) had a display celebrating their 100th anniversary. I was struck by the close association between the CTA and the BTS highlighted by how the CTA breaks their history into innovation eras and milestones.

CTA began in 1924 as the Radio Manufacturers Association (RMA) and at that time, radio was the most powerful medium available for the distribution of content to inform mass audiences instantly. Around 12 years earlier in 1912, BTS began its existence as the Institute of Radio Engineers (IRE), a name which it kept until 1963 the IRE merged with the American Institute of Electrical Engineers (AIEE) to form the Institute of Electrical and Electronics Engineers (IEEE). But I digress, during its "Radio Era," the RMA worked on creating standards for the consumer end of the radio industry just as the IRE worked on standard for the professional end of the radio industry. According to the CTA timeline displayed, the "Radio Era" was from 1924 until 1950.

The Radio Era" and "The Television Era.

While television broadcasting began in the 1930's, World War II delayed the deployment and adoption as the resources of much of the industrialized world went into support for the war efforts. Because of this delay, the CTA "Television Era" begins in 1950 with the organization changing its name to the Radio-Television Manufactures Association (RTMA). What followed was rapid growth in the broadcasting industry and several name changes. In 1953 with the addition of the word electric they became the Radio-Electronics-Television Manufacturers Association (RETMA) and then four years later, the Electronics Industry Association (EIA). The CTA folks were recognizing that their members were about more than radio and television and they were rebranding so that their name reflected the interests of their members. Six years after the rebranding to the EIA, the IRE and AIEE merged to form the IEEE with Signal Processing and Broadcast Technology being the first two societies formed with the new structure.

According to the CTA timeline, 1980 to 1994 is the era when "Consumer Tech Takes Off" and while radio and certainly television are dominating drivers, the focus from the EIA is on consumer technologies that augment and enhance the consumers' experience with these dominating mediums. Home recording, stereo sound and closed captioning are just a few of the technologies that improved quality and expanded access to content and importantly, not all of it delivered via the broadcast methodology.

1995 to 2014 represent the "Digital Transformation" era. The EIA became the Consumer Electronics Manufacturers Association (CEMA) and a few years later it was shortened to the Consumer Electronics Association (CEA). This change reflected the CTA's recognition of the broadening areas of interest of its members. Television broadcasting was still a significant driver within the CEA with the introduction of digital television broadcasting around the world, but broadcasting wasn't the Goliath that it had been in the past as digital technology brought consumer manufacturers and consumers under the influence of Moore's Law.

The timeline has 2015 being the beginning of present era which began with the CEA changing it name to the CTA as "every company is a tech company" according to their show display. Walking around the show floor and seeing the incredible variety of companies and products, I have to agree that every company is a tech company to some degree. Which brings me to my observations about the 2024 CES.

There is a 115 inch Mini-LED that I have my eye on once the price comes down.

Since I was at the show to find out what BTS related technologies are on display and being talked about, it was sobering to see how little "broadcasting" was actually part of the narrative. That is not to say there was nothing. There

were numerous displays of various sizes featuring HDR, mini-LED's, micro-LED's, transparent televisions that could be hung in front of a window, and displays that could roll up into a credenza. I was actually pleasantly surprised at the number of manufacturer representatives that were not confused when I asked if a particular display was NextGen TV or ATSC 3.0 capable. Most were able to answer the question and even point out particular models that were NextGen TV ready and when they would be available to the public.

For those actually interested in the latest developments related to NextGen TV, the ATSC booth was always busy and the people coming to the booth had specific questions or were there to see specific technology demonstrations and from that standpoint, it was a successful show. While NextGen TV broadcasting wasn't a center piece except at the ATSC booth, it also wasn't an unknown technology at the exhibits where is needed to be.

Now, this is the image that Broadcast Technology Society brings to mind for many.

The challenge I believe we in BTS face is that in 1963 when the IEEE formed our society selected the name Broadcast Technology Society. 61 years ago, when broadcasting was the only way to deliver content to audiences and since our old name didn't even recognize television, Broadcast Technology Society looked futuristic and all encompassing.

Looking back at the CTA and their timeline I was struck by how many times they changed their name to better reflect the interests and focus of their members. I am not advocating for a name change, I don't think just changing the name of the society would solve the problems of shrinking membership and misperception. I think what would be valuable would be for the membership to let leadership and other members know what interests them. Which brings me full circle back to writing and sharing. What better way to find others with similar interests and concerns and to let society leaders and members know where the society should go next.

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# BTS Broadcast Symposium Examines New Technologies And Industry Issues

## Event resumes in a big way after four-year absence

By James E. O'Neal

**WASHINGTON, D.C.**

After being dormant for four years due to the global pandemic, the IEEE Broadcast Technology Society's annual Fall Symposium restarted in a big way, with little indication that the Covid-driven hiatus had dampened spirits, attendance levels, or quality and number of presentations.

The 2023 Symposium, returned to its roots here in the nation's capital, and was hosted by the National Association of Broadcasters in their brand-new headquarters building. The Nov. 14-15 event attracted nearly 90 attendees, who traveled from 10 U.S. states and six foreign countries to participate

This year's broadcast engineering forum featured some 20 papers and discussions about the latest in content delivery technologies, and while radio was well represented, television was definitely out in front, with more than half of the presentations being television-specific. And while ATSC 3.0 was a big topic of discussion, it was not the exclusive focus.


BTS president Paul Shulins opens the proceedings at the 2023 BTS Broadcast Symposium.

Following opening remarks from BTS president, Paul Shulins, and Broadcast Symposium chair, Jim Stenberg, the proceedings got underway with session chair Theodore Stoner introducing the first presenter, Don Smith, director of New Technologies, Compliance, and Planning at PBS North Carolina.

In his presentation, "ATSC 3.0 and Public Broadcasting: A Flash-Cut Update," Smith addressed considerations in moving directly from ATSC 1.0 TV broadcasting to ATSC 3.0, or NextGen TV.

He prefaced his presentation by noting that "while the presentation will focus on public broadcasting, a lot of it will apply to commercial broadcasters."

Smith cited the June 23, 2023 FCC 23-53 "Third Report and Order and Fourth Further Notice of Proposed Rulemaking," which addresses the preservation of access to over-the-air (OTA) television, but also acknowledges the fact that broadcasters need to move on with their transition to ASTC 3.0 broadcasting.

He then reviewed current requirements for stations to move to NextGen TV, while out maintaining the ATSC 1.0 service originally mandated by the FCC, noting that the

requirement could be met in several ways, including the provisioning of ATSC 3.0 to ATSC 1.0 conversion devices for OTA viewers and reliance on the maintenance of ATSC 1.0 coverage from other simulcasting stations that provide coverage into the market.


Don Smith

"Some of the network stations can have overlap" stated Smith. "That can be used to cover the overlap requirement and stations can provide free or low-cost receivers to the public."

He offered that flash-cutting to ATSC 3.0 amounts to "a balancing act between loss of 1.0 service and other ways for former 1.0 viewers to get service."

Using the Charlotte, North Carolina television market as an example, Smith described several scenarios and "balancing acts" between the stations carrying PBS programming with signals that extend into the Charlotte market (including PBS broadcasting carried by the neighboring South Carolina ETV network, as Charlotte is in the southern part of the state and as such is very close to the North Carolina/South Carolina border.

He identified one PBS station (WUNE-TV) in that market as meeting the requirement for abandoning 1.0 programming and flash-cutting to 3.0. "There's a big overlap, with WUNE-TV's signal covering 97 percent of the population," remarked Smith, adding, however, that there were other considerations in addition to projected signal penetration.

"Another thing that has to be taken into account is signal level reduction," said Smith. "(There could be) a home where someone has an indoor antenna and gets satisfactory service with 1.0, but the 3.0 transmitter is further away and the indoor antenna is not satisfactory," adding that in the case of viewers living in apartment buildings, "outdoor antennas are a non-starter."

He noted that broadcasters considering flash-cutting had to be aware of a large number of factors before moving forward, including duplication of service areas, population figures, number of households affected, and more, stating that such information was available from the FCC's TVStudy software, advising that prospective flash-cutters should take population data from the 2020 U.S. census, as TVStudy data is based on the 2010 census, which may no longer reflect current numbers.

"The U.S. Census Bureau indicates that there has been about a 20 percent change in population in the Charlotte area," said Smith.

In summing up the case for flash-cutting, he observed that some stations have better and more options for making such a move, and that stations should be prepared to make compromises.

"The FCC requirements don't guarantee that there will be no loss of viewers," he said. "Go to (your station's) management and discuss signal expectations in areas of the market being considered."

Smith stressed that in all cases, "you should consult with your FCC counsel before you do anything."

### Sending Data Along With Entertainment Video

The program then shifted to another aspect of moving to a NextGen TV broadcasting platform, with the chief operating officer at SpectraRep, John McCoskey's presentation "ATSC 3.0 Datacasting: Technical Capabilities Creating Real-World Solutions."

McCoskey began with a description of datacasting, describing it as using broadcast television infrastructure to carry (non-TV) IT content, and doing this in such a way as not to interfere with the mainstream television service.

"Datacasting utilizes a one-to-many (modality) and can target content delivery, with a police department receiving the data rather than both police and fire departments," said McCoskey. "And you can add security."


Presenter John McCoskey displays a receiver used in connection with ATSC 3.0 datacasting.

He noted that such a datacasting methodology was IP-based and "you can do anything that you can do with IP," adding that while datacasting didn't necessarily require an ATSC 3,.0 transmission platform, 3.0 "does bring some significant technical advantages."

McCoskey recalled making use of the vertical blanking interval for transmitting a limited amount of data during broadcast television's analog existence, as one example of datacasting.

He observed that the move to digital broadcasting (with ATSC 1.0) made datacasting easier, as the standard itself involved data transmission, and that of 3.0 is better suited for datacasting as it

provides more capacity for data through better compression technology. Also, as ATSC 3.0 employs COFDM modulation, transmission of data (and video) to moving receiving devices is enabled.

"With ATSC 1.0, you have to encapsulate data packets within the video stream," he explained. "In 3.0 this encapsulation isn't necessary."

McCoskey stated that receivers needed for use in connection with datacasting initiatives can be constructed and supplied to users inexpensively, and that the advent of "core network" technology will bolster datacasting.

"Core networks are something that you're going to hear a lot more about," he said, describing such a network that's now under development in the United States involving some 125 full-power television transmitters.

McCoskey described potential applications for this ancillary data capability, with one of these being remote education in situations where Internet access was limited or absent,

"Datacasting would enable content being produced by educators to reach students either by conventional Internet or by core broadcast networks," said McCoskey. "When kids log in (using a special OTA data receiving device), they see only the content targeted to them. We deployed about 25,000 of these (receivers) during Covid across multiple states."

Another application described by McCoskey was in connection with public safety.

"This is part of a methodology involving video communications," he explained. "It doesn't depend on a single communications network when public safety is involved," citing the vulnerability to failure of "traditional" data communications networks in catastrophic situations such as the Christmas 2020 explosion of a recreational vehicle near the Nashville, Tennessee AT&T operation center.

"Those involved in restoring Nashville public safety communications had not really developed a plan to deal with such contingencies," said McCoskey.

He observed that datacasting was also a "great way to deliver content that most people never had before," and noted the inadequacies of the current U.S. Emergency Alerting System (EAS).

In citing shortcomings associated with the current emergency alerting system, McCoskey noted that it takes considerable time to get such messages delivered and such delays could sometimes affect the outcome in a catastrophic situation and said that with the datacasting system currently in place at five California TV stations it's possible to deliver warnings about earthquakes in less than one second.

McCoskey described an ancillary device that could be triggered by TV station-delivered emergency alert datacasts that could automatically open fire house doors, and close off gas and water valves when such earthquake warnings are transmitted.

"This is a great usage and we will probably see this expand into other areas," he said.

**The Impact Of Transmission Latency On Video Scalability**

The program then shifted to a report on video scalability latency testing in connection with Brazil's initiative to move to a new DTV platform. In beginning his presentation ("Video Scalability Latency Test for Brazilian TV 3.0"), Rodrigo Admir Vaz, a senior Samsung development engineer and also a Mackenzie University PhD candidate, provided symposium attendees with an overview of the current plan to overhaul Brazilian television, moving it to what has been designated "TV 3.0."

Rodrigo Admir Vaz

Vaz noted that this initiative began in 2020 and was laid out in three phases, with the final phase involving standardization of technologies, physical layer testing and adoption, video assessment testing, and related work due to be completed at the end of 2024.

"The new system is expected to be launched in 2025, but the schedule has not yet been set," said Vaz, adding that one of the areas of the new transmission system being investigated in this final phase involved video scalability.

He explained that video was encoded into a base layer and an additional layer (or layers) and at the receiver these could be combined to provide a very high-quality image in some situations, but when desired image quality could be traded off in favor of robustness and other considerations.

"There are three 'classical' types of scalabilities, spatial, temporal and quality," said Vaz. "In setting scalability, a number of things are taken into consideration, including Internet speed and availability, noting that the experimental work undertaken examined four methodologies for transmitting scalable or different information used to reconstruct the video. These included hybrid OTA/Internet, layer division multiplex, channel bonding, and MIMO (multiple-input/multiple-output).

After describing the advantages and disadvantages of these four transmission technologies, Vaz described his own research project, which is focused on the use of a scalable video streaming feature to enhance base layer video from 2K to 4K.

"(We would) transmit the enhancement layer via the Internet, and synchronize layers via ROUTE/DASH protocols," said Vaz.

He then described the laboratory setup for implementing such hybrid transmission, observing that it was based on the use of software simulation, and involved the investigation of base/enhancement layer involving a range of controlled latency conditions. Vaz added that a download Internet speed of 50 Mbps was set, with 10 Mbps being used for uploading of information.

He said that the conclusion reached in such testing was that Brazilian TV 3.0 system receivers should be equipped to support hybrid modalities of reception and should accommodate "at least 1,000 milliseconds or one second of latency

in order to overcome system instabilities and offer a good user experience."

Vaz said that additional work involving transmission latencies will involve real-world field testing with an over-the-air station and the use of commercial CDNs, and will investigate the impact of various Internet speeds and connectivities that might be involved in actual real-world conditions.

### Reliving A Television Game Show In A Slightly Different Way

Presentations next shifted to a very different format, with symposium chair Jim Stenberg honoring the late U.S. radio/television personality, game show host, and animal rights activist, Bob Barker, who died in August of 2023 at the age of 99. Stenberg donned a wig that was reminiscent of Barker's hairstyle and launched into a modified version of Barker's long-running TV show, "The Price Is Right," with "contestants" being selected from the symposium audience and being awarded prizes if they came closest to guessing performance figures for various ATSC 3.0 modcod configurations, rather than the value of large consumer items as was done in Barker's show.

"We're going to use the show format to learn how 3.0 modulation and coding variables affect station coverage and capacity," began Stenberg (aka Barker), "Our contestants will guess the population counts and win 'fabulous' prizes."

In beginning the "show," Stenberg reminded his audience that there are literally "millions of combinations of ATSC 3.0 physical layer variables," with each governing a particular aspect of system performance.

"The art of designing a configuration is in optimizing these variables for your particular situation," he said, noting that system parameters were easily changed, and that "you should experiment.

"Coverage, SNR and capacity are highly dependent on the calculation and measurement assumptions," said Stenberg. "And my numbers will be slightly different than those from you and/or your consultants. There are many valid ways to quantify ATSC 3.0 performance.

The television station used as the model for predicting performance/coverage in the "game show" was the Boston, Massachusetts market's WUNI-DT, which operates on Ch. 27 (548-554 MHz.) with an ERP of 400 kW and an antenna height of 1,168 feet (356 meters) above average terrain.

Prior to "bringing the game show contestants on stage," Stenberg described some of the technical makeup of the ATSC 3.0 DTV standard, with a concentration of its COFDM modulation scheme. He noted that the non-uniform constellations used optimized performance, and explained that the most important transmission variables were modulation rates, code rates and lengths, FFT lengths, pilot patterns, and guard intervals.

At that point Stenberg introduced the show's "announcer," Dennis Glavin, and introduced the" panelists," Michael Fisher, Don Smith, Guy Bouchard, and Nicole Starett.

"Panelists" were reminded that the goal was to predict the increase the coverage of WUNI-DT as changes were made in modcod parameters, with the winner being awarded a (scale model) automobile and other "valuable prizes."

Don Smith took top honors and was awarded the car, and others also had a chance to show their skill in a bonus round, where four modcod scenarios were offered and contestants guessing "high or low" in terms of station coverage.

### Lunch, A Keynote Speech, And An Award Presentation

After a break for lunch that included a keynote address by the IEEE's new president, Tom Coughlin, and a short awards ceremony, presentations resumed with Mary Pratt-Henaghan, WETA and NewsHour Productions's chief technology officer, chairing the first p.m. session and Shane Toven, senior broadcast engineer at the Educational Media Foundation K-LOVE & Air1 media network operations, providing some useful tips on safeguarding computer systems.

### Keeping Broadcast Operations Secure From Hackers

The only thievery broadcasters used to fear was in losing a top-rated personality to a competing station in the market, or perhaps someone spiriting a record album or two out of the studio during an overnight shift.

Today—thanks to the connected world in which we live—thievery can be much worse, and can be far more subtle, with someone half a world away at a computer making a few key clicks, and this is what Toven focused on in his presentation "Common Sense Cybersecurity for Broadcasters."

Jim Stenberg (left) masquerading as the late U.S. TV game show host, Bob Barker, presses 'contestant' Don Smith to name a performance figure in a special version of 'The Price Is Right.'

He began by pointing out that while cyber intrusions and thievery have been a part of the landscape for some time, the situation has gotten much worse during the past decade or so.

"There have been 47 major attacks on media organizations in the first half of 2022 alone," he remarked. "These attacks have cost billions of dollars in lost revenue and recovery costs," reminding his

audience of the ransomware attacks on San Francisco's KQED a few years ago, and a recent attack on TV broadcast giant, the Sinclair Media Group, and that these were just the literal tip of the iceberg.

Toven noted that the cost of such hacks is not only in lost revenue and paying large amounts to cyberthieves, but also in many other areas.


Shane Toven

The consequences can be far-reaching," he remarked. "(There can also be) loss of consumer trust, financial and legal penalties, loss of control of company data such as information about facilities and corporate practices."

He advised broadcasters to take steps to prevent or minimize the possibility of cyber intrusions by making sure that their physical house is in order by implementing facility access controls, locking rack and cabinet doors, disabling unused or unneeded switch and host ports, and maintain tight control over such things as laptop computers, as these could provide network information and make it easy for an outsider to log into a system.

Toven also advocated encryption of important information, use of strong passwords, two-factor authentication for log-ins, implementation of secure firewalls, and establishing access control lists for routers and switches. He noted, however, that perhaps the greatest area of cyber vulnerability involves humans.

He stated that "social engineering is one of the biggest threats to your infrastructure," noting that it was very easy for an employee to unintentionally click on a bogus hyperlink in an email, give out information that could be valuable to a hacker during a phone call, or to respond to a bogus phone message.

"Even the best security can be defeated by a well-meaning employee," he said, advising his audience to do their best to make employees aware of "phishing," "vishing" "spear phishing" and "SMSishing" tactics utilized by hackers.

Toven stated that the best defense against such cyberattacks was by training employees to recognize such avenues for intrusion and not responding to them.

"Train your people, train them again, and then train them again," he aid. "You can't over-train people to spot intrusion attempts."

### New Developments In Video Coding Technology

The program next shifted to a review of the latest developments in video coding presented by BTS member and independent broadcast industry advisor, Peter Siebert, in his presentation "Commercial and Technical Aspects of Next Generation Video Coding for Broadcast and Broadband."

He began with a description of very high data rates needed for transporting uncompressed digitized video, stating that could range from around 331 Mbps for 576-line standard-definition images, 1,558 Mbps for 1080-line HD television, and nearly 8,300 Mbps for 4K resolutions.

"Luckily, the industry has developed video coding algorithms (to deal with these)," he remarked, and then provided an overview of video coding technology and its evolution.


Peter Siebert

Siebert noted that early on, the International Telecommunications Union (ITU) became involved with signal compression technology, stating "beginning with the creation of the MPEG-2 coding, ISO MPEG and the ITU started to combine efforts and develop video codecs jointly."

He observed that the "most relevant codecs in digital TV so far" were MPEG-2/H.262, which was developed in 1993; AVC/H.264, which came in 2002; and HEVC/H.265, which was released in 2013.

Siebert noted that a measure of design flexibility was part of the panning in the various coding schemes, as "only the decoder and bitstream format are specified, allowing encoders from one vendor to work with all decoders."

He then described "Ken's Law" (which basically states that the difficulty of finding something is directly proportional to its size), and used this axiom in illustrating the increase in codec performance (efficiency) versus with the amount of data reduction achieved to provide higher and higher television resolutions.

"There is a constant performance increase," said Siebert. "Every new generation of codecs is about five times more powerful than the previous one. (However), there is a price for this—an increase in the complexity of the decoder or computational complexity."

Siebert observed that "new video codecs drive the industry, with H.264 enabling us to do high definition, and also allowing us to use telephone lines for video transmission."

In illustrating the evolution of video codec technology, Siebert provided a timeline of the development of ATSC digital television, noting that the original early-1990s ATSC 1.0 standard was based around MPEG-2, while today's ATSC 3.0 system operates with H.265/HEVC codecs.

He also addressed the adoption of codec technology used in broadband video transmission, observing "the most popular video codecs today for broadband are H.264/AVC, the H.265/HEVC, then MPEG-2, then VP9 and in last place, AV1, with H.265/HEVC gaining in ascendency."

He added that the most popular codec technology for digital terrestrial television (DTT) broadcasting is H.264/AVC.

"Only six DTT systems use HEVC," he remarked.

Siebert also offered an overview of the next generation of codecs, listing these as VVC (versatile video coding)/H.266; AV1, and AVS3. He noted that "VCC/H.266 was jointly developed by the ITU and ISO MPEG, and focuses on immersive applications such as 8k and 360-degree virtual reality. AV1

was developed by the Alliance for Open Media for streaming applications and was designed as a license-free codec, and AVS3 which was developed in China with a focus on 4K and 8K. The objective is a clear and reasonable licensing policy and (AVS3) is mandatory for 8K broadcasts within China."

Siebert also discussed some of the DVB's requirements in terms of next-generation video codecs, including delivery of "excellent 8K subjective video quality at both 45 and 60 Mbps, at least 27 percent better efficiency than HEVC, and the ability to accommodate five UHD services within a single 40 Mbps multiplex".

Siebert said that VCC coding seems to be gaining in ascendency, as in transmitting 4K resolutions it can provide a bitrate savings of some 46.5 percent as compared to HEVC.

In summarizing the next-generation video codec landscape, Siebert stated that MPEG, AVOM and AVS are all providing improved technologies, with improved efficiencies over HEVC for 4k and 8k resolutions. He added that the DVB has incorporated both VCC and AVS3 next-generation codec technologies, while the ATSC's interest is primarily in VCC coding.

Siebert concluded by observing that "the market introduction of new codecs is a slow process and will take years" and that "work on new codecs beyond the current next-generation has already stated."

### Best Practices For Seamlessly Inserting Commercial Material

The program then shifted to station revenues, with Enensys Technologie's vice president of marketing, Laurent Roul, addressing a technology that has emerged with the shift to digital and IP-based television operations.

In beginning his presentation ("Perfect Ad Insertion in Broadcast and Broadband Delivery: Challenges, Strategies and Monitoring"), Roul described the current landscape in which television ad revenues are dwindling due to the rise of digital media and its rapidly escalating consumption.

"Digital video advertising spending is now greater than that for traditional broadcast television, with Nielsen studies showing that streaming is the most popular way of consuming content now," said Roul.


Laurent Roul

He observed that this trend has led to the rise of targeted advertising, and that replacing part of live-streamed content with pre-recorded (advertising) content has also become commonplace.

"Splicer technology allows the launching of regional ad campaigns in existing inventories," said Roul. It can provide a full ad break to address new audiences with targeted advertising, and can be used within a program to create new inventories and revenue streams."

He cautioned, however, that in successfully accomplishing this type of "splicing" of live content and pre-recorded material, matching of encoding types was crucial.

"The substituted material must match the encoding characteristics of the mainstream program into which it's inserted."

In concluding his remarks, Roul offered several "takeaway" suggestions, including the use of either manual triggering or following SCTE-104 or SCTE-35 (the Society of Cable Television Engineers) protocols for ad insertion, to make sure that spliced-in commercials were frame accurate and transitions to and from the commercials were invisible to viewers. He also stressed the need to support both OTA television and broadband delivery of content.

### 5G And Its Impact On Broadcasting

The Symposium's first day concluded with a panel discussion examining ways in which broadcasting was being


Moderator Tim Stevens (left) leads a discussion on 5G technology and its impact on broadcasting with panelists Robin Herin (2nd from left), Ben Garverick (3rd from left) and Josh Arenberg (right).

transformed by the advent of 5G connectivity and mobile edge computing. Panelists Benjamin Garverick, Zixi's senior architect; Robin Herin, the senior innovation and technologies engineer at Ateme; and Josh Arenberg, the chief technology officer within Verizon Business's Media and Entertainment division. The discussion was led by Tim Stevens, Verizon's global leader in the area of strategic innovation for sports, media and entertainment.

In his opening remarks, panelist Arenberg stated that as engineers, we need to find more ways to engage and motivate younger people to enter the field of broadcast engineering.

"We need more diversity," said Arenberg. "We need more people who don't look like me up here helping navigate and lead our industry. We're doing so much great stuff. People are watching the content we create every evening (and while) we're behind the scenes, we don't live in a vacuum. We've got to do a lot more than we're doing today to get younger people interested in broadcast engineering."

He also observed that there was a lot happening today in connection with 5G, and that the broadcast engineering community had been bypassed by much of this.

"We, as broadcasters, kind of missed that 3GPP conversation about cellphone standards while we were off working on MPEG," said Arenberg. "We were on parallel paths for a long time. 3GPP was the current 5G standard and we didn't have a seat at the table. Now, (the broadcast industry) is starting to think about 5G. What does this mean when (the technologies) merge? How do they work together and how do we deliver the best possible consumer experience? I don't think we have all of the answers yet."

Arenberg described creation of the 5G-MAG (5G-Media Action Group) organization, noting that while his company, Verizon, and that of fellow panelist Herin (Ateme), both had 5G-MAG seats, there was plenty of room for others needing to get involved in the group's activities.

"There's definitely not enough representation in this group from our people, especially those in the U.S."

Panelist Herin commented that a "real life test" of what is achievable with 5G multicast technology is one of the main things the group should be addressing.

Panelist Garverick noted that 5G offered a real advantage in terms of overcoming latency in transmission.

Glass-to-glass in 5 milliseconds," stated moderator Stevens in referring to the time it took to deliver an image captured by a camera's lens to the consumer's display screen. "This is the power of 5G."

Wrapping up the events of the day was a "welcome night" reception, which also took place in the National Association of Broadcasters' building.

## Day Two: A Focus On Radio And Transmission Systems

Day two of the 2023 BTS Symposium began with opening remarks from Symposium Chair Stenberg, and President Paul Shulins, and then shifted to a morning of presentations keyed to radio broadcasting, with Mike Cooney, the chief technology officer and executive vice president of engineering at BBGI (Beasley Broadcast Group Inc.) chairing the morning session.

## Do Compression Artifacts Affect FM Multiplex Transport?

First on the program was Worldcast System's Tony Peterle, who's curiosity about possible audio signal degradation in connection with the compression technology now commonly used for transmitting FM multiplexes led to a series of experiments.

Peterle reported on his findings in his "Effects of IP Transport Compression on a Broadcast FM MPX Signal" presentation.

He began by noting that due to the large amount of data associated with an FM multiplex, there is a need for reduction of payload size to make its transport practical.


Tony Peterle

"It takes 3 Mbps or more to transmit, so various companies have developed technology to reduce this down to around 320 kbps," said Peterle, "But at what cost? You're going to lose something, right?"

In describing his testing methodologies, Peterle noted that while the focus was primarily on "what actually reaches a listener's ears, (but it) also included measurements of frequency response, distortion, and stereo separation." Peterle also acknowledged the assistance from Paul Shulins and Shane Toven in connection with his research efforts.

As described by Peterle, the testing involved a representative sample of codecs, including units from 2WCom, APT, GatesAir, Omnia, and Thimeo Audio Technology.

"Aside from codecs, the Omnia 9 became the hub for the testing with its stereo gen, composite input demodulator, audio playback, PPM insertion and audio recording features," said Peterle. "We also used a dScope (for determining) frequency response and distortion measurement," adding that Nielsen's PPM encoder and MCEM monitor was also involved in the testing.

He said that a "baseline" test was performed with none of the codecs involved, followed by runs with the various codecs at data rates ranging from 300 to 900 kbps. "Dry speech," "dense music," and "ambient music" samples were involved in the subjective listening tests, with rankings of overall quality involving both processing and no processing.

Peterle noted that in general there was some roll-off in upper-end frequency response, and this is where slightly increased distortion was observed also; however, this varied somewhat, depending on the unit under test. Stereo

separation was generally acceptable. He did report some inconsistencies, especially in connection with the PPM measurements, as in some cases, the confidence score was higher with compressed signals that those with no compression. Be sending him back to the lab for additional testing.

"You can run the same signal through an encoder five times and you get five different results," said Peterle. "There's no consistency. More work needs to be done."

### Adding Audio Broadcasting In With ATSC 3.0 Television

If you've been around any of the presentations involving the ATSC 3.0 digital television delivery standard, one word that you've certainly heard more than once is "extensibility."

In moving away from the older ATSC 1.0, architects of this latest methodology for providing consumers with better television went out of their way to futureproof their design. If a better way of sending out video or audio should come along, the standard doesn't have to be scrapped and started all over again. Adding features not thought about today basically boils down to developing and plugging some new code and then creating a new appendage to the standard.


S. Merrill Weiss

Building on this concept, S. Merrill Weiss, principal at the Merrill Weiss Group consultancy, has developed a methodology for adding a digital radio service to ATSC 3.0 television with no effect on the video.

In his presentation, "Integrating Radio Services With Television And Data Transmisson On The ATSC 3.0 Platform," Weiss said the motivation for the initiative came from countries interested in ATSC 3.0 wanting to add "full-featured digital radio services to the platform." The DRM (Digital Radio Mondiale) standard was selected, as it was being used in those countries.

Weiss noted that DRM was ITU-endorsed, full-featured and highly efficient, and that its transport was standardized for any platform, and that both broadcasters and listeners could derive benefits from linking DRM with ATSC 3.0.

According to Weiss, the project had several objectives, including addition of capacity for full-featured digital radio service carriage with ATSC 3.0 television, capacity for a large number of high-quality mono and stereo audio services—200 or more, to make highly-efficient use of channel capacity, to add advanced text-based adjunct services along with icons and other graphics, and support for a service selection guide.

Weiss added that the radio implementation had to be fully standards-based, and usable with a range of consumer devices all the way from small handheld receivers to large TVs.

He said that the integration of DRM with ATSC 3.0 involved incorporation of a "radio gateway," and described in detail other additions and changes necessary to add the desired ancillary services to the 3.0 signal.

Weiss noted that MPEG Extended High-Efficiency AAC (xHE-AAC) audio coding was used "as this comes with DRM," and that loudness metadata was incorporated to provide a consistent user experience.

He said that the implementation could provide more than 1,000 stereo audio services along with 360 "Journaline" DRM text services.

In concluding his presentation, Weiss noted that in connection with the DRM addition, documents needed to be added to ATSC standards list involving both A/330 link layer protocols and A/324 scheduler and studio-to-transmitter protocols. Also, "two new standards need to be created; one for the radio gateway, and another to (describe) recommended practices for ATSC 3.0 radio."

### Making Audience Measurements (And Listener Feedback) Easier

Jaap Dekkinga, founder and CEO of TuneURL, described a new methodology for obtaining feedback from listeners, as well as determining their listening patterns and response to program material and commercials in his presentation "Audience Measurements and Coding Technology."


Jaap Dekkinga

Dekkinga observed that while radio broadcasting is great for reaching mass audiences and delivering commercials, it's been a "one-way street," with only limited ways in which to track and measure audience engagement. If a methodology was available for interactivity with listeners, it would enable personalization, add convenience, promote engagement by listeners, and could also enhance advertising.

He noted that while there's been some experimentation with interactivity in radio broadcasting, this has been limited to such feedback channels as email or a web address where listeners can respond to surveys about programming and the like.

Dekkinga's company has developed a technology that allows almost instant listener feedback and engagement through use of an "audio trigger" and an application running on a listener's cellphone.

As explained by Dekkinga, a radio host transmits the audio trigger, which is analogous to a QR code or audio hyperlink. A short-duration "window" then opens, allowing the listener to respond if he or she desires.

"Following this audible 'call to action,' the listener is asked if they are interested (in responding)," he said. "They can do that with a click, shake, or voice command (picked up by the cellphone) 100 percent safely."

Dekkinga said that the technology allows broadcasters to determine such things as listener impressions to content, listener engagement, and aid advertisers as to the best time to place their messages and on which station to reach a particular demographic. He noted that it would also be very easy to deliver such things as discount coupons to a listener's phone if they expressed an interest in an offer.

According to Dekkinga, field trials of the TuneURL technology are expected to begin next year.

### An Easier Way To Implement Virtual Machine Technology

If there's one thing that broadcasters have learned from the global pandemic, it's that the show can, and does, go on from just about anywhere there's internet connectivity. Even "morning teams" can appear to listeners to be in the same studio when they're actually separated by a continent.


Kirk Harnack

In the final presentation of the morning, Kirk Harnack, senior solutions consultant at The Telos Alliance, brought symposium attendees up to date on the latest technology for allowing broadcasters to work remotely in his presentation "Real Radio Hosts Working Virtually. How Engineers Work with Containerized Broadcast Systems"

Harnack noted that in recent years the broadcast industry has been moving away from purpose-built equipment that hands only a single function to "a more generic platform, "with apps running on servers to emulate physical devices.

"We can now even do all audio console functions on a generic computing device and control it via a user interface," he said, adding that other elements of a broadcast chain, such as playout devices, audio processors, intercoms, and talk show systems could all be virtualized.

He then moved on to the concept of "containerization," explaining that a 'container' amounts to software packages with all of the necessary elements to run in any computing environment. With such technology, the operating system is itself virtualized, allowing the container to run anywhere from a private or public cloud environment to a user's laptop.

"Instead of virtualizing the whole machine, we share the operating system with 'buckets' or 'containers' that hold the one application in isolation, but allow it to share the resources of the platform," said Harnack.

"It's a matter of 'containers' versus virtual machines (VMs). The container achieves the same goal as a VM, but you don't need to buy another physical computer. The container runs the software you want to run. A VM may be more comfortable (to users), but a container is very strategically-designed virtual environment that runs the desired software.

"Containerized software is the future of computing services, and is being used by such IT forward-thinking companies as Google, Amazon, Visa, PayPal and MetLife for critical applications."

Harnack said that container technology brings a number of benefits to broadcasters, such as the ability to quickly set up or relocate a studio operation, as it's no longer necessary to bring in specialized gear and wire it all together.

"You can add an audio console to your facility without buying control surface hardware, replace legacy audio consoles, and in the process free up desk space in smaller operations," he observed, adding that containerized technology can also replace broadcast phone systems and intercoms, and that adopters can opt to either make an outright purchase or acquire use on a subscription basis. "Your investment can last beyond the lifespan of purpose-built hardware."

### Entering The Home Stretch

Following a break for lunch and a keynote address by the U.S. Naval Academy's Provost, Samara Firebaugh, the 2023 Symposium moved into its final group of presentations, with Jeff Andrew, senior vice president of engineering and operations at the Signal Infrastructure Group chairing the session, which examined transmission infrastructure and technologies.

### Transmission Facilities: Rebuilding Or Replacement

Expanding group ownerships and doing more with fewer resources are two trends in radio that show no signs of reversing themselves, with shared transmission sites being an outgrowth of this movement. Some of these sites are getting a bit long in tooth, while others have seen a change in utilization, with stations who once shared a common antenna moving elsewhere.

Dielectric's Nicole Starrett and American Tower's Dan Glavin offered a look at some of the considerations involved in updating these sites in their presentation "Retrofitting Community Transmission Systems, Supporting Legacy Broadcast Systems."

They explained that while common or "community" transmission plants provide a number of advantages, including reduced construction and operating costs due to multiple ownership, and better coverage associated with better antenna systems and higher platform for those antennas, there were also some downsides. These included an increased complexity stemming from the use of combiner and filter networks necessary for operation with a common antenna. Also, as the concept of shared transmission facilities has been around for a number of decades, some of these sites are getting a bit "long in tooth" with their antennas, transmission lines and combining systems having been in continuous use for a number of years, and feeling the effects of both time and the elements. An additional factor is the change made to systems in transitioning from analog to digital TV broadcasting operations and

additional changes that may have taken place due to repacking of broadcast channels.

"Some of these systems are very old, and some that aren't that old but have some legacy technology that they utilize," said Glavin. "Community systems have been around for the lion's share of a century. Numerous systems are still in operation (that were constructed) well before the analog to digital conversion."

He observed also that even if community transmission site/system is operating satisfactorily, there is no guarantee that manufacturers of older gear will be around forever, adding to the difficulties in maintaining such legacy operations.


Nicole Starrett and Dan Glavin

Glavin noted too that some systems in operation were designed for operation by stations that have moved to their own transmission plants or are no longer in operation, thus reducing sharing requirements.

He said that additional factors in determining whether to keep a legacy system going or scrapping it in favor of all-new technology included the on-going move to ATSC 3.0 transmission.

These include the ability of existing combiners and filters to be retuned for 3.0, difficulties in delivering usable NextGen TV signals to portable/handheld viewing devices with existing horizontally-polarized antennas, and the generation and transmission of the a higher peak-to-average power (PAPR) that's associated with ATSC 3.0's orthogonal frequency division multiplexing (OFDM) modulation.

Glavin and Starrett suggested that some of these difficulties could be resolved by replacement of an existing horizontally-polarized antenna with one designed for elliptical polarization, as this allows reuse of existing mast structures. Transmission lines that are inadequate for higher PAPRs can also be replaced on an as-needed basis.

"You can save (a lot of ) dollars by avoiding a complete 'drop and swap,'" stated Glavin.

The reuse of existing combining and filter networks may also be possible through retuning and reconfiguration.

"You can combine existing and new hardware to expand or repurpose an existing system, with optimization done in software," said Glavin. "There's no need to throw the baby out with the bath water. Just replace the portion necessary for ATSC 3.0 operation."

In discussing when a full system replacement might make sense, Starrett suggested that this might be something to consider when an existing wideband system is no longer needed due to some of the users establishing their own transmission plants.

"With only a single channel or dual channels remaining, a replacement is cheaper and more cost-effective than retrofitting," she said. "(This is also the case) when a system reconfiguration can't meet coverage or bandwidth requirements."

She added that a full replacement should also be considered if there are recurring age-related maintenance issues, or if new transmission demands (additional channels) make retrofitting/expansion impractical.

In concluding the presentation, Starrett observed that an older shared transmission plant is not necessarily "toast."

"There are economical options for expanding or updating systems," she said. "Broadcast is important for the future, and new solutions can keep it relevant."

### Spectrum Reductions Lead To Another Kind Of Broadcaster Difficulty

Consulting engineer Guy Bouchard, who was formerly in charge of the digital delivery infrastructure at Canadian broadcaster, Télé-Québec, was next on the program, and reminded his audience of an issue created by the continuing loss of spectrum to telcoms. However, in his case, it was not loss of OTA broadcast channels, but rather the reduction in C-band satellite spectrum, which became official a few years ago.


Guy Bouchard

"In February 2020, the U.S. Federal Communications Commission adopted new rules for the 3.7 to 4.2 GHz C-band that allocated the lower 280 megahertz of that band for terrestrial wireless use," said Bouchard. "Existing satellite operators had to repack their operations into the upper 200 megahertz of the band, from 4.0 to 4.2 GHz, noting that this forced move created an operational problem for the organization he was with then, Montreal-based Télé-Québec, a Canadian public broadcaster television with an educational mandate.

"It's available on cable, over-the-air, and now via OTT, covering 96 percent of the Quebec population," said Bouchard, adding that even though only some seven percent of the province's viewers receive Télé-Québec with home antennas, providing OTA service to that audience was important.

"That number is very stable; it hasn't shrunk, and we want to keep those who grew up watching us."

He described the OTA service as consisting of 18 terrestrial transmitter sites, all linked to the Télé-Québec's studios

via C-band satellite, and only about a third of these sites having access to high-speed Internet connectivity.

Bouchard said that prior to the loss of the lower portion of the 3.7 to 4.2 GHz downlink spectrum to wireless carriers' 5G implementation there was sufficient link margin to overcome most weather conditions. However, the splitting of the band required the installation of 12-pole bandstop filters ahead of receive site LNBs, effectively lowering LNB gain and reducing link margins to the point that a heavy wet snow could wipeout program feeds.

"Sticky snow is the worse factor affecting low-margin C-Band service," said Bouchard, observing that snowfalls could cause outages lasting up to an hour, and that while satellite dish deicing systems helped to reduce the duration of outages, they didn't entirely eliminate them.

While an obvious solution would be to retrofit the sites with larger satellite antennas, given the small percentage of audience served by terrestrial signals, the cost couldn't be justified, and another more cost-effective solution had to be found. This led to investigation of "SRT (secure reliable transport) to bolster the poorly performing transmitter site Internet connections so that it could be used as a backup for C-band program delivery.

Bouchard explained that SRT combines low-latency streaming with an advanced technology to deal with missing packets, making it possible to reliably delivery data even over less-than-ideal signal paths.

"With SRT, the payload is sent via UDP (user datagram protocol) and flow control packets are sent via TCP (transmission control protocol)," said Bouchard. "A flow control feature permits the use of error detection and provides retransmission of missing packets.

"Our solution to the reduced link margin issue was to continue to send programming via C-band satellite, but to back this up with an SRT-encoded compressed feed going via the public Internet," said Bouchard, explaining that the main delivery path continues to be via satellite, but when the dish signal becomes unstable, the transmitter feeds failback to the Internet-delivered video and audio.

He added that while more testing is in order, the SRT-encoded feeds now provide a viable alternative to installation of larger satellite dishes at the transmitter sites.

"For now, SRT transmission is a viable option to improve low-margin site reliability," he concluded.

### How Well Does ATSC 3.0 Fair In Adjacent Channel Situations?

The most recent reduction in, and "repacking" of, U.S. television broadcast spectrum began in late 2018. It resulted in changes in the operating frequencies of nearly 1,000 stations, with some being required to operate immediately adjacent to other stations within the same market, a situation which historically the FCC had been careful to avoid in the assignment of channels, due to the potential for adjacent channel interference.

In his presentation, "ATSC 3.0 Adjacent Channel Testing," Hitachi Comark's vice president of engineering, Tom Barbeau, examined a particular aspect of this co-location, associated with the combining of stations operating with the ATSC 3.0 DTV standard, and transmitting from a shared antenna.


Tom Barbeau

As background for his presentation, Barbeau referred his audience to the FCC's "DTV Report On COFDM And 8-VSB Performance" document, which was released in September 1999.

In summarizing the FCC Report, Barbeau noted that it acknowledged that the COFDM modulation incorporated in the (then planned) ATSC 3.0 standard had advantages in terms of resistance to signal distortion and group delay issues over ATSC 1.0 with its 8-VBS modulation, and that while advances in receiver design had "mitigated" some of the difficulties associated with 8-VSB, its single-carrier and fixed-bandwidth characteristics had destined it to become an obsolete technology.

He said that FCC reported that as a result of the most-recent repacking, some 56 communities wound up with stations operating on channels adjacent to each other, and that in some television markets, the repack resulted in three or more sets of adjacent channels. Barbeau stated that in numerous other post-repack relocations, stations were operating adjacently to other stations in fairly close proximity, but not within the same market.

Barbeau said that curiosity about the effects of operating on adjacent channel allocations led to the development of a testing program involving NextGen TV signals, and then described the testing program.

"This was something that was definitely worth looking at."

In describing the testing methodology used, he stated that "the idea here is to use an ATSC 3.0 signal from an exciter on a UHF channel and feed it into Radio Frequency Systems adjacent channel combiner and (then) apply the output to a measurement receiver to understand what the filter impairments do to the quality of the signal."

"The plan was to completely understand the impairments and what effect changing the modcod has on those impairments for a given combiner input location; in other words, the broadband port or narrowband port of the combiner. By using a complete ATSC 3.0 ecosystem, we could easily reconfigure the exciters to change the parameter under test, and see what if any effects occur."

In further describing the trialing, Barbeau said that the Ch. 24 and Ch. 25 (530-536 MHz and 536-542 MHz) pair was used. The Ch. 24 simulation operated with 4096-QAM, 13/15 coding and the Ch. 25 simulation initially used 256-QAM modulation.

In discussing the results of the testing, Barbeau said that it revealed combining of adjacent channels had "little or no effect

on performance and offers a reasonable way for SFNs to be implemented with adjacent channels on a single antenna.

"No errors were introduced to the stream content due to the combining," he said, adding that "varying the coding seemed to have little to no impact in our lab setting, and varying the carrier reduction state also appeared to have little to no impact."

### A Look Inside Today's Transmission Antennas

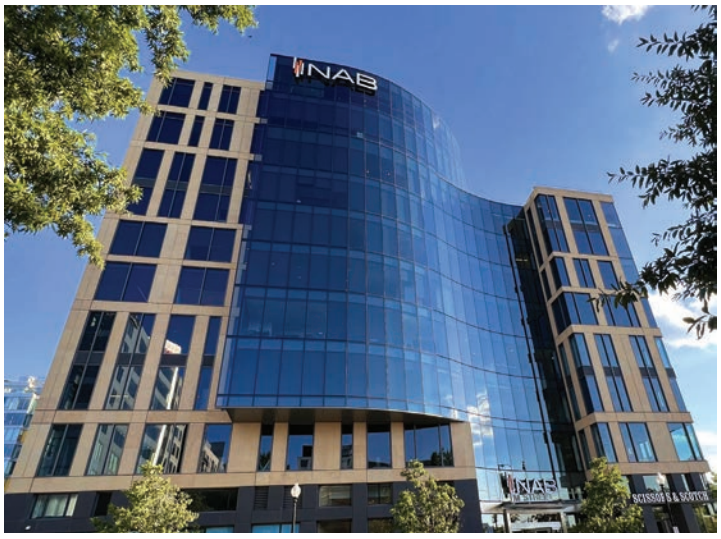
Wrapping up the presentations at this year's BTS Symposium was Dielectric's mechanical engineering manager, James Butts, with an examination of what it takes to make the large transmitting antennas in use today reliable and providing service for many years.

James Butts

Butts, in his paper, "Vibration and Fatigue Criteria in the Design of Television Antennas," observed that there's a lot that goes into the design of large mechanical structures such as transmitting antennas, and any such design needs to be carefully planned out so as to circumvent failures that could affect performance of the antenna or result in its demise.

"The goal is to integrate a fatigue assessment into Dielectric's antenna design methodology," said Butts, explain that a big consideration is how winds affect such structure, and that analysis of wind gust loading of antennas affected the design in terms of welds and analysis of stress concentration on the structures.

He stated that stress analysis in antennas is modeled on the CSA (Canadian Standards Association) S37-18 document Annex N, which deals with tower dynamics and fatigue. Butts noted that this standard provides a clear methodology for calculating wind loading and is similar to a number of other standards, including those that examine antenna supporting structures, large wind turbines and the AASHTO (American Association of State Highway and Transportation Officials) that deal with the support of highway signs and traffic signals.

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The 2024 BTS Fall Symposium was hosted by the National Association of Broadcasters in their new building in southeast Washington, D.C.

Butts provided a detailed explanation of the calculations used in his wind gust loading analyses, stating that the methodology led to the identification of critical structures and features in the antenna, and from this "we're able to calculate nominal stresses at critical locations" and then "compare nominal stresses against the fatigue threshold for the specific feature."

He explained that proper flange designs and fabrications used in antennas were essential in ensuring its ability to withstand stresses, stating that three common flange designs were considered in the analysis program, welded neck flanges, "socketed" flanges fabricated without gussets, and socketed flanges with gussets

Butts noted that such analyses involved a number of continuing efforts, including the "running of parametric FES models of the common welded flange designs to determine stress concentrations in bending," as additional research into structural fatigue details, as well as analysis of the materials used in construction and various fatigue factors.

"The goal is to verify the AASHTO (fatigue analysis) or to present a flange design criterion for top-mounted masts," said Butts in concluding his presentation.

### Closing Thank Yous

In wrapping up the 2024 Symposium, Chairman Jim Stenberg expressed his special thanks to IEEE staff members Margaux Toral and Jen Barbato, as well as the NAB for making the meeting facility available, the NAB's Bob Weller, who handled PowerPoint presentations; and Towson University student volunteers, Miguel Umana and Shaylynn Fitzgerald for their assistance in connection with the conference.

The IEEE Broadcast Technology Society gratefully acknowledges the following sponsors, without whose support the 2023 Symposium would not have been possible:; The Association of Federal Communications Consulting Engineers (AFCCE), Dielectric; The MaxxKonnect Group, Televes, The Telos Alliance, and Shively Labs – American Amplifier Technologies.

# IEEE President-Elect Speaks At Joint BTS/AFCCE Awards Luncheon

## Event live-streamed

Luncheon keynote addresses have long been a part of BTS Symposia proceedings, and the 2023 event was no exception, with the IEEE's president-elect, Tom Coughlin providing a look at the IEEE itself at the Nov. 14 joint BTS and AFCCE (Association of Federal Communications Consulting Engineers) awards luncheon. BTS president Paul Shulins introduced Coughlin, noting that the president-elect's remarks were also being streamed to AFCCE members who could not be present in person.

Tom Coughlin

Coughlin began his address —"The Future of the IEEE"— with a description of the IEEE's role and scope, noting that "it's the largest technical professional society in the world" and that "its members are in volved in all aspects of technology creation and use." He additionally observed that the research by IEEE members has been responsible for numerous patents, that it is responsible for a large number of global standards, and that it serves as a source of information for formulating public policy.

"We work with innovators to improve the quality of life," said Coughlin. "(In addition) the IEEE sponsors more than 2000 conferences in more than 96 countries each year, and we publish some 200 transactions, journals and magazines.

"We cover a wide range of disciplines—from aerospace to life sciences and more."

In describing the membership of the IEEE, Coughlin noted that "only about 40 percent of IEEE members are electrical engineers; (in addition), we have doctors, we have lawyers; we have physicists.

"Last year, 143,000 patents were applied for by IEEE members."

Coughlin observed that the IEEE was also involved in areas of public safety, health, and well-being, and that since the organization was established, 21 IEEE members had been awarded Nobel Prizes.

"The basic electrical standards that are used for installing electrical systems are managed by the IEEE and have been for a long time," he said..

### Working For The Global Good

Coughlin remarked that the organization was also involved in sustainability, and that it had several outreach programs, including the involvement of Women in Engineering, an entrepreneurship program to assist those wanting to start their own businesses, a "young professional," program, and an honor society, the Eta Kappa Nu.

"These groups have a global presence. But they can also have a presence at the local level," said Coughlin. "There are a lot of activities going on."

In discussing the "future directions" of the IEEE, he listed such areas as virtualization, sustainability on a global basis, and the overall digital transformation of technologies, including blockchain, virtual reality, quantum computing, low earth orbiting satellites, smart lighting, digital privacy, wireless power transfer, and the development of advanced semiconductors.

Coughlin said that the IEEE also had a role in helping to develop technology policies for the public good.

"We're committed to help people throughout the world in terms of technology development, and to use this to make their lives better," he said.

"We can provide technology insight that can help in making decisions," said Coughlin, noting the organization's role in providing information about benefits, risks and social implications associated with the adoption of technologies, and that the IEEE does not represent any specific company technology, or innovation.

Coughlin said that a particular priority of the IEEE is in reaching out to younger members and to keep them engaged in the organization.

"We need to bring in the young folks; they are going to be our future."

He concluded by stating that as the newly-elected IEEE president, he wanted to use his time office to help build the organization and help achieve its goals to use technology in the betterment of mankind.

"I want to give talks such as this one to find out from people about their ideas," said Coughlin. "I've got a year as president to make a difference. I'm not getting paid, and if I'm going to do something for free, I want it to be as impactful (as possible). Any help is greatly appreciated."

# U.S. Naval Academy Subject Of Wednesday Luncheon Keynote

## Provost provides a look at the institution's past and present

The Symposium's Wednesday box lunch event featured a keynote address on the U.S. Naval Academy, which is located in nearby Annapolis, Maryland. The keynote speaker, Samara L. Firebaugh, provost at that organization, presented a comprehensive look at the service academy's long history, as well as insight into its academic programs and role in major technological developments during its existence.

In introducing Firebaugh, BTS president Paul Shulins noted that she holds a PhD in electrical engineering, with specialization in the area of microelectromechanical systems. She is also an IEEE Senior Member and has published a number of papers in the IEEE's **Transactions**.)

Samara L. Firebaugh

In her address, Firebaugh recounted the history of the nearly 180-year-old institution, discussed its academic programs, and spoke about some of its scientific and engineering accomplishments.

"The Navy has been such a driver over the years for innovation and technology," said Firebaugh, adding that "the needs of the Navy drove such things as timekeeping (and such things as) spring-wound watches came out of that technology."

She noted that radar had been developed by the Navy, as well as nuclear propulsion of submarines and ships, and the global positioning system (GPS) in use today.

### Academy History Includes Early Speed Of Light Measurement

In reviewing the Academy's academic program, Firebaugh observed that a number of its graduates had gone on to distinguish themselves in scientific and engineering endeavors, including an 1873 graduate, Albert Michelson, who is noted for his early work in accurately measuring the speed of light and who won the Nobel Prize for Physics in 1907.

"His first measurements of the speed of light happened at the Naval Academy along the seawall, and were done as demonstrations for his class," she said. "He was a graduate of the Academy and came back to teach as an Ensign."

"Today, we have a class size of over a thousand," said Firebaugh, adding that this includes 15 international students from naval programs in other countries.

She noted that the student body is very diverse, with students coming from every U.S. state, as well as the District of Columbia, American Samoa, Guam, Puerto Rico, and the Northern Marianas Islands. In further describing the makeup of the current class of 2027, Firebaugh said that the students accepted were all high-achievers during their high school careers, with 90 percent of them involved in high school varsity athletics, 56 percent chosen as members of the National Honor Society, and more than half having served as high school student body leaders. She noted also that more than a third had participated in music education programs, and that 14 percent had been active in scouting programs.

"A big part of our educational philosophy is leadership… and a big part of leadership is relationships," said Firebaugh. "We try to emphasize a relationship educational model. This means small class sizes, a lot of group work, a lot of intentional development of leadership opportunities within a class."

She described one class activity as the launching (in coordination with NASA) of a small satellite and tracking it with a ground station located at the Academy.

According to Firebaugh, the Academy offers degrees in 26 areas, including electrical. mechanical, nuclear and robotics and control engineering, as well as computer and data science, and even Arabic and Chinese languages.

"We don't have a graduate studies program," she said, explaining that many of the undergraduates do get involved in specialized research work and independent studies, as well as partnering with other outside institutions and firms, which include the U.S. Department of Energy and the National Science Foundation.

She concluded by describing various traditions and specialized observances that are part of the Naval Academy, including rivalry in sporting events, and the Fourth of July, Easter, and Halloween.

# ATSC Insider

By Madeleine Noland and Jerry Whitaker,
Advanced Television Systems Committee

## NextGen TV at CES 2024

CES 2024 reported over 130,000 attendees as the Las Vegas Convention Center was again filled with exhibitors and industry people from the moment the show opened until the closing bell.

The variety of products and services across hundreds of verticals creates a challenge for any particular topic or company to get noticed, and the ATSC booth at CES created a central point of NextGen TV information, allowing those interested to easily find the latest news and developments, as well as provide a visible forum for product and service debuts – and there were plenty of new developments for TV viewers to learn about at this year's ATSC CES booth.

A number of CES announcements about NextGen TV underscored the excitement at the ATSC booth.

- US Broadcasters announced that 75% US households have access to NextGen TV services with the addition of Chicago, San Diego and Tucson – all scheduled to launch in time for the "big game".
- The Consumer Technology Association research department issued its January update on NextGen TV sales and more, reporting that 10.3 million NextGen TVs have sold in the US to date.
- The CTA numbers also predicted a 45% increase in NextGen TV sales in 2024.
- CTA also issued numbers on US antenna usage, reporting that 25% of households use an antenna to watch free over-the-air services on at least one TV in their home.
- Set-top-boxes were also making news with the addition of Stavix to the group of companies offering products, Zinwell announcing a new device that handles DRM without an internet connection, the ADTH box by Tolka now available at Walmart.com, and Zapperbox displaying their DVR-featured box.

On the product front, the biggest news was the entry of TCL into the group of manufacturers offering NextGen TV capability in many of their 2024 models. Signage was on view at the TCL booth, as this welcome news not only impacts US viewers, but also bodes well for other countries transitioning


Busy ATSC Booth.


NextGen TV Set Top Boxes on Display.


HDR 10 Improves Viewer Experience.

to ATSC 3.0 technologies, such as Jamaica, Trinidad & Tobago and Brazil[1].

In fact, booth visitors were first greeted by a video roll of consumer commercials for new television services powered by ATSC 3.0. Korean commercials touted interactivity and 4K video, Jamaican commercials touched on a wide range of benefits accompanied by the perfect soundtrack that could only come from Jamaica! The US commercials were in the loop, many of which people across the US have seen on air at home.

India recently announced[2] new Direct to Mobile services (D2M) to launch in 19 cities across the country on the Prasar Bharati (India's public broadcaster) infrastructure. Visitors to the ATSC booth could check out the prototype smartphone and accessories that are being developed to support the service. With some 1.2 billion cell phones in the country, these devices are the primary screen that people watch TV on in India.

NextGen TV success rests on three facets. First, broadcasters must launch the service – and 75% of US HH is a major milestone. Second, manufacturers need to make products that people are buying – and with multiple set-top-boxes available, upwards of 100 TV models, and better-than-expected sales numbers are all great steps forward. The third facet is the content. Once the service is on the air and the audience has the receiver, what do they see? What will they love that they didn't experience with the legacy system? This year's CES showed major strides in the development of exciting content offerings powered by NextGen TV and ATSC was delighted to show off some of these new content offerings at CES.

Great pictures and sound were front and center. Demonstrations of HDR10+ and Advanced HDR by Technicolor were supported by logos of major league sports franchises, including the Phoenix Suns and Utah Jazz NBA teams, which have transferred games from regional sports networks to broadcast. Dolby offered demonstrations of immersive audio and audio accessibility in a dedicated acoustic room within the booth.

A special display of NextGen TV apps available from broadcasters garnered a lot of attention. A sports stats and betting app was shown, along with an "IP Channels" demonstration. IP Channels are stations that are accessed via the electronic program guide but are delivered via the internet. Viewers can "channel zap" between these IP Channels and over-the-air channels, just as if they were all delivered over-the-air. Shown live on-air in Las Vegas was a local station app, offering access to a wide range of the station's content on-demand via a menu-driven UI.

Two app demos garnered particular attention at the show. One showed "start over" TV, which has proven to be an audience favorite in Europe. Imagine tuning into a program a few minutes after it started and having the option to restart the program from the beginning, and then return to live viewing at any time – all with the click of the remote. The other was a live on-air music video service called ROXi. The service is accessed via the OTA electronic program guide and can be selected like any other channel. The consumer has the option of skipping a particular song or even selecting a completely different genre and more, all within the UI of the traditional OTA experience. Post CES articles heralded these two services as "killer apps."


ATSC booth staff at CES.


Pearl TV's Anne Schelle discussing market place eco system created in NextGen TV.

While the focus of CES is on products and services available to consumers in 2024, ATSC took the opportunity to present a vision of two future services. People know NextGen TV as the consumer-facing moniker in the US for the new television services powered by ATSC 3.0. But this new system enables a broad range of possibilities in addition to better and better TV. Music services is one use case, and a full radio service line-up delivered to a car was on display. And the seemingly limitless possibilities of ATSC 3.0 were showcased in the NexusConnect area envisioning a rich "marketplace" ecosystem where people come together to build smart, successful, sustainable communities with datacasting as a central pillar.

So, again, CES delivered a very positive experience, and at ATSC we have only one thing to add: We'll see again you at CES 2025!

## Footnotes

[1]Brazil has selected key technologies from the ATSC 3.0 standard, including ROUTE/DASH, Advanced Emergency Messaging, MPEG-H Audio, and IMSC1 Closed Captions. Testing for the physical layer selection is ongoing. See https://forumsbtvd.org.br/tv3_0/ for details.

[2]https://telecom.economictimes.indiatimes.com/news/policy/d2m-broadcasting-technology-likely-to-be-launched-next-year-govt-official/106892526


# DRM News

By Yogendra Pal
Honorary Chairman of the India Chapter of the DRM Consortium

## DRM Digital Radio Services In FM Band – Suggested India Roadmap

### Introduction

At present most of the terrestrial radio services (public and commercial) in India are in analogue, except for some services of the public service broadcaster, All India Radio (AIR), in medium wave and shortwaves bands, which are in DRM digital.

Some time back, the broadcasting regulator, Telecom Regulatory Authority of India (TRAI), recommended that digital broadcasting in FM band (VHF band II) should also be allowed, without disturbing the existing analogue transmissions. Recently, the regulator has further recommended the commercial use of low power terrestrial FM broadcasting for small range coverage by residential complexes, industrial exhibitions, and small businesses. The licensees should be allowed to deploy any type of transmission technologies (analogue/digital/any other).

### DRM Digital Radio Standard For FM Broadcasting – The Arguments

The DRM Consortium has stressed to the Indian authorities that the DRM digital radio is the most modern, non-proprietary, and open digital radio standard. It is the only digital radio standard that works in all the radio broadcast bands and some of its benefits are:

- **State-of-the-Art future-proof technology** - Analogue FM, power and spectrum-hungry, is a 20th-century technology with limited innovation scope. DRM Digital broadcasting in the FM band provides multiple services, within the same allocated frequency band, at much-reduced power along with a host of other value-added services.
- **Half the frequency spectrum required** – One audio channel in analogue FM requires a 200 kHz frequency spectrum, whereas one block of DRM digital (which enables the broadcast of up to 3 audio programmes and additional multimedia services like Journaline) requires only 100 kHz, i.e., half the spectrum that is required for an analogue FM transmission.
- **Multiple single audio channels and value-added services** – In analogue FM only one audio programme can be broadcast in the allocated 200 kHz bandwidth, whereas DRM digital enables to broadcast of up to 3 audio programmes (and additional multimedia services like Journaline), within just 100 kHz bandwidth.
- **Much Lower frequency offset required** – In India, centre-to-centre spacing of 800 kHz is kept between the two analogue FM transmitters (i.e., 600 kHz frequency gap) but a DRM digital transmitter can be installed at a spacing of only a 50 kHz frequency gap from an analogue FM transmission and/or another digital transmitter. Thus, DRM digital permits the operation of much more radio services in digital in the FM band.
- **Innovation** – In addition to excellent audio quality, DRM digital radio offers data services such as Journaline, SlideShow, etc, which fits use cases where each audio service can be of a different language while complementing the audio with text and graphics (subtitles, additional info, ads, etc.) on Journaline.
- **Reception in mobile phones** - DRM standard is supported natively on all mobile phones based on the already available tuners for analogue FM reception. No additional hardware and therefore no additional design or component cost is required to enable DRM digital FM support on those phones. The DRM App for mobile phones has already been developed. The mobile phone manufacturers need to provide access of the base band digital output to enable reception of DRM digital signals. The mobile phone industry is also expecting the clear policy announcement for India to start incorporating this functionality in future phone models. For legacy phone models, external FM front-end dongles are available. These dongles along with the already developed DRM radio app can be used to receive full DRM FM functions.

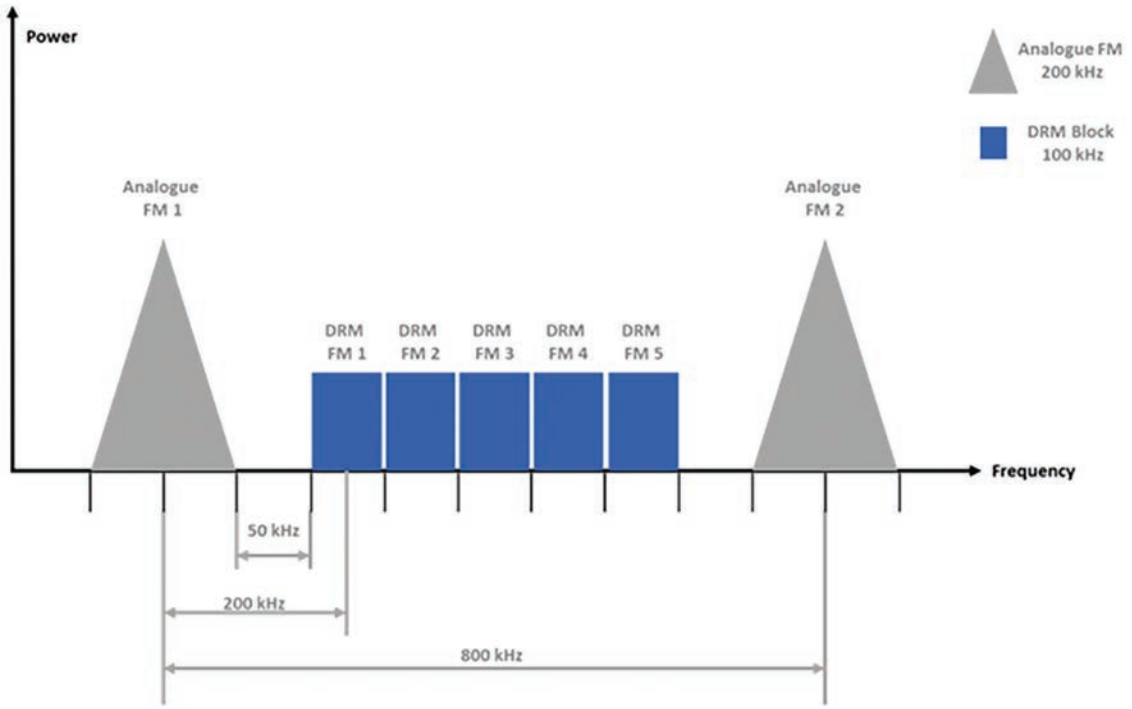
### An Efficient And Innovative DRM Rollout Approach In The FM Band

The cheapest and easiest way to rollout digital radio services in the FM band is to add a broadband transmitter, in every city/town in India, in the unused white space of 600 kHz between the two analogue FM transmitters. The output of this transmitter can be fed to a separate antenna, to be installed on the same tower hosting antennae for the analogue FM transmitters. This transmitter can carry multiple DRM blocks made up of 3 audio and one valued-added channel.

It is possible to transmit up to 5 DRM blocks (Fig) in this white space of 600 kHz from a single transmitter. This has been demonstrated successfully by the DRM Consortium in India.

One DRM block can be assigned to every broadcaster, who will be able to carry up to 3 high quality audio services with a lot of value-added services; and will have full control on their content.

If more than 5 DRM blocks are required per city/town, then two or more transmitters can be installed for DRM digital services. Output of these DRM digital transmitters can be combined and fed to a single antenna.




DRM Blocks in white space of 600kHz between 2 analogue FM transmitters.

## To Sum Up

The argument for extending DRM to the FM space in India is that DRM is a high-quality and feature-enhanced digital replacement for the former analogue radio broadcasting standards for AM and FM; as such it can be operated with the same channeling and spectrum allocations as currently employed.

DRM is on-air in India (with over 6 million cars with DRM receivers in the dashboard) and expanding in Asia – with Indonesia, China and Pakistan adopting DRM. Over the past years, DRM receiver, chipset and automotive manufacturers have invested significantly to bring down the cost of new receiver models, and to increase their sensitivity and feature completeness. New chipsets and modules are now available, which will enable the production of low-cost "Make in India" DRM receivers.

The government has already requested for all mobile phone manufacturers to provide FM reception, and including the DRM digital radio reception in the mobile phones is possible without any additional hardware. TRAI has recommended that the Ministry of Information and Broadcasting may constitute a committee to oversee its implementation by the mobile phone manufacturers of FM in mobiles (opening a great opportunity for including DRM as well).

For substantial power saving, excellent sound, efficient use of spectrum, multi-channel provisions, E-learning options, Emergency Warning Functionality and win-win situation for all the stakeholders, it is hoped that Government of India will soon announce the policy for the use of DRM in the FM band by Public Service Broadcaster (AIR/Prasar Bharati), Private Broadcasters, Community Radio Stations (CRS) and for small range low power FM broadcasting.

## Footnotes

*https://prasarbharati.gov.in/drm-digital-radio-of-air/*

*https://www.trai.gov.in/sites/default/files/Recommendation_Digital_Radio_01022018.pdf*

*https://www.trai.gov.in/sites/default/files/Recommendations_21092023.pdf*

*https://www.drm.org/*

*https://www.drm.org/digitizing-the-fm-band-with-drm-new-delhi-jaipur-trial-2021-results-overview/*

## About The Author

***Yogendra Pal*** *is the Honorary Chairman of the India Chapter of the DRM Consortium, the international not-for-profit organisation which has been created for the development and implementation of the DRM standard for the digitisation of the terrestrial radio transmissions. He is also the honorary member of Board of DRM Consortium.*

*He was Advisor with the Ministry of Information & Broadcasting, for the implementation of Digitisation Addressable System (DAS) in the Cable TV network in the country and was closely associated with the strengthening of the Community Radio network in the country.*

*He superannuated from All India Radio & Doordarshan as Additional Director General after over 36 years of glorious service and was associated with implementation of state-of-the-art fully digital studio setup (New Broadcasting House) in Delhi; News-on-Phone, Internet and AIRNET services and networking of AIR stations.*

*He is the life fellow of Broadcast Engineering Society (India) and Institution of Electronics & Telecommunication Engineers.*

# Non-Line-of-Sight TV

## - Longley-Rice, ITWOM and P1812 Predictions
## - Real-world Experience

By Doug Lung, BTS 2023 Jules Cohen Outstanding Engineering Achievement Award Winner

Over half a century ago when I was growing up in Hagerstown Maryland, most people relied on over-the-air TV, watching the analog VHF stations from Washington D.C. and Baltimore using large antennas mounted on a chimney or on a short tower. I was fascinated by this and credit it and an assortment of Gilbert electronic kits and, later, Heathkits, with starting me on the career path I'm on now. However, I didn't think much about how the signal got from Washington D.C. to Hagerstown. After my parents moved to a new house, and I put together a TV antenna system for them, I knew I had to point it at a particular spot on South Mountain to get the stations, but didn't think about the path or obstructions. I knew the mountain was the reason I could never hear ham radio stations in the Washington D.C. area on two meters (144 MHz) from my house but hadn't considered its impact on the TV and FM radio signals. There were no personal computers then so doing any propagation modeling was a pen and paper exercise using USGS topo maps. That was beyond my ability!

Later, I put up an antenna at my brother's new house and he had no problem watching the D.C. and Baltimore stations. However, the rotor on the antenna stopped working and after the analog shutdown he switched to cable. An attempt to get it working again failed when I found a translator had popped up on his favorite channel after the repack and he was receiving PBS instead of NBC. The translator moved to another channel and last year he decided he wanted to cut his cable bill and go back to over the air. I recommended an antenna and a SiliconDust HDHomerun so he could see TV on all his devices. After giving him a shopping list of items to buy, which he promptly ordered, I thought it might be worth running some studies to see what sort of reception to expect.

TVStudy showed WRC-TV's field strength well below the noise limited threshold. I found similar results looking at web sites like https://www.rabbitears.info/ , the FCC's DTV coverage page (https://www.fcc.gov/media/engineering/dtvmaps), and https://www.antennaweb.org/ . However, I knew reception was possible – I'd received WRC-TV on channel 48 in Hagerstown on one trip using an indoor antenna and preamp and had seen UHF and VHF channels from Baltimore and D.C. in analog there before. Mentioning this to Mark Colombo, he confirmed that his experience was good reception was possible in Hagerstown Maryland and Winchester Virginia, even with the terrain blockage. While my focus here is on the Appalachian mountains, Longley-Rice's under-prediction of signal strength over mountains is well documented on the west coast as well. Reception of signals from Mount Wilson in the Palmdale/Lancaster area north of Los Angeles is one example.

### Longley-Rice ITM Versus ITU P1812 Predictions

I decided to run some studies comparing field strength predictions from the Longley-Rice ITM (from SPLAT 1.4.2 and TVStudy 2.25), ITU P1812-4 (from RadioPlanner 2.1), and ITWOM (Irregular Terrain With Obstructions Model) 3.0 (from SPLAT 1.4.2).

All studies were based on a 20' (6.1 meter) receive antenna height. For the SPLAT studies I used the 30 meter resolution ASTER terrain data (https://asterweb.jpl.nasa.gov/gdem.asp). The RadioPlanner ITU-P1812-4 study used USGS 1 arc-second terrain data and clutter data derived from OpenStreetMap. TVStudy used the USGS 1-arc-second terrain data and the USGS NLCD 2006 clutter data included with the program. The SPLAT studies did not include clutter, although the ASTER elevation data includes reflections from large buildings which will cause them to be counted as obstructions in the path or Fresnel zone. Transmit and receive antenna heights above ground were adjusted to give the same height above sea level when using the ASTER elevation data. (I noticed the impact of a building in the ASTER data when comparing field strength predictions in New York City at the same test location but with slightly different GPS coordinates. One prediction was much higher than the others. Mapping the odd location on Google Earth put the test van on a rooftop, while the other GPS coordinates were on the street.)

The SPLAT terrain profile is shown in Figure 1. The path loss plot, using the ASTER digital elevation data, from the Longley-Rice model is shown in Figure 2. The results are similar to the web-based predictions – a signal level well below threshold. The SPLAT software provided the mode of propagation: "Double Horizon, Troposcatter Dominant" with an Error Code 3. The predicted field strength was 13.70 dBµV/m.

SPLAT can also use ITWOM created several years ago by Sid Shumate. When I reran the study using ITWOM 3.0 it showed a signal level closer to what my field experience indicated. The path profile is shown in Figure 3. As you can see it is quite different than that from Longley-Rice ITM shown in Figure 2. The predicted field strength was 69.20 dBµV/m. The path report shows the mode of propagation as "Double Horizon Diffraction Dominant" with no errors. The accuracy of ITWOM, when used in SPLAT without clutter data, can vary significantly depending on

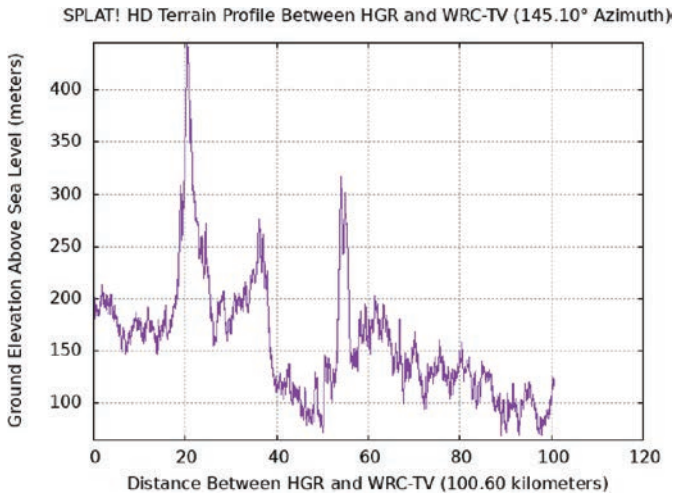



Figure 1.

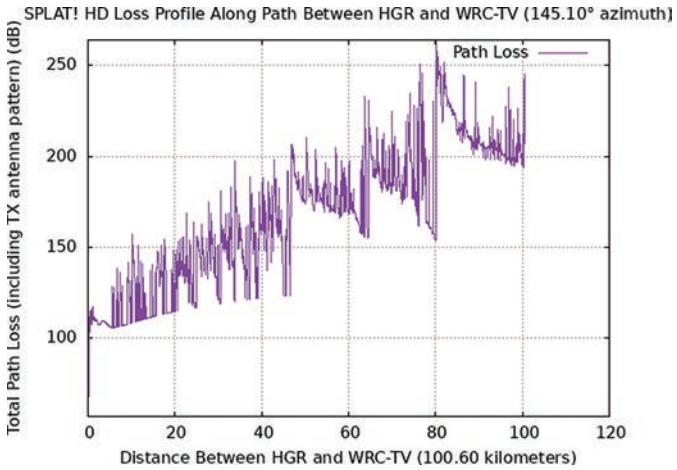



Figure 2.

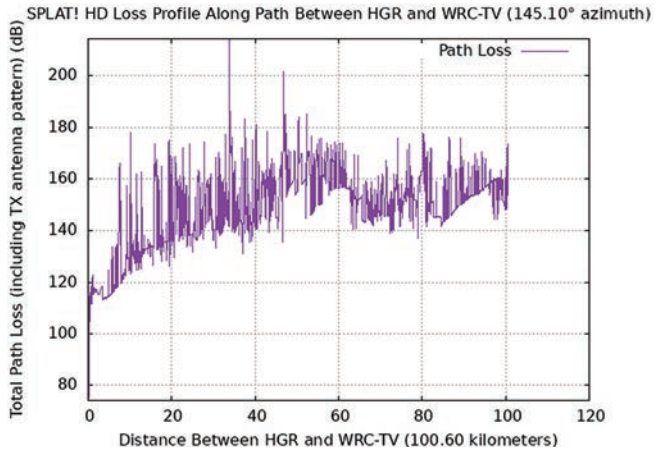



Figure 3.

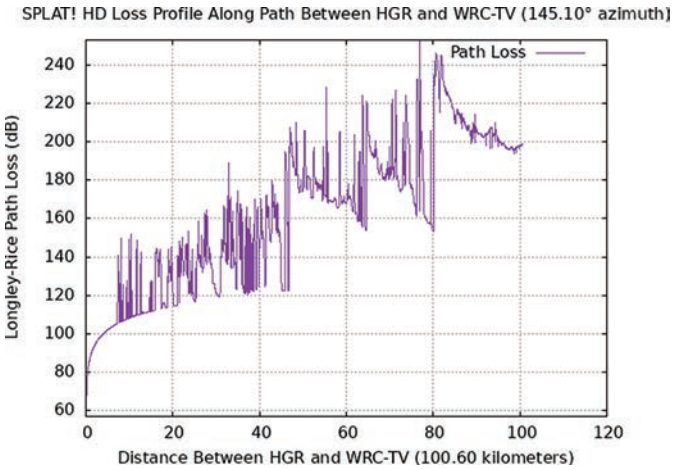



Figure 4.

the path. There is a good comparison of the propagation models at: https://www.researchgate.net/publication/261061432_Comparison_of_Longley-Rice_ITM_and_ITWOM_propagation_models_for_DTV_and_FM_broadcasting.

To provide a comparison with TVStudy, I used the USGS 1-arc-second terrain data with SPLAT's Longley-Rice ITM. Converting the USGS GeoTiff to SRTMHGT using gdal_translate and then to sdf format using SPLAT's srtm2sdf-hd program resulted in a slight offset of approximately 30 meters (about one-second) in the terrain data. Figure 4 shows the path loss using the USGS elevation data.

I ran point to point studies using TVStudy, with 10 points per kilometer for the terrain profile and specifying 6.1 meters as the receive antenna height. The studies were done with and without clutter. The results are shown in Table 1. The SPLAT receive site USGS elevation was 3.7 meters lower (after format conversion) than that provided by TVStudy, which could account for difference in field strength between the two studies. All studies with the USGS terrain data provided higher field strengths than the study using ASTER terrain data, with a maximum of 26.8 dBµV/m from TVStudy. Adding clutter dropped this by 5 dB. The SPLAT field strength with USGS elevation data was 23.7 dBµV/m.

For the RadioPlanner P1812-4 study, I set the receive antenna height at 6.1 meters and for the clutter specified the antenna at rooftop at clutter height. P1812-4 clutter loss values were used. Figure 5 shows P1812 coverage in the Hagerstown area for an antenna mounted 20' (6.1 meters) above ground, typical height for a short rooftop mast or tower. For my brother's house, the program determined the antenna was in an open area suburban location and assigned no clutter loss. Figure 6 shows the path plot to my brother's house, using the USGS 1-arc-second data. The plot shows clutter type and height as colored vertical lines above the curve but they may be difficult to see. The results, which may also be hard to read on the figure, are a P1812-4 predicted field strength of 47.4 dBµV/m based on 128 dB of path loss and 46.1 dB of diffraction loss.

## Real-World Experience

Based on recommendations from other engineers and after checking reviews, the antenna I selected was the Televes Ellipse Mix 80. When comparing antennas, I focus on the driven

| Obstructed Path Field Strength Predictions – WRC-TV to HGR | | | | | | |
|---|---|---|---|---|---|---|
| Model | ITM 7.0 / Longley-Rice 1.22 | | | | ITWOM 3.0 | P1812-4 |
| Software | *SPLAT!* | *SPLAT!* | *TVStudy* | *TVStudy* | *SPLAT!* | *RadioPlanner 2.1* |
| Elevation data | ASTER | USGS | USGS | USGS | ASTER | USGS |
| Clutter data | None | None | None | NLCD 2006 | None | OpenStreetMap |
| | | | | | | |
| Path Loss (dB): | | | | | | |
| Free Space | 128.15 | 128.15 | | | 128.15 | 128 |
| Terrain | 80.59 | 71.07 | | | 25.08 | 46.1 |
| Total | 208.74 | 199.23 | | | 153.24 | 174.1 |
| | | | | | | |
| Field (dBµV/m): | **13.7** | **23.67** | **26.8** | **21.8** | **69.2** | 47.4 |
| | | | | | | |
| Path notes: | Double Horizon | Double Horizon | | | Double Horizon | |
| Dominant mode: | Troposcatter | Diffraction | | | Diffraction | |
| Model errors: | #3 (Out of range) | None | | | None | |

Table 1.

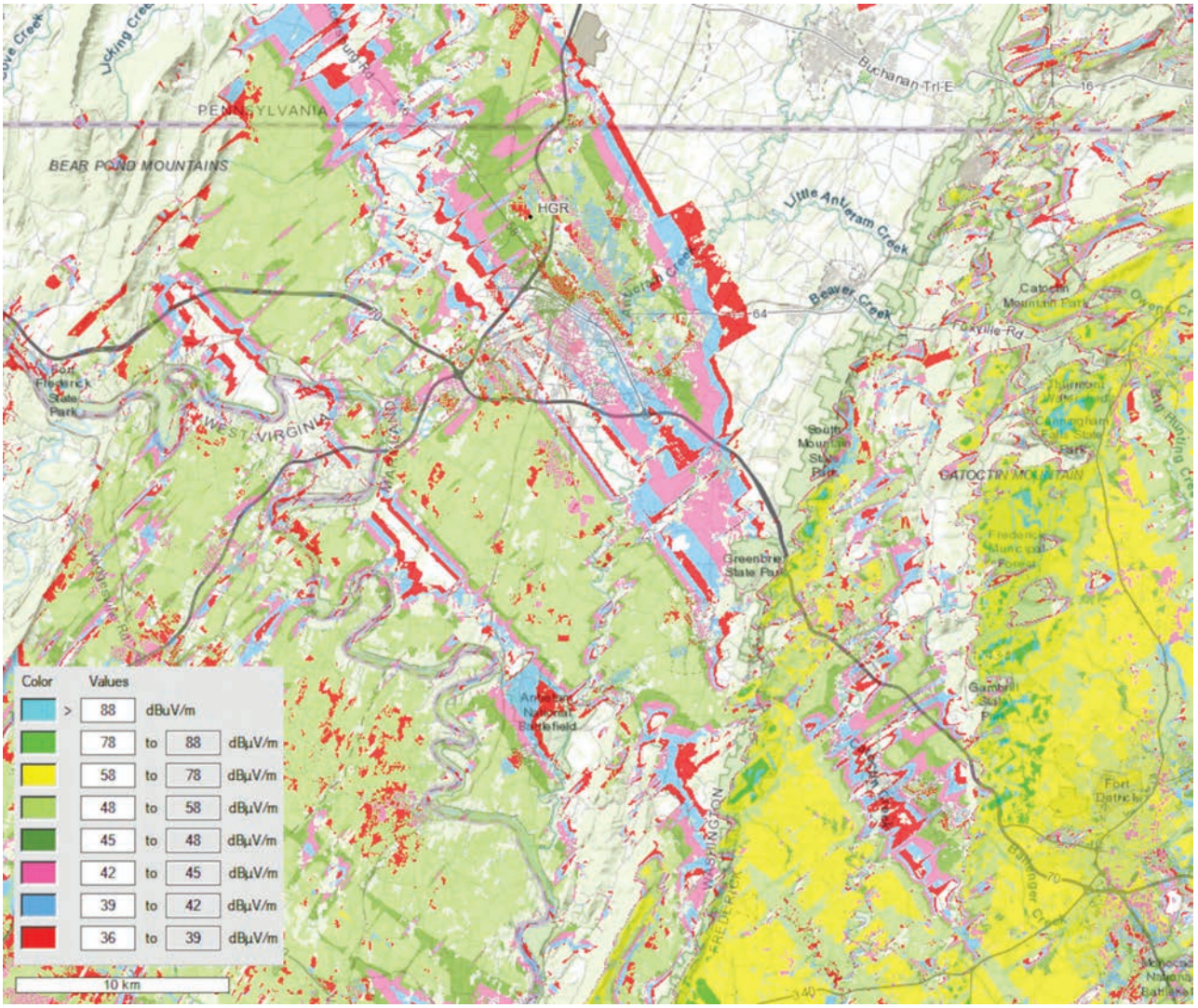



Figure 5.


Figure 6.

element – does it look like something broadband (a fan dipole or collection of log-periodic elements versus a single dipole, for example) and the reflector. The Televes antenna's UHF element looked like it would handle the 470-608 MHz band and the VHF element, while not a fan dipole, looked large enough to work well in the 174-216 MHz band. The reflector was curved (I didn't measure it to confirm it was a parabola), which based on my positive experience with corner reflectors and the Scala Paraflector antennas was encouraging. The antenna went together quickly and looked like it will survive the winters.

How did it work? At Hagerstown, at a height of around 20', spot checking both VHF and UHF stations from Washington D.C. and Baltimore showed a received SNRs of over 20 dB and up to 26 dB. I didn't bother with signal level measurements as the antenna had a built LNA with unknown gain. We had the ability to go five feet higher, but I found increasing height dropped the signal strength. The antenna was not that far above the roof so I suspect reflection from the roof was the reason for this. A channel scan showed all full power UHF and high-VHF Baltimore and Washington D.C. TV stations could be received without errors.

In summary, as others have said before, treat Longley-Rice coverage predictions over obstructed terrain with caution. My focus here was on coverage, but in an area with multiple weak signals, this under-prediction of field strength could lead to interference from unexpected obstructed stations. I'd be interested in hearing your experiences with non-line-of-sight coverage. Email me at dlung@transmitter.com.

# Women In Broadcast

## BTS's impact around the world

**By Samina Husain, Vice President, Broadcast Technology Society**


2024 will bring exciting new BTS events at the Asia-Pacific Broadcasting Union's (ABU) annual Digital Broadcasting Symposium (DBS) and the NAB Show. In addition, Marta Fernández, Assistant professor at University of the Basque Country has been active in motivating young professionals. For the upcoming IEEE International Symposium on Broadband Multimedia Systems and Broadcasting (BMSB), we are looking forward to the Young Professional and Women in Engineering Workshop. Join the event and experience the benefits.

Hot off the press, BTS is launching a new Podcast Series, geared for Young Professionals. Read about the upcoming events https://bts.ieee.org/. We would love to hear your feedback, tell us what you want to hear about.

I am delighted to announce that IEEE WIE has opened a new grant, Family Cares Grant. This grant fosters and facilitates participation in IEEE conferences, particularly for individuals whose financial commitments to the care of family members might otherwise impede their attendance.

Consider joining IEEE WIE, a global network which connects nearly 30,000 members in over 100 countries to advance women in technology through out their lives and careers. Latest information found on https://wie.ieee.org.


Marta Fernández

Elevate your grade and become a Senior Member, it is the highest grade for which IEEE members can apply. Read more details https://www.ieee.org/membership/index.html

Thank you for all your support and contributions, the articles address interesting topics, motivate young professional and engage women in broadcast. Tell us your stories, please reach out and share your thoughts on women in engineering/broadcast, recognizing their extraordinary contributions and achievements: email: bts@ieee.org

# Young Professional And Women In Engineering Workshop Coming to the 2024 BMSB

**By Marta Fernández**
**University of the Basque Country Assistant Professor, TSR Radiocommunications and Signal Processing**

Building on the success of previous YP and WIE events, a workshop is being organized at the 2024 BMSB. This year's workshop will be part of the both the BTS Young Professionals (YP) and Women in Engineering (WIE) program. It is a wonderful opportunity for students to meet industry professionals from other countries, participate in an educational forum of experts, obtain constructive feedback, and develop collaboration opportunities.

The free of charge workshop will take place during the 2024 BMSB, hosted by Humber College in Canada, where conference attendees will be able to participate. In addition, local students, even if they do not attend the conference, can take part in the workshop.

Students can participate by doing short presentations about their research or by listening and learning how a scientific session works. Moreover, this event is not only for the early-entry students, but also the more experienced students, enabling a mixed audience and participation, resulting in constructive feedback and exciting debates. Young professionals are always delighted to contrast opinions with those with more experience!

This will be the third year that a face-to-face workshop will be held during the BMSB. The 2022 edition took place in Bilbao (Spain), and the 2023 edition in Beijing (China). In both cases, there were researchers, bachelor, master, and PhD students having lively discussions, and who had a very positive and favorable opinions of the event.

Among their points of view, the young professionals highlighted that the workshop was an excellent chance to develop networking for young researchers and meet students in the same situation as themselves.

Participants also appreciated the encouraging feedback they received after presenting their works. For some it was the first time to present their research. Attendees had the opportunity to exchange ideas with others during a coffee break, had a great time taking group pictures and all participants received their certificate of attendance. Stay tuned for more information related to this event.

**Launching The YP Podcast Series**

This year the Broadcast Technology Society is launching a series of podcasts which will be of great benefit to young people interested in technical careers, entitled "Adventures in Broadcasting."

This initiative is included in the BTS Young Professionals (YP) program that offers activities designed to help engineering students build their future. The idea arose from the need to highlight career paths of experienced industry professionals known to those still studying or starting their professional careers. For young professionals, the experience of senior professionals regarding their career path, challenges and achievements is relevant. As the senior professionals were also once young and have faced the same situation as students do today.

It is beneficial and motivating for students to hear about the experiences of senior professionals. The first series of podcasts includes 10-minute interviews about engineering careers in which the interviewees are relevant members from the BT society. They answer questions related to their jobs and their initial steps in the professional world; offer their points of view on significant broadcasting-related issues and give advice to the new generations interested in technical areas.

The first interviewees are Paul Shulins and Samina Husain, who are the president and vice president of BTS, respectively, and David H. Layer, who is the vice president of Advanced Engineering at National Association of Broadcasters. Many other professionals from different parts of the world are delighted to assist students by sharing their experiences and expertise. Therefore, we will collect their stories in new podcasts.

Anyone can access these recordings and listen to these exciting stories at any time. This can make commuting to the university or study breaks more informative and entertaining while learning from the most relevant people in the field.

# Valentino Trainotti

## Honorary Professor At The University of Buenos Aires

By Marisabel Rodriguez - Senior Member
IEEE - BTS AdCom

Engineer Trainotti has been designated by the University of Buenos Aires Council, as an Honorary Professor, to highlight his fabulous career, while he still works and writes books about Antennas and Broadcast Technologies.

Tino, as we all fondly call him, is a man who embodies the spirit of boundless energy and a lifelong love for learning. Even in his 80s, his zest for life remains as contagious as his booming laughter. Tino and Stella, his beloved wife, shared a wanderlust that took them around the globe in his numerous flights or even sailing in rivers and oceans, because he is also ship captain. He stood by her side until her last days, a testament to his unwavering love and the true heart of a gentleman.

Behind his unassuming demeanor and those twinkling, mischievous eyes lies a brilliant mind. He holds the title of Electronics Engineer from the esteemed National Technological University (UTN) in Argentina, a foundation for a career marked by both teaching and research excellence. From the very halls of the UTN to institutions like the National University of Tucumán, Tino spread his knowledge, nurturing countless minds with the same patience.

Always eager to push the boundaries of understanding, Tino left his mark in renowned research institutions like CONICET's Research Institute and the Argentinian Ministry of Defense's CITEFA. But it's through his written work that his brilliance truly shines. He published 5 technical books, 2 of them this year, and the latest, together with other specialists at University of Buenos Aires is called "Electromagnetic compatibility", a compendium of his fruitful career.

Never one to rest on his laurels, Tino has graced countless conferences, symposiums, and scientific gatherings, both at home and abroad. His reputation earned him the respect of global organizations like the IEEE and URSI (Unión Científica Internacional de Radio in Argentina). And of course, his accolades go far beyond membership: his Life Senior Member and Life Fellow titles from the IEEE and the Julius Cohen Award are just a few highlights in a lifetime of groundbreaking work abroad.

Tino is a man who has lived and breathed his passion for Antennas, yet his warmth and humility make him the most approachable of geniuses. He's worn many hats – professor, researcher, mentor, leader – but the one he wears most proudly is that of a friend, and to me, my chosen uncle, part of my family.

# IEEE BTS Distinguished Lecturer Dr. Peter Siebert Presents At ABU

## Technical Assembly Takes Place In Seoul On The Challenges Of Broadcast To Handhelds

The Asian Broadcasting Union (ABU) serves as a pivotal organization, akin to NABA in North America and EBU in Europe, bringing together public service media organizations across its vast region. With a membership spanning from the Middle East to the Pacific, ABU acts as a dynamic platform for broadcasters to exchange expertise, tackle common challenges, and explore collaborative opportunities. One of its key functions is the discussion and dissemination of technical aspects crucial to broadcasting.

At the forefront of technological advancements in the Asia-Pacific region is the Technical Committee of the ABU. Comprising experts, engineers, and professionals from ABU member organizations, this committee plays a vital role in addressing and advancing technology within the rapidly evolving landscape of broadcasting. Key areas of focus include broadcasting technology advancements, regulatory challenges, cybersecurity, content production and distribution, sustainability, and emergency broadcasting.

A notable event on the ABU calendar is the Technical Assembly (TA), a significant gathering of experts, professionals, and decision-makers from the broadcasting industry. This assembly serves as a forum for in-depth discussions on technical aspects and challenges faced by broadcasters in the region, covering everything from technological innovations to regulatory issues.

This year's TA, held concurrently with the ABU General Assembly (GA) in Seoul and hosted by the Korean public broadcaster KBS, marked a special occasion. IEEE BTS received a unique invitation from ABU's Dr. Veysel Binbay, Director Technology & Innovation, to participate in the meeting, as the sole organization outside ABU membership. Representing BTS, Peter Siebert, in his role as a Distinguished Lecturer, delivered a presentation on "Lost in Transmission: Exploring the Pitfalls of Mobile Broadcast TV."

Super Panel Attendees.


ABU's Dr. Veysel Binbay, Director Technology & Innovation.

Siebert's presentation delved into the historical challenges of bringing broadcast TV to handheld devices. He highlighted the technical, user interest, and commercial challenges that hindered the success of past attempts. Specifically, he identified indoor reception restrictions, low end-user interest, and commercial obstacles as major roadblocks.

Discussing the historical context, Siebert emphasized the "throwing over the wall concept" adopted by broadcasters, where broadcast TV to handhelds was introduced with a broadcast-centric perspective. He outlined the lack of specific content for mobile use cases and the critical role of handhelds equipped with broadcast receivers in this context.

Siebert expressed careful optimism about the potential success of LTE-based 5G Broadcast, a new technology developed by 3GPP. Unlike previous attempts, 5G Broadcast offers easy integration with existing 3GPP technologies, making it more likely to be supported in handhelds and less costly to implement. However, he acknowledged the lower spectral efficiency compared to DVB-T2 and ATSC3.0, resulting in a more expensive transmitter network infrastructure.

Dr. Peter Siebert, BTS Distinguished Lecturer.

In addressing whether 5G Broadcast could lead to success in broadcast to handhelds, Siebert raised critical questions about consumer interest and the business case for additional investments. While he deemed it unlikely to replace existing technologies, he suggested potential use cases by combining 5G Broadcast with other 3GPP features, leveraging existing mobile broadband networks.

Super Panel.

The presentation sparked a lively question-and-answer session, with discussions centering on the extent to which broadcasters should support the "direct to mobile (D2M)" use case. Participants debated the relevance of handheld devices for media consumption, considering potential extra costs and gatekeepers associated with telecommunication network operators. The open-ended nature of the discussion left the future of broadcast to handhelds uncertain, emphasizing the need for continued exploration and adaptation within the industry.

# The General Conference Of Asia-Pacific Institute For Broadcasting Development (AIBD) Held In Mauritius

## Event re-emphasised Sustainability for the broadcast and media sector in Asia-Pacific Region

By Amal Punchihewa,
BTS Distinguished Lecturer

The General Conference of the Asia Pacific Institute for Broadcasting Development (AIBD) was held in Balaclava, Mauritius from the 2nd to the 4th of October 2023. During those three days, AIBD members discussed various issues relevant to AIBD members and the broadcast and media sector in general. Among them, AIBD discussed sustainability aspects for the sector.

The AIBD General Conference (GC) and its Associated Meetings is the annual official gathering of the Institute. The General Conference is open to member countries, affiliates, partners, observers and leading broadcasters by invitation only.

Member Countries, Affiliates and partners reviewed several activities and projects that AIBD has implemented for the past year and also looked into future projects. Member countries also discussed their developmental needs to uplift their respective organisations.

Besides this, the AIBD Strategic Plan Team (SPT) Meeting and the Executive Board (EXBO) Meeting also took place and looked into the future major AIBD activities.

The meetings of the Strategic Plan Team and the Executive Board were limited to members of the SPT and EXBO only.


On the of 3rd October 2023, Amal Punchihewa presented to the GC some insights and strategic directions of the broadcast and media sector.

The rapid advancements in technology and increased availability and consumption of broadcast and media content have ignored considerations for sustainability and impact on climate change in the past. Countries operate a wide range and mix of technologies for media and broadcast production, distribution, and consumption. Broadcasting services' primary aim during the last decade was to service through multiple platforms by deploying enormous amounts of resources. Little or no consideration was given to the carbon footprint of the complete value chain. How can we mitigate the impact that our industry has on climate change and improve sustainability while serving the audience and maintaining operational viability?

AIBD leads sustainability discussions, education, and actions among Asia-Pacific region (APAC) broadcast and media organisations with its members and partners such as the International Telecommunication Union (ITU). Having pledged during the 2022 General Conference (GC) of AIBD in Delhi, India followed by the Asia Media Summit 2023 of AIBD in May 2023 in Bali, AIBD joined the ITU Regional Development Forum (RDF) held recently in Bangkok to share its commitments to digital transformation having sustainability at its core. On 20 Sep 2023, it also reported in ITU news the importance of placing sustainability at the heart of digital transformation.

AIBD strongly believe in and is leading sustainability initiatives, especially for the broadcast and media sector including the converged ICT sector. AIBD could play an important role in Asia and Pacific (ASP) to facilitate unlocking innovation for the broadcast and media sectors. In that context, AIBD collaborates with the ITU Development sector, and AIBD members and partners will contribute to the acceleration programme of ITU to unlock innovation and accelerate sustainable digital transformation, especially in the broadcast and media sector.

### Some Outcomes Of The AIBD's 21st General Conference

The 21st General Conference held in Balaclava, Mauritius was indeed a momentous occasion for the AIBD, and it was graced by the distinguished presence of His Excellency Timothy Mark Masiu, Minister for Communication & Information Technology

of Papua New Guinea. AIBD was deeply honoured to have H.E. Timothy Masiu for GC2023, and his participation enriched the conference in numerous ways.

Fourteen Countries attended the GC, and AIBD was also proud to have the International Telecommunication Union (ITU) as well our esteemed host, the Mauritius Broadcasting Corporation (MBC) was part of this important gathering. Their involvement lent an invaluable global perspective to our deliberations and discussions.

During this gathering, the General Conference proudly appointed H.E. Masiu as a Special Envoy of AIBD in the Pacific Region. In this role, H.E. Masiu will play a pivotal role in empowering the Pacific to enhance media growth.

Furthermore, under the adept leadership of H.E. Masiu, we witnessed the successful electoral process which resulted in the appointment of new office bearers for key positions, including President and Vice President, and the election of Executive Board Members. The election was followed by the selection of the Chairman and Vice Chairman of the Executive Board (EXBO).

This General Conference also saw the selection of new EXBO Members. These members consist of Bhutan, Cambodia, France, India, Korea, Malaysia, Nepal, Sri Lanka, Thailand & Vietnam.

In addition, AIBD was pleased to share that the General Conference unanimously approved the extension of Ms. Philomena Gnanapragasam, as the Secretariat Director of AIBD. Her commitment and contributions to the organisation were recognised and celebrated during the conference.

AIBD expressed its sincere gratitude to all its esteemed members for their active participation in this General Conference. Their presence, engagement, and contributions were instrumental in making this event a tremendous success. Together, AIBD and its members can take steps toward shaping the future of broadcasting in the Asia-Pacific region.

As AIBD reflected on the achievements of the 21st General Conference, we look forward to a bigger and brighter future for the AIBD. The commitment and enthusiasm displayed by AIBD members inspire members to strive for excellence and innovation in our shared mission.

AIBD Director and staff thanked all AIBD esteemed members for their continued support, and collaboration to a promising journey ahead. AIBD eagerly anticipates the opportunities and challenges that lie before its members and the industry, and members are confident that, together, AIBD will continue to make a positive impact in our industry.

## About the Author

***Dr Amal Punchihewa*** *is a researcher, educator, advisor and consultant in ICT, Media, and Broadcasting with close to four decades of experience in the industry, academia, and research. Amal is a Chartered Professional Engineer and Fellow of IET(UK) and a senior member of IEEE(USA) He is also a distinguished lecturer of the IEEE-Broadcast Technology Society. Amal facilitates and advocates technical guidelines and standards, and provides expertise related to the convergence of media, and evolving technology needs. He creates, encourages, and manages member communities, and understands and explains the trends that shape the media, to empower media & ICT stakeholders to continue to make good strategic decisions. Currently, he volunteers as the Chair of the Engineering New Zealand Manawatu Branch, STEM Ambassador and a Mentor of emerging engineers and the Deputy Chair of IET Wellington and South Island. He is also the Technical Advisor of the AIBD.*

# DAB Radio News And Views

By Will Jackson, Communications Manager, WorldDAB

## Radio's digital future: DAB+ saving lives


Will Jackson

Emergency warnings help protect people. They offer important information and initial recommendations about the best ways for affected persons to react to sudden unexpected events. In Germany, a variety of different technical mechanisms are used to issue warnings to the population. This mix of warning mechanisms ensures that emergency warnings reach a broad swatch of the population.

Even if a person in the hazard zone misses a warning issued via one particular warning mechanism (such as television, radio, or smartphone), or if any specific warning mechanism breaks down, a variety of other warning mechanisms (such as city information boards, warning apps, loudspeaker vehicles, and Internet pages) continue issuing the warning at the same time. The more warning mechanisms added to the coverage mix, the greater the number of affected persons that may be reached with warning messages.

The informational content of a warning issued via a warning app or radio is significantly higher than from a siren signal, for example. In particular, that extra content is necessary to deliver initial recommended actions, a crucial step in helping the affected protect themselves against danger starting from the first moment.

DAB+, the current digital radio standard, offers more than just clear sound and the ability to transmit music and voices. Thanks to its digital data services, DAB+ is also capable of serving as a reliable instrument for delivering alarms and emergency warnings. Emergency warnings issued via DAB+ supplement the familiar warning channels, including cell broadcast, warning apps, sirens, loudspeaker announcements, and classic analog FM radio.

Given its strong transmission strength and broad reach (high-tower/high-power), DAB+ radio also remains available in crisis situations even if the cellular network infrastructure fails, which could be caused by flooding or loss of DSL switches.

With several major natural catastrophes observed in the recent past, including those in Germany's Ahr Valley and parts of Upper Bavaria in 2021, as well as the tense international situation (such as the war in Ukraine), the members of Digital radio Deutschland e.V. are calling for international standards for emergency warnings.

The members of Digital radio Deutschland e.V. work towards the safety of the populace in the following ways:

- Through work on international committees, such as WorldDAB and with inter- nationally active partners from industry, applying Digital radio Deutschland e.V. recommendations to incorporate the technical possibilities for the DAB+ warning system into standards that will serve as the basis for ongoing international implementation.
- Developing, testing, and implementing a DAB+ warning system in Germany to market readiness.
- Documenting the necessary steps on the path to implementation in a manner transparent for third parties, made available independent of industrial sector and with a low threshold, preferably license free, with the goal of quick market penetration by broadcasters, network operators, industry, and ultimately the population.
- Rolling out the DAB+ system internationally to emphasize the benefits of "broadcast radio" and underscore its importance worldwide.

### DAB+ In The Warning Mix: Technology And New Radio Receiver Functions

The Federal Republic of Germany currently relies on the Federal Office for Civil Protection and Disaster Assistance (BKK) and its modular warning system (Mows) as a powerful, high availability warning and communication system. Mows emergency warnings are disseminated via stable satellite connections. A variety of so-called warning multipliers are connected to the Mows: radio studios, the BKK's Nina warning app, cell broadcast functionality for cellular service, as well as the Emergency Warning System (EWS) for DAB+.

The most important characteristics for the new DAB+ warning system are:

- Real-time alarming with (automatic) program switchover and/or presentation by radio announcer: Emergency warnings can be played acoustically on the receiver within a few seconds of triggering the warning, and shown on the display: Alarm Announcement (AA).

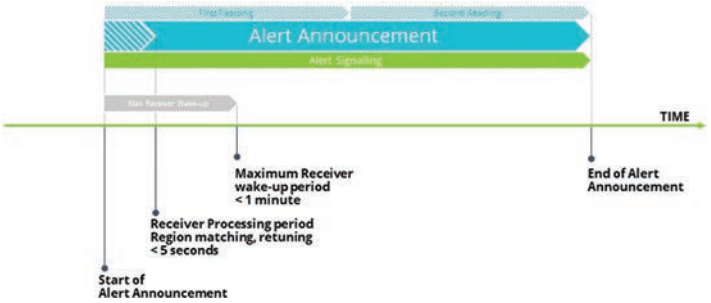
- Audio channel: As previously with analog radio, an audio message is played. The receivers can potentially automatically raise the volume.
- Ticker with short messages: The receiver displays a short text message with a maximum length of 128 characters in addition to the spoken message.
- Wake-up function: Receivers in standby mode (such as radio alarm clocks) are automatically turned on and will issue the acoustic emergency warning. Further details can then be shown on the color display. The standby receivers search efficiently and automatically in the background, looking for any available emergency warnings.
- Automatic tuning to warning channels: If an emergency warning is being broadcast on another ensemble, the active receiver switches automatically from the current program to the warning channel on the other ensemble: Other Ensemble Alarm Announcement (OE-AA).
- Indication by receiver about alarms on other frequencies and regionalization: Other DAB+ ensembles can reference the alarming ensemble to trigger the receiver to switch frequencies to the alarm ensemble. Regionalization can be undertaken based on postal code and, where possible, georeferencing.
- Accessibility, multilingualism, and detailed information above the warning scenario: Detailed information in multiple languages, including for staggered review via the Journalize text service.
- Return option: Users can interrupt playback of the active alarm notification and return to their previous radio program.
- Test option: Emergency warning-compatible radios should allow for functional tests, such as on Germany's nationwide emergency test day. During the test, it should be possible to distinguish between real alarms and the test version.

The technical specifications for these characteristics and services are described in detail in the full system concept. Differentiation is made between minimal and advanced characteristics, with the minimal specifications defined to ensure that even affordable devices are compatible with the fundamental warning options needed to protect the population, while advanced receiver supplementary functions address factors such as accessibility.

At the IFA 2022, for example, device manufacturer Telstar and its partner Fraunhofer IIS presented an initial set of devices primarily developed and partially supported by Digitalradio Deutschland e.V. and offering full compatibility with the warning characteristics indicated above.

Warning apps via the cellular network cannot serve as the sole path for warnings since the technical parameters of the system have limitations that can involve decisive disadvantages in a crisis.

More information on how DAB+ can help save lives through provision of emergency warnings, including the full system concept is available on the WorldDAB website at: *https://www.worlddab.org/dab/emergency-warnings*

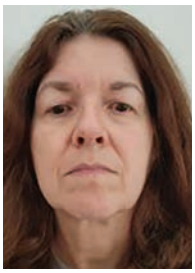



DAB+ emergency warnings alert timeline.

# ITU Update

By Christine DiLapi, BTS Adcom Member

## WRC-23 convened


Christine DiLapi

The World Radiocommunication Conference of 2023, WRC-23, convened in Dubai, United Arab Emirates from 20 November to 15 December 2023. WRC is a treaty conference of the International Telecommunication Union (ITU), a UN-based organization which deals with the governance of radio frequency spectrum, both on Earth and in space. The instrument which governs spectrum use is the Radio Regulations, which every WRC updates and revises to reflect the needs and demands of UN members with respect to management of spectrum resources.

Within the Radiocommunication Sector of the ITU (ITU-R), Study Group (SG) 6 deals with radiocommunication broadcasting, including vision, sound, multimedia and data services principally intended for delivery to the general public (see itu.int/go/itu-r/sg6).

As at the prior WRC, WRC-19 in Sharm el-Sheikh, Egypt, WRC-23 identified additional frequency bands for International Mobile Telecommunications (IMT), the ITU jargon for broadband wireless systems of both 4th, 5th, and ultimately 6th generation. This new spectrum for IMT includes the 3300-3400 MHz, 3600-3800 MHz, 4800-4990 MHz and 6425-7125 MHz frequency ranges in various countries and regions.

Portions of the 2 GHz and 2.6 GHz bands were identified for use by HIBS (High Altitude IMT Base Stations) to facilitate the provision of wireless broadband services in remote and/or rural areas. It is anticipated that HiBS can provide coverage to what can be considered a super macrocell in a more cost-effective manner over ground infrastructure, from a stationary platform in the stratosphere.

And with regards to frequency bands of interest to the terrestrial broadcasting community, WRC-23 modified the regulatory structure of the 470-694 MHz band in regions of the world where the GE-06 treaty is applicable, which includes Europe, Middle East, Africa, and the Islamic Republic of Iran. This agreement was adopted to enable the transition to digital TV (DTV) broadcasting in these areas. These modifications to the Radio Regulations intend to enable the introduction of mobile services in portions of this frequency range while maintaining the protection of DTV that is governed by the GE-06 treaty.

Each WRC established the agenda of the next WRC. Notable items on the agenda of WRC-27:

Possible new or modified space research service (space-to-space) allocations for future development of communications on the lunar surface, and between lunar orbit and the lunar surface. Frequency ranges in UHF, S-band, C-band, X-band, and Ka-Band are to be considered for this agenda item.

Potential new frequency allocations in the L-band and S-band frequency ranges and associated regulatory actions for future development of low-data-rate non-geostationary mobile-satellite systems (small satellites).

Possible new allocations to the mobile-satellite service in between 694/98 MHz and 2.7 GHz for direct connectivity between space stations and mobile user equipment to enhance terrestrial IMT network coverage.

Consideration of regulatory provisions for receive-only space weather sensors and their protection in the Radio Regulations in several VHF and UHF frequency bands.

Working Party 6A of SG 6 will be a contributing group in terms of preparatory studies for several WRC-27 agenda items, including those listed above.

In addition there is another item on the WRC-27 agenda to consider identification of frequency bands for IMT applications, in the 4400-4800 MHz, 7125-8400 MHz (or parts thereof), and 14.8-15.35 GHz frequency ranges.

# BTS Italy Chapter Hosts 2023 IEEE SPS / EURASIP Summer School On Metaverse Technologies

**By Mattei Anedda, BTS Italy Chapter Chair**

The year 2023 was marked by hard work leading to the realization of the "2023 IEEE SPS / EURASIP Summer School on Metaverse Technologies," the first summer school on the metaverse held in Italy to date. "We have structured the summer school with highly cross-cutting themes, aiming to provide a broad overview of presentations centered around and closely related to the Metaverse. There is a particular emphasis on emerging technologies such as IoT and 5G, which can enable widespread usage." says Matteo Anedda. The IEEE BTS played a crucial role in making the event, which took place from September 18-22, 2023, at the iconic "Il Lido" venue on Poetto beach in Cagliari, Italy. The summer school provided IEEE BTS with an added opportunity for international visibility, introducing itself to more than 24 doctoral students from various Italian and European universities. Additionally, it highlighted a keen interest in topics that are both relevant and interdisciplinary, extending beyond the scope of those traditionally addressed within the context of BTS activities.

Twelve internationally renowned lecturers took turns on different topics related to the metaverse, from technical-scientific to legal, through humanities, social sciences, and communication. Therefore, heartfelt thanks are due to the lecturers who made outstanding contributions with talks of the highest quality. **Maurizio Murroni**, Distinguished Lecturer Chair of the IEEE BTS (https://bts.ieee.org/educational-programs/distinguished-lecturer-program/current-distinguished-lecturers.html) opened the first days proceedings with a presentation entitled "5G/6G for XR communications."

The event featured additional speakers who delivered insightful presentations on various aspects. **Giuseppe Fioccola** provided intriguing insights in his presentation titled "Metaverse and Networking: Performance and Enabling Technologies." **Leonardo Chiariglione** discussed "The MPAI Metaverse Architecture," and **Gordon Wetzstein** presented "Beyond the Metaverse - Towards a Human-Centric XR." Other notable contributors included **Cornelius Hellge**, who addressed "Streaming of Immersive Media," **Riccardo Scateni**, exploring "What do you see when you look around in the Metaverse? Behind the Scene of Virtual Reality," and **Pablo Pérez**, introducing "The Realverse - Challenges in XR Communications." **Davide Maiorca** delved into "Towards an (in)secure Metaverse: Challenges and Open Problems." **Elisabetta Gola** engaged the audience with her talk, "Extended Minds and Immersive Reality: Truths and Metaphors of the Metaverse." **Thomas Stockhammer** covered "XR and the Metaverse: Technologies and Standards," **Luigi Atzori**

provided insights into "Quality of Experience for the Metaverse," and **Massimo Farina** discussed "Privacy and Legal Aspects for the Metaverse."

## About The Author

***Matteo Anedda**, Assistant Professor at the Department of Electrical and Electronic Engineering, University of Cagliari (Italy). Matteo Anedda, a Senior Member of the IEEE, earned his M.Sc. degree (summa cum laude) in telecommunication engineering and the Ph.D. degree in electronic and computer engineering from the University of Cagliari in 2012 and 2017, respectively. Throughout his academic career, he has undertaken various international experiences. In 2010, he served as a Visiting Erasmus Student at the University of Basque Country, Bilbao, Spain. In 2015, he was a Visiting Researcher at Dublin City University, Ireland, and in 2016, he undertook a seven-month research period at Universidad de Montevideo, Uruguay. In 2020, he held the position of Visiting Professor at the Department of Electronics and Computers, Transilvania University of Braşov, Romania. Matteo served as secretary/treasurer of the IEEE BTS Italy Chapter from 2014 through 2016. His term as Chapter Chair commenced at the beginning of 2023.*

# Upcoming Events

## of Interest to BTS Members

- **May 17–19, 2024** – Dayton Hamvention – Green County Fair and Expo Center; Xenia, Ohio
- **May 21–23, 2024** – CABSAT – Dubai World Trade Center; United Arab Emirates
- **May 29–31 2024** – BroadcastAsia – Singapore Expo; Singapore
- **June 15–17, 2024** – AES EU International Convention – Universidad Politécnica De Madrid; Madrid, Spain
- **June 19–21, 2024** – IEEE International Symposium on Broadband Multimedia Systems and Broadcasting; Toronto, Canada
- **June 26–28, 2024** – Communications & Broadcasting Week – Koto-Tokyo Big Sight International Exposition Center; Tokyo, Japan
- **Sept. 13–16, 2024** – IBC Show 2023 – Amsterdam RAI; Amsterdam, Netherlands
- **Oct. 9–10, 2024** – NAB NY Show – Jacob Javits Center; New York City, New York
- **Oct. 21–24, 2024** – SMPTE Media Technology Summit – Los Angeles, California
- **Jan. 7–10, 2025** – CES Show and Exhibition – Las Vegas Convention Center; Las Vegas, Nevada

**(IMPORTANT NOTE: Event dates and locations listed above are subject to change. When making plans to attend any of these trade shows, conferences, or meetings, always confirm details with event organizers first.)**

*If you have information on broadcast-related events that may be of interest to other Broadcast Technology Society members, please submit them at least three months in advance to the Broadcast Technology editor at BTSeditor@ieee.org.*

### Editorial Deadlines

***Broadcast Technology*** *welcomes contributions from its members. Please forward materials you would like included to the editor at* BTSeditor@IEEE.org. *Here are our editorial deadlines for upcoming issues:*

| Issue | Due Date |
|---|---|
| Quarter 2 | Apr. 3, 2024 |
| Quarter 3 | June 28, 2024 |
| Quarter 4 | Oct. 31, 2024 |
| Quarter 1 | Jan. 10, 2025 |

# What's New

## Broadcast Technology presents new product releases from broadcast equipment manufacturers

### UHD PTZ Camera

The new CV630-NDIW PTZ camera from Marshall Electronics delivers UHD video for a multitude of uses, including live newscasts, reality television, houses of worship and other applications requiring very high quality and low-latency imagery from a remotely-controlled camera.

The camera features a 30X optical zoom, simultaneous HDMI and 3G SDI video outputs, and an 8-megapixel sensor that's capable of capturing 3840 x 2160 video at 30 fps. It requires only a single cable for controlling all functions, with connection to any Ethernet port, and is compatible with Marshall's VS-PTC-IP PTZ camera controller


For additional information, please visit Marshall Electronics at *www.marshall-usa.com.*

### AVC/HEVC Encoders

The new Matrox Maevex 7100 series of 4K/60 AVC/HEVC encoders are ideal for applications involving economical high-quality, low-latency encoding of single HDMI sources for audio and video streaming, contribution, and collaboration.

The Maevex 7112A provides H.264 encoding and the Maevex 7112H is designed for applications involving H.264/H.265 encoding. Both models support five streaming protocols—RTSP, MPEG2-TS, RTP, SRT, and RTMP. They are easily deployed with the included Maevex PowerStream Plus application and the web-based Maevex Command Center, which provides configuration, monitoring, and streaming management.

The Maevex 7100 series operates without the need for cooling fans, and boasts a small form factor for quiet, energy-efficient, high-density installations.


For additional information, please visit Matrox at *www.video.matrox.com.*

### Shotgun Microphone

DPA Microphones has added another entry into their line of microphones designed for broadcast and other professional applications

The new 2017 shotgun mic is designed for high-quality sound pickup, along with a high degree of directionality and the ability to withstand the rigors of live event and sports broadcasts.

The new microphone features a compact design, measuring only 7.24 inches (184 mm) in length, and can be mounted on booms, cameras, other supports. It has been tested for operation in temperature extremes ranging from −40 degrees Fahrenheit (−40 degrees C) to 104 degrees Fahrenheit (40 degrees C), as well as in both dry and humid conditions, including direct rain showers.

For additional information, please visit DPA Microphones at *www.dpamicrophones.com.*

### USB/HDMI Adapter

Sonnet Technologies has added a new entry to its lineup of USB adapters for Windows and Apple computer platforms, the USB-C to Dual 4K 60Hz HDMI device. It allows connection of two 4K/60 Hz HDMI video displays to a single USB-C computer port. The adapter enables users to easily add a larger display for viewing spreadsheets, editing code or other applications where a second and larger screen is helpful and where ports for connecting external devices are limited.

The new Sonnet adapter provides passthrough of USB-C power, providing as much as 90 Watts for operation and charging functions.


For additional information, please visit Sonnet Technologies at *www.sonnettech.com.*

**Mini-Converter Card Frame**

AJA Video Systems recently unveiled a new addition to its lineup of Mini-Converter products, the DRM2 rackmount frame that can accommodate and power as many as 12 regular Mini-Converters, or up to 24 of the company's FIDO converters.

The compact 3RU card frame features a 200-Watt power supply that operates without the need for fan in normal temperature conditions. It includes a removeable faceplate, allowing quick access to the frame. Its power cable harness is fitted with DP/10-PC connectors and plugs, providing users with quick and easy connections to installed converter modules. Available options include an active faceplate with four fans to ensure sufficient cooling in conditions of high ambient temperatures.

For additional information, please visit AJA Video Systems at *www.aja.com.*

**Weather Visualization Graphics**

Chyron's new Weather 2.0 platform simplifies data-driven visualization of weather with map-based graphics, customized forecasting elements, realistic 3D panoramic presentations, and a dynamic analysis of global phenomena affecting weather. Users can access a full library of their station's weather graphics templates, select regions of interest to be displayed, customize forecast displays, preview of the assets, and add graphics to show rundowns.

The weather platform features an intuitive graphic design, a "dark-look" user interface, secure data retrieval, integration with the company's MOS-connected "CAMIO" newsroom graphics system, and support for the latest version of Windows operating systems. In includes specialized tools to support all aspects of establishing required data flows and connectivity, as well as graphic design, on-air presentations, rendering management, and real-time playout.


For additional information, please visit Chyron at *www.chyron.com.*

**2110 Interface**

Cobalt Digital's new Indigo 2110-DC-01option for its 9904-UDX-4K openGear audio/video processing unit provides native SMPTE ST 2110 interfacing without the need for the addition of multiple outboard devices in the signal path when switching from SDI to IP. The new factory option includes dual 25G Ethernet interfaces, and supports uncompressed 4K video operations, and offers a cost-effective and compact integrated solution for introducing ST 2110 signals into an SDI environment.

The ST 2110 processor option accommodates HD, 3G and 4K IP streams, and when added to Cobalt's 9904 platform facilitates up/down/cross signal conversions, audio signal routing, color correction, and more.


For additional information, please visit Cobalt Digital at *www.cobaltdigital.com.*

**Fresnel Lighting Instrument**

Brightline's Minnow profile spotlights provide adjustable short-throw LED lighting, allowing users to precisely adjust the beam spot size, and are ideal for broadcast and production studio applications, as well as for use in presentation rooms. Two models are available, the Minnow/2 with two-color variable white light, and the Minnow/5, which provides red, green, blue, lime and amber illumination.

The devices feature fan-less cooling for noiseless operation, robust die-cast aluminum housings, flicker-free illumination, a 50,000-hour operational life span, smooth 0 to 100 percent dimming capability, a power supply with active power factor correction, and more.

For additional information, please visit Brightline at *www.brightlines.com*

**Multi-Channel Processor**

For-A's FA-1616 multi-channel processor provides up to 16 independent channels of video processing, color correction and frame synchronization of sources. It's housed in a compact single RU package, and also provides remapping of audio sources in addition to its video functions.

The processor supports IP. SDI (12G/3G/HD and SD), along with 4K video, and is designed with a software-defined architecture that allows users to create a system optimized for their individual needs and applications. Features include a browser-based control without the need to install a dedicated graphical user interface, redundant power supplies, SNMP monitoring, and more.

For additional information, please visit For-A at *www.for-a.com.*

# Calling all Chapter Chairs

The IEEE Broadcast Technology is interested in your chapter activities, but have you ever wondered how to write a chapter report. Below are some directions that can help you get your chapter noticed.

## Information for submitting Chapter Reports:

• Chapter Reports ideally should run approximately 200 to 500 words. (If a really newsworthy or unusual event is being described, we can accept slightly longer Reports, but nothing greater than 800 words.) We are looking for a summary of the event program or presentation. Please keep Reports straightforward and focused on the event. When someone is mentioned in a Report, it is very important that we receive the person's full name, title or position, organization they are affiliated with, and their connection with the story.

- Please identify all recognizable persons in your photos. We need their names, with title or position and affiliation. (Example: Mr. John Smith, vice president of consumer electronics production, Ajax Corporation.) If there is more than one person in a photo, please clearly identify everyone from left-to-right; please do not assume that we know persons depicted and will be able to fill in this blanks.

•This need for complete identification also applies to place and building names. Please make sure to provide the complete location of the event. (Don't just say the meeting took place in Smith Hall, as readers will likely not know that Smith Hall of part of the School of Engineering at Jones University.) Provide complete information about meeting venues.

• Very important—submit your Report as a straight Word file with no embedded logos, pictures, etc. Please do not send PDFs.

• Pictures are a very important part of every Report; however, they need to be good quality and tell a story; i.e., if a presentation is made at your meeting, your photograph should show the presenter standing at a podium, or at a chalkboard, etc. Group photographs are nice, but we really need at least one good photo of the lecturer making his/her presentation. Image size is very important too. An image that is acceptable on a Website is not necessarily large enough for publication in a printed magazine. Images must be at least 250 kb in size (one to two MB preferred). These must be sent as .jpg file attachments—no PDF— and PLEASE DO NOT EMBED IMAGES IN REPORTS.

• Please include answers to all of the following questions in your first paragraph: **Who** was involved? **What** happened? **Where** did it take place? **When** did it happen? **Why** (what was the reason?). Further, if the event you are describing was facilitated by an institution (university, company, etc.) that provided a meeting room, refreshments, etc.. Please include this information in every Report.

• Also, when submitting a Report, please provide complete identification about yourself, including your title or position and the name of the organization that you are affiliated with.

• Lastly, Reports must be timely. They need to be received by the **Broadcast Technology** staff no later than two to three weeks after the meeting or event took place.

If these items are not received in the required order, the Editorial Assistant will contact you for a revision. The **Broadcast Technology** editorial staff thanks you for your cooperation. We look forward to receiving and publishing your Reports. If you have any questions please send an email to btseditor@ieee.org

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# BTS Business

## Web Site

**http://bts.ieee.org/** If you have any suggestions for our web site, please send an e-mail to: *bts@ieee.org*.

## Phone Number

We have a telephone number that's dedicated for IEEE BTS business: **732-562-6061**.

*IEEE Broadcast Technology, Volume 1, Number 1 (ISSN 23794682) is published quarterly by the Broadcast Technology Society of the Institute of Electrical and Electronics Engineers, Inc. Headquarters address: 3 Park Avenue, 17th Floor New York, NY 10016-5997. It is sent at a cost of $1.00 per year to each member of the Broadcast Technology Society and printed in USA. Periodicals postage paid at New York, NY and at additional mailing offices. Postmaster: Send address changes to: IEEE Broadcast Technology, IEEE, 445 Hoes Lane, Piscataway, NJ 08854.*